U.S. Department of Housing and Urban Development
451 Seventh Street, SW
Washington, DC 20410
www.hud.gov

espanol.hud.gov

Environmental Review for Activity/Project that is Categorically Excluded Subject to Section 58.5

Pursuant to 24 CFR 58.35(a)

Project Information

Project Name: Brooklyn Museum - African Art Galleries

Responsible Entity: City of New York Mayor's Office of Management and Budget (OMB)

RE Preparer: Juliet Jacobs

Grant Recipient (if different than Responsible Entity): Brooklyn Museum

Point of Contact: Elizabeth Venditto

Certifying Officer Name and Title: Julie Freeman, Associate Director, OMB-Managed Grants, OMB

Funding Information

Grant Number	HUD Program	Program Name
B-22-CP-NY-0647	Community Planning and Development (CPD)	Community Project Funding (CPF) Grants

Estimated Total HUD Funded Amount: $3,000,000, of which $1,500,000 used for design and pre-development work on this project, was previously released in July of 2023.

Estimated Total Project Cost [24 CFR 58. 2(a)(5)]**:** $15,000,000

Project Location: 200 Eastern Parkway, Brooklyn, NY 11238

Description of the Proposed Project [24 CFR 50.12 & 58.32; 40 CFR 1508.25]:

Housed in a landmark building in the heart of Brooklyn, the Brooklyn Museum is home to an astounding encyclopedic collection of more than 140,000 objects representing cultures worldwide and over 6,000 years of history. As one of the oldest and largest art museums in the country, the Museum is committed to innovation, creating compelling experiences for its communities and celebrating the power of art to inspire awe, conversation, and joy.

The proposed project would involve the development of a permanent gallery for the Museum's vast African art collection, which features approximately 4,500 works spanning from 200 C.E. to today. The project would transform two large rooms, currently used for storage on the museum's third floor, into a 6,150 square foot gallery space. The proposed African Art Gallery would connect to the Museum's existing Egyptian Art Gallery, centering Egyptian Art in the context of the African continent. The proposed project would be limited to interior renovations and would not involve ground disturbance.

In July of 2023, an environmental review was completed for design and predevelopment project costs, for which half of the CPF grant was allocated. The remaining $1,500,000 would be used towards implementation of the proposed project.

Level of Environmental Review Determination:

Categorically Excluded per 24 CFR 58.35(a), and subject to laws and authorities at §58.5:
24 CFR § 58.35(a)(3)(iii)

Determination:

☐	This categorically excluded activity/project converts to EXEMPT per Section 58.34(a)(12), because it does not require any mitigation for compliance with any listed statutes or authorities, nor requires any formal permit or license. Funds may be committed and drawn down after certification of this part for this (now) EXEMPT project; OR
☒	This categorically excluded activity/project cannot convert to Exempt status because one or more statutes or authorities listed at Section 58.5 requires formal consultation or mitigation. Complete consultation/mitigation protocol requirements, publish NOI/RROF and obtain "Authority to Use Grant Funds" (HUD 7015.16) per Section 58.70 and 58.71 before committing or drawing down any funds; OR
☐	Extraordinary circumstances exist and this project may result in significant environmental impact. This project requires preparation of an Environmental Assessment (EA) according to Part 58 Subpart E due to extraordinary circumstances (Section 58.35(c)).

Compliance with 24 CFR 50.4, 58.5, and 58.6 Laws and Authorities

Record below the compliance or conformance determinations for each statute, executive order, or regulation. Provide credible, traceable, and supportive source documentation for each authority. Where applicable, complete the necessary reviews or consultations and obtain or note applicable permits of approvals. Clearly note citations, dates/names/titles of contacts, and page references. Attach additional documentation as appropriate.

Compliance Factors: Statutes, Executive Orders, and Regulations listed at 24 CFR §58.5 and §58.6	Are formal compliance steps or mitigation required?	Compliance determinations
STATUTES, EXECUTIVE ORDERS, AND REGULATIONS LISTED AT 24 CFR 50.4 and 58.6		
Airport Hazards 24 CFR Part 51 Subpart D	Yes ☐ No ☒	The project site is not within 15,000 feet of a military airport or 2,500 feet of a civilian airport. The closest airports are LaGuardia Airport and John F. Kennedy International Airport (Attachment 1). The project site is located a sufficient distance from the Runway Protection Zones for each airport. Therefore, no further assessment is warranted, and no significant adverse impacts would occur to airport clear zones or accident potential zones as a result of the proposed project.
Coastal Barrier Resources Coastal Barrier Resources Act, as amended by the Coastal Barrier Improvement Act of 1990 [16 USC 3501]	Yes ☐ No ☒	As shown in the attached map (Attachment 2), there is only one Coastal Barrier Resource System (CBRS) Unit in NYC (NY-60P Jamaica Bay), which primarily consists of undeveloped land in the Gateway National Recreation Area. The Brooklyn Museum is excluded from the CBRS Unit; therefore, this project has no potential to impact a CBRS Unit and is in compliance with the Coastal Barrier Resources Act.
Flood Insurance Flood Disaster Protection Act of 1973 and National Flood Insurance Reform Act of 1994 [42 USC 4001-4128 and 42 USC 5154a]	Yes ☐ No ☒	The Brooklyn Museum is not located within the 100-year floodplain (Attachment 3). The project does not require flood insurance or is excepted from flood insurance. While flood insurance may not be mandatory in this instance, HUD recommends that all insurable structures maintain flood insurance under the National Flood Insurance Program (NFIP). The project is in compliance with Flood Insurance requirements.
STATUTES, EXECUTIVE ORDERS, AND REGULATIONS LISTED AT 24 CFR § 50.4 & § 58.5		
Air Quality Clean Air Act, as amended, particularly section 176(c) & (d); 40 CFR Parts 6, 51, 93	Yes ☐ No ☒	The proposed project does not include new construction or conversion of land use facilitating the development of public, commercial, or industrial facilities or five or more dwelling units. Accordingly, no further assessment is required.

Compliance Factors: Statutes, Executive Orders, and Regulations listed at 24 CFR §58.5 and §58.6	Are formal compliance steps or mitigation required?	Compliance determinations
Coastal Zone Management Coastal Zone Management Act, sections 307(c) & (d)	Yes ☐ No ☒	The Brooklyn Museum is not located within New York City's designated Coastal Zone Boundary or Waterfront Revitalization Program boundaries (Attachment 4). Therefore, the proposed project would not violate the Coastal Zone Management Act.
Contamination and Toxic Substances 24 CFR Part 50.3(i) & 58.5(i)(2)	Yes ☐ No ☒	Websites including NEPAssist, the Superfund National Priorities List (NPL) Where You Live Map, and the NYS Department of Environmental Conservation's (DEC's) DECinfo Locator were reviewed to determine any toxic sites that may be in proximity to the proposed project (Attachments 5.1-5.5) The site itself is listed as a minor operating ICIS-Air site (FRS ID: 110054885335). No violations or concerns were listed on the U.S. Environmental Protection Agency's (EPA's) Enforcement and Compliance History Online (ECHO) database. Additionally, DEC's Bulk Storage Database lists several active underground storage tanks at the project site which contain diesel and #2 fuel for onsite consumption. The tanks appear to be operational with no concerns or violations reported (Attachment 5.3). Review of the NEPAssist database revealed that 83 RCRA sites and 20 ICIS-Air sites, sites are within 3,000 feet of the proposed project. None of these sites presented any violations or concerns on the ECHO database (Attachments 5.1 and 5.5). Review of the DECinfo Locator reveals several New York State Brownfield Cleanup Program sites within one mile of the project that are actively undergoing remediation, or have unresolved contamination issues (Attachments 5.4 and 5.5). None of these sites is expected to pose a risk to those visiting the project site, due to ongoing remediation, and / or the nature of exposure not being relevant to the project site (e.g., direction of groundwater flow, contamination risks limited to onsite exposure). Proposed project work is limited to interior renovations, further limiting the potential for exposure to contaminants. Additionally, none of these sites are within close proximity to the proposed project. The nearest active brownfields site, Consumers Park Brewery (C224381), is more than 1,500 feet to the southeast of the project site.

Compliance Factors: Statutes, Executive Orders, and Regulations listed at 24 CFR §58.5 and §58.6	Are formal compliance steps or mitigation required?	Compliance determinations
		It was determined through analysis of Centers for Disease Control and Prevention (CDC) data that the project does not present a risk to building occupants for radon contamination (Attachment 5.6). Finally, historic uses of the project site were reviewed. In the 1880's the Brooklyn Parks Commission proposed purchasing the land the Museum now sits on as an addition to Prospect Park. The building, constructed between 1895 and 1906, is described in the National Register of Historic Places (Attachment 5.7). The structure was built for the purpose of holding a museum, and has always been used for that purpose. These previous land uses are not expected to lead to toxic residues at the project site, or hazards which would conflict with the intended utilization of the property. The project is in compliance with contamination and toxic substances requirements.
Endangered Species Endangered Species Act of 1973, particularly section 7; 50 CFR Part 402	Yes ☐ No ☒	The proposed project is limited to interior renovations of the existing Brooklyn Museum building. The proposed project does not involve any activities that have the potential to affect species or habitats, therefore, compliance with Section 7 of the Endangered Species Act has been achieved.
Explosive and Flammable Hazards 24 CFR Part 51 Subpart C	Yes ☐ No ☒	The proposed project does not include a hazardous facility (a facility that mainly stores, handles, or processes flammable or combustible chemicals such as bulk fuel storage facilities and refineries). The project also does not include development, construction, rehabilitation that will increase residential densities, or conversion. Thus, no further compliance or mitigation is required.
Farmlands Protection Farmland Protection Policy Act of 1981, particularly sections 1504(b) and 1541; 7 CFR Part 658	Yes ☐ No ☒	The project is located in developed, urban areas of New York City and would not involve the conversion of farmland to non-agricultural uses. Therefore, the proposed activity is not subject to the Farmland Protection Policy Act and no further assessment is required.

Compliance Factors: Statutes, Executive Orders, and Regulations listed at 24 CFR §58.5 and §58.6	Are formal compliance steps or mitigation required?	Compliance determinations
Floodplain Management Executive Order 11988, particularly section 2(a); 24 CFR Part 55	Yes ☐ No ☒	This project does not occur in the 100-year or Federal Flood Risk Management Standard (FFRMS) floodplain (Attachment 3). In the absence of Climate-Informed Science Approach (CISA) data, the horizontal limit of the FFRMS floodplain is being defined as the 500-year floodplain, according to Federal Emergency Management Agency (FEMA) Effective or Preliminary Flood Insurance Rate Maps (FIRMs), whichever is more stringent. The project is in compliance with Executive Orders 11988 and 13690.
Historic Preservation National Historic Preservation Act of 1966, particularly sections 106 and 110; 36 CFR Part 800	Yes ☒ No ☐	The proposed project would be limited to interior repairs which would not include new ground disturbance. Thus, there is no possibility to impact archaeological resources or architectural resources outside of the project site. Coordination with the State Historic Preservation Office (SHPO) has been ongoing throughout design of the proposed project. On January 14, 2026, SHPO determined that, based upon the submitted design drawings and specifications, the proposed project would have No Adverse Effect on historic or archaeological resources (Attachment 6). Thus, no further compliance or mitigation is required.
Noise Abatement and Control Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978; 24 CFR Part 51 Subpart B	Yes ☐ No ☒	Based on the project description, this project includes no activities that would require further evaluation under HUD's noise regulation. The project is in compliance with HUD's Noise regulation.

Compliance Factors: Statutes, Executive Orders, and Regulations listed at 24 CFR §58.5 and §58.6	Are formal compliance steps or mitigation required?	Compliance determinations
Sole Source Aquifers Safe Drinking Water Act of 1974, as amended, particularly section 1424(e); 40 CFR Part 149	Yes ☐ No ☒	As shown in the attached map from the EPA interactive Sole Source Aquifer (SSA) mapper (Attachment 7.1), the Project Site is located within the boundaries of the recharge area of the Brooklyn-Queens Aquifer System. However, properties in these areas are primarily connected to the NYC municipal water supply and sewer system maintained by the NYC Department of Environmental Protection. Per the Memorandum of Understanding for Region II between the EPA and HUD (Attachment 7.2), attached is a completed Initial Screen for Non-Housing Projects (7.3-7.4). Based on the work scope and the attached maps and documentation from DEC, the screening resulted in no affirmative responses. Thus, no further compliance steps or mitigation is required.
Wetlands Protection Executive Order 11990, particularly sections 2 and 5	Yes ☐ No ☒	The proposed project is limited to interior renovations of the existing Brooklyn Museum building. This project does not involve new construction as defined in Executive Order 11990, expansion of a building's footprint, or ground disturbance. Thus, no further compliance steps or mitigation is required.
Wild and Scenic Rivers Wild and Scenic Rivers Act of 1968, particularly section 7(b) and (c)	Yes ☐ No ☒	There are no designated wild and scenic rivers within New York City (Attachment 8). Therefore, no further analysis is required.
ENVIRONMENTAL JUSTICE		
Environmental Justice Executive Order 12898	Yes ☐ No ☒	Compliance not currently required due to executive orders issued in January of 2025.

Mitigation Measures and Conditions [40 CFR 1505.2(c)]

The following strategies provide the policy, standard, or process to be followed in the site-specific review for each law, authority, and factor that will require completion of a site-specific review.

N/A

CERTIFICATION

Preparer Signature: Juliet Jacobs Date: April 13, 2026
Name / Title / Organization: Juliet Jacobs, Environmental Unit Head, Community Development, NYC Mayor's Office of Management and Budget

Official Signature: J. Freeman Date: April 23, 2026
Name/ Title: Julie Freeman, Associate Director, OMB-Managed Grants, NYC Mayor's Office of Management and Budget

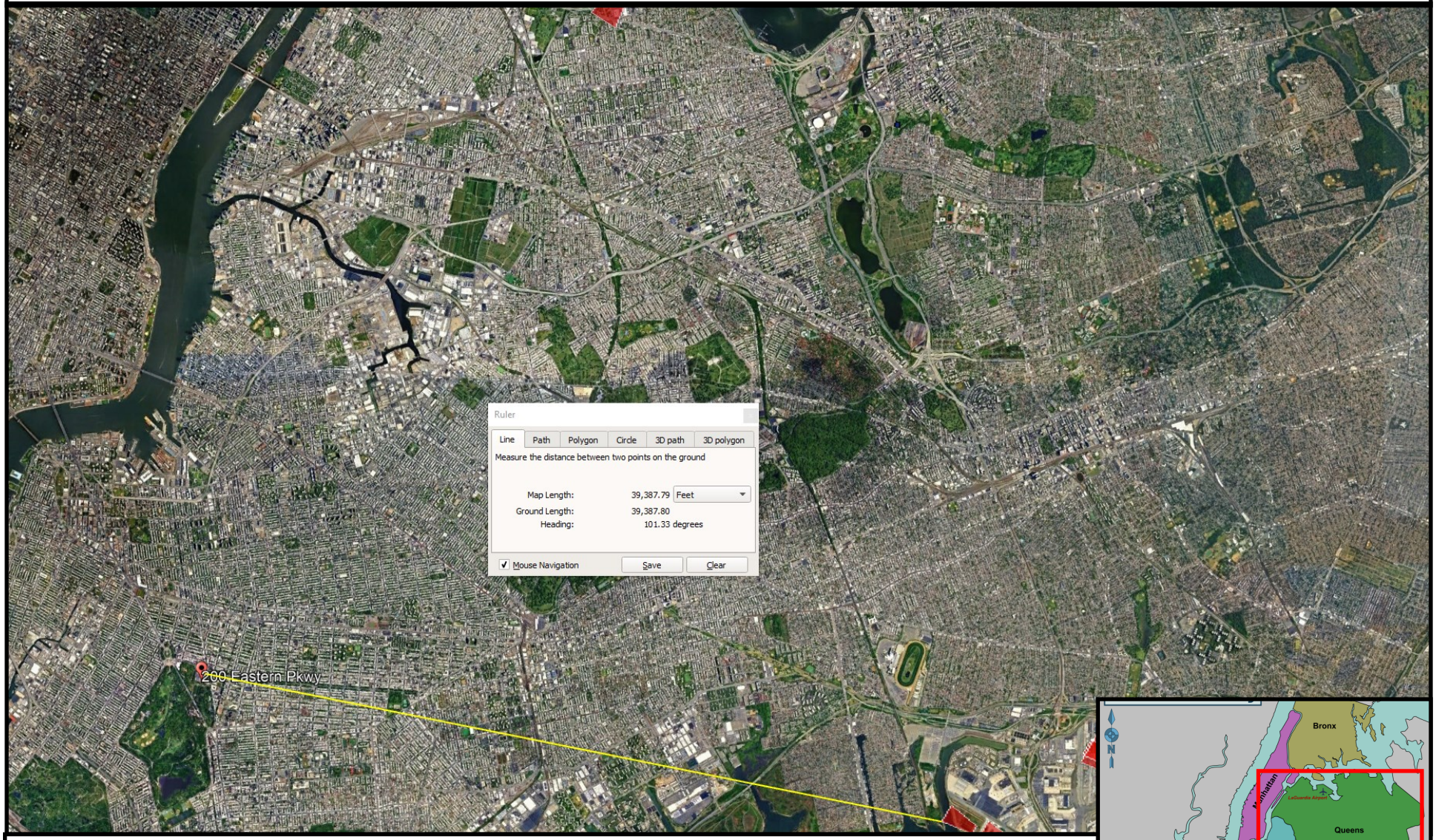
This original, signed document and related supporting material must be retained on file by the Responsible Entity in an Environmental Review Record (ERR) for the activity/project (24 CFR § 58.38) and in accordance with recordkeeping requirements for the HUD program(s).

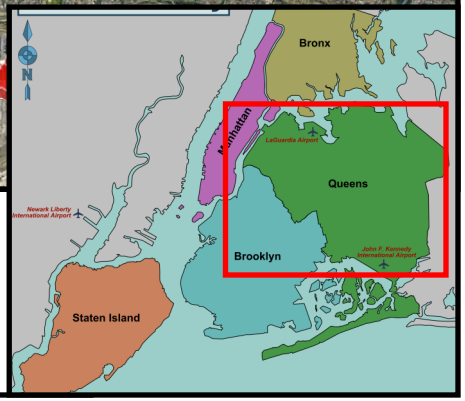
ATTACHMENTS

Attachment	Description
1	Airport Hazards Map
2	CBRS Mapper Documentation
3	Flood Hazards Document
4	Coastal Zone Map
5.1	NEPAssist EPA Facilities Map
5.2	Superfund Map
5.3	Bulk Storage Database
5.4	DECinfo Locator Map
5.5	Sites with Potential for Contamination in Proximity to Project
5.6	Radon Statement
5.7	National Register Inventory Form
6	SHPO Consultation Package
7.1	Sole Source Aquifers Map
7.2	Signed MOU
7.3	Non-Housing Project Screen
7.4	Water Wells Map
8	Wild and Scenic Rivers Statement

Brooklyn Museum - African Art Galleries

Airport Hazards Map





Legend

- Project Site
- Airport Distance
- Runway Protection Zone

N

Data source: Google Earth on 01/20/2026

U.S. Fish and Wildlife Service

Coastal Barrier Resources System Mapper Documentation

CBRS Units

Otherwise Protected Area
System Unit
CBRS Buffer Zone
-73.963376, 40.670953

0 65 130 260 390 ft

1:4,514

The pin location displayed on the map is a point selected by the user. Failure of the user to ensure that the pin location displayed on this map correctly corresponds with the user supplied address/location description below may result in an invalid federal flood insurance policy. **The U.S. Fish and Wildlife Service (Service) has not validated the pin location with respect to the user supplied address/location description below. The Service recommends that all pin locations be verified by federal agencies prior to use of this map for the provision or denial of federal funding or financial assistance** . Please note that a structure bisected by the Coastal Barrier Resources System (CBRS) boundary (i.e., both "partially in" and "partially out") is within the CBRS and therefore affected by CBRA's restrictions on federal flood insurance. A pin placed on a bisected structure must be placed on the portion of the structure within the unit (including any attached features such as a deck or stairs).

User Name: Brooklyn Museum
User Supplied Address/Location Description: 200 Eastern Parkway, Brooklyn, New York
Pin Location: Outside CBRS
Pin Flood Insurance Prohibition Date: N/A
Pin System Unit Establishment Date: N/A

The user placed pin location is not within the CBRS. The official CBRS maps are accessible at https://www.fws.gov/library/collections/official-coastal-barrier-resources-system-maps .

The CBRS information is derived directly from the CBRS web service provided by the Service. This map was exported on 7/20/2023 and does not reflect changes or amendments subsequent to this date. The CBRS boundaries on this map may become superseded by new boundaries over time.

This map image may be void if one or more of the following map elements do not appear: basemap imagery, CBRS unit labels, prohibition date labels, legend, scale bar, map creation date. For additional information about flood insurance and the CBRS, visit: https://www.fws.gov/node/263838 .

Comparison of Flood Hazard

Effective & Preliminary Flood Hazards

FEMA

Effective

Preliminary

Effective	
POI Longitude/Latitude	40.6714, -73.9637
Effective FIRM Panel	3604970212F
Effective Date	9/5/2007
Flood Zone	X
Static BFE*	Not Available
Flood Depth	Not Available
Vertical Datum	Not Available

Preliminary	
POI Longitude/Latitude	40.6714, -73.9637
Preliminary FIRM Panel	3604970212G
Preliminary Issue Date	1/30/2015
Flood Zone	X
Estimated Static BFE*	Not Available
Estimated Flood Depth	Not Available
Vertical Datum	Not Available

* A **Base Flood Elevation** is the expected elevation of flood water during the 1% annual chance storm event. Structures below the estimated water surface elevation may experience flooding during a base flood event.

Hazard Level	Flood Hazard Zone
High Flood Hazard	**AE, A, AH, AO, VE and V Zones.** Properties in these flood zones have a 1% chance of flooding each year. This represents a 26% chance of flooding over the life of a 30-year mortgage.
Moderate Flood Hazard	**Shaded Zone X.** Properties in the moderate flood risk areas also have a chance of flooding from storm events that have a less than 1% chance of occuring each year. Moderate flood risk indicates an area that may be provided flood risk reduction due to a flood control system or an area that is prone to flooding during a 0.2% annual chance storm event. These areas may have been indicated as areas of shallow flooding by your community.
	Unshaded Zone X. Properties on higher ground and away from local flooding sources have a reduced flood risk when compared to the Moderate and High Flood Risk categories. Structures in these areas may be affected by larger storm events, in excess of the 0.2% annual chance storm event.
Low Flood Hazard	**Insurance Note:** High Risk Areas are called 'Special Flood Hazard Areas' and flood insurance is mandatory for federally backed mortgage holders. Properties in Moderate and Low Flood Risk areas may purchase flood insurance at a lower-cost rate, known as Preferred Risk Policies. See your local insurance agent or visit https://www.fema.gov/national-flood-insurance-program for more information.

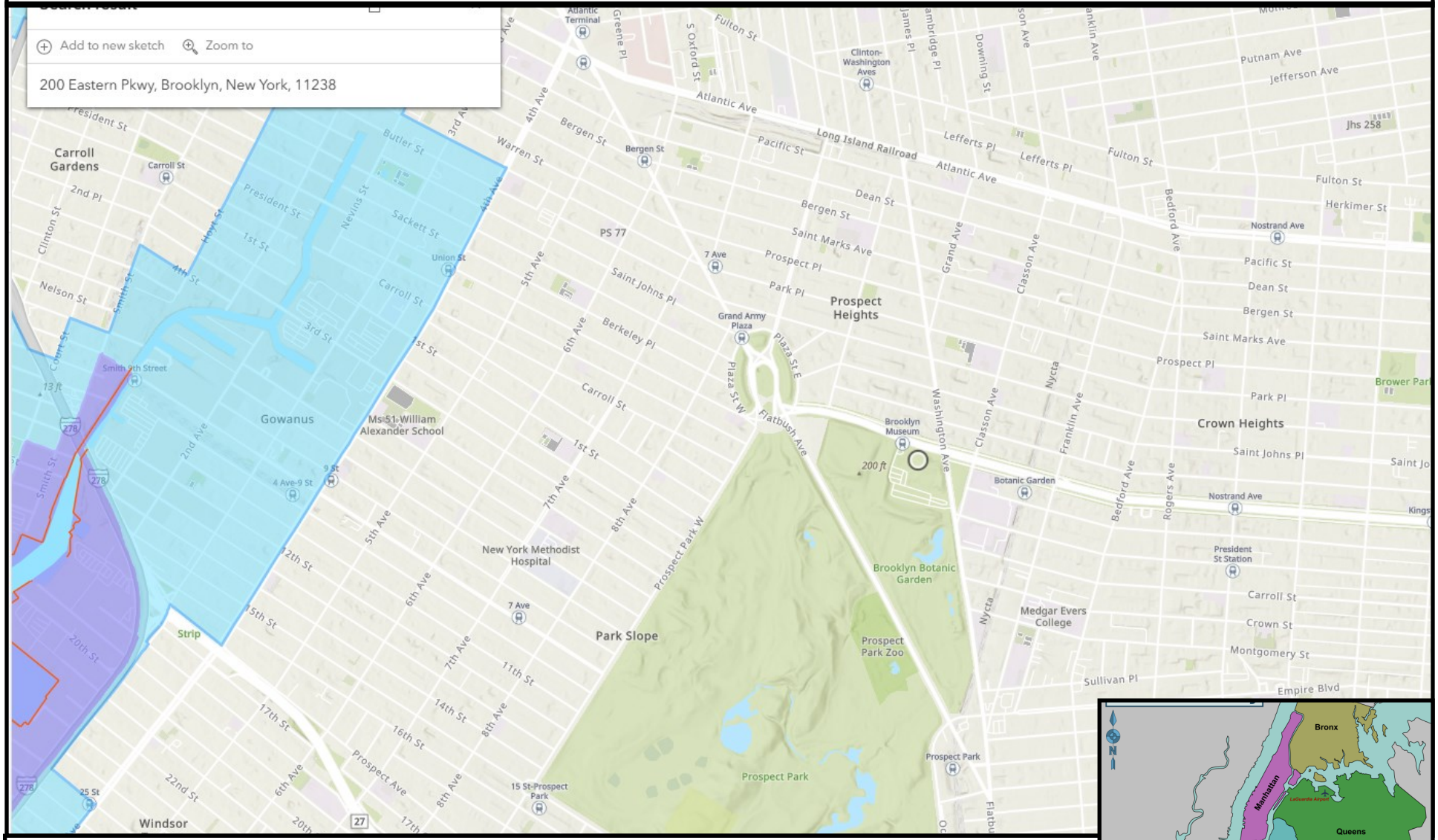
Disclaimer: *This report is for informational purposes only and is not authorized for official use. The positional accuracy may be compromised in some areas. Please contact your local floodplain administrator for more information or go to msc.fema.gov to view an official copy of the Flood Insurance Rate Maps.*

Service Layer Credits: USGS, USDA

1/20/2026 2:42 PM

Brooklyn Museum - African Art Galleries

Coastal Zone Map



Legend

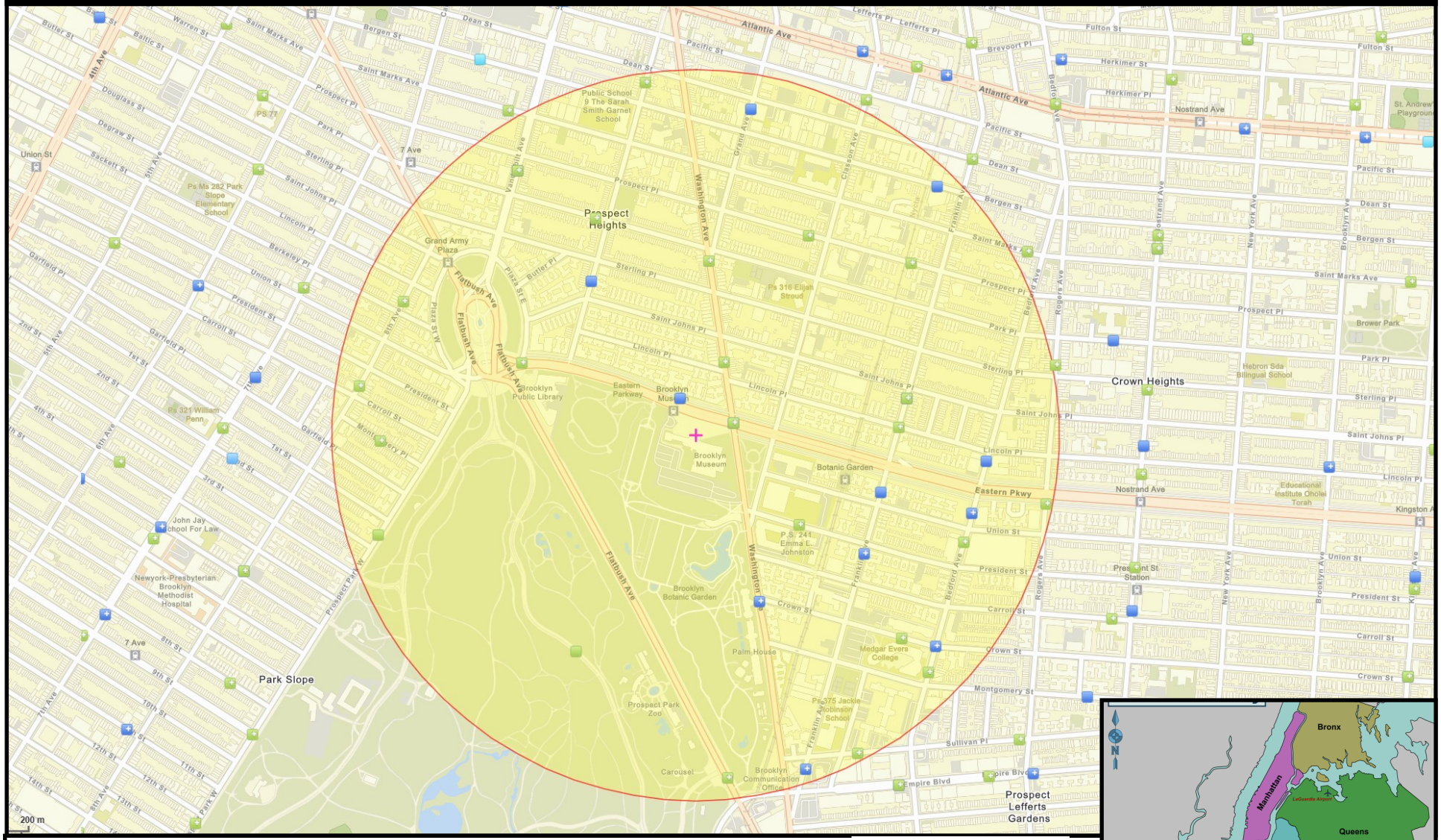
- Special Natural Waterfront Area
- Coastal Zone Boundary
- Recognized Ecological Complex
- Significant Maritime & Industrial Area
- Ecological Sensitive Maritime & Industrial Area
- Priority Marine Activity Zone

N

Data source: NYC Waterfront Revitalization Program (WRP) - Overview on 01/20/2026

Brooklyn Museum - African Art Galleries

NEPAssist EPA Facilities Map



Legend

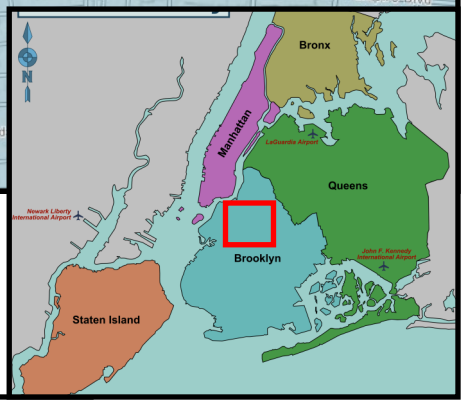
- Project Site
- 3,000 Foot Buffer
- Hazardous Waste (RCRAInfo)
- Air Pollution (ICIS-AIR)
- Water Dischargers (NPDES)
- Toxic Releases (TRI)
- Superfund (NPL & SAA)
- Brownfields (ACRES)

N

Data source: NEPAssist on 01/20/2026

Brooklyn Museum - African Art Galleries

Superfund Map



Legend

Project Site

Superfund National Priorities List (NPL) Sites with Status Information

- NPL Site
- Deleted NPL Site
- Proposed NPL Site

Data source: Superfund National Priorities List (NPL) Where You Live Map on 01/20/2026

NYS Department of Environmental Conservation
DER Environmental Remediation Databases

Facility Information from Bulk Storage Database

Facility Information

Site Number: 2-600929
Status: Active
Expiration Date: 10/07/2027
Site Type: PBS
Facility Type: Municipality (Incl. Waste Water Treatment Plants, Utilities, Swimming Pools, etc.)
Site Name: BROOKLYN MUSEUM
Address: 200 EASTERN PARKWAY
Locality: BROOKLYN
State: NY
Zipcode: 11238
County: Kings

Facility (Property) Owner(s) Information

Facility Owner: BROOKLYN INSTITUTE OF ARTS & SCIENCE DBA BROOKLYN MUSEUM
Mail Contact: BROOKLYN MUSEUM, 200 EASTERN PARKWAY, BROOKLYN, NY, 11238

Facility Operator

Facility Operator: BENJAMIN FAROUL

Tank Information

Tank No.	Tank Location	Status	Capacity (Gal.)
001	Underground including vaulted with no access for inspection	Closed - Removed	2500
001-A	Underground including vaulted with no access for inspection	In Service	2500
004	Aboveground - in contact with impervious barrier	In Service	60
03	Underground including vaulted with no access for inspection	Closed - Removed	1080
1	Underground including vaulted with no access for inspection	In Service	20000
2	Underground including vaulted with no access for inspection	In Service	20000

Refine This Search | Return To Results

DER Environmental Remediation Databases

Privacy Policy | Terms of Service

NYS Department of Environmental Conservation
DER Environmental Remediation Databases

First Previous Next Last

2 out of 6

Tank Information

Site Number: 2-600929
Site Name: BROOKLYN MUSEUM
Tank Number: 001-A
Tank Location: Underground including vaulted with no access for inspection
Subpart: 2
Category: 2
Tank Status: In Service
Tank Install Date: 04/29/2009
Tank Closed Date:
Tank Out Of Service Date:

Tank Capacity: 2500 gal.
Tank Type: 04 - Fiberglass Coated Steel
Tank Internal Protection: None
Tank External Protection: None
Tank Secondary Containment: Double-Walled (Underground)
Tank Leak Detection: Interstitial - Electronic Monitoring
Overfill: Vent Whistle
Spill Prevention: Catch Basin
Dispenser: Suction Dispenser

Pipe Location: Underground/On-ground
Pipe Type: Steel/Carbon Steel/Iron
Pipe External Protection: None

Piping Secondary Containment: Double walled UG
Piping Leak Detection: Exempt Suction Piping
UDC: No

Tank Next Test Due:
Tank Last Test: 05/14/2010
Tank Test Method: Horner EZY3/EZY3 Locator Plus

Line Next Test Due:
Line Last Test:
Line Test Method: -
Product Stored: Diesel (E-Gen)

Tank Owner Information

Company: BROOKLYN INSTITUTE OF ARTS & SCIENCE DBA BROOKLYN MUSEUM
Address: 200 EASTERN PARKWAY
Zip: 11238
City: BROOKLYN
State: NY

Class Operator Information

Class A Operator: BENJAMIN FAROUL
Class B Operator: BENJAMIN FAROUL

Refine This Search | Return To Details

NYS Department of Environmental Conservation
DER Environmental Remediation Databases

Bulk Storage Tank Details

First | Previous | Next | Last

5 out of 6

Tank Information

Site Number: 2-600929
Site Name: BROOKLYN MUSEUM
Tank Number: 1
Tank Location: Underground including vaulted with no access for inspection
Subpart: 3
Category: 1
Tank Status: In Service
Tank Install Date: 12/01/1976
Tank Closed Date:
Tank Out Of Service Date:

Tank Capacity: 20000 gal.
Tank Type: 01 - Steel/Carbon Steel/Iron
Tank Internal Protection: None
Tank External Protection: Painted/Asphalt Coating
Tank Secondary Containment: None
Tank Leak Detection: Other
Overfill: Product Level Gauge (A/G)
Spill Prevention: Other
Dispenser: Suction Dispenser

Pipe Location: Underground/On-ground
Pipe Type: Steel/Carbon Steel/Iron
Pipe External Protection: None

Piping Secondary Containment: None
Piping Leak Detection: Exempt Suction Piping
UDC: No

Tank Next Test Due: 06/14/2023
Tank Last Test: 06/14/2022
Tank Test Method: EZY 3 Locator Plus

Line Next Test Due:
Line Last Test: 06/14/2022
Line Test Method: S3
Product Stored: #2 fuel oil (on-site consumption)

Tank Owner Information

Company: BROOKLYN INSTITUTE OF ARTS & SCIENCE DBA BROOKLYN MUSEUM
Address: 200 EASTERN PARKWAY
Zip: 11238
City: BROOKLYN
State: NY

Refine This Search | Return To Details

DER Environmental Remediation Databases Privacy Policy Terms of Service

NYS Department of Environmental Conservation
DER Environmental Remediation Databases

Bulk Storage Tank Details

First | Previous | Next | Last

6 out of 6

Tank Information

Site Number: 2-600929
Site Name: BROOKLYN MUSEUM
Tank Number: 2
Tank Location: Underground including vaulted with no access for inspection
Subpart: 3
Category: 1
Tank Status: In Service
Tank Install Date: 12/01/1976
Tank Closed Date:
Tank Out Of Service Date:

Tank Capacity: 20000 gal.
Tank Type: 01 - Steel/Carbon Steel/Iron
Tank Internal Protection: None
Tank External Protection: Painted/Asphalt Coating
Tank Secondary Containment: None
Tank Leak Detection: Other
Overfill: Product Level Gauge (A/G)
Spill Prevention: Other
Dispenser: Suction Dispenser

Pipe Location: Underground/On-ground
Pipe Type: Steel/Carbon Steel/Iron
Pipe External Protection: None

Piping Secondary Containment: None
Piping Leak Detection: Exempt Suction Piping
UDC: No

Tank Next Test Due: 06/14/2023
Tank Last Test: 06/14/2022
Tank Test Method: EZY 3 Locator Plus

Line Next Test Due:
Line Last Test: 06/14/2022
Line Test Method: S3
Product Stored: #2 fuel oil (on-site consumption)

Tank Owner Information

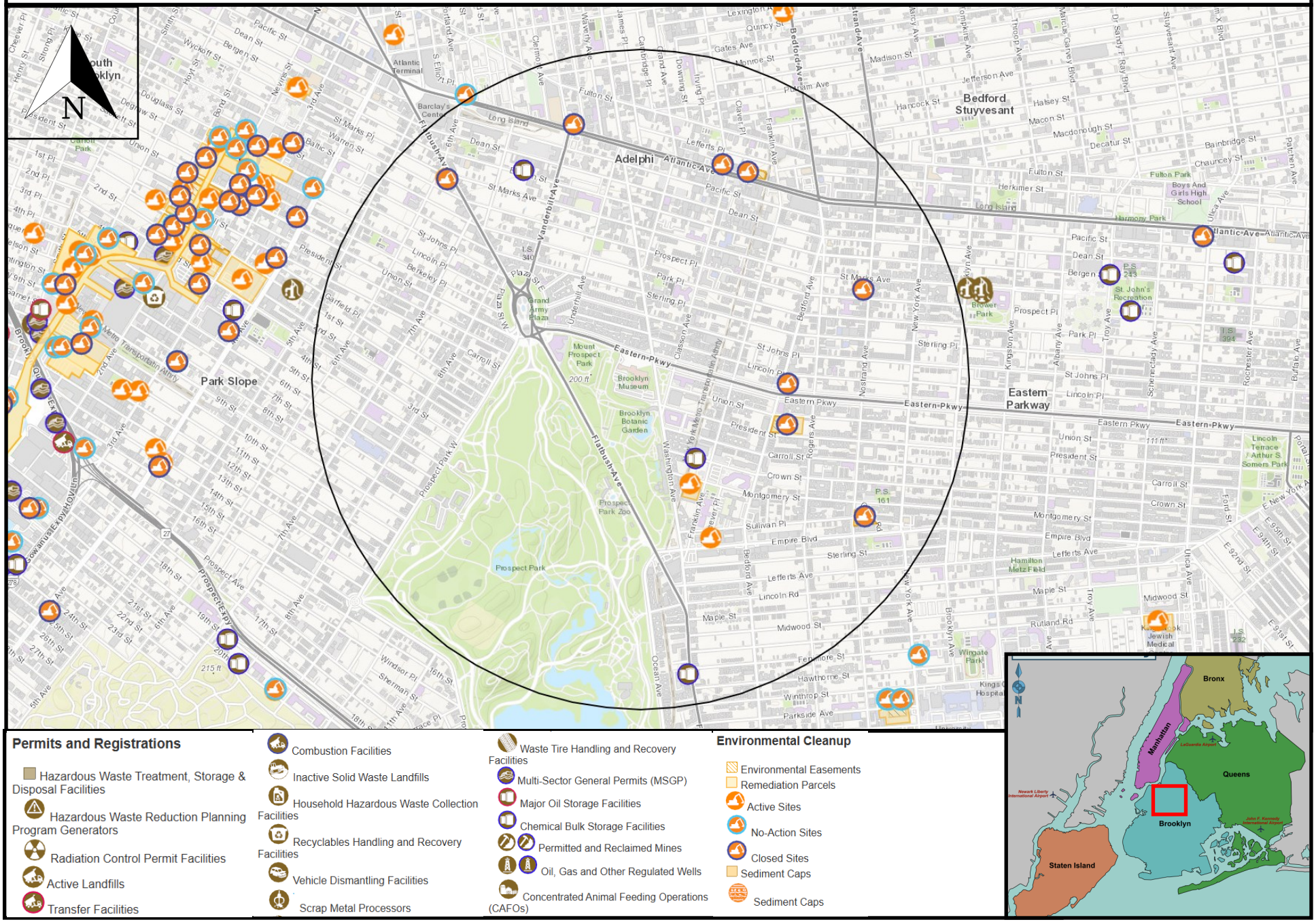
Company: BROOKLYN INSTITUTE OF ARTS & SCIENCE DBA BROOKLYN MUSEUM
Address: 200 EASTERN PARKWAY
Zip: 11238
City: BROOKLYN
State: NY

Refine This Search | Return To Details

DER Environmental Remediation Databases Privacy Policy Terms of Service

Brooklyn Museum - African Art Galleries

DECinfo Locator Map



Permits and Registrations

- Hazardous Waste Treatment, Storage & Disposal Facilities
- Hazardous Waste Reduction Planning Program Generators
- Radiation Control Permit Facilities
- Active Landfills
- Transfer Facilities
- Combustion Facilities
- Inactive Solid Waste Landfills
- Household Hazardous Waste Collection Facilities
- Recyclables Handling and Recovery Facilities
- Vehicle Dismantling Facilities
- Scrap Metal Processors
- Waste Tire Handling and Recovery Facilities
- Multi-Sector General Permits (MSGP)
- Major Oil Storage Facilities
- Chemical Bulk Storage Facilities
- Permitted and Reclaimed Mines
- Oil, Gas and Other Regulated Wells
- Concentrated Animal Feeding Operations (CAFOs)

Environmental Cleanup

- Environmental Easements
- Remediation Parcels
- Active Sites
- No-Action Sites
- Closed Sites
- Sediment Caps
- Sediment Caps

Data source: DECinfo Locator on 01/21/2026

Site Type	Site Name	Site Adress	ID Number	Unresolved Violations or Issues Identified
RCRA	BRAGLEY SHIPPING & CARRYING CASE CORP	924 BERGEN STREET, BROOKLYN, NY 11238	FRS ID: 110004467648	No
RCRA	ONE HMS CLEANERS	779 FRANKLIN AVENUE, BROOKLYN, NY 11238	FRS ID: 110002366662	No
RCRA	AMOCO-1009830306005	1525 BEDFORD AVE, BROOKLYN, NY 11216	FRS ID: 110001573075	No
RCRA	CAO TIEN CLEANERS	192 UNDERHILL AVE, BROOKLYN, NY 11238	FRS ID: 110004311593	No
RCRA	FOUR SEASON CLEANERS	381 FLATBUSH AVENUE, BROOKLYN, NY 11238	FRS ID: 110001609331	No
RCRA	VIP FRENCH CLEANERS	655 VANDERBILT AVENUE, BROOKLYN, NY 11238	FRS ID: 110004512064	No
RCRA	CAREE CLEANERS	646A VANDERBILT AVENUE, BROOKLYN, NY 11238	FRS ID: 110002361792	No
RCRA	EXXON 3-7078-1550 BEDFORD AVE	1550 BEDFORD AVENUE, BROOKLYN, NY 11225	FRS ID: 110000900703	No
RCRA	GOODY'S CLEANERS	812-A FRANKLYN AVE, BROOKLYN, NY 11225	FRS ID: 110004394931	No
RCRA	NEW GARDEN CLEANER	879 FRANKLIN AVENUE, BROOKLYN, NY 11225	FRS ID: 110004535343	No
RCRA	MEDGAR EVERS COLLEGE	1638 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110042190134	No
RCRA	BROOKLYN BOTANIC GARDENS	1000 WASHINGTON AVE, BROOKLYN, NY 11225	FRS ID: 110055616445	No
RCRA	CON EDISON - MANHOLE 4522	PLAZA ST EAST AND ST JOHNS PL, BROOKLYN, NY 11201	FRS ID: 110031432386	No
RCRA	NYCDOT MANHATTAN BRIDGE	OVER EAST RIVER, NEW YORK, NY 10000	FRS ID: 110017238032	No
RCRA	CON EDISON	SULLIVAN PL & WASHINGTON AVE, BROOKLYN, NY 11215	FRS ID: 110067686739	No
RCRA	CON EDISON	55 PROSPECT PARK W, BROOKLYN, NY 11215	FRS ID: 110067701017	No
RCRA	CON EDISON SERVICE BOX: 38743	565 1ST ST, BROOKLYN, NY 11201	FRS ID: 110060179943	No
RCRA	NYC BROOKLYN PUBLIC LIBRARY	EASTERN PKWY & FLATBUSH AVE GRAND ARMY PLZ, BROOKLYN, NY 11238	FRS ID: 110008100900	No
RCRA	CON EDISON	470 1ST ST, BROOKLYN, NY 11215	FRS ID: 110067699645	No
RCRA	CON EDISON	GARFIELD PL & FISKE PL COR OF, BROOKLYN, NY 11215	FRS ID: 110069387773	No
RCRA	CON EDISON SERVICE BOX: 38728	478 1ST ST, BROOKLYN, NY 11215	FRS ID: 110063839066	No
RCRA	CON EDISON SERVICE BOX: 38734	508 1ST ST, BROOKLYN, NY 11201	FRS ID: 110060183992	No
RCRA	CONGREGATION BETH ELOHIM	274 GARFIELD PL, BROOKLYN, NY 11215	FRS ID: 110022529575	No
RCRA	EFFECTS HOUSE THE	111 8TH AVE RM 914, NEW YORK, NY 10011	FRS ID: 110004440882	No
RCRA	INSIGNIA ESG	111 8TH AVE - BASEMENT, NEW YORK, NY 10011	FRS ID: 110004561331	No
RCRA	NEW YORK TELEPHONE CO	111 8TH AVE - 2ND FLOOR, NEW YORK, NY 10011	FRS ID: 110004505465	No
RCRA	V L G NORTH AMERICA INC	111 8TH AVE STE 500, NEW YORK, NY 10011	FRS ID: 110012235624	No
RCRA	GETTY REALTY CORP 58205	63 8TH AVE, NEW YORK, NY 10014	FRS ID: 110009462900	No
RCRA	N & C CLEANERS	53-16 8TH AVE, BROOKLYN, NY 11220	FRS ID: 110004522534	No
RCRA	SUNSET CLEANERS	44-15 8TH AVE, BROOKLYN, NY 11220	FRS ID: 110004461500	No
RCRA	K F C NATIONAL MANAGEMENT CO	1715 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110012260258	No
RCRA	MID-COUNTY MOTORS	44 EMPIRE BLVD, BROOKLYN, NY 11225	FRS ID: 110004374971	No
RCRA	VICTOR LOGAN COLLISION CORP	62 SULLIVAN PL, BROOKLYN, NY 11225	FRS ID: 110004402815	No
RCRA	IS 320	46 MCKEEVER PLACE, BROOKLYN, NY 11225	FRS ID: 110012569327	No
RCRA	NEW YORK TELEPHONE	MONTGOMERY & WASHINGTON, BROOKLYN, NY 11225	FRS ID: 110017239200	No
RCRA	GARDEN CLEANERS	96 MONTGOMERY ST, BROOKLYN, NY 11225	FRS ID: 110004421144	No
RCRA	CONGRESS CLEANERS	1685 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110004434327	No
RCRA	RITE AID #3978	1679 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110004525292	No
RCRA	1645 BEDFORD CLEANERS	1645 BEDFORD AVENUE, BROOKLYN, NY 11225	FRS ID: 110002367019	No
RCRA	NYC SANITATION	115 CROWN ST - BK-E-9, BROOKLYN, NY 11225	FRS ID: 110004421297	No
RCRA	NYCDOT BRIDGE BIN 2243230	CROWN ST OVER FRANKLIN SHUTTLE, BROOKLYN, NY 11225	FRS ID: 110007987116	No
RCRA	NYCTA - CHEMICAL LABORATORY	960 CARROLL ST, BROOKLYN, NY 11225	FRS ID: 110000808886	No
RCRA	NYCDOT BRIDGE BIN 2243210	PRESIDENT ST BRG OVER FRANKLIN, BROOKLYN, NY 11225	FRS ID: 110007987107	No
RCRA	JOE CLEANERS	832 FRANKLIN AVE, BROOKLYN, NY 11225	FRS ID: 110004435941	No
RCRA	PS 241	976 PRESIDENT STREET, BROOKLYN, NY 11225	FRS ID: 110012568514	No
RCRA	BEDFORD UNION ARMORY	1555-1579 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110004552911	No
RCRA	NYARNG OMS 40	1579 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110006518278	No
RCRA	NYC DEPT OF EDUCATION - HS 440K	883 CLASSON AVE, BROOKLYN, NY 11225	FRS ID: 110066948762	No
RCRA	CLARA BARTON VOCATIONAL HIGH SCHOOL	901 CLASSON AVENUE, BROOKLYN, NY 11225	FRS ID: 110036079016	No
RCRA	MTA NYCT - BEDFORD AVE PUMP ROOM	BEDFORD AVE & EASTERN PKWY, BROOKLYN, NY 11225	FRS ID: 110008096274	No
RCRA	NYCT - MANHOLE 108	EASTERN PARKWAY & RODGERS AVE, BROOKLYN, NY 11225	FRS ID: 110070540535	No
RCRA	MTA NYCT - FRANKLIN AVENUE STATION - 2 3 4 5 LINES	EASTERN PKWY & FRANKLIN AVE, BROOKLYN, NY 11238	FRS ID: 110008095818	No
RCRA	MTA NYCT - NOSTRAND LINE 2 5	EASTERN PKWY & FRANKLIN AVE TO FLATBUSH &, BROOKLYN, NY 11207	FRS ID: 110070126431	No
RCRA	MTA NYCT - BROOKLYN MUSEUM STATION	EASTERN PKWY & WASHINGTON AVE, BROOKLYN, NY 11238	FRS ID: 110008112620	No
RCRA	NYC DEPT OF CULTURAL AFFAIRS	200 EASTERN PKWY, BROOKLYN, NY 11238	FRS ID: 110004530357	No
RCRA	1499 BEDFORD LLC	1499 BEDFORD AVE, BROOKLYN, NY 11216	FRS ID: 110071318936	No
RCRA	GREARGYS FRENCH CLEANERS	787 WASHINGTON AVE, BROOKLYN, NY 11238	FRS ID: 110004522561	No
RCRA	CARMEN VALET CLEANERS	832 WASHINGTON AVE, BROOKLYN, NY 11238	FRS ID: 110004436334	No
RCRA	PS 316	750 CLASSON AVE, BROOKLYN, NY 11238	FRS ID: 110019709323	No
RCRA	469 STERLING PLACE LLC	469-481 STERLING PL, BROOKLYN, NY 11217	FRS ID: 110024873449	No
RCRA	CLIFTONS BEDFORD AUTO COLLISION	476 STERLING PL, BROOKLYN, NY 11238	FRS ID: 110004491274	No
RCRA	GOOD GUYS DRY CLEANERS	760 WASHINGTON AVE, BROOKLYN, NY 11238	FRS ID: 110004436110	No
RCRA	INTERFAITH MEDICAL CENTER.	555 PROSPECT PLACE (BROOKLYN JEWISH DIV), BROOKLYN, NY 11238	FRS ID: 110019770559	No
RCRA	PROSPECT LAND ACQUISITION LLC-550 PROSPECT PLACE	550 PROSPECT PL, BROOKLYN, NY 11238	FRS ID: 110070812455	No
RCRA	ROTHMAN MARTIN C/O S M ALTSCUL	584 PROPSPECT PL, BROOKLYN, NY 11238	FRS ID: 110004319327	No
RCRA	G & B AUTO COLLISION INC	773 BERGEN ST, BROOKLYN, NY 11238	FRS ID: 110004547134	No
RCRA	HOLY LAND IRON WORKS	825 BERGEN ST, BROOKLYN, NY 11238	FRS ID: 110004553956	No
RCRA	945 BERGEN STREET LLC	945 BERGEN STREET, BROOKLYN, NY 11238	FRS ID: 110031344720	No
RCRA	NYCDOT BRIDGE BIN 2243200	UNION ST OVER FRANKLIN SHUTTLE, BROOKLYN, NY 11238	FRS ID: 110007987090	No

RCRA	ONE GRAND ARMY PLAZA ASSOCIATION	1 GRAND ARMY PLZ, BROOKLYN, NY 11238	FRS ID: 110071061383	No
RCRA	MTA NYCT EMERGENCY EXIT #210	GRAND ARMY PLAZA 85 FEET W OF PLAZA ST E, BROOKLYN, NY 11238	FRS ID: 110071381000	No
RCRA	MTA NYCT - GRAND ARMY PLAZA STATION - 3,	FLATBUSH AVE & EASTERN PKWY, BROOKLYN, NY 11238	FRS ID: 110032965021	No
RCRA	NYCDEP DERTA	192 BERKELEY PL, BROOKLYN, NY 11217	FRS ID: 110070122083	No
RCRA	COLUMBIA PICTURES - NYS ARMORY	14-02 8TH AVE - 1ST FL MAIN STRUCTURE, BROOKLYN, NY 11215	FRS ID: 110009462759	No
RCRA	SIMON SAYS PRODUCTIONS	14-02 8TH AVE, BROOKLYN, NY 11215	FRS ID: 110004318765	No
RCRA	EASTERN PARKWAY CLEANERS	236 UNDERHILL AVE, BROOKLYN, NY 11238	FRS ID: 110004445583	No
RCRA	NYC DEPT OF EDUCATION - I S 340K AT K874	227 STERLING PL, BROOKLYN, NY 11238	FRS ID: 110004536574	No
RCRA	201 STERLING PLACE BRKLYN	201 STERLING PL, BROOKLYN, NY 11238	FRS ID: 110014358248	No
RCRA	NYC DEPT OF EDUCATION - PS 813K	355 PARK PL DIST OFFICE 13, BROOKLYN, NY 11238	FRS ID: 110066948717	No
RCRA	NYCDEP	333 ST MARKS AVE, BROOKLYN, NY 11238	FRS ID: 110042433426	No
RCRA	NEW YORK TELEPHONE CO	280 ST MARKS AVE, BROOKLYN, NY 11238	FRS ID: 110004479500	No
RCRA	PS 9	80 UNDERHILL AVE, BROOKLYN, NY 11238	FRS ID: 110019631184	No
RCRA	REGENCY SILVER INC	52-58 UNDERHILL AVE, BROOKLYN, NY 11238	FRS ID: 110004335461	No
ICIS-Air	BRAGLEY SHIPPING & CARRYING CASE CORP	924 BERGEN STREET, BROOKLYN, NY 11238	FRS ID: 110004467648	No
ICIS-Air	ACORN COMMUNITY H.S.	561 GRAND AVE, BROOKLYN, NY 11238	FRS ID: 110036017609	No
ICIS-Air	ONE HMS CLEANERS	779 FRANKLIN AVENUE, BROOKLYN, NY 11238	FRS ID: 110002366662	No
ICIS-Air	AMOCO-1009830306005	1525 BEDFORD AVE, BROOKLYN, NY 11216	FRS ID: 110001573075	No
ICIS-Air	CAO TIEN CLEANERS	192 UNDERHILL AVE, BROOKLYN, NY 11238	FRS ID: 110004311593	No
ICIS-Air	FOUR SEASON CLEANERS	381 FLATBUSH AVENUE, BROOKLYN, NY 11238	FRS ID: 110001609331	No
ICIS-Air	VIP FRENCH CLEANERS	655 VANDERBILT AVENUE, BROOKLYN, NY 11238	FRS ID: 110004512064	No
ICIS-Air	CAREE CLEANERS	646A VANDERBILT AVENUE, BROOKLYN, NY 11238	FRS ID: 110002361792	No
ICIS-Air	BROOKLYN MUSEUM	200 EASTERN PKWY, BROOKLYN, NY 11238	FRS ID: 110054885335	No
ICIS-Air	EXXON 3-7078-1550 BEDFORD AVE	1550 BEDFORD AVENUE, BROOKLYN, NY 11225	FRS ID: 110000900703	No
ICIS-Air	GOODY'S CLEANERS	812-A FRANKLYN AVE, BROOKLYN, NY 11225	FRS ID: 110004394931	No
ICIS-Air	NEW GARDEN CLEANER	879 FRANKLIN AVENUE, BROOKLYN, NY 11225	FRS ID: 110004535343	No
ICIS-Air	991 CARROLL ST BUILDING	991 CARROLL ST BUILDING	FRS ID: 110043220608	No
ICIS-Air	MEDGAR EVERS COLLEGE	1638 BEDFORD AVE, BROOKLYN, NY 11225	FRS ID: 110042190134	No
ICIS-Air	49 CROWN STREET BUILDING	49 CROWN STREET, BROOKLYN, NY 11225	FRS ID: 110001613031	No
ICIS-Air	BROOKLYN BOTANIC GARDENS	1000 WASHINGTON AVE, BROOKLYN, NY 11225	FRS ID: 110055616445	No
ICIS-Air	MORRIS J GOLOMBECK-960 FRANKLIN AVE	960 FRANKLIN AVENUE, BROOKLYN, NY 11225	FRS ID: 110010285789	No
ICIS-Air	R. V. G. AUTO CENTER	1028 FRANKLIN AVE, BROOKLYN, NY 11225	FRS ID: 110043635894	No
ICIS-Air	TURNER TOWERS	135 EASTERN PARKWAY, BROOKLYN, NY 11238	FRS ID: 110040726907	No
NYS DEC	BOAR'S HEAD PROVISIONS CO.	632 FLATBUSH AVE	2-000067	No
NYS DEC	73 - 99 Empire Boulevard	73 - 99 Empire Boulevard	C224343	Yes
NYS DEC	Consumers Park Brewery Site	122A, 124, 130 Montgomery Street	C224381	Yes
NYS DEC	CENTRAL LAUNDRY CORP.-SEACREST DIV.	46 CROWN STREET	2-000158	No
NYS DEC	702 Nostrand Avenue - Off-site	702 Nostrand Avenue	C224270A	Yes
NYS DEC	Atlantic Brooklyn Project	1045-1065 Atlantic Avenue	C224305	Yes
NYS DEC	ULANO CORP.	601 BERGEN STREET	2-000123	No
NYS DEC	Cinderella 248 LLC - Off-site	248 Flatbush Avenue	C224160A	Yes

The City of New York
Office of Management and Budget
255 Greenwich Street • New York, New York 10007-2146

NYC Office of Management and Budget
Environmental Review Statement on Radon – 2026

In January 2024, HUD's Office of Community Planning and Development (CPD) issued Notice CPD-23-103, which notified grantees that radon must be considered in the contamination analysis for reviews conducted under 24 CFR Part 58. The requirements went into effect in April of 2024.

HUD's notice provided a brief explanation of the risks posed by radon, which is a radioactive gas that can lead to lung cancer, and ways grantees can demonstrate compliance with HUD's policy or mitigate the negative effects of radon exposure. Per CPD-23-103, Responsible Entities (RE) must consider radon for projects that:

- Require an environmental review at the level of Categorically Excluded Subject To ("CEST"), Environmental Assessment, or Environmental Impact Statement; and
- Involve structures that are occupied or are intended to be occupied at least four (4) hours a day.

However, the notice exempts buildings meeting the following criteria from further review:

- Buildings/facilities with no enclosed areas having ground contact.
    - Buildings containing crawlspaces, utility tunnels, or parking garages would *not* be exempt, however buildings built on piers would be exempt, provided that there is open air between the lowest floor of the building and the ground.
- Buildings that are not residential *and* will not be occupied for more than 4 hours per day.
- Buildings with existing radon mitigation systems, in which case the City must document radon levels are below 4 pCi/L8 with test results dated within two years of the date the environmental review is certified.[1]

For projects subject to the radon requirements that do not meet one of the exemptions identified above, the City's CDBG programs document compliance using the "Scientific Review Method" identified in the notice. Specifically, the City reviews radon testing data from the Centers for Disease Control and Prevention's (CDC) Environmental Public Health Tracking Network map[2], which shows radon testing data on a county level. If both of the following criteria are met for the county in which the project is located, no further analysis or actions are needed:

- least 10 tests have been conducted over the most recently reported 10 years; **and**
- The average of the tests over that time is **below** 4 pCi/L.

[1] *The exemptions listed are those most applicable to the City's CDBG programs based on past usage. For a fuller understanding of exemptions, considerations, and effects of radon, please consult the HUD notice and the HUD Exchange at https://www.hudexchange.info/programs/environmental-review/site-contamination/.*

[2] https://ephtracking.cdc.gov/DataExplorer/

Radon Policy Statement for Calendar Years 2026

The NYC Mayor's Office of Management and Budget (OMB) has assessed the potential for radon contamination using a scientific data review. Specifically, OMB reviewed data from the Centers for Disease Control and Prevention (CDC) Environmental Public Health Tracking Network, which collates lab testing results from within New York State on a county-by-county basis.

The included chart shows data reported for counties within New York City between 2008 and 2017, the most recent 10-year period for which data are available.

County	# of Tests Conducted	Mean Pre-mitigation Radon Measurement in Tested Buildings	Further Assessment Necessary?
Bronx	132	1.0 pCi/L	No
Kings County (Brooklyn)	489	1.4 pCi/L	No
New York County (Manhattan)	498	1.5 pCi/L	No
Queens County	320	2.3 pCi/L	No
Richmond County (Staten Island)	231	1.8 pCi/L	No

As measurements for all New York City counties are below the EPA's recommended action level of 4 pCi/L, mitigation for radon is not required and further assessment of radon is not necessary.

The City will reflect this information into the Contamination and Toxic Substances factor in HEROS (or in an EA or EIS review if applicable) to demonstrate compliance with 24 CFR 58.5(i).

Form No. 10-300 (Rev. 10-74)

OFFICE COPY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC: The Brooklyn Museum

AND/OR COMMON: The Brooklyn Museum

2 LOCATION

STREET & NUMBER: Eastern Parkway, Southwest of / intersection with Washington Avenue — NOT FOR PUBLICATION

CITY, TOWN: Brooklyn — VICINITY OF — CONGRESSIONAL DISTRICT: ~~16th~~ 12th - Elizabeth Holtzman

STATE: New York — CODE: 36 — COUNTY: Kings — CODE: 047

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
_DISTRICT	_PUBLIC	X_OCCUPIED	_AGRICULTURE	X_MUSEUM
X_BUILDING(S)	X_PRIVATE	_UNOCCUPIED	_COMMERCIAL	_PARK
_STRUCTURE	_BOTH	_WORK IN PROGRESS	_EDUCATIONAL	_PRIVATE RESIDENCE
_SITE	PUBLIC ACQUISITION	ACCESSIBLE	_ENTERTAINMENT	_RELIGIOUS
_OBJECT	_IN PROCESS	X_YES: RESTRICTED	_GOVERNMENT	_SCIENTIFIC
	_BEING CONSIDERED	_YES: UNRESTRICTED	_INDUSTRIAL	_TRANSPORTATION
		_NO	_MILITARY	_OTHER

4 OWNER OF PROPERTY

NAME: Brooklyn Institute of Arts and Sciences

STREET & NUMBER: Eastern Parkway and Washington Avenue

CITY, TOWN: Brooklyn — VICINITY OF — STATE: New York 1228

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC: City Register's Office

STREET & NUMBER: Municipal Building

CITY, TOWN: Brooklyn — STATE: New York

6 REPRESENTATION IN EXISTING SURVEYS

TITLE: New York City Landmarks Preservation Commission, LP-0155

DATE: March 15, 1966 — _FEDERAL _STATE _COUNTY XLOCAL

DEPOSITORY FOR SURVEY RECORDS: NYC Landmarks Preservation Commission

CITY, TOWN: New York — STATE: New York

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
X EXCELLENT	__DETERIORATED	__UNALTERED	X ORIGINAL SITE
__GOOD	__RUINS	X__ALTERED	__MOVED DATE_____
__FAIR	__UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Brooklyn Museum stands on the south side of Eastern Parkway northeast of the Brooklyn Botanical Gardens, at the north end of Prospect Park. Grand Army Plaza and the Park Slope residential district are located west of the museum, and the Botanical Garden is adjacent on the south.

The museum's architects originally conceived of the building as an immense square divided into four quadrants with four inner courts surrounded by galleries. Of this plan only the north side and the northeast quadrant have been constructed, forming an L-shaped structure which occupies four and a half acres. Constructed of Indiana Limestone, the building is 510' in length, and stands four and a half stories in height.

The main portion of the neo-classical structure is the north side, along Eastern Parkway. The long horizontal mass of this facade is balanced by projecting pavillions located in the center and at the ends of the facade. The central pavillion constitutes the dominant feature of the composition because of its greater projection, the dome which rises above it, and its Ionic hexastyle portico. The portico's pediment is decorated by elaborate architectural elements including sculptured figures in the tympanum, and the shell and anthemion cresting. The end pavillions project less prominently from the main wall plane, and rise only a little higher than the walls of the basic horizontal mass. A pair of engaged Ionic columns mark these pavillions. The bays which intervene between the pavillions are articulated by pilasters which rise from the structure's raised basement to a full classical entablature. The walls extend above the entablature and are decorated by cresting and by twenty heroic-sized sculptured figures which stand on low pedestal blocks above each pilaster and engaged columns. Simple classical architraves surround each window. The sculpture which ornaments the facade and the names carved in the frieze represent aspects of knowledge.

The east elevation consists of seven bays and a corner pavillion. The wall treatment repeats the architectural motifs of the east elevation except that low pilasters were substituted for statuary above the cornice of the main wall.

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

The Brooklyn Museum, Brooklyn, Kings County

Deviating from the original scheme, the rear (south side) of the building was finished off with plain masonry walls pierced by a few windows. The interior of the building contains numerous galleries, but only one of the four courts envisioned in the original scheme. Known as the auditorium Court, this room is an interpretation of the small cloister at the Church of Santa Maria della Pace (1504) in Rome.

The only significant alteration of the main facade was the removal in 1937 of the portico stairway by the Works Progress Administration. The scuptured figures at the front entrance, installed in 1963, were carved in 1916 by Daniel Chester French for the entrance to the Manhattan Bridge. The firm of Brown, Lawford and Forbes added a projection at the rear of the structure to accomodate a stairwell and an entrance from the parking lot. A new addition to the rear has been planned by the firm of Prentice, Chan, and Ohlhausen. Within the museum, installation of additional gallery space has at least partially concealed the colonnades which separated the central rotunda from the galleries which lay to the east and west.

8 SIGNIFICANCE

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
__PREHISTORIC	__ARCHEOLOGY-PREHISTORIC	__COMMUNITY PLANNING	__LANDSCAPE ARCHITECTURE	__RELIGION	
__1400-1499	__ARCHEOLOGY-HISTORIC	__CONSERVATION	__LAW	__SCIENCE	
00-1599	__AGRICULTURE	__ECONOMICS	__LITERATURE	X SCULPTURE	
__1600-1699	X ARCHITECTURE	__EDUCATION	__MILITARY	__SOCIAL/HUMANITARIAN	
__1700-1799	__ART	__ENGINEERING	__MUSIC	__THEATER	
X1800-1899	__COMMERCE	__EXPLORATION/SETTLEMENT	__PHILOSOPHY	__TRANSPORTATION	
X1900-	__COMMUNICATIONS	__INDUSTRY	__POLITICS/GOVERNMENT	__OTHER (SPECIFY)	
		__INVENTION			

SPECIFIC DATES 1893 design
1895-1906 construction

BUILDER/ARCHITECT McKim, Mead, and White

STATEMENT OF SIGNIFICANCE

The Brooklyn Museum, significant architecturally as an example of the American neo-classical style and historically as an important cultural institution, was built between 1895 and 1906 according to the design of McKim, Mead, and White. Although only a portion of the grandiose architectural scheme originally conceived by the architects, the museum building is an expression of the civic pride and cultural sophistication of Brooklyn at the turn of the century. The museum's architectural significance is enhanced by exterior statuary and sculptural decoration by Daniel Chester French.

In 1823 one hundred residents of the community of Brooklyn formed the Apprentice's Library which, although short-lived, was reorganized in 1843 as the Brooklyn Institute. Formed for the purpose of "enlarging the knowledge in literature, science and art," the organization received a large endowment from Augustus Graham, a wealthy Brooklyn distiller.

The community which the Institute served grew into a significant urban center during the second half of the nineteenth century, particularly after the opening of the Brooklyn Bridge in 1883. An influx of wealthy merchants and professionals heightened the cultural aspirations of the community and expanded the needs of the Institute. In 1890 the organization founded the Brooklyn Institute of Arts and Sciences, and three years later a grandiose architectural scheme for a new museum facility was devised for the Instiure by the architectural firm of McKim, Mead, and White.

Financed by the City of Brooklyn and subsequently the City of New York, construction began in 1895 at the northern most end of Prospect Park. The west wing was completed in 1897, the central pavillion in 1904, and the east wing in 1906. The immense square edifice conceived by the architects was never completed. The structure which did result however constitutes the completed north or street side of the design and is in itself a significant architectural achievement. Monumental in scale, the museum building is an articulate American expression of neo-classical design of the late

nineteenth century. It is an excellent example of McKim, Mead, and White's work in this style.

With the construction of the limestone facility on Eastern Parkway, the Institute began redirecting its efforts away from a generalist educational institution toward a museum specializing in the fine arts. This change was completed during the 1930's. Continuing to serve the cultural needs of Brooklyn, the Institute today uses its structure to house its offices, to exhibit its well regarded collections, and to present a variety of educational, theatrical, and musical programs. A significant contribution to the visual environment, the Brooklyn Museum is an important part of Brooklyn's physical and cultural identity.

9 MAJOR BIBLIOGRAPHICAL REFERENCES

See continuation sheet.

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY 5 acres

UTM REFERENCES

	ZONE	EASTING	NORTHING
A	18	587520	4510,248,0
B			
C			
D			

VERBAL BOUNDARY DESCRIPTION

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

with information supplied by: Betty Esequelle
NYC Landmarks Preservation Commission
305 Broadway, New York, New York

NAME / TITLE
Elizabeth K. Ralph /

ORGANIZATION
NYS Office of Parks & Recreation
Division for Historic Preservation

DATE
August, 1976

STREET & NUMBER
Agency Bldg. #1, Empire State Plaza

TELEPHONE
518-474-0479

CITY OR TOWN
Albany,

STATE
New York

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL ___ STATE ___ LOCAL XXX

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE

TITLE Deputy Commissioner for Historic Preservation

DATE 11/29/76

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST:

DATE

KEEPER OF THE NATIONAL REGISTER

GPO 892-453

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

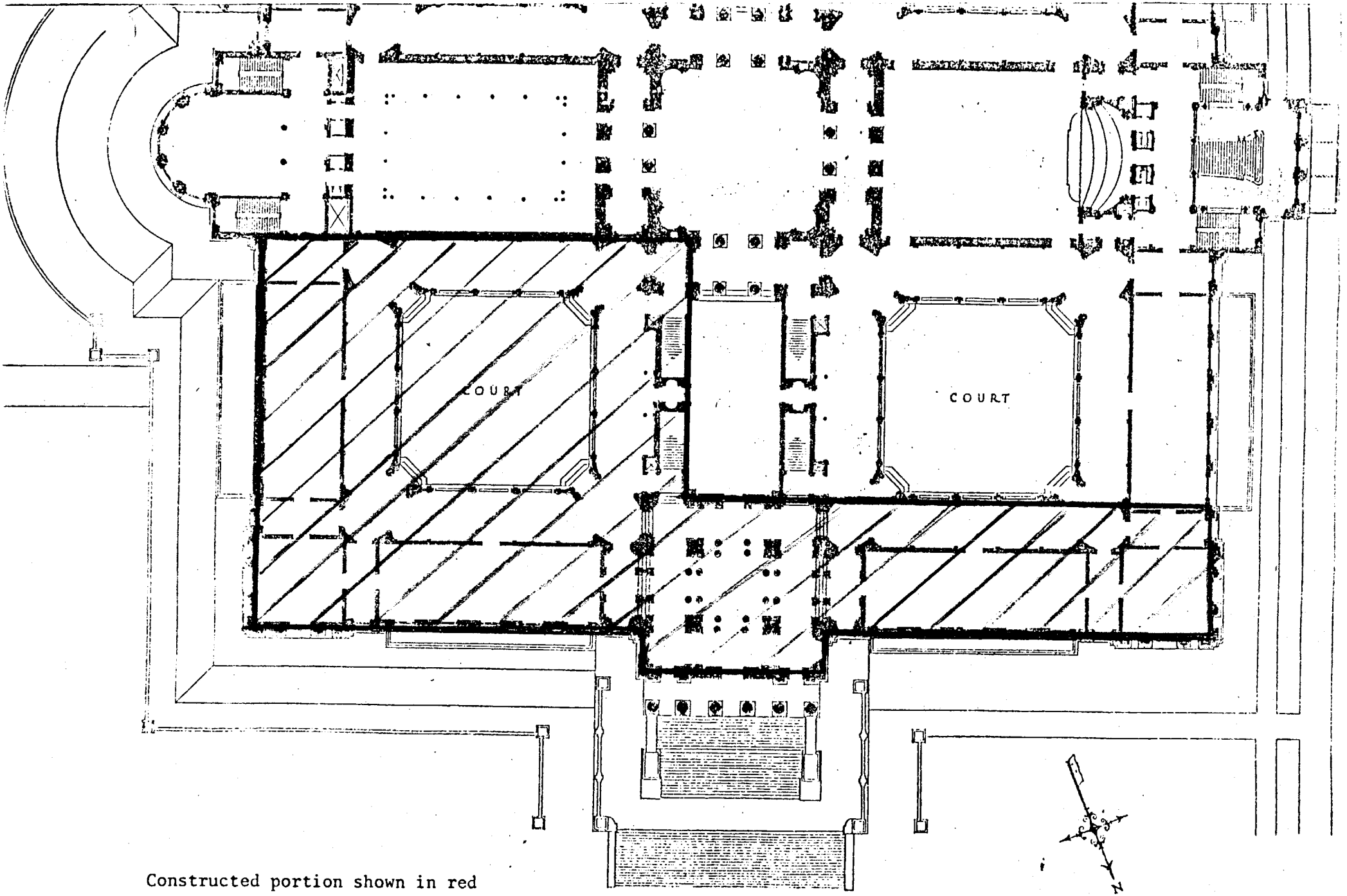
FOR NPS USE ONLY
RECEIVED
DATE ENTERED

The Brooklyn Museum, Brooklyn, Kings County

Brooklyn Museum. The Brooklyn Museum Handbook. Brooklyn: Brooklyn Museum, 1967.

Goldstone, Harmon H. and Martha Dalrymple. History Preserved: A Guide to New York City Landmarks and Historic Districts. New York: Simon and Schuster, 1974.

New York City Landmarks Preservation Commission. Designation Report. March 15, 1966.



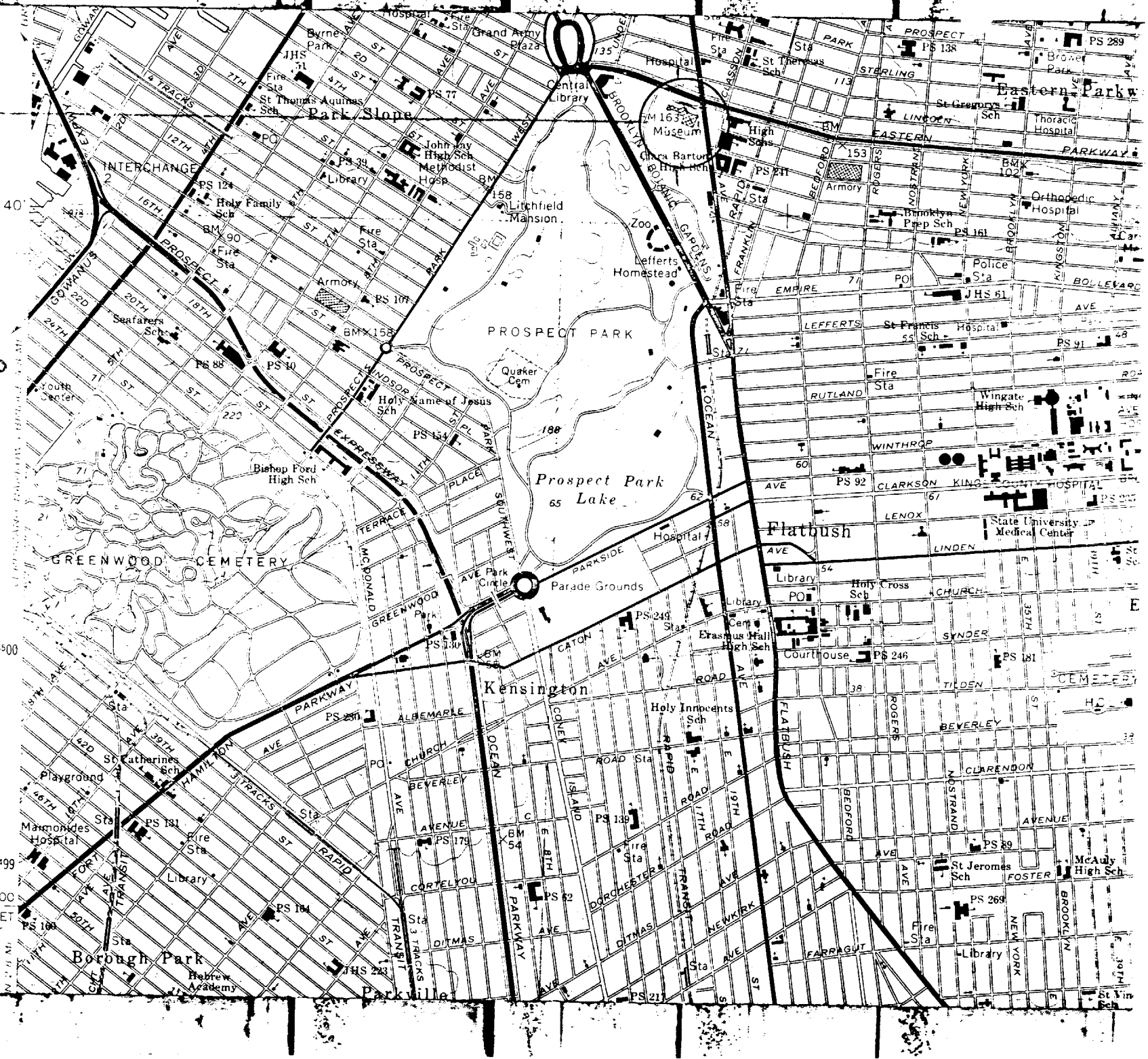
Constructed portion shown in red

THE BROOKLYN MUSEUM
KINGS CO., N.Y.

Brooklyn Quad

Brooklyn Museum
Brooklyn Kings Co

Easting 5/87/520
Northing 45/02/48



New York State
Parks, Recreation and
Historic Preservation

KATHY HOCHUL
Governor
KATHY MOSER
Acting Commissioner

January 14, 2026

Elizabeth Venditto
Brooklyn Museum
200 Eastern Parkway
Brooklyn, NY 11238

Re: HUD
BMA - Brooklyn Museum - African Art Gallery Renovations
200 Eastern Pkwy, Brooklyn, NY 11238
23PR04943
HUD Grant Number B-22-CP-NY-0647

Dear Elizabeth Venditto:

Thank you for continuing to consult with the New York State Historic Preservation Office (SHPO). We have reviewed the provided documentation in accordance with Section 106 of the National Historic Preservation Act of 1966. These comments are those of the SHPO and relate only to Historic/Cultural resources. They do not include other environmental impacts to New York State Parkland that may be involved in or near your project.

We have reviewed the design drawings and specifications dated October 17, 2025. Based on that review, it is SHPO's opinion that the proposed African Arts Gallery Renovations, as described, will continue to have No Adverse Effect on historic or archeological resources.

If you have any questions, you can call or e-mail me at the contact information below.

Sincerely,

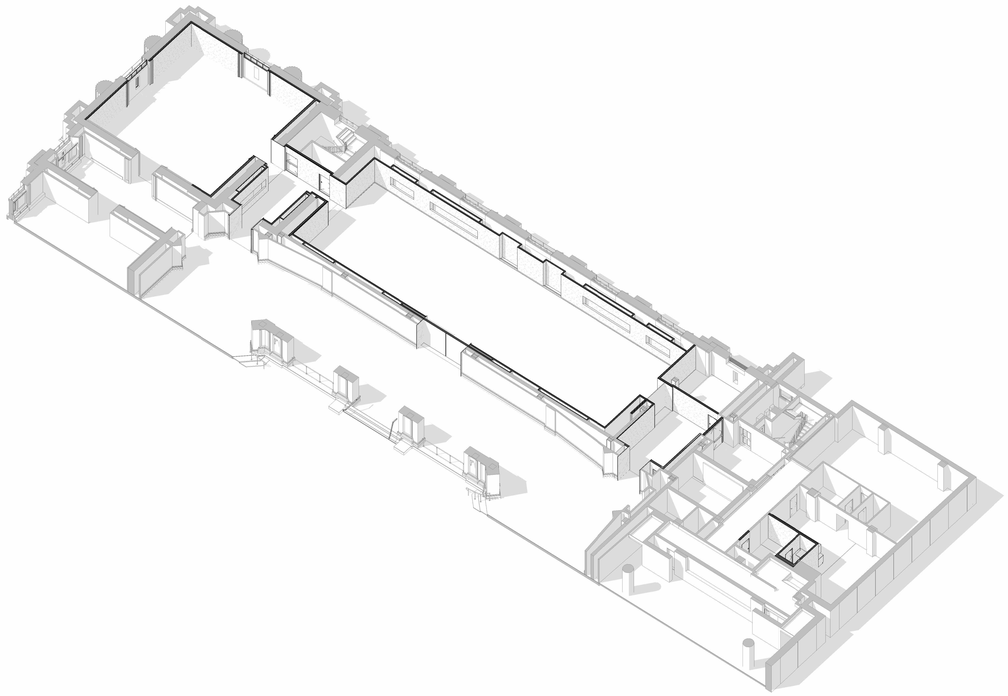
Sara McIvor
Historic Site Restoration Coordinator
518-268-2127 | sara.mcivor@parks.ny.gov

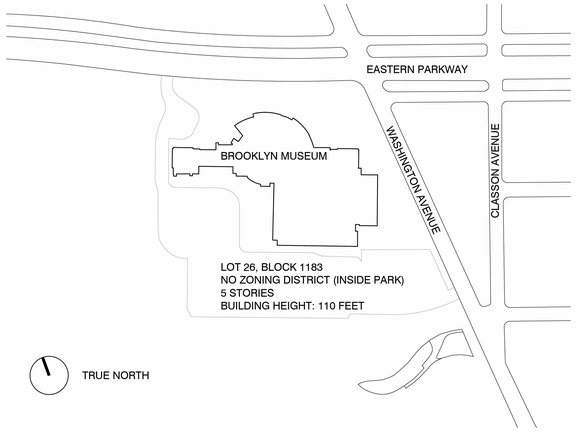
Cc: K. Kurtz – Brooklyn Museum
M. Halper – Brooklyn Museum

ARTS OF AFRICA

163A

200 Eastern Parkway,
Brooklyn, NY 11238





1 G000 SITE KEY PLAN
1/2" = 1'-0"

AOA DRAWING LIST

SHEET NUMBER	SHEET NAME
G001	GENERAL NOTES
G002	ABBREVIATIONS, LEGENDS, SYMBOLS
G003	ADA/ANSI ACCESSIBILITY DIAGRAMS, NOTES AND TYP MOUNTING HEIGHTS
AD101	BASEMENT DEMO PLAN
AD102	FIRST AND SECOND FLOOR DEMO PLAN
AD103	THIRD FLOOR & THIRD FLOOR MEZZ DEMO PLANS
A001	KEY PLANS
A002	KEY PLANS
A101	BASEMENT FLOOR PLAN
A102	FIRST AND SECOND FLOOR PLANS
A103	THIRD FLOOR & THIRD FLOOR MEZZ PLANS
A111	FINISH FLOOR PLANS - THIRD FLOOR WING F
A112	FINISH FLOOR PLANS - THIRD FLOOR WING E AND HYPHENS
A113	FINISH FLOOR PLANS - THIRD FLOOR GREEN ROOM AND BAC
A121	BASEMENT RCP
A122	FIRST & SECOND FLOOR RCPS
A123	THIRD FLOOR & THIRD FLOOR MEZZ RCPS
A201	BUILDING ELEVATIONS
A301	BUILDING SECTIONS
A311	ENLARGED SECTIONS - WING F
A312	ENLARGED SECTIONS - WING E AND HYPHENS
A401	ENLARGED INTERIOR ELEVATIONS
A402	ENLARGED INTERIOR ELEVATIONS
A403	ENLARGED INTERIOR ELEVATIONS
A404	ENLARGED INTERIOR ELEVATIONS
A601	PLAN DETAILS - WING F
A602	PLAN DETAILS - WING E & HYPHEN E-F
A603	PLAN DETAILS - HYPHEN F-H
A611	SECTION DETAILS - WING F
A612	SECTION DETAILS - WING F
A613	SECTION DETAILS - HYPHEN E-F
A614	SECTION DETAILS - HYPHEN F-H
A615	SECTION DETAILS - WING E
A616	SECTION DETAILS - WING E
A617	SECTION DETAILS - MILLWORK
A618	TYPICAL FLOORING DETAILS
A701	WINDOW SCHEDULE & TYPES
A702	DOOR SCHEDULE & TYPES
A703	WALL TYPES
A704	SCHEDULES
A801	SCHEMATIC RENDERINGS
AD201	ENLARGED INTERIOR DEMO ELEVATIONS - WING E
S001	GENERAL STRUCTURAL NOTES, LEGENDS AND ABBREVIATIONS
S103	THIRD FLOOR AND THIRD FLOOR MEZZANINE FRAMING PLAN - WINGS E AND F
S501	TYPICAL DETAILS
S502	TYPICAL DETAILS
S503	TYPICAL DETAILS
M001	COVER SHEET - MECHANICAL
M002	SYMBOLS, ABBREVIATIONS AND NOTES - MECHANICAL
M003	FLOW AND CONTROLS DIAGRAMS - MECHANICAL
M200	BASEMENT FLOOR PLAN - MECHANICAL
M201	FIRST AND SECOND FLOOR PLANS - MECHANICAL
M202	THIRD FLOOR AND THIRD FLOOR MEZZ PLANS - MECHANICAL
M300	PART PLANS - MECHANICAL
M500	SCHEDULES - MECHANICAL
M600	DETAILS - MECHANICAL
M601	DETAILS - MECHANICAL
MD100	BASEMENT FLOOR DEMOLITION PLANS - MECHANICAL
MD101	THIRD FLOOR AND THIRD FLOOR MEZZ DEMO PLANS - MECHANICAL
E001	COVER SHEET - ELECTRICAL
E002	COVER SHEET - ELECTRICAL
E102	THIRD FLOOR & THIRD FLOOR MEZZ DEMO PLANS - ELECTRICAL
E200	BASEMENT FLOOR PLAN - ELECTRICAL
E201	FIRST AND SECOND FLOOR PLANS - ELECTRICAL
E202	THIRD FLOOR & THIRD FLOOR MEZZ PLANS - ELECTRICAL
E302	THIRD FLOOR & THIRD FLOOR MEZZ CEILING PLAN - LIGHTING
E400	EXISTING RISER DIAGRAM - ELECTRICAL
E401	NEW RISER DIAGRAM - ELECTRICAL
E500	SCHEDULES - ELECTRICAL
E600	DETAILS - ELECTRICAL
FA001	COVER SHEET - FIRE ALARM
FA202	THIRD FLOOR AND THIRD FLOOR MEZZ PLANS - FIRE ALARM
FA400	RISER DIAGRAM - FIRE ALARM
PL001	COVER SHEET - PLUMBING
PL102	EXISTING SECOND FLOOR PLAN - PLUMBING
PL103	THIRD FLOOR DEMO PLANS - PLUMBING
PL201	SECOND FLOOR PLAN - PLUMBING
PL202	THIRD FLOOR PLAN - PLUMBING
PL300	PART PLANS AND RISER DIAGRAMS - PLUMBING
PL500	SCHEDULES - PLUMBING
PL600	DETAILS - PLUMBING
FP001	COVER SHEET - SPRINKLER
FP103	THIRD FLOOR DEMO PLAN - SPRINKLER
FP202	THIRD FLOOR PLAN - SPRINKLER
FP400	EXISTING FIRE STANDPIPE RISER DIAGRAM - SPRINKLER
FP401	NEW FIRE STANDPIPE RISER DIAGRAM - SPRINKLER
FP402	EXISTING SPRINKLER RISER DIAGRAM - SPRINKLER
FP403	NEW SPRINKLER RISER DIAGRAM - SPRINKLER
FP500	SCHEDULES AND DETAILS - SPRINKLER
TN001	COVER SHEET - IT
TN002	SYMBOL LIST - IT
TN202	THIRD FLOOR PLAN - IT
TN302	THIRD FLOOR AND THIRD FLOOR MEZZ CEILING PLANS - IT
TN400	PARTIAL PLANS - IT
TND103	THIRD FLOOR DEMO PLAN - IT

AOA DRAWING LIST

SHEET NUMBER	SHEET NAME
TY001	COVER SHEET - SECURITY
TYD103	THIRD FLOOR DEMO PLAN - SECURITY
TYD202	THIRD FLOOR PLAN - SECURITY
AV001	GENERAL NOTES - AUDIOVISUAL
AV010	KEY PLAN - AUDIOVISUAL
AV201	THIRD FLOOR PART PLAN - AUDIOVISUAL
AV202	THIRD FLOOR PART RCP - AUDIOVISUAL
AV301	THIRD FLOOR ENLARGED PLAN - AUDIOVISUAL

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

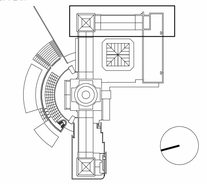
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

COVER SHEET

SCALE	1/2" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

G000

10/17/2025 8:40:49 PM

RESTORATION NOTES

1. THE HISTORICAL AND ARCHITECTURAL SIGNIFICANCE OF THE BUILDING REQUIRE PARTICULAR CARE WHEN INTERVENING WITH EXISTING FABRIC TO ENSURE RESTORATION WORK AND THE CONSTRUCTION OF NEW INTERVENTIONS ARE OF APPROPRIATE QUALITY AND UNDERTAKEN WITH APPROPRIATE CARE FOR THE HISTORIC FABRIC. ALL WORK IS TO COMPLY WITH THE SECRETARY OF THE INTERIOR'S STANDARDS FOR THE TREATMENT OF HISTORIC PROPERTIES.

2. SUBMIT HISTORICAL TREATMENT PROGRAM COMPRISING A WRITTEN PLAN FOR EACH PHASE OR PROCESS, INCLUDING PROTECTION OF SURROUNDING MATERIALS DURING OPERATIONS AND TREATMENT OF HISTORIC FABRIC TO REMAIN. DESCRIBE IN DETAIL MATERIALS, METHODS, AND EQUIPMENT TO BE USED FOR EACH PHASE OF WORK.

3. ALL WORK ON HISTORIC FABRIC TO REMAIN AND HISTORIC FABRIC TO BE REMOVED AND REPLICATED IS TO BE COMPLETED BY ARCHITECT-APPROVED HISTORIC TREATMENT SPECIALISTS. HISTORIC FABRIC INCLUDES BUT IS NOT LIMITED TO:
A. STONE MOSAIC FLOOR BORDER
B. CEMENTITIOUS TERRAZZO FLOOR FIELD
C. ORNAMENTAL PLASTER MOULDINGS AND TRIM
D. STEEL WINDOWS

4. ITEMS SCHEDULED TO BE REMOVED ARE TO BE DOCUMENTED, LABELLED, AND PHOTOGRAPHED PRIOR TO REMOVAL, CAREFULLY DISMANTLED, AND SALVAGED FOR REUSE OR REPLICATION. SALVAGED HISTORIC FABRIC IS TO BE STORED IN A SAFE LOCATION.

5. PROTECT EXISTING HISTORIC MATERIALS TO REMAIN.

GENERAL NOTES - CONSTRUCTION

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE NEW YORK CITY BUILDING CODE, FIRE DEPARTMENT REGULATIONS, UTILITY COMPANY REQUIREMENTS AND THE BEST TRADE PRACTICES.

2. THE CONTRACTOR SHALL DO ALL CUTTING, PATCHING, REPAIRING AS REQUIRED TO PERFORM ALL OF THE WORK INDICATED ON THE DRAWINGS, AND ALL OTHER WORK THAT MAY BE REQUIRED TO COMPLETE THE JOB.

3. BEFORE COMMENCING WORK, THE CONTRACTOR SHALL FILE ALL REQUIRED CERTIFICATES OF INSURANCE WITH THE DEPARTMENT OF BUILDINGS, OBTAIN ALL REQUIRED PERMITS, AND PAY ALL FEES REQUIRED BY GOVERNING NEW YORK CITY AGENCIES.

4. THE PROVISIONS OF SUBCHAPTER 19 OF THE NYC BUILDING CODE SHALL GOVERN THE CONDUCT OF ALL CONSTRUCTION AND DEMOLITION OPERATIONS WITH REGARD TO THE SAFETY OF THE PUBLIC AND PROPERTY.

5. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS IN THE FIELD PRIOR TO COMMENCING WORK. AND SHALL REPORT ANY DISCREPANCIES BETWEEN DRAWINGS AND FIELD CONDITIONS TO THE ARCHITECT.

6. ALL EXISTING SURFACES, EQUIPMENT AND FINISHED TO REMAIN SHALL BE FULLY PROTECTED FROM DAMAGE. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR DAMAGE AND SHALL MAKE REPAIRS REQUIRED WITHOUT ADDITIONAL COST TO THE OWNER.

7. ALL DIMENSIONS ARE TO FINISHED FACE OF SURFACES UNLESS OTHERWISE NOTED.

8. NEW SUSPENDED CEILINGS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 27-350 AND RSS-16 OF THE BUILDING CODE.

9. DOORS & CASED OPENINGS
A. ALL NEW DOORS AND CASED OPENINGS SHALL BE A MINIMUM OF 3'-0" WIDE UNLESS OTHERWISE NOTED.
B. ALL NEW DOOR HARDWARE IS TO BE HANDICAPPED USEABLE.

10. ILLUMINATED EXIT SIGNS AND DIRECTIONAL SIGNS SHALL COMPLY WITH CHAPTER 1, SUBCHAPTER 6, ARTICLES 6, 7 AND 8.

11. THE CONTRACTOR IS NOT TO SCALE DRAWINGS OR DETAILS. ONLY WRITTEN DIMENSIONS ARE TO BE USED.

12. MINOR DETAILS AND BLOCKING NOT USUALLY SHOWN OR SPECIFIED, BUT NECESSARY FOR PROPER CONSTRUCTION OF ANY PART OF THE WORK SHALL BE INCLUDED AS IF THEY WERE INDICATED IN THE DRAWINGS.

13. THE CONTRACTOR SHALL COORDINATE ALL WORK PROCEDURES WITH REQUIREMENTS OF LOCAL AUTHORITIES.

14. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL CONDITIONS AND MATERIALS WITHIN THE PROPOSED CONSTRUCTION AREA. THE CONTRACTOR SHALL DESIGN AND INSTALL ADEQUATE SHORING AND BRACING FOR ALL STRUCTURAL OR REMOVAL TASKS. THE CONTRACTOR SHALL HAVE SOLE RESPONSIBILITY FOR ANY DAMAGE OR INJURIES CAUSED BY OR DURING THE EXECUTION OF THE WORK.

15. THE CONTRACTOR SHALL LAY OUT HIS OWN WORK, AND SHALL PROVIDE ALL DIMENSIONS REQUIRED FOR OTHER TRADES (PLUMBING, ELECTRICAL, ETC).

16. MECHANICAL, PLUMBING, AND ELECTRICAL WORK SHALL BE PERFORMED BY PERSONS LICENSED IN THEIR TRADES, WHO SHALL ARRANGE FOR AND OBTAIN INSPECTIONS AND REQUIRED SIGN-OFFS.

17. ALL MATERIALS, ASSEMBLIES, FORMS AND METHODS OF CONSTRUCTION AND SERVICE EQUIPMENT SHALL COMPLY WITH THE REQUIREMENTS OF SECTION 27-131 (C26-106.2) OF NYC BUILDING CODE.

18. AT LEAST 24 HR WRITTEN NOTICE SHALL BE GIVEN TO THE COMMISSIONER BEFORE COMMENCEMENT OF WORK. 27-195 (C26-118).

19. NO WORK AT SITE TO COMMENCE UNTIL PLAN HAS BEEN APPROVED AND PERMIT ISSUED BY THE DEPARTMENT OF BUILDINGS.

20. ALL NEW WORK TO COMPLY WITH APPLICABLE REQUIREMENTS OF ICC A117.1 AND CHAPTER 11 ACCESSIBILITY OF THE 2014 NEW YORK CITY BUILDING CODE.

21. SEE MECH, PLUMBING AND FIRE PROTECTION DRAWINGS AND NARRATIVE FOR ADDITIONAL SCOPE OF WORK.

22. ABATEMENT OF HAZARDOUS MATERIALS IS NOT SHOWN ON THESE DRAWINGS, OWNER TO IDENTIFY ABATEMENT SCOPE AS NECESSARY.

23. ADJOINING PROPERTY OWNERS SHALL BE NOTIFIED OF UPCOMING DEMOLITION OPERATIONS IN WRITING NOT LESS THAN 10 DAYS PRIOR TO THE SCHEDULED STARTING DATE OF DEMOLITION.

24. CONTRACTOR SHALL NOTIFY THE NYC DOB VIA PHONE OR ELECTRONICALLY, AT LEAST 24 HOURS, BUT NOT MORE THAN 48 HOURS PRIOR TO THE COMMENCEMENT OF DEMO WORK.

25. REFER TO GENERAL CONSTRUCTION REQUIREMENTS ON G003 FOR MINIMUM REQUIRED DIMENSIONS PER ANSI A117.1.

26. RATINGS FOR PATCHES SHALL FOLLOW REQUIREMENTS FOR NYC BLDG. PATCHES SHALL BE FINISHED TO BE INDISTINGUISHABLE FROM EXISTING CONSTRUCTION ADJACENT.

27. PROVIDE ACCESS PANELS WHERE REQUIRED FOR ACCESS TO MEP & OTHER EQUIPMENT BEHIND WALLS, FLOORS & CEILINGS. IN COORDINATION WITH THE MEP COORDINATION DRAWING(S) SPECIFIED, CONTRACT SHALL SUBMIT ACCESS DOOR LAYOUT DRAWINGS FOR REVIEW BY THE ARCHITECT.

28. EXISTING FINISH FLOOR ELEVATIONS ARE APPROXIMATE AND ARE BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF CONSTRUCTION DOCUMENTS. FIELD VERIFY ALL DIMENSIONS, CONFIGURATIONS AND FINISH FLOOR ELEVATIONS AND NOTIFY ARCHITECT OF ANY DISCREPANCIES.

29. PROVIDE SPRAY ON FIREPROOFING FOR ALL NEW STEEL FRAMING SHOWN ON STRUCTURAL DRAWINGS AND AT ALL LOCATIONS WHERE EXG. FIREPROOFING HAS BEEN REMOVED. RATINGS FOR NEW SPRAY-ON FIREPROOFING TO FOLLOW REQUIREMENTS FOR NYC BLDG. CODE CONSTRUCTION ELEMENT CLASSIFICATION AS SHOWN IN TABLE ON DRAWING LS-101

30. CONTRACTOR SHALL COORDINATE SCHEDULING, STAGING AND ACCESS AND OVERTIME REQUIREMENTS WITH THE OWNER'S REQUIREMENTS.

31. THE WORK IS TO TAKE PLACE IN AN EXISTING BUILDING OF VARYING FLOOR CONSTRUCTION TYPES. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS IN FIELD.

32. ALL HANGING CEILINGS AND CEILING ELEMENTS SHALL BE MOUNTED TO EXG STEEL, NEW STEEL, EXG OR NEW CONC. SLAB OR UNISTRUT SYSTEM. REFER TO TYPICAL ARCHITECTURAL AND STRUCTURAL DETAILS. CONTRACTOR TO PERFORM PULL TEST PRIOR TO MOUNTING HANGING ELEMENTS.

33. FLOOR SUBSTRATES SHALL BE FLAT AND SMOOTH W/ CONCRETE TOPPING SLAB AS REQUIRED BY SPECIFIED FLOOR TYPE PRIOR TO INSTALLATION OF FINISHED FLOOR, NOT TO EXCEED 1/8" IN 10'-0" SLOPE.

34. CONFIRM SIZE & ENGINEERING REQUIREMENTS OF ALL FINAL OWNER & VENDOR PROVIDED EQUIPMENT PRIOR TO ATTACHMENT TO ARCHITECTURE, INTEGRATING W/ ARCHITECTURE & FINISHES

35. ALL NOTES REFER TO NEW WORK, BUT DO NOT NECESSARILY USE THE DESIGNATION "NEW". "EXG" REFERS TO EXISTING CONDITIONS WHERE INDICATED.

36. REFER TO AG.XX - AG.XX LIFE SAFETY PLANS FOR RATINGS OF PARTITIONS AND OPENING PROTECTIVES

37. REFER TO AX.XX THERMAL IMPROVEMENTS FOR SCOPE OF DEMO & NEW EXT WALL FURRING/FINISH

38. REFER TO AX.XX SERIES DRAWINGS FOR FLOOR FINISHES AND CLASSROOM FINISH TYPES

39. FURNISH AND INSTALL FIRE RETARDANT TREATED WOOD BLOCKING AS REQUIRED AT ALL LOCATIONS FOR THE PROPER AND SECURE INSTALLATION OF ALL WALL MOUNTED EQUIPMENT OR MILLWORK WHETHER SPECIFICALLY NOTED IN THE DRAWINGS OR NOT.

40. WHERE ELECTRICAL AND PLUMBING FIXTURES OR OTHER RELATED EQUIPMENT OCCUR IN MILLWORK, PROVIDE CUT-OUTS, ROUGH-INS AND STUB-INS FOR THESE ITEMS AND COORDINATE THE WORK TO ASSURE PROPER LOCATION AND INSTALLATION.

41. PROVIDE FIRESTOPPING/SAFING MATERIALS AS REQUIRED TO MAINTAIN THE FIRE-RATING OF FLOOR, WALL AND CEILING ASSEMBLIES WHETHER SPECIFICALLY NOTED IN PLAN OR NOT. THIS APPLIES TO EXISTING AS WELL AS NEW PENETRATIONS.

42. SEE STRUCTURAL FOR SCOPE OF FRP REINFORCEMENT AT EXISTING MASONRY WALLS

GENERAL NOTES - DEMOLITION

1. CONTRACTOR SHALL PERFORM ALL OPERATIONS OF SELECTIVE DEMOLITION, DISMANTLING, AND REMOVAL INDICATED ON THE DRAWINGS AND AS MAY BE REQUIRED BY THE WORK AND SHALL WORK CAREFULLY AND NEATLY IN A SYSTEMATIC MANNER

2. PROTECT ALL HISTORIC FINISHES ADJACENT TO DEMOLITION FROM VIBRATION, DUST & DEBRIS. FINISHES INCLUDE: MARBLE, GRANITE, TERRAZZO, PLASTER, AND MOULDINGS. PROTECT ALL WINDOWS.

3. NO DEBRIS SHALL BE ALLOWED TO ACCUMULATE ON THE SITE. DEBRIS SHALL BE REMOVED BY THE CONTRACTOR AS THE JOB PROCEEDS. THE SITE SHALL BE LEFT BROOM CLEAN AT THE COMPLETION OF THE DEMOLITION AS DEFINED IN THE CONTRACTOR'S SCOPE OF WORK.

4. CONTRACTOR SHALL PROVIDE, ERECT AND MAINTAIN ALL TEMPORARY BARRIERS AND GUARDS AND ALL TEMPORARY SHORING, BRACING, AND TEMPORARY HEAT AS REQUIRED BY OSHA.

5. COORDINATE DIMENSIONS OF ALL DEMOLITION WORK WITH MECHANICAL, ELECTRICAL AND ARCHITECTURAL DRAWINGS. ALL WALL OPENINGS TO BE MARKED BY CONTRACTOR AND APPROVED BY ARCHITECT BEFORE DEMOLITION.

6. ALL STRUCTURAL ELEMENTS TO REMAIN INTACT AND UNTOUCHED INCLUDING ALL FIREPROOFING, U.O.N.

7. IN AREAS WHERE WALLS ARE INDICATED TO BE REMOVED, REMOVE EXISTING WALLS, WALL BASES, WALL FINISHES, DOORS, DOOR FRAMES, DOOR HARDWARE, ELECTRICAL CONDUIT AND ASSOCIATED WIRING FROM FLOOR TO UNDERSIDE OF SLAB.

8. WHERE ORIGINAL MATERIAL IS TO BE DISMANTLED, PROVIDE ALL NEEDED REPAIRS TO NEWLY-EXPOSED SUBSTRATE AFTER DISMANTLING WORK IS COMPLETE. REINSTALL SALVAGED MATERIAL ON SOUND SUBSTRATE ONLY.

9. ALL DOOR DEMOLITION TO INCLUDE FRAME, SILL AND ANY ASSOCIATED HARDWARE, U.O.N.

10. ALL MEP SYSTEMS AND EQUIPMENT TO BE REMOVED EXCEPT AS SPECIFICALLY NOTED. SEE MEP DRAWINGS FOR SCOPE OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT REMOVALS.

11. ALL FIRE DEVICES, FIRE PULLS, FIRE ALARMS, SMOKE ALARMS, AND FIRE STROBES TO REMAIN. U.O.N. SEE MEP DRAWINGS FOR SCOPE.

13. REMOVE ALL UNUSED FASTENERS AND APPURTENANCES FROM FINISH SURFACES TO REMAIN.

14. REMOVE ALL EXISTING LIGHTING AND ASSOCIATED WIRING/CONDUIT THROUGHOUT, U.O.N.

15. REMOVE ALL EXISTING ABANDONED CONDUIT AND WIRING. REMOVE FLOOR- MOUNTED OUTLETS AND ACCESSORIES THAT EXTEND ABOVE FLOOR PLANE, INCLUDING FLOOR-MOUNTED BRASS DOOR STOPS.

16. PROTECT ALL WINDOWS AND SURROUNDS, U.O.N.

17. PROTECT ALL MARBLE FLOORS, BASE, DOOR SURROUNDS AND THRESHOLDS. ALL EXISTING MARBLE THRESHOLDS TO REMAIN, U.O.N.

18. THE INTENT OF DEMOLITION PLANS IS TO COORDINATE DEMOLITION BETWEEN ARCHITECTURE, MECHANICAL, ELECTRICAL, PLUMBING AND STRUCTURAL SCOPE.

19. ALL LOOSE FURNITURE AND EQUIPMENT SHALL BE REMOVED WHETHER OR NOT THEY ARE SHOWN ON THE PLANS. VERIFICATION OF EXISTING CONDITIONS, I.E. FURNITURE, EXHAUST FANS, ETC. CAN BE ASCERTAINED VIA THE FIRE-BID WALKTHROUGH. FAILURE TO PERFORM A SITE VISIT PRIOR TO BID DOES NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY OF REMOVING ALL EXISTING EQUIPMENT AND FURNITURE AS NOTED.

20. SIZES OF NEW OR EXISTING EXPANDED OPENING IN EXISTING WALLS TO REMAIN TO BE VERIFIED IN THE FIELD AND COORDINATED WITH STRUCTURAL DEMOLITION.

21. ALL EXISTING SURFACES AND EQUIPMENT TO REMAIN SHALL BE FULLY PROTECTED FROM DAMAGE DURING CONSTRUCTION. CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR DAMAGE AND SHALL MAKE REPAIRS REQUIRED WITHOUT ADDITIONAL COST TO THE OWNER.

22. NO DEBRIS SHALL BE ALLOWED TO ACCUMULATE ON THE SITE. THE CONTRACTOR SHALL REMOVE DEBRIS AS THE JOB PROCEEDS. THE SITE SHALL BE LEFT BROOM CLEANED AT THE COMPLETION OF DEMOLITION.

23. NO STRUCTURAL ELEMENTS SHALL BE REMOVED UNLESS PORTIONS AFFECTED ARE ADEQUATELY SUPPORTED BY EITHER TEMPORARILY SHORING OR NEW STRUCTURAL ELEMENTS AS REQUIRED TO PROTECT THE STABILITY AND INTEGRITY OF THE EXISTING STRUCTURE. ALL STRUCTURAL REMOVALS TO BE COORDINATED WITH STRUCTURAL DRAWINGS.

24. REMOVE OR RELOCATE M.E.P. EQUIPMENT AFFECTED BY REMOVAL OF PARTITIONS. REMOVED PIPES AND/OR LINES SHALL BE CUT TO A POINT OF CONCEALMENT BEHIND OR BELOW EXISTING FINISH SURFACES AND SHALL BE PROPERLY CAPPED OR PLUGGED. REFER TO MECHANICAL AND PLUMBING DEMOLITION DRAWINGS.

25. CONTRACTOR SHALL PROVIDE, ERECT AND MAINTAIN ALL TEMPORARY BARRIERS AND GUARDS AND ALL TEMPORARY SHORING, BRACING, AND TEMPORARY HEAT AS REQUIRED BY OSHA.

26. CONTRACTOR SHALL PROVIDE ADEQUATE WEATHER PROTECTION FOR THE BUILDING AND ITS CONTENTS DURING THE COURSE OF CONSTRUCTION. ALL OPENINGS IN ANY WALL OR ROOF SHALL BE PROTECTED FROM ALL FORMS OF WATER PENETRATION.

27. AT AREAS OF REMOVAL DIRECTLY ADJACENT TO WORK NIC, CAREFULLY DISMANTLE MATERIALS SO AS NOT TO DAMAGE ADJACENT MATERIALS TO REMAIN.

28. CUT AND REMOVE ALL PERIMETER FAN COIL UNITS AND ASSOCIATED PIPING.

29. IN AREAS WHERE WALLS ARE INDICATED TO BE REMOVED, REMOVE EXISTING WALLS, WALL BASES, WALL FINISHES, DOORS, DOOR FRAMES, DOOR HARDWARE, ELECTRICAL CONDUIT AND ASSOCIATED WIRING FROM FLOOR TO UNDERSIDE OF SLAB.

30. HAZARDOUS MATERIALS REMOVAL IS TO BE COORDINATED WITH HAZMAT AGENT.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

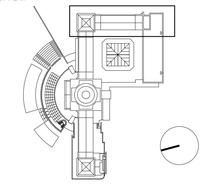
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

GENERAL NOTES

SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

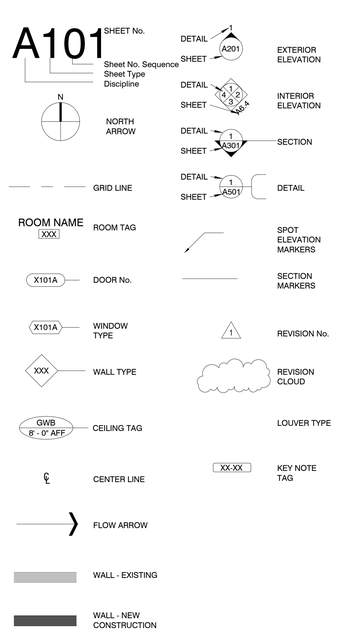
G001

10/17/2025 8:40:51 PM

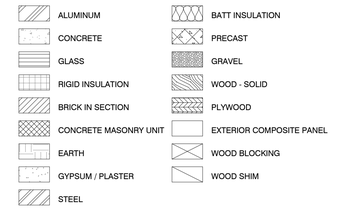
@	AT
A/C	AIR CONDITIONER / CONDITIONING
ACC	ACCESSIBLE
ACCSY	ACCESSORY
ACOUS	ACOUSTICAL INSULATION
INSUL	
ACOUS PNL	ACOUSTICAL PANELS
ACP	LAY-IN ACOUSTIC PANEL CEILING PADS
ACS DR	ACCESS DOOR
ACS FLR	ACCESS FLOOR
ACS PNL	ACCESS PANEL
ACST	ACOUSTICAL
ACT	ACOUSTICAL CEILING TILE
AD	AREA DRAIN
ADA	AMERICANS WITH DISABILITIES ACT
ADDL	ADDITIONAL
ADDM	ADDENDUM
ADJ	ADJUSTABLE / ADJACENT
ADMIN	ADMINISTRATION
AFC	ABOVE FINISHED COUNTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AFS	ABOVE FINISHED SLAB
AHR	ANCHOR
AHU	AIR HANDLING UNIT
ALNMT	ALIGNMENT
ALT	ALTERNATE
ALUM	ALUMINUM
ANOD	ANODIZED
APC	ACOUSTICAL PANEL CEILING
APPROX	APPROXIMATELY
APPVD	APPROVED
APT	APARTMENT
ARCH	ARCHITECT(URAL)
ASPH	ASPHALT
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
ATC	ACOUSTICAL TILE CEILING
AUTO	AUTOMATIC
AVG	AVERAGE
AWP	WALL-MOUNTED SOUND ABSORPTION PANEL
AWT	ACOUSTIC WALL TREATMENT
BD	BOARD
BITUM	BITUMINOUS
BL	BASELINE
BL	BLACK
BLDG	BUILDING
BM	BEAM
BO	BLOWOFF
BOT	BOTTOM
BR	BEDROOM
BRG	BEARING
BS	BOTH SIDES
BSMT	BASEMENT
BTWN	BETWEEN
BUR	BUILT UP ROOFING
BW	BOTH WAYS
C	CELSIUS
C	CHANNEL
C TO C	CENTER TO CENTER
CAB	CABINET
CB	CATCH BASIN
CEM	CEMENT
CEM PLAS	CEMENT PLASTER (STUCCO)
CER	CERAMIC
CG	CORNER GUARD
CH	CHILLER
CH	COAT HOOK
CHBD	CHALKBOARD
CHFR	CHAMFER
CI	CAST IRON
CIP	CAST IN PLACE
CJ	CONTROL JOINT
CL	CENTERLINE
CL D	CLOTHES DRYER
CLG	CEILING
CLG HT	CEILING HEIGHT
CLL	CONTRACT LIMIT LINE
CLO	CLOSET
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CNTR	COUNTER
CO	CARBON MONOXIDE
CO	CASED OPENING
CO	CERTIFICATE OF OCCUPANCY
CO	CLEANOUT
CO	COMPANY
CO	CUTOUT
COL	COLUMN
COMB	COMBINATION
CONC	CONCRETE
CONC FLR	SEALED CONCRETE FLOOR
CONSTR	CONSTRUCTION
CONT	CONTINUE
CONT	CONTROLLER
CONV	CONVERT
CORR	CORRIDOR / CORRUGATED
CPT	CARPET
CR	CLOSET ROD
CR	CONTROL RELAY
CR	CONTROL ROOM
CR	CRASH RAIL
CS	CAST STONE
CS	CONTROL SWITCH
CSWK	CASEWORK
CT	CERAMIC TILE
CTB	CERAMIC TILE BASE
CTR	CENTER
CU	COPPER
CU FT	CUBIC FOOT
CU YD	CUBIC YARD
CUB	CUBICLE CURTAIN
CURT	CURTAIN
CW	CASEMENT WINDOW
CW	CHEMICAL WASTE LINE
CW	CLOCKWISE
CW	COLD WATER PIPING
D	DEEP
DBL	DOUBLE
DEG	DEGREE
DEMO	DEMOLITION
DET	DETAIL
DF	DRINKING FOUNTAIN
DH	DOUBLE HUNG
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DISP	DISPENSER
DIV	DIVISION
DMPF	DAMPPROOFING
DR	DOOR / DRAIN
DS	DOWNSPOUT
DW	DISHWASHER
DWG	DRAWING
DWR	DRAWER
E	EAST
EA	EACH
EF	EACH FACE
EG	VERTICAL END GUARDS
EHD	ELECTRIC HAND DRYER
EIFS	EXTERIOR INSULATION AND FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
ELEV	ELEVATOR
EM	ELECTROMAGNETIC
EM	EXPANDED METAL
EMER	EMERGENCY
ENCL	ENCLOSED / ENCLOSURE
ENGR	ENGINEER
ENTR	ENTRANCE
EOS	EDGE OF SLAB
EPB	ELECTRIC PANEL BOARD
EQ	EQUAL(LY)
EQUIP	EQUIPMENT
ER	POURED EPOXY
ERF	POURED EPOXY FLOORING
EST	ESTIMATE
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EXF	EXTERIOR FINISH
EXH	EXHAUST
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERIOR
FA	FIRE ALARM
FAB	FABRIC
FAI	FRESH AIR INTAKE
FBRK	FIREBRICK
FCP	PREFABRICATED FABRIC CEILING PANEL
FCU	FAN COIL UNIT
FD	FLOOR DRAIN
FDTN	FOUNDATION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF EL	FINISH FLOOR ELEVATION
FGL	FIBERGLASS
FH	FIRE HOSE
FHC	FIRE HOSE CABINET
FIN	FINISH(ED)
FIN FLR	FINISHED FLOOR
FIN FLR	FINISH FLOOR
FIXT	FIXTURE
FLASH	FLASH(ING)
FLR	FLOOR
FLRSK	FLOOR SINK
FLUOR	FLUORESCENT
FM	FACTORY MUTUAL
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOW	FACE OF WALL
FP	FIREPROOF
FPL	FIREPLACE
FR	FRAME
FRG	FIBER REINFORCED GYPSUM
FRP	FIBERGLASS REINFORCED PLASTIC
FRT	FIRE RETARDANT TREATED
FSP	FIRE STAND PIPE
FSTNR	FASTENER
FTG	FOOTING
FURG	FURRING
FUT	FUTURE
FWC	FABRIC WALL COVER
FWP	NON-ACOUSTIC STRETCHED FABRIC PANEL WALL INSTALATION
G	GROUND
GA	GAGE
GALV	GALVANIZE(D)
GB	GRAB BAR
GC	GENERAL CONTRACTOR
GDISP	GARBAGE DISPOSAL
GEN	GENERAL
GFP	GFRP OR GFRG FREESTANDING PANEL
GFRG	GLASS FIBER REINFORCED GYPSUM
GFRP	GLASS FIBER REINFORCED POLYMER
GL	GLASS / GLAZING
GL BLK	GLASS BLOCK
GLT	GLASS MOSIAC TILE
GLZ	GLAZING
GLZ CMU	GLAZED CONCRETE MASONRY UNIT
GPM	GALLONS PER MINUTE
GR	GROSS
GR LN	GRADE LINE
GRAN	GRANITE
GT	GREASE TRAP
GT	GROSS TON
GT	GROUT
GYP	GYPSUM
GYP BD	GYPSUM BOARD
H	HIGH
HC	HOLLOW CORE
HCP	HANDICAPPED
HD	HEAVY DUTY
HD	HAND DRYER
HDBD	HARDBOARD
HDR	HEADER
HDW	HARDWARE
HDWD	HARDWOOD
HDWL	HEADWALL
HM	HOLLOW METAL
HNDRL	HANDRAIL
HORIZ	HORIZONTAL
HP	HEAT PUMP
HP	HIGH PRESSURE
HP	HORSEPOWER
HR	HAND RAIL
HS	HAND SINK
HT	HEIGHT
HVAC	HEATING / VENTILATION / AIR CONDITIONING
HW	HOT WATER
HWP	HOT WATER PUMP
HYD	HYDRANT
IC	IRONING CABINET
ID	INSIDE DIAMETER
IN	INCH / INCHES
INCL	INCLUDE(D) / INCLUDING
INSUL	INSULATE / INSULATION
INT	INTERIOR
INV	INVERT
ITS	INTERTEK TESTING SERVICES
J-BOX	JUNCTION BOX
JAN CLO	JANITOR'S CLOSET
JS	JANITOR'S SINK
KIT	KITCHEN
L	ANGLE
L	LITER
LAB	LABORATORY
LAM	LAMINATE(D)
LAV	LAVATORY
LB(S)	POUND(S)
LC	LINEN CLOSET
LF	LINEAR FOOT (FEET)
LH	LEFT HAND
LIB	LIBRARY
LINO	LINOLEUM
LKR	LOCKER
LNO	LINOLEUM
LPT	LOW POINT
LT	LIGHT
LTF	LINOLEUM TILE FLOORING
LTWT	LIGHT WEIGHT
LVR	LOUVER
m	METER
MACH	MACHINE
MAT	WALK-OFF MAT
MATL	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MB	MAIL BOX
MB	MIXING BOX
MBH	MOP/BROOM HOLDER
MC	MEDICINE CABINET
MCP	ACOUSTIC LAY-IN METAL CEILING PADS
ME	MECHANICAL ENGINEER
MECH	MECHANICAL
MED	MEDIUM
MEZZ	MEZZANINE
MFR	MANUFACTURER(R)
MH	MANHOLE
MIN	MINIMUM
MIRR	MIRROR
MISC	MISCELLANEOUS
MKR BD	MARKER BOARD
MLDG	MOULDING
mm	MILLIMETER
MO	MASONRY OPENING
MR	MOISTURE RESISTANT
MS	MOP SINK
MSB	MOP SERVICE BASIN
MTD	MOUNTED
MTL	METAL
MTS	METAL TRANSITION STRIP
MULL	MULLION
MVBL	MOVABLE
MW	MICROWAVE
N	NORTH
NA	NOT AVAILABLE / APPLICABLE
NAT	NATURAL
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OA	OVERALL
OC	ON CENTER
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
OF / CI	OWNER FURNISHED / CONTRACTOR INSTALLED
OFD	OVERFLOW DRAIN
OFF	OFFICE
OPH	OPPOSITE HAND
OPNG	OPENING
OPP	OPPOSITE
OZ	OUNCE
PAR	PARALLEL
PAR	PARAPET
PART	PARTIAL
PAT	PATTERN
PBD	PARTICLE BOARD
PCC	PRECAST CONCRETE
PED	PEDESTAL
PERF	PERFORATED
PERIM	PERIMETER
PERP	PERPENDICULAR
PL	PROPERTY LINE
PLAM	PLASTIC LAMINATE
PLAS	PLASTIC
PLAS	PLASTER
PLYWD	PLYWOOD
PR	PAIR
PREFAB	PREFABRICATED
PREFIN	PRE-FINISHED
PRF	POLYURETHANE SPORTS FLOORING
PROP	PROPERTY
PRST	PRESSURE TREATED
PS	POURED SEALANT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PAINT(ED)
PT/E	EPOXY PAINT
PT/F	FLAT PAINT
PT/HG	HIGH GLOSS PAINT
PT/SG	SEMIGLOSS PAINT
PTD	PAPER TOWEL DISPENSER
PTN	PARTITION
PV	PAVED
PVC	POLYVINYL CHLORIDE
PVG	PAVING
Q	HEAT TRANSFER
Q	RATE OF FLOW
QT	QUARRY TILE
QTY	QUANTITY
QZF	QUARTZ FLOORING
QZR	QUARTZ RESIN
QZT	QUARTZ TILE
R	RISER
R	RADIUS
RA	RETURN AIR
RB	RUBBER BASE
RB	RUBBER BASE
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REC	RECESSED
RECPT	RECEPTACLE
REF	REFERENCE
REF	REFRIGERATOR
REFL	REFLECTED
REG	REGISTER
REINF	REINFORCE(D)
REQ	REQUIRED
RESIL	RESILIENT
REST	RESTROOM
RET	RETURN
REV	REVISE / REVISION
RF	RESILIENT FLOORING
RFG	ROOFING
RH	RIGHT HAND
RM	ROOM
RO	ROUGH OPENING
ROW	RIGHT OF WAY
RR	RAILROAD
RR	ROLL ROOFING
RS	RAPID START
RS	ROUGH SAWN
RS	RUBBER SHEET
RSF	RUBBER SHEET FLOORING
RST	REINFORCING STEEL
RT	RIGHT
RTF	RUBBER TILE FLOORING
RTS	RUBBER TRANSITION STRIP
RWD	REDWOOD
RWL	RAIN WATER LEADER
S	SOUTH
SAN	SANITARY
SC	SOLID CORE
SCHED	SCHEDULE
SCRN	SCREEN
SCT	STRUCTURAL CLAY TILE
SD	SOAP DISPENSER
SECT	SECTION
SF	SQUARE FEET
SGL	SINGLE
SH	SINGLE HUNG
SHR	SHOWER
SHR HD	SHOWER HEAD
SHT	SHEET
SHTHG	SHEATHING
SIM	SIMILAR
SL	SEA LEVEL
SL	SPOT LIGHT
SLDG	SLIDING
SND	SANITARY NAPKIN DISPENSER
SNDU	SANITARY NAPKIN DISPOSAL UNIT
SPC	SUSPENDED PLASTER CEILING
SPEC	SPECIFY / SPECIFICATION
SPH	SOLID PHENOLIC POLYMER (TRESPA)
SPKR	SPEAKER
SPR	SOLID POLYMER RESIN (3FORM)
SQ	SQUARE
SQIN	SQUARE INCH(ES)
SSP	SOLID SURFACE POLYMER (CORIAN)
SSPR	SOLID POLYMER (CORIAN) RUB RAIL
SST	STAINLESS STEEL
SSTR	STAINLESS STEEL RUB RAIL
ST	SINGLE THROW
ST	STAIRS
ST	STREET
ST	STAIN
STA	STATION
STD	STANDARD
STIF	STIFFENER
STON	STONE
STOR	STORAGE
STRUCT	STRUCTURE / STRUCTURAL
SUH	SUSPENDED UNIT HEATER
SURF	SURFACE
SUSP	SUSPENDED
SVP	VINYL SOLID PANEL (ACROVYN)
SW	SWITCH
SYMM	SYMMETRICAL
SYNTH	SYNTHETIC
SYS	SYSTEM
T	TREAD
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T/S	TUB / SHOWER
TB	TOWEL BAR
TC	TERRA COTTA
TEL	TELEPHONE
TEMP	TEMPERATURE
TEMP	TEMPORARY
THK	THICKNESS
THRES	THRESHOLD
THRU	THROUGH
TK BD	TACK BOARD
TKP	TACKABLE PANELING
TOC	TOP OF CONCRETE
TOS	TOP OF SLAB
TOW	TOP OF WALL
TPD	TOILET PAPER DISPENSER
TR	ACCENT RAIL
TRTD	TREATED
TRZ	INTERIOR POURED EPOXY RESIN TERRAZZO
TV	TELEVISION
TYP	TYPICAL
UC	UNDERCUT
UGND	UNDERGROUND
UL	UNDERWRITER'S LABORATORY
UNFIN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UR	URINAL
V	VOLT
VB	VINYL BASE
VCT	VINYL COMPOSITION TILE
VENT	VENTILATE
VERT	VERTICAL
VEST	VESTIBULE
VIF	VERIFY IN FIELD
VNR	VENEER
VOL	VOLUME
VP	VACUUM PUMP
VP	VANISHING POINT
VP	VAPOR PRESSURE
VP	VENEER PLASTER
VPC	VENEER PLASTIC CEILING/SOFFIT
VR	VAPOR RETARDER
VRR	VINYL (ACROVYN) RAIL
VS	VENT STACK
VS	VOLUMETRIC SWITCH
VS	SHEET VINYL
VT	SOLID VINYL TILE
VTR	VENT THRU ROOF
VTS	VINYL TRANSITION STRIP
VWC	VINYL WALLCOVERING
W	WIDE
W	WEST
W / W	WALL TO WALL
W/	WITH
W/D	WASHER / DRYER
W/O	WITHOUT
WB	WOOD BASE
WC	WATER CLOSET
WC	WALLCOVERING
WD	WOOD
WDH	WOOD HAND RAIL
WDM	WOOD WALL MOULDINGS
WDP	WOOD PANELING
WDR	WOOD CHAIR, CRASH, OR HAND RAIL
WDSHV	WOOD SHELVING
WDT	WOOD TILE OR PARQUET FLOORING
WDV	WOOD VENEER
WDW	WINDOW
WF	WIDE FLANGE
WGL	WIRED GLASS
WH	WALL HUNG
WI	WROUGHT IRON
WP	WATERPROOF
WP	WORKING POINT
WPM	WATERPROOF MEMBRANE
WR	WEATHER RESISTANT
WR	WIRE ROPE
WRP	WATER REPELLENT
WT	WEIGHT
WWF	WELDED WIRE FABRIC
XPS	EXTRUDED POLYSTYRENE
YD	YARD

SYMBOLS LEGEND

SEE DISCIPLINE SHEETS FOR DISCIPLINE SPECIFIC SYMBOLS



MATERIALS LEGEND



BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

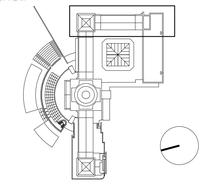
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

ABBREVIATIONS, LEGENDS, SYMBOLS

SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

G002

10/17/2025 8:40:53 PM

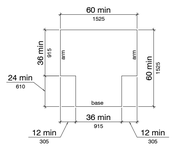


Figure 304.3.2
T-Shaped Turning Space

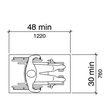


Figure 305.3
Clear Floor or Ground Space

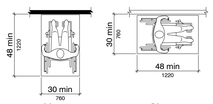


Figure 305.5
Position of Clear Floor or Ground Space

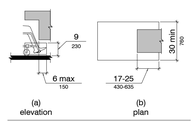


Figure 306.2
Toe Clearance

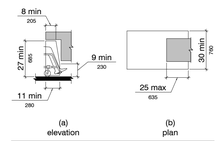


Figure 306.3
Knee Clearance

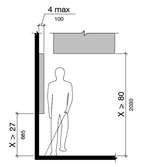


Figure 307.2
Limits of Protruding Objects

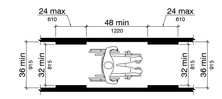


Figure 403.5.1
Clear Width of an Accessible Route

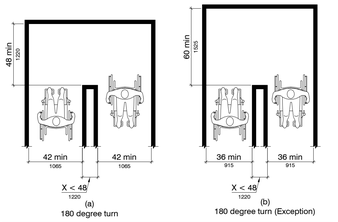


Figure 403.5.2
Clear Width at Turn

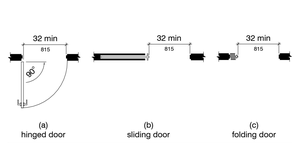


Figure 404.2.3
Clear Width of Doorways

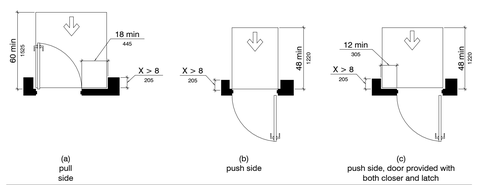


Figure 404.2.4.3
Maneuvering Clearance at Recessed Doors and Gates

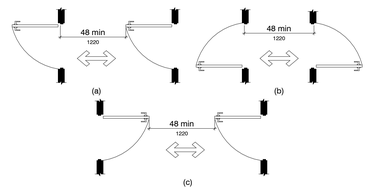


Figure 404.2.6
Doors in Series and Gates in Series

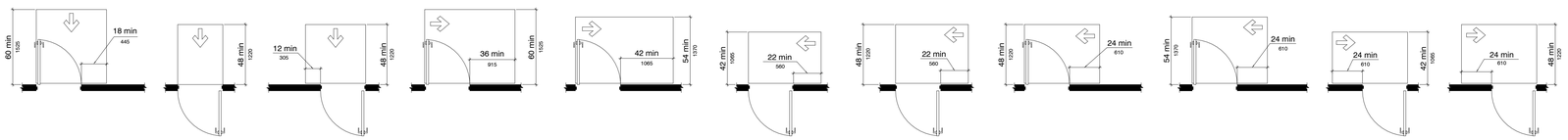


Figure 404.2.4.1
Maneuvering Clearance at Manual Swinging Doors and Gates

Figure 602.5
Drinking Fountain Spout Location

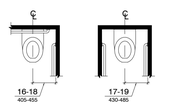


Figure 604.2
Water Closet Location

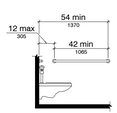


Figure 604.5.1
Side Wall Grab Bar at Water Closets

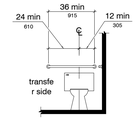


Figure 604.5.2
Rear Wall Grab Bar at Water Closets

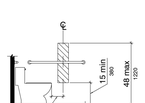


Figure 604.7
Dispenser Outlet Location

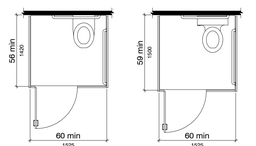


Figure 604.8.1.1
Size of Wheelchair Accessible Toilet Compartment

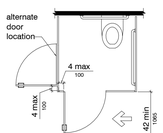


Figure 604.8.1.2
Wheelchair Accessible Toilet Compartment Doors

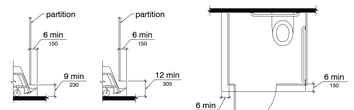


Figure 604.8.1.4
Wheelchair Accessible Toilet Compartment Toe Clearance

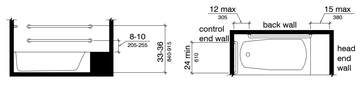


Figure 607.4.1
Grab Bars for Bathtubs with Permanent Seats

Figure 604.8.2
Ambulatory Accessible Toilet Compartment

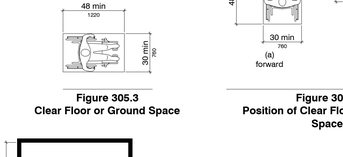


Figure 607.2
Clearance for Bathtubs

Figure 605.2
Height and Depth of Urinals

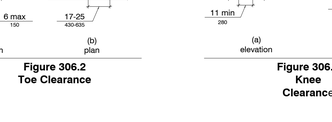


Figure 607.4.2
Grab Bars for Bathtubs with Removable In-Tub Seats

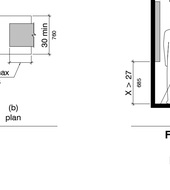


Figure 608.2.1
Transfer Type Shower Compartment Size and Clearance

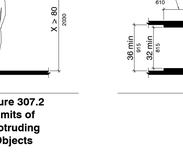


Figure 608.2.2
Standard Roll-In Type Shower Compartment Size and Clearance

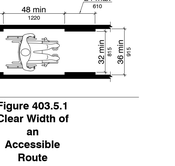


Figure 608.2.3
Alternate Roll-In Type Shower Compartment Size and Clearance

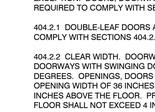


Figure 608.3.1
Grab Bars for Transfer-Type Showers

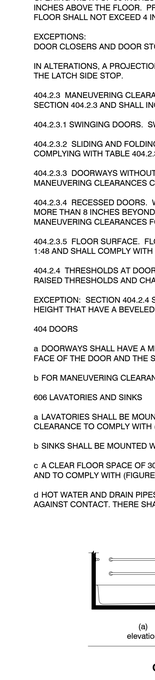


Figure 608.3.3
Grab Bars for Alternate Roll-in Type Showers

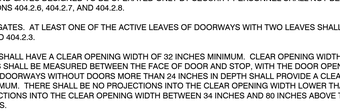
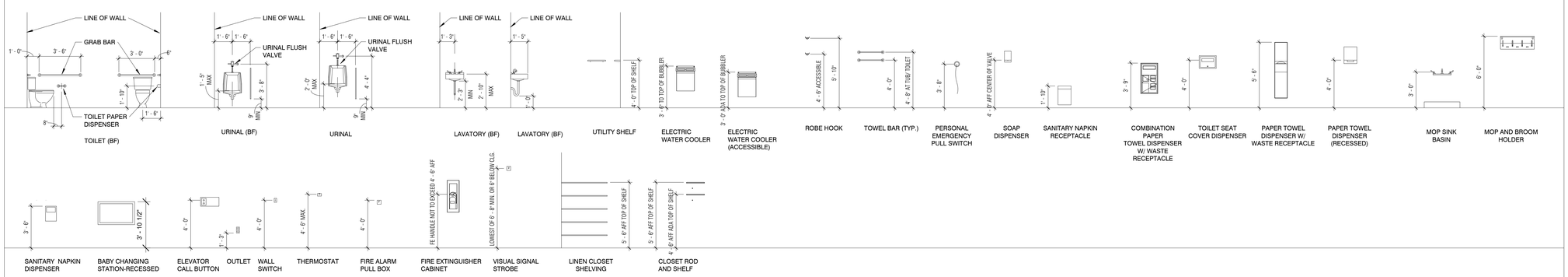


Figure 608.3.2
Grab Bars for Standard Roll-In Type Showers

TYPICAL MOUNTING HEIGHTS (ADA)



10/17/2025 8:40:57 PM

ACCESSIBILITY NOTES

PROPOSED WORK SHALL COMPLY WITH THE APPLICABLE REQUIREMENTS OF ICC A117.1 AND CHAPTER 11 ACCESSIBILITY OF THE 2014 NEW YORK CITY BUILDING CODE.

ICC A117.1

404 DOORS AND DOORWAYS

404.1 GENERAL. DOORS AND DOORWAYS THAT ARE PART OF AN ACCESSIBLE ROUTE SHALL COMPLY WITH SECTION 404.

404.2 MANUAL DOORS. MANUAL DOORS AND DOORWAYS, AND MANUAL GATES INCLUDING TICKET GATES. SHALL COMPLY WITH THE REQUIREMENTS OF SECTION 404.2.

EXCEPTION: DOORS, DOORWAYS, AND GATES DESIGNED TO BE OPERATED ONLY BY SECURITY PERSONNEL SHALL NOT BE REQUIRED TO COMPLY WITH SECTIONS 404.2.6, 404.2.7, AND 404.2.8.

404.2.1 DOUBLE-LEAF DOORS AND GATES. AT LEAST ONE OF THE ACTIVE LEAVES OF DOORWAYS WITH TWO LEAVES SHALL COMPLY WITH SECTIONS 404.2.2 AND 404.2.3.

404.2.2 CLEAR WIDTH. DOORWAYS SHALL HAVE A CLEAR OPENING WIDTH OF 32 INCHES MINIMUM. CLEAR OPENING WIDTH OF DOORWAYS WITH SWINGING DOORS SHALL BE MEASURED BETWEEN THE FACE OF DOOR AND STOP, WITH THE DOOR OPEN 90 DEGREES. OPENINGS, DOORS AND DOORWAYS WITHOUT DOORS MORE THAN 24 INCHES IN DEPTH SHALL PROVIDE A CLEAR OPENING WIDTH OF 36 INCHES MINIMUM. THERE SHALL BE NO PROJECTIONS INTO THE CLEAR OPENING WIDTH LOWER THAN 34 INCHES ABOVE THE FLOOR. PROJECTIONS INTO THE CLEAR OPENING WIDTH BETWEEN 34 INCHES AND 80 INCHES ABOVE THE FLOOR SHALL NOT EXCEED 4 INCHES.

EXCEPTIONS:
DOOR CLOSERS AND DOOR STOPS SHALL BE PERMITTED TO BE 78 INCHES MINIMUM ABOVE THE FLOOR.

IN ALTERATIONS, A PROJECTION OF 5/8 INCH MAXIMUM INTO THE REQUIRED CLEAR OPENING WIDTH SHALL BE PERMITTED FOR THE LATCH SIDE STOP.

404.2.3 MANEUVERING CLEARANCES AT DOORS. MINIMUM MANEUVERING CLEARANCES AT DOORS SHALL COMPLY WITH SECTION 404.2.3 AND SHALL INCLUDE THE FULL CLEAR OPENING WIDTH OF THE DOORWAY.

404.2.3.1 SWINGING DOORS. SWINGING DOORS SHALL HAVE MANEUVERING CLEARANCES COMPLYING WITH TABLE 404.2.3.1.

404.2.3.2 SLIDING AND FOLDING DOORS. SLIDING DOORS AND FOLDING DOORS SHALL HAVE MANEUVERING CLEARANCES COMPLYING WITH TABLE 404.2.3.2.

404.2.3.3 DOORWAYS WITHOUT DOORS. DOORWAYS WITHOUT DOORS THAT ARE LESS THAN 36 INCHES IN WIDTH SHALL HAVE MANEUVERING CLEARANCES COMPLYING WITH TABLE 404.2.3.3.

404.2.3.4 RECESSED DOORS. WHERE ANY OBSTRUCTION WITHIN 18 INCHES OF THE LATCH SIDE OF A DOORWAY PROJECTS MORE THAN 8 INCHES BEYOND THE FACE OF THE DOOR, MEASURED PERPENDICULAR TO THE FACE OF THE DOOR, MANEUVERING CLEARANCES FOR A FORWARD APPROACH SHALL BE PROVIDED.

404.2.3.5 FLOOR SURFACE. FLOOR SURFACE WITHIN THE MANEUVERING CLEARANCES SHALL HAVE A SLOPE NOT STEEPER THAN 1:48 AND SHALL COMPLY WITH SECTION 302.

404.2.4 THRESHOLDS AT DOORWAYS. IF PROVIDED, THRESHOLDS AT DOORWAYS SHALL BE 1/2 INCH MAXIMUM IN HEIGHT. RAISED THRESHOLDS AND CHANGES IN LEVEL AT DOORWAYS SHALL COMPLY WITH SECTIONS 302 AND 303.

EXCEPTION: SECTION 404.2.4 SHALL NOT APPLY TO EXISTING THRESHOLDS OF ALTERED THRESHOLDS 3/4 INCH MAXIMUM IN HEIGHT THAT HAVE A BEVELED EDGE ON EACH SIDE WITH A MAXIMUM SLOPE OF 1:2 FOR THE HEIGHT EXCEEDING 1/4 INCH.

404 DOORS

a DOORWAYS SHALL HAVE A MINIMUM CLEAR OPENING OF 32" WITH THE DOOR OPEN 90 DEGREES MEASURED BETWEEN THE FACE OF THE DOOR AND THE STOP. FOR CLEARWAY WIDTH AND DEPTH SEE (FIGURE 24)

b FOR MANEUVERING CLEARANCES AT DOORS SEE (FIGURE 25)

606 LAVATORIES AND SINKS

a LAVATORIES SHALL BE MOUNTED WITH A CLEARANCE OF 29" FROM THE FLOOR TO THE BOTTOM OF THE APRON. KNEE AND TOE CLEARANCE TO COMPLY WITH (FIGURE 31)

b SINKS SHALL BE MOUNTED WITH THE COUNTER OR RIM NO HIGHER THAN 34" FROM THE FLOOR

c A CLEAR FLOOR SPACE OF 30"X 48" SHALL BE PROVIDED IN FRONT OF A LAVATORY OR SINK TO ALLOW A FORWARD APPROACH AND TO COMPLY WITH (FIGURE 32)

d HOT WATER AND DRAIN PIPES UNDER LAVATORIES OR SINKS SHALL BE INSULATED OR OTHERWISE CONFIGURED TO PROTECT AGAINST CONTACT. THERE SHALL BE NO SHARP OR ABRASIVE SURFACES UNDER LAVATORIES AND SINKS.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

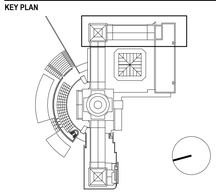
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

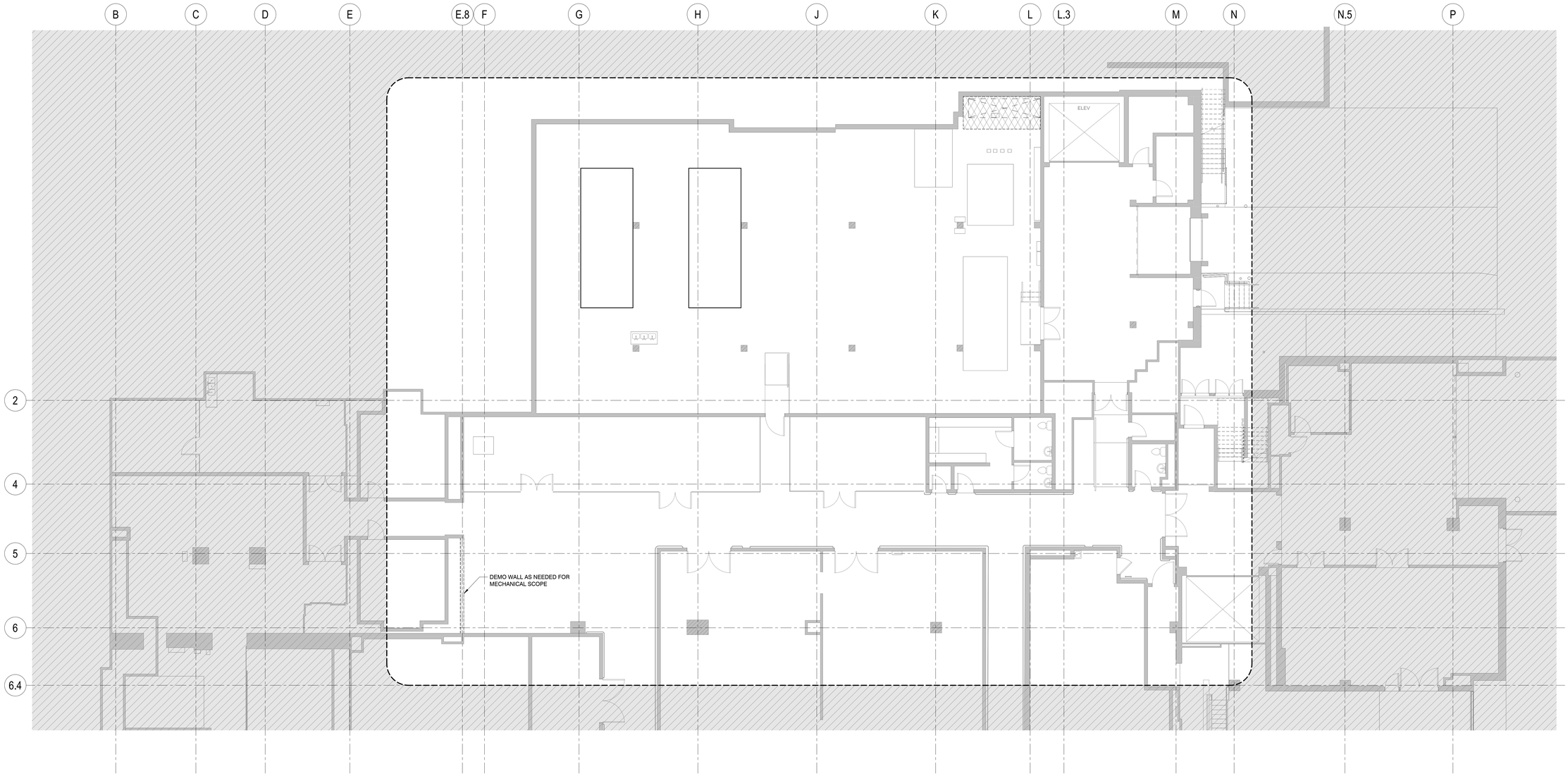
DRAWING TITLE

ADA/ANSI ACCESSIBILITY DIAGRAMS, NOTES AND TYP MOUNTING HEIGHTS

SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

G003



NOTE: SEE MEP AND STRUCTURAL FOR SCOPE

1 AD101 BASEMENT DEMO PLAN
1/8" = 1'-0"

GENERAL NOTES FOR SELECTIVE DISMANTLING

1. CONTRACTOR SHALL PERFORM ALL OPERATIONS OF SELECTIVE DEMOLITION, DISMANTLING, AND REMOVAL INDICATED ON THE DRAWINGS AND AS MAY BE REQUIRED BY THE WORK AND SHALL WORK CAREFULLY AND NEATLY IN A SYSTEMATIC MANNER.

2. PROTECT ALL HISTORIC FINISHES ADJACENT TO DEMOLITION FROM VIBRATION, DUST & DEBRIS. FINISHES INCLUDE: TERRAZZO, STONE, PLASTER, MOULDINGS, AND MILLWORK. PROTECT ALL WINDOWS.

3. NO DEBRIS SHALL BE ALLOWED TO ACCUMULATE ON THE SITE. DEBRIS SHALL BE REMOVED BY THE CONTRACTOR AS THE JOB PROCEEDS. THE SITE SHALL BE LEFT BROOM CLEAN AT THE COMPLETION OF THE DEMOLITION AS DEFINED IN THE CONTRACTOR'S SCOPE OF WORK.

4. COORDINATE DIMENSIONS OF ALL DEMOLITION WORK WITH MECHANICAL, ELECTRICAL AND ARCHITECTURAL DRAWINGS. ALL WALL OPENINGS TO BE MARKED BY CONTRACTOR AND APPROVED BY ARCHITECT BEFORE DEMOLITION.

5. ALL STRUCTURAL ELEMENTS TO REMAIN INTACT AND UNTOUCHED INCLUDING ALL FIREPROOFING, U.O.N. WHEN REMOVING PARTITIONS NEAR EXISTING COLUMNS OR BEAMS, CARE TO BE TAKEN TO MAINTAIN FIRE RATED ENCLOSURE OF COLUMN/BEAM.

6. ALL DOOR DEMOLITION TO INCLUDE FRAME, SILL AND ANY ASSOCIATED HARDWARE, U.O.N.

7. SEE MEP DRAWINGS FOR SCOPE OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT REMOVALS.

8. REMOVE ALL UNUSED FASTENERS AND APPURTENANCES FROM FINISH SURFACES TO REMAIN.

9. REMOVE ALL EXG LIGHTING AND ASSOCIATED WIRING/CONDUIT THROUGHOUT, UON.

10. REMOVE ALL EXG ABANDONED CONDUIT AND WIRING. REMOVE FLOOR-MOUNTED OUTLETS AND ACCESSORIES THAT EXTEND ABOVE FLOOR PLANE.

11. PROTECT ALL EXG WALLS, WAINSCOTING AND CORNICES, UON.

12. PROTECT ALL WINDOWS AND SURROUNDS, UON.

13. PROTECT ALL MARBLE FLOORS, BASE, DOOR SURROUNDS AND THRESHOLDS.

14. SALVAGE AND RETURN TO OWNER ITEMS DESIGNATED TO BE REUSED OR STORED.

15. DISCONNECT, CAP OR REROUTE ALL UTILITIES (MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION) IN AREAS OF DEMOLITION AS REQUIRED.

Keynotes	
Note	Description

DEMOLITION LEGEND

- EXISTING PARTITION / LOAD BEARING WALL TO REMAIN
- EXISTING PARTITION / LOAD BEARING WALL TO BE REMOVED
- REMOVE STRUCTURAL SLAB, SEE STRUCTURAL DWGS FOR DETAILS
- REMOVE RAISED FLOOR ASSEMBLY AND FLOOR FINISH
- REMOVE FLOOR FINISH
- REMOVE CASEWORK/ DOORS;FURNITURE;FIXTURE
- OPENING TO BELOW
- OPENING ABOVE

10/17/2025 8:41:00 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

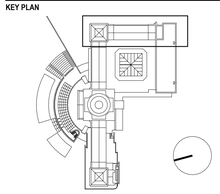
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

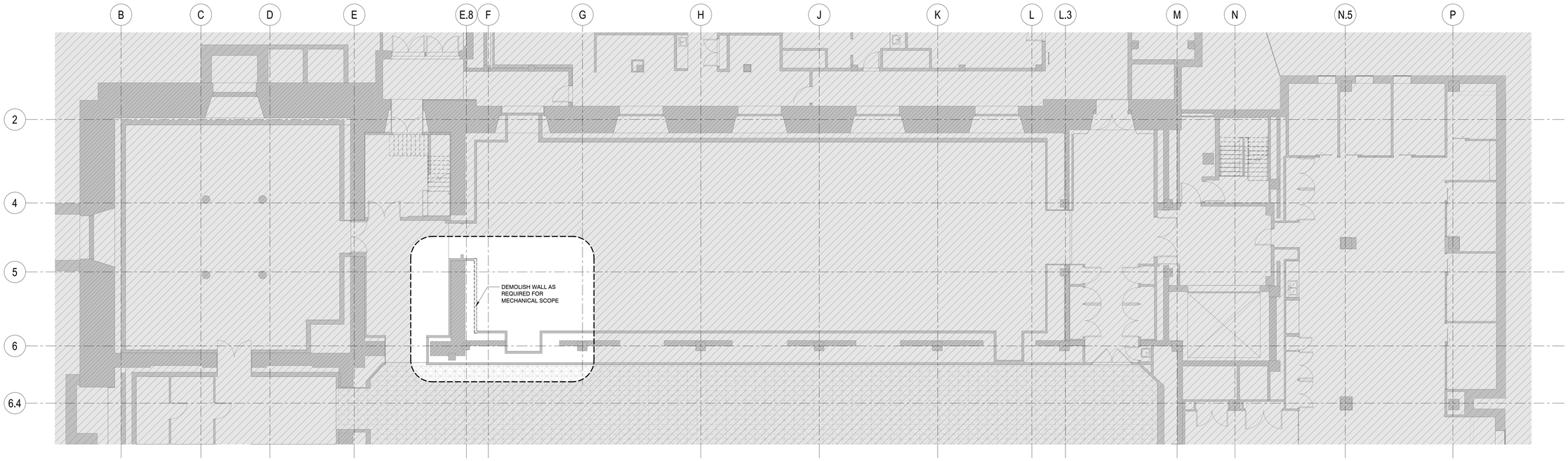
DRAWING TITLE

BASEMENT DEMO PLAN

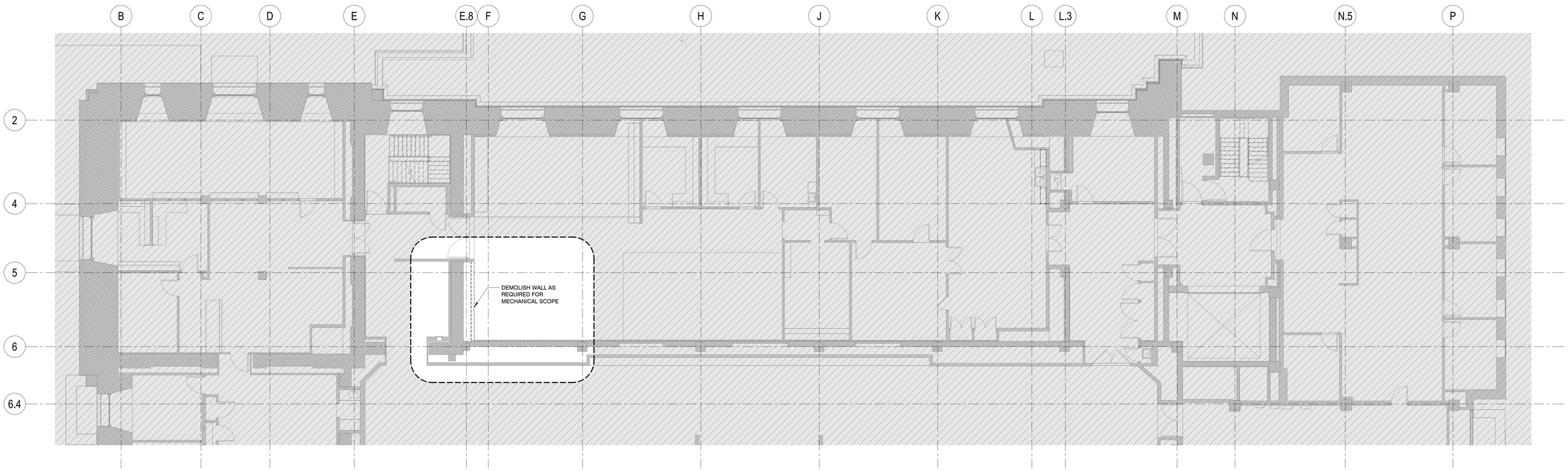
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

AD101



2 FIRST FLOOR DEMO PLAN
AD102 1/8" = 1'-0"



1 SECOND FLOOR DEMO
AD102 1/8" = 1'-0"

GENERAL NOTES FOR SELECTIVE DISMANTLING

1. CONTRACTOR SHALL PERFORM ALL OPERATIONS OF SELECTIVE DEMOLITION, DISMANTLING, AND REMOVAL INDICATED ON THE DRAWINGS AND AS MAY BE REQUIRED BY THE WORK AND SHALL WORK CAREFULLY AND NEATLY IN A SYSTEMATIC MANNER.

2. PROTECT ALL HISTORIC FINISHES ADJACENT TO DEMOLITION FROM VIBRATION, DUST & DEBRIS. FINISHES INCLUDE: TERRAZZO, STONE, PLASTER, MOULDINGS, AND MILLWORK. PROTECT ALL WINDOWS.

3. NO DEBRIS SHALL BE ALLOWED TO ACCUMULATE ON THE SITE. DEBRIS SHALL BE REMOVED BY THE CONTRACTOR AS THE JOB PROCEEDS. THE SITE SHALL BE LEFT BROOM CLEAN AT THE COMPLETION OF THE DEMOLITION AS DEFINED IN THE CONTRACTOR'S SCOPE OF WORK.

4. COORDINATE DIMENSIONS OF ALL DEMOLITION WORK WITH MECHANICAL, ELECTRICAL AND ARCHITECTURAL DRAWINGS. ALL WALL OPENINGS TO BE MARKED BY CONTRACTOR AND APPROVED BY ARCHITECT BEFORE DEMOLITION.

5. ALL STRUCTURAL ELEMENTS TO REMAIN INTACT AND UNTOUCHED INCLUDING ALL FIREPROOFING, U.O.N. WHEN REMOVING PARTITIONS NEAR EXISTING COLUMNS OR BEAMS, CARE TO BE TAKEN TO MAINTAIN FIRE RATED ENCLOSURE OF COLUMN/BEAM.

6. ALL DOOR DEMOLITION TO INCLUDE FRAME, SILL AND ANY ASSOCIATED HARDWARE, U.O.N.

7. SEE MEP DRAWINGS FOR SCOPE OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT REMOVALS.

8. REMOVE ALL UNUSED FASTENERS AND APPURTENANCES FROM FINISH SURFACES TO REMAIN.

9. REMOVE ALL EXG LIGHTING AND ASSOCIATED WIRING/CONDUIT THROUGHOUT, UON.

10. REMOVE ALL EXG ABANDONED CONDUIT AND WIRING. REMOVE FLOOR-MOUNTED OUTLETS AND ACCESSORIES THAT EXTEND ABOVE FLOOR PLANE.

11. PROTECT ALL EXG WALLS, WAINSCOTING AND CORNICES, UON.

12. PROTECT ALL WINDOWS AND SURROUNDS, UON.

13. PROTECT ALL MARBLE FLOORS, BASE, DOOR SURROUNDS AND THRESHOLDS.

14. SALVAGE AND RETURN TO OWNER ITEMS DESIGNATED TO BE REUSED OR STORED.

15. DISCONNECT, CAP OR REROUTE ALL UTILITIES (MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION) IN AREAS OF DEMOLITION AS REQUIRED.

DEMOLITION LEGEND

- EXISTING PARTITION / LOAD BEARING WALL TO REMAIN
- EXISTING PARTITION / LOAD BEARING WALL TO BE REMOVED
- REMOVE STRUCTURAL SLAB, SEE STRUCTURAL DWGS FOR DETAILS
- REMOVE RAISED FLOOR ASSEMBLY AND FLOOR FINISH
- REMOVE FLOOR FINISH
- REMOVE CASEWORK/ DOORS/FURNITURE/FIXTURE
- OPENING TO BELOW
- OPENING ABOVE

10/17/2025 8:41:02 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

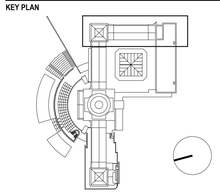
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

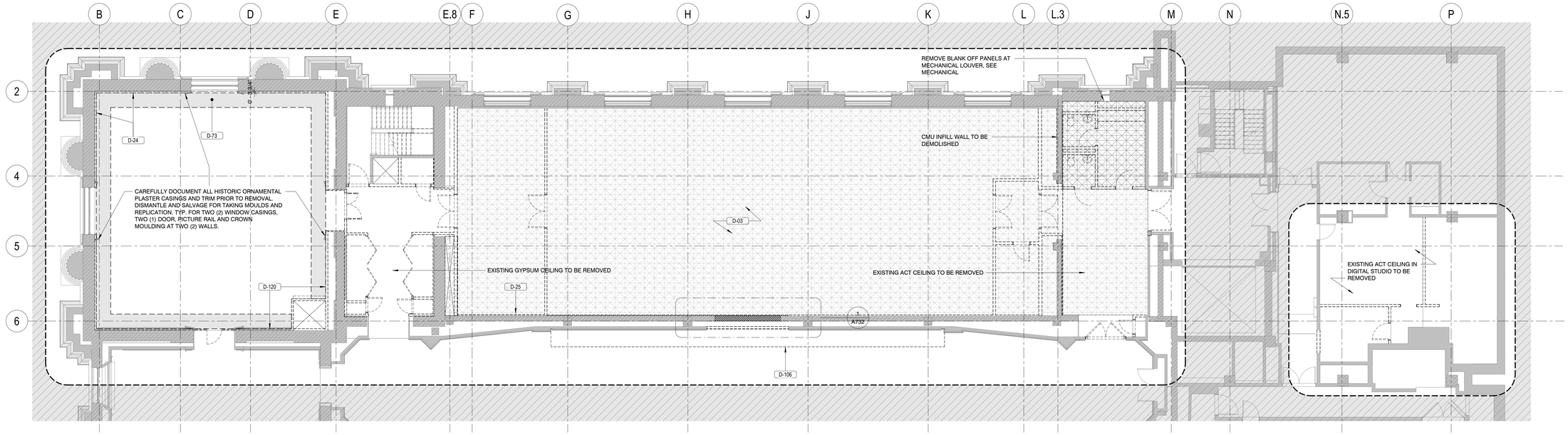
DRAWING TITLE

FIRST AND SECOND FLOOR DEMO PLAN

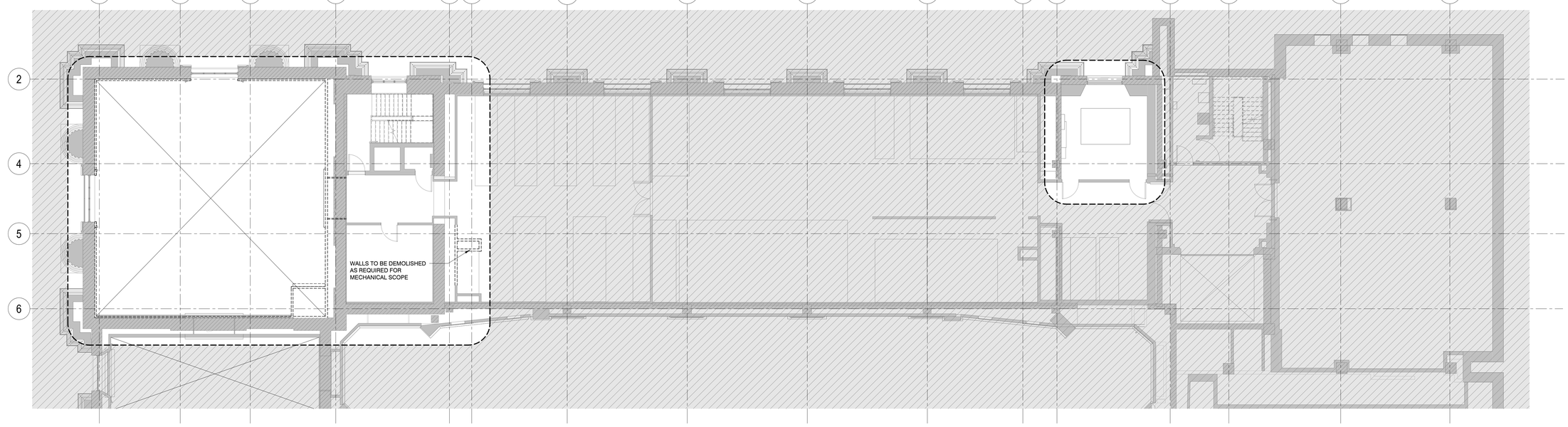
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

AD102



1 AD103 THIRD FLOOR DEMO PLAN
1/8" = 1'-0"



2 AD103 THIRD FLOOR MEZZ DEMO PLAN
1/8" = 1'-0"

GENERAL NOTES FOR SELECTIVE DISMANTLING

1. CONTRACTOR SHALL PERFORM ALL OPERATIONS OF SELECTIVE DEMOLITION, DISMANTLING, AND REMOVAL INDICATED ON THE DRAWINGS AND AS MAY BE REQUIRED BY THE WORK AND SHALL WORK CAREFULLY AND NEATLY IN A SYSTEMATIC MANNER.

2. PROTECT ALL HISTORIC FINISHES ADJACENT TO DEMOLITION FROM VIBRATION, DUST & DEBRIS. FINISHES INCLUDE: TERRAZZO, STONE, PLASTER, MOULDINGS, AND MILLWORK. PROTECT ALL WINDOWS.

3. NO DEBRIS SHALL BE ALLOWED TO ACCUMULATE ON THE SITE. DEBRIS SHALL BE REMOVED BY THE CONTRACTOR AS THE JOB PROCEEDS. THE SITE SHALL BE LEFT BROOM CLEAN AT THE COMPLETION OF THE DEMOLITION AS DEFINED IN THE CONTRACTOR'S SCOPE OF WORK.

4. COORDINATE DIMENSIONS OF ALL DEMOLITION WORK WITH MECHANICAL, ELECTRICAL AND ARCHITECTURAL DRAWINGS. ALL WALL OPENINGS TO BE MARKED BY CONTRACTOR AND APPROVED BY ARCHITECT BEFORE DEMOLITION.

5. ALL STRUCTURAL ELEMENTS TO REMAIN INTACT AND UNTOUCHED INCLUDING ALL FIREPROOFING, U.O.N. WHEN REMOVING PARTITIONS NEAR EXISTING COLUMNS OR BEAMS, CARE TO BE TAKEN TO MAINTAIN FIRE RATED ENCLOSURE OF COLUMN/BEAM.

6. ALL DOOR DEMOLITION TO INCLUDE FRAME, SILL AND ANY ASSOCIATED HARDWARE, U.O.N.

7. SEE MEP DRAWINGS FOR SCOPE OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT REMOVALS.

8. REMOVE ALL UNUSED FASTENERS AND APPURTENANCES FROM FINISH SURFACES TO REMAIN.

9. REMOVE ALL EXG LIGHTING AND ASSOCIATED WIRING/CONDUIT THROUGHOUT, UON.

10. REMOVE ALL EXG ABANDONED CONDUIT AND WIRING. REMOVE FLOOR-MOUNTED OUTLETS AND ACCESSORIES THAT EXTEND ABOVE FLOOR PLANE.

11. PROTECT ALL EXG WALLS, WAINSCOTING AND CORNICES, UON.

12. PROTECT ALL WINDOWS AND SURROUNDS, UON.

13. PROTECT ALL MARBLE FLOORS, BASE, DOOR SURROUNDS AND THRESHOLDS.

14. SALVAGE AND RETURN TO OWNER ITEMS DESIGNATED TO BE REUSED OR STORED.

15. DISCONNECT, CAP OR REROUTE ALL UTILITIES (MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION) IN AREAS OF DEMOLITION AS REQUIRED.

Keynotes

Note	Description
D-03	REMOVE 3/16" EPOXY AND GRIND DOWN 1/2" OF TERRAZZO TILE FLOORING, PREPARE SURFACE TO RECEIVE SELF-LEVELING CONCRETE
D-24	REMOVE EXG PLASTER AND TERRACOTTA TO FACE OF EXG BRICK
D-25	REMOVE GWB FURRING DOWN TO MASONRY WALL
D-73	PROTECT EXG MOSAIC BORDER
D-106	DISMANTLE TEMPORARY EXHIBITION PLATFORM
D-120	REMOVE ALL EXG, EXPOSED CONDUIT, DEVICES AND CABLING

DEMOLITION LEGEND

- EXISTING PARTITION / LOAD BEARING WALL TO REMAIN
- EXISTING PARTITION / LOAD BEARING WALL TO BE REMOVED
- REMOVE STRUCTURAL SLAB, SEE STRUCTURAL DWGS FOR DETAILS
- REMOVE RAISED FLOOR ASSEMBLY AND FLOOR FINISH
- REMOVE FLOOR FINISH
- REMOVE CASEWORK/ DOORS/FURNITURE/FIXTURE
- OPENING TO BELOW
- OPENING ABOVE

10/17/2025 8:41:07 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

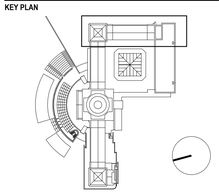
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

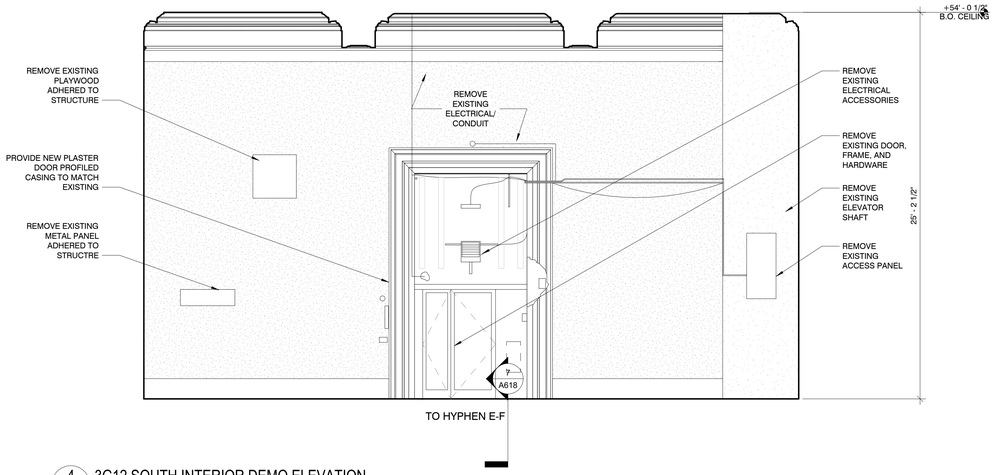
DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ DEMO PLANS

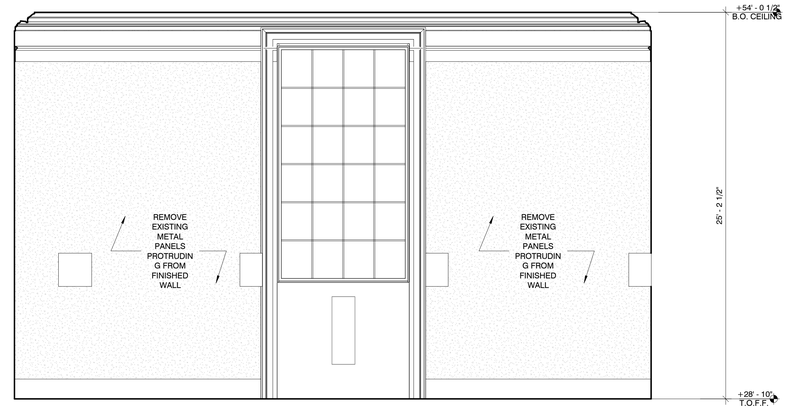
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

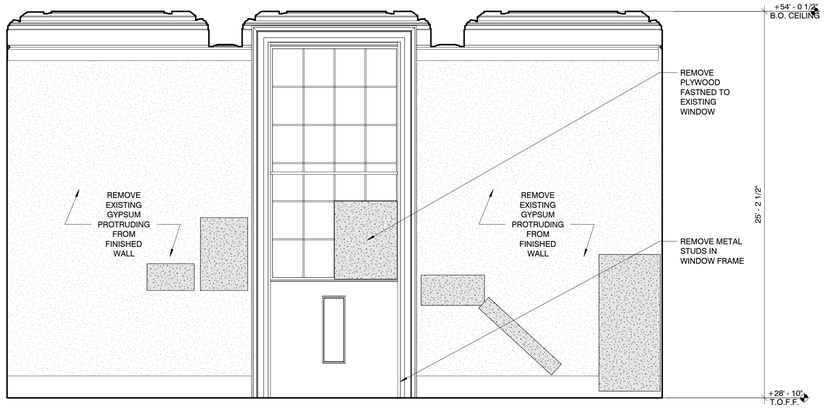
AD103



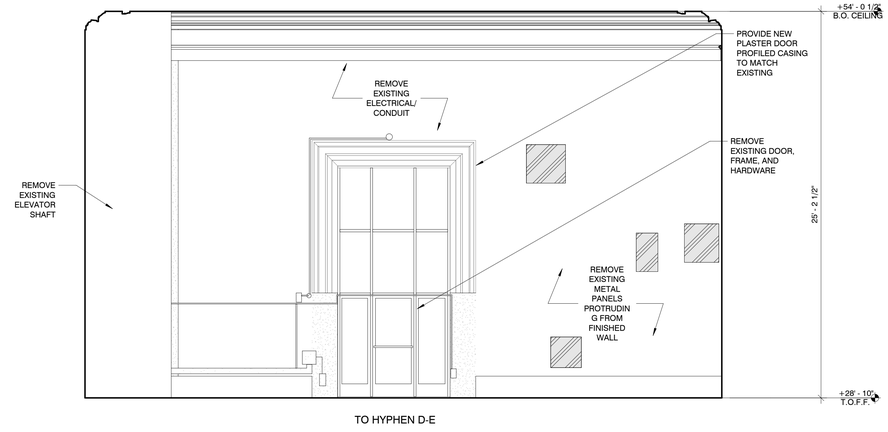
4 AD201 3G12 SOUTH INTERIOR DEMO ELEVATION
1/4" = 1'-0"



3 AD201 3G12 EAST INTERIOR DEMO ELEVATION
1/4" = 1'-0"



2 AD201 3G12 NORTH INTERIOR DEMO ELEVATION
1/4" = 1'-0"



1 AD201 3G12 WEST INTERIOR DEMO ELEVATION
1/4" = 1'-0"

GENERAL NOTES FOR SELECTIVE DISMANTLING

1. CONTRACTOR SHALL PERFORM ALL OPERATIONS OF SELECTIVE DEMOLITION, DISMANTLING, AND REMOVAL INDICATED ON THE DRAWINGS AND AS MAY BE REQUIRED BY THE WORK AND SHALL WORK CAREFULLY AND NEATLY IN A SYSTEMATIC MANNER.

2. PROTECT ALL HISTORIC FINISHES ADJACENT TO DEMOLITION FROM VIBRATION, DUST & DEBRIS. FINISHES INCLUDE: TERRAZZO, STONE, PLASTER, MOULDINGS, AND MILLWORK. PROTECT ALL WINDOWS.

3. NO DEBRIS SHALL BE ALLOWED TO ACCUMULATE ON THE SITE. DEBRIS SHALL BE REMOVED BY THE CONTRACTOR AS THE JOB PROCEEDS. THE SITE SHALL BE LEFT BROOM CLEAN AT THE COMPLETION OF THE DEMOLITION AS DEFINED IN THE CONTRACTOR'S SCOPE OF WORK.

4. COORDINATE DIMENSIONS OF ALL DEMOLITION WORK WITH MECHANICAL, ELECTRICAL AND ARCHITECTURAL DRAWINGS. ALL WALL OPENINGS TO BE MARKED BY CONTRACTOR AND APPROVED BY ARCHITECT BEFORE DEMOLITION.

5. ALL STRUCTURAL ELEMENTS TO REMAIN INTACT AND UNTOUCHED INCLUDING ALL FIREPROOFING, U.O.N. WHEN REMOVING PARTITIONS NEAR EXISTING COLUMNS OR BEAMS, CARE TO BE TAKEN TO MAINTAIN FIRE RATED ENCLOSURE OF COLUMN/BEAM.

6. ALL DOOR DEMOLITION TO INCLUDE FRAME, SILL AND ANY ASSOCIATED HARDWARE, U.O.N.

7. SEE MEP DRAWINGS FOR SCOPE OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT REMOVALS.

8. REMOVE ALL UNUSED FASTENERS AND APPURTENANCES FROM FINISH SURFACES TO REMAIN.

9. REMOVE ALL EXG LIGHTING AND ASSOCIATED WIRING/CONDUIT THROUGHOUT, UON.

10. REMOVE ALL EXG ABANDONED CONDUIT AND WIRING. REMOVE FLOOR-MOUNTED OUTLETS AND ACCESSORIES THAT EXTEND ABOVE FLOOR PLANE.

11. PROTECT ALL EXG WALLS, WAINSCOTING AND CORNICES, UON.

12. PROTECT ALL WINDOWS AND SURROUNDS, UON.

13. PROTECT ALL MARBLE FLOORS, BASE, DOOR SURROUNDS AND THRESHOLDS.

14. SALVAGE AND RETURN TO OWNER ITEMS DESIGNATED TO BE REUSED OR STORED.

15. DISCONNECT, CAP OR REROUTE ALL UTILITIES (MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION) IN AREAS OF DEMOLITION AS REQUIRED.

FIG. 1: EXISTING DOOR CASING EAST

REMOVE EXISTING, GRIND DOWN PATCH AND REPAIR PORTAL TO MATCH ADJACENT FINISHES. EXTEND MOLDING, MATCH DIMENSIONS, FINISHES, SEAMS, AND JOINTS TO EXISTING EXACTLY.

FIG. 2: EXISTING DOOR CASING SOUTH

REMOVE EXISTING, PROVIDE NEW PLASTER DOOR PROFILED CASING TO MATCH EXISTING. NEW PROFILES, DIMENSIONS, FINISHES, SEAMS, AND JOINTS TO MATCH EXISTING EXACTLY. REMOVE ALL ELECTRICAL.

FIG. 3: EXISTING PORTAL CONDITION SOUTH

REMOVE AND RELOCATE ALL EXISTING ELECTRICAL CONDUIT AND LIGHTING CONTROL DEVICES. RELOCATE FIRE EXTINGUISHER.

FIG. 4: EXISTING DOOR CASINGS

PROVIDE NEW PLASTER WINDOW PROFIL CASING TO MATCH EXISTING. NEW PROFILES, DIMENSIONS, FINISHES, SEAMS, AND JOINTS TO MATCH EXISTING EXACTLY. TYP. FOR (2) WINDOWS. REMOVE EXISTING PLYWOOD AND GYPSUM FASTNED TO STRUCTURE.

FIG. 5: EXISTING ELECTRICAL

REMOVE EXISTING LIGHT FIXTURES, CONDUITES, SMOKE DETECTORS AND PLYWOOD FASTNED TO STRUCTURE.

FIG. 6: EXISTING ELEVATOR SHAFT

REMOVE EXISTING SHAFT. REPLACE MOLDING EXACTLY AT CEILING. REMOVE EXISTING LIGHT FIXTURES, CONDUITES, SMOKE DETECTORS, JUNCTION BOXES AND ACCESS PANEL.

FIG. 7: EXISTING MARBLE SADDLE

REMOVE EXISTING DUCT TO FINISH SURFACE. PATCH AND REPAIR WALL WHERE NECESSARY.

10/17/2025 8:41:11 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

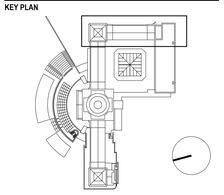
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

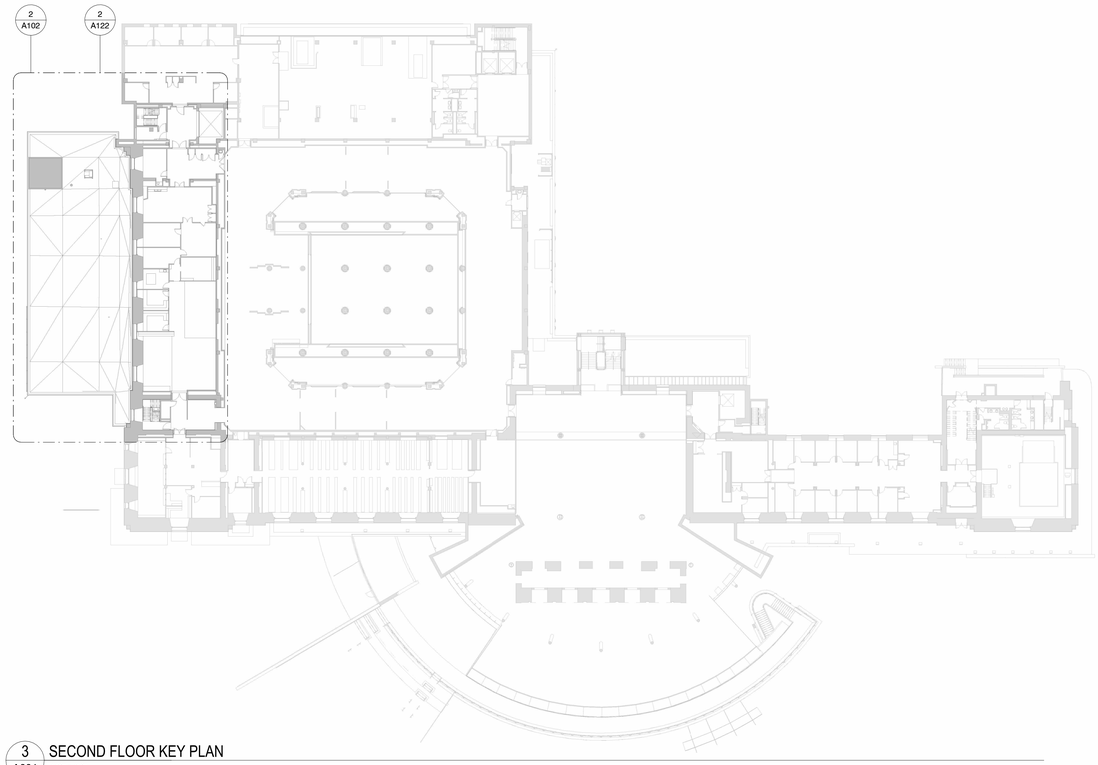
DRAWING TITLE

ENLARGED INTERIOR DEMO ELEVATIONS - WING E

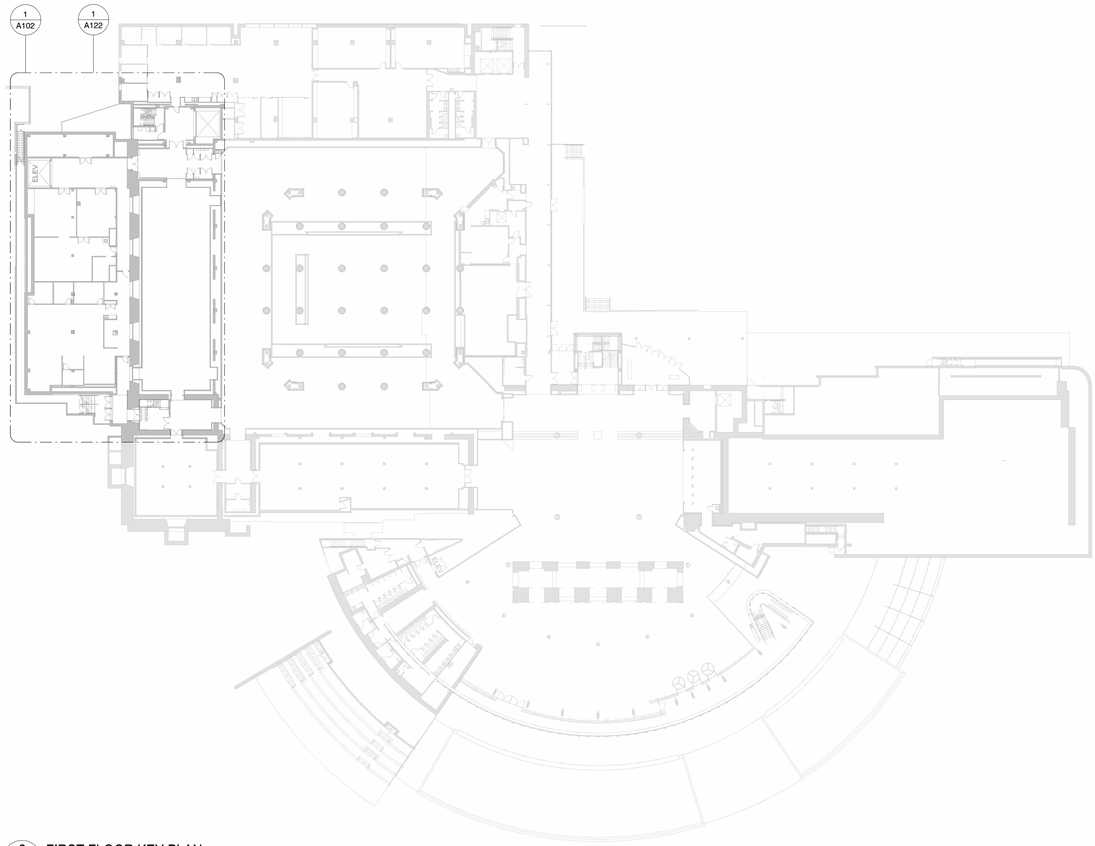
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

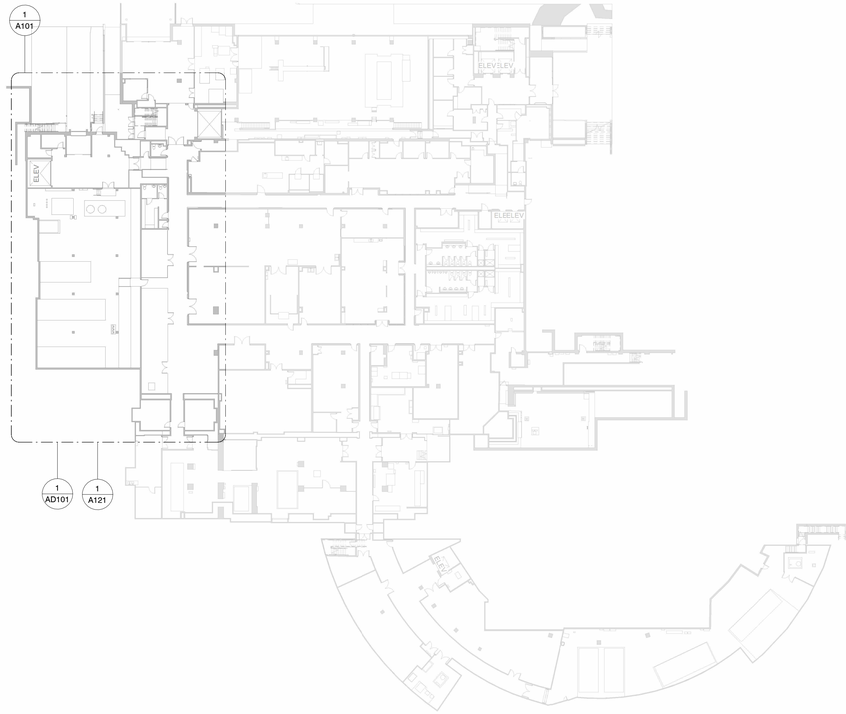
AD201



3 A001 SECOND FLOOR KEY PLAN
1/32" = 1'-0"



2 A001 FIRST FLOOR KEY PLAN
1/32" = 1'-0"



1 A001 BASEMENT FLOOR KEY PLAN
1/32" = 1'-0"

10/17/2025 8:41:23 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

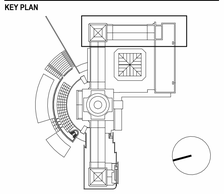
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

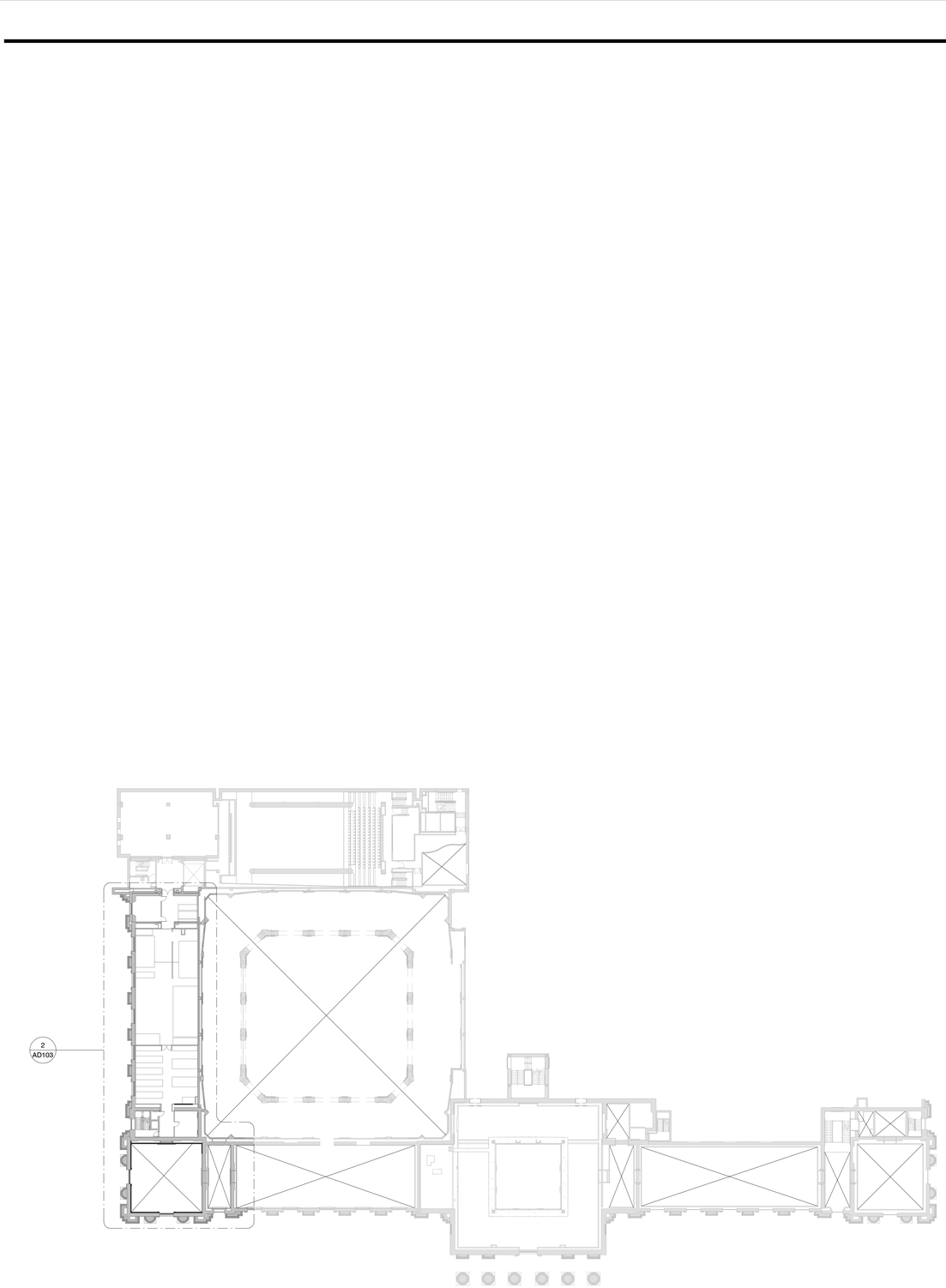
DRAWING TITLE

KEY PLANS

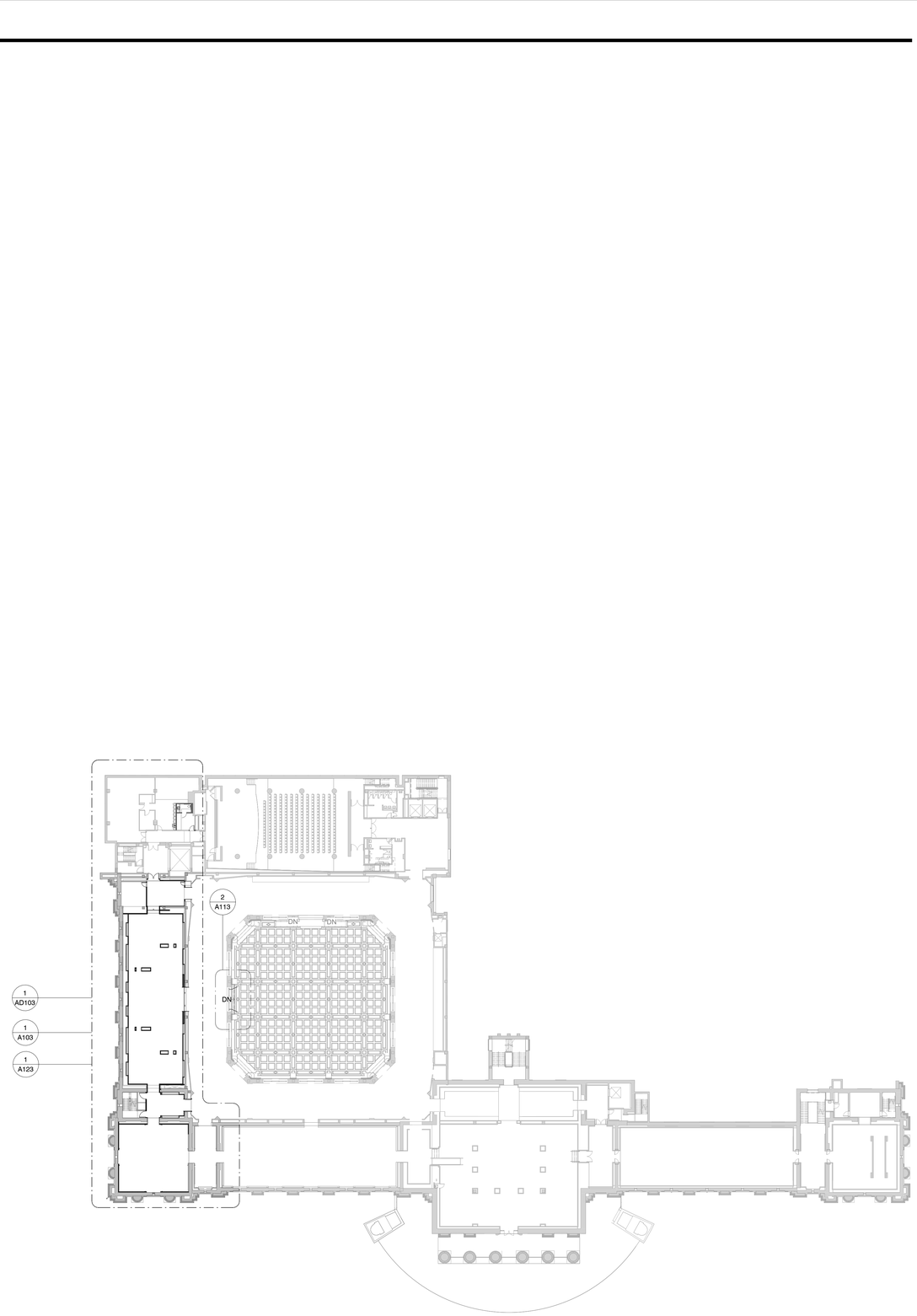
SCALE	1/32" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A001



2 THIRD FLOOR MEZZ KEY PLAN
A002 1/32" = 1'-0"



1 THIRD FLOOR KEY PLAN
A002 1/32" = 1'-0"

10/17/2025 8:41:28 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

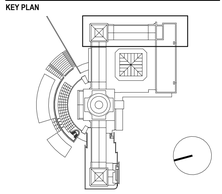
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

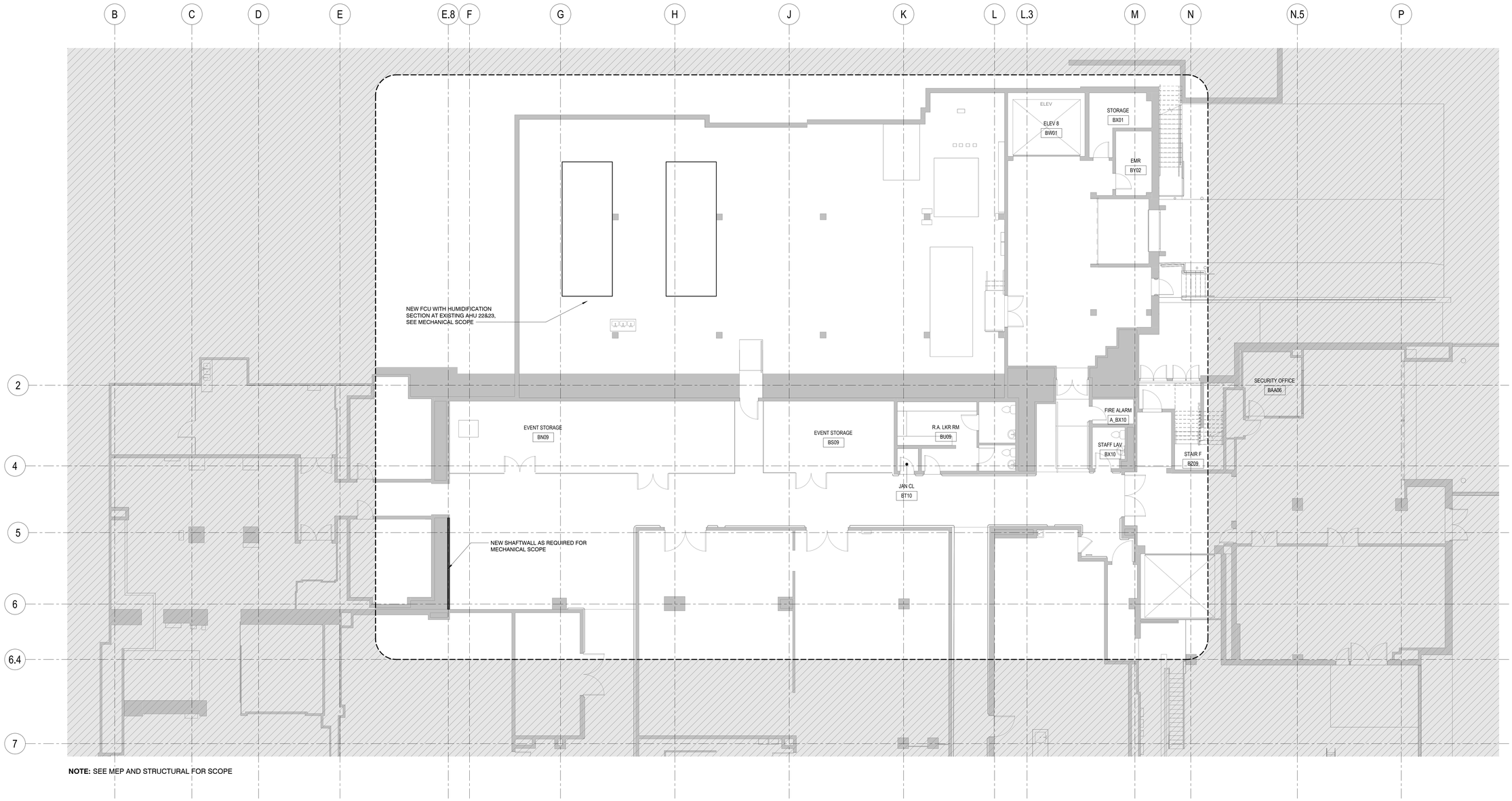
DRAWING TITLE

KEY PLANS

SCALE	1/32" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A002



NOTE: SEE MEP AND STRUCTURAL FOR SCOPE

1 A101 BASEMENT FLOOR PLAN
1/8" = 1'-0"

GENERAL NOTES - CONSTRUCTION

1. SEE ARCHITECTURAL NARRATIVE FOR ADDITIONAL DESCRIPTIONS OF SCOPE OF WORK

2. SEE MECHANICAL, ELECTRICAL, LIGHTING, AV, IT DWGS AND NARRATIVES FOR ADDITIONAL SCOPE OF WORK, INCLUDING WALL MOUNTED AND FLOOR DEVICES

3. ALL NOTES REFER TO NEW WORK, BUT DO NOT NECESSARILY USE THE DESIGNATION "NEW". "EXG" REFERS TO EXISTING CONDITIONS WHERE INDICATED.

4. SEE INTERIOR ELEVATIONS AND DETAILS WHERE INDICATED FOR SCOPE OF WORK.

5. SEE ARCHITECTURAL NARRATIVE FOR FINISH MATERIALS.

6. ALL NEW FULL-HEIGHT PARTITIONS SHALL EXTEND TO STRUCTURAL SLAB.

7. ALL NEW, ABANDONED, AND EXISTING PENETRATIONS SHALL BE FIRESTOPPED.

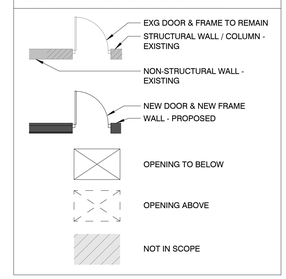
8. ALL NEW FLOOR FINISHES TO MATCH EXG FLOOR FINISH ELEVATION UON. CONTRACTOR TO PROVIDE CONCRETE TOPPING/SETTING BED THICKNESS AS REQUIRED TO FILL AREA BETWEEN SLAB AND FINISH MATERIAL TO ACHIEVE EXG FLOOR LEVEL.

9. WHEN CORING THROUGH TERRA COTTA FLAT ARCH, MAINTAIN 3X THE DIAMETER OF THE CORE BETWEEN ADJACENT CORES.

10. ALL AREAS IN SCOPE SHALL RECEIVE FINE CLEANING UPON COMPLETION OF CONSTRUCTION.

Keynotes	
Note	Description

CONSTRUCTION LEGEND



10/17/2025 8:41:31 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

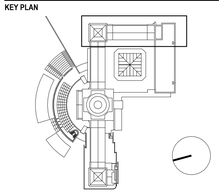
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

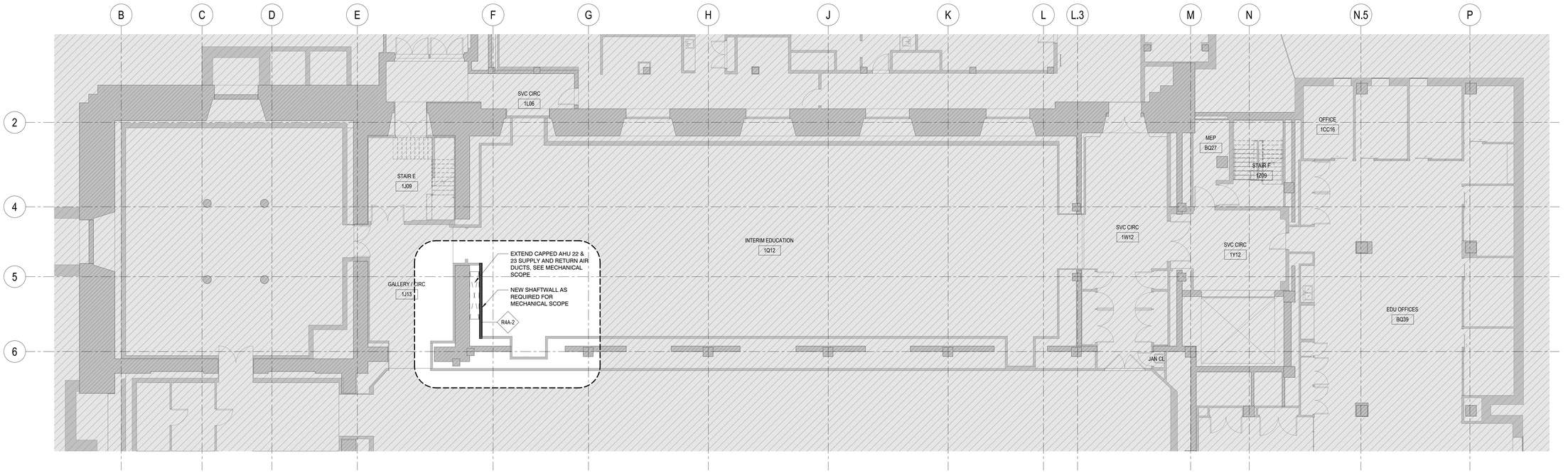
DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

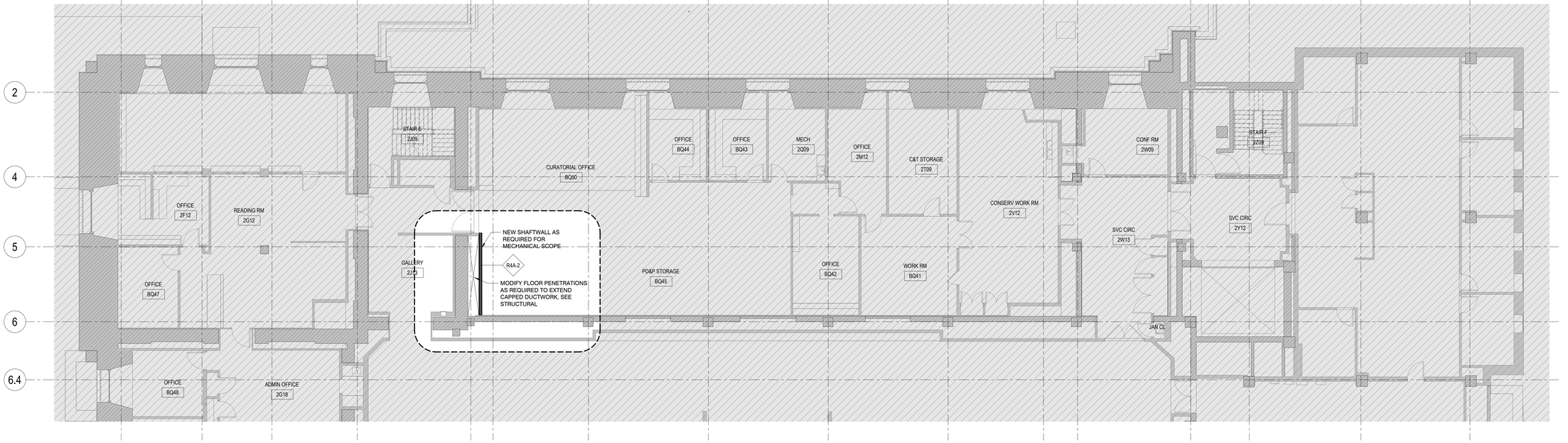
DRAWING TITLE

BASEMENT FLOOR PLAN

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A101



1 A102 FIRST FLOOR PLAN
1/8" = 1'-0"



2 A102 SECOND FLOOR PLAN
1/8" = 1'-0"

GENERAL NOTES - CONSTRUCTION

1. SEE ARCHITECTURAL NARRATIVE FOR ADDITIONAL DESCRIPTIONS OF SCOPE OF WORK

2. SEE MECHANICAL, ELECTRICAL, LIGHTING, AV, IT DWGS AND NARRATIVES FOR ADDITIONAL SCOPE OF WORK, INCLUDING WALL MOUNTED AND FLOOR DEVICES

3. ALL NOTES REFER TO NEW WORK, BUT DO NOT NECESSARILY USE THE DESIGNATION "NEW". "EXG" REFERS TO EXISTING CONDITIONS WHERE INDICATED.

4. SEE INTERIOR ELEVATIONS AND DETAILS WHERE INDICATED FOR SCOPE OF WORK.

5. SEE ARCHITECTURAL NARRATIVE FOR FINISH MATERIALS.

6. ALL NEW FULL-HEIGHT PARTITIONS SHALL EXTEND TO STRUCTURAL SLAB.

7. ALL NEW, ABANDONED, AND EXISTING PENETRATIONS SHALL BE FIRESTOPPED.

8. ALL NEW FLOOR FINISHES TO MATCH EXG FLOOR FINISH ELEVATION UON. CONTRACTOR TO PROVIDE CONCRETE TOPPING/SETTING BED THICKNESS AS REQUIRED TO FILL AREA BETWEEN SLAB AND FINISH MATERIAL TO ACHIEVE EXG FLOOR LEVEL.

9. WHEN CORING THROUGH TERRA COTTA FLAT ARCH, MAINTAIN 3X THE DIAMETER OF THE CORE BETWEEN ADJACENT CORES.

10. ALL AREAS IN SCOPE SHALL RECEIVE FINE CLEANING UPON COMPLETION OF CONSTRUCTION.

Keynotes	
Note	Description

CONSTRUCTION LEGEND

- EXG DOOR & FRAME TO REMAIN
- STRUCTURAL WALL / COLUMN - EXISTING
- NON-STRUCTURAL WALL - EXISTING
- NEW DOOR & NEW FRAME
- WALL - PROPOSED
- OPENING TO BELOW
- OPENING ABOVE
- NOT IN SCOPE

10/17/2025 8:41:34 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

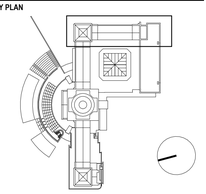
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

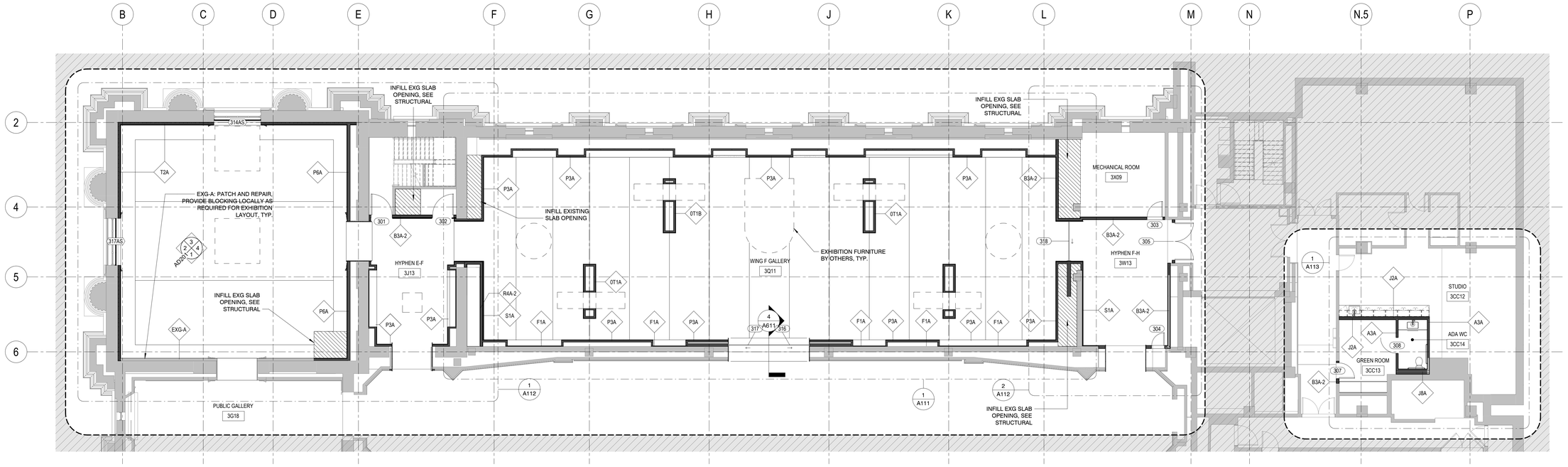
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

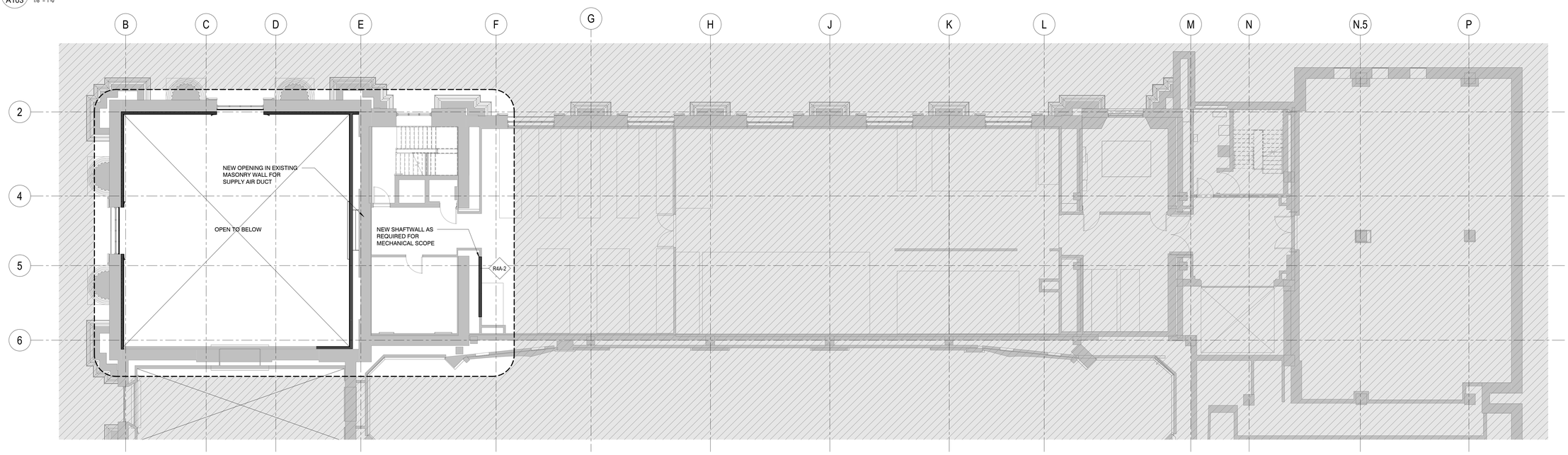
FIRST AND SECOND FLOOR PLANS

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

A102



1 A103 THIRD FLOOR PLAN
1/8" = 1'-0"



2 A103 THIRD FLOOR MEZZ PLAN
1/8" = 1'-0"

CONSTRUCTION LEGEND

- EXG DOOR & FRAME TO REMAIN
- STRUCTURAL WALL / COLUMN - EXISTING
- NON-STRUCTURAL WALL - EXISTING
- NEW DOOR & NEW FRAME
- WALL - PROPOSED
- OPENING TO BELOW
- OPENING ABOVE
- NOT IN SCOPE

10/17/2025 8:41:38 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN

STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

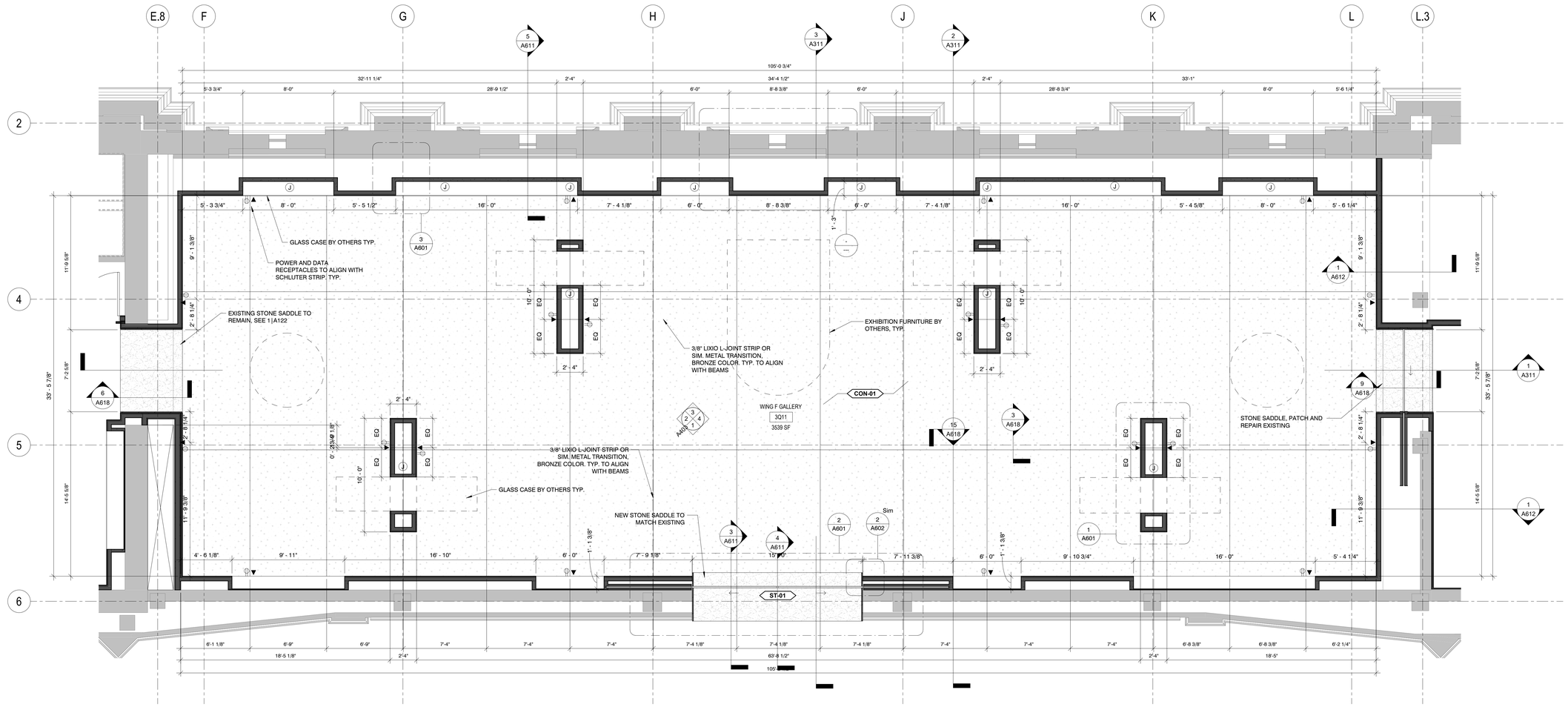
DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ PLANS

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A103



1 A111 THIRD FLOOR ENLARGED PLAN - WING F

1/4" = 1'-0"

10/17/2025 8:41:40 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

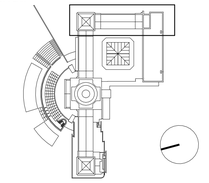
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

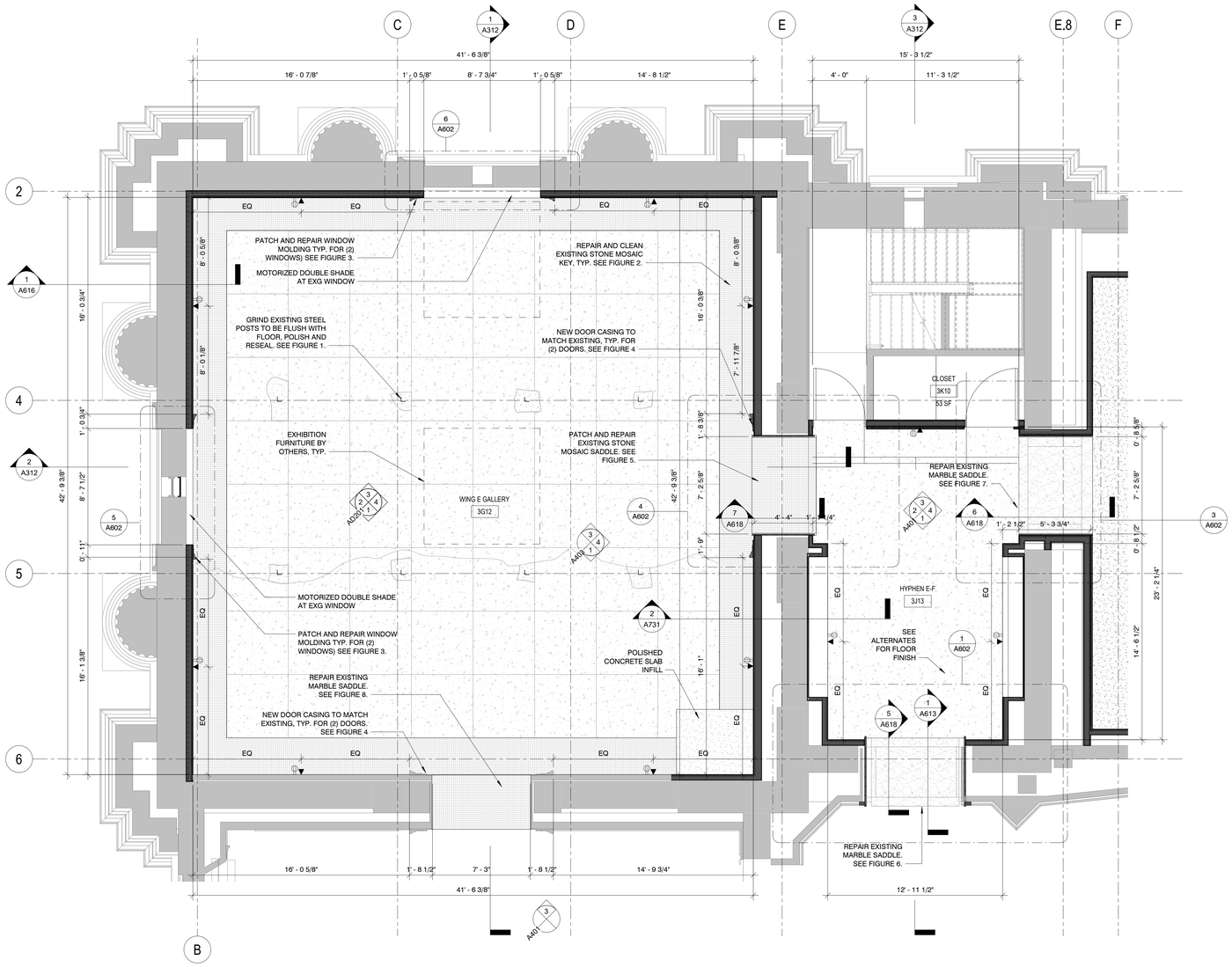
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

FINISH FLOOR PLANS - THIRD FLOOR WING F

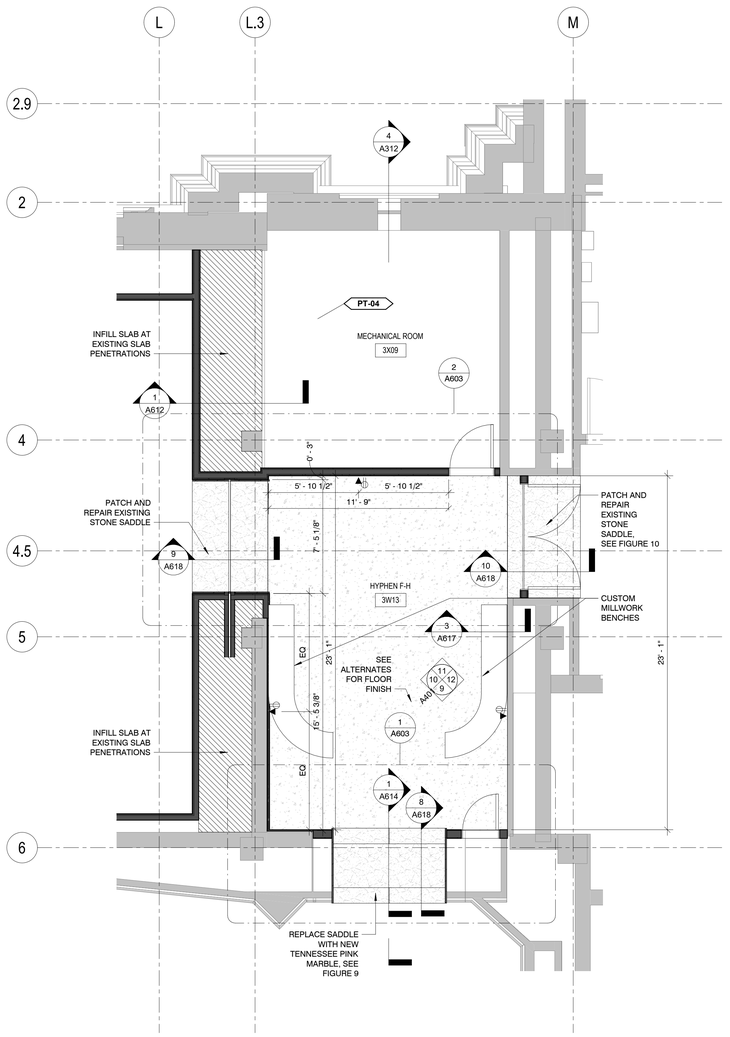
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

A111



1 A112 THIRD FLOOR ENLARGED PLAN - WING E & HYPHEN E-F

1/4" = 1'-0"



2 A112 THIRD FLOOR ENLARGED PLAN - HYPHEN F-H

1/4" = 1'-0"

FIG. 1: EXISTING CUT STORAGE POSTS

GRIND DOWN EXISTING STEEL POST TO BE FLUSH WITH FLOOR, CLEAN AND REPOLISH

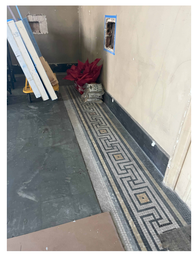


FIG. 2: EXISTING STONE MOSAIC KEY

REPAIR STONE MOSAIC, CLEAN, AND PROVIDE INFILL AT AREAS OF MISSING MOSAIC TO MATCH EXISTING STONE MOSAIC TYPE, COLOR, AND TEXTURE.

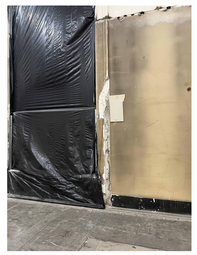


FIG. 3: EXISTING WINDOW CASINGS

PROVIDE NEW PLASTER WINDOW PROFILED CASING TO MATCH EXISTING. NEW PROFILES, DIMENSIONS, FINISHES, SEAMS, AND JOINTS TO MATCH EXISTING EXACTLY. TYP. FOR (2) WINDOWS

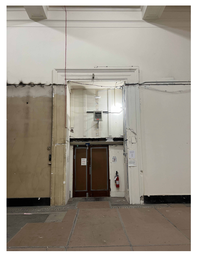


FIG. 4: EXISTING DOOR CASINGS

PROVIDE NEW PLASTER DOOR PROFILED CASING TO MATCH EXISTING. NEW PROFILES, DIMENSIONS, FINISHES, SEAMS, AND JOINTS TO MATCH EXISTING EXACTLY. TYP. FOR (2) DOORS

FIG. 5: EXISTING STONE MOSAIC SADDLE

REPAIR STONE MOSAIC, CLEAN, AND PROVIDE INFILL AT AREAS OF MISSING MOSAIC TO MATCH EXISTING STONE MOSAIC TYPE, COLOR, AND TEXTURE.

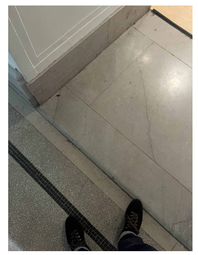


FIG. 6: EXISTING MARBLE SADDLE

CLEAN AND REPAIR EXISTING TENNESSEE PINK MARBLE SADDLE.

FIG. 7: EXISTING STONE MOSAIC SADDLE

CLEAN AND REPAIR EXISTING TENNESSEE PINK MARBLE SADDLE.

FIG. 8: EXISTING STONE MOSAIC SADDLE

CLEAN AND REPAIR EXISTING MOSAIC SADDLE. REMOVE DOOR, PATCH AND REPAIR PORTAL AND MOLDING TO MATCH ADJACENT.

FIG. 9: EXISTING MARBLE SADDLE

REPLACE EXISTING TENNESSEE PINK MARBLE SADDLE IN KIND.

FIG. 10: EXISTING MARBLE SADDLE

CLEAN AND REPAIR EXISTING TENNESSEE PINK MARBLE SADDLE.

10/17/2025 8:41:46 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

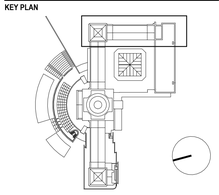
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

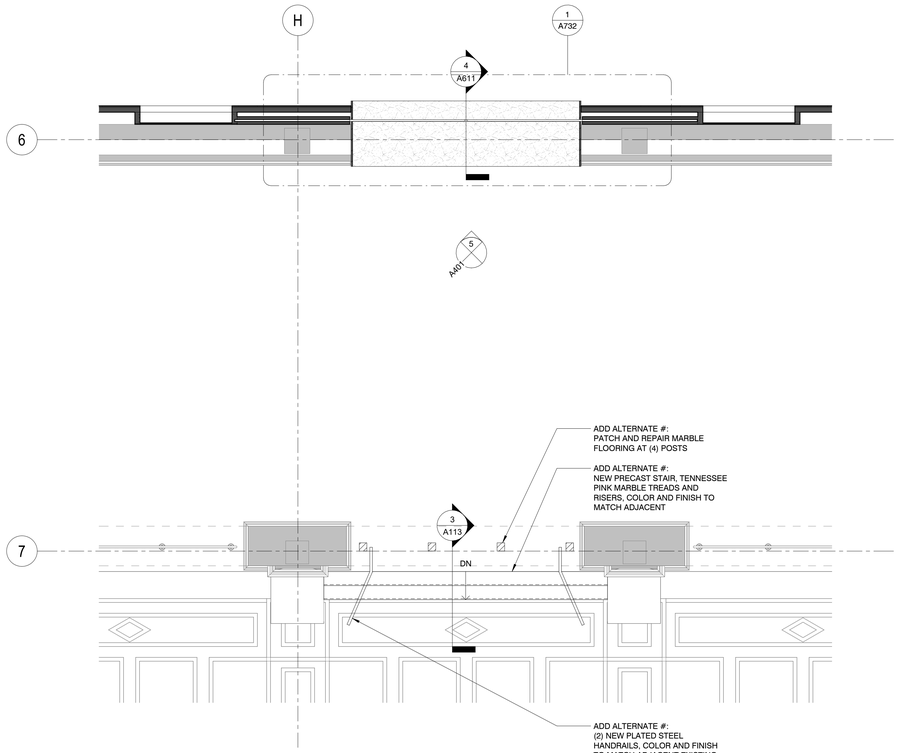
DRAWING TITLE

FINISH FLOOR PLANS - THIRD FLOOR WING E AND HYPHENS

SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A112

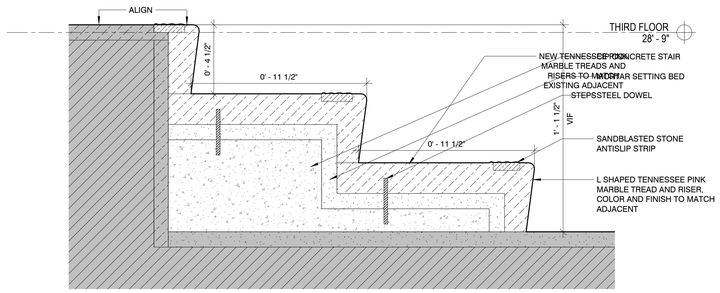


2 A113 ENLARGED PLAN - BEAUX ARTS COURT AMBULATORY STAIRS

1/4" = 1'-0"

ADD ALTERNATE # - STAIR AT BEAUX ARTS COURT

ALL PROPOSED STAIR AND RELATED RESTORATION SCOPE AT BEAUX ARTS COURT SHOWN IN 2|A113 TO BE PRICED AS PART OF ADD ALTERNATE #.

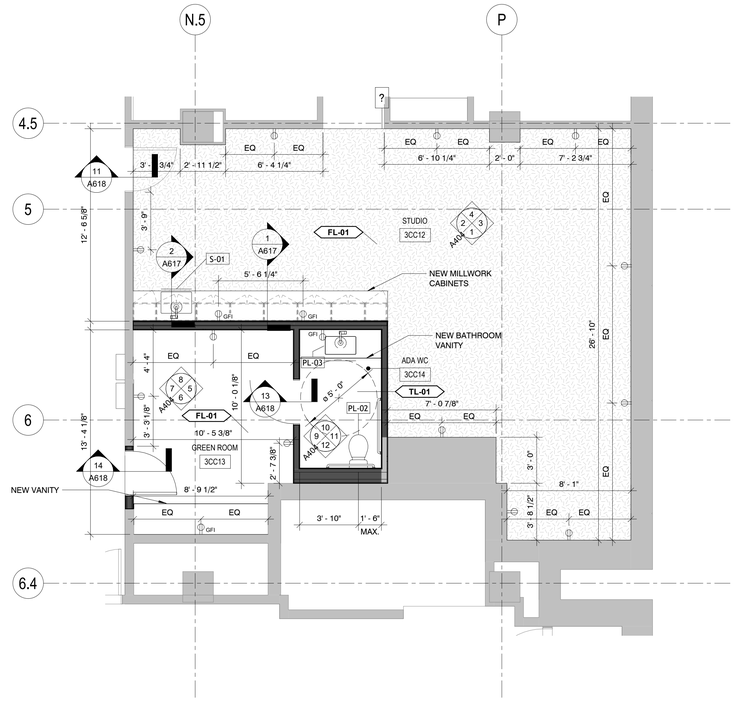


3 A113 ENLARGED SECTION - BEAUX ARTS COURT STAIRS

3" = 1'-0"

ADD ALTERNATE # - STAIR AT BEAUX ARTS COURT

ALL PROPOSED STAIR AND RELATED RESTORATION SCOPE AT BEAUX ARTS COURT SHOWN IN 2|A113 TO BE PRICED AS PART OF ADD ALTERNATE #.



1 A113 THIRD FLOOR ENLARGED PLAN - GREEN ROOM AND DIGITAL STUDIO

1/4" = 1'-0"

GENERAL NOTES - CONSTRUCTION

1. SEE ARCHITECTURAL NARRATIVE FOR ADDITIONAL DESCRIPTIONS OF SCOPE OF WORK

2. SEE MECHANICAL, ELECTRICAL, LIGHTING, AV, IT DWGS AND NARRATIVES FOR ADDITIONAL SCOPE OF WORK, INCLUDING WALL MOUNTED AND FLOOR DEVICES

3. ALL NOTES REFER TO NEW WORK, BUT DO NOT NECESSARILY USE THE DESIGNATION "NEW". "EXG" REFERS TO EXISTING CONDITIONS WHERE INDICATED.

4. SEE INTERIOR ELEVATIONS AND DETAILS WHERE INDICATED FOR SCOPE OF WORK.

5. SEE ARCHITECTURAL NARRATIVE FOR FINISH MATERIALS.

6. ALL NEW FULL-HEIGHT PARTITIONS SHALL EXTEND TO STRUCTURAL SLAB.

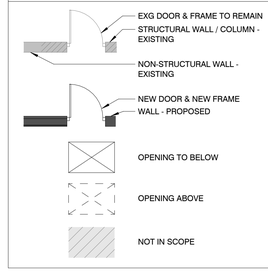
7. ALL NEW, ABANDONED, AND EXISTING PENETRATIONS SHALL BE FIRESTOPPED.

8. ALL NEW FLOOR FINISHES TO MATCH EXG FLOOR FINISH ELEVATION UON. CONTRACTOR TO PROVIDE CONCRETE TOPPING/SETTING BED THICKNESS AS REQUIRED TO FILL AREA BETWEEN SLAB AND FINISH MATERIAL TO ACHIEVE EXG FLOOR LEVEL.

9. WHEN CORING THROUGH TERRA COTTA FLAT ARCH, MAINTAIN 3X THE DIAMETER OF THE CORE BETWEEN ADJACENT CORES.

10. ALL AREAS IN SCOPE SHALL RECEIVE FINE CLEANING UPON COMPLETION OF CONSTRUCTION.

CONSTRUCTION LEGEND



10/17/2025 8:41:49 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

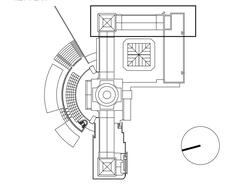
LIGHTING DESIGN
L'Observatoire International
120 Eastern Parkway, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

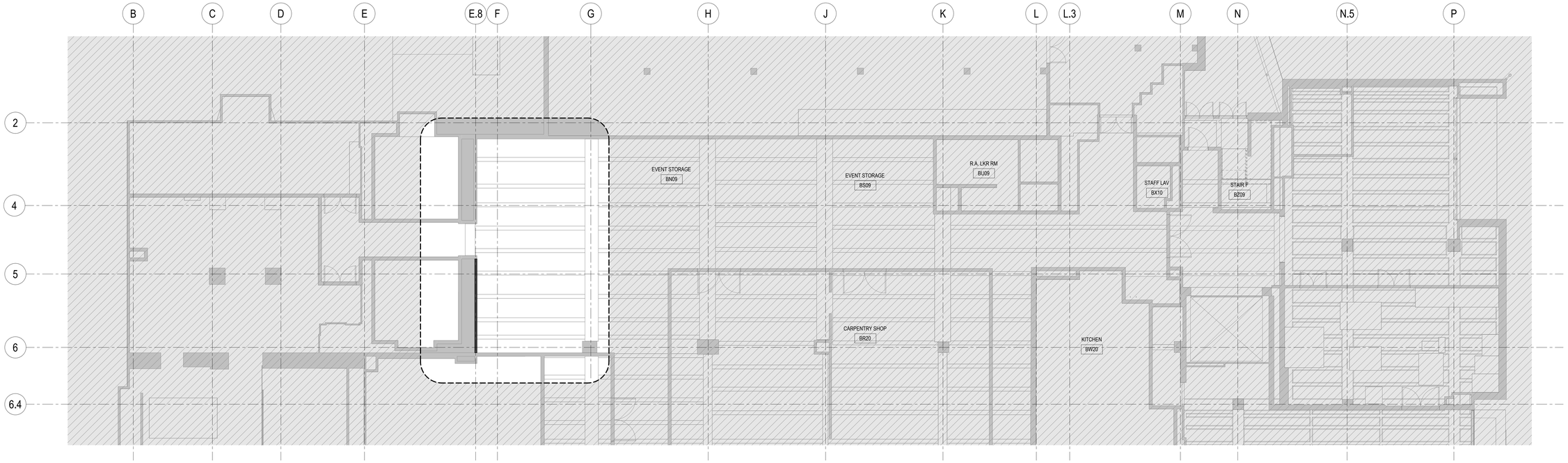
DRAWING TITLE

FINISH FLOOR PLANS - THIRD FLOOR GREEN ROOM AND BAC

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A113



1 BASEMENT RCP
A121 1/8" = 1'-0"

SD REFLECTED CEILING PLANS - GENERAL NOTES

1. ALL NEW FIXTURES IN SPACES OTHER THAN SERVICE AREAS ARE TO HAVE NEW JUNCTION BOXES WITH CONCEALED CONDUIT. NO EXPOSED CONDUIT WILL BE ACCEPTED.

2. FOR SPRINKLER DISTRIBUTION, SEE FIRE PROTECTION NARRATIVE.

3. SEE PROJECT NARRATIVE FOR ADDITIONAL INFORMATION RELATED TO RCP SCOPE: LIGHTING, FINISHES, ETC.

4. PROTECT ALL EXISTING PLASTER TO REMAIN. AT EXISTING CEILINGS TO REMAIN, PATCH, REPAIR, AND INFILL AS REQUIRED TO MATCH EXISTING ADJACENT MATERIAL AND TEXTURE. CEILING HEIGHTS FOR PATCHED AREAS ARE TO MATCH ADJACENT UON.

CEILING PLAN LEGEND

- EXISTING TO REMAIN
- NEW PARTITION: SEE A-700 SERIES FOR WALL TYPES
- SPRINKLER HEAD, FOR REFERENCE ONLY. SEE FIRE PROTECTION DWGS FOR DETAILS
- SPEAKER STROBE, FOR REFERENCE ONLY. SEE FIRE ALARM DWGS FOR DETAILS.
- ACCESS PANEL, SEE SPECS; SEE MEPFP/T DWGS FOR ADDITIONAL ACCESS PANELS
- FIRE ALRM SPEAKER - 80" AFF U.O.N.
- WAP WIRELESS ACCESS POINT

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

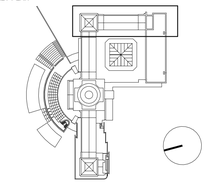
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

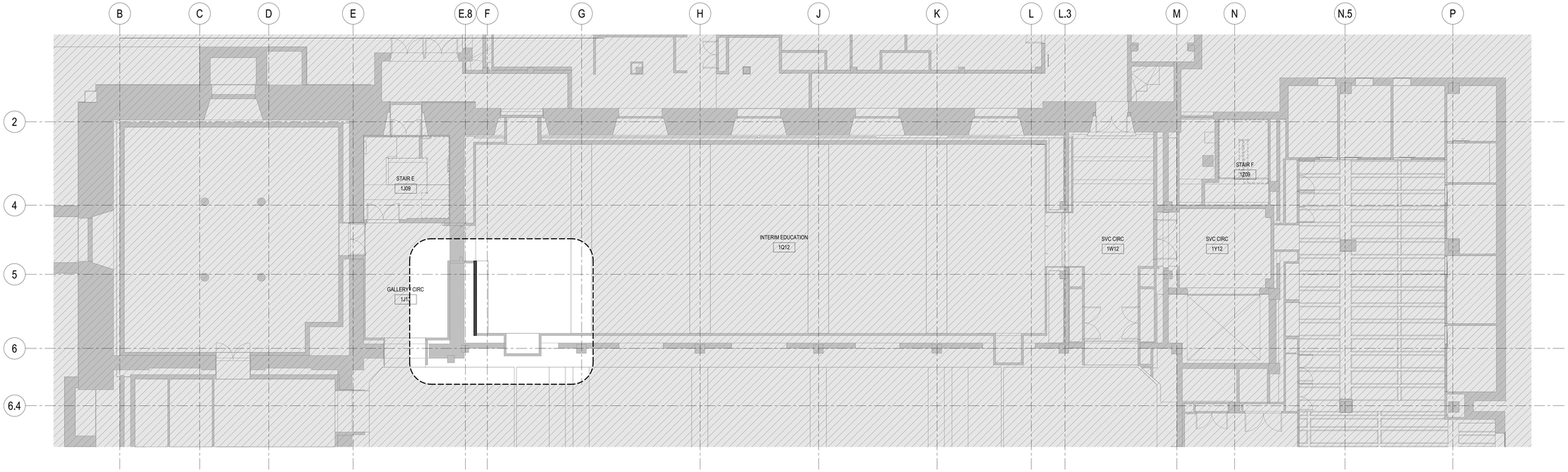
BASEMENT RCP

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

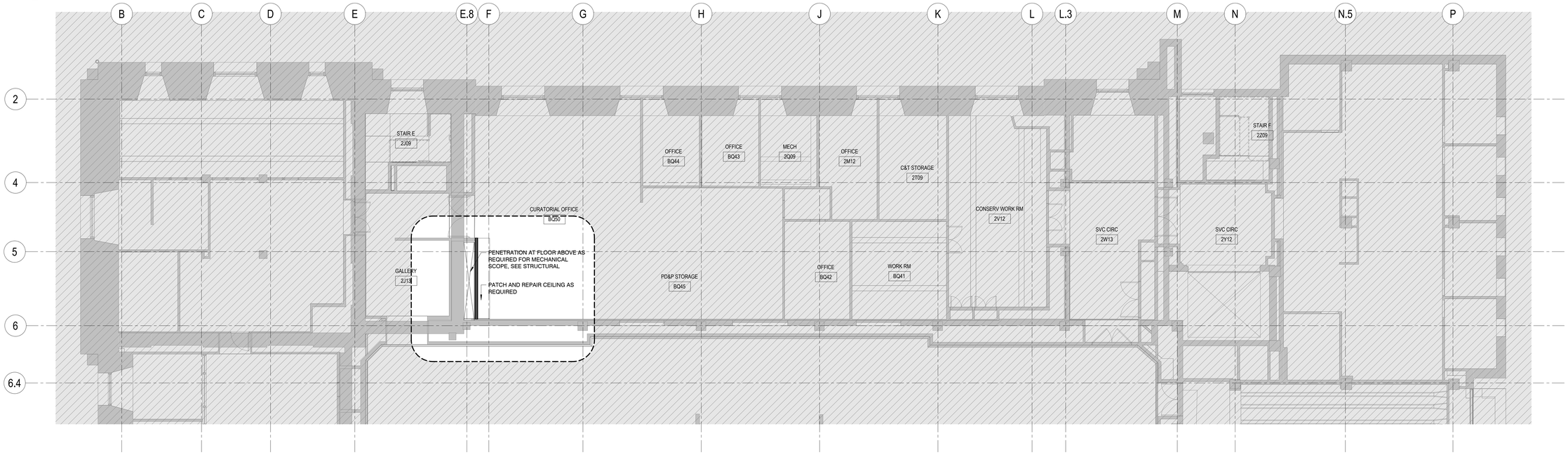
DRAWING NUMBER

A121

10/17/2025 8:41:51 PM



1 A122 FIRST FLOOR RCP
1/8" = 1'-0"



2 A122 SECOND FLOOR RCP
1/8" = 1'-0"

SD REFLECTED CEILING PLANS - GENERAL NOTES

1. ALL NEW FIXTURES IN SPACES OTHER THAN SERVICE AREAS ARE TO HAVE NEW JUNCTION BOXES WITH CONCEALED CONDUIT. NO EXPOSED CONDUIT WILL BE ACCEPTED.

2. FOR SPRINKLER DISTRIBUTION, SEE FIRE PROTECTION NARRATIVE.

3. SEE PROJECT NARRATIVE FOR ADDITIONAL INFORMATION RELATED TO RCP SCOPE: LIGHTING, FINISHES, ETC.

4. PROTECT ALL EXISTING PLASTER TO REMAIN. AT EXISTING CEILINGS TO REMAIN, PATCH, REPAIR, AND INFILL AS REQUIRED TO MATCH EXISTING ADJACENT MATERIAL AND TEXTURE. CEILING HEIGHTS FOR PATCHED AREAS ARE TO MATCH ADJACENT UON.

CEILING PLAN LEGEND

- EXISTING TO REMAIN
- NEW PARTITION: SEE A-700 SERIES FOR WALL TYPES
- SPRINKLER HEAD, FOR REFERENCE ONLY. SEE FIRE PROTECTION DWGS FOR DETAILS
- SPEAKER STROBE, FOR REFERENCE ONLY. SEE FIRE ALARM DWGS FOR DETAILS.
- ACCESS PANEL, SEE SPECS; SEE MEPFPIT DWGS FOR ADDITIONAL ACCESS PANELS
- FIRE ALRM SPEAKER - 80" AFF U.O.N.
- WAP WIRELESS ACCESS POINT

10/17/2025 8:41:55 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

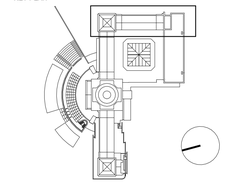
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

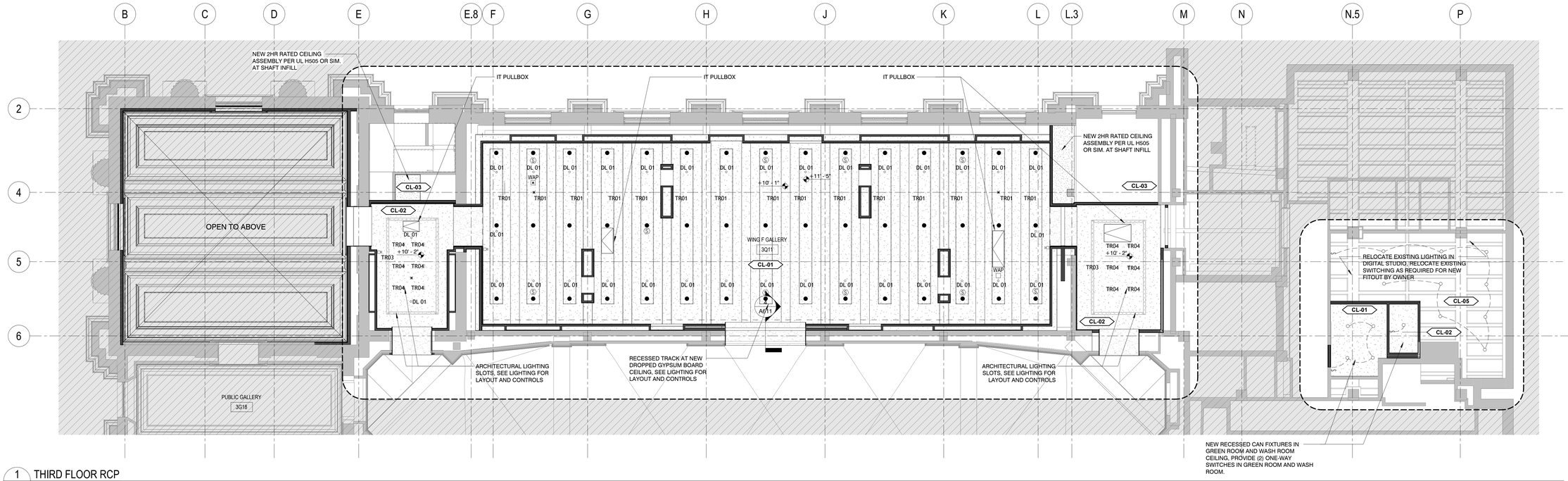
DRAWING TITLE

FIRST & SECOND FLOOR RCPS

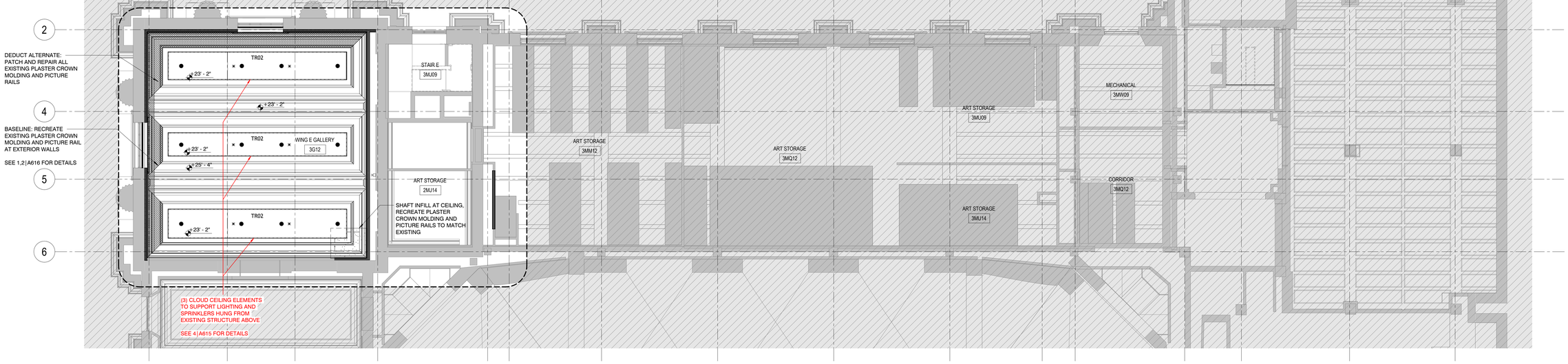
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A122



1 A123 THIRD FLOOR RCP
1/8" = 1'-0"



2 A123 THIRD FLOOR MEZZ RCP
1/8" = 1'-0"

SD REFLECTED CEILING PLANS - GENERAL NOTES

1. ALL NEW FIXTURES IN SPACES OTHER THAN SERVICE AREAS ARE TO HAVE NEW JUNCTION BOXES WITH CONCEALED CONDUIT. NO EXPOSED CONDUIT WILL BE ACCEPTED.

2. FOR SPRINKLER DISTRIBUTION, SEE FIRE PROTECTION NARRATIVE.

3. SEE PROJECT NARRATIVE FOR ADDITIONAL INFORMATION RELATED TO RCP SCOPE: LIGHTING, FINISHES, ETC.

4. PROTECT ALL EXISTING PLASTER TO REMAIN. AT EXISTING CEILINGS TO REMAIN, PATCH, REPAIR, AND INFILL AS REQUIRED TO MATCH EXISTING ADJACENT MATERIAL AND TEXTURE. CEILING HEIGHTS FOR PATCHED AREAS ARE TO MATCH ADJACENT UON.

CEILING PLAN LEGEND

- EXISTING TO REMAIN
- NEW PARTITION; SEE A-700 SERIES FOR WALL TYPES
- SPRINKLER HEAD, FOR REFERENCE ONLY. SEE FIRE PROTECTION DWGS FOR DETAILS
- SPEAKER STROBE, FOR REFERENCE ONLY. SEE FIRE ALARM DWGS FOR DETAILS.
- ACCESS PANEL, SEE SPECS; SEE MEPFPIT DWGS FOR ADDITIONAL ACCESS PANELS
- FIRE ALRM SPEAKER - 80" AFF U.O.N.
- WAP WIRELESS ACCESS POINT

10/17/2025 8:42:01 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

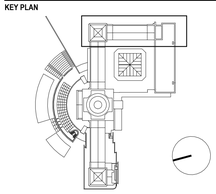
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

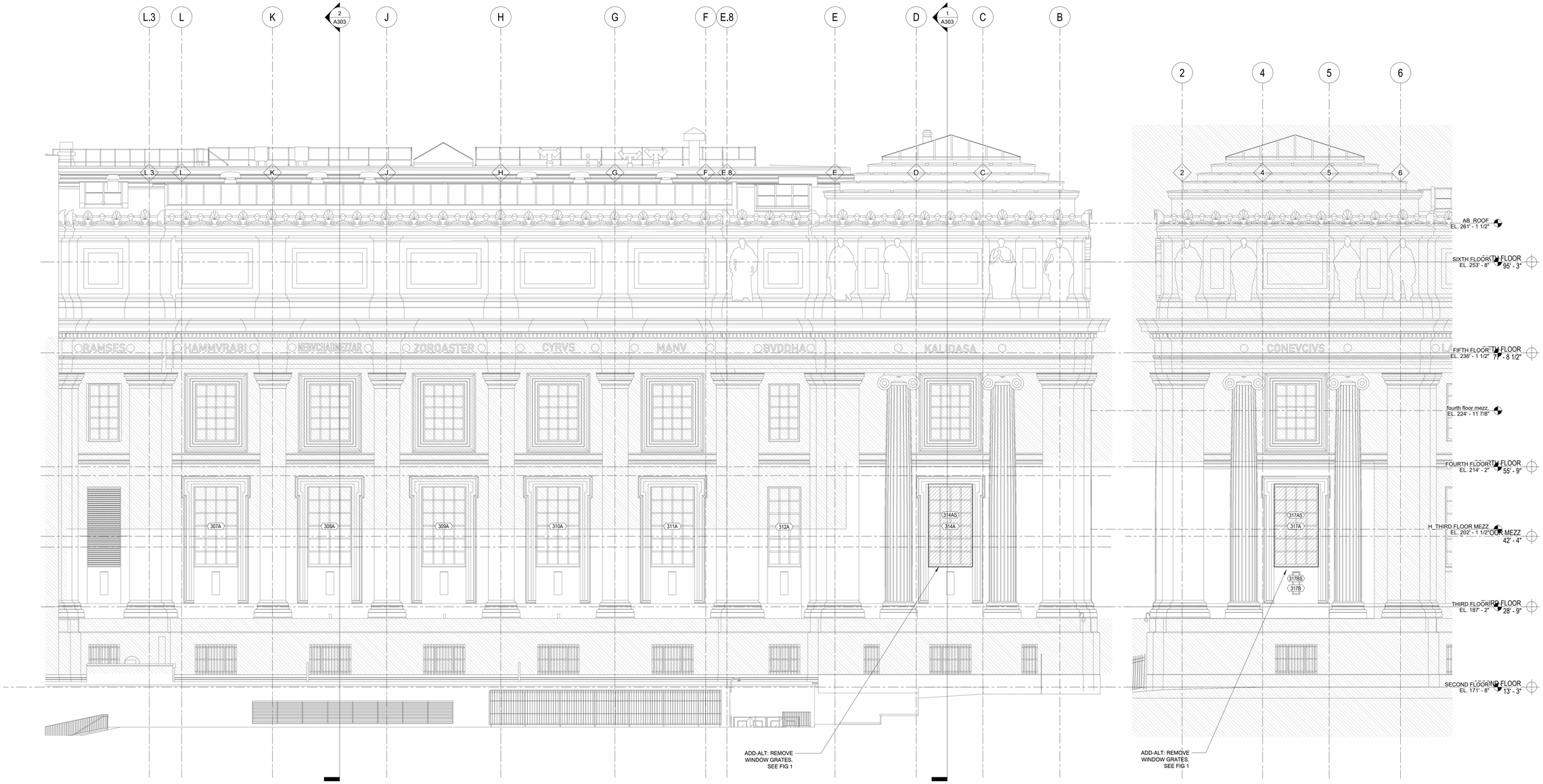
DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ RCPS

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A123



2 A201 EAST ELEVATION
1/8" = 1'-0"

1 A201 NORTH ELEVATION
1/8" = 1'-0"

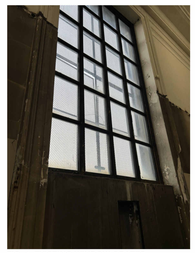


FIG. 1: EXISTING WINDOW GRATES

GRIND DOWN EXISTING WINDOW GRATES.
PATCH AND REPAIR EXTERIOR FACADE.

BUILDING ELEVATIONS NOTES

1. ELEVATION VIEWS SHOWN FOR REFERENCE - NO EXTERIOR WORK SCOPE INCLUDED IN THE PROJECT.

2. EXISTING METAL MESH GATES LOCATED ON THE EXTERIOR SIDE OF WINDOWS 307A, 308A, 309A, 310A, 311A, 317A HIDDEN HERE FOR DRAWING CLARITY.

3. REFER TO A400 FOR NEW WINDOW TYPES.

4. REFER TO A361 FOR NEW WINDOW DETAILS.

10/17/2025 8:42:12 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

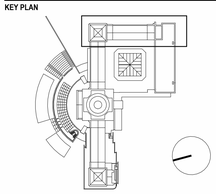
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

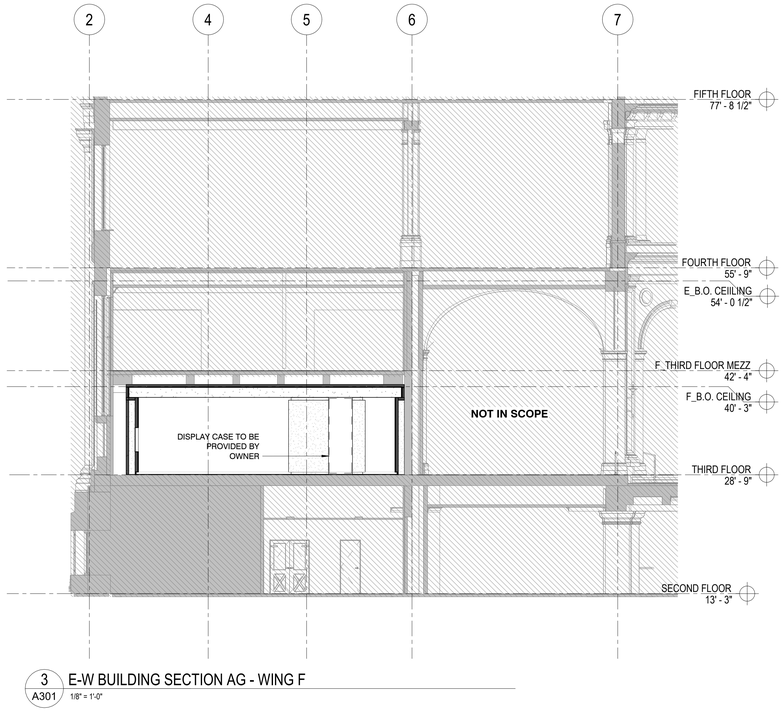
DRAWING TITLE

BUILDING ELEVATIONS

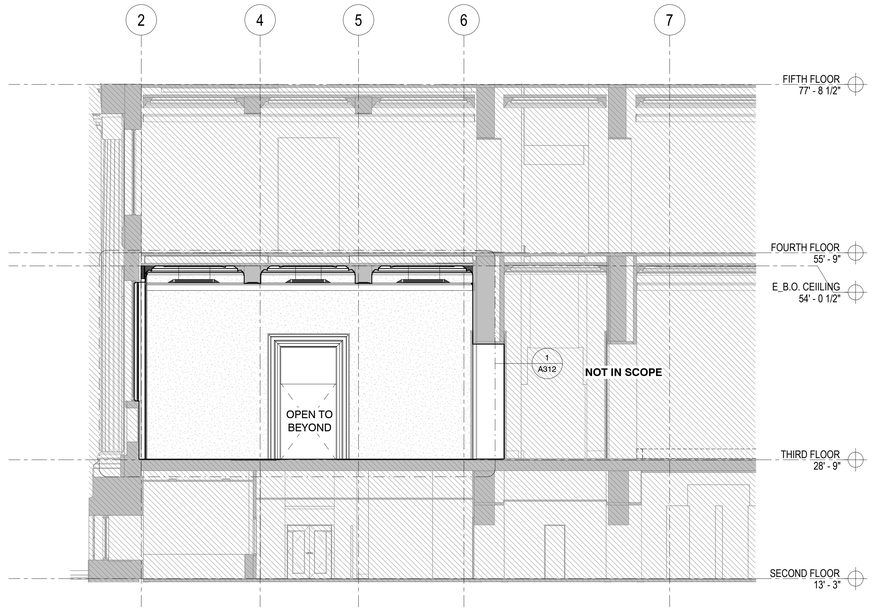
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

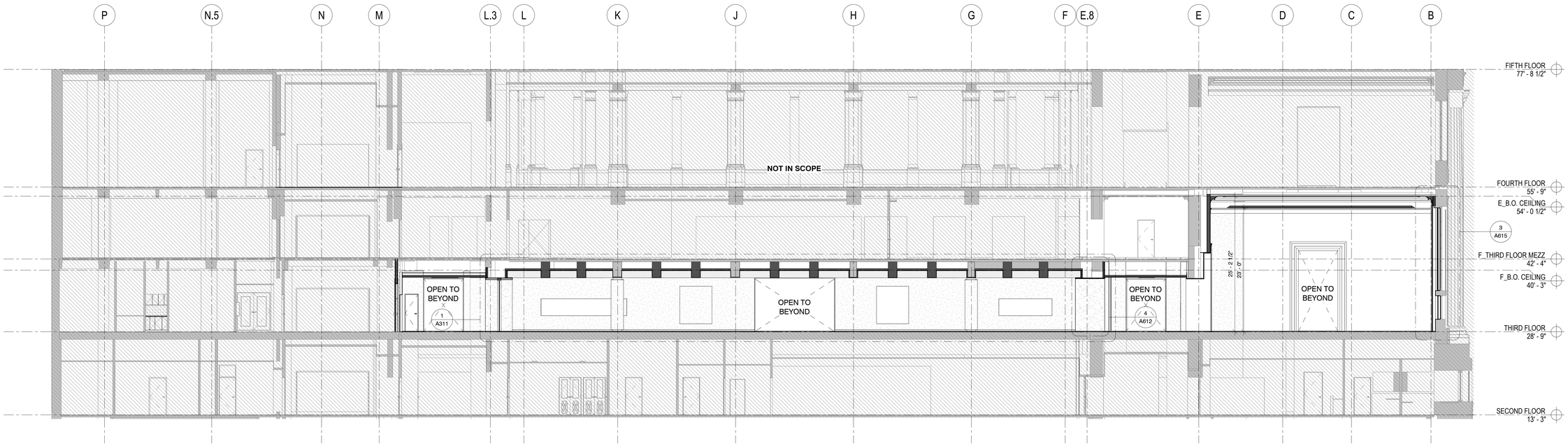
A201



3 A301 E-W BUILDING SECTION AG - WING F
1/8" = 1'-0"



2 A301 E-W BUILDING SECTION AG
1/8" = 1'-0"



1 A301 N-S BUILDING SECTION AG
1/8" = 1'-0"

10/17/2025 8:42:20 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

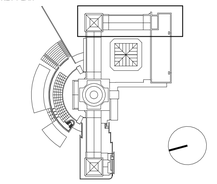
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

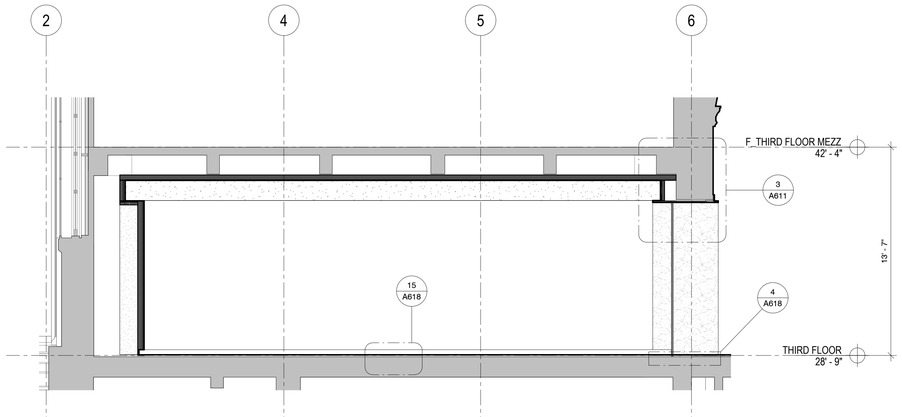
DRAWING TITLE

BUILDING SECTIONS

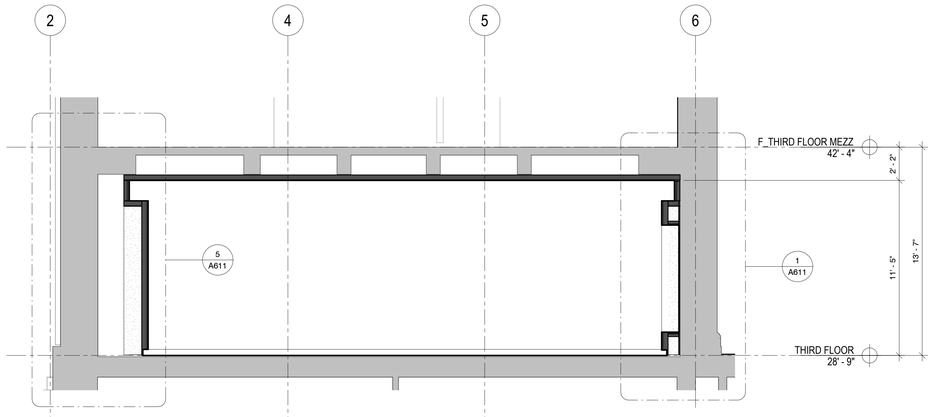
SCALE	1/8" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

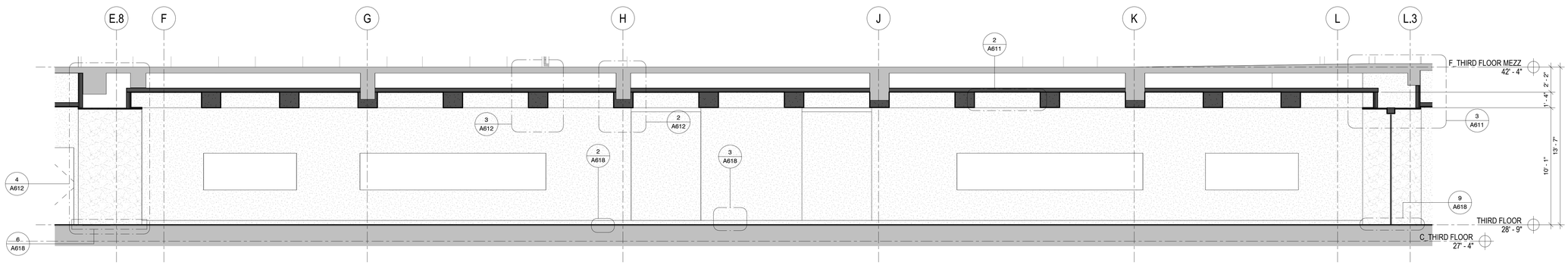
A301



3 A311 ENLARGED SECTION - WING F - SOUTH
1/4" = 1'-0"



2 A311 ENLARGED SECTION - WING F - NORTH
1/4" = 1'-0"



1 A311 ENLARGED SECTIONS - WING F - EAST
1/4" = 1'-0"

10/17/2025 8:42:23 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

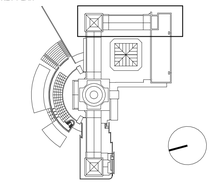
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

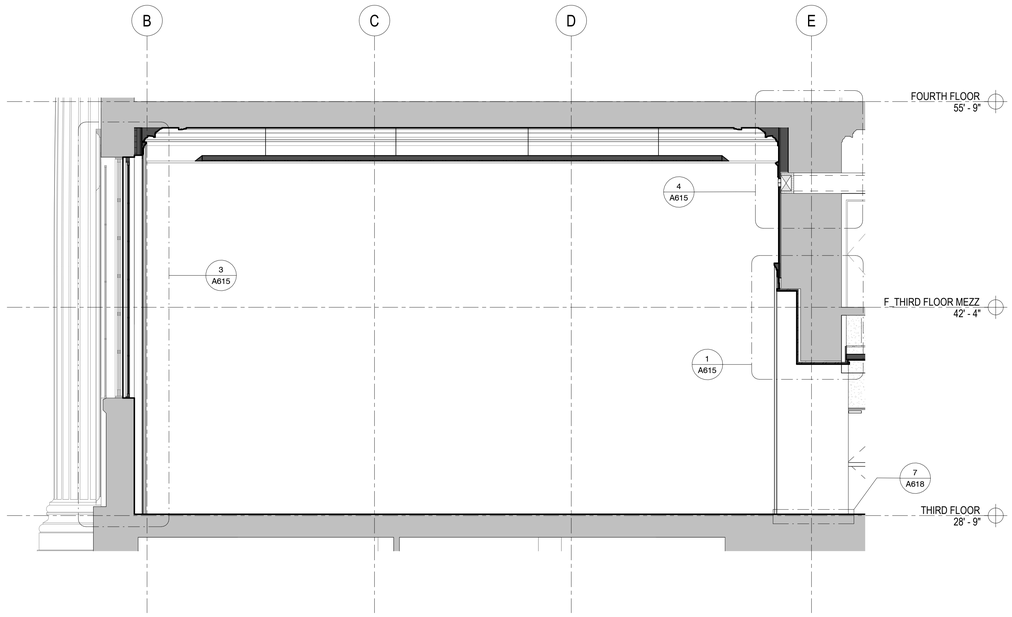
DRAWING TITLE

ENLARGED SECTIONS - WING F

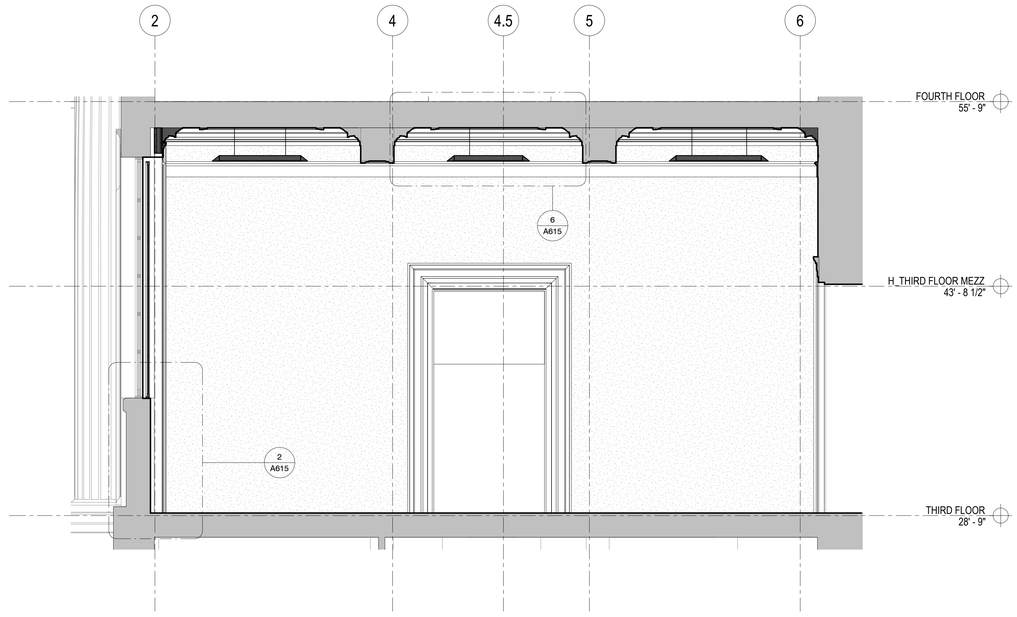
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

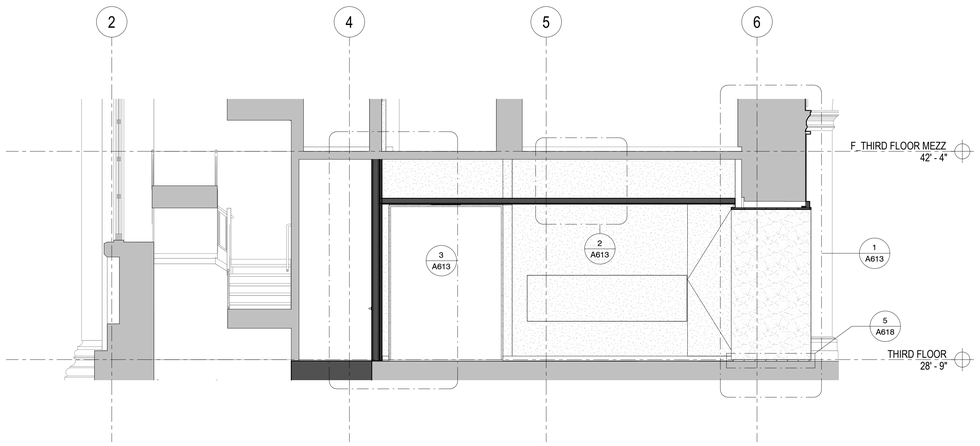
A311



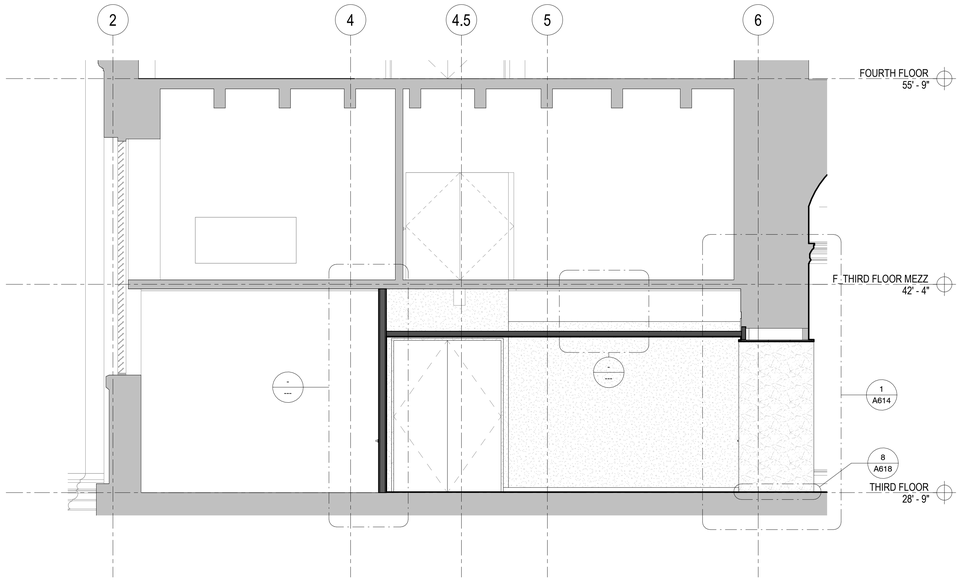
2 A312 ENLARGED SECTION - WING E NORTH-SOUTH
1/4" = 1'-0"



1 A312 ENLARGED SECTION - WING E - EAST-WEST
1/4" = 1'-0"



3 A312 ENLARGED SECTION - HYPHEN E-F - SOUTH
1/4" = 1'-0"



4 A312 ENLARGED SECTION - HYPHEN F-H - SOUTH
1/4" = 1'-0"

10/17/2025 8:42:26 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

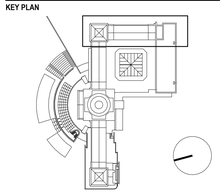
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

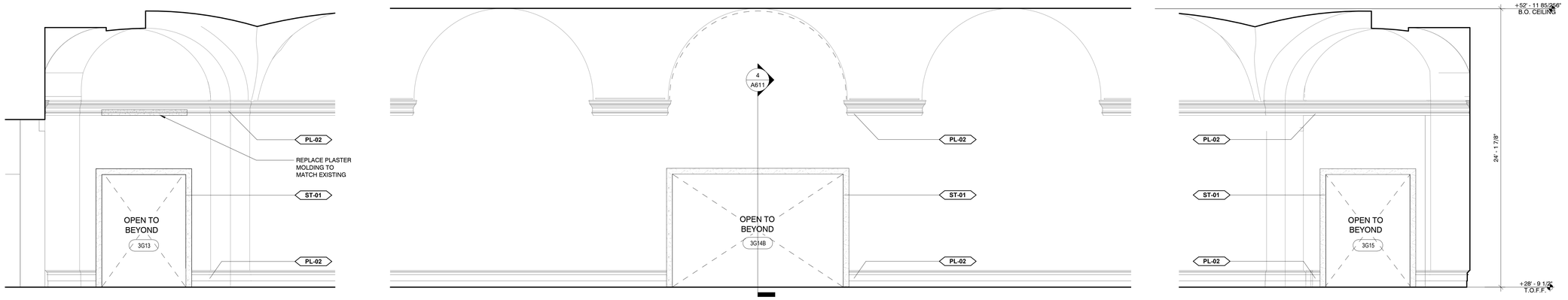
DRAWING TITLE

ENLARGED SECTIONS - WING E AND HYPHENS

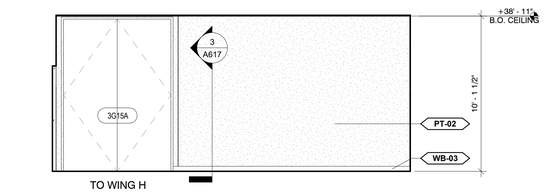
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

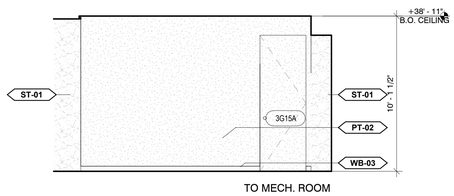
A312



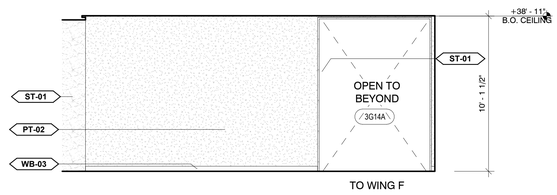
5 A401 BEAUX ARTS COURT - WING F AMBULATORY - INTERIOR ELEVATION
1/4" = 1'-0"



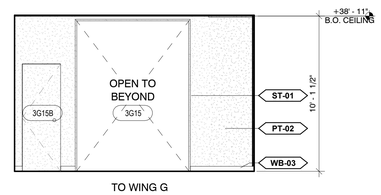
12 A401 3G15 SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



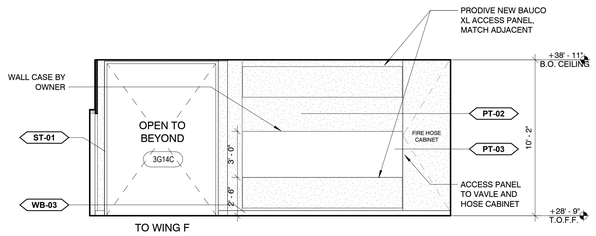
11 A401 3G15 EAST INTERIOR ELEVATION
1/4" = 1'-0"



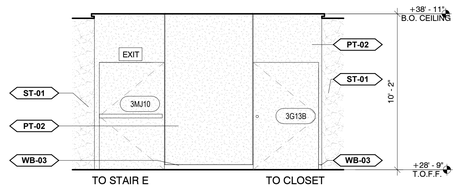
10 A401 3G15 NORTH INTERIOR ELEVATION
1/4" = 1'-0"



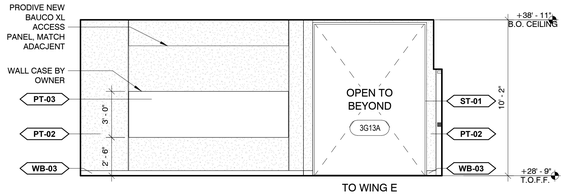
9 A401 3G15 WEST INTERIOR ELEVATION
1/4" = 1'-0"



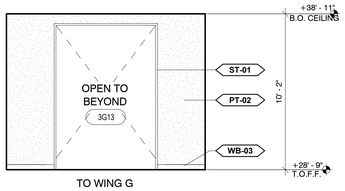
4 A401 3G13 SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



3 A401 3G13 EAST INTERIOR ELEVATION
1/4" = 1'-0"



2 A401 3G13 NORTH INTERIOR ELEVATION
1/4" = 1'-0"



1 A401 3G13 WEST INTERIOR ELEVATION
1/4" = 1'-0"

10/17/2025 8:42:34 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

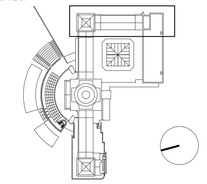
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

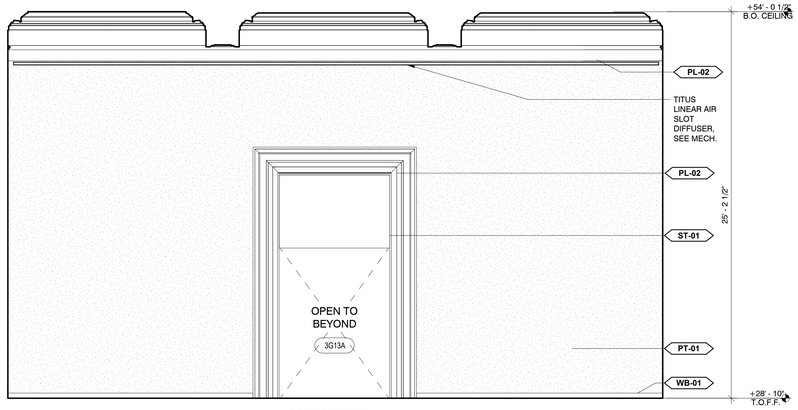
DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

ENLARGED INTERIOR ELEVATIONS

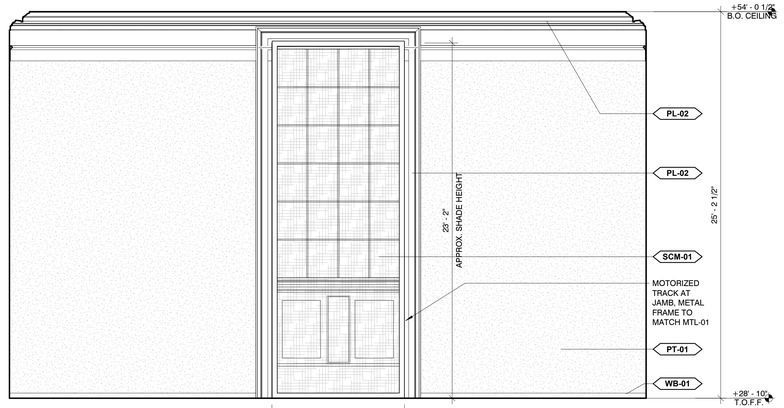
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A401



TO HYPHEN E-F

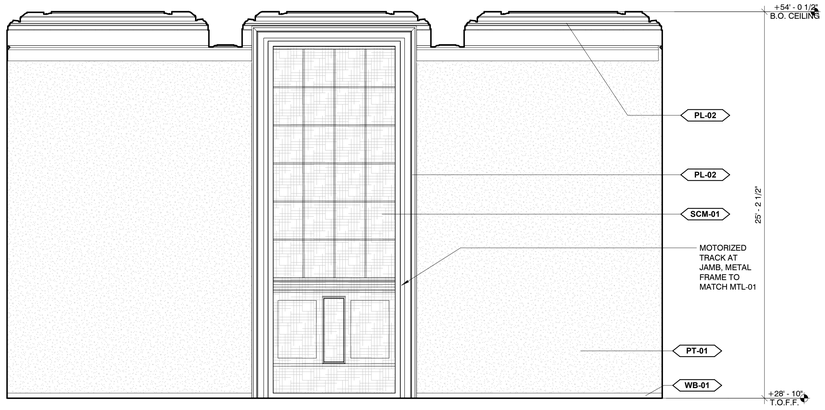
4 A402 3G12 SOUTH INTERIOR ELEVATION

1/4" = 1'-0"



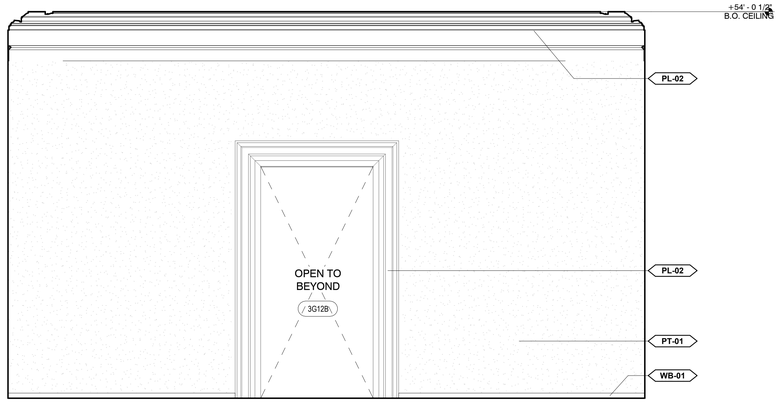
3 A402 3G12 EAST INTERIOR ELEVATION

1/4" = 1'-0"



2 A402 3G12 NORTH INTERIOR ELEVATION

1/4" = 1'-0"



TO HYPHEN D-E

1 A402 3G12 WEST INTERIOR ELEVATION

1/4" = 1'-0"

10/17/2025 8:42:38 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

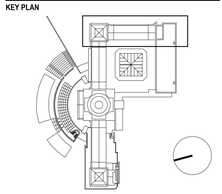
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

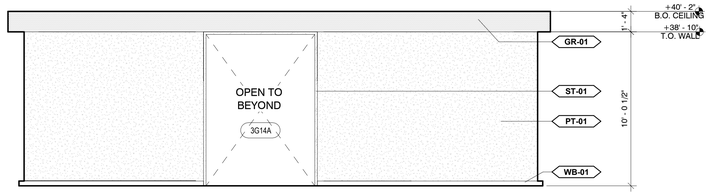
DRAWING TITLE

ENLARGED INTERIOR ELEVATIONS

SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

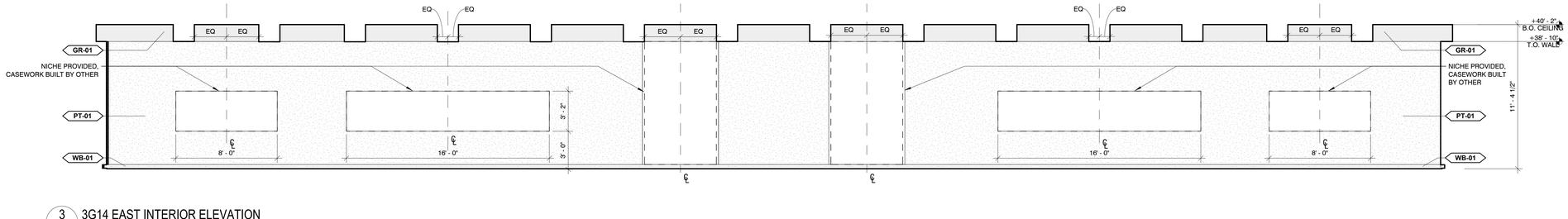
DRAWING NUMBER

A402

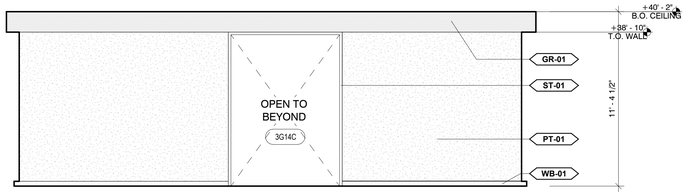


TO HYPHEN F-G

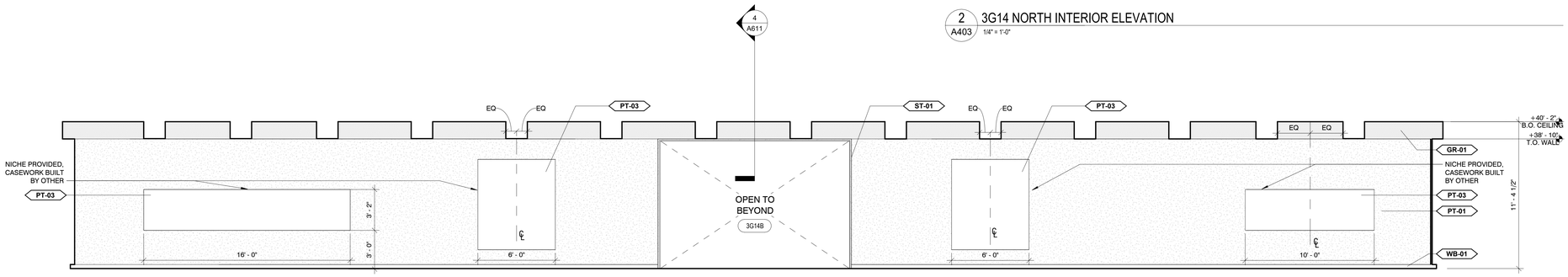
4 A403 3G14 SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



3 A403 3G14 EAST INTERIOR ELEVATION
1/4" = 1'-0"



TO HYPHEN E-F



TO WING G

2 A403 3G14 NORTH INTERIOR ELEVATION
1/4" = 1'-0"

1 A403 3G14 WEST INTERIOR ELEVATION
1/4" = 1'-0"

10/17/2025 8:42:41 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

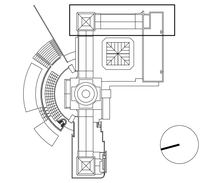
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

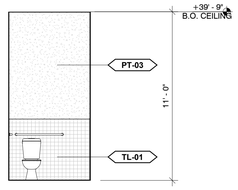
DRAWING TITLE

ENLARGED INTERIOR ELEVATIONS

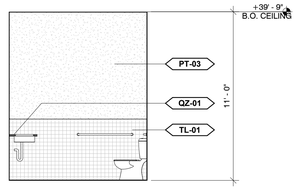
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

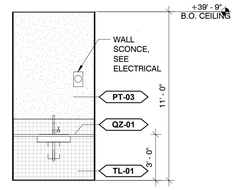
A403



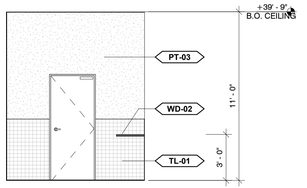
12 A404 3CC14 WC - WEST INTERIOR ELEVATION
1/4" = 1'-0"



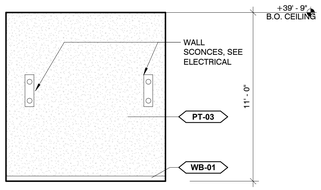
11 A404 3CC14 WC - SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



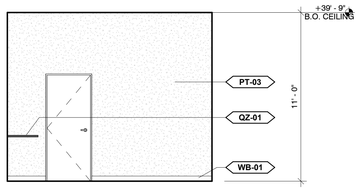
10 A404 3CC14 WC - EAST INTERIOR ELEVATION
1/4" = 1'-0"



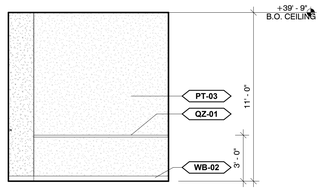
9 A404 3CC14 WC - NORTH INTERIOR ELEVATION
1/4" = 1'-0"



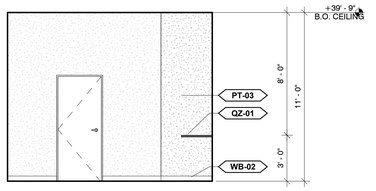
8 A404 3CC13 GREEN ROOM - EAST INTERIOR ELEVATION
1/4" = 1'-0"



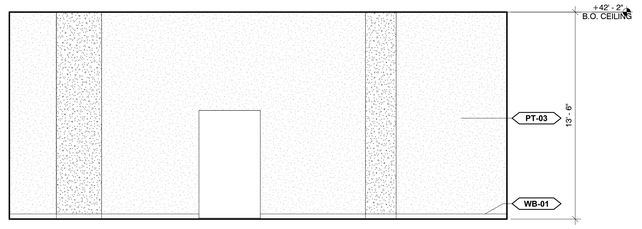
7 A404 3CC13 GREEN ROOM - NORTH INTERIOR ELEVATION
1/4" = 1'-0"



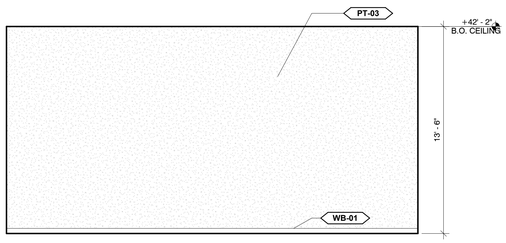
6 A404 3CC13 GREEN ROOM - WEST INTERIOR ELEVATION
1/4" = 1'-0"



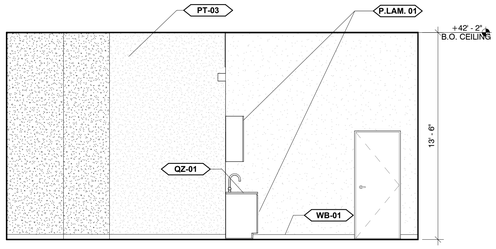
5 A404 3CC12 GREEN ROOM - SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



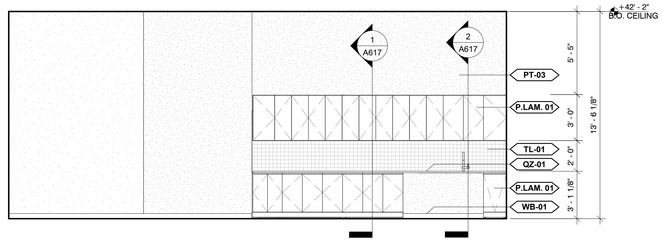
4 A404 3CC12 STUDIO - EAST INTERIOR ELEVATION
1/4" = 1'-0"



3 A404 3CC12 - STUDIO SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



2 A404 3CC12 STUDIO - NORTH INTERIOR ELEVATION
1/4" = 1'-0"



1 A404 3CC12 STUDIO - WEST INTERIOR ELEVATION
1/4" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

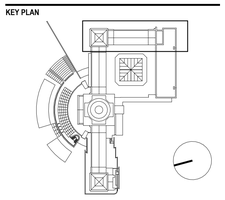
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

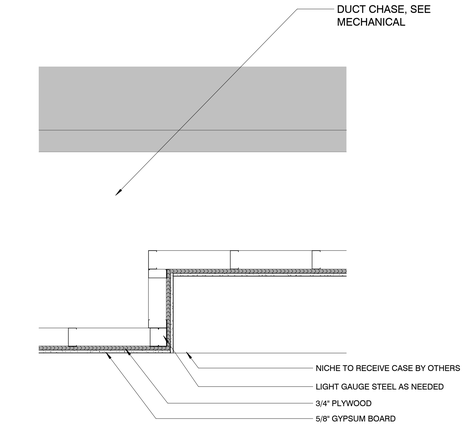
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

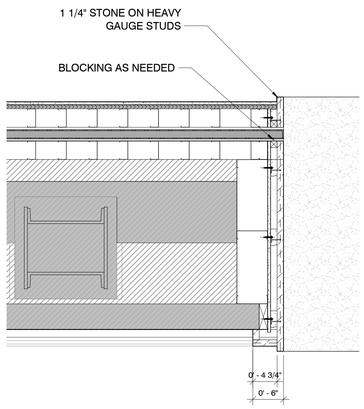
ENLARGED INTERIOR ELEVATIONS

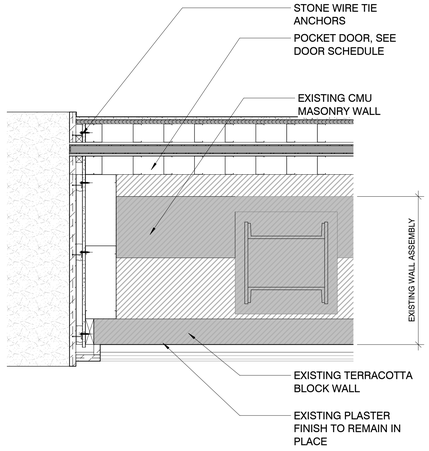
SCALE	1/4" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A404

10/17/2025 8:42:47 PM

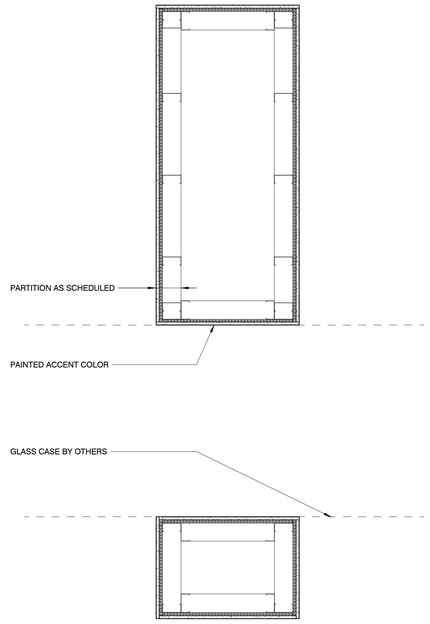


3 A601 ENLARGED PLAN DETAIL - WALL DISPLAY NICHE
1" = 1'-0"





2 A601 ENLARGED PLAN DETAIL - G TO F PORTAL
1" = 1'-0"



1 A601 ENLARGED PLAN DETAIL - WING F DISPLAY WALL
1" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

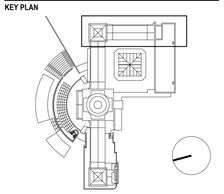
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

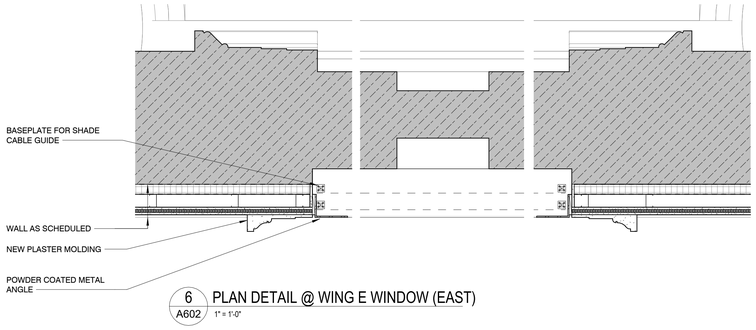
PLAN DETAILS - WING F

SCALE	1" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

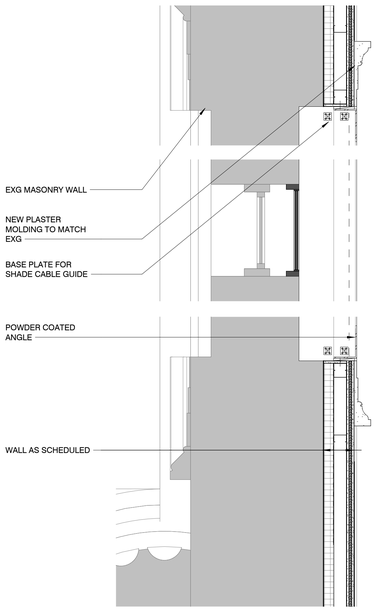
DRAWING NUMBER

A601

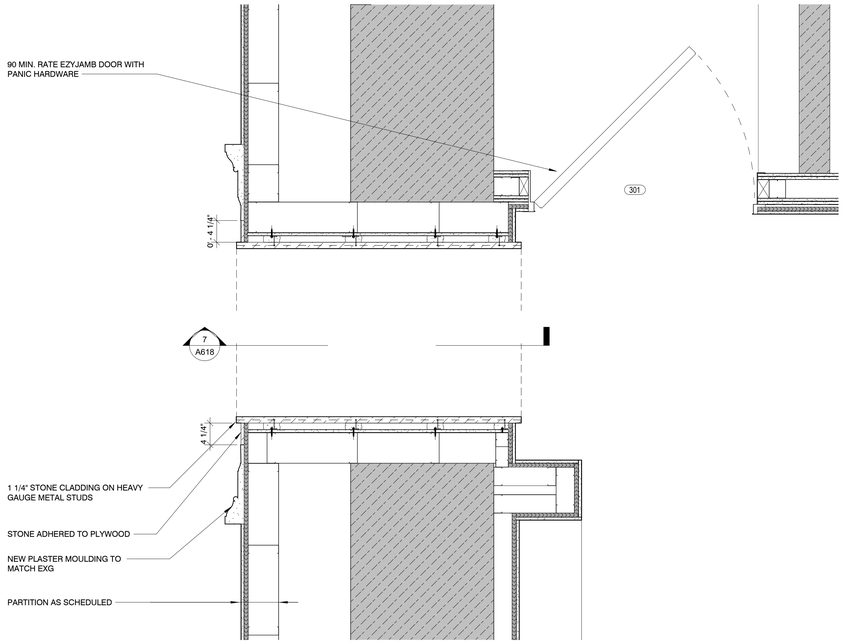
10/17/2025 8:42:50 PM



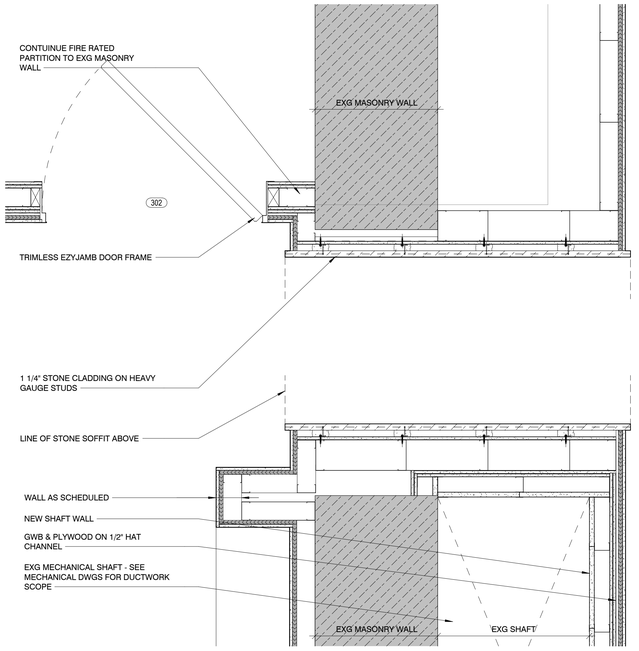
6 A602 PLAN DETAIL @ WING E WINDOW (EAST)
1" = 1'-0"



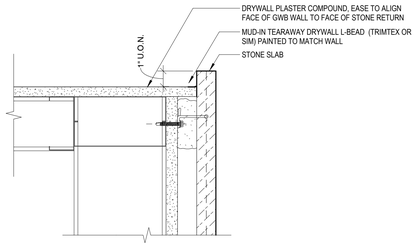
5 A602 PLAN DETAIL @ WING E WINDOW (NORTH)
1" = 1'-0"



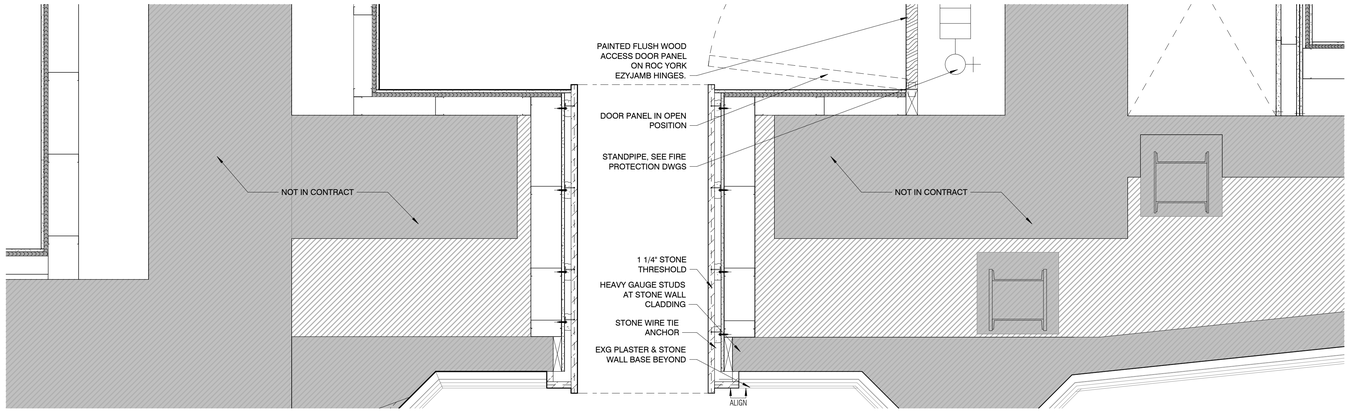
4 A602 ENLARGED PLAN DETAIL - WING E TO E-F PORTAL
1" = 1'-0"



3 A602 ENLARGED PLAN DETAIL - E-F TO F PORTAL
1" = 1'-0"



2 A602 TYPICAL PLAN DETAIL @ GYPSUM/STONE TRANSITON
3" = 1'-0"



1 A602 ENLARGED PLAN DETAIL - G TO E-F PORTAL
1" = 1'-0"

10/17/2025 8:42:54 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

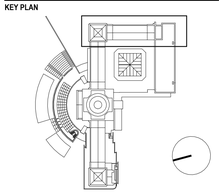
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

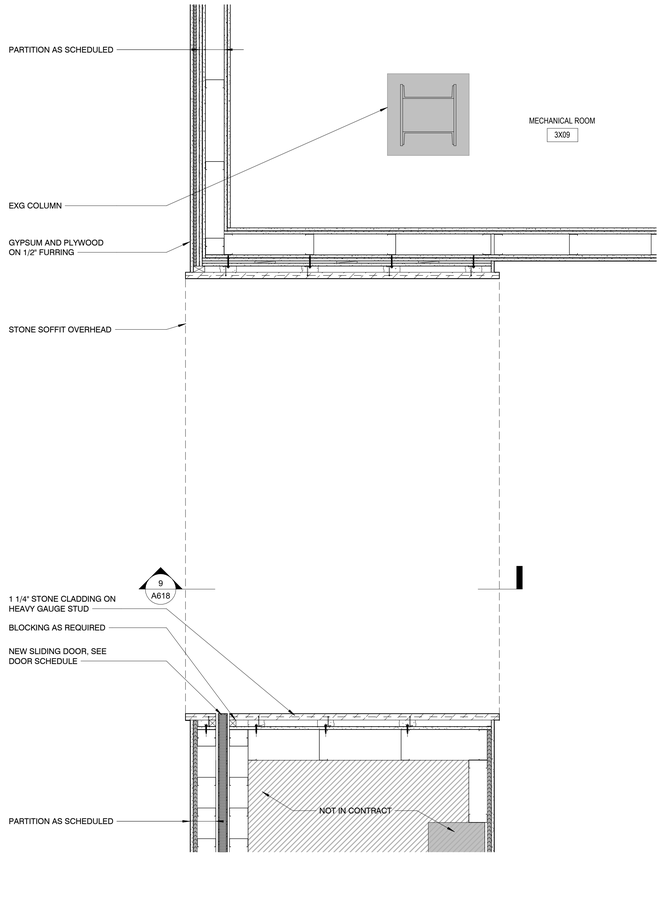
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

PLAN DETAILS - WING E & HYPHEN E-F

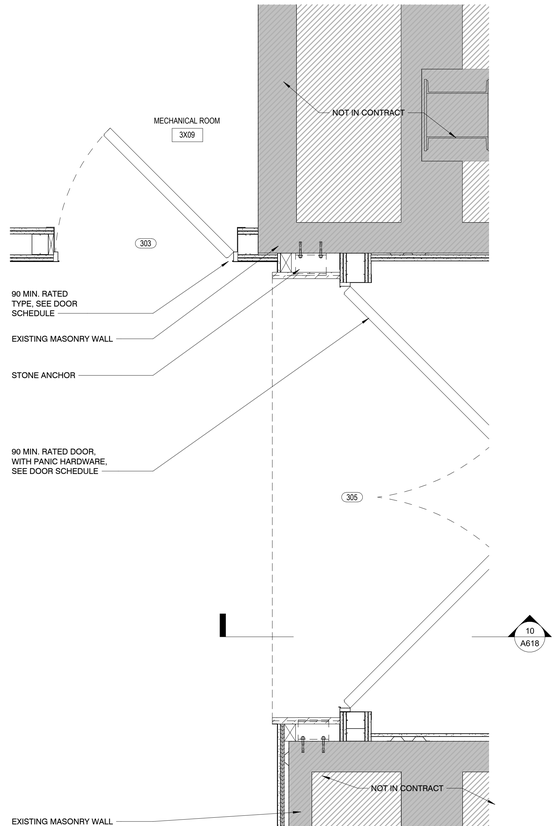
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

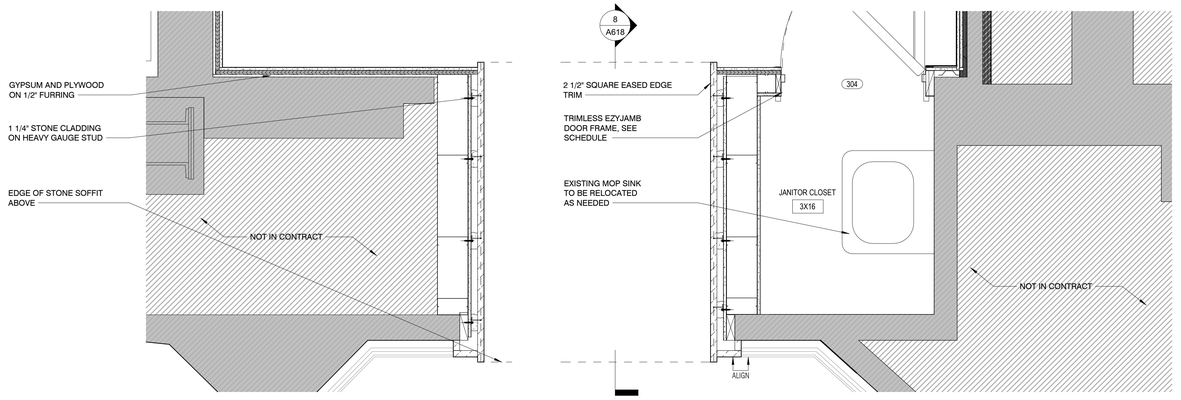
A602



2 A603 ENLARGED PLAN DETAIL - HYPHEN F-H OPENINGS

1" = 1'-0"





1 A603 ENLARGED PLAN DETAIL - G TO F-H PORTAL

1" = 1'-0"

10/17/2025 8:42:57 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

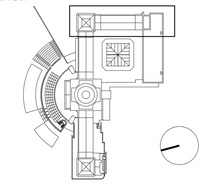
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

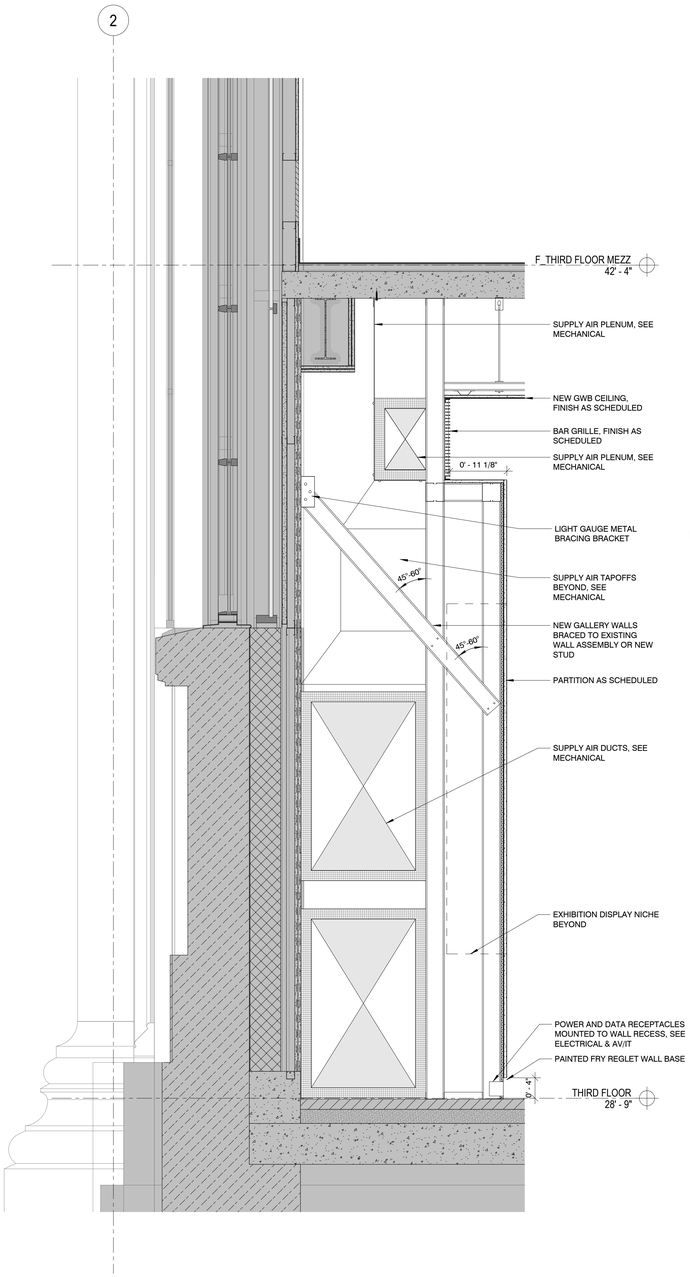
DRAWING TITLE

PLAN DETAILS - HYPHEN F-H

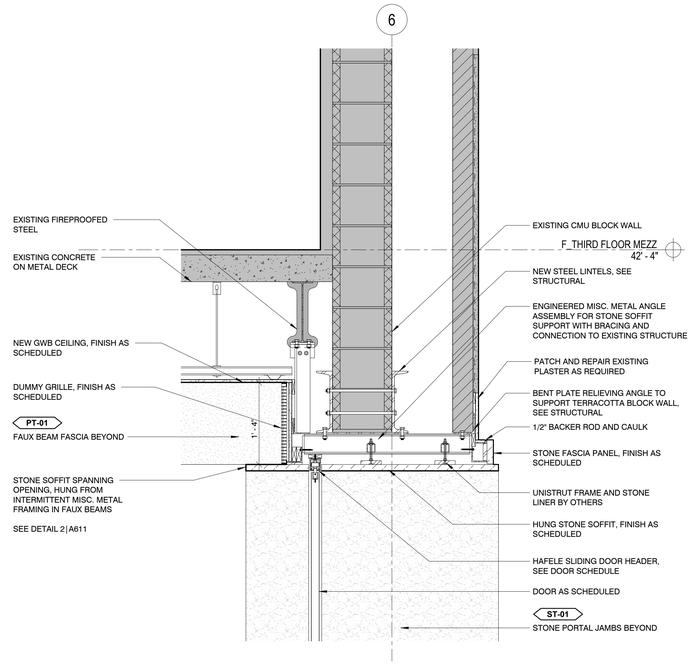
SCALE	1" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

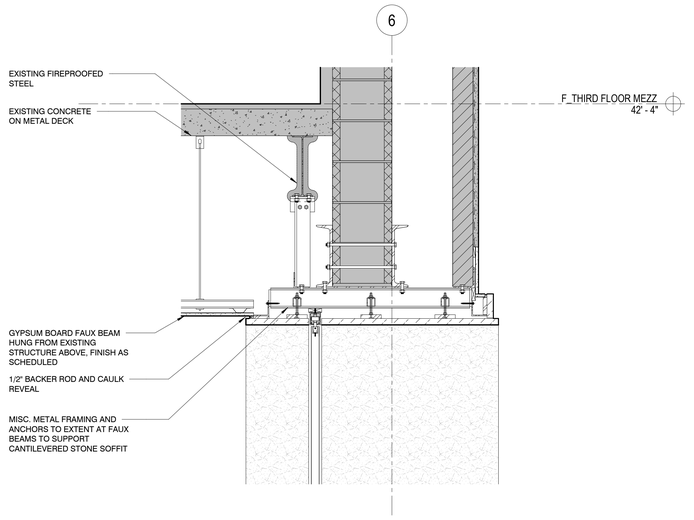
A603



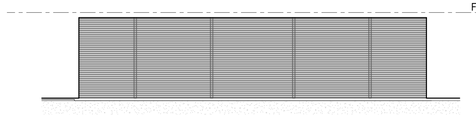
5 A611 SECTION DETAIL - WING F TYPICAL WEST WALL SECTION
1" = 1'-0"



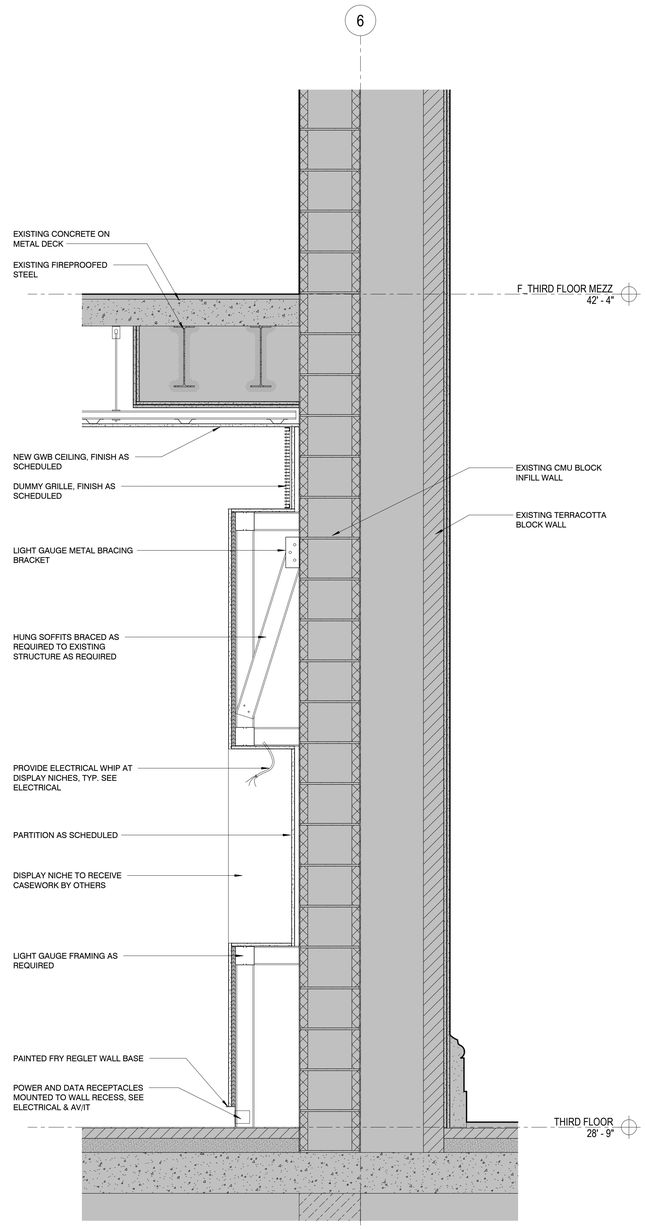
4 A611 SECTION DETAIL - WING F CENTRAL PORTAL HEADER
1" = 1'-0"



3 A611 SECTION DETAIL - WING F CENTRAL PORTAL HEADER @ FAUX BEAM
1" = 1'-0"



2 A611 WING F - GRILLE ELEVATION
1" = 1'-0"



1 A611 WING F TYP. WALL SECTION @ DISPLAY NICHE - FACING SOUTH
1" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

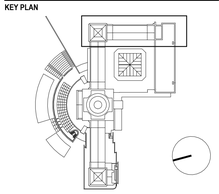
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

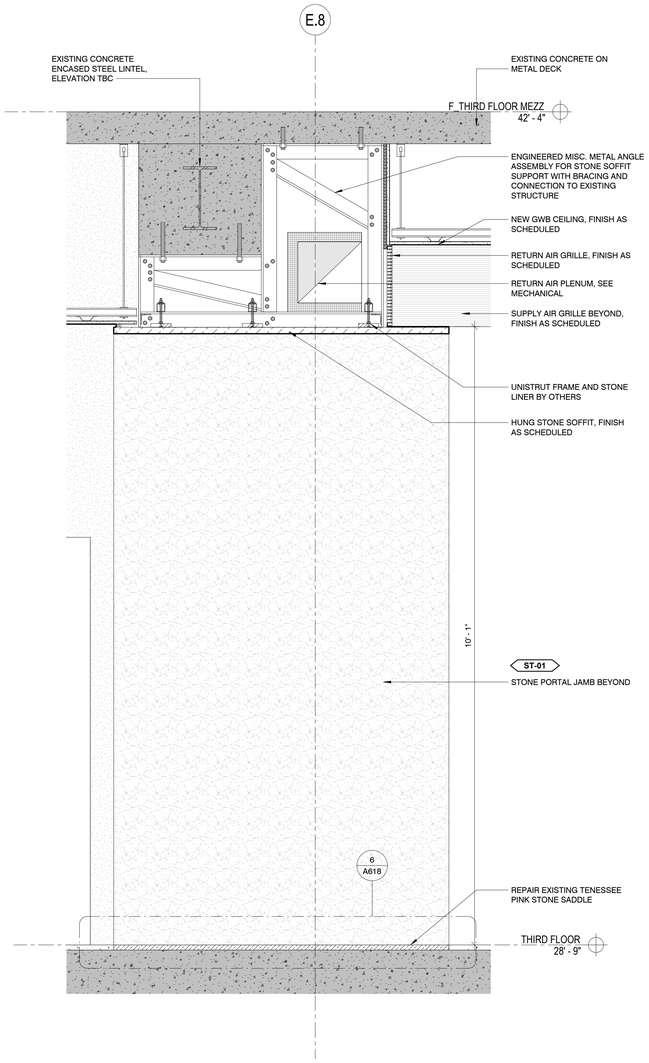
DRAWING TITLE

SECTION DETAILS - WING F

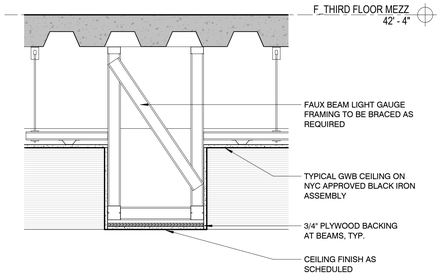
SCALE	1" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

A611

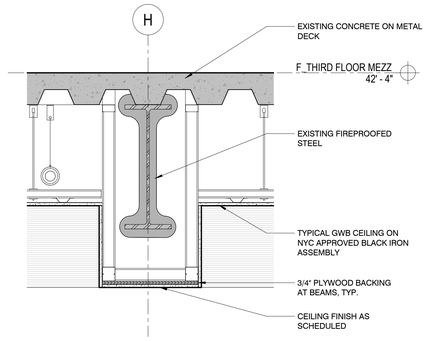
10/17/2025 8:43:00 PM



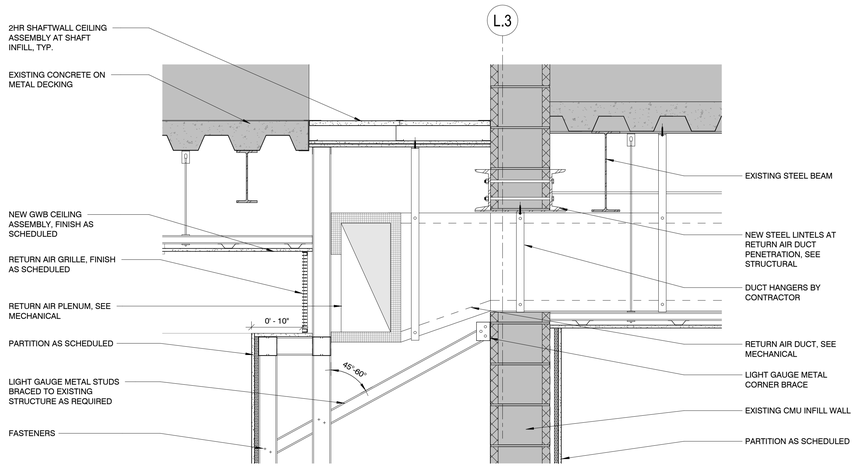
4 WING F TO E-F SECTION THRESHOLD - FACING EAST
A612 1" = 1'-0"



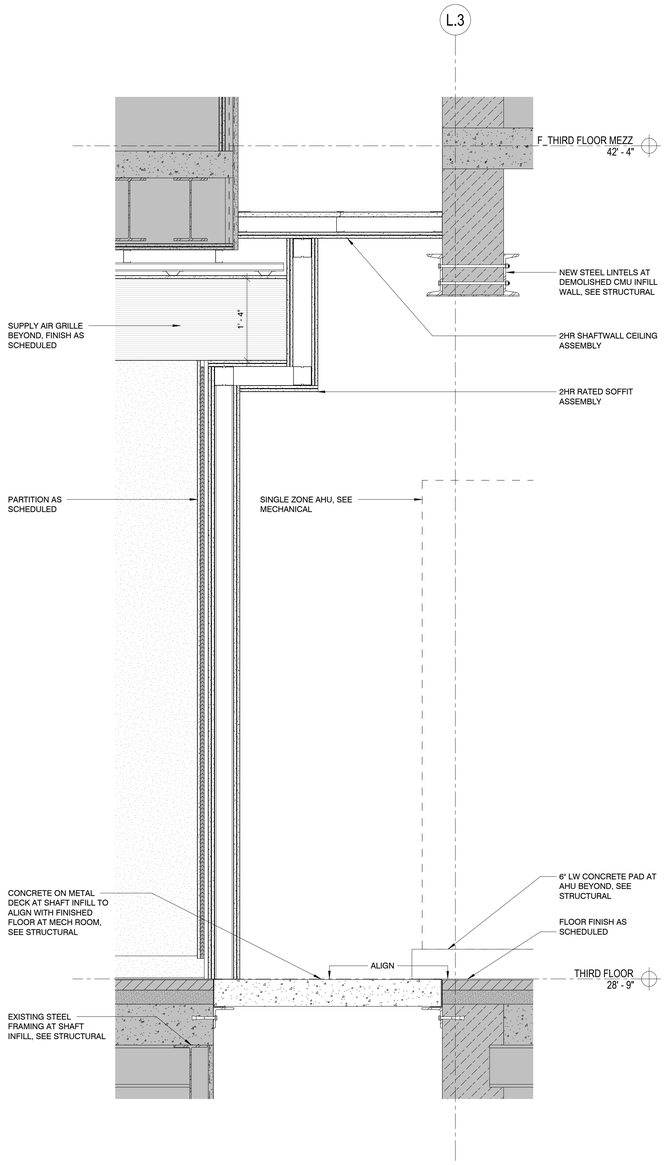
3 WING F - TYPICAL CEILING DETAIL AT FAUX BEAMS
A612 1" = 1'-0"



2 WING F - TYPICAL CEILING DETAIL AT EXISTING BEAMS
A612 1" = 1'-0"



5 ENLARGED SECTION - WING F - SOUTH WALL RETURN AIR DETAIL
A612 1" = 1'-0"



1 ENLARGED SECTION - WING F - SOUTH WALL
A612 1" = 1'-0"

10/17/2025 8:43:02 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

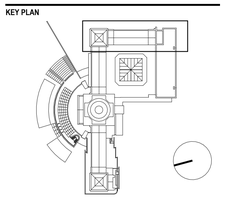
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

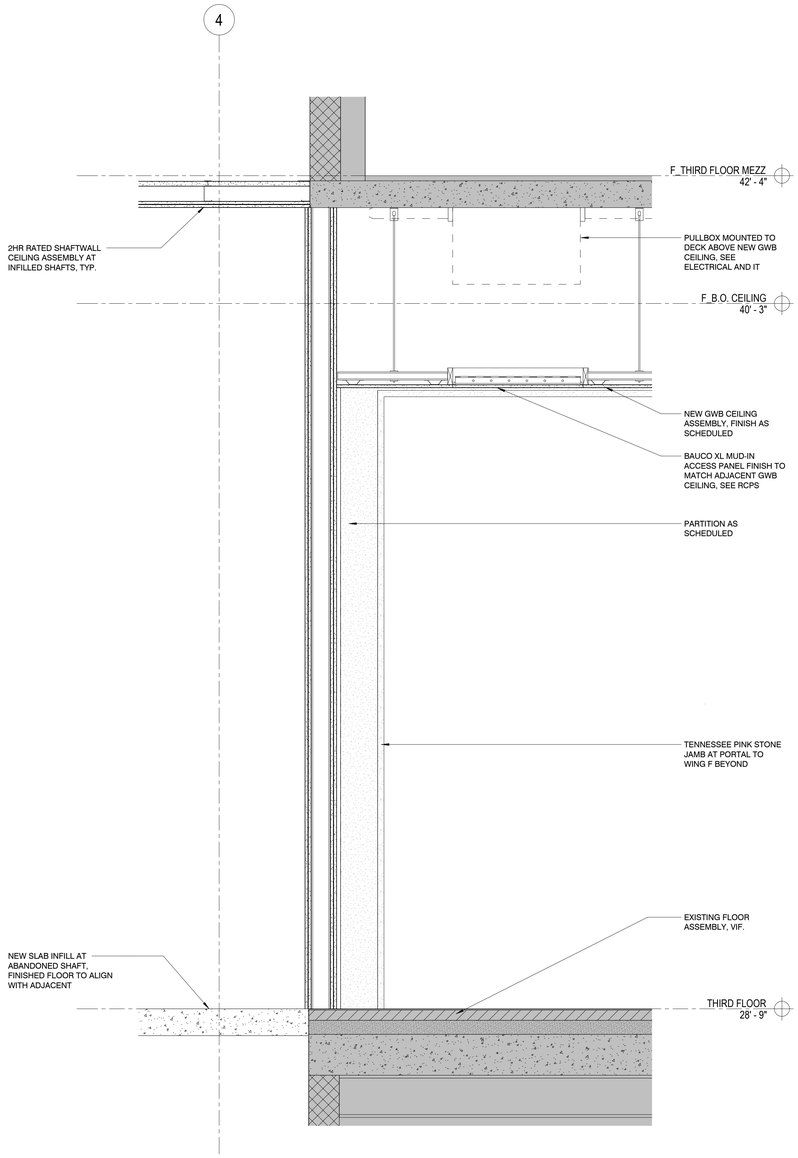
DRAWING TITLE

SECTION DETAILS - WING F

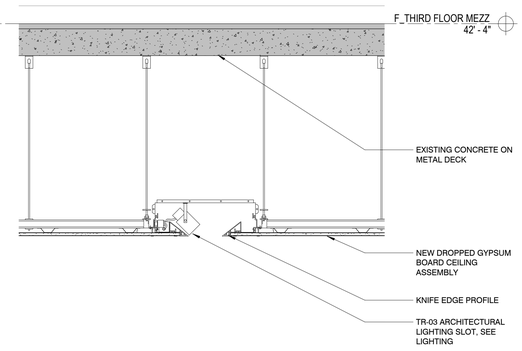
SCALE	1" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

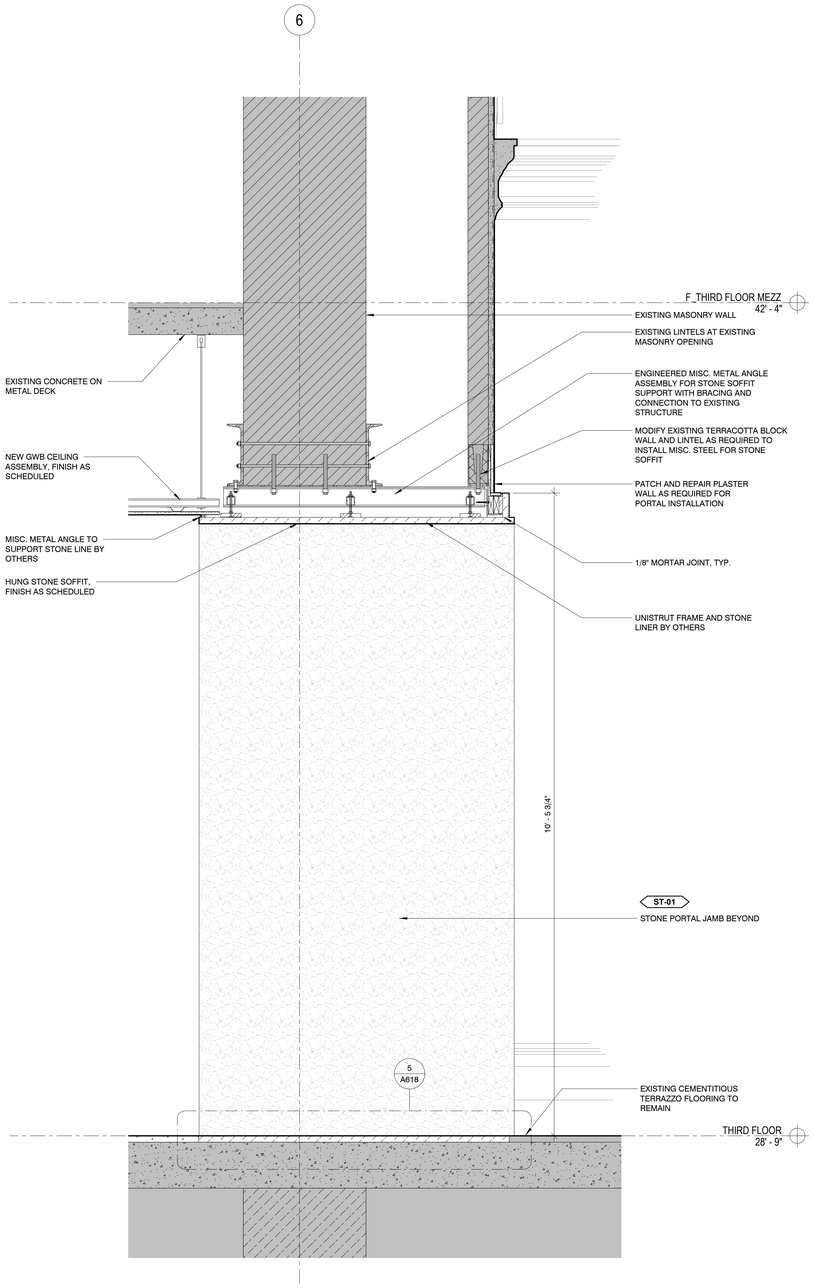
A612



3 A613 ENLARGED SECTION - HYPHEN E-F - SOUTH - Callout 2
1" = 1'-0"



2 A613 ENLARGED SECTION - HYPHEN E-F CEILING ASSEMBLY
1" = 1'-0"



1 A613 G TO E-F THRESHOLD SECTION - FACING SOUTH Copy 1
1" = 1'-0"

10/17/2025 8:43:04 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

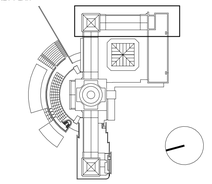
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

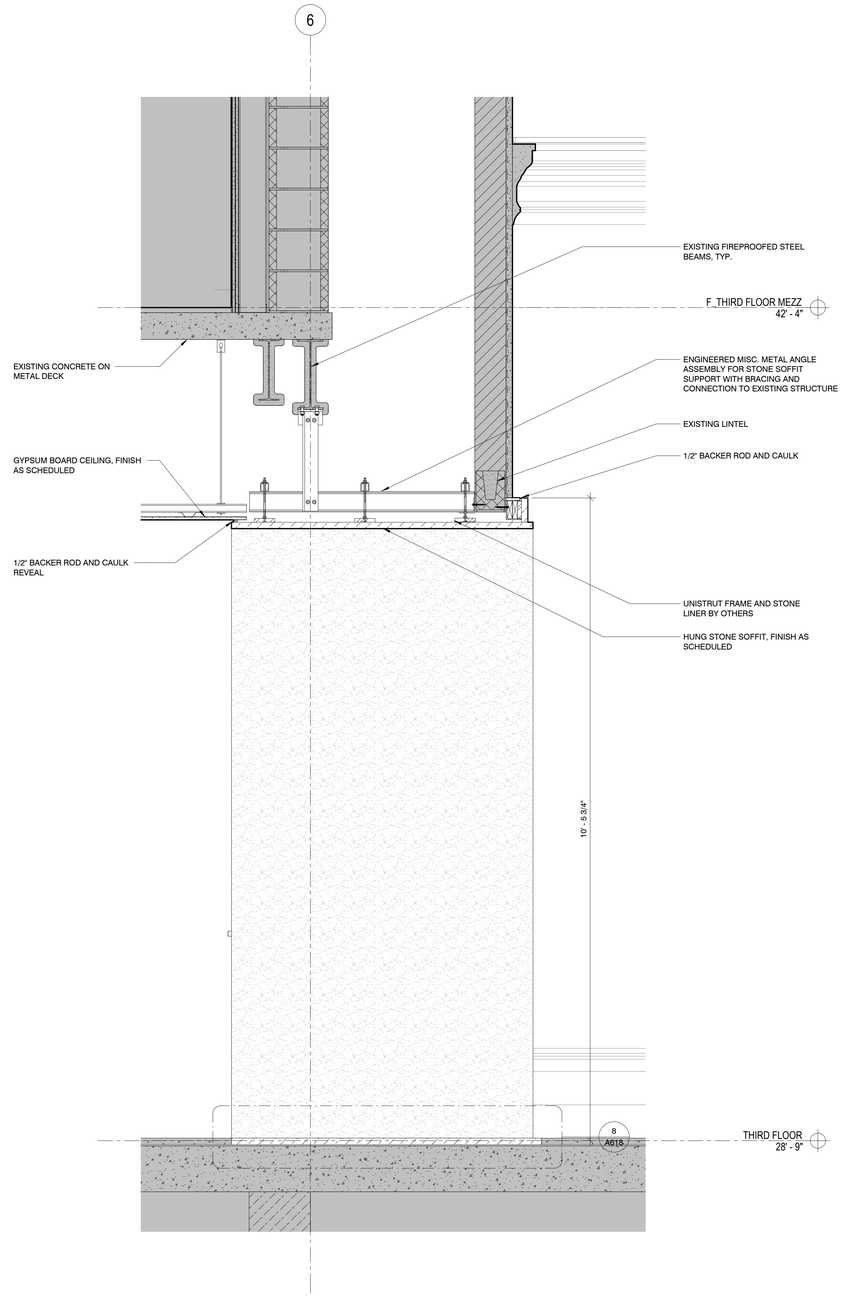
DRAWING TITLE

SECTION DETAILS - HYPHEN E-F

SCALE	1" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A613



1 A614 G TO F-H THRESHOLD SECTION - FACING SOUTH Copy 1
1" = 1'-0"

10/17/2025 8:43:06 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

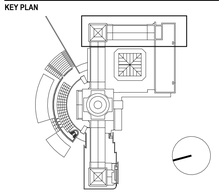
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

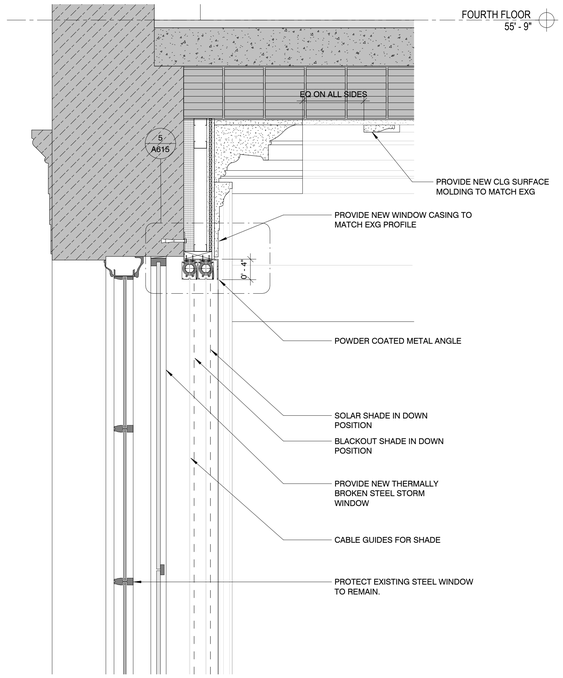
DRAWING TITLE

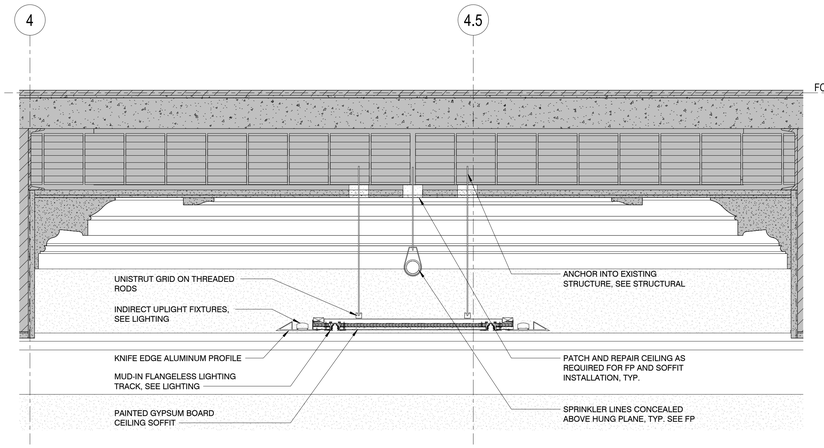
SECTION DETAILS - HYPHEN F-H

SCALE	1" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

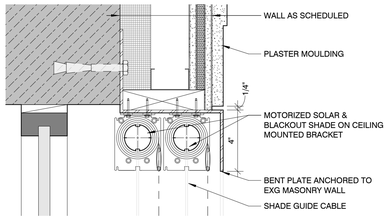
DRAWING NUMBER

A614

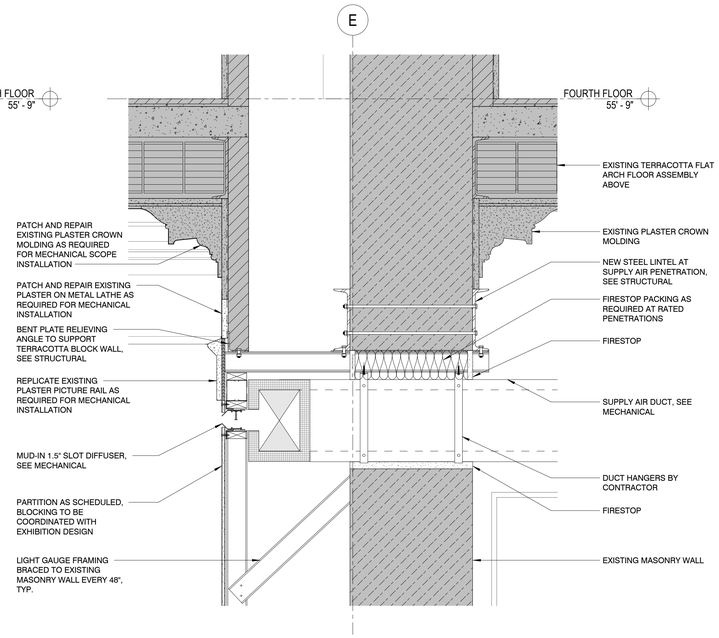




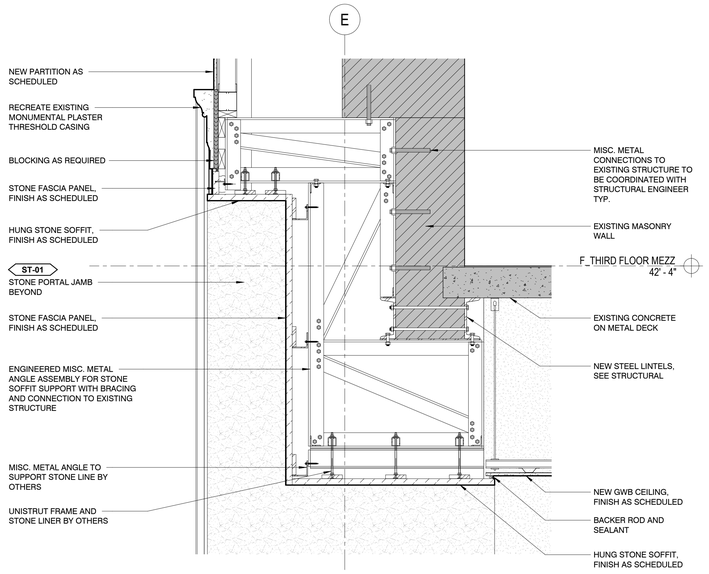
6 A615 ENLARGED SECTION - WING E CEILING FIXTURE
1" = 1'-0"



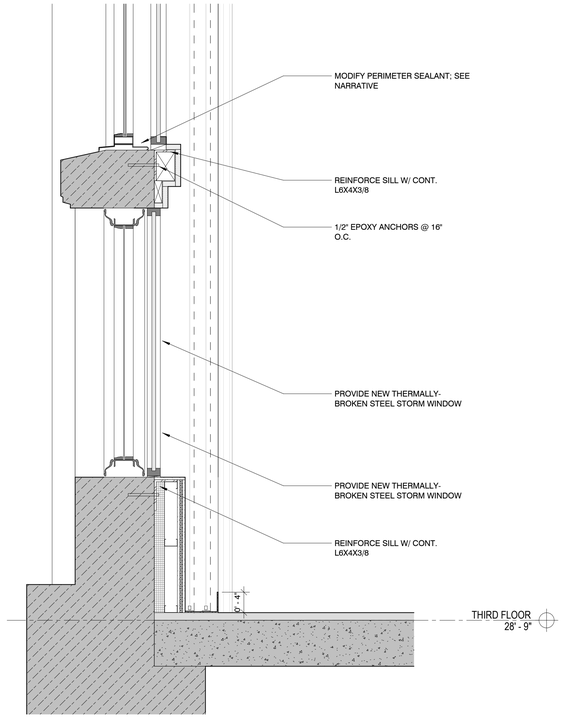
5 A615 SECTION DETAIL @ SHADE BRACKET
3" = 1'-0"



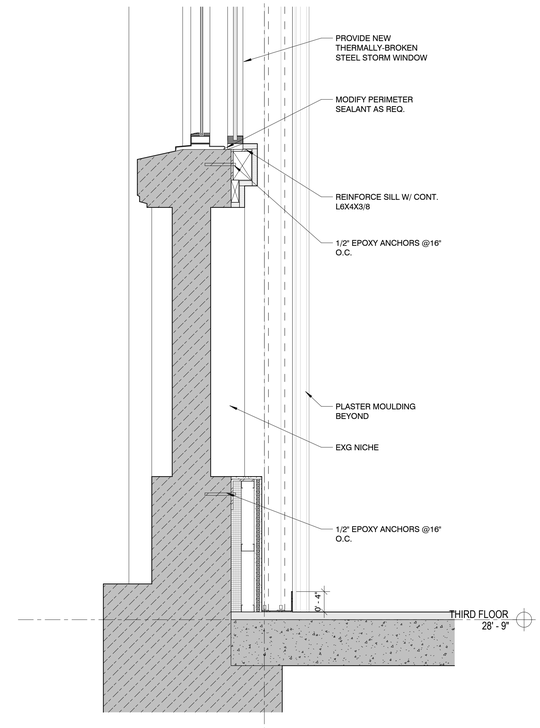
4 A615 ENLARGED SECTION - WING E SOUTH WALL SUPPLY AIR DIFFUSER
1" = 1'-0"



1 A615 ENLARGED SECTION - WING E TO E-F THRESHOLD HEADER
1" = 1'-0"



3 A615 LEVEL 03 E WING WINDOW 317A - SECTION
1" = 1'-0"



2 A615 SECTION DETAIL @ WING E LANCET WINDOW (EAST)
1" = 1'-0"

10/17/2025 8:43:09 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

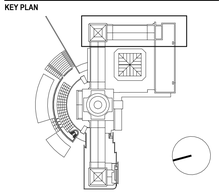
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

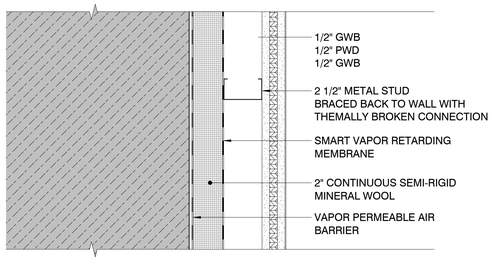
DRAWING TITLE

SECTION DETAILS - WING E

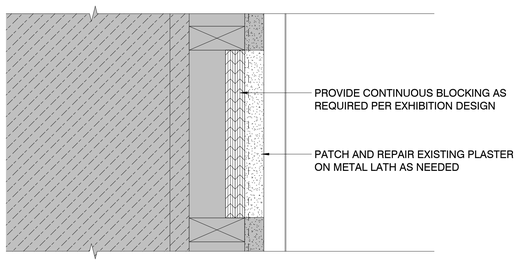
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

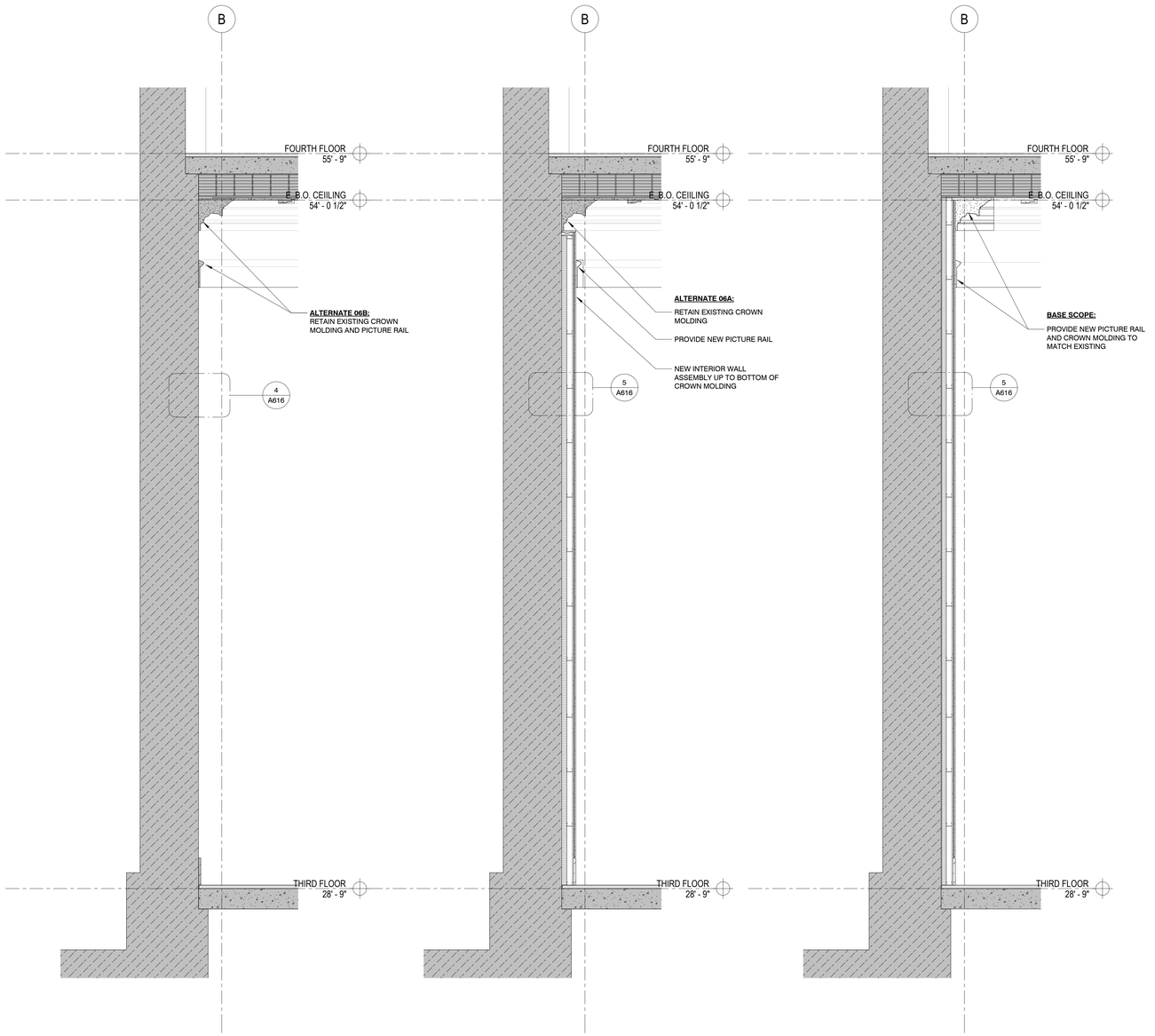
A615



5 A616 WING E EXTERIOR WALL - BASELINE SCOPE
3" = 1'-0"



4 A616 WING E EXTERIOR WALL - ALTERNATE NO.06B
3" = 1'-0"



3 A616 E WING WALL SECTION - ENVELOPE ALTERNATE NO. 06B
1/2" = 1'-0"

2 A616 E WING WALL SECTION - ENVELOPE ALTERNATE NO. 06A
1/2" = 1'-0"

1 A616 E WING WALL SECTION - BASE SCOPE
1/2" = 1'-0"

10/17/2025 8:43:13 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

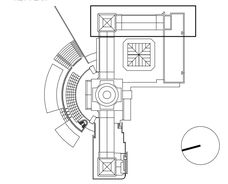
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

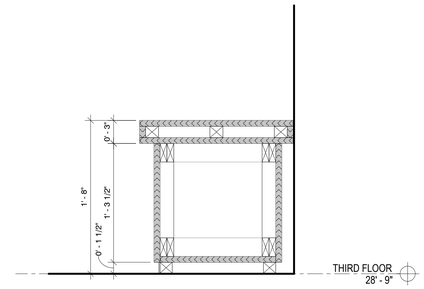
DRAWING TITLE

SECTION DETAILS - WING E

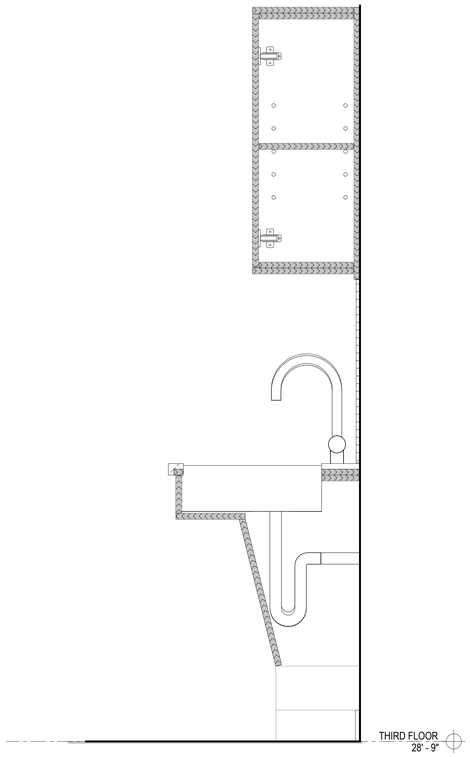
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

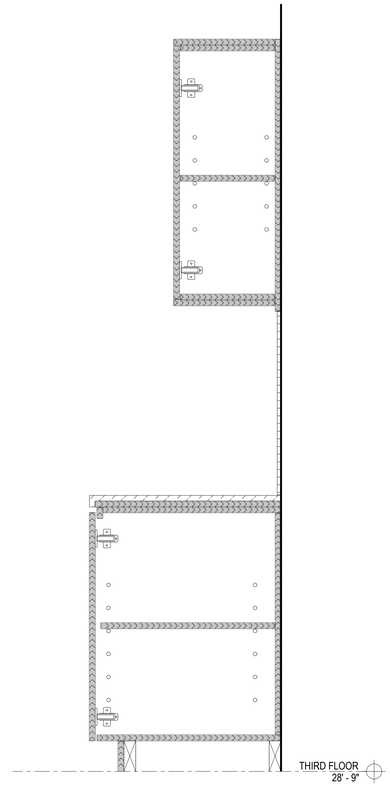
A616



3 A617 BENCH SECTION MILLWORK
1 1/2" = 1'-0"



2 A617 KITCHENETTE MILLWORK SECTION DETAIL 2
1 1/2" = 1'-0"



1 A617 KITCHENETTE MILLWORK SECTION DETAIL
1 1/2" = 1'-0"

10/17/2025 8:43:15 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

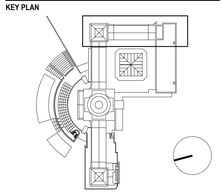
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

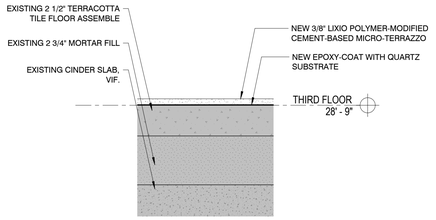
DRAWING TITLE

SECTION DETAILS - MILLWORK

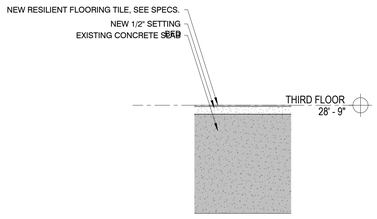
SCALE	1 1/2" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

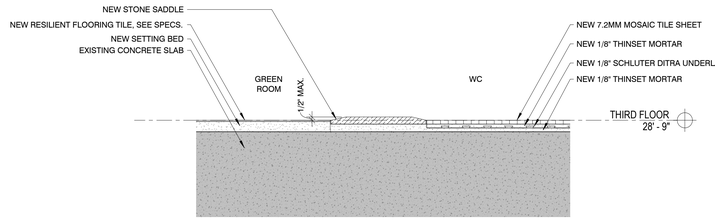
A617



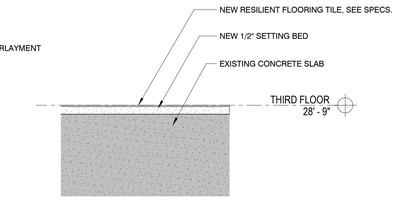
15 A618 TYPICAL FLOOR DETAIL ON TERRAZZO
3" = 1'-0"



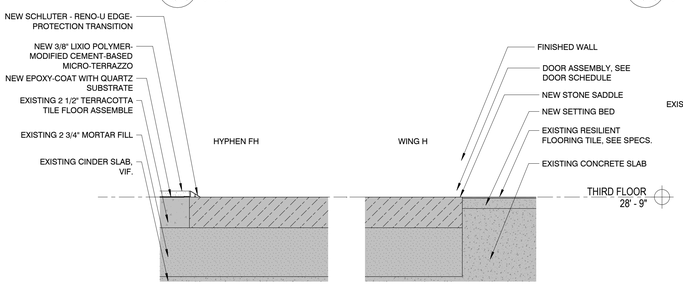
14 A618 ENLARGED SECTION DETAIL - GREEN ROOM FLOORING TYPICAL
3" = 1'-0"



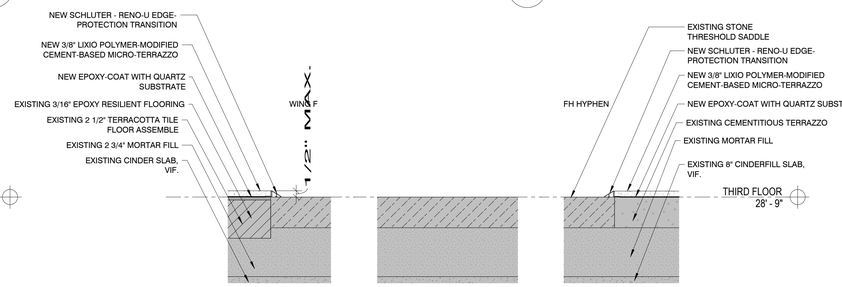
13 A618 ENLARGED SECTION DETAIL - GREEN ROOM WC TRANSITION
3" = 1'-0"



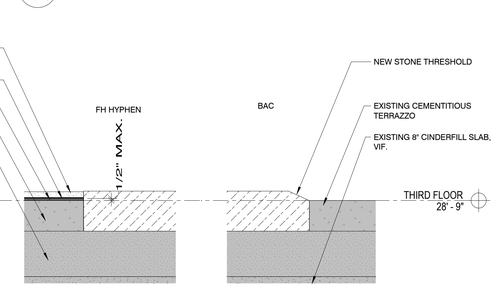
11 A618 ENLARGED SECTION DETAIL - STUDIO TYPICAL FLOORING ASSEMBLY
3" = 1'-0"



10 A618 ENLARGED SECTION DETAIL - FH HYPHEN SOUTH PORTAL THRESHOLD
3" = 1'-0"



9 A618 ENLARGED SECTION DETAIL - FH HYPHEN NORTH PORTAL THRESHOLD
3" = 1'-0"

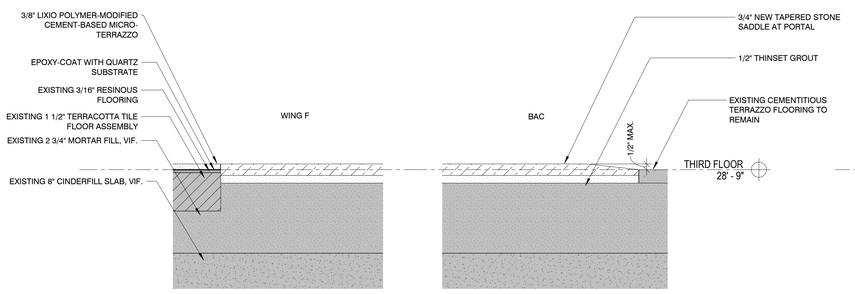


8 A618 ENLARGED SECTION DETAIL - FH HYPHEN WEST PORTAL THRESHOLD
3" = 1'-0"

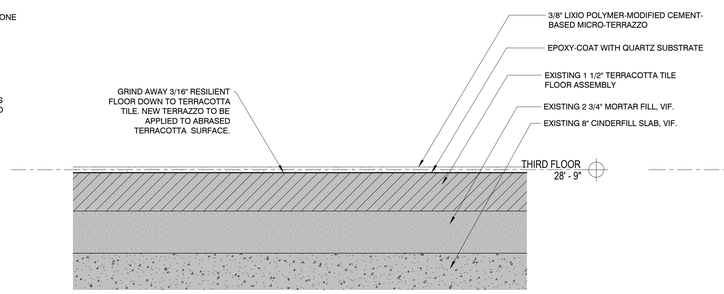
7 A618 EF - NORTH SADDLE FLOOR SECTION
3" = 1'-0"

6 A618 ENLARGED SECTION DETAIL - EF HYPHEN SOUTH PORTAL THRESHOLD
3" = 1'-0"

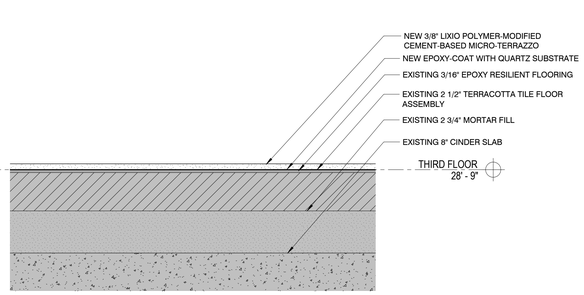
5 A618 ENLARGED SECTION DETAIL - EF HYPHEN WEST PORTAL THRESHOLD
3" = 1'-0"



4 A618 ENLARGED SECTION DETAIL - WING F CENTRAL PORTAL THRESHOLD
3" = 1'-0"



3 A618 ALTERNATE NO. 05 - WING F FLOOR DEMO EXISTING EPOXY
3" = 1'-0"



2 A618 ENLARGED SECTION DETAIL - WING F BASE FLOORING ASSEMBLY
3" = 1'-0"

FIG. 1: EXISTING CUT STORAGE POSTS

FIG. 2: EXISTING STONE MOSAIC KEY

FIG. 5: EXISTING STONE MOSAIC SADDLE

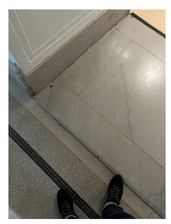


FIG. 6: EXISTING MARBLE SADDLE

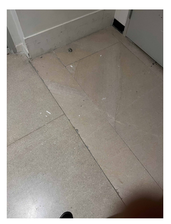
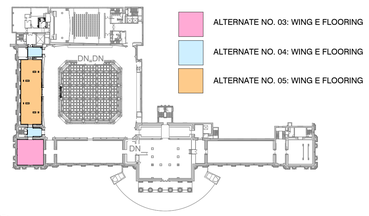


FIG. 7: EXISTING STONE MOSAIC SADDLE

FIG. 8: EXISTING STONE MOSAIC SADDLE

FIG. 9: EXISTING MARBLE SADDLE

FIG. 10: EXISTING MARBLE SADDLE



1 A618 THIRD FLOOR KEY PLAN
1" = 100'-0"

10/17/2025 8:43:27 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

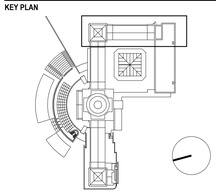
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

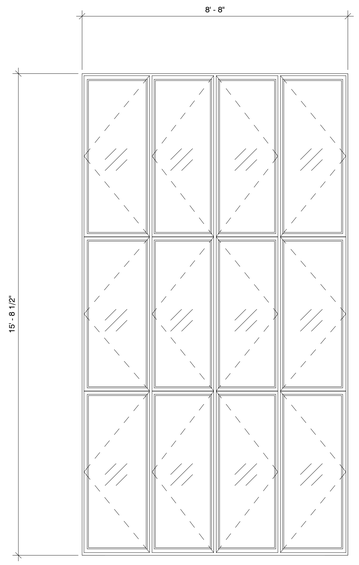
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

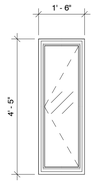
TYPICAL FLOORING DETAILS

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A618

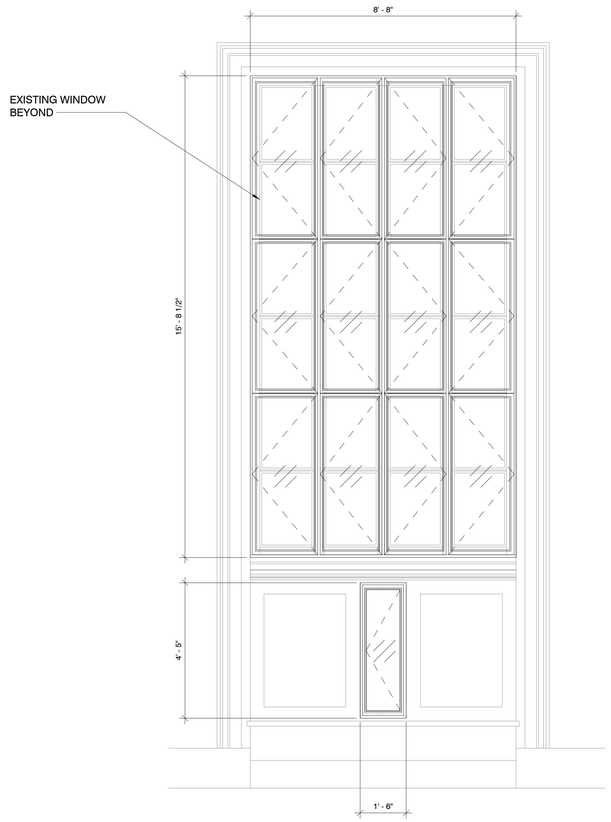
NEW WINDOW SCHEDULE								
TAG	BUILDING ELEVATION	TYPE	HEIGHT	WIDTH	FRAME MATERIAL	FRAME FINISH	GLAZING	COMMENTS
314AS	EAST	S1	15' - 5"	8' - 7"	METAL	PT	See narrative	12 lites, 6 are operable casements
317AS	NORTH	S1	15' - 5"	8' - 7"	METAL	PT	See narrative	12 lites, 6 are operable casements
317BS	NORTH	S2	4' - 4"	1' - 6"	METAL	PT	See narrative	Single operable casement



3 A701 TYPE S1
1/2" = 1'-0"



2 A701 TYPE S2
1/2" = 1'-0"



1 A701 STORM WINDOWS INSTALLED
1/2" = 1'-0"

10/17/2025 8:43:29 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

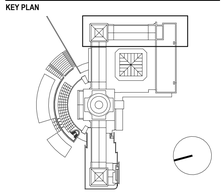
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

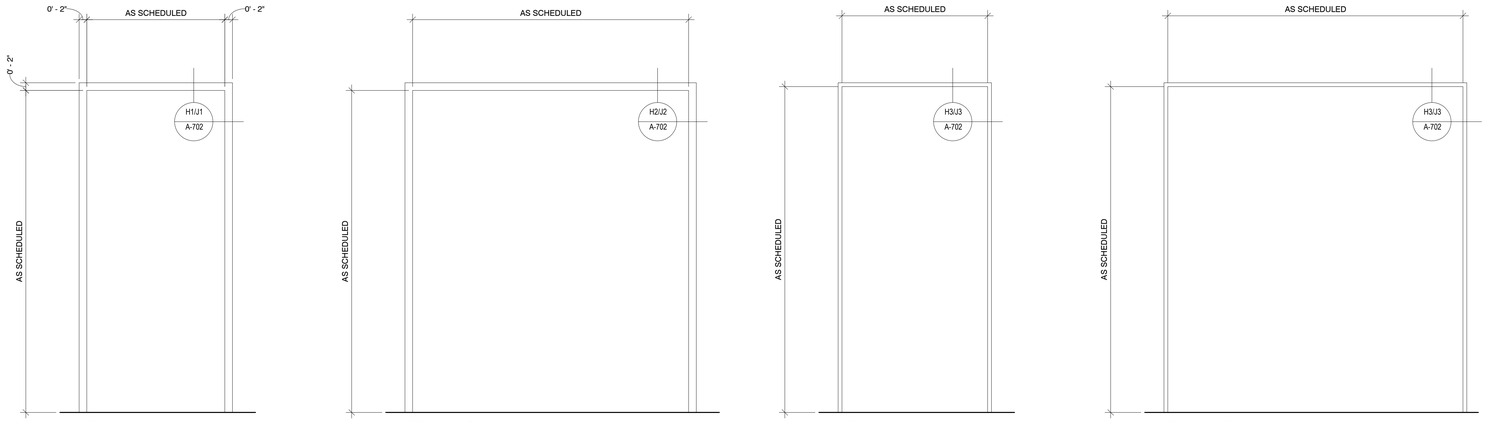
DRAWING TITLE

WINDOW SCHEDULE & TYPES

SCALE	1/2" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A

DRAWING NUMBER

A701



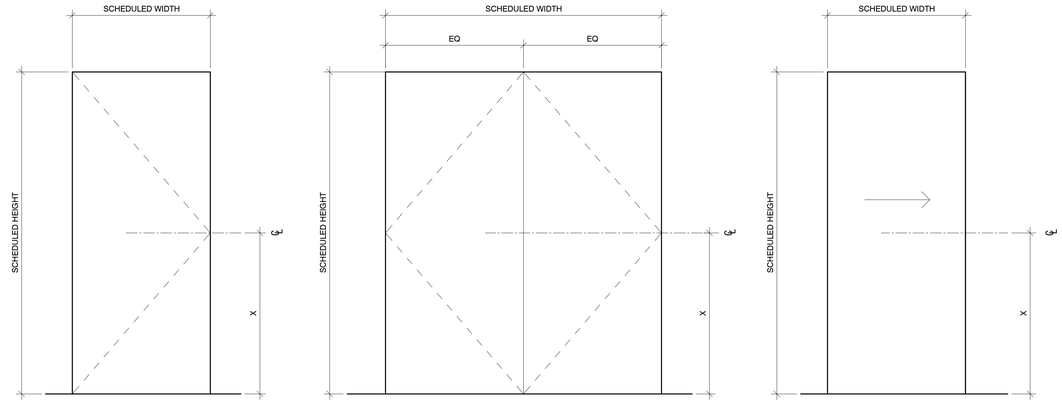
DOOR FRAME F1
HOLLOW METAL

DOOR FRAME F2
WOOD

DOOR FRAME F3
CONCEALED METAL (EZYJAMB)

DOOR FRAME F4
CONCEALED METAL (EZYJAMB)

2 AOA DOOR FRAME TYPES - ELEVATION
A702 3/4" = 1'-0"

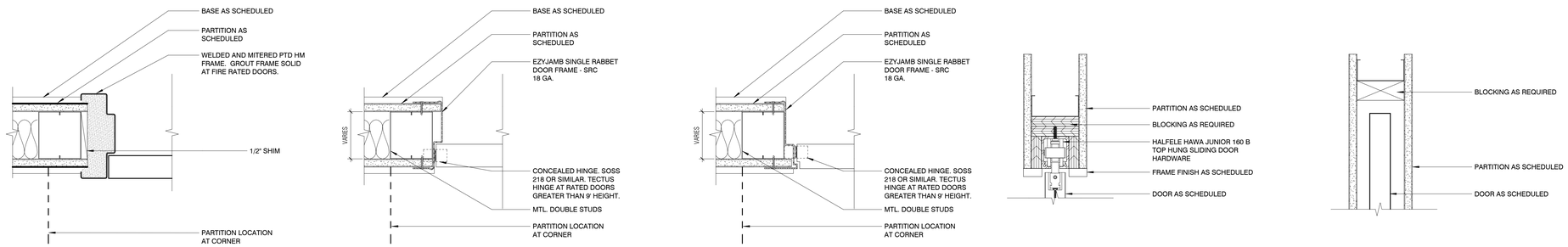


DOOR TYPE P1
SINGLE SWING
HOLLOW METAL OR WOOD PANEL
AS SCHEDULED

DOOR TYPE P1D
PAIR SWING
HOLLOW METAL PANELS

DOOR TYPE P3
SLIDING
ALUMINUM HONEYCOMB
AS SCHEDULED

1 AOA DOOR TYPES - ELEVATION
A702 3/4" = 1'-0"



H1 HEAD / J1 JAMB DETAIL
HOLLOW METAL

H2 HEAD / J2 JAMB DETAIL
CONCEALED METAL (EZYJAMB)

ISD JAMB DETAIL
CONCEALED METAL (EZYJAMB)

H3 HEAD DETAIL
TOP HUNG SLIDING TRACK (HALFELE)

J3 JAMB DETAIL
TOP HUNG SLIDING TRACK (HALFELE)

3 AOA DOOR HEAD/JAMB TYPES
A702 3" = 1'-0"

AOA DOOR SCHEDULE

Mark	Manufacturer	Height	Width	Finish	Door Hardware Finish	Door Head	Door Jamb	Door Material	Door Sill	Door Type	Fire Rating	Frame Finish	Frame Material	Frame Type	Comments
301	EZYJAMB	7' - 0"	4' - 0"	PTD		H2	J2	SC		P1	90 Min	PTD	MTL	F3	PANIC HARDWARE TO BE PROVIDED
302	EZYJAMB	7' - 0"	4' - 0"	PTD		H2	J2	SC		P1	90 Min	PTD	MTL	F3	
303	EZYJAMB	7' - 0"	3' - 0"	PTD		H2	J2	SC		P1	90 Min	PTD	MTL	F3	
304	EZYJAMB	7' - 0"	2' - 6"	PTD		H2	J2	SC		P1		PTD	MTL	F3	
305		9' - 0"	7' - 0"								90 Min				
307	BY CONTRACTOR	7' - 0"	3' - 0"	PTD		H1	J1	HM		P1	90 Min	PTD	HM	F1	
308	BY CONTRACTOR	7' - 0"	3' - 0"	PTD		H1	J1	HM		P1		PTD	HM	F1	
316	HAFELE	9' - 6"	7' - 6"	MTL		H3	J3	AH		P3					
317	HAFELE	9' - 6"	7' - 6"	MTL		H3	J3	AH		P3					
318		9' - 6"	7' - 3"	MTL		H3	J3	AH		P3					

DOOR MATERIAL
HM - HOLLOW METAL
AH - ALUMINUM HONEYCOMB
SC - SOLIDCORE

10/17/2025 8:43:31 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

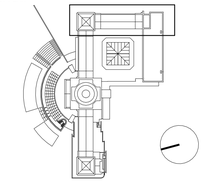
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

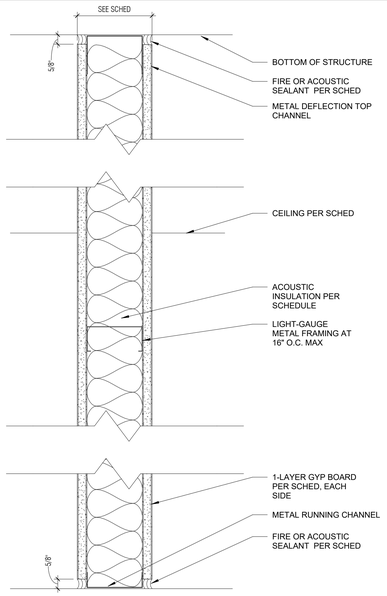
DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

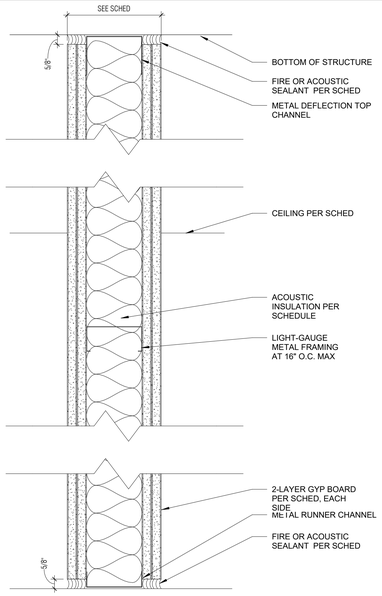
DOOR SCHEDULE & TYPES

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A702



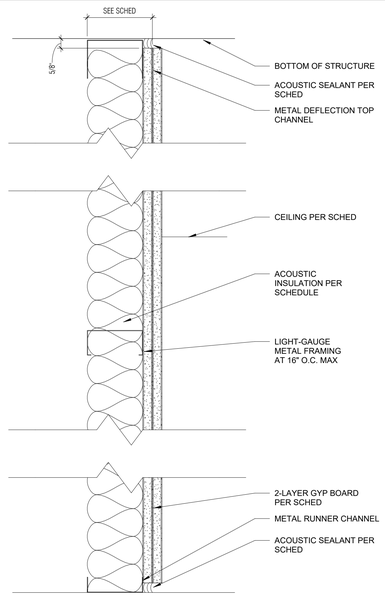
Type A - GWB SINGLE LAYER

Wall Type A								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments	
A2A	0' - 3 3/4"	0' - 2 1/2"						
A3A	0' - 4 7/8"	0' - 3 5/8"						
A5A	0' - 6 3/4"	0' - 5 1/2"						



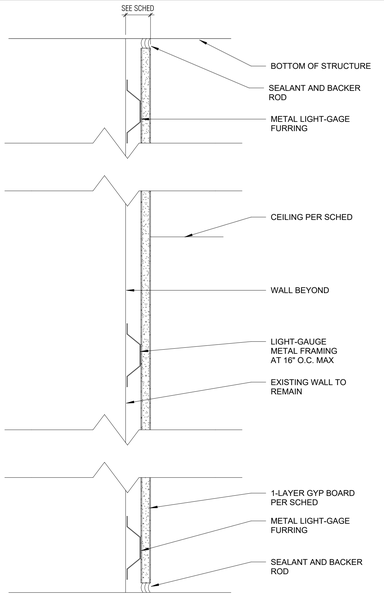
Type B - GWB DOUBLE LAYER

Wall Type B								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments	
B3A-2	0' - 6 1/8"	0' - 3 5/8"	2	U419	48			



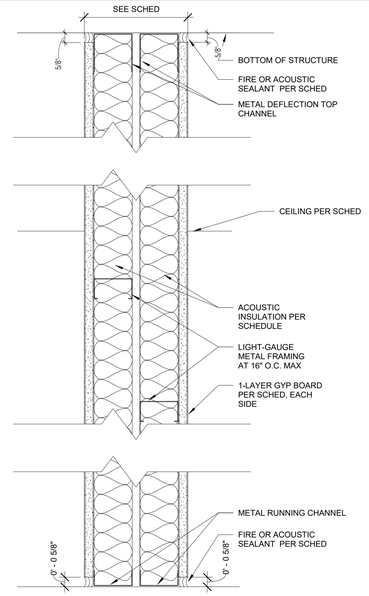
Type E - GWB FURRING DOUBLE LAYER

Wall Type E								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments	
E3A	0' - 4 7/8"	0' - 3 5/8"						



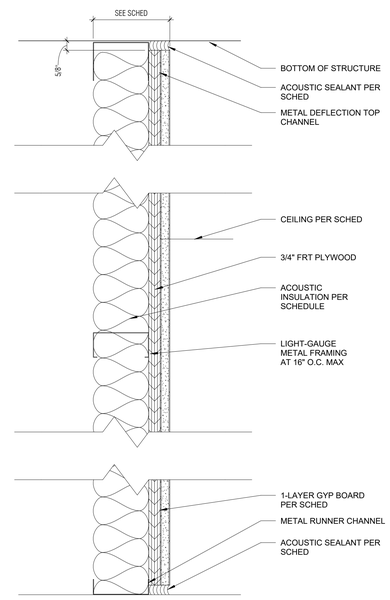
Type F - GWB CHANNEL FURRING SINGLE LAYER

Wall Type F								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Furring Thickness	Comments
F1A	0' - 1 1/8"	0' - 0"					0' - 0 1/2"	
F1B	0' - 1 1/2"	0' - 0"					0' - 0 7/8"	
F1C	0' - 2 1/8"	0' - 0"					0' - 1 1/2"	



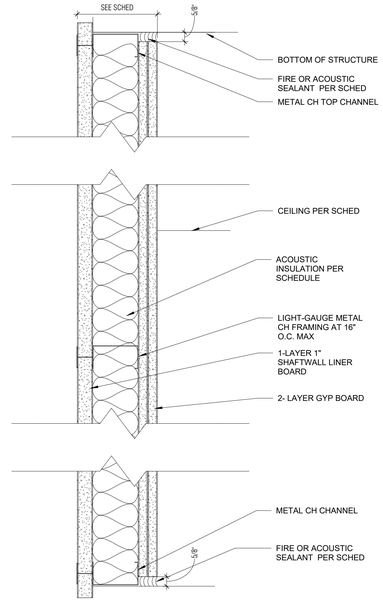
Type J - GWB SINGLE LAYER CHASE WALL

Wall Type J							
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments
J2A	0' - 6 3/4"	0' - 2 1/2"				No	
J8A	0' - 11 3/4"	0' - 2 1/2"				No	



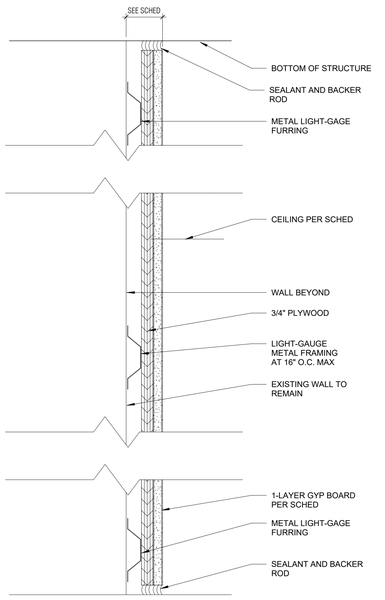
Type P - FURRING SINGLE LAYER PLYWOOD BACKED

Wall Type P								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments	
P3A	0' - 5"	0' - 3 5/8"						
P6A	0' - 7 3/8"	0' - 6"						



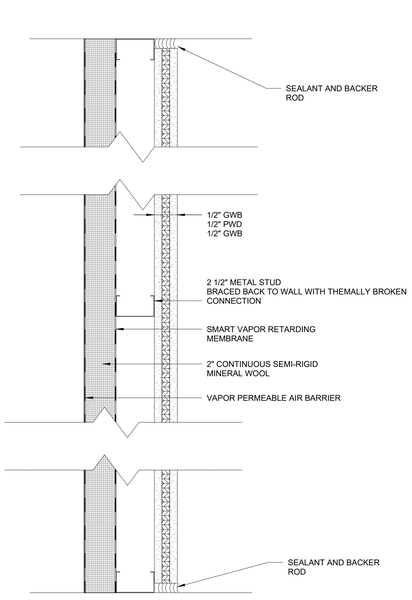
Type R - GWB SHAFTWALL

Wall Type R								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments	
R4A-2	0' - 6 1/4"	0' - 4"	2	U415	38			



Type S - GWB CHANNEL FURRING PLYWOOD BACKED

Wall Type S								
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments	
S1A	0' - 1 7/8"	0' - 0"						



Type T - INSULATED FURRING ASSEMBLY

Wall Type T							
Type Mark	Width	Framing Width	Fire Rating	Fire Test #	STC	Sound Insulation	Comments
T2A	0' - 6"	0' - 2 1/2"				No	

10/17/2025 8:43:37 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

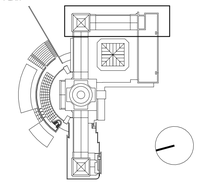
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

WALL TYPES

SCALE	3" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	A703

PLUMBING FIXTURE SCHEDULE						
Type Mark	Type	Manufacturer	Model	Description	Count	Plumbing Fixture Notes
PL-01	SINGLE COMP. SINK	ELKAY; SLOANE	LUSTERTONE MODEL# LRAD171665PD-1; EAF-700-HLT-ISM-CP-1.5GPM-LAM-IQ-FCT	18 GAUGE, ADA COMPLIANT, 17" X 16" DEEP DROP-IN SINK W/ PERFECT DRAIN/STRAINED ASSEMBLY, SENSOR FAUCET	1	SEE PLUMBING
PL-02	WATER CLOSET WALL HUNG FLUSH VAVLE	AMERICAN STANDARD; SLOANE	AFWALL MODEL#2257.101; MODEL# 111 ESS	VITREOUS CHINA, ADA COMPLIENT, 128 GPF HIGH EFFICINCY, SIPHON JET, ELONGATED IM, CONCEALED TRAP WAY, WITH 1-1/2" TOP	1	SEE PLUMBING
PL-03	LAVATORY WALL MOUNTED	KOHLER; SLOANE	PINOIR MODEL #K-2035-4; ETF-80-4-BOX-BDT-CP-0.5GPM-MLM-FCT	VITEOUS CHINA; ADA COMPLIANT, WALL MOUNT, OVAL BASIN WITH OVERFLOW DRAIN, GRID DRAIN	1	SEE PLUMBING

AOA MATERIAL SCHEDULE						
Type	MATERIAL	FINISH	MANUFACTURER	DESCRIPTION	LOCATION	SIZE
CL-01	PAINT	WHITE; FLAT; LEVEL 5 DRYWALL FINISH TO BE APPROVED BY ARCHITECT	BENJAMIN MOORE	HARDLID GWB CEILING ON NYC APPROVED BLACK IRON CEILING ASSEMBLY. PAINTED.	WING FCEILING	N/A
CL-02	PAINT	ACCENT COLOR; FLAT; LEVEL 5 DRYWALL FINISH TO BE APPROVED BY ARCHITECT	BENJAMIN MOORE	HARDLID GWB CEILING ON NYC APPROVED BLACK IRON CEILING ASSEMBLY. PAINTED.	HYPHEN SPACES CEILING	N/A
CL-03	PAINT	WHITE; FLAT; LEVEL 3 DRYWALL FINISH TO BE APPROVED BY ARCHITECT	BENJAMIN MOORE	HARDLID GWB CEILING ON NYC APPROVED BLACK IRON CEILING ASSEMBLY. PAINTED.	MECHANICAL ROOMS AND UTILITY CLOSESTS	N/A
CL-05	PAINT	WHITE; FLAT; FINISH TO BE APPROVED BY ARCHITECT	BENJAMIN MOORE	PAINTED EXISTING EXPOSED CONCRETE CEILING	STUDIO	N/A
CONC-01	CEMENTITIOUS MICRO-TERRAZZO	LIXIO; POLISHED TERRAZZO; TO BE APPROVED BY ARCHITECT	IDEAL WORKS; SCREPO	600 GRIT GRIND TO EXPOSE AGGREGATE, SATIN CLEAR SEAL FINISH	WING F; HYPEN SPACES	N/A
FL-01	VINYL FLOOR TILE		BY CONTRACTOR	VINYL FLOOR TILE, COLOR AND FINISH TO BE APPROVED BY ARCHITECT		12"X12"
GL-01	CHROMA RESIN	CLEAR ANODIZED, BACKED WITH DIIFFUSION FILM	3FORM	BACKLIT PLANEL	CENTER OF EAST WALL, GALLERY WING F	1/2" THICK
GR-01	ALUMINUM	MATCH ACCENT COLOR; TO BE APPROVED BY ARCHITECT	ARCHITECTURAL GRILLE	212 STRAIGHT HOLE PERFORATED GRILLE	BETWEEN BEAMS, GALLERY WING F	N/A
MTL-01	ANNODIZED ALUMINUM	MIST; ALUMINUM	FORMS + SURFACES	COATED STAINLESS STEEL; CERAMILOC+ TRATMENT; 0.8MM THICKNESS	ACCENT METAL	N/A
P.LAM. 01	LAMINATE	LAMINATED WOOD - FINISH TO BE APPROVED BY ARCHITECT	ABET LAMINATI	MILLWORK	STUDIO KITCHEN MILLWORK	DIMENSIONS VARY
PL-01	TUSCANY LIMESTONE CEMENT PLASTER	VPC-209h-SDS.5	TEXTSTON	N/A	TRANSOM PANEL ABOVE PROTALS ON BAC SIDE	DIMENSIONS VARY
PL-02	PLASTER	MATCH ADJACENT WALL; SATIN FINISH	BY CONTRACTOR	N/A	MOLDING IN WING E	N/A
PL-02 ALT1	PLASTER	MATCH ADJACENT WALL; SATIN FINISH	BY CONTRACTOR	N/A	MOLDING IN WING E	PATCH AND REPAIR MODLING WHERE NECESSARY
PT-01	INTERIOR LIME PAINT	WHITE SAND #12; DRYWALL LEVEL 5 FINISH; TO BE APPROVED BY ARCHITECT	VASARI PLASTER	N/A	BASE GALLERY INTERIOR WALLS	RECREAT ALL MOLDING THROUGHOUT
PT-01 ALT1	INTERIOR PAINT	WHITE; EGGSHELL; LEVEL 5 DRYWALL FINISH	BENJAMIN MOORE	N/A	BASE GALLERY INTERIOR WALLS	N/A
PT-02	INTERIOR PAINT	MARGAUX; LEVEL 5 DRYWALL FINISH; TO BE APPROVED BY ARCHITECT	ATELIER PAINT	N/A	ACCENT COLOR TBD	N/A
PT-03	INTERIOR PAINT	WHITE; FLAT; LEVEL 4 DRYWALL FINISH	BENJAMIN MOORE	N/A	BASE GALLERY INTERIOR CEILING; NICHES TO RECEIVE WALL CASE	N/A
PT-04	2K-PUR	CLASS B	KEMPER	FLUID APPLIED WATERPROOFING SYSTEM	MECH ROOM	
QZ-01	QUARTZ	POLISHED FINISH	CAESARSTONE	1" COUNTERTOP FOR KITCHEN, GREEN ROOM AND WC	GREEN ROOM, STUDIO AND WC	1"
SCM-01	ISOLDE 8-POINT SHARKSTOOTH SCRIM	WHITE	GERRIETS	WOVEN WITH 8 VERTICA "TEETH" PER INCH, LESS TRANSPARENT WHEN BACKLIT.	WING E WINDOWS	N/A
ST-01	STONE	TENNESSEE PINK MARBLE; TO BE APPROVED BY ARCHITECT	TENNESSEE PINK MARBLE	STONE TO LINE THE PORTALS ON THE BAC. REFER TO DETAILS FOR PROFILES AND STONE THICKNESS.	NEW POSRTAL THROUGHOUT; WING E, WING F; HYPHEN SPACES AND BEAUX ARTS COURT	VARYING BETWEEN 1-1/4" AND 2-1/2" IN THICKNESS.
TL-01	GLAZED MOSAIC TILE	GLOSSY	NEMO TILE	SKU#: APPDIVA15 APPDIVA15	BASE BUILDING BATHROOM WALL TILE, KITCHEN BACKSPLASH	1/2"X1/2" TILE, 12X12" SHEETS
WB-01	BRUSHED STAINLESS STEEL	POWDER COATED; FINISH TO BE APPROVED BY ARCHITECT	FRY REGLET	4" RECESSED WALL BASE WITH CEMCO FAS-RBR INTUMESCENT PAINTED STRAPPING BEHIND	GALLERY WALLS	4" TALL
WB-02	VINYL	MATTE	TARKETT	4" VINYL WALL BASE WITH COVED PROFILE	GREEN ROOM, STUDIO AND WC	4" TALL
WB-03	BRUSHED STAINLESS STEEL	POWDER COATED; FINISH TO BE APPROVED BY ARCHITECT	FRY REGLET	4" RECESSED WALL BASE WITH CEMCO FAS-RBR INTUMESCENT PAINTED STRAPPING BEHIND	GALLERY WALLS	4" TALL
WD-02	LAMINATE	LAMINATED WOOD - FINISH TO BE APPROVED BY ARCHITECT	ABET LAMINATI	MILLWORK	GREEN ROOM AND WC	DIMENSIONS VARY

10/17/2025 8:43:39 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

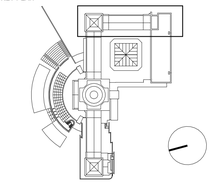
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

SCHEDULES

SCALE

DATE 10/17/25

PROJECT NUMBER 163A

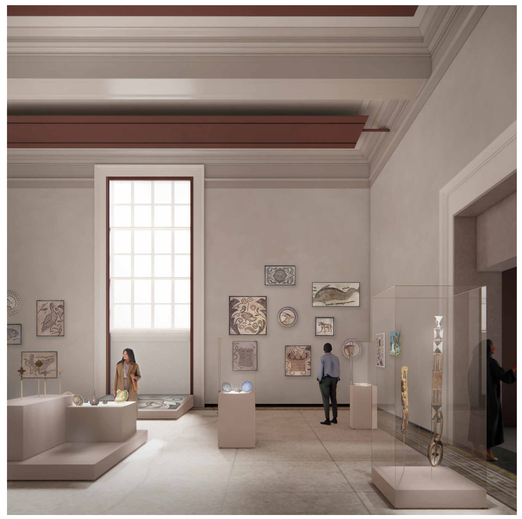
DRAWING NUMBER

A704

EF HYPHEN - FACING EAST

FH HYPEN - FACING EAST

WING F - VIEW FACING SOUTH



WING E - VIEW FACING EAST

WING F - VIEW FACING SOUTH TOWARDS WING F-H

WING G - VIEW OF DOOR 3G13 FACING EAST TOWARDS WING E-F

WING G - VIEW OF DOOR 3G14B FACING EAST TOWARDS WING F

WING G - VIEW OF DOOR 3G15 FACING EAST TOWARDS WING F-H

10/17/2025 8:43:41 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

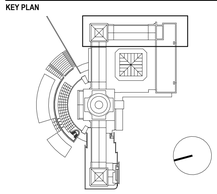
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

SCHEMATIC RENDERINGS

SCALE	
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

A801

GENERAL NOTES

1. ALL STRUCTURAL WORK SHALL BE COORDINATED WITH ARCHITECTURAL AND MECHANICAL DRAWINGS AND SHALL CONFORM TO THE PROJECT SPECIFICATIONS, INCLUDING THE NYC 2022 BUILDING CODE. THE FOLLOWING STANDARDS WERE USED AS SPECIFIED IN THE GOVERNING BUILDING CODE:
   a. ASCE 7-16 MINIMUM DESIGN LOADS (AND ASSOCIATED CRITERIA) FOR BUILDINGS AND OTHER STRUCTURES
   b. ACI 318-16 BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
   c. TMS 402/602-16 BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES
   d. AISC 360-16 SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS
2. CONTRACTOR SHALL PROVIDE TEMPORARY SHORING, BRACING, AND SHEETING AND SHALL MAKE SAFE ALL FLOORS, ROOFS, WALLS, AND ADJACENT PROPERTY AS PROJECT CONDITIONS REQUIRE. SHORING AND SHEETING SHALL BE DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER LICENSED IN THE PROJECT JURISDICTION, HIRED BY THE CONTRACTOR, WHO SHALL SUBMIT SHOP DRAWINGS AND CALCULATIONS FOR THE OWNER'S REVIEW.
3. DIMENSIONS AND ELEVATIONS OF EXISTING CONSTRUCTION GIVEN IN STRUCTURAL DRAWINGS ARE BASED ON INFORMATION CONTAINED IN VARIOUS ORIGINAL DESIGN AND CONSTRUCTION DOCUMENTS PROVIDED BY THE OWNER, AND LIMITED FIELD OBSERVATIONS AND MEASUREMENTS. THE CONTRACTOR SHALL VERIFY ALL INFORMATION PERTAINING TO EXISTING CONDITIONS BY ACTUAL MEASUREMENT AND OBSERVATION AT THE SITE. ALL DISCREPANCIES BETWEEN ACTUAL CONDITIONS AND THOSE SHOWN IN THE CONTRACT DOCUMENTS SHALL BE REPORTED TO THE ENGINEER OF RECORD FOR EVALUATION BEFORE THE AFFECTED CONSTRUCTION IS PUT IN PLACE.
4. THE CONTRACT DRAWINGS AND SPECIFICATIONS ARE COMPLEMENTARY. THESE NOTES HIGHLIGHT RATHER THAN REPLACE THE SPECIFICATIONS CONTAINED IN THE PROJECT MANUAL.

CONCRETE

1. ALL CONCRETE WORK SHALL CONFORM TO THE FOLLOWING GOVERNING STANDARDS:
   A. AMERICAN CONCRETE INSTITUTE (ACI) "BUILDING CODE REQUIREMENTS FOR CONCRETE" (ACI 318)
   B. ACI COLLECTION, LATEST EDITION
   C. CONCRETE REINFORCING STEEL INSTITUTE (CRSI) "MANUAL OF STANDARD PRACTICE"
2. ALL CONCRETE COMPOSITE ON METAL DECK SHALL BE LIGHT WEIGHT CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS, UNLESS OTHERWISE NOTED.
3. ALL OTHER CONCRETE SHALL BE NORMAL WEIGHT CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS, UNLESS OTHERWISE NOTED.
4. CONTRACTOR SHALL SUBMIT A PROJECT-SPECIFIC SIGNED AND SEALED CONCRETE MIX DESIGN FOR EACH CONCRETE TYPE SPECIFIED IN THE CONTRACT DOCUMENTS. WHERE 033000 SPECIFICATIONS HAVE BEEN INCLUDED IN THE CONTRACT DOCUMENTS, REFER TO THAT SPECIFICATION SECTION FOR BALANCE OF MIX DESIGN REQUIREMENTS (AGGREGATES, ADMIXTURES, W/C RATIO, AIR CONTENT, ETC.)
5. REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO ASTM A615, GRADE 60 OR A775 EPOXY COATED WHEN CALLED OUT ON PLAN. REINFORCING STEEL SHALL BE DETAILED ACCORDING TO THE ACI "DETAILS AND DETAILING OF REINFORCEMENT" (ACI 315).
6. REINFORCING STEEL TO BE WELDED TO CONFORM TO ASTM A706 GRADE 60.
7. WELDED WIRE REINFORCEMENT (W.W.R.) SHALL CONFORM TO ASTM A1064, WITH A MINIMUM YIELD STRENGTH OF 65,000 PSI.
8. COORDINATE SIZE AND LOCATION OF ALL OPENINGS AND PIPE SLEEVES WITH ALL OTHER DISCIPLINES. MINIMUM CONCRETE BETWEEN SLEEVES SHALL BE 6".
9. GENERAL CONTRACTOR SHALL PROVIDE COORDINATED MEP TRADE SUBMITTALS FOR DESIGN TEAM REVIEW OF PENETRATIONS. ALL TRADES SHALL BE OVERLAID INTO ONE SUBMITTAL TO CAPTURE AND EVALUATE ALL PENETRATIONS THROUGH SLABS AND WALLS TOGETHER.
10. ALL GROUT SHALL BE NONSHRINK WITH A MINIMUM COMPRESSIVE STRENGTH OF 5000 PSI.
11. MINIMUM CONCRETE COVER FOR REINFORCING STEEL IN CAST-IN-PLACE NON-PRESTRESSED MEMBERS SHALL BE AS FOLLOWS:
    A. ALL CONCRETE CAST AGAINST AND PERMANENTLY IN CONTACT WITH GROUND: 3"
    B. ALL CONCRETE EXPOSED TO WEATHER OR IN CONTACT WITH GROUND:
       a. 2" (#6 THROUGH #18 BARS)
       b. 1-1/2" (#5 BAR, W31 OR D31 WIRE, AND SMALLER)
    C. NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND:
       a. SLABS, JOISTS, AND WALLS:
          - 1-1/2" (#14 THROUGH #18 BARS)
          - 3/4" (#11 BAR AND SMALLER)
       b. BEAMS, COLUMNS, PEDESTALS, AND TENSION TIES (STIRRUPS, TIES, SPIRALS, HOOPS, AND PRIMARY REINFORCEMENT): 1-1/2"
    D. SHEAR WALLS: SEE ELEVATIONS FOR SPECIFIED CONCRETE COVER.
12. SHOP DRAWINGS SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR REVIEW AND APPROVAL. NO CONCRETE WORK SHALL COMMENCE WITHOUT APPROVED SHOP DRAWINGS.
13. CLEAN AND ROUGHEN TO 1/4" AMPLITUDE ALL EXISTING CONCRETE SURFACES TO RECEIVE NEW CONCRETE PRIOR TO PLACEMENT.
14. SEE OTHER DRAWINGS IN THIS PROJECT FOR SIZE AND LOCATIONS OF EQUIPMENT PADS, INSERTS, AND EMBED ITEMS.
15. REINFORCING DOWELS, WATER STOPS, AND OTHER EMBED ITEMS SHALL BE INSTALLED AND SECURED PRIOR TO CONCRETE PLACEMENT. "WET-SETTING" OF EMBEDDED ITEMS IS NOT PERMITTED.
16. WELDED WIRE REINFORCEMENT IN COMPOSITE CONSTRUCTION SHALL HAVE TENSION SPLICES AND BE ANCHORED AT DISCONTINUOUS EDGES, AND SHALL NOT BE SUBSTITUTED WITH ALTERNATIVE MATERIALS INCLUDING BUT NOT LIMITED TO FIBERS.
17. CONDUIT EMBEDDED IN CONCRETE SHALL FOLLOW THE GUIDELINES IN THE TYPICAL DETAILS. THE CONTRACTOR SHALL NOT VIOLATE THESE GUIDELINES WITHOUT WRITTEN APPROVAL BY THE STRUCTURAL ENGINEER OF RECORD. CONTRACTOR TO PROVIDE SHOP DRAWINGS SHOWING LAYOUT OF ALL EMBEDDED CONDUIT FOR APPROVAL BY ENGINEER OF RECORD BEFORE PLACEMENT.
18. PER ACI, PLACEMENT OF STRUCTURAL CONCRETE WITH A LEAST DIMENSION GREATER THAN OR EQUAL TO 4 FEET SHALL BE CONSIDERED "MASS CONCRETE". SIMILAR CONSIDERATIONS SHOULD BE GIVEN TO OTHER CONCRETE PLACEMENTS THAT DO NOT MEET THIS MINIMUM DIMENSION BUT CONTAIN TYPE III CEMENT, ACCELERATING ADMIXTURES, OR CEMENTITIOUS MATERIALS IN EXCESS OF 660 LB PER CUBIC YARD OF CONCRETE. CONSIDERATION SHOULD ALSO BE GIVEN TO PLACEMENTS THAT TRAP HEAT. WHERE APPLICABLE PER ACI DEFINITION ABOVE, CONTRACTOR SHALL ADHERE TO MASS CONCRETE PROCEDURES AND RECOMMENDATIONS OF ACI 301 AND ACI 211. CONTRACTOR SHALL PROVIDE SPECIFIC MASS CONCRETE MIX DESIGN TO MINIMIZE HEAT.
19. WHERE REBAR CONGESTION DICTATES, LAP SPLICES SHALL BE STAGGERED IN ACCORDANCE WITH ACI REINFORCEMENT DETAILING REQUIREMENTS. ALTERNATIVELY, MECHANICAL SPLICES MAY BE EMPLOYED, AT THE CONTRACTOR'S OPTION AND EXPENSE, PROVIDED THEY ARE STAGGERED TO MAINTAIN MINIMUM SPACING AND COVER PER ACI REINFORCEMENT DETAILING REQUIREMENTS.

CONCRETE BLOCK

1. ALL CONCRETE BLOCK WORK SHALL CONFORM TO THE "NATIONAL CONCRETE MASONRY ASSOCIATION TEK MANUAL FOR THE DESIGN AND CONSTRUCTION OF CONCRETE MASONRY", LATEST EDITION, AND "ACI 530-BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES".
2. CONCRETE BLOCK SHALL BE OF LIGHTWEIGHT AGGREGATE AND CONFORM TO THE FOLLOWING STANDARDS: HOLLOW BLOCK: ASTM C90.

NET AREA COMPRESSIVE STRENGTH OF CONCRETE MASONRY UNIT (PSI)	NET AREA COMPRESSIVE STRENGTH OF MASONRY ASSEMBLY, F'm (PSI) USING TYPE S MORTAR
2000	2000
3250	2500
3900	2750
4500	3000

UNLESS OTHERWISE NOTED ON PLANS AND/OR ELEVATIONS, CONCRETE BLOCK UNIT STRENGTH SHALL BE 2000 PSI MIN. (NOTE: CONCRETE BLOCK WITH UNIT STRENGTH HIGHER THAN 2000 PSI GENERALLY REQUIRES LONGER DELIVERY LEAD TIMES.)

3. ALL MORTAR SHALL BE ASTM C270, TYPE S.
4. ALL GROUT FOR FILLING CELLS SHALL BE ASTM C 476 WITH MINIMUM COMPRESSIVE STRENGTH OF 2000 PSI BUT NOT LESS THAN THE COMPRESSIVE STRENGTH OF THE MASONRY ASSEMBLY, F'm. WHERE GROUT CELLS DO NOT EXCEED 4" IN DIAMETER FINE GROUT SHALL BE USED.
5. ALL BLOCK DIMENSIONS INDICATED ON STRUCTURAL PLANS ARE NOMINAL DIMENSIONS. DESIGN OF WALL REINFORCING ASSUMES CONCRETE MASONRY UNITS THAT ARE 16" LONG AND HAVE TWO CORES/CELLS, RESULTING IN A NOMINAL BAR SPACING OF 8" ON CENTER.
6. ALL CONCRETE BLOCK BELOW GRADE SHALL BE FILLED SOLID WITH GROUT.
7. CONCRETE BLOCK BELOW BEAM OR TRUSS BEARING POINTS SHALL BE FILLED SOLID FOR A MINIMUM OF TWO COURSES IN DEPTH AND A MINIMUM OF 32" IN WIDTH, UNLESS NOTED OTHERWISE.
8. INSTALL STANDARD WEIGHT LADDER-TYPE JOINT REINFORCEMENT AT 16" ON CENTER (SPACED VERTICALLY).
9. UNLESS NOTED OTHERWISE ALL MASONRY WALLS SHALL BE REINFORCED WITH #4@48" ON CENTER VERTICAL. GROUT ALL REINFORCED CELLS SOLID. PROVIDE DOWELS TO MATCH VERTICAL REINFORCING AT FOUNDATION.
10. PROVIDE CONTINUOUS BOND BEAM WITH 2-#5 CONTINUOUS MINIMUM AT TOPMOST COURSE OF EACH FLOOR LEVEL AND AT ALL TOP OF PARAPET CONDITIONS, TYPICAL THROUGHOUT.
11. ALL CMU WALLS (STRUCTURAL AND NON-STRUCTURAL) SHALL BE PERMANENTLY BRACED TO FLOOR SLABS OR SPANDREL BEAMS AT EACH FLOOR LEVEL. SEE TYPICAL DETAILS FOR BALANCE OF INFORMATION. IF BRACING DETAILS NOT SHOWN, CONTRACTOR TO PROVIDE PREFERRED DETAIL FOR EOR REVIEW.
12. WHERE CMU IS SUPPORTED ON STRUCTURAL STEEL MEMBERS, PROVIDE WELDABLE REBAR COUPLERS CONNECTED TO TOP FLANGE OF STEEL BEAM. DOWELS TO MATCH SIZE AND SPACING OF CMU REINFORCEMENT. DOWELS MUST PROVIDE FULL TENSION LAP SPLICE WITH CMU REINFORCEMENT.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL WORK SHALL CONFORM TO THE FOLLOWING GOVERNING STANDARDS:
   A. AISC 360 "SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS".
   B. AISC 303 "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES".
   C. AMERICAN WELDING SOCIETY (AWS D1.1) "STRUCTURAL WELDING CODE - STEEL".
   D. RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC) "SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH-STRENGTH BOLTS".
2. ALL STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING ASTM SPECIFICATIONS:
   A. WIDE FLANGE BEAMS, COLUMNS, AND STRUCTURAL TEES: ASTM A992.
   B. HOLLOW STRUCTURAL SECTIONS: ASTM A500, GRADE C.
   C. STRUCTURAL PIPE SECTIONS: ASTM A53, GRADE B.
   D. CHANNELS, ANGLES, AND PLATES: ASTM A36 UNLESS OTHERWISE NOTED.
   E. BOLTED CONNECTIONS SHALL BE PER ASTM F3125. GRADES ARE TO BE SELECTED AS FOLLOWS:
      a. STANDARD BEAM TO BEAM/GIRDER: ASTM F3125, GRADES A325, F1852, A490 OR F2280 BOLTS IN SNUG-TIGHTENED JOINTS (3/4" DIAMETER MINIMUM WITH HARDENED WASHERS).
      b. BEAM/GIRDER TO COLUMN CONNECTIONS, COLUMN SPLICES AND BOLTS EXPERIENCING TENSION LOADS (UNLESS OVERSIZED OR SLOTTED HOLES ARE USED, IN WHICH CASE SLIP-CRITICAL JOINTS SHALL BE USED): ASTM F3125, GRADES A325, F1852, A490 OR F2280 BOLTS IN PRETENSIONED JOINTS (3/4" DIAMETER MINIMUM WITH HARDENED WASHERS).
      c. MOMENT CONNECTIONS AND BRACED FRAME CONNECTIONS: ASTM F3125, GRADES A325, F1852, A490 OR F2280 BOLTS IN SLIP CRITICAL JOINTS (3/4" DIAMETER MINIMUM WITH HARDENED WASHERS). FAYING SURFACES SHALL BE CLASS A UNLESS OTHERWISE NOTED.
      d. PER AISC 341, ALL BOLTS SHALL BE INSTALLED AS PRETENSIONED HIGH STRENGTH BOLTS AND MEET THE REQUIREMENTS FOR SURFACE PREPARATION FOR SLIP CRITICAL CONNECTIONS WITH CLASS A SLIP COEFFICIENT OR HIGHER. THE AVAILABLE SHEAR STRENGTH OF BOLTED JOINTS USING STANDARD HOLES SHALL BE CALCULATED AS THAT FOR BEARING TYPE JOINTS.
   F. ANCHOR RODS: ASTM F1554, GRADE 36.
3. STEEL CONNECTIONS SHALL BE STANDARD AISC FRAMED BEAM CONNECTIONS, AND SHALL BE DESIGNED BY A LICENSED ENGINEER WORKING FOR THE FABRICATOR, WHO SHALL PROVIDE CALCULATIONS, UTILIZING ASD LOADS AND PROCEDURES.
   A. WHERE CONNECTIONS HAVE BEEN DESIGNED BY A LICENSED ENGINEER, STEEL CONTRACTOR IS RESPONSIBLE FOR INTEGRATING RESULTS OF ALL CALCULATIONS INTO THE SHOP DRAWINGS.
   B. UNLESS OTHERWISE NOTED ON PLAN, PROVIDE CONNECTIONS BASED ON MINIMUM SHEAR CAPACITY REQUIREMENTS IN THE FOLLOWING TABLE WHICH ARE BASED ON AISC SINGLE SHEAR TAB CONNECTIONS.

MINIMUM SHEAR CAPACITY REQUIREMENTS			
BEAM DEPTH (NOMINAL)	MIN. SHEAR CAPACITY ASD (Kips)	MIN. SHEAR CAPACITY LRFD (Kips)	MIN. NUMBER OF BOLT ROWS
8", 10"	16	24	2
12", 14"	28	42	3
16"	40	62	3
18"	52	78	4
21"	58	88	4
24"	60	90	5
27"	72	108	6
30"	84	126	7
33"	94	142	7
36"	102	155	8
40"+	110	165	9

   B. REINFORCING IS TO BE PROVIDED AT CONNECTIONS WHERE CUTS REDUCE THE SHEAR OR MOMENT CAPACITY BELOW THAT REQUIRED TO SUSTAIN THE REACTION. FLANGES AND WEBS ARE TO BE REINFORCED WHERE THE LOCAL CAPACITY TO SUSTAIN CONNECTION LOADS ARE INADEQUATE. CUTS OR COPES MAY PREVENT MINIMUM NUMBER OF BOLT ROWS SHOWN ABOVE FROM BEING ACHIEVED, WHICH IS ACCEPTABLE PENDING WRITTEN APPROVAL AND CONFIRMATION THAT MINIMUM SHEAR CAPACITY HAS BEEN MET.
   C. CONNECTIONS SHALL BE DESIGNED FOR SHEAR AND ECCENTRICITY, CONSIDERING THAT THE CONNECTIONS ARE AN EXTENSION OF THE BEAMS AND GIRDERS.
4. MINIMUM WELD SIZE IS 1/4" FILLET UNLESS NOTED OTHERWISE.
5. ALL BEAMS EXCEPT CANTILEVER BEAMS SHALL BE FABRICATED AND INSTALLED WITH NATURAL CAMBER UP. CANTILEVER BEAMS SHALL BE FABRICATED AND INSTALLED SO THAT NATURAL CAMBER RAISES CANTILEVER END.
6. FIELD CUTTING OR BURNING OF STEEL IS PROHIBITED EXCEPT WITH THE EXPRESS WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD (IN WHICH CASE ALL BURNING OF STEEL MUST CONFORM TO THE THERMAL CUTTING REQUIREMENTS OF AISC AND AWS).
7. WELDING SHALL BE PERFORMED BY CERTIFIED, AWS-QUALIFIED WELDERS. WELDING ELECTRODES FOR CARBON STEEL SHALL BE AWS 5.1, CLASS E70XX. FOR ASTM A572 GRADE 50 KSI PLATE USE ELECTRODE E7018 OR APPROVED EQUAL (OR ELECTRODES THAT MEET THE REQUIREMENT OF__). WELDING ELECTRODES FOR ASTM A276 STAINLESS STEEL, TYPE 304, SHALL CONFORM TO AWS A5.4 FOR SHIELDED METAL ARC WELDING, ELECTRODE CLASS E308; OR AWS A5.9 FOR GAS METAL ARC WELDING, ELECTRODE CLASS ER308. WELDING ELECTRODES FOR ASTM A276 TYPE 316L STAINLESS STEEL SHALL CONFORM TO AWS A5.4 FOR SHIELDED METAL ARC WELDING, ELECTRODE CLASS E316; OR AWS A5.9 FOR GAS METAL ARC WELDING, ELECTRODE CLASS ER316. WELDING ELECTRODES FOR JOINING STAINLESS STEEL TO CARBON STEEL SHALL CONFORM TO ELECTRODE CLASS E309/ER309.
8. SHOP PAINT EXPOSED STEEL MEMBERS, STEEL MEMBERS NOT ENCASED IN CONCRETE OR SPRAY FIREPROOFED, AND ALL STEEL MEMBERS AT THE EXTERIOR WALL WITH TNEMEC V10-99 OR APPROVED EQUAL EXCEPT FOR MEMBERS TO BE HOT DIPPED GALVANIZED.
9. ALL EXTERIOR EXPOSED STEEL AND STEEL SUPPORTING EXTERIOR SHALL BE HOT DIPPED GALVANIZED. HOT DIP GALVANIZING SHALL CONFORM TO ASTM A123, REPAIR SCRATCHES OR ABRADED GALVANIZED SURFACE WITH ZINC RICH PAINT.
10. LINTELS SHALL BE INSTALLED OVER ALL OPENINGS IN MASONRY WALLS AS FOLLOWS:

MASONRY OPENING	LINTEL
4' - 0" OR LESS	L4x3-1/2x5/16 LLV
4' - 1" TO 7' - 0"	L6x3-1/2x5/16 LLV

    A. 3-1/2" LEGS ARE HORIZONTAL.
    B. PROVIDE ONE ANGLE FOR EACH 4" OF WALL THICKNESS.
    C. PROVIDE L5x5x5/16 ANGLES FOR 6" THICK WALLS AND PARTITIONS WITH OPENINGS UP TO 6' - 0".
    D. PROVIDE MINIMUM 6" BEARING AT EACH END.
    E. LINTELS OVER 6' - 4" SHALL BE FIREPROOFED.
11. SHOP AND ERECTION DRAWINGS SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR REVIEW AND APPROVAL. NO FABRICATION OF STEEL SHALL COMMENCE WITHOUT APPROVED SHOP DRAWINGS.
12. SHOP DRAWING SUBMITTALS SHALL FOLLOW THE FOLLOWING SEQUENCE (WITH EACH NOT BEING SUBMITTED UNTIL THE PREVIOUS ONE IS APPROVED):
    A. JOB STANDARDS (BASIS OF DESIGN AND REPRESENTATIVE CALCULATIONS FOR VARIOUS CONNECTION TYPES)
    B. ERECTION PLANS
    C. PIECE DETAILS AND PIECE-SPECIFIC CONNECTION CALCULATIONS
13. PROVIDE MECHANICALLY GALVANIZED BOLTS FOR EXTERIOR APPLICATIONS.
14. ALL STEEL CONNECTIONS MUST MEET THE REQUIREMENTS OF SECTION 2212 OF THE NYC BUILDING CODE.

STEEL DECK

1. STEEL DECKING WORK SHALL CONFORM TO THE AISI NORTH AMERICAN "SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS."
2. STEEL DECKING UNITS AND ACCESSORY ITEMS SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A1008 OR A653 WITH A MINIMUM YIELD STRENGTH OF 50,000 PSI (33,000 PSI FOR STEEL ROOF DECKING UNITS). SEE DECK SCHEDULE FOR MORE INFORMATION. BEFORE FORMING, THE STEEL SHEET SHALL RECEIVE A HOT DIP GALVANIZED COATING CONFORMING TO ASTM A653, GRADE 90.
3. STEEL DECKING SHALL BE SHORED AS REQUIRED BY PLANS OR BY SPAN AND LOAD CONDITIONS TO SUPPORT WET WEIGHT OF CONCRETE AND ALL CONSTRUCTION LOADS.
4. THE SIDE LAPS OF ADJACENT UNITS SHALL BE FASTENED BY APPROVED METHOD (TO BE SHOWN ON SHOP DRAWINGS) BETWEEN SUPPORTS, AT INTERVALS TO PROVIDE SUFFICIENT DIAPHRAGM STRENGTH TO MAINTAIN BUILDING ALIGNMENT AND TO SUSTAIN LOCAL CONSTRUCTION LOADS WITHOUT DISTORTION OR SEPARATION, MAXIMUM SPACING SHALL BE 3'-0" [2'-0" FOR NYC] BETWEEN SUPPORT BEAMS. END LAPS OF SHEETS SHALL BE A MINIMUM OF 2 INCHES.
5. EXCEPT AS OTHERWISE NOTED, DECK SHALL BE ATTACHED TO STRUCTURAL STEEL BY 3/4"Ø FUSION WELDS @ 12" ON CENTER AT END AND INTERIOR SUPPORTS PERPENDICULAR TO THE DECK SPAN AND AT EDGE AND INTERIOR SUPPORTS PARALLEL TO THE DECK SPAN. WELDS MAY BE OMITTED IN RIBS IN WHICH SHEAR CONNECTORS ARE TO BE APPLIED, AS LONG AS MAXIMUM SPACING BETWEEN ATTACHMENTS DOES NOT EXCEED 18" ON CENTER, AND SUCH THAT EACH DECK SECTION SHALL HAVE SUFFICIENT WELDS TO ADEQUATELY SECURE THE DECK, BRING THE DECK INTO DIRECT CONTACT WITH THE SUPPORTING STEEL AND TO PROVIDE SUFFICIENT DIAPHRAGM STRENGTH TO MAINTAIN BUILDING ALIGNMENT.
6. AS AN ALTERNATE TO PUDDLE WELDS FOR STEEL DECK ATTACHMENT TO STRUCTURAL STEEL, HILTI X-HSN-24 OR X-ENP-19 POWDER ACTUATED FASTENERS, OR AN APPROVED EQUAL, WITH EQUIVALENT OR GREATER CAPACITY TO THE SPECIFIED ATTACHMENT MAY BE USED. PRIOR TO INSTALLATION, THE CONTRACTOR SHALL SUBMIT ALTERNATE FASTENING PATTERN TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL. SUBMITTAL SHALL INCLUDE PROPOSED ALTERNATE PATTERN AND ANY CALCULATIONS OR SUPPORTING MANUFACTURER DATA NEEDED TO DEMONSTRATE THAT THE PATTERN MEETS OR EXCEEDS THE CAPACITY OF THE SPECIFIED ATTACHMENT.
7. POWDER ACTUATED FASTENERS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. CONTRACTOR SHALL BE CERTIFIED AND TRAINED BY THE MANUFACTURER'S REPRESENTATIVE ON PROPER USE PRIOR TO INSTALLATION.
8. PRIOR TO FABRICATION, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR THE STEEL DECKING SHOWING DECK GAUGE, SIZE, AND LAYOUT AS WELL AS CLOSURE CONDITIONS, WELDS TO SUPPORTS AND SIDE LAP DETAILS.
9. ALL REINFORCED OPENINGS IN STEEL DECK SHALL BE INSTALLED BY STEEL DECK SUBCONTRACTOR. STEEL DECK SUBCONTRACTOR TO PROVIDE REINFORCING AS PER TYPICAL DETAILS.
10. AT STEEL DECK WITHOUT CONCRETE FILL THE FOLLOWING MAY BE ATTACHED WITHOUT SPECIFIC APPROVAL OF THE STRUCTURAL ENGINEER: ACOUSTICAL TILE AND GYPSUM BOARD CEILING ONLY; NO PIPING, DUCTING OR CONDUIT. MAXIMUM CEILING WEIGHT = 3.5 PSF. MAXIMUM WIRE HANGER LOAD = 60 LBS.
11. WHERE SUSPENSION OF HANGER WIRES ARE REQUIRED BY OTHERS, VERIFY AND COORDINATE LOCATIONS, PATTERNS, SPACING, ETC. WITH THE APPROPRIATE TRADE. DRILL OR PUNCH HOLES AT BOTTOM OF DECK FLUTES OF SUFFICIENT SIZE TO PASS SUPPORT WIRES. WIRE SUPPORTS SHALL BE LOOPED AND SECURED WITH A MINIMUM OF THREE (3) TIGHT TURNS AROUND A MINIMUM 1-1/2" x 12" LONG FURRING CHANNEL OR NO. 3x12" LONG REINFORCING BAR CENTERED ABOVE THE HOLE AND LAID IN THE DECK FLUTES.

POST-INSTALLED ADHESIVE AND MECHANICAL ANCHORS

1. POST INSTALLED ANCHORAGE SHALL BE INSTALLED BY QUALIFIED PERSONNEL PER THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII), AS INCLUDED IN THE ANCHOR PACKAGING, TO INTACT BASE MATERIAL. INSTALLATION OF ANCHORS SHALL BE CARRIED OUT BY AN INSTALLER TRAINED TO INSTALL THE SPECIFIED ANCHORS. NOTIFY ENGINEER OF RECORD PRIOR TO INSTALLATION IF BASE MATERIAL CONDITION DEVIATES FROM STRUCTURAL DRAWINGS OR ASSUMPTIONS AND CONDITIONS OF THE MPII. ALL HOLES SHALL BE DRY AND HAMMER DRILLED UNLESS OTHERWISE NOTED, AND ALL CONCRETE BASE MATERIAL TO RECEIVE ADHESIVE ANCHORS SHALL HAVE A MINIMUM AGE OF 21 DAYS.
2. INSTALLATION OF ADHESIVE ANCHORS IN A HORIZONTAL OR UPWARDLY INCLINED ORIENTATION AND SUPPORTING A SUSTAINED TENSION LOAD SHALL BE PERFORMED BY A CERTIFIED ADHESIVE ANCHOR INSTALLER. CERTIFICATION SHALL INCLUDE WRITTEN AND PERFORMANCE TESTS IN ACCORDANCE WITH THE ACI/CRSI ADHESIVE ANCHOR INSTALLER CERTIFICATION PROGRAM OR APPROVED EQUAL. PRIOR TO THE COMMENCEMENT OF INSTALLING ANCHORS PROVIDE OWNER AND ENGINEER OF RECORD WITH DOCUMENTED CONFIRMATION THAT ALL OF THE CONTRACTOR'S PERSONNEL WHO INSTALL HORIZONTAL OR UPWARDLY INCLINED ADHESIVE ANCHORS SUPPORTING SUSTAINED TENSION LOADS ARE TRAINED AND CERTIFIED.
   A. OVERHEAD ADHESIVE ANCHORS MUST BE INSTALLED USING THE PISTON PLUG SYSTEM SPECIFIED BY THE MPII AND PRODUCED BY THE CORRESPONDING MANUFACTURER FOR THE ANCHOR SYSTEM BEING INSTALLED.
3. EXISTING REINFORCING BARS IN THE STRUCTURE MAY CONFLICT WITH SPECIFIC ANCHOR LOCATIONS. REINFORCING BARS SHALL NOT BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER OF RECORD. UNLESS NOTED ON THE DRAWINGS THAT THE EXISTING REBARS CAN BE CUT, THE CONTRACTOR SHALL REVIEW THE EXISTING STRUCTURAL DRAWINGS AND SHALL UNDERTAKE TO LOCATE THE POSITION OF THE REINFORCING BARS BY A MEANS APPROVED BY THE ENGINEER OF RECORD.
4. ANCHOR CAPACITY IS DEPENDENT UPON SPACING BETWEEN ADJACENT ANCHORS, PROXIMITY OF ANCHORS TO EDGE OF CONCRETE, AND EMBEDMENT DEPTH INTO THE SUBSTRATE. INSTALL ANCHORS IN ACCORDANCE WITH SPACING, EDGE CLEARANCES, AND EMBEDMENT DEPTHS INDICATED ON THE DRAWINGS.
5. UNLESS OTHERWISE INDICATED, POST INSTALLED ANCHORAGE SHALL BE ADHESIVE TYPE HILTI HIT-HY 200-R INTO CONCRETE OR HILTI HIT-HY 270 INTO BRICK MASONRY, GROUT FILLED CMU OR UNGROUTED CMU BASE MATERIAL. PROVIDE MESH SCREEN IN UNGROUTED CMU, UNREINFORCED MASONRY CONSTRUCTION, AND BRICK MASONRY WITH HOLES OR VOIDS.
6. SUBSTITUTION REQUESTS FOR ALTERNATE ANCHORAGE PRODUCTS SHALL BE SUBMITTED TO ENGINEER OF RECORD FOR REVIEW AND APPROVAL PRIOR TO USE. THIS SHALL INCLUDE MANUFACTURER PRODUCT DATA AND CALCULATIONS DEMONSTRATING THAT THE PROPOSED SUBSTITUTE CAN ACHIEVE THE PERFORMANCE VALUES OF THE SPECIFIED PRODUCT. ANCHOR CAPACITY USED IN DESIGN SHALL BE BASED ON THE TECHNICAL DATA PUBLISHED BY THE MANUFACTURER OR SUCH OTHER METHOD AS APPROVED BY THE ENGINEER OF RECORD. SUBSTITUTIONS WILL BE EVALUATED BY THEIR HAVING AN ICC-ES EVALUATION REPORT SHOWING COMPLIANCE WITH THE RELEVANT BUILDING CODE, SEISMIC USE, LOAD RESISTANCE, INSTALLATION CATEGORY, AND AVAILABILITY OF MPII. ADHESIVE ANCHOR EVALUATION WILL ALSO CONSIDER CREEP, IN-SERVICE TEMPERATURE AND INSTALLATION TEMPERATURE AND MUST PROVIDE INFORMATION ON THESE ITEMS. SUBSTITUTION REQUESTS FOR ALTERNATE PRODUCTS MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PRIOR TO USE.

PROGRESS INSPECTIONS (NYC)

1. INSPECTIONS REQUIRED BY THE LOCAL JURISDICTION SHALL BE PERFORMED BY A TESTING AGENCY PROVIDED BY THE OWNER FOR THE FOLLOWING ITEMS:
   A. FINAL (28-114, 28-116.2.4.2, BC 110.5, DIRECTIVE 14 OF 1975, AND 1 RCNY 101-10)

   THE TESTING AGENCY FOR THE INSPECTIONS SHALL FILE ALL APPROPRIATE FORMS WITH THE BUILDING DEPARTMENT.

SPECIAL INSPECTIONS (NYC)

1. SPECIAL INSPECTIONS REQUIRED BY THE LOCAL JURISDICTION SHALL BE PERFORMED BY A TESTING AGENCY PROVIDED BY THE OWNER FOR THE FOLLOWING ITEMS:
   A. STRUCTURAL STEEL – WELDING (BC 1705.2.1)
   B. STRUCTURAL STEEL – DETAILS (BC 1705.2.2)
   C. STRUCTURAL STEEL – HIGH STRENGTH BOLTING (BC 1705.2.3)
   D. STRUCTURAL STABILITY – EXISTING BUILDINGS (BC 1705.25.1)
   E. POST-INSTALLED ANCHORS (BC 1705.37)
2. THE WORK MEETS THE CRITERIA OF NYCBC SECTION 1905.4 FOR CONCRETE PROPORTIONING WITHOUT FIELD EXPERIENCE OR TRIAL MIXTURES AND I HEREBY ELECT TO WAIVE THE REQUIREMENT OF DESIGN MIX REPORTS AND OF THE TR-3 FORM.
   A. TOTAL LOAD-CARRYING STRUCTURAL CONCRETE PLACEMENT ON A GIVEN PROJECT IS LESS THAN 50 CUBIC YARDS
   B. STRUCTURAL OR NON-STRUCTURAL CONCRETE WILL NOT BE EXPOSED TO EXPOSURE CLASSES S1, W1, OR C2

THE TESTING AGENCY FOR THE INSPECTIONS SHALL FILE ALL APPROPRIATE FORMS WITH THE BUILDING DEPARTMENT.

STANDARD ABBREVIATIONS

ADD'L	ADDITIONAL
ADJ.	ADJACENT
A/E	DESIGN TEAM OF RECORD
ALT.	ALTERNATE
ANCH.	ANCHOR
APPROX.	APPROXIMATE/APPROXIMATELY
ARCH.	ARCHITECT/ARCHITECTURAL
BLDG.	BUILDING
BM.	BEAM
B.O.	BOTTOM OF
BOT.	BOTTOM
BRG.	BEARING
BSMT.	BASEMENT
CANT.	CANTILEVER
CFS	COLD FORMED STEEL
C.I.P.	CAST IN PLACE
C.J.	CONTRACTION JOINT
CLG.	CEILING
CLR.	CLEAR
CMU	CONCRETE MASONRY UNIT
COL.	COLUMN
COMP.	COMPOSITE
CONC.	CONCRETE
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
COORD.	COORDINATE/COORDINATION
CONTR.	CONTRACTOR
COTR	CONTRACT OFFICER'S TECHNICAL REPRESENTATIVE
CTR.	CENTER
DBL.	DOUBLE
DEMO	DEMOLITION/DEMOLISH
DIA.	DIAMETER
DIAG.	DIAGONAL
DIM.	DIMENSION
D.L.	DEAD LOAD
DN.	DOWN
DTL.	DETAIL
DWG(S)	DRAWING(S)
DWL.	DOWEL
EA.	EACH
E.F.	EACH FACE
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEC.	ELECTRICAL
ELEV.	ELEVATOR
EMBED.	EMBEDMENT
E.O.	EDGE OF
ENGR.	ENGINEER
E.O.R.	ENGINEER OF RECORD
EQ.	EQUAL
E.S.	EACH SIDE
E.W.	EACH WAY
EXP.	EXPANSION
EXT.	EXTERIOR
FDN.	FOUNDATION
FIN.	FINISH
FLR.	FLOOR
FRMG.	FRAMING
F.S.	FAR SIDE
FT.	FEET
FTG.	FOOTING
GA.	GAGE
GALV.	GALVANIZED
G.B.	GRADE BEAM
HDR.	HEADER
HGR.	HANGER
HORIZ.	HORIZONTAL
H.P.	HIGH POINT
HT.	HEIGHT
HVAC	HEATING, VENTILATION, & AIR CONDITIONING
I.D.	INSIDE DIAMETER
I.F.	INSIDE FACE
I.J.	ISOLATION JOINT
INFO	INFORMATION
INT.	INTERIOR
JT.	JOINT
K	KIP
LB.	POUND
L.L.	LIVE LOAD
LLBB	LONG LEGS BACK-TO-BACK
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
L.P.	LOW POINT
L.W.	LIGHTWEIGHT
L.W.	LONG WAY
MAS.	MASONRY
MAX.	MAXIMUM
MECH.	MECHANICAL
MEP	MECH., ELECT., PLUMBING, & FIRE PROTECTION
MFR.	MANUFACTURER
MIN.	MINIMUM
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
MPII	MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS
N.F.	NEAR FACE
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
N.S.	NEAR SIDE
N.T.S.	NOT TO SCALE
N.W.	NORMAL WEIGHT
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
OPNG.	OPENING
OPP.	OPPOSITE
PC.	PIECE
P/C	PRECAST
PED.	PEDESTAL
PERP.	PERPENDICULAR
PL.	PLATE
PLF	POUNDS PER LINEAR FOOT
PREFAB.	PREFABRICATED
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
P-T	POST-TENSIONED
REINF.	REINFORCE(D)/REINFORCEMENT
REQ'D	REQUIRED
REV.	REVISION
SCHED.	SCHEDULE
SECT.	SECTION
S.I.F.	STEP IN FOOTING
SLBB	SHORT LEGS BACK-TO-BACK
SIM.	SIMILAR
S.O.G.	SLAB ON GRADE
SPEC.	SPECIFICATION
SQ.	SQUARE
S.S.	STAINLESS STEEL
STD.	STANDARD
STIFF.	STIFFENER
STL.	STEEL
S.W.	SHORT WAY
SYM.	SYMMETRIC
T & B	TOP & BOTTOM
TEMP.	TEMPORARY/TEMPERATURE
THK.	THICK(NESS)
T.O.	TOP OF
TR.	TRANSFER
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
VERT.	VERTICAL
W/	WITH
W.P	WORK POINT
W.W.R.	WELDED WIRE REINFORCEMENT
#	NUMBER/SIZE
Ø	DIAMETER

STANDARD ABBREVIATIONS FOR EXISTING STRUCTURES

C.I.	CAST IRON
(E)	EXISTING MEMBER OR DIMENSION
EXIST.	EXISTING
T.C.	TERRA COTTA
U-P	UNDERPINNING
V.I.F.	VERIFY IN FIELD

LEGEND

	WALL OR CONCRETE BEAM BELOW
	BRICK MASONRY
	EXISTING WALL, BEAM FLOOR, OR FOUNDATION (SEE NOTES FOR MATERIAL)
	EXISTING CONCRETE COLUMN
	EXISTING ELEMENT TO BE DEMOLISHED
	STEEL COLUMN
	EXISTING STEEL COLUMN
	COLUMN ABOVE / BELOW
	EXISTING STEEL BEAM
	STEEL BEAM
	LEDGER ANGLE (SEE DETAIL)
	SHEAR CONNECTION
BP-#	BEAM BEARING PLATE IN CONCRETE OR MASONRY (SEE DETAIL)
(E) S	EXISTING SLAB, V.I.F.
S5.25	3-1/4" LIGHTWEIGHT CONCRETE ON 2" 18 GA. COMPOSITE STEEL DECK. REINFORCE W/ 6X6 W2.0XW2.0 WWR. OPEN ARROW INDICATES SPAN DIRECTION
	STEP IN SLAB
	SLAB SLOPE TRANSITION
#' - #"	TOP OF SLAB ELEVATION
#' - #"	SPOT ELEVATION
	OPENING IN SLAB
	EXISTING OPENING IN EXISTING SLAB
0	EXISTING COLUMN LINE. (DIMENSIONS BETWEEN EXISTING COLUMN LINES ARE FOR REFERENCE ONLY.)
#	KEYNOTE
1	REVISION
PL	PROPERTY LINE
<##' - ##">	TOP OF FRAMING ELEVATION RELATIVE TO DATUM
BP__	STEEL BEAM BEARING PLATE, SEE SCHEDULE & DETAILS
S__	CONCRETE SLAB OR CONCRETE SLAB ON METAL DECK, SEE SCHEDULE & DETAILS

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

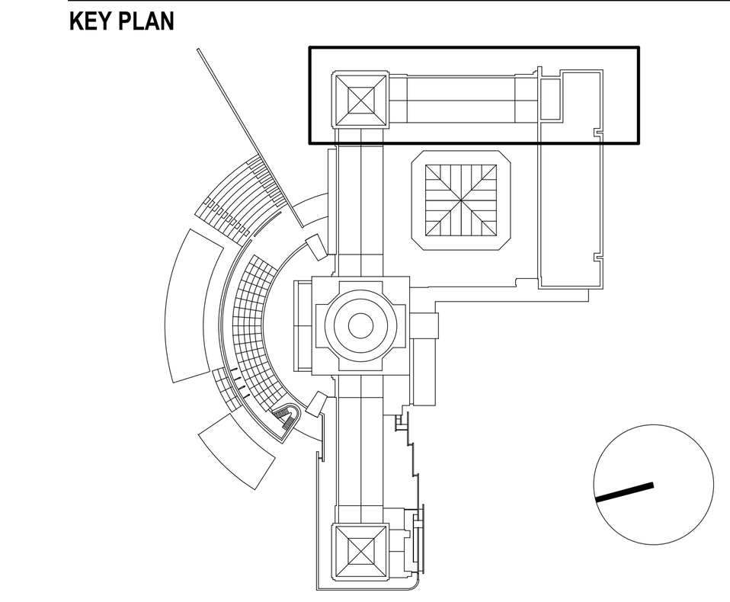
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

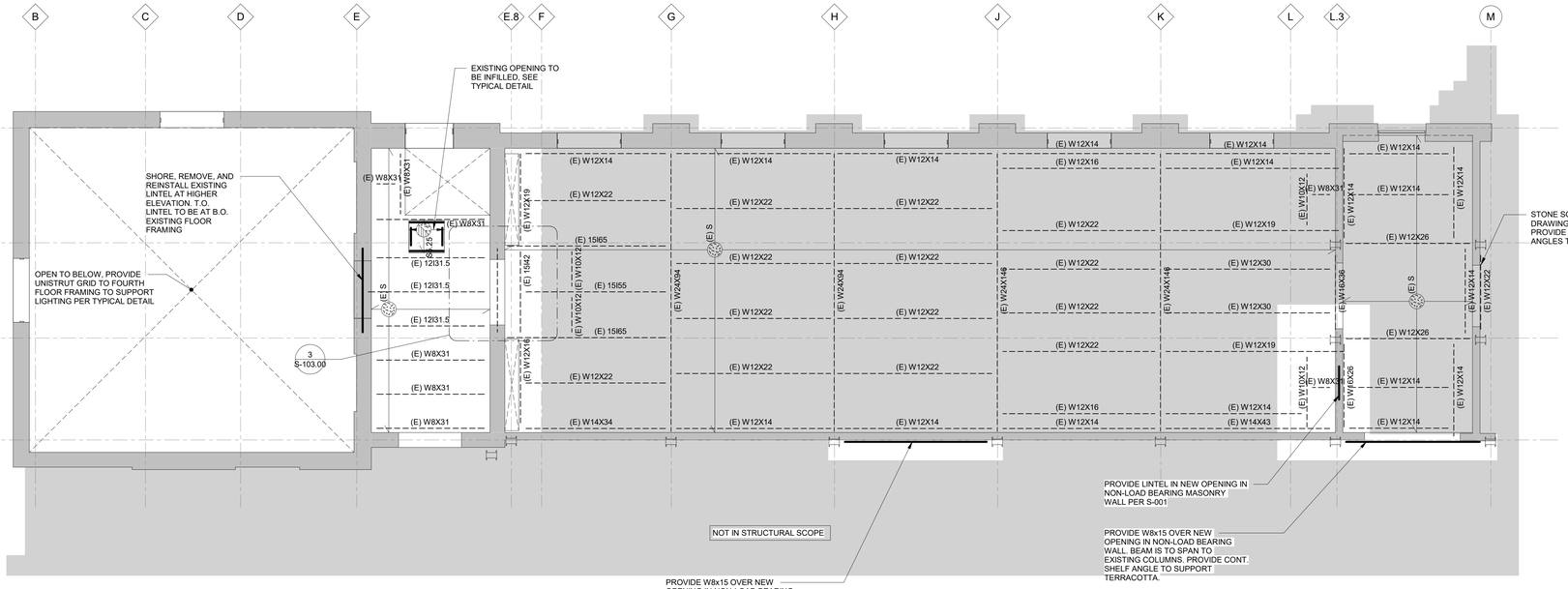
DRAWING TITLE

GENERAL STRUCTURAL NOTES, LEGEND & ABBREVIATIONS

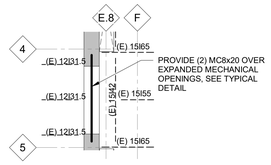
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

S-001.00

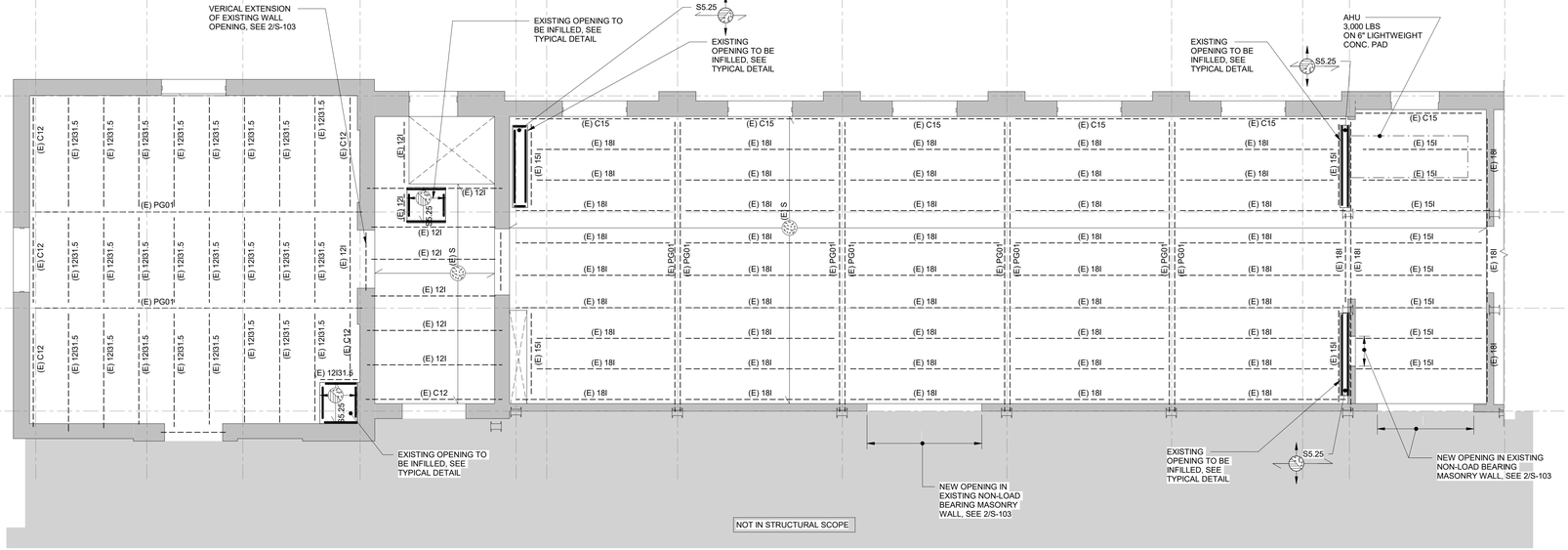
10/17/2025 2:25:53 PM



2 S-103.00 THIRD FLOOR MEZZANINE FRAMING PLAN - WINGS E & F
1/8" = 1'-0"



3 S-103.00 FOURTH FLOOR PARTIAL FRAMING PLAN
1/8" = 1'-0"



1 S-103.00 THIRD FLOOR FRAMING PLAN - WINGS E & F
1/8" = 1'-0"

NOTES:

1. TOP OF SLAB ELEVATION AS NOTED ON PLAN - X'-XX" .
2. TOP OF STEEL ELEVATION TO BE SET 5-1/4" BELOW TOP OF SLAB, UNLESS NOTED OTHERWISE. CONTRACTOR SHALL VERIFY AND COORDINATE ALL SLAB/DECK ELEVATIONS WITH FINISH FLOORING DEPTH PRIOR TO FABRICATION.
3. SEE ARCHITECTURAL DRAWINGS FOR ALL DIMENSIONS AND ELEVATIONS NOT SHOWN ON STRUCTURAL DRAWINGS. SEE ARCHITECTURAL EDGE OF SLAB SERIES FOR ALL SLAB EDGE DIMENSIONS AND CONCRETE CURBS.
4. AS PER APPROPRIATE SPECIFICATION SECTIONS, THE DESIGN TEAM HAS SPECIFIED THE FOLLOWING ITEMS AS DELEGATED DESIGN: ALL COLD-FORMED STEEL FRAMING (STUDS, KICKERS, ETC.), MISCELLANEOUS METALS (STEEL STAIRS, ENTRY & ROOF GATES, STEEL GUARDRAILS, STEEL HANDRAILS, ROOF ACCESS LADDERS, ETC.). SIGNED AND SEALED DRAWINGS AND CALCULATIONS BY A LICENSED PROFESSIONAL ENGINEER ARE REQUIRED FOR THESE ITEMS. SEE ARCHITECTURAL SPECIFICATION SECTIONS FOR FULL INFORMATION.
5. SEE ARCHITECTURAL DRAWINGS FOR DETAILED FACADE SECTIONS INCLUDING FACADE HANGERS, BRACES, RELIEVING ANGLES, PARAPETS, TOP OF WALL CONDITIONS, AND CONCRETE CURBS. REVIEW ARCHITECTURAL SECTIONS TOGETHER WITH STRUCTURAL DRAWINGS TO ESTABLISH COMPLETE FACADE STEEL AND CONCRETE WALL/CURB SCOPE.
6. SEE ARCHITECTURAL DRAWINGS FOR ALL RELIEVING ANGLE ELEVATIONS WHERE APPLICABLE.
7. SEE MEP DRAWINGS FOR CONCRETE PADS REQUIRED UNDER UNITS. COORDINATE ALL FINAL UNIT LOCATIONS, UNIT SIZES, AND UNIT SUPPORT REQUIREMENTS WITH MEP DRAWINGS AND MEP SUBCONTRACTORS.
8. CONTRACTOR SHALL VERIFY ALL DIMENSIONS TO EXISTING STRUCTURE BEFORE FABRICATION. NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES THAT IMPACT STRUCTURAL SCOPE.
9. STEEL BEAMS ARE EQUALLY SPACED BETWEEN COLUMN LINES, UNLESS NOTED OTHERWISE
10. CUTTING, NOTCHING, CORING OR OTHER PARTIAL OR FULL REMOVAL OF EXISTING STRUCTURAL ELEMENTS SHALL NOT EXCEED OF ANY PROPOSED REMOVALS AND REQUEST APPROVAL PRIOR TO PERFORMING ANY REMOVALS THAT EXCEED SUCH EXTENTS.
11. PRIOR TO CUTTING OR CORING CONCERETE, THE CONTRACTOR SHALL LOCATE REBAR, POST-TENSIONING BARS, CONDUITS AND OTHER INCLUSIONS IN THE CONCRETE BY THE USE OF NON-DESTRUCTIVE TESTING (NDT) METHODS. THE INTENT OF THE NDT IS TO AVOID CUTTING OR DAMAGING ELEMENTS WITHIN THE CONCRETE.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

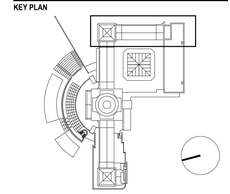
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

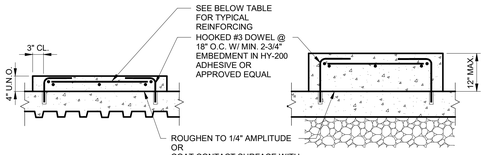
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR AND THIRD FLOOR MEZZANINE FRAMING PLAN - WINGS E & F

SCALE	1/8" = 1'-0"
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	S-103.00

10/17/2025 2:25:57 PM



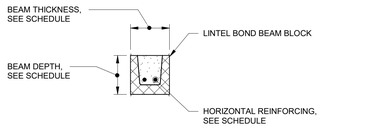
EQUIPMENT PAD TEMPERATURE AND SHRINKAGE REINFORCING	
PAD THICKNESS	REINFORCING
4"-5"	#3 @ 12" O.C. EACH WAY
6"-9"	#4 @ 12" O.C. EACH WAY
10"-12"	#5 @ 12" O.C. EACH WAY

NOTES:

1. FOR SIZE AND LOCATION SEE ARCHITECTURAL AND MECHANICAL DRAWINGS.
2. CONCRETE FOR PADS SHALL BE NORMAL WEIGHT WITH f'c = 4,000 PSI.

TYPICAL EQUIPMENT PAD

N.T.S.



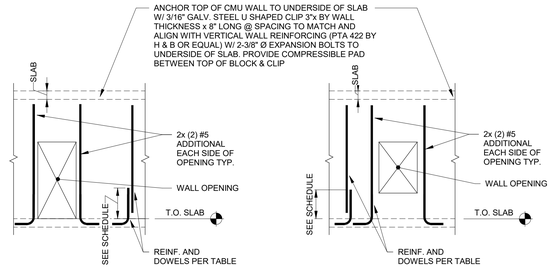
CMU BOND BEAM SCHEDULE				
LENGTH	BEAM THICKNESS	BEAM DEPTH	HORIZONTAL REINF.	SHEAR REINF.
0'-0" - 4'-0"	7 5/8"	7 5/8" (1 COURSE HIGH)	2-#5	

NOTES:

1. ALL CMU BOND BEAM BEAMS TO BE GROUTED SOLID FOR FULL LENGTH OF BEAM.
2. ALL CMU BOND BEAM TO HAVE MIN. 7 5/8" BEARING ON EACH END.
3. ALL BOND BEAMS (SPANNING) WITH NO MASONRY ABOVE TO BE SINGLE COURSE WITH 2-#5 HORIZONTAL REINFORCING.
4. ALL OTHER (NON-SPANNING) BOND BEAMS TO BE SINGLE COURSE WITH 2-#4 HORIZONTAL REINFORCING.
5. VERTICAL PLACEMENT OF HORIZONTAL REINFORCEMENT IN ALL BOND BEAMS SHALL BE 3" FROM THE BOTTOM OF THE BEAM TO CENTER OF BAR, U.N.O. LINTEL REINFORCEMENT SHALL BE SUPPORTED BY WIRE CHAIRS.
6. CLEAR DISTANCE BETWEEN PARALLEL BARS SHALL NOT BE LESS THAN THE NOMINAL DIAMETER OF THE BARS OR 1", WHICHEVER IS GREATER.

TYPICAL CMU BOND BEAM LINTEL

N.T.S.



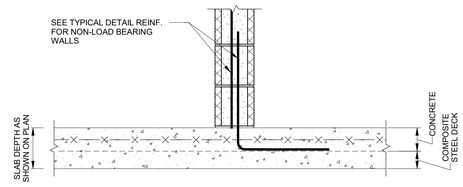
NOTE: PROVIDE LINTELS AS REQUIRED OVER WALL OPENINGS.

INTERIOR WALLS				
NOMINAL CMU THICKNESS	VERTICAL REBAR	HORIZONTAL REBAR	MAXIMUM HEIGHT (FT)	DOWELS
6"	#4 @ 48"	9 GAGE LADDER REINFORCING @ 16" O.C.	23'-6"	SAME AS VERTICAL BARS
8"	#4 @ 48"	9 GAGE LADDER REINFORCING @ 16" O.C.	27'-7"	SAME AS VERTICAL BARS

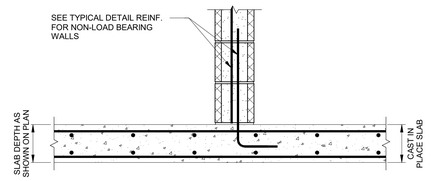
EXTERIOR WALLS				
NOMINAL CMU THICKNESS	VERTICAL REBAR	HORIZONTAL REBAR	MAXIMUM HEIGHT (FT)	DOWELS
6"	#5 @ 24"	9 GAGE LADDER REINFORCING @ 16" O.C.	14'-6"	SAME AS VERTICAL BARS
8"	#5 @ 24"	9 GAGE LADDER REINFORCING @ 16" O.C.	18'-8"	SAME AS VERTICAL BARS
8"	#5 @ 16"	9 GAGE LADDER REINFORCING @ 16" O.C.	21'-0"	SAME AS VERTICAL BARS

TYPICAL REINFORCING FOR NON-BEARING MASONRY WALLS (ELEVATION)

N.T.S.



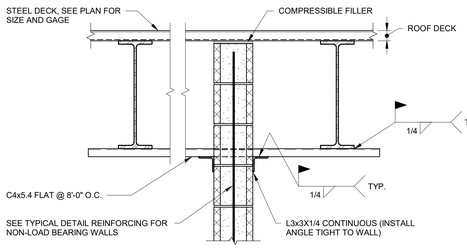
AT STEEL DECK SLAB

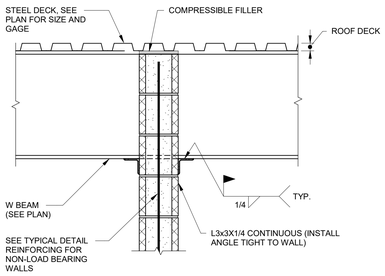


AT CAST IN PLACE SLAB

TYPICAL REINFORCING FOR NON-BEARING MASONRY WALLS (SECTION)

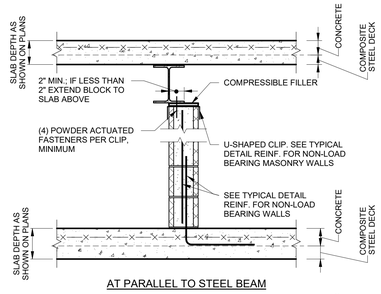
N.T.S.





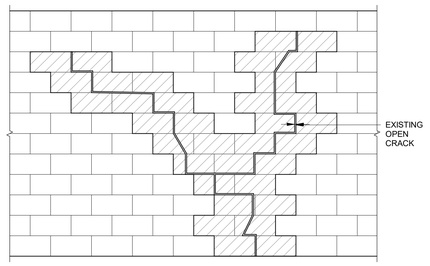
TYPICAL SUPPORT FOR MASONRY PARTITIONS AT STEEL BEAM

N.T.S.



TYPICAL SUPPORT FOR MASONRY PARTITIONS AT CONCRETE SLAB

N.T.S.

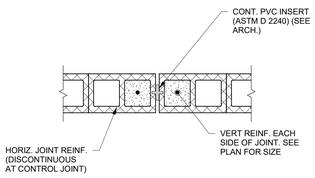


NOTES:

1. _____ DENOTES BRICK TO BE REPLACED. WHERE CRACK IS THRU WALL REPLACE ALL WYTHES OF BRICK ON EACH SIDE OF CRACK TO 1ST MORTAR JOINT. REPLACE EXISTING HEADERS WITH NEW HEADERS. REPLACE LOOSE AND CRACKED BRICKS. WHERE CRACK IS ONLY IN OUTER WYTHE, REPLACE ONLY OUTER WYTHE.
2. WHERE CRACK IS OPEN AND 1/4" OR LESS AND IS PRESENT ONLY IN OUTER WYTHE AND ONLY IN JOINTS, RAKE AND REPOINT JOINTS ONLY.

TYPICAL REPAIR IN BRICK MASONRY

N.T.S.

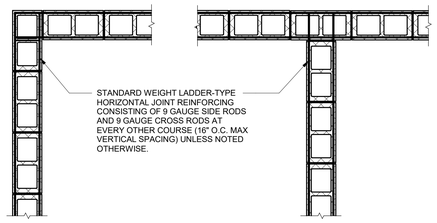


NOTE:

1. PROVIDE CONTROL JOINTS AT A MAXIMUM OF 20 FEET O.C. AND AT ALL CORNERS.
2. SEE TYPICAL WALL DETAIL AND ARCH. FOR WATERPROOFING AND DRAINAGE REQUIREMENTS.

TYPICAL CMU CONTROL JOINT

N.T.S.



NOTES:

CORNERS AND INTERSECTIONS
UNLESS OTHERWISE NOTED OR SPECIFIED, AT POINTS WHERE CONCRETE MASONRY WALLS MEET OR INTERSECT, PLACE UNITS IN RUNNING BOND WITH ALTERNATE UNITS BEARING NOT LESS THAN 8 INCHES ON THE UNIT BELOW.

DOWELS
UNLESS OTHERWISE NOTED OR SPECIFIED, PROVIDE DOWELS FROM CONCRETE FOOTINGS OR WALLS BELOW, WITH SAME SIZE AND SPACING AS VERTICAL WALL REINFORCING. LAP DOWELS WITH VERTICAL REINFORCING 48 BAR DIAMETERS MINIMUM U.N.O. (SEE ALSO LAP SPLICE SCHEDULE) GROUT SOLID CELLS WITH VERTICAL REINFORCING, FULL HEIGHT.

TYPICAL REINFORCING DETAILS FOR MASONRY WALL CONSTRUCTION

N.T.S.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

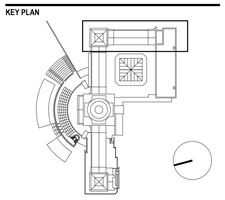
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

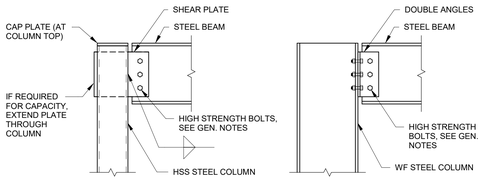
PROGRESS PRINT / INTERIM REVIEW ONLY NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

TYPICAL DETAILS

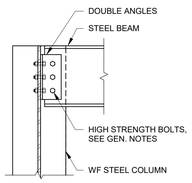
SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	S-501.00

10/17/2025 2:25:59 PM

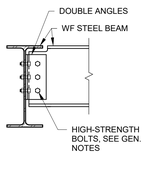


BEAM TO HSS COLUMN

BEAM TO WF COLUMN FLANGE



BEAM TO WF COLUMN WEB



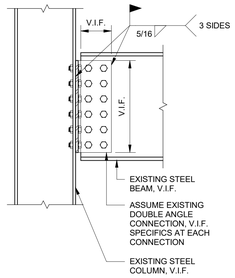
WF BEAM TO WF BEAM

NOTES:

1. CONNECTION DETAILS SHOWN ABOVE ARE SCHEMATIC ONLY. THE CONTRACTOR MAY SUBMIT ALTERNATE DETAILS FROM THOSE SHOWN ABOVE, BUT IN ANY CASE THE CONTRACTOR IS RESPONSIBLE FOR PRODUCING STEEL SHOP DRAWINGS IN ACCORDANCE WITH THE PROJECT GENERAL NOTES AND AISC GUIDELINES. CALCULATIONS SHALL BE SUBMITTED AS REQUIRED IN THE GENERAL NOTES AND ELSEWHERE IN THE CONTRACT DOCUMENTS.
2. THE CONTRACTOR SHALL DETAIL THE PROJECT CONNECTIONS FOR THE LOADS AS INDICATED IN THE CONTRACT DOCUMENTS, PER AISC GUIDELINES. THE SCHEMATIC DETAILS ABOVE ARE NOT SUGGESTIVE OF SPECIFIC CAPACITIES. THE NUMBER AND SIZE OF BOLTS, SIZE AND LENGTH OF WELDS, AND SIZE OF STEEL PIECES MUST BE DETERMINED PER AISC GUIDELINES AND THE CONTRACT DOCUMENTS.
3. PROVIDE FULL DEPTH CONNECTIONS AT ALL PERIMETER BEAM CONNECTIONS AND AT BEAM CONNECTIONS TO PERIMETER BEAMS, UNLESS OTHERWISE NOTED.

TYPICAL SUGGESTED SHEAR CONNECTIONS AT GRAVITY LOADS ONLY

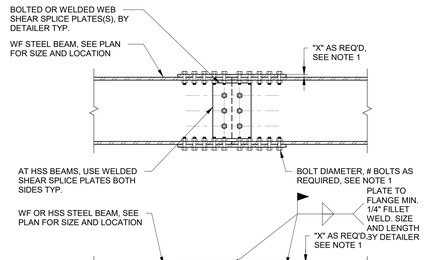
N.T.S.



NOTE: TYPICAL DETAILS ARE BASED ON LIMITED KNOWLEDGE OF EXISTING CONDITIONS AND PROVIDED FOR BID PRICING ONLY. CONTRACTOR SHALL EXPOSE EACH CONNECTION TO BE REINFORCED AND SUMBIT FIELD VERIFIED CONNECTION DETAIL FOR REVIEW.

TYPICAL DETAIL REINFORCING OF EXISTING BEAM ON COLUMN CONNECTION

N.T.S.

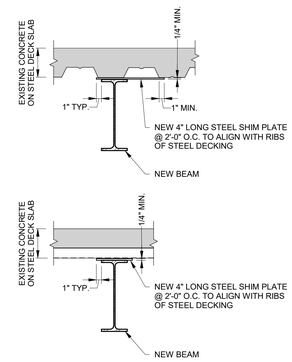


NOTES:

1. FLANGE AND WEB SPLICE CONNECTIONS TO BE SELECTED OR ENGINEERED BY DETAILER TO DEVELOP THE FULL CAPACITY OF THOSE BEAM ELEMENTS SIDE OF JOINT.
2. COORDINATE AND SUBMIT SPLICE LOCATIONS TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
3. ALL STEEL CONNECTIONS ARE SUBJECT TO SPECIAL INSPECTION INCLUDING ULTRASONIC TESTING OF PJP OR CJP GROOVE WELDS.

TYPICAL STEEL BEAM SPLICE

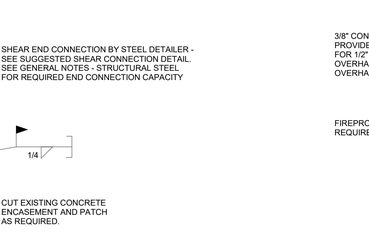
N.T.S.



NOTE: TACK WELD NEW SHIM PLATE TO BEAM AND STEEL DECK

TYPICAL BEAM AND SHIM PLATE BELOW EXISTING METAL DECK SLAB

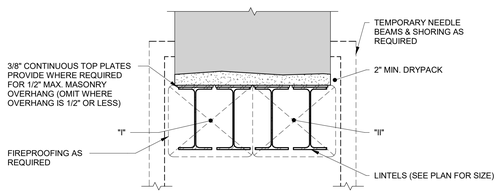
N.T.S.



NOTE: IF EXISTING CONNECTIONS INTERFERE WITH THIS DETAIL, CONTRACTOR SHALL SUBMIT ALTERNATE DETAIL FOR REVIEW.

TYPICAL CONNECTION OF NEW BEAM TO EXISTING BEAM

N.T.S.

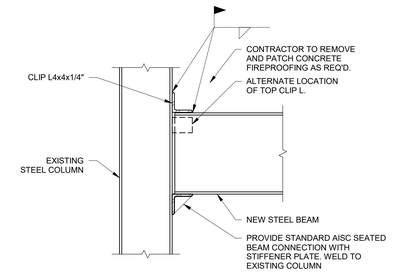


SEQUENCE OF CONSTRUCTION:

1. PROVIDE NEEDLING AND SHORING AS REQUIRED FOR EXISTING WALL ABOVE.
2. INSTALL BEARING PLATE AT EACH END FOR LINTEL BEAM BEARING ON EXISTING WALL.
3. CHASE OUT EXISTING MASONRY AT "I" AND INSTALL NEW LINTEL BEAM(S) "I".
4. PROVIDE CONTINUOUS DRYPACK ABOVE LINTEL.
5. AFTER DRYPACK AT "I" HAS SET REPEAT STEPS 2 THRU 4 FOR LINTEL BEAM(S) "II".
6. INSTALL BOLT AND PIPE SEPARATORS AT LINTEL SPAN 1/3 POINTS AND AT EACH END.
7. REMOVE WALL BELOW LINTEL AT NEW OPENING.

TYPICAL MULTI WF LINTEL IN EXISTING INTERIOR MASONRY WALL

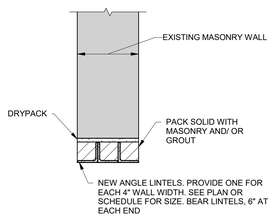
N.T.S.



NOTE: IF EXISTING CONNECTIONS ON COLUMN INTERFERE WITH THIS DETAIL, CONTRACTOR SHALL SUBMIT ALTERNATE DETAIL FOR REVIEW.

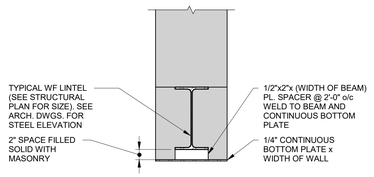
TYPICAL CONNECTION OF NEW BEAM TO EXISTING COLUMN

N.T.S.



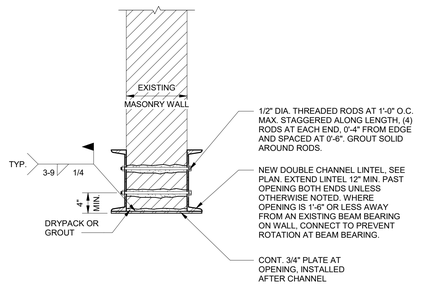
TYPICAL ANGLE LINTEL IN EXISTING MASONRY WALL

N.T.S.



TYPICAL FIREPROOFED STEEL LINTEL IN EXTERIOR MASONRY WALL

N.T.S.



TYPICAL DETAIL REINFORCING OF OPENING AT EXISTING MASONRY WALL

N.T.S.

10/17/2025 2:26:00 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

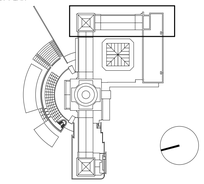
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

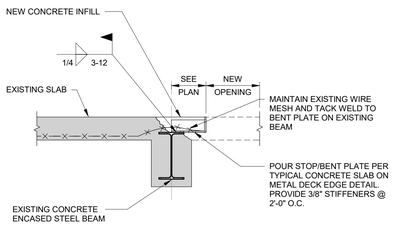
DRAWING TITLE

TYPICAL DETAILS

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A

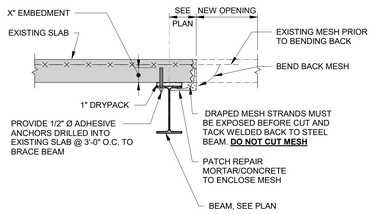
DRAWING NUMBER

S-502.00



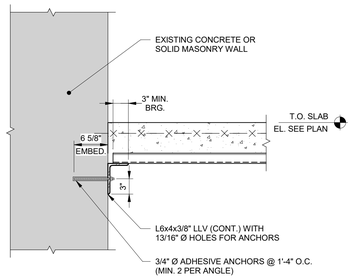
TYPICAL EXISTING BEAM AND SLAB AT NEW OPENING

N.T.S.



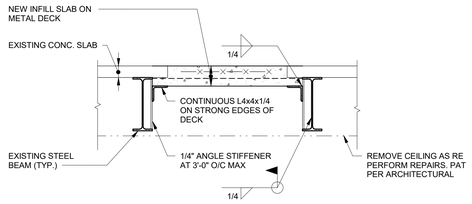
TYPICAL DETAIL OF BEAM DRYPACKED BELOW EXISTING SLAB AT NEW OPENING

N.T.S.



TYPICAL SHELF ANGLE AT EXISTING LOAD BEARING WALL FOR COMPOSITE FLOOR DECK SUPPORT

N.T.S.



TYPICAL DETAIL SLAB INFILL

N.T.S.

AT BEAM PARALLEL TO SPAN OF DECK

AT BEAM PERPENDICULAR TO SPAN OF DECK

TYPICAL CONCRETE SLAB ON METAL DECK CONSTRUCTION

N.T.S.

LIGHTING GRID SUPPORT DETAIL

N.T.S.

NOTE: MIN. 25% OF ALL RODS TO BE LOAD TESTED. SUITABILITY OF THIS DETAIL IS PENDING CONDITION OF EXISTING TERRACOTTA

LIGHTING GRID SUPPORT DETAIL - ALTERNATE FOR PRICING

N.T.S.

10/17/2025 2:26:01 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
171 Madison Avenue, New York, NY 10016

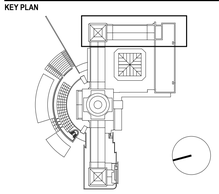
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

TYPICAL DETAILS

SCALE	As indicated
DATE	10/17/25
PROJECT NUMBER	163A
DRAWING NUMBER	

S-503.00

GENERAL MECHANICAL NOTES

GENERAL

WHEN A CONFLICT BETWEEN THE DRAWINGS, NOTES AND/OR SPECIFICATIONS OCCUR, THE MORE STRINGENT, AND/OR LARGER QUANTITY AND/OR MORE EXPENSIVE SHALL APPLY. THE REQUIREMENTS LISTED WITHIN NOTES OR SPECIFICATIONS SHALL BE REQUIRED, PROVIDED AND INSTALLED WHETHER SPECIFICALLY INDICATED ON THE DRAWINGS OR NOT.

IT IS THE INTENTION OF THE SPECIFICATIONS AND DRAWINGS TO PROVIDE FOR FINISHED WORK, TESTED AND READY FOR OPERATION.

ITEMS AND SERVICES NOT SHOWN ON DRAWINGS OR SPECIFICATIONS BUT REQUIRED TO RENDER THE WORK COMPLETE AND READY FOR OPERATION, SHALL BE PROVIDED WITHOUT ADDITIONAL COST.

WORK OF THIS SECTION SHALL BE GOVERNED BY THE CONTRACT DOCUMENTS. PROVIDE MATERIALS, LABOR, EQUIPMENT AND SERVICES NECESSARY TO FURNISH, DELIVER AND INSTALL ALL WORK AS SPECIFIED AND AS REQUIRED BY JOB CONDITIONS. WHERE A CONFLICT EXISTS BETWEEN THESE NOTES, THE DRAWINGS AND THE SPECIFICATIONS, THE MORE STRINGENT REQUIREMENT SHALL APPLY.

DRAWINGS ARE DIAGRAMMATIC AND INDICATE A GENERAL ARRANGEMENT OF WORK AND ARE NOT TO BE CONSIDERED SUB-CONTRACTOR DOCUMENTS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND ALL SUBCONTRACTORS TO INCLUDE THE PROVISIONS AND INSTALLATION OF ALL NECESSARY WORK AND MATERIALS FOR COMPLETE, OPERATIONAL AND CODE COMPLIANT SYSTEMS. GENERAL DESIGN CONCEPTS INDICATED MUST BE FOLLOWED OR BETTERED. THE BID SHALL INCLUDE OFFSETS, ADDITIONAL PIPING, VALVES AND EQUIPMENT AND COMPONENTS AS REQUIRED TO MEET CONSTRUCTION CONDITIONS FOR PROPER OPERATION. DO NOT SCALE DRAWINGS. CONSULT ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR SPACE CONDITIONS AND ADDITIONAL REQUIREMENTS.

PERFORM THE WORK IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT GENERAL CONDITIONS AND WITH THE PROVISIONS OF ALL APPLICABLE LOCAL, STATE, AND FEDERAL CODES AND LAWS.

WORK SHALL INCLUDE ALL INCIDENTALS, LABOR, MATERIAL, EQUIPMENT, APPLIANCES, SERVICES, HOISTING, SCAFFOLDING, SUPPORTS, TOOLS, CONSUMABLE ITEMS, FEES, LICENSES, AND ADMINISTRATIVE TASKS REQUIRED TO COMPLETE AND MAKE OPERABLE WORK SHOWN ON THE DRAWINGS, SPECIFIED HEREIN AND AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

STORE MATERIALS INSIDE AND PROTECTED FROM DEBRIS, WEATHER AND MOISTURE.

THIS CONTRACTOR SHALL PROVIDE AND INSTALL ALL POWER AND CONTROL WIRING REQUIRED FOR EQUIPMENT OPERATION NOT SPECIFICALLY PROVIDED BY OTHERS BUT REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM. THIS CONTRACTOR SHALL PROVIDE MOTOR STARTERS. COORDINATE REQUIREMENTS WITH DIVISION 26.

COORDINATE ALL HVAC WORK AND EQUIPMENT WITH STRUCTURAL STEEL, FIRE PROTECTION PIPING, PLUMBING PIPING, LIGHT FIXTURES, ELECTRICAL EQUIPMENT AND OWNER'S EQUIPMENT.

ALL EXISTING CONDITIONS AS INDICATED ARE APPROXIMATIONS OF EXACT CONDITIONS TO BE VERIFIED IN THE FIELD. CONTRACTOR SHALL VISIT THE SITE TO VERIFY THE CONSTRUCTION CONDITIONS BEFORE SUBMITTING BID.

WHENEVER THE DOCUMENTS INDICATE FOR NEW PIPING TO CONNECT TO AN EXISTING PIPING SYSTEM (OTHER THAN A STEAM SYSTEM), CONTRACTOR SHALL INSTALL A TEMPORARY CORROSION INHIBITOR SYSTEM TO TREAT THE EXISTING PIPING. THE SYSTEM SHALL CONSIST OF AN INJECTOR, PIPING MODIFICATIONS AND APPLICABLE CHEMICALS REQUIRED TO TREAT THE EXISTING SYSTEM FOR A MINIMUM OF THREE WEEKS PRIOR TO ANY NEW CONNECTIONS. UPON INSTALLATION OF THE NEW PIPING SYSTEM, THE ENTIRE SYSTEM (NEW & EXISTING) SHALL BE FLUSHED WITH A CHEMICAL CLEANSING AGENT.

REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATION OF ALL CEILING GRILLES, REGISTERS AND DIFFUSERS.

PROVIDE VOLUME DAMPERS IN EACH BRANCH DUCTWORK SERVING REGISTERS, GRILLES AND DIFFUSERS WHETHER INDICATED OR NOT.

PROVIDE CABLE OPERATED DAMPERS IN BRANCH DUCTWORK SERVING REGISTERS, GRILLES, AND DIFFUSERS IN INACCESSIBLE CEILING LOCATIONS WHETHER INDICATED OR NOT.

LOCATE ALL BALANCING DAMPERS AT MAIN DUCTWORK ABOVE ACCESSIBLE CEILINGS, OR PROVIDE ACCESS DOORS.

INSTALL ALL FLOOR MOUNTED HVAC EQUIPMENT, INCLUDING AHU'S, PUMPS, CHILLERS, ETC.
ON 4" CONCRETE PADS UNLESS OTHERWISE INDICATED.

PROVIDE TRAPPED CONDENSATION DRAIN PIPING FROM COOLING COIL DRAIN PAN TO AN APPROVED POINT OF DISCHARGE WHETHER INDICATED OR NOT. REFER TO PLUMBING PLANS FOR FLOOR DRAIN LOCATIONS.

ALL CONCRETE HOUSEKEEPING PADS FOR HVAC EQUIPMENT ARE BY DIVISION 23.

RUN REFRIGERATION PIPING FROM AIR COOLED CONDENSING UNITS TO RESPECTIVE DX COOLING COILS. ROUTE AND SIZE PIPING PER EQUIPMENT MANUFACTURER'S RECOMMENDATIONS.

ALL HWS AND HWR PIPING SERVING RADIATION SHALL BE CONCEALED IN WALLS OR FLOORS UNLESS OTHERWISE NOTED.

PROVIDE FIRE DAMPERS, SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS AS REQUIRED TO MAINTAIN WALL & FLOOR RATINGS AS DEFINED IN ARCHITECTURAL DRAWINGS.

PROVIDE PITCH CORRECTION CURBS FOR ALL MECHANICAL EQUIPMENT AS REQUIRED. ROOF MOUNTED EQUIPMENT TO BE INSTALLED PLUMB AND LEVEL ACCORDING TO EQUIPMENT MANUFACTURERS INSTALLATION INSTRUCTIONS.

PROVIDE STAINLESS STEEL DRIP PANS WITH LEAK DETECTION FOR ALL SUSPENDED EQUIPMENT WITH COOLING COILS. LEAK DETECTION ALARM TO ALERT TO BMS.

PROVIDE SEISMIC EXPANSION JOINTS AT ALL PIPING AND DUCTWORK PASSING THROUGH SEISMIC EXPANSION JOINTS.

REFER TO SPECIFICATION SECTION 230000 AND DIVISION 7 FOR ADDITIONAL PENETRATION SEALING REQUIREMENTS. PENETRATIONS TO COMPLY WITH ASTM E84 & E814 AND APPROVED UL 1479 AND SPECIFIC UL ASSEMBLIES AS REQUIRED TO SUIT PENETRATION CONDITIONS.

LOCATE ALL ROOF MOUNTED EQUIPMENT REQUIRING SERVICE A MINIMUM OF 10'-0" FROM EDGE OF ROOF. CONTRACTOR MUST COMPLY W/ THIS SET BACK.

DO NOT RUN ANY MECHANICAL OR CONTROL SERVICES THROUGH RATED STAIR ENCLOSURES UNLESS SYSTEMS ARE DESIGNED AND DESIGNATED TO SERVICE STAIRS.

COORDINATE ALL ROOF AND FLOOR PENETRATIONS W/ STRUCTURAL DWGS AND PROVIDE STRUCTURAL CONTRACTOR W/ FLOOR, WALL & ROOF OPENING SIZES.

TEMPERATURE CONTROL CONTRACTOR (TCC) IS RESPONSIBLE FOR ALL CONTROL WIRING 120 VOLT AND LESS. EXTEND POWER FOR VAV BOXES FROM JUNCTION BOXES PROVIDED BY DIVISION 26. REFER TO ELECTRICAL DRAWINGS FOR LOCATIONS. TCC TO EXTEND 120V POWER TO EACH VAV BOX TRANSFORMER.SHARED TRANSFORMERS ARE NOT ALLOWED. RUN POWER PER DIVISION 26 REQUIREMENTS.

TCC SHALL EXTEND ALL POWER FOR DAMPER ACTUATORS, VALVE ACTUATORS AND OTHER CONTROL DEVICES FROM LOCAL ELECTRICAL PANEL. DIVISION 26 TO SUPPLY POWER TO TCPS. REFER TO ELECTRICAL DRAWINGS FOR PANEL LOCATIONS.

CONTROL CONTRACTOR TO FIELD MOUNT CONTROL ACTUATORS AND CONTROLS FOR VAV BOXES.

THE DRAWINGS AND SPECIFICATIONS ARE DIVIDED INTO SECTIONS TO MEET THE NEEDS OF THE ARCHITECT, THE ENGINEERS, AND THE DESIGN CONSULTANTS. THEY ARE NOT PREPARED AS INSTRUCTIONS TO THE CONTRACTOR FOR HOW TO BUY OUT OR SUBCONTRACT THE WORK. THE CONTRACTOR IS RESPONSIBLE FOR ALL THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS, REGARDLESS OF WHERE IT IS SHOWN. FOR EXAMPLE, ELECTRICAL WORK IS SHOWN ON FP-SERIES DRAWINGS AS WELL AS ON M-SERIES DRAWINGS AND E-SERIES DRAWINGS. MISCELLANEOUS METALS AND STRUCTURAL ELEMENTS ARE SHOWN ON A-SERIES DRAWINGS AS WELL AS ON S-SERIES DRAWINGS. STRUCTURAL SUPPORTS ARE REQUIRED BY THE FP DRAWINGS. TO AVOID OMITTING ANY COMPONENT OF THE PROJECT, REFER TO ALL THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.

CONTRACTOR TO PROVIDE INTERNAL MIXING BAFFLES IN AIR HANDLING UNITS, PLENUMS AND FAN COILS TO ALLOW PROPER MIXING OF OUTSIDE AIR AND RETURN AIR IN THE EVENT THERE IS INSUFFICIENT SPACE FOR MIXING TO PREVENT NUISANCE FREEZE STAT TRIPS. CONTRACTOR REVIEW DRAWING AND INSTALLATION AND PROVIDE BAFFLES AS REQUIRED.

WHEREVER EXISTING SYSTEMS ARE ALTERED OR EXTENDED THE INTEGRITY OF THE SYSTEM IS TO BE MAINTAINED AND FUNCTION FULLY AS BEFORE. COORDINATE SCHEDULE FOR HOOK-UPS TO EXISTING SYSTEMS AND EQUIPMENT REMOVAL OR RELOCATION WITH THE OWNER AND PERFORM THIS WORK AT SUCH TIMES TO ENSURE THAT PERIODS OF SHUTDOWN WILL BE ACCEPTABLE TO THE OWNER.

VERIFY EXACT LOCATION OF CONNECTION POINTS (NEW TO EXISTING) IN FIELD PRIOR TO CONSTRUCTION.

RELOCATE EXISTING DUCTWORK AND/OR PIPE WORK IN EXISTING CEILING SPACES TO ACCOMMODATE ALL RENOVATIONS AND ADDITIONS.

TAKE DOWN AND REINSTALL EXISTING CEILINGS IN ALL AREAS WHERE MECHANICAL WORK IS INDICATED AND EXISTING CEILINGS REMAIN. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN DRAWINGS FOR LOCATIONS WHERE EXISTING CEILINGS REMAIN. REPLACE CEILING TILES DAMAGED DURING WORK.

PATCH ALL WALLS, FLOORS, CEILINGS, AND ROOFS TO MATCH EXISTING IN ALL CASES WHERE EXISTING WALLS, FLOORS, CEILINGS, AND ROOFS REMAIN AND HVAC DEMOLITION IS INDICATED.

THIS PROJECT CONSISTS OF MULTIPLE PHASES OF CONSTRUCTION OVER A SPECIFIED TIME PERIOD. PROVIDE ALL WORK NECESSARY TO KEEP EXISTING SYSTEMS IN SAFE OPERATION. PROVIDE ISOLATION (SHUTOFF) VALVES AT ALL CONNECTION POINTS TO EXISTING SYSTEMS.

ALTERATION WORK AND DEMOLITION

ALL EQUIPMENT, DUCTWORK, PIPING, CONTROL DEVICES, ETC. TO BE REMOVED, SHALL BE DISPOSED OF, TURNED OVER TO THE OWNER, OR SALVAGED AS DIRECTED BY THE OWNER. EQUIPMENT, DUCTWORK, PIPING, CONTROL DEVICES, ETC. SHALL NOT BE REMOVED FROM THE PREMISES WITHOUT THE OWNER'S APPROVAL.

UPON COMPLETION OF REMOVALS AND MODIFICATIONS, ALL DUCTWORK AND PIPING TO REMAIN SHALL BE PROPERLY VALVED, CAPPED AND/OR BY PASSED SUCH THAT UPON COMPLETION OF WORK ALL SYSTEMS TO REMAIN, REMAIN OPERATIONAL.

NO DEAD ENDS SHALL BE LEFT ON ANY DUCTWORK OR PIPING SYSTEM UPON COMPLETION OF WORK.

EXISTING DUCTWORK AND PIPING SYSTEMS NOT TO BE REUSED, AND NOT SPECIFICALLY NOTED FOR REMOVAL SHALL BE COMPLETELY REMOVED.

ALL SYSTEMS SHALL BE LEFT IN WORKING ORDER TO THE SATISFACTION OF THE OWNER UPON COMPLETION OF ALL NEW WORK.

ALL EXISTING UNNECESSARY DUCTWORK AND PIPING NOT RELATED TO NEW WORK SHALL BE COMPLETELY REMOVED.

RE-ROUTE ALL EXISTING DUCTWORK, PIPING AND SYSTEMS WHERE NECESSARY TO AVOID NEW EQUIPMENT, STRUCTURAL, OR MASONRY WORK AS REQUIRED BY THE PROPOSED ALTERATIONS.

WHERE PORTIONS OF EXISTING DUCT SYSTEMS ARE TO REMAIN CONTRACTOR SHALL TAKE AIRFLOW READINGS AT ALL AIR REGISTER, GRILLES AND DIFFUSERS ASSOCIATED WITH THE DUCT SYSTEM TO BE MODIFIED BEFORE COMMENCEMENT OF WORK AND AFTER ALTERATION WORK IS COMPLETE. AIR BALANCING WORK SHALL BE PERFORMED BY AN INDEPENDENT NEEB CERTIFIED COMPANY, NOT ASSOCIATED WITH THE CONTRACTOR. REPORTS ARE TO BE ISSUED TO THE OWNER AND ENGINEER AT BOTH OCCURRENCES. IF AS-BUILTS ARE AVAILABLE, DISCREPANCIES NOTED BETWEEN THE AS BUILT DRAWINGS AND THE INITIAL AIR FLOW READINGS ARE TO BE NOTED ON THE AIR FLOW REPORT. EXISTING AIR REGISTERS, GRILLES AND DIFFUSERS ARE TO BE BALANCED TO THE ORIGINAL READINGS AT COMPLETION OF WORK UNLESS OTHERWISE IDENTIFIED.

SHOP DRAWINGS

CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO BE REVIEWED BY THE ENGINEER PRIOR TO CONSTRUCTION. SHOP DRAWINGS SHALL BE SUBMITTED FOR DUCTWORK LAYOUT, PIPING LAYOUT, SHEET METAL SHOP STANDARDS AND ALL EQUIPMENT FURNISHED.

ELECTRONIC DRAWING FILES SHALL BE GENERATED BY THE CONTRACTOR. DRAWINGS SHALL BE SUBMITTED IN BOTH HARD COPY AND ELECTRONIC VERSION (AUTOCAD VERSION AS REQUIRED BY THE OWNER) OR AUTOCAD VERSION 2010 IF NOT SPECIFIED.

PRIOR TO THE SUBMISSION AND REVIEW OF SHEET METAL SHOP DRAWINGS, THE CONTRACTOR SHALL SUBMIT FOR REVIEW SHEET METAL SHOP STANDARDS. ANY SHEET METAL SHOP DRAWINGS SUBMITTED PRIOR TO THE SUBMISSION OF THE SHOP STANDARDS SHALL BE RETURNED "NOT REVIEWED".

COORDINATION DRAWINGS

ELECTRONIC DRAWING FILES SHALL BE GENERATED BY THE CONTRACTOR. IF REQUESTED, ELECTRONIC FILES OF THE MECHANICAL FLOOR PLANS, SECTIONS AND ELEVATIONS ONLY WILL BE MADE AVAILABLE. ELECTRONIC FILES WILL BE RELEASED ONLY UPON RECEIPT OF THE SIGNED AGREEMENT FOR TRANSFER OF ELECTRONIC FILE DATA, AGREEMENT FOR TRANSFER OF BUILDING INFORMATION MODEL AND ALL FEES INDICATED THEREIN.

DEVELOP AND SUBMIT COORDINATION DRAWINGS AS OUTLINED.

A. SHEET METAL, PLUMBING AND FIRE PROTECTION SHOP DRAWINGS THAT HAVE BEEN COORDINATED WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO ENGINEER FOR REVIEW. DRAWINGS MUST BE RETURNED FROM ENGINEER EITHER "REVIEWED" OR "FURNISH AS CORRECTED" PRIOR TO BEING USED AS BASIS FOR COORDINATION DRAWINGS.

B. AFTER SHEET METAL AND PIPING DRAWINGS HAVE BEEN REVISED PER ENGINEERS COMMENTS, REPRODUCIBLE COPIES SHALL BE SENT TO THE TRADES IN THE FOLLOWING SEQUENCE FOR THE INCLUSION OF THEIR WORK:

-MECHANICAL SHEET METAL
-PLUMBING PIPING
-MECHANICAL PIPING
-SPRINKLER PIPING
-ELECTRICAL WORK

AFTER ALL TRADES HAVE INCLUDED THEIR WORK ON THE COORDINATION DRAWING AND NOTED CONFLICTS, ALL TRADES SHALL MEET TO RESOLVE CONFLICTS AND AGREE TO ACCEPTABLE SOLUTIONS. EACH TRADE SHALL SIGN COORDINATION DRAWINGS. ITEMS NOT SHOWN ON COORDINATION DRAWING IS RESPONSIBILITY OF OMITTING CONTRACTOR AND CONTRACTOR IS SUBJECT TO ADDITIONAL COSTS INCURRED BY OTHER TRADES.

THE ARCHITECT AND ENGINEER ARE NOT PART OF THE COORDINATION DRAWING PROCESS. THE ENGINEER WILL PROVIDE ASSISTANCE FOR NOTED CONFLICTS ONLY. COORDINATION DRAWINGS ARE NOT TO BE CONSIDERED PIPING OR DUCT SHOP DRAWINGS. THE CONTRACTOR IS REQUIRED TO SUBMIT INDIVIDUAL PIPING AND DUCTWORK SHOP DRAWINGS FOR REVIEW BY THE ENGINEER. PIPING AND DUCTWORK SHOP DRAWINGS SHALL FOLLOW THE DESIGN INTENT OF THE CONTRACT DOCUMENTS.

SUBMIT FINAL SIGNED COORDINATION DRAWING TO ENGINEER FOR REVIEW. ENGINEER WILL REVIEW COORDINATION DRAWINGS FOR GENERAL ARRANGEMENT AND FOR NOTED CONFLICTS ONLY. SPECIFIC INSTALLATION REQUIREMENTS WILL BE REVIEWED ONLY IN INDIVIDUAL TRADE SHOP DRAWINGS.

ANY WORK FABRICATED OR INSTALLED PRIOR TO SIGN OFF BY ALL TRADES WHICH IS DEEMED TO BE IN CONFLICT WITH COORDINATION DRAWINGS SHALL BE REMOVED AND RE-INSTALLED IN CONFORMANCE WITH COORDINATION DRAWINGS.

EACH CONTRACTOR (MENTIONED ABOVE) IS RESPONSIBLE FOR THE COORDINATION OF HIS SUB-CONTRACTORS.

THE OVERALL COORDINATION OF THE COORDINATION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER IS NOT RESPONSIBLE FOR THE COORDINATION PROCESS. THE ENGINEER WILL RESPOND TO QUESTIONS THAT ARISE FROM THE COORDINATION PROCESS. DRAWINGS SUBMITTED WILL BE REVIEWED FOR CLEARLY IDENTIFIED CONFLICTS ONLY. SOLUTIONS TO CONFLICTS WILL NOT BEAR ADDITIONAL COST.

AS BUILT DRAWINGS

PROVIDE A COMPLETE SET OF AS-BUILT DRAWINGS REFLECTING AS INSTALLED CONDITIONS. AS-BUILT DRAWINGS SHALL INDICATE ALL INSTALLED CONDITIONS OF SYSTEMS WITHIN THIS DISCIPLINE. DRAWINGS SHALL BE OF SIMILAR SCALE AS THE CONSTRUCTION DOCUMENTS AND INCLUDE DETAILS AS NECESSARY TO CLEARLY REFLECT THE INSTALLED CONDITION. DRAWINGS SHALL BE BOUND IN A COMPLETE AND CONSECUTIVE SET. SUPPLEMENTAL SKETCHES AND LOOSE PAPERWORK WILL NOT BE ACCEPTABLE AND WILL BE RETURNED FOR REVISION. THE CONTRACTOR SHALL COMPLY WITH THE ENGINEERS COMMENTS TO PRODUCE A CLEAR AND CONCISE SET OF DRAWINGS. DRAWINGS SHALL BE SUBMITTED IN BOTH HARD COPY AND ELECTRONIC VERSION (AUTO-CAD VERSION AS REQUIRED BY THE OWNER) OR AUTOCAD VERSION 2010 IF NOT SPECIFIED. NUMBER OF COPIES OF EACH AS REQUESTED BY THE OWNER.

PROVIDE "AS-BUILT DRAWINGS" INDICATING IN A NEAT AND ACCURATE MANNER A COMPLETE RECORD OF ALL REVISIONS OF THE ORIGINAL DESIGN OF THE WORK. INDICATE THE FOLLOWING INSTALLED CONDITIONS:

- INCLUDE ALL CHANGES AND AN ACCURATE RECORD IN AUTOCAD DRAWING OR APPROPRIATE SHOP DRAWINGS, OF ALL DEVIATIONS, BETWEEN THE WORK SHOWN AND WORK INSTALLED.
- MAINS AND BRANCHES OF PIPING SYSTEMS, WITH VALVES AND CONTROL DEVICES LOCATED AND NUMBERED, CONCEALED UNIONS LOCATED, AND WITH ITEMS REQUIRING MAINTENANCE LOCATED (I.E., TRAPS, STRAINERS, EXPANSION COMPENSATORS, TANKS, ETC.). VALVE LOCATION DIAGRAMS, COMPLETE WITH VALVE TAG CHART.
- EQUIPMENT LOCATIONS (EXPOSED AND CONCEALED), DIMENSIONED FROM PROMINENT BUILDING LINES.
- APPROVED SUBSTITUTIONS, CONTRACT MODIFICATIONS, AND ACTUAL EQUIPMENT AND MATERIALS INSTALLED.
- CONTRACT MODIFICATIONS, ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

SUBMIT FOR REVIEW BOUND SETS OF THE REQUIRED DRAWINGS, MANUALS AND OPERATING INSTRUCTIONS.

SUBMIT A COMPLETE MAINTENANCE MANUAL OF ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT.

HOUSEKEEPING PADS

PROVIDE CONCRETE HOUSEKEEPING PADS FOR FLOOR-MOUNTED EQUIPMENT. COORDINATE EXACT LOCATIONS, DIMENSIONS, PIPING LOCATIONS, AND ANCHOR BOLT REQUIREMENTS. PROVIDE CONCRETE HOUSEKEEPING PADS UNDER ALL FLOOR MOUNTED EQUIPMENT. PADS SHALL BE CONSTRUCTED OF 3,000 PSI CONCRETE. PADS SHALL BE 4 INCHES HIGH (OR THE MINIMUM HEIGHT TO ACCOMMODATE THE CONDENSATE TRAP HEIGHT), AND MINIMUM 4 INCHES WIDER THAN THE EQUIPMENT IN BOTH DIRECTIONS.

COORDINATE FLOOR DRAIN LOCATIONS WITH RESPECT TO EQUIPMENT HOUSEKEEPING PADS. PLACE DRAINS SUCH THAT EDGE OF THE FLOOR GRATE EXTENDS NO CLOSER THAN 2 INCHES FROM THE SIDE OF THE PAD. FLOOR DRAINS TO BE COORDINATED WITH PLUMBING CONTRACTOR.

HANGERS AND SUPPORT

PROVIDE ALL NECESSARY STRUCTURAL MEMBERS INCLUDING ADDITIONAL STRUCTURAL SUPPORT TO SUPPORT PIPING AND EQUIPMENT. HANGERS AND SUPPORTS SHALL BE OF AN APPROVED DESIGN NECESSARY TO SUPPORT DUCTWORK, PIPING, EQUIPMENT AND TO KEEP IN PROPER ALIGNMENT AND PREVENT TRANSMISSION OF INJURIOUS THRUSTS AND VIBRATIONS. IN ALL CASES WHERE HANGERS, BRACKETS, ETC., ARE SUPPORTED FROM CONCRETE CONSTRUCTION, DO NOT WEAKEN CONCRETE OR PENETRATE WATERPROOFING. ALL HANGERS AND SUPPORTS SHALL BE CAPABLE OF SCREW ADJUSTMENT AFTER EQUIPMENT AND PIPING IS ERECTED. HANGERS SUPPORTING PIPING EXPANDING INTO LOOPS, BENDS AND OFFSETS SHALL BE SECURED TO THE BUILDING STRUCTURE IN SUCH A MANNER THAT HORIZONTAL ADJUSTMENT PERPENDICULAR TO THE RUN OF PIPING SUPPORTED MAY BE MADE TO ACCOMMODATE DISPLACEMENT DUE TO EXPANSION. ALL SUCH HANGERS SHALL BE FINALLY ADJUSTED BOTH IN THE VERTICAL AND HORIZONTAL DIRECTION, AS REQUIRED. HANGERS IN CONTACT WITH COPPER OR BRASS PIPE SHALL BE DIELECTRIC, COMPATIBLE WITH COPPER AND BRASS ALLOY OR PROVIDED WITH FELT SLEEVE.

PROVIDE ADDITIONAL SUPPORT FOR DUCTWORK PIPING AND EQUIPMENT WHEN DECK IS NOT CAPABLE OF SUPPORT.

BEAM CLAMPS - HANGERS SUPPORTED FROM STEEL SHALL BE CENTER LOADING BEAM CLAMPS FOR HANGERS SUPPORTING PIPING 2-1/2 INCHES AND LARGER. FOR PIPING 2 INCHES AND SMALLER, I BEAM CLAMPS, WITH RETAINING STRAPS, SHALL BE FORGED STEEL. "C" CLAMPS ARE NOT TO BE USED.

PROVIDE AND INSTALL EXPANSION COMPENSATION FOR ALL PIPING. SUBMIT PLANS, CALCULATIONS AND EQUIPMENT DATA.

NYC BUILDING DEPARTMENT NOTES

2022- NYC BUILDING CODE

ALL WORK SHALL COMPLY WITH THE APPLICABLE SECTIONS OF THE BUILDING CODE, CITY OF NEW YORK, EFFECTIVE NOVEMBER 7, 2022 AND ALL AMENDMENTS AND RULES AND REGULATIONS OF THE DEPARTMENT OF BUILDINGS TO DATE. INSPECTIONS AND SIGN-OFF OF COMPLETED WORK SHALL BE MADE AS PER ARTICLE 28-116 OF THE GENERAL ADMINISTRATIVE PROVISIONS.

1. THE FOLLOWING SPECIAL INSPECTIONS ARE REQUIRED BY THE NYC BUILDING CODE FOR HVAC SYSTEMS:
   A. ALTERNATIVE MATERIALS - OTCR BUILDING BULLETIN - BC 1705.1.1
   B. SMOKE CONTROL SYSTEMS - BC 1705.18
   C. MECHANICAL SYSTEMS - BC 1705.21
   D. FUEL OIL STORAGE AND PIPING SYSTEMS - BC 1705.22
   E. HIGH PRESSURE STEAM PIPING - BC 1705.23
   F. HIGH TEMPERATURE HOT WATER PIPING - BC 1705.23
   G. HEATING SYSTEMS - BC 1705.31
   H. CHIMNEYS - BC 1705.32
   I. FIRE-RESISTANT PENETRATIONS AND JOINTS - BC 1705.17
   J. FLOOD ZONE COMPLIANCE - BC 1705.34
   K. EMERGENCY AND STANDBY POWER SYSTEMS - BC 1705.36
   L. CONSTRUCTION OPERATIONS INFLUENCING ADJACENT STRUCTURES - BC 1705.25.2
   M. POST INSTALLED ANCHORS - BC 1705.37
   N. SEISMIC MECHANICAL FUEL GAS COMPONENTS - BC 1705.12.3
   O. TENANT PROTECTION PLAN COMPLIANCE INSPECTOR - BC 1705.26
2. THE FOLLOWING PROGRESS INSPECTIONS ARE REQUIRED BY THE NYC BUILDING CODE FOR HVAC SYSTEMS:
   A. ENERGY CODE COMPLIANCE - BC 110.3.5
   B. FIRE RESISTANCE RATED CONSTRUCTION - BC 110.3.4
   C. FINAL (TR1) - 28-114,28-116, BC-110.5
   D. LOWEST FLOOR ELEVATION - BC - 110.3.2
   E. PRELIMINARY - 28-116.2.1, BC-110.2
3. TESTS OF MECHANICAL SYSTEMS SHALL BE PERFORMED IN ACCORDANCE WITH SECTION MC 107 AND THE FOLLOWING SECTIONS OF THE NEW YORK CITY MECHANICAL CODE:
   A. VENTILATION SYSTEM BALANCING - MC 403.3.1.6
   B. VENTILATION SYSTEM SERVING COMMERCIAL COOKING APPLIANCES - MC 507.6
   C. SMOKE CONTROL SYSTEMS - MC 513 AND BC 909
   D. CHIMNEYS - MC 810
   E. BOILERS AND PRESSURE VESSELS - MC 1011
   F. REFRIGERATION SYSTEMS - MC 1108
   G. HYDRONIC PIPING SYSTEMS - MC 1208
   H. HIGH PRESSURE STEAM PIPING - MC 1211
   I. HIGH TEMPERATURE HOT WATER - MC 1211
   J. FUEL STORAGE TANKS AND PIPING - MC 1308
4. THE OWNER/CONTRACTOR SHALL ENGAGE THE SERVICES OF A PROFESSIONAL ENGINEER TO PROVIDE THE REQUIRED SPECIAL INSPECTIONS AND TESTS:
   A. UPON COMPLETION OF THE VENTILATION SYSTEM:
      1. A TEST SHALL BE CONDUCTED IN THE PRESENCE OF AND UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER QUALIFIED TO CONDUCT SUCH TESTS. THE TESTS SHALL SHOW COMPLIANCE WITH THE CODE REQUIREMENTS FOR VENTILATION AND THE PROPER FUNCTIONING OF ALL SMOKE DETECTION, FIRE PROTECTION AND OPERATING DEVICES BEFORE THE SYSTEM IS APPROVED.
      2. THE LICENSED PROFESSIONAL ENGINEER WHO CONDUCTS THE TESTS SHALL FILE A CERTIFICATE AS TO WHETHER THE SYSTEM COMPLIES WITH THE APPLICABLE LAWS. THEY SHALL ALSO FILE WITH THIS CERTIFICATION A REPORT OF THE TEST. THE TEST AND REPORT SHALL BE MADE IN A MANNER SATISFACTORY TO THE OWNER.
5. THE FOLLOWING WORK ITEMS, COMPONENTS, MATERIALS, CAPACITIES, ETC. SHALL COMPLY WITH THE REFERENCED CODE OR STANDARD:
   A. STANDARDS OF HEATING - MC 309.1
   B. INTAKES - MC 401
   C. EXHAUSTS - MC 501
   D. SMOKE CONTROL SYSTEMS - MC 513
   E. DUCT CONSTRUCTION AND INSTALLATION - MC 603
   F. AIR FILTERS - MC 605
   G. SMOKE DETECTION SYSTEMS CONTROL - MC 606
   H. FIRE DAMPERS AND SMOKE DAMPERS AND SMOKE DETECTORS - MC 607
   I. NOISE CONTROL - MC 313
   J. BOILERS - MC 1004
   K. PIPING AND INSULATION - MC 1201 AND 1204
   L. FUEL OIL STORAGE EQUIPMENT - MC 1301
   M. GAS FIRED EQUIPMENT - FUEL GAS CODE
6. MINIMUM TEMPERATURE TO BE MAINTAINED IN OCCUPIED SPACES DURING HEATING SEASON: 68°F.
7. VENTILATION FOR ALL AREAS SHALL COMPLY WITH MC 401.
8. A STATEMENT SHALL BE FILED BY THE OWNER OR TENANT IN POSSESSION THAT THE VENTILATING SYSTEM WILL BE KEPT IN CONTINUOUS OPERATION AT ALL TIMES DURING THE NORMAL OCCUPANCY OF THE STRUCTURE AS REQUIRED BY CODE MC 403.3
9. ALL FIRE DAMPERS SHALL BE ACCEPTED FOR USE BY THE NEW YORK CITY DEPARTMENT OF BUILDINGS SHALL BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH UL 555, STANDARD FOR FIRE DAMPERS AND CEILING DAMPERS.
10. ALL SMOKE DAMPERS SHALL BE ACCEPTED FOR USE BY THE NEW YORK CITY DEPARTMENT OF BUILDINGS SHALL BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH UL 555S, STANDARD FOR SMOKE DAMPERS.
11. COMBINATION FIRE/SMOKE DAMPERS AND SMOKE DAMPERS SHALL BE ACCEPTED FOR USE BY THE NEW YORK CITY DEPARTMENT OF BUILDINGS SHALL BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH UL 555 AND UL555S.
12. SMOKE DETECTORS, COMBINATION FIRE/SMOKE DAMPERS AND SMOKE DAMPERS SHALL BE INSTALLED AS REQUIRED TO CLOSE DAMPERS AND AUTOMATICALLY STOP THE FAN - MC 606.
13. REFER TO ARCHITECTURAL DRAWINGS FOR REQUIRED FIRE RATED WALL AND SMOKE WALL CONSTRUCTION AND LOCATIONS.
14. THESE PLANS ARE APPROVED ONLY FOR THE WORK INDICATED ON THE APPLICATION SPECIFICATION SHEET. ALL OTHER MATTERS SHOWN ARE NOT TO BE RELIED UPON OR TO BE CONSIDERED AS EITHER BEING APPROVED OR IN ACCORDANCE WITH APPLICABLE CODES.
15. TO THE BEST OF THE APPLICANT'S KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS ARE IN COMPLIANCE WITH THE NYC ENERGY CONSERVATION CODE.
16. TESTS OF SOUND POWER LEVEL OF MECHANICAL EQUIPMENT SHALL BE CONDUCTED AND RESULTS
17. SUBMITTED WHERE WINDOWS OF A DWELLING UNIT ARE WITHIN 100 FEET OF EQUIPMENT. THE SOUND PRESSURE LEVEL SHALL NOT EXCEED THE LEVELS GIVEN IN MC 313 AND NYC NOISE CONTROL CODE.
18. SEISMIC REQUIREMENT:
   - THE BUILDING IS A SEISMIC DESIGN CATEGORY A. SEISMIC ISOLATION SYSTEMS ARE NOT REQUIRED.
   - THE BUILDING IS A SEISMIC DESIGN CATEGORY B. SEISMIC ISOLATION SYSTEMS ARE NOT REQUIRED.
   - THE BUILDING IS A SEISMIC DESIGN CATEGORY C. SEISMIC ISOLATION SYSTEMS ARE REQUIRED FOR ALL LIFE SAFETY AND HAZARDOUS SYSTEMS.
   - THE BUILDING IS A SEISMIC DESIGN CATEGORY D. SEISMIC ISOLATION SYSTEMS ARE REQUIRED FOR ALL SYSTEMS.
   - THE BUILDING WAS BUILT PRIOR TO THE SEISMIC CODE AND ARE NOT REQUIRED.

MECHANICAL DRAWING LIST

DRAWING NUMBER	DRAWING DESCRIPTION
M001.00	COVER SHEET - MECHANICAL
M002.00	SYMBOLS, ABBREVIATIONS AND NOTES - MECHANICAL
M003.00	FLOW AND CONTROL DIAGRAMS - MECHANICAL
MD100.00	BASEMENT FLOOR DEMOLITION PLANS - MECHANICAL
MD101.00	THIRD FLOOR AND THIRD FLOOR MEZZ DEMOLITION PLANS - MECHANICAL
M200.00	BASEMENT FLOOR PLAN - MECHANICAL
M201.00	FIRST AND SECOND FLOOR PLANS - MECHANICAL
M202.00	THIRD FLOOR AND THIRD FLOOR MEZZ PLANS - MECHANICAL
M300.00	PART PLAN - MECHANICAL
M500.00	SCHEDULES - MECHANICAL
M600.00	DETAILS - MECHANICAL
M601.00	DETAILS - MECHANICAL

HVAC DESIGN DATA

OUTDOOR DESIGN TEMPERATURES: 94 °F DB SUMMER; 80 °F WB SUMMER; 0 °F DB WINTER	DESIGN ALTITUDE: 25 FT			
INDOOR AREA DESIGN CONDITIONS	SUMMER		WINTER	
	DRYBULB	RELATIVE HUMIDITY	DRYBULB	RELATIVE HUMIDITY
GALLERIES	70±3°F	50±10%	70±3°F	50±10%

MECHANICAL DEMOLITION NOTES

1. COORDINATE PHASING OF DEMOLITION WITH C.M./G.C. AND PROPOSED CONSTRUCTION SCHEDULE TO MAINTAIN MECHANICAL SERVICES (HEATING, TEMPERATURE CONTROLS, EXHAUSTS, MAKE UP AIR ETC.) TO OCCUPIED AREAS OF THE BUILDING DURING CONSTRUCTION.
2. THE EXISTING FACILITY WILL BE OCCUPIED AND IN OPERATION DURING THE PERFORMANCE OF THE WORK.
3. WHEN NECESSARY TO TEMPORARILY DISCONNECT ANY EXISTING PIPING OR DUCTWORK WHICH MAY CAUSE DISRUPTION OF OCCUPIED FACILITIES, CONFER WITH THE OWNER AND SCHEDULE A MUTUALLY AGREEABLE PERIOD OF INTERRUPTION.
4. THE EXISTING FACILITY WILL BE OCCUPIED AND IN OPERATION DURING THE PERFORMANCE OF THE WORK. INDICATED, PROVIDE AND MAINTAIN ALL TEMPORARY SERVICES, CONNECTIONS, CONTROLS, AND ANY OTHER MATERIALS AND APPURTENANCES REQUIRED TO MAINTAIN SERVICES TO OCCUPIED AREAS.
5. NO WORK SHALL BE LEFT INCOMPLETE, NOR ANY HAZARDOUS SITUATION CREATED, WHICH WILL AFFECT THE LIFE OR SAFETY OF THE PUBLIC AND/OR BUILDING OCCUPANTS. AT NO TIME SHALL THE WORK INTERFERE WITH OR CUT OFF ANY OF THE EXISTING SERVICES WITHOUT THE OWNER'S PRIOR WRITTEN PERMISSION.
6. THE OWNER RESERVES THE RIGHT TO OPERATE ALL EXISTING MECHANICAL EQUIPMENT UNTIL THE NEW SYSTEMS COME ON LINE.
7. IT IS REQUIRED THAT THE WORK INDICATED AND/OR SPECIFIED SHALL BE CARRIED OUT WITH A MINIMUM OF INTERFERENCE TO THE ESTABLISHED OPERATIONS OF THE BUILDING.
8. REMOVED MATERIALS SHALL BE DISPOSED OF USING LICENSED CARTING SERVICE.
9. HAZARDOUS MATERIALS - SHALL BE DISPOSED OF BY AN EPA APPROVED, LICENSED DISPOSAL SERVICE. CONTRACTOR SHALL OBTAIN AND HAVE ON FILE, AFFIDAVIT, AND RECEIPTS STATING HOW AND WHERE THE WASTE WAS DISPOSED OF OR CONVERTED.
10. IT IS THE INTENTION OF THESE DEMO DRAWINGS TO INDICATE GENERAL SYSTEMS AND MATERIALS TO BE REMOVED. CONTRACTOR SHALL REMOVE ALL OBSOLETE PIPING, DUCTWORK, EQUIPMENT, CONTROLS, ETC, INDICATED OR NOT.
11. DUCTWORK, EQUIPMENT AND TERMINAL DEVICES HAVE BEEN TAKEN FROM FIELD OBSERVATION AND ARE TO BE USED FOR REFERENCE AND SHALL NOT BE CONSTRUED TO BE ACTUAL FIELD CONDITIONS. CONTRACTOR IS RESPONSIBLE TO VERIFY ALL SYSTEMS PRIOR TO COMMENCEMENT OF DEMOLITION WORK.
12. ALL EQUIPMENT TO BE REMOVED SHALL BE DISPOSED OF PER OR STORED PER DIRECTION OF OWNER. ANY ITEM NOT RETAINED BY OWNER SHALL BE REMOVED FROM SITE AND DISCARDED IN AN APPROVED MANNER.
13. IT IS THE INTENTION OF THESE SPECIFICATION TO REMOVE ALL MATERIALS ABANDONED BY THE SCOPE OF THIS CONSTRUCTION PROJECT. NO OBSOLETE MATERIALS (I.E. HANGERS, SUPPORTS, INSULATION, DUCTWORK, ETC.) SHALL REMAIN.
14. DISCONNECT AND REMOVE ALL DUCTWORK AND ASSOCIATED SUPPLY, RETURN OR EXHAUST GRILLES INCLUDING BUT NOT LIMITED TO ALL HANGERS, SUPPORTS, VOLUME DAMPERS AND FLEXIBLE DUCTWORK.
15. CONTRACTOR SHALL PROVIDE TEMPORARY PROTECTION TO ANY EXPOSED OR UNCAPPED NEW OR EXISTING DUCTWORK TO REMAIN TO MINIMIZE DUST CONTAMINATION IN ANY AND ALL OF THE AIR SYSTEMS. THIS SHALL INCLUDE BUT IS NOT LIMITED TO TEMPORARY FILTERS, CAPS, ENCLOSURES, ETC.

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

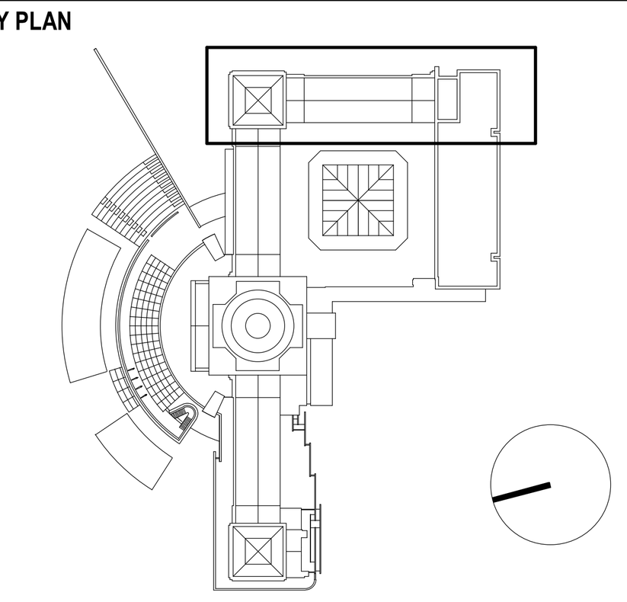
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

COVER SHEET - MECHANICAL

SCALE	12" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

M001.00

10/17/2025 9:39:29 AM

GENERAL MECHANICAL SYMBOLS

CHS	CHILLED WATER SUPPLY PIPING
CHR	CHILLED WATER RETURN PIPING
HWS	HOT WATER SUPPLY PIPING
HWR	HOT WATER RETURN PIPING
CD	CONDENSATE DRAIN PIPING
	HIDDEN PIPING
	EXISTING PIPING/EQUIPMENT TO REMAIN
	EXISTING PIPING/EQUIPMENT TO BE REMOVED
	DIRECTION OF FLOW IN PIPE
	PITCH PIPE DOWN IN DIRECTION OF ARROW
	PIPE ELBOW UP / DOWN
	PIPE TOP CONNECTION
	PIPE BOTTOM CONNECTION
	CAPPED PIPING
	PIPING CONTINUATION
	PIPE UNION
	PIPE ANCHOR
	PIPE GUIDE
	PIPE EXPANSION JOINT
	FLEXIBLE PIPE CONNECTOR
	PRESSURE REDUCING VALVE
	MOTORIZED CONTROL VALVE 2 WAY
	MOTORIZED CONTROL VALVE 3 WAY
	BALL VALVE
	GLOBE VALVE
	GATE VALVE
	BUTTERFLY VALVE
	COMBINATION BALANCING/FLOW MEASURING DEVICE
	PLUG VALVE
	BALL VALVE
	PRESSURE GAUGE WITH BALL VALVE
	PIPE REDUCER OR INCREASER
	THERMOMETER
	PIPE WELL
A.V.	PIPE AIR VENT (M-MANUAL, A-AUTOMATIC)
	DRAIN VALVE WITH HOSE COUPLING AND CAP
	CHECK VALVE
	RELIEF VALVE
	ANGLE RELIEF VALVE
	STRAINER W/ BLOWDOWN BALL VALVE
F	FLOW MEASURING STATION
	OSY GATE VALVE
	MANUAL BUTTERFLY VALVE W/ HAND WHEEL
M	MOTORIZED VALVE

	EXISTING DUCTWORK TO REMAIN
	EXISTING DUCTWORK TO BE REMOVED
	HIDDEN DUCTWORK
	SUPPLY DUCT UP / DN
	RETURN AIR DUCT UP / DN
	EXHAUST AIR DUCT UP / DN
24x12	DOUBLE LINE DUCTWORK WITH INDICATION OF INSIDE DIMENSIONS
24x12	DOUBLE LINE DUCTWORK WITH INTERNAL ACOUSTICAL INSULATION AND INDICATION OF INSIDE DIMENSIONS
24x12	DOUBLE LINE DUCTWORK WITH DUCT LAGGING AND INDICATION OF INSIDE DIMENSIONS
	ACCESS DOOR IN DUCT
12"Ø	ROUND DUCT DIAMETER SIZE
	FLEXIBLE DUCT CONNECTION
	UNDERCUT DOOR
	SUPPLY AIR FLOW
	EXHAUST/RETURN AIR FLOW
	90° ELBOW WITH AIRFOIL TURNING VANES
	DUCT TAKE-OFF
	VANE EXTRACTOR
	CEILING DIFFUSER REFER TO SCHEDULE FOR SIZE & TYPE
	RETURN / EXHAUST GRILLE REFER TO SCHEDULE FOR SIZE & TYPE
	LINEAR DIFFUSER REFER TO SCHEDULE FOR SIZE & TYPE
T	THERMOSTAT
TS	TEMPERATURE SENSOR
H	RELATIVE HUMIDITY SENSOR OR HUMIDISTAT
S	SMOKE DETECTOR IN DUCT
SP	STATIC PRESSURE SENSOR
SD SD	SMOKE DAMPER
FD FD	FIRE DAMPER
FSD FSD	COMBINATION SMOKE & FIRE DAMPER
MD MD	MOTORIZED DAMPER
VD	MANUAL VOLUME DAMPER/CABLE OPERATED DAMPER (COD)
XXX	UNDERLINED TEXT DENOTES EQUIPMENT REFER TO SCHEDULES
LTR CFM-#	DIFFUSER LEGEND LTR= TYPE DESIGNATION, REFER TO SCHEDULES CFM= CFM QUANTITY #= BLOW ARRANGEMENT, 4-WAY BLOW IS TYPICAL UNLESS OTHERWISE NOTED 3 = 3-WAY BLOW 2 = 2-WAY BLOW 1 = 1-WAY BLOW
TCP	TEMPERATURE CONTROL PANEL
	POINT OF CONNECTION
	POINT OF DEMOLITION
OC	OCCUPANCY SENSOR
CO2	CARBON DIOXIDE SENSOR

* ALL SYMBOLS MAY NOT BE USED IN THESE DOCUMENTS.

GENERAL MECHANICAL ABBREVIATIONS

ABV	ABOVE
ACCU-#	AIR COOLED CONDENSING UNIT
AD	ACCESS DOOR
AF	AIRFOIL
AFF	ABOVE FINISHED FLOOR
AFMS	AIR FLOW MEASURING STATION
AHU-#	AIR HANDLING UNIT
AL	ACOUSTIC LINING
ALD	AUTOMATIC LOUVER DAMPER
ALP	ACOUSTICALLY LINED PLENUM
APD	AIR PRESSURE DROP
AUTO	AUTOMATIC
BC	BACKWARD CURVED
BD	BYPASS DAMPER
BMCS	BUILDING MANAGEMENT & CONTROL SYSTEM
BTU	BRITISH THERMAL UNIT
BV	BYPASS VALVE
CHR	CHILLED WATER RETURN
CHS	CHILLED WATER SUPPLY
CAP	CAPACITY
CB-#	CONTROL BOX
CC-#	COOLING COIL
CD	CEILING DIFFUSER
CFM	CUBIC FEET PER MINUTE
CLG	CEILING
C-#	CONVECTOR
C.O.D.	CABLE OPERATED DAMPER
CP	CONDENSATE RECEIVER/PUMPING SYSTEM
CTD	CEILING TRANSFER DUCT
CUH-#	CABINET UNIT HEATER
CV	CONTROL VALVE
DB	DRY BULB
DD	DIRECT DRIVE
DDC	DIRECT DIGITAL CONTROL
DIFF	DIFFUSER
DN	DOWN
DP	DEWPOINT TEMPERATURE
DR	DROP
EF-#	EXHAUST FAN
EAT	ENTERING AIR TEMPERATURE
EER	ENERGY EFFICIENCY RATIO
EHC-#	ELECTRIC HEATING COIL
ENT	ENTERING
HEPA	HIGH EFFICIENCY PARTICULATE FILTER
ESP	EXTERNAL STATIC PRESSURE
ETR	EXISTING TO REMAIN
EUH-#	ELECTRIC UNIT HEATER
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING
EXH	EXHAUST
EXT	EXTERNAL
°F	DEGREES FAHRENHEIT
FA	FACE AREA
FC	FORWARD CURVE
F.C.	FLEX CONNECTION
FCU-#	FAN COIL UNIT
FD	FIRE DAMPER WITH ACCESS DOOR
FF	FINAL FILTER
FIN FL	FINISH FLOOR
FL	FLOOR
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE
FPF	FINS PER FOOT
FT	FEET
FV	FACE VELOCITY
GC	GENERAL CONTRACTOR
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
H/C	HEATING/COOLING
H-#	HUMIDIFIER
HD	FEET OF HEAD
HP	HORSEPOWER
HTG	HEATING
HTR	HEATER
HVAC	HEATING, VENTILATING & AIR CONDITIONING
ID	INSIDE DIMENSION
IN	INCHES
IV	INLET GUIDE VANES
KW	KILOWATT
KWH	KILOWATT HOUR
IL	INLINE
LAT	LEAVING AIR TEMPERATURE
LD	LINEAR DIFFUSER
LIN	LINEAR
LRA	LOCKED ROTOR AMPERES
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
MAN	MANUAL
MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBH	1000 BTUS
MCA	MINIMUM CIRCUIT AMPACITY
MD	MOTORIZED DAMPER
MER	MECHANICAL EQUIPMENT ROOM
MEZZ	MEZZANINE
MFS	MAXIMUM FUSE SIZE
MIN	MINIMUM
MTR	MOTOR
MUA	MAKE-UP AIR
MV	MOTORIZED VALVE
NC	NOISE CRITERIA
NFA	NET FREE AREA
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAT	OUTDOOR AIR TEMPERATURE
OAI	OUTDOOR AIR INTAKE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIMENSION
O.E. T.D.	OPEN END TRANSFER DUCT
OED	OPEN END DUCT
P-#	PUMP
PB	PUSH BUTTON
PBD	PARALLEL BLADE DAMPER
PD	PRESSURE DROP
PF	PREFILTER
PH	PHASE
PHC	PREHEAT COIL
PPH	POUND PER HOUR
PSI	POUND PER SQUARE INCH
RA	RETURN AIR
RAT	RETURN AIR TEMPERATURE
REG	REGISTER
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RLA	RATED LOAD AMPERES
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
RTU-#	ROOFTOP AIR CONDITIONING UNIT
SA	SUPPLY AIR
SAF-#	SUPPLY AIR FAN
SAT	SUPPLY AIR TEMPERATURE
SD	SMOKE DAMPER
SG	SUPPLY GRILLE
SP	STATIC PRESSURE
SQ.FT	SQUARE FOOT (AREA)
ST	SINGLE POLE SWITCH
TSTAT	THERMOSTAT
TB	TERMINAL BOX
TCP	TEMPERATURE CONTROL PANEL
TD	TEMPERATURE DIFFERENCE
TEMP	TEMPERATURE
TG	AIR TRANSFER GRILLE
TOT	TOTAL
TN-HR	TON HOUR REFRIGERATION
TRD	TRANSFER DUCT
TYP	TYPICAL
UC	UNDERCUT DOOR
UH-#	UNIT HEATER HOT WATER
VD	VOLUME DAMPER
VFD	VARIABLE FREQUENCY DRIVE
VI	VIBRATION ISOLATOR
VSF	VARIABLE SPEED FAN SWITCH
W/	WITH
WB	WET BULB
WMS	WIRE MESH SCREEN
WPD	WATER PRESSURE DROP
WT	WEIGHT (LBS)

* ALL ABBREVIATIONS MAY NOT BE USED IN THESE DOCUMENTS.

10/17/2025 9:39:31 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

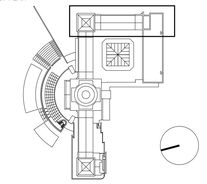
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

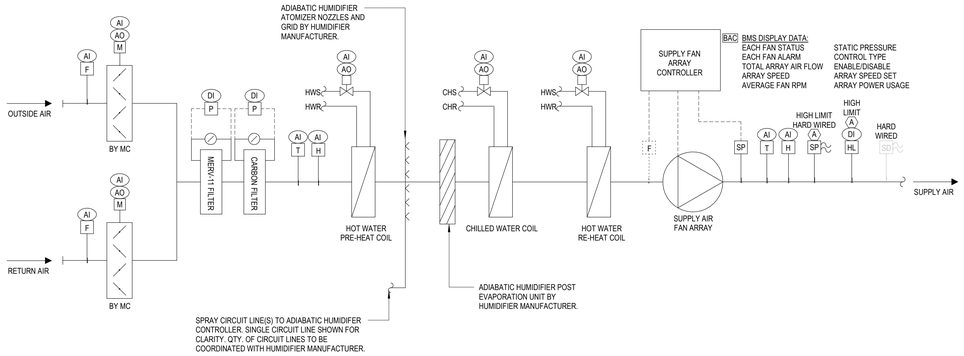
DRAWING TITLE

SYMBOLS, ABBREVIATIONS AND NOTES - MECHANICAL

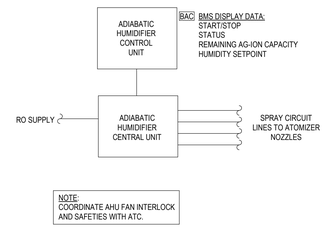
SCALE	12" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

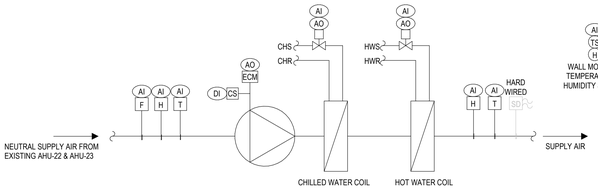
M002.00



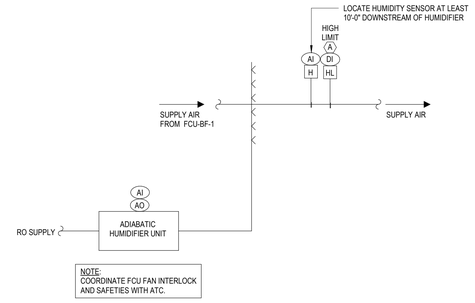
1 M003.00 **AHU-31-F**
SCALE: NOT TO SCALE



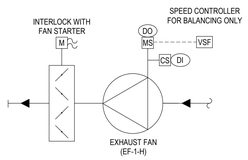
2 M003.00 **H-3F-1 ADIABATIC HUMIDIFIER**
SCALE: NOT TO SCALE



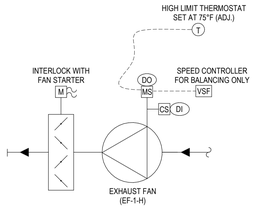
3 M003.00 **FCU-BF-1**
SCALE: NOT TO SCALE



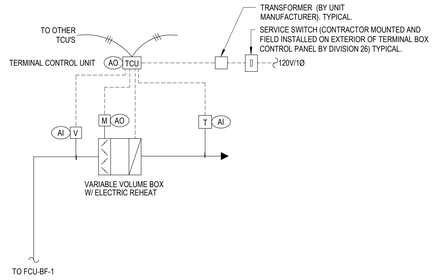
4 M003.00 **H-3E-2 ADIABATIC HUMIDIFIER**
SCALE: NOT TO SCALE



5 M003.00 **EF-2H-1**
SCALE: NOT TO SCALE



6 M003.00 **EF-3E-1**
SCALE: NOT TO SCALE



7 M003.00 **VAV-3E-1**
SCALE: NOT TO SCALE

MECHANICAL CONTROLS SYMBOL LIST

A	ALARM
AI	DDC ANALOG INPUT POINT
AO	DDC ANALOG OUTPUT POINT
BAC	BACNET CONNECTION TO BMS
CO2	CARBON DIOXIDE SENSOR
CS	CURRENT SENSOR
DI	DDC DIGITAL INPUT POINT
DO	DDC DIGITAL OUTPUT POINT
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
ECM	ELECTRONICALLY COMMUTATED MOTOR
ES	END SWITCH
F	FLOW MEASURING STATION
H	ROOM HUMIDISTAT / HUMIDITY SENSOR
H	HUMIDITY SENSOR
HL	HIGH LIMIT HUMIDISTAT
L	ELECTRONIC LIQUID LEVEL SENSOR
M	DAMPER/VALVE MOTOR
MS	MOTOR STARTER
SD	SMOKE DETECTOR; FURNISHED AND WIRED BY DIVISION 26 CONTRACTOR AND MOUNTED BY DIVISION 23 CONTRACTOR
SP	STATIC PRESSURE SENSOR
TCP	TEMPERATURE CONTROL PANEL
TCU	TERMINAL CONTROL UNIT
T	SPACE THERMOSTAT **
TS	SPACE TEMPERATURE SENSOR
T	TEMPERATURE SENSOR
VFD VS	VARIABLE FREQUENCY CONTROLLER *
VSF	VARIABLE SPEED FAN SWITCH
	MAGNAHELIC PRESSURE GAUGE
	HUMIDIFIER
	COIL
	DAMPER
	PUMP / FAN
	HARD WIRED
	CONTROL VALVE
	COMBINATION MOTOR STARTER/DISCONNECT
	LOCAL SWITCH WITH PILOT LIGHT
X	EQUIPMENT/DEVICE FURNISHED BY UNIT MANUFACTURER. REFER TO SYMBOL LIST FOR EQUIPMENT TYPE

ALL SYMBOLS MAY NOT BE USED IN THESE DOCUMENTS.
* REFER TO VARIABLE FREQUENCY CONTROLLER CONTROL DIAGRAM FOR REQUIRED CONTROL POINTS FOR ALL VFD AND VS SYMBOLS INDICATED.
** REFER TO SPACE THERMOSTAT CONTROL DIAGRAM FOR REQUIRED CONTROL POINTS FOR ALL T SYMBOLS INDICATED.
*** N.C. & N.O. INDICATE NORMALLY CLOSED & NORMALLY OPEN CONTROL VALVES.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

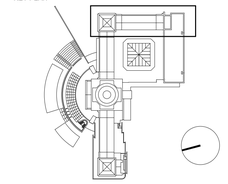
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

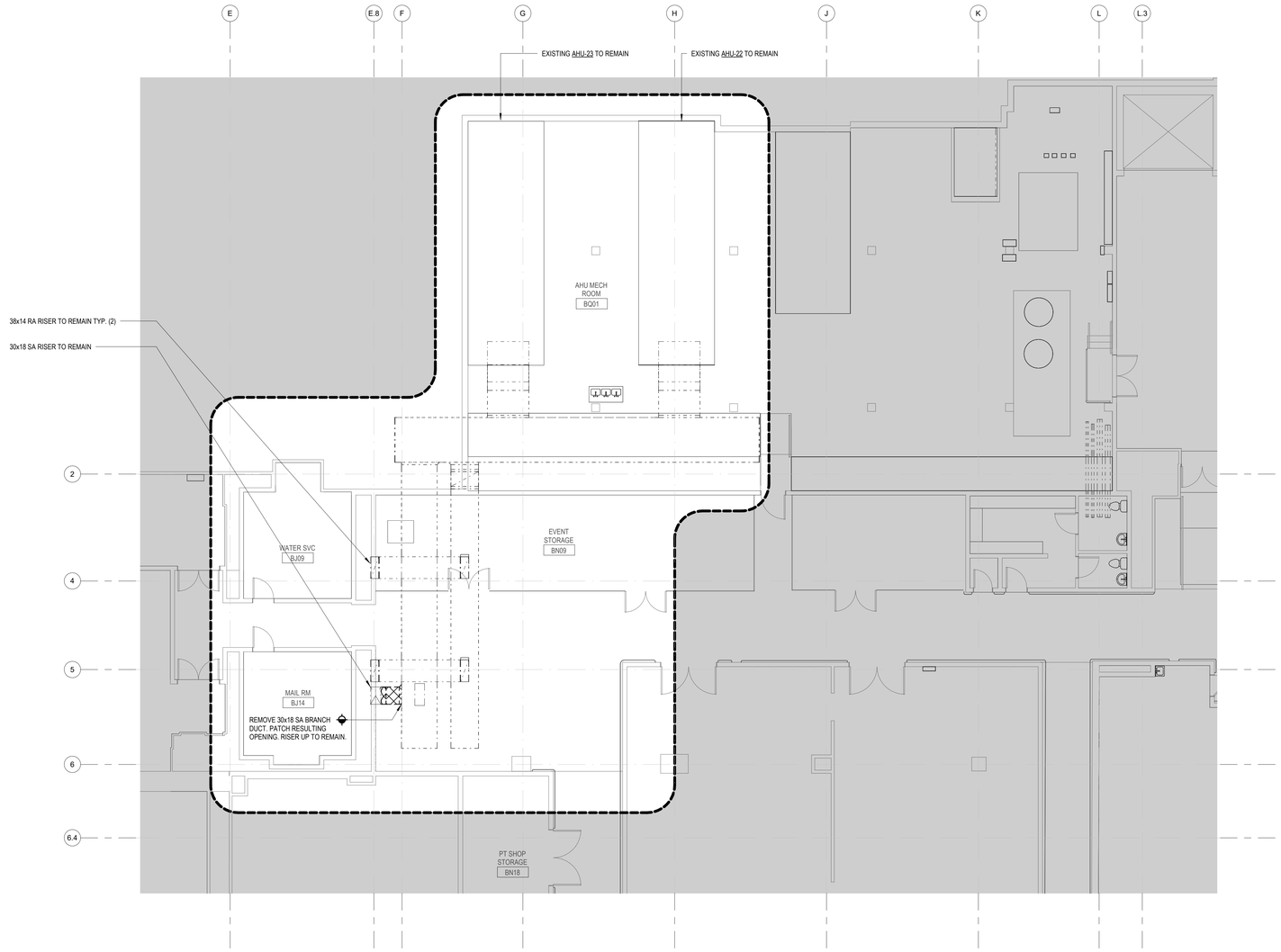
FLOW AND CONTROL DIAGRAMS - MECHANICAL

SCALE	NOT TO SCALE
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

M003.00

10/17/2025 9:39:31 AM



1 BASEMENT FLOOR DEMOLITION PLAN
MD100.00 SCALE: 1/8" = 1'-0"

10/17/2025 9:39:32 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

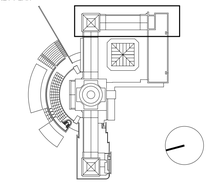
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

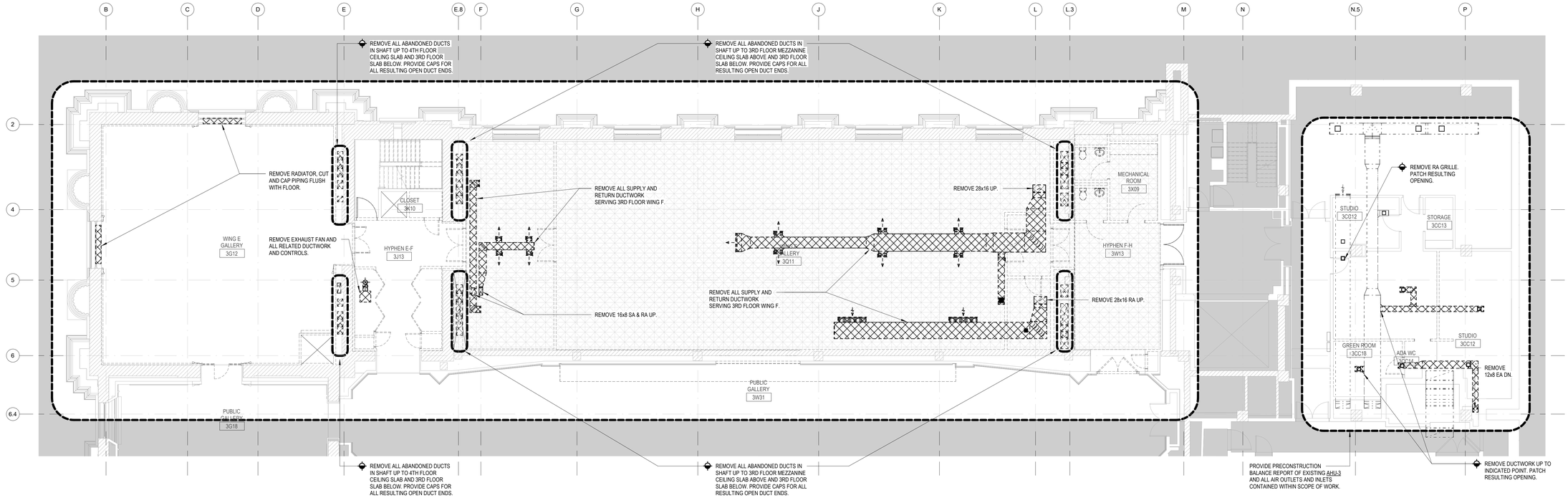
DRAWING TITLE

BASEMENT FLOOR DEMOLITION PLANS - MECHANICAL

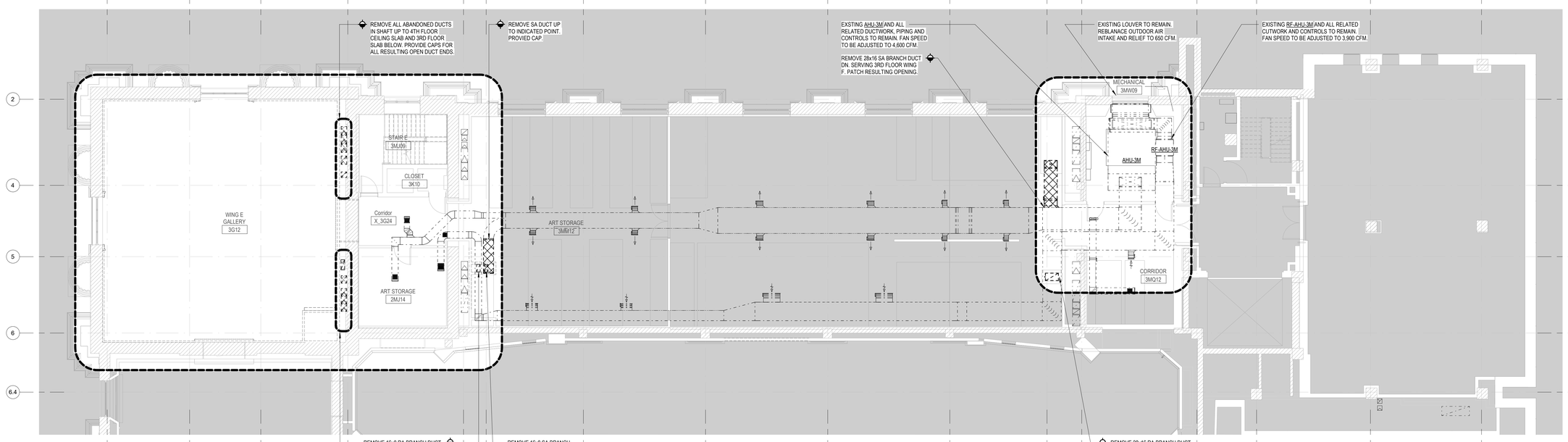
SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

MD100.00



1 03-THIRD FLOOR DEMOLITION PLAN - MECHANICAL
MD101.00 SCALE: 1/8" = 1'-0"



2 03M-THIRD FLOOR MEZZ DEMOLITION PLAN - MECHANICAL
MD101.00 SCALE: 1/8" = 1'-0"

10/17/2025 9:39:35 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

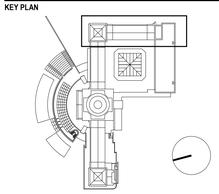
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

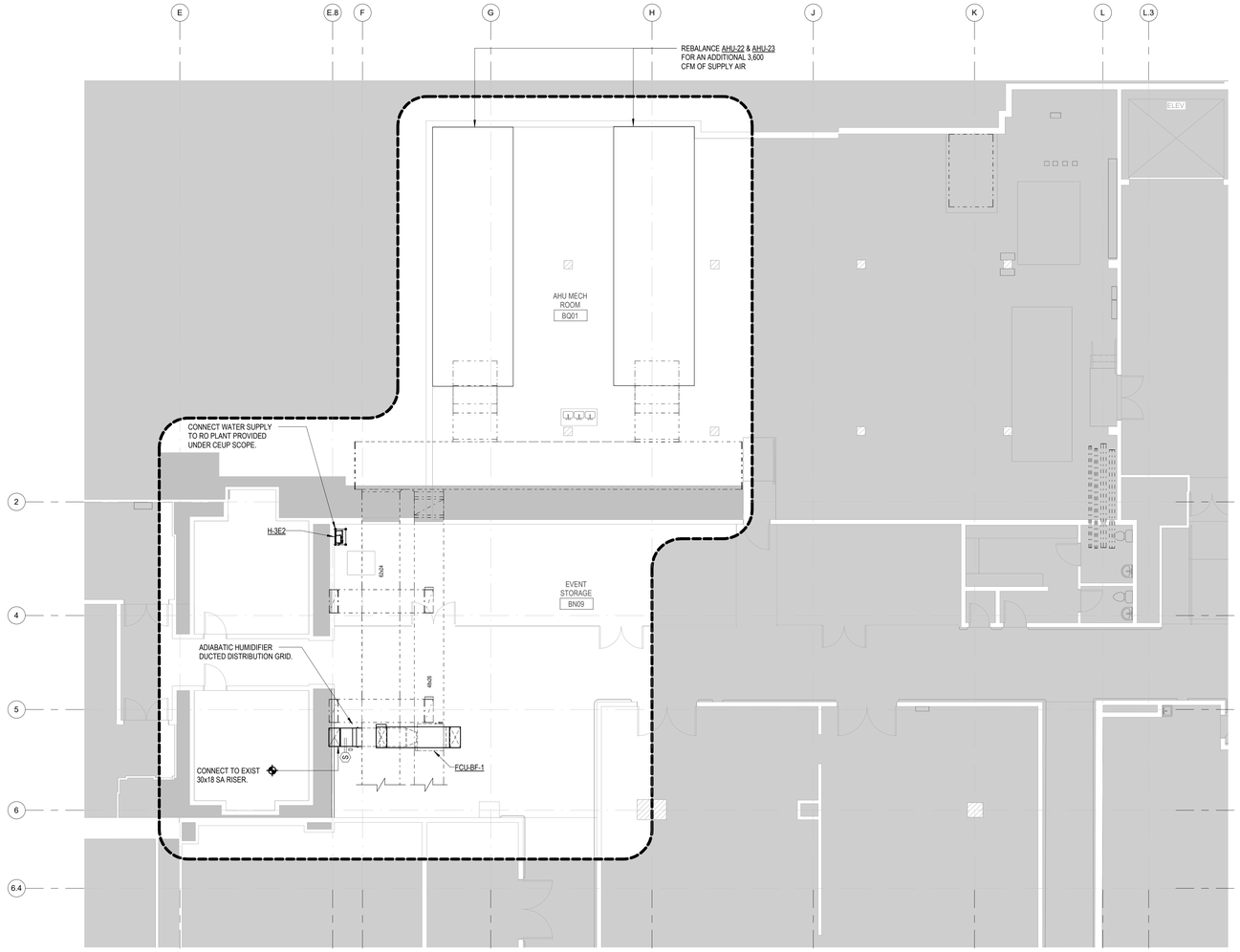
DRAWING TITLE

THIRD FLOOR AND THIRD FLOOR MEZZ DEMOLITION PLANS - MECHANICAL

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

MD101.00



1 M200.00 BASEMENT FLOOR PLAN
SCALE: 1/8" = 1'-0"

10/17/2025 9:39:37 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

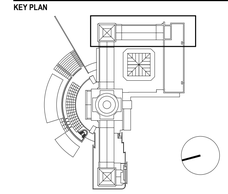
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

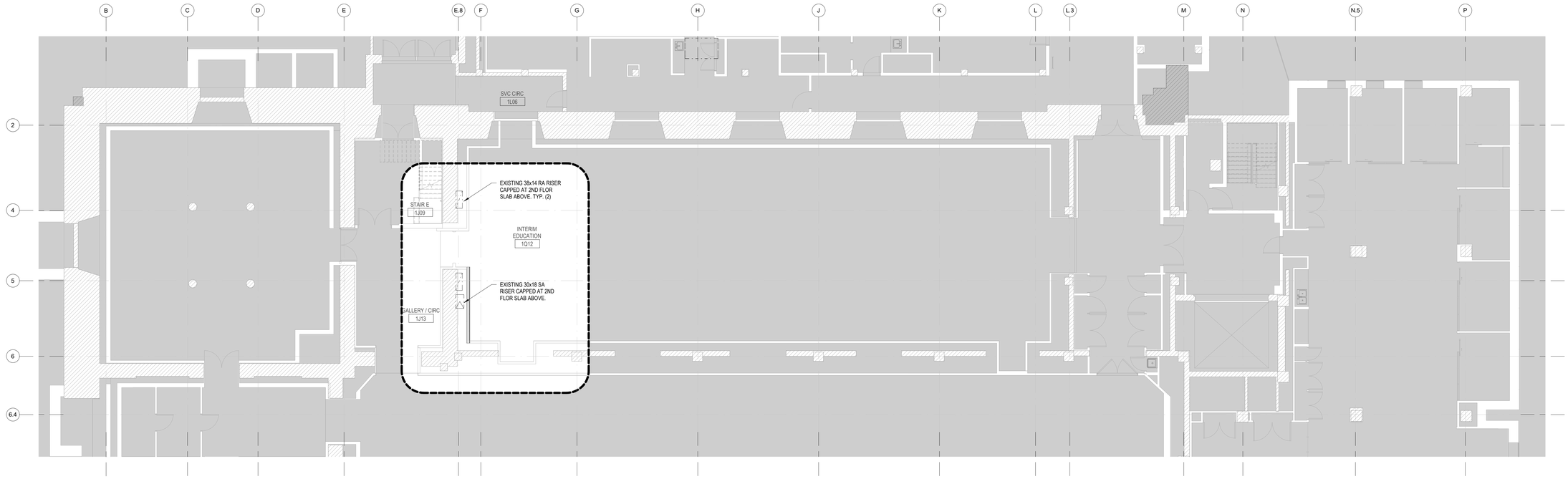
DRAWING TITLE

BASEMENT FLOOR PLAN - MECHANICAL

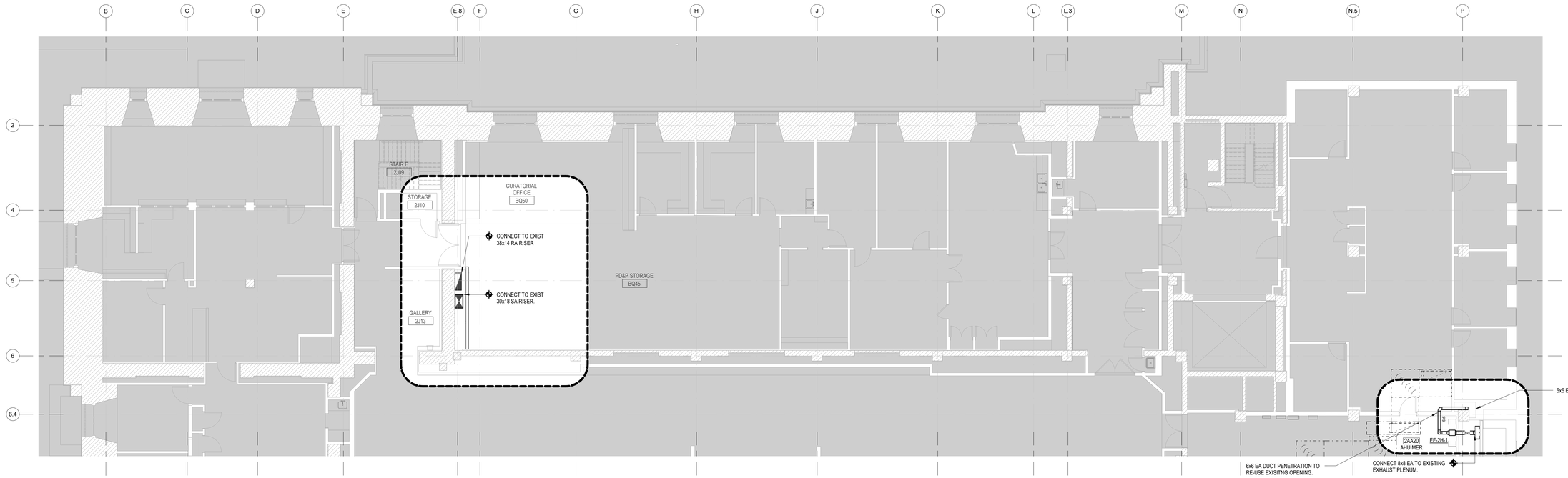
SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

M200.00



1 M201.00 FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"



2 M201.00 SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

10/17/2025 9:39:39 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

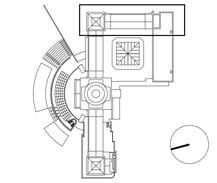
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

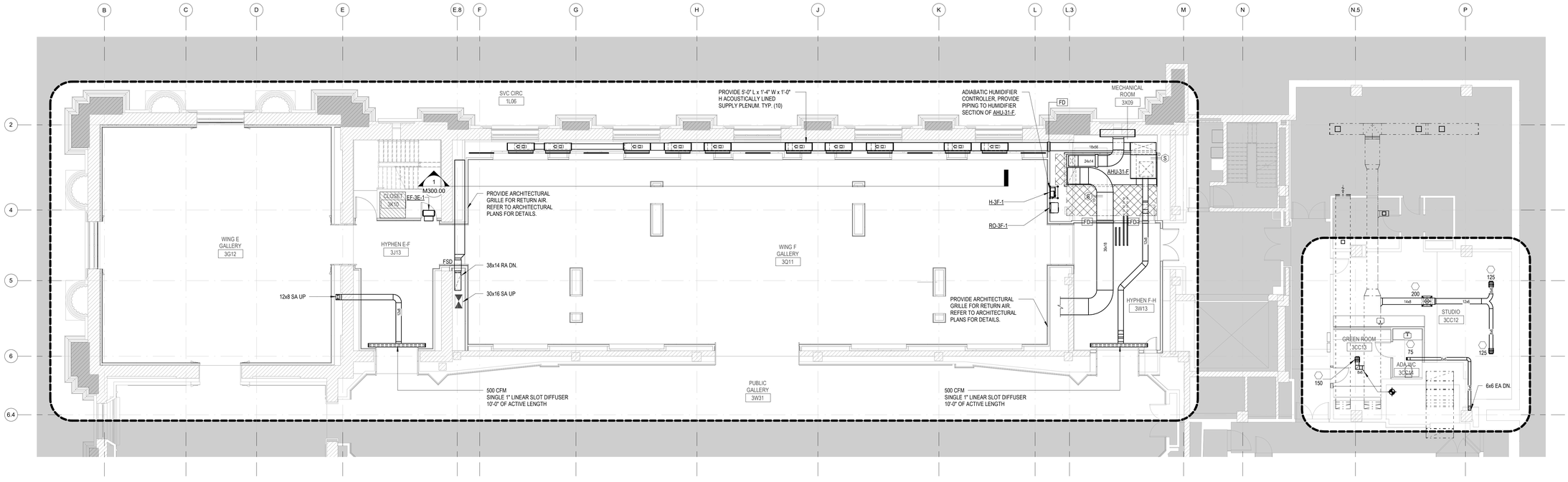
DRAWING TITLE

FIRST AND SECOND FLOOR PLANS - MECHANICAL

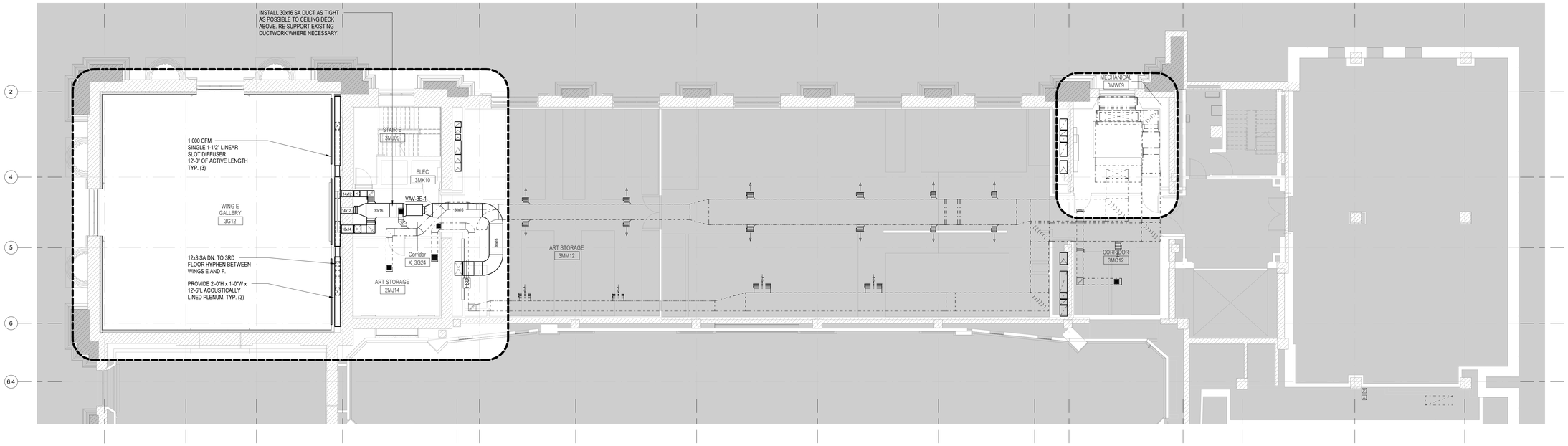
SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

M201.00



1 THIRD FLOOR PLAN
M202.00 SCALE: 1/8" = 1'-0"



2 THIRD FLOOR MEZZ PLAN
M202.00 SCALE: 1/8" = 1'-0"

10/17/2025 9:39:42 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

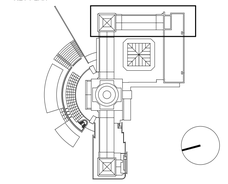
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

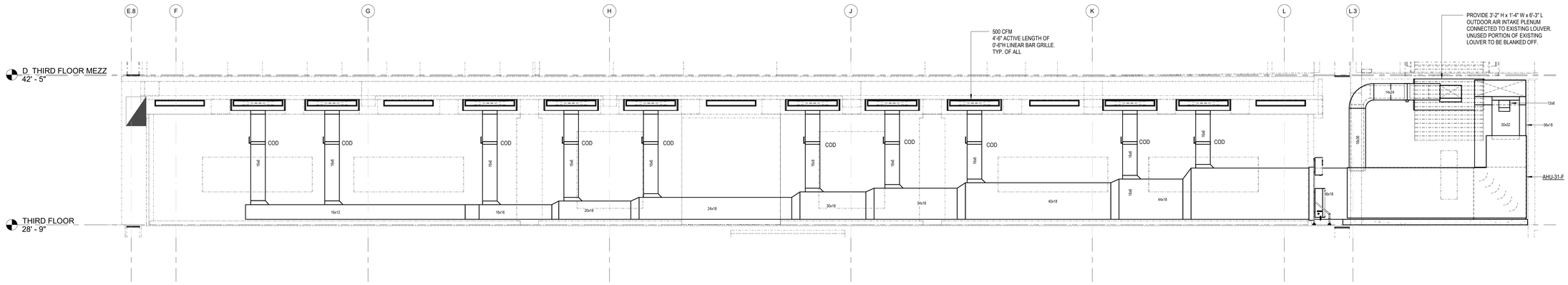
DRAWING TITLE

THIRD FLOOR AND THIRD FLOOR MEZZ PLANS - MECHANICAL

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

M202.00



1 M300.00 3RD FLOOR F WING SECTION VIEW - MECHANICAL
SCALE: 1/4" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

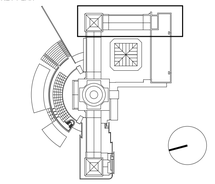
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

PART PLAN - MECHANICAL

SCALE	1/4" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

M300.00

10/17/2025 9:39:44 AM

DUCT PRESSURE CLASS

APPLICATION	PRESSURE CLASS
AHU SUPPLY AIR DUCTWORK TO RISERS (HORIZONTAL MAINS)	4" W.G.
AHU SUPPLY AIR RISERS (VERTICAL MAINS)	4" W.G.
SUPPLY AIR DUCTWORK TO TERMINAL BOX	4" W.G.
SUPPLY AIR DUCTWORK FROM MAIN AND/OR TERMINAL UNIT TO AIR OUTLET	2" W.G.
RETURN AIR DUCTWORK	2" W.G.
OUTDOOR AIR DUCTWORK	2" W.G.

NOTES:

1. PRESSURE CLASS SHALL BE DEFINED PER SMACNA THIRD EDITION - 2015.
2. DUCTWORK, JOINTS, SEALING, AND FITTINGS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SMACNA THIRD EDITION - 2015.

HVAC VIBRATION-CONTROL

EQUIPMENT	BASE	ISOLATOR*	DEFLECTION
VAV BOXES > 50LB IN WEIGHT	-	-	-
INDOOR AHU'S, FLOOR MOUNTED	4" HOUSEKEEPING PAD	NP	0.2"
PIPING WITHIN 50FT OF CONNECTION TO ANY PIECE OF EQUIPMENT WITH A MOTOR	-	HSN	1.2"
DUCTWORK IN MECH. ROOMS OR WITHIN 50FT OF CONNECTED VIBRATION-ISOLATED EQUIPMENT	-	HN	0.25"

REMARKS:

1. REFER TO SPECIFICATION SECTION 230548 - "VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT" FOR A DESCRIPTION OF EACH VIBRATION CONTROL DEVICE:
   (HN) - NEOPRENE HANGER
   (HSN) - SPRING AND NEOPRENE HANGER
   (NP) - NEOPRENE PAD.
2. SEISMIC ANCHORS, SUPPORTS AND BRACING EQUIPMENT SHALL BE PROVIDED. THE DESIGN OF ALL COMPONENTS SHALL BE SUBMITTED SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF THE PROJECT INDICATING ALL NECESSARY COMPONENT CUT SHEETS, PLAN LOCATIONS, AND CALCULATIONS FOR A COMPLETE SYSTEM.
3. PROVIDE SUPPLEMENTAL STEEL WITHIN THE ROOF CURB TO SUPPORT DUCTWORK INDEPENDENT FROM THE ROOF CURB.

* IN ADDITION TO ANY INTERNAL VIBRATION ISOLATION.
** SYSTEM SHALL BE DESIGNED TO BE 90% EFFICIENT.

HVAC PIPING/TUBING MATERIAL, JOINTS & FITTINGS

SYSTEM	PIPE SIZE	CONSTRUCTION	PIPING	FITTINGS	UNIONS	FLANGES
CHILLED WATER, GLYCOL AND COOLING BRINE SUPPLY AND RETURN, VENTS AND DRAINS	2" AND SMALLER	SOLDER JOINT CONSTRUCTION WITH THREADED ADAPTERS AS REQUIRED. 95-5 TIN/ANTIMONY SOLDER.	COPPER, TYPE L, HARD DRAWN, ANSI H23.1, ASTM B88.	CAST BRONZE OR WROUGHT COPPER, SOLDER ENDS, ANSI B16.9 OR ANSI B16.22.	BRONZE SOLDER ENDS, GROUND JOINTS, ANSI B16.19 OR ANSI B16.22.	CAST BRONZE, CLASS 150, SOLDER TYPE, ANSI B16.24.
	2 1/2" AND LARGER	BUTT WELDED CONSTRUCTION WITH FLANGED CONNECTIONS TO VALVES AND EQUIPMENT AS REQUIRED.	BLACK STEEL, SCHEDULE 40, SEAMLESS, ASTM A53, GRADE B.	STEEL, CLASS 150, BUTT WELD ENDS, ANSI B16.9, ASTM A234.	STEEL, CLASS 150, WELD TYPE, ANSI B16.5, ASTM 181, GRADE 1.	STEEL, CLASS 150, WELD TYPE, ANSI B16.5, ASTM A234, GRADE WPA.
HOT WATER, GLYCOL AND HEATING BRINE SUPPLY AND RETURN, VENTS AND DRAINS	2" AND SMALLER	SOLDER JOINT CONSTRUCTION WITH THREADED ADAPTERS AS REQUIRED. 95-5 TIN/ANTIMONY SOLDER.	COPPER, TYPE L, HARD DRAWN, ANSI H23.1, ASTM B88.	CAST BRONZE OR WROUGHT COPPER, SOLDER ENDS, ANSI B16.9 OR ANSI B16.22.	BRONZE SOLDER ENDS, GROUND JOINTS, ANSI B16.19 OR ANSI B16.22.	CAST BRONZE, CLASS 150, SOLDER TYPE, ANSI B16.24.
	2 1/2" AND LARGER	BUTT WELDED CONSTRUCTION WITH FLANGED CONNECTIONS TO VALVES AND EQUIPMENT AS REQUIRED.	BLACK STEEL, SCHEDULE 40, SEAMLESS, ASTM A53, GRADE B.	STEEL, CLASS 150, BUTT WELD ENDS, ANSI B16.9, ASTM A234.	STEEL, CLASS 150, WELD TYPE, ANSI B16.5, ASTM 181, GRADE 1.	STEEL, CLASS 150, WELD TYPE, ANSI B16.5, ASTM A234, GRADE WPA.
COOLING COIL CONDENSATE DRAINS	2" AND SMALLER	SOLDER JOINT CONSTRUCTION WITH THREADED ADAPTERS AS REQUIRED. 95-5 TIN/ANTIMONY SOLDER.	COPPER, TYPE L, HARD DRAWN, ANSI H23.1, ASTM B88.	CAST BRONZE OR WROUGHT COPPER, SOLDER ENDS, ANSI B16.9 OR ANSI B16.22.	BRONZE SOLDER ENDS, GROUND JOINTS, ANSI B16.19 OR ANSI B16.22.	USE UNIONS
	2 1/2" AND LARGER	SOLDER JOINT CONSTRUCTION WITH THREADED ADAPTERS AS REQUIRED. 95-5 TIN/ANTIMONY SOLDER.	COPPER, TYPE L, HARD DRAWN, ANSI H23.1, ASTM B88.	CAST BRONZE OR WROUGHT COPPER, SOLDER ENDS, ANSI B16.9 OR ANSI B16.22.	BRONZE SOLDER ENDS, GROUND JOINTS, ANSI B16.19 OR ANSI B16.22.	USE UNIONS

HVAC DUCT/PLENUM INSULATION

SYSTEM	INSULATION TYPE	MINIMUM INSULATION VALUES	NOMINAL DENSITY
INDOOR DUCT/PLENUM CONCEALED SA, RA, OA, EA.	MINERAL FIBER BLANKET.	2" R-6.0	3/4 LB/FT^3
	MINERAL FIBER BOARD WITH VAPOR BARRIER.	2" R-6.0	3 LB/FT^3
INDOOR DUCT/PLENUM EXPOSED SA, RA, OA, EA; LOCATED IN MECHANICAL ROOMS, OTHER NON-OCCUPIED SPACES, NON-AIR CONDITIONED SPACES, OTHER THAN ATTICS AND CRAWL SPACES, OR PASSING THROUGH AIR CONDITIONED SPACES.	MINERAL FIBER BOARD WITH VAPOR BARRIER.	1-1/2" R-6.0	3 LB/FT^3
INDOOR DUCT/PLENUM EXPOSED SA, RA, OA, EA: ALL ATTIC SPACES AND CRAWL SPACES.	MINERAL FIBER BLANKET.	2" R-8.0	1.5 LB/FT^3
	MINERAL FIBER BOARD WITH VAPOR BARRIER.	2" R-8.0	3 LB/FT^3
INDOOR DUCT/PLENUM EXPOSED SA AND RA: LOCATED WITHIN THE AIR CONDITIONED SPACE IT SERVES.	NONE; UNLESS OTHERWISE NOTED ON THE DRAWINGS OR IN THE SPECIFICATION.	-	-
DUCT LINING DUCTS/PLENUMS INSTALLED OUTDOORS, ATTICS, AND CRAWL SPACES SA AND RA: SA AND RA DUCTWORK WHERE INDICATED ON THE DRAWINGS AND IN THE SPECIFICATION, 15 FT UPSTREAM & DOWNSTREAM OF SUPPLY FANS, RETURN FANS AND 10 FT DOWNSTREAM OF TERMINAL BOXES WHETHER INDICATED OR NOT.	FIBROUS-GLASS DUCT LINER WITH CLEANABLE COMPOSITE COATING ON AIRSTREAM SIDE. METAL NOSING SHALL BE FURNISHED ON ALL LEADING EDGES. (REFER TO NOTES #1, #2, #4)	2" R-8.0	-
DUCT LINING DUCTS/PLENUMS INSTALLED IN INDOOR SPACES: EXPOSED AND CONCEALED SA OR RA DUCTWORK WHERE INDICATED ON THE DRAWINGS AND IN THE SPECIFICATION, 15 FT UPSTREAM & DOWNSTREAM OF SUPPLY FANS, RETURN FANS AND 10 FT DOWNSTREAM OF TERMINAL BOXES WHETHER INDICATED OR NOT.	FIBROUS-GLASS DUCT LINER WITH CLEANABLE COMPOSITE COATING ON AIRSTREAM SIDE. METAL NOSING SHALL BE FURNISHED ON ALL LEADING EDGES. (REFER TO NOTES #2, #4)	1-1/2" R-6.0	-
ABOVEGROUND, OUTDOOR DUCT/PLENUM CONCEALED OR EXPOSED SA, RA, OA.	MINERAL FIBER BOARD OR ELASTOMERIC (REFER TO NOTE #1)	2" R-8.0	3 LB/FT^3

1. ALL DUCTWORK INSTALLED OUTDOOR: PROVIDE A PRE-MANUFACTURED SELF ADHERING PRODUCT WITH AN UV RESISTANT, STUCCO EMBOSSED FACING. WATER VAPOR TRANSMISSION OF THE INSTALLED PRODUCT SHALL BE .020 PERMS OR LESS. PRODUCT SHALL BE SUITABLE FOR CONTINUOUS USE IN LOW TEMPERATURES OF -10°F. MANUFACTURERS SHALL BE SIMILAR TO FLEX-CLAD 400, MFM BUILDING PRODUCTS CORP. OR ALUMAGUARD 60, POLYGUARD PRODUCTS, INC.
2. DUCT LINING SHALL NOT BE INSTALLED WITHIN 10 FT UPSTREAM OR DOWNSTREAM OF A DUCT MOUNTED HUMIDIFIER DISPERSION TUBE OR DISPERSION GRID.
3. INSULATION TYPES INDICATED IN THE SCHEDULE SHALL USED UNLESS OTHERWISE INDICATED ON THE PLANS OR SPECIFICATIONS.
4. CLOSED CELL, FIBER FREE, ANTI-MICROBIAL COATED, LOW VOC CERTIFIED, MOISTURE AND MOLD RESISTANT DUCT LINING SHALL BE PROVIDED IN DUCTWORK AND EQUIPMENT WITHIN HOSPITAL AND HEALTHCARE FACILITIES AND ROOMS CLASSIFIED AS MOIST OR WET ENVIRONMENTS WHERE THIS SCHEDULE, DRAWINGS AND SPECIFICATION INDICATE DUCT LINING.
5. DUCTWORK SHALL BE FIRE WRAPPED FROM THE APPLIANCE CONNECTION TO THE TERMINATION POINT.

OA = OUTDOOR AIR DUCTWORK.
SA = SUPPLY AIR DUCTWORK. FOR DOAS: SUPPLY TO DIFFUSERS.
RA = RETURN AIR DUCTWORK. FOR DOAS: RETURN FROM GRILLES TO UNIT.
EA = EXHAUST AIR DUCTWORK. FOR DOAS: EXHAUST FROM UNIT TO OUTDOORS.
EXHAUST DOWNSTREAM OF AUTOMATIC OR BAROMETRIC DAMPERS TO OUTDOORS.
EXHAUST OF SHOWER ROOMS OR OTHER HUMID ENVIRONMENTS FROM GRILLE TO OUTDOORS.

HVAC PIPING/TUBING INSULATION

SYSTEM	LOCATION	PIPE SIZE	CELLULAR GLASS		FLEXIBLE ELASTOMERIC		FIBERGLASS	
			THICKNESS, IN.	CONDUCTIVITY, K	THICKNESS, IN.	CONDUCTIVITY, K	THICKNESS, IN.	CONDUCTIVITY, K
CONDENSATE & EQUIPMENT DRAIN, BELOW 60°F	INDOOR	ALL	-	-	1/2"	0.25	1/2"	0.23
	OUTDOOR ABOVE GRADE	NOT REQUIRED	-	-	-	-	-	-
CHILLED WATER, GLYCOL AND BRINE, 20°F TO 60°F	INDOOR	ALL	-	-	1"	0.25	1"	0.23
	OUTDOOR ABOVE GRADE	ALL	1-1/2"	0.29	1"	0.25	-	-
CONDENSER WATER	INDOOR	ALL	-	-	1"	0.25	1"	0.23
	OUTDOOR ABOVE GRADE	ALL	1-1/2"	0.29	1"	0.25	-	-
HEATING HOT WATER, BOILER FEEDWATER, STEAM BOILER CONDENSATE DRAIN, AND GLYCOL, BELOW 200°F	INDOOR	1-1/4" & SMALLER	-	-	-	-	1-1/2"	0.25
		1-1/2" & LARGER	-	-	-	-	2"	0.25
	OUTDOOR ABOVE GRADE	ALL	3"	0.33	-	-	-	-

BLANKS (-) INDICATE INSULATION TYPE SHALL NOT BE USED.

THICKNESS BASED ON INSULATION HAVING A THERMAL CONDUCTIVITY (K) NOT EXCEEDING VALUES NOTED IN TABLE ABOVE (BTU PER INCH/HR°FT²*°F). FOR ALL OTHER K VALUES CONTRACTOR TO PERFORM AND SUBMIT CALCULATIONS OUTLINED IN APPLICABLE ENERGY CONSERVATION CODE TO PROVE OTHER INSULATION THICKNESSES.

1. ALL EXPOSED INDOOR PIPING/TUBING AND FITTINGS WITHIN OCCUPIED SPACES, CORRIDORS, MECHANICAL ROOMS AND OTHER NON-CONCEALED LOCATIONS SHALL BE FITTED WITH PVC FITTING COVERS AND PVC PIPE COVERS FROM THE FLOOR LEVEL. PVC FITTING AND PIPE COVERS SHALL BE 25/50 FLAME AND SMOKE SPREAD RATED. COVERS AND JACKETING COLOR TO BE SELECTED BY ARCHITECT. PROVIDE TEMPLATE OF JACKET COLORS FOR THE ARCHITECT'S REVIEW.
2. ALL ELBOWS, CONCEALED OR EXPOSED, SHALL BE INSULATED WITH PRE-MOLDED, FACTORY FORMED FIBROUS GLASS WITH 3.5 PCF MINIMUM DENSITY AS MANUFACTURED BY HAMFAB OR APPROVED EQUAL. ALL ELBOWS, CONCEALED OR EXPOSED, SHALL BE COVERED WITH PVC FITTING COVERS. PVC FITTING COVERS SHALL BE 25/50 FLAME AND SMOKE SPREAD RATED. COVER COLOR TO BE SELECTED BY ARCHITECT. PROVIDE TEMPLATE OF JACKET COLORS FOR THE ARCHITECT'S REVIEW.
3. DIAPER AND LOOSE FILL STYLE INSULATION ON PIPE FITTINGS IS NOT ACCEPTABLE. ELBOWS WITHOUT PVC COVERS ARE NOT ACCEPTABLE.
4. INSULATE ALL COILS MOUNTED IN DUCTWORK OR TERMINAL BOXES. INSULATION THICKNESS SHALL BE EQUAL TO THE ASSOCIATED DUCT INSULATION THICKNESS.
5. PIPING 1-1/4" AND BELOW LOCATED IN PARTITIONS WITHIN CONDITIONED SPACES MAY HAVE INSULATION REDUCED BY 1" THICKNESS FROM SCHEDULED VALUES ABOVE, BUT NOT BE LESS THAN 1" IN THICKNESS.
6. ALL OUTDOOR PIPING/TUBING SHALL BE FITTED WITH A PRE-MANUFACTURED ALUMINUM JACKET PRODUCT. 0.024" ALUMINUM JACKET LOCK-ON OR SLIP-ON TYPE JACKETING TO BE COVERED WITH ACRYLIC COATING ON THE OUTER SURFACE AND A BAKED EPOXY MOISTURE BARRIER ON THE INNER SURFACE. MANUFACTURER SHALL BE SIMILAR TO CHILDERS PRODUCTS, DIVISION OF ITW; METAL JACKETING SYSTEMS. ALL EXPOSED JOINTS IN THE JACKET PRODUCT SHALL BE INSTALLED IN SUCH A WAY AS TO PREVENT THE INFILTRATION OF MOISTURE AND WATER.
7. ALL BURIED PIPING/TUBING SHALL A PRE-MANUFACTURED PIPE/INSULATION SYSTEM. REFER TO SPECIFICATIONS FOR REQUIREMENTS.

HVAC DUCT MATERIAL

APPLICATION	SUPPLY	RETURN	EXHAUST
TYPICAL (UNLESS OTHERWISE SPECIFIED)	G90 GALVANIZED STEEL	G90 GALVANIZED STEEL	G90 GALVANIZED STEEL
10 FT UPSTREAM AND DOWNSTREAM OF DUCT MOUNTED HUMIDIFIER DISPERSION TUBE OR DISPERSION GRID.	3003 H-14 ALUMINUM	3003 H-14 ALUMINUM	3003 H-14 ALUMINUM
OUTDOOR AIR INTAKE PLENUM	3003 H-14 ALUMINUM	-	-
OUTDOOR AIR	3003 H-14 ALUMINUM	-	-
EXPOSED DUCTWORK LOCATED IN AND SERVING AIR-CONDITIONED SPACES TO BE FIELD PAINTED OTHER THAN DUCTWORK LOCATED IN SPACES REQUIRED TO BE ALUMINUM.	A60 GALVANNEALED STEEL	A60 GALVANNEALED STEEL	A60 GALVANNEALED STEEL
EXPOSED DUCTWORK LOCATED IN AND SERVING CONDITIONED SPACES OTHER THAN DUCTWORK LOCATED IN SPACES REQUIRED TO BE ALUMINUM OR TO BE FIELD PAINTED.	G90 GALVANIZED STEEL	G90 GALVANIZED STEEL	G90 GALVANIZED STEEL

1. DUCT CONSTRUCTION SHALL MEET SMACNA METAL & FLEXIBLE 2005 3RD EDITION STANDARDS.

AIR HANDLING UNITS

UNIT NO	LOCATION	SERVES	VENT AIR	FAN SECTION: CFM	TOTAL SP	NUMBER OF FANS	WHEEL TYPE	FAN RPM	MAX BHP	ELECTRICAL: HP	VOLTS	PH	RPM	PREHEAT COIL: CAP MBH	AIR DATA: EAT	LAT	WATER DATA: EWT	LWT	GPM	VEL FPM	AIR PD	WATER PD	ROWS FINS
AHU-31-F	3RD FLOOR F WING MER	3RD FLOOR WING F	2,100	6,000	1.25"	2	-	-	-	10	460	-	-	194.6	50°F	80°F	140°F	120°F	20.4	471	0.15	12.8	1 / 12

UNIT NO	CHILLED WATER COIL: CAP MBH	AIR DATA: EAT	LAT	WATER DATA: EWT	LWT	GPM	VEL FPM	AIR PD	WATER PD	ROWS FINS	REHEAT COIL: CAP MBH	AIR DATA: EAT	LAT	WATER DATA: EWT	LWT	GPM	VEL FPM	AIR PD	WATER PD	ROWS FINS	PRE-FILTER	FINAL FILTER	MAKE/MODEL	REMARKS
AHU-31-F	254.5	78.3°F DB 65.7°F WB	52°F DB 51.6°F WB	44°F	56°F	12.4	448	0.74"	13.8'	8 / 10	185.5	60°F	88.5°F	140°F	120°F	18.8	471	0.14	18.5'	1 / 11	MERV-11	MERV-15	KLIMAK / CUSTOM	-

NOTES:

1. PROVIDE WITH SINGLE POINT POWER.
2. PROVIDE WITH UV LIGHTS.
3. AHU-31-F TO BE PROVIDED WITH HUMIDIFICATION SECTION, DISPERSION GRID AND HUMIDIFICATION CONTROL UNIT TO BE SUPPLIED SEPARATELY AS PER SCHEDULE.
4. FAN MOTORS TO BE INVERTER DUTY RATED FOR USE WITH VARIABLE FREQUENCY DRIVES.
5. PROVIDE VFD(S) FOR SUPPLY FAN(S) WITH THREE CONTACTOR ELECTRONIC BYPASS.

HUMIDIFIERS

UNIT NO	LOCATION	SERVES	CAP LBS/HR	NO MANFLD	RO: PRESS	ORIFICE	SUPPLY	ELECTRICAL: KW	VOLT	PH	AMPS	MAKE/MODEL	REMARKS
H-3E-2	BASEMENT	3RD FLOOR WING E	20	-	-	-	-	-	-	-	-	CONDAIR HP	HUMIDIFIER TO BE INSTALLED DOWN STREAM OF FCU-BF-1
H-3F-1	3RD FLOOR F WING MER	3RD FLOOR WING F	70	-	-	-	-	-	-	-	-	CONDAIR DL	HUMIDIFIER TO BE INSTALLED IN AHU-31-F

NOTES:

1. TUBE AND ORIFICE SIZING AND SPACING SHALL BE BY MANUFACTURER. HUMIDIFIER GRID SHALL MATCH UNIT CASING.
2. ALL HUMIDIFIERS SHALL BE HARD PIPED WITH THREADED CONNECTIONS FOR 2" AND SMALLER AND FLANGED CONNECTIONS FOR LARGER THAN 2".
3. ALL HUMIDIFIERS SHALL BE FURNISHED WITH ULTRA-SOB DISTRIBUTION AND FLOOR STAND.
4. PROVIDE H-FCU-1-E WITH INTEGRATED PUMP WITH VFD.

FANS

UNIT NO	LOCATION	AREA SERVED	TYPE	CFM	SP	MAX BHP	FAN RPM	TIP SPEED	SOUND SONES	ELECTRICAL: HP / WATTS	VOLTS	PH	RPM	MAKE/MODEL	REMARKS
EF-2H-1	2ND FLOOR H WING MER	3RD FLOOR G WING GREEN ROOM	INLINE	75	0.2"	0.01	-	-	-	1/80 HP	115	1	-	GREENHECK / SQ-60	
EF-3E-1	3K10	3RD FLOOR E WING ELEC. CLOSET	CEILING INLINE	300	0.1"	0.03	-	-	-	24 WATTS	115	1	-	GREENHECK / SP-A700-VG	

NOTES:

1. ALL FANS SHALL BE BALANCED TO AIRFLOW QUANTITY INDICATED ON PLANS AT INLETS AND OUTLETS.
2. FANS SHALL BE FURNISHED WITH SPEED CONTROLLER FOR BALANCING.
3. EF-3E-1 TO BE PROVIDED WITH INTEGRAL INLET GRILLE.

FAN COIL SCHEDULE

UNIT NO	CFM	EXT SP	COOLING COIL: MBH	EAT	LAT	EWT	LWT	GPM	PD	HEATING COIL: MBH	EAT	LAT	EWT	LWT	GPM	PD	ELECTRICAL: HP	VOLTS	PH	RPM	MAKE/MODEL	REMARKS
FCU-BF-1	3,600	-	85.2	75°F DB 63°F WB	56.4°F DB 55°F WB	45°F	55°F	16.9	4.1	197.3	70°F	119.6°F	180°F	150°F	13.4	3.4	3	208	3	-	IEC / HDY30	

NOTES:

1. -

TERMINAL BOXES

UNIT NO	OCCUPIED CFM: DESIGN	MINIMUM	HEATING CFM: MINIMUM	UNOCCUPIED MINIMUM CFM	TOTAL SP	DUCT CONN: INLET	OUTLET	ELECTRIC COIL: MBH	EAT	LAT	AIR PD	KW	VOLTS	PH	MAKE/MODEL	REMARKS
VAV-3E-1	3600	1080	1080	1080	1.5	16"	24"x18"	58.6	60°F	75°F	-	17.1	480	3	PRICE SDV5000	

NOTES:

1. PROVIDE CONTROLLERS IN ACCORDANCE WITH SEQUENCE OF OPERATION REQUIREMENTS. COORDINATE WITH ATC CONTRACTOR.
2. CONTRACTOR RESPONSIBLE FOR COORDINATING COIL CONNECTION AND CONTROL PANEL ARRANGEMENT (LEFT/RIGHT HAND)

VAV-#X.#
- TERMINAL BOX NUMBER
- BUILDING SECTION
- FLOOR LEVEL

REVERSE OSMOSIS WATER FILTER SCHEDULE

UNIT NO.	LOCATION	SERVICE	HEAD (PSI)	GPM	HEAD (FT)	ELECTRICAL: HP	VOLTAGE	PHASE	AMPS	MANUFACTURER: MODEL NO.	REMARKS
RO-3F-1	3RD FLOOR F WING MER	AHU-31-F	23.2	1	--	--	120	1	30	CONDAIR RO-E 100	

NOTES:

1. PROVIDE PRV AS NECESSARY
2. PROVIDE FACTORY PRE-FILTER
3. PROVIDE WITH FACTORY SAMPLING TAP
4. PROVIDE WITH INTEGRATED SUPPLY TANK

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

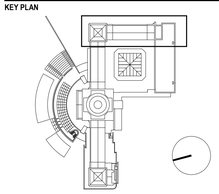
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

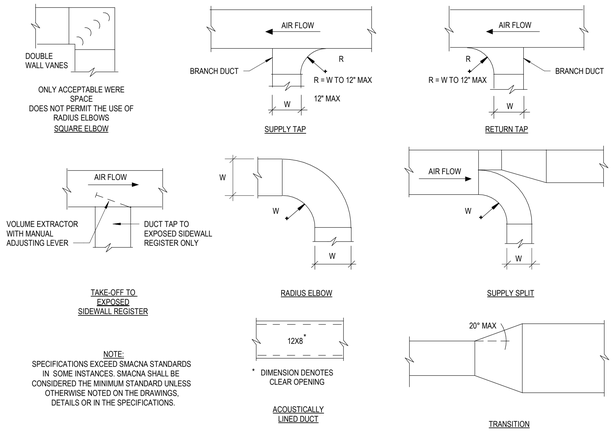
SCHEDULES - MECHANICAL

SCALE	N.T.S.
DATE	10/17/2025
PROJECT NUMBER	163A

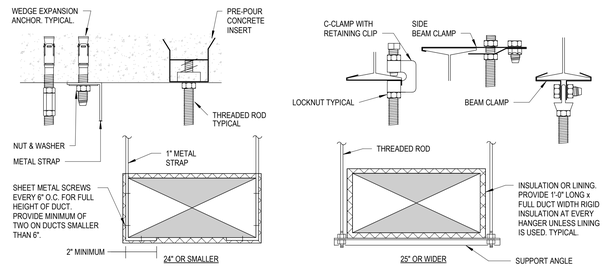
DRAWING NUMBER

M500.00

10/17/2025 9:39:47 AM



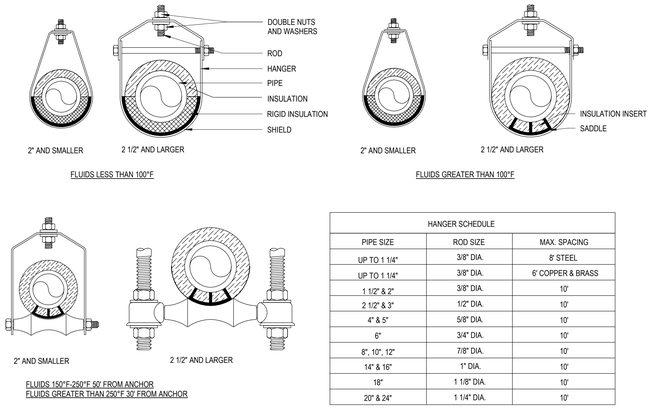
1 RECTANGULAR DUCT CONSTRUCTION DETAIL-AG
M600.00 SCALE: NOT TO SCALE



DUCT WIDTH	SUPPORT ANGLE OR EQUIV. CHANNEL	ROD DIA.	MAXIMUM SPACING	MAXIMUM AREA *
25" TO 30"	1 1/2" X 1 1/2" X 1/8"	3/8"	8'-0" O.C.	4 SQ. FT.
31" TO 42"	1 1/2" X 1 1/2" X 1/8"	3/8"	6'-0" O.C.	10 SQ. FT.
43" TO 60"	1 1/2" X 1 1/2" X 1/8"	1/2"	6'-0" O.C.	10 SQ. FT.
61" TO 84"	2" X 2" X 1/4"	1/2"	4'-0" O.C.	-
85" AND UP	2" X 2" X 1/4"	1/2"	4'-0" O.C.	-

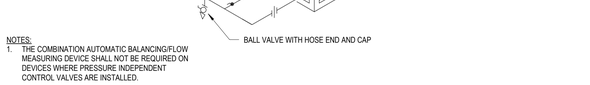
* REDUCE SPACING TO NEXT SMALLER INTERVAL IF DUCT AREA EXCEEDS MAXIMUM

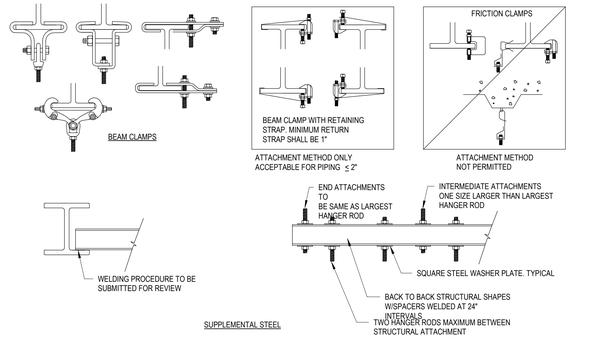
2 RECTANGULAR DUCT SUPPORT DETAIL -AG
M600.00 SCALE: NOT TO SCALE



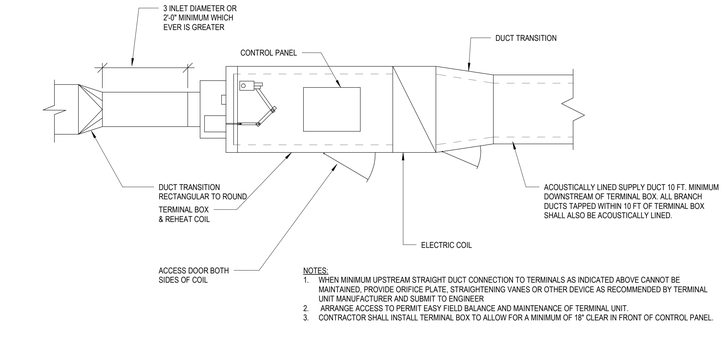
HANGER SCHEDULE		
PIPE SIZE	ROD SIZE	MAX. SPACING
UP TO 1 1/4"	3/8" DIA.	8' STEEL
UP TO 1 1/4"	3/8" DIA.	6' COPPER & BRASS
1 1/2" & 2"	3/8" DIA.	10'
2 1/2" & 3"	1/2" DIA.	10'
4" & 5"	5/8" DIA.	10'
6"	3/4" DIA.	10'
8", 10", 12"	7/8" DIA.	10'
14" & 16"	1" DIA.	10'
18"	1 1/8" DIA.	10'
20" & 24"	1 1/4" DIA.	10'

3 PIPE HANGER-AG
M600.00 SCALE: NOT TO SCALE



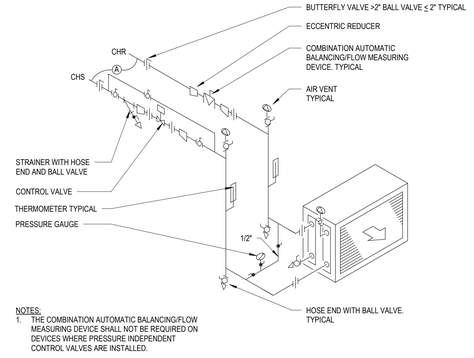


4 PIPE HANGER ATTACHMENT-AG
M600.00 SCALE: NOT TO SCALE



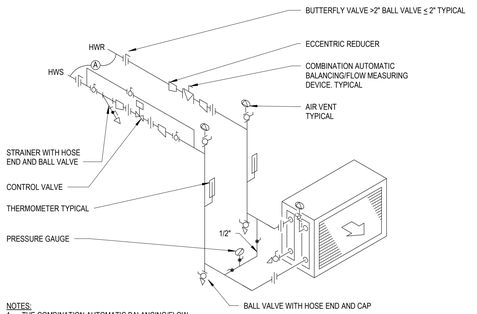
NOTES:
1. WHEN MINIMUM UPSTREAM STRAIGHT DUCT CONNECTION TO TERMINALS AS INDICATED ABOVE CANNOT BE MAINTAINED, PROVIDE ORIFICE PLATE, STRAIGHTENING VANES OR OTHER DEVICE AS RECOMMENDED BY TERMINAL UNIT MANUFACTURER AND SUBMIT TO ENGINEER
2. ARRANGE ACCESS TO PERMIT EASY FIELD BALANCE AND MAINTENANCE OF TERMINAL UNIT.
3. CONTRACTOR SHALL INSTALL TERMINAL BOX TO ALLOW FOR A MINIMUM OF 18" CLEAR IN FRONT OF CONTROL PANEL.

5 ELECTRIC REHEAT COIL - TERMINAL BOX INSTALLATION DETAIL
M600.00 SCALE: NOT TO SCALE



NOTES:
1. THE COMBINATION AUTOMATIC BALANCING/FLOW MEASURING DEVICE SHALL NOT BE REQUIRED ON DEVICES WHERE PRESSURE INDEPENDENT CONTROL VALVES ARE INSTALLED.

6 CHILLED WATER COIL 2 WAY VALVE
M600.00 SCALE: NOT TO SCALE



NOTES:
1. THE COMBINATION AUTOMATIC BALANCING/FLOW MEASURING DEVICE SHALL NOT BE REQUIRED ON DEVICES WHERE PRESSURE INDEPENDENT CONTROL VALVES ARE INSTALLED.

7 HOT WATER COIL 2 WAY VALVE
M600.00 SCALE: NOT TO SCALE

10/17/2025 9:39:50 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

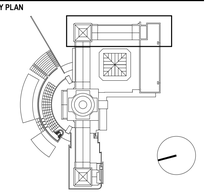
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

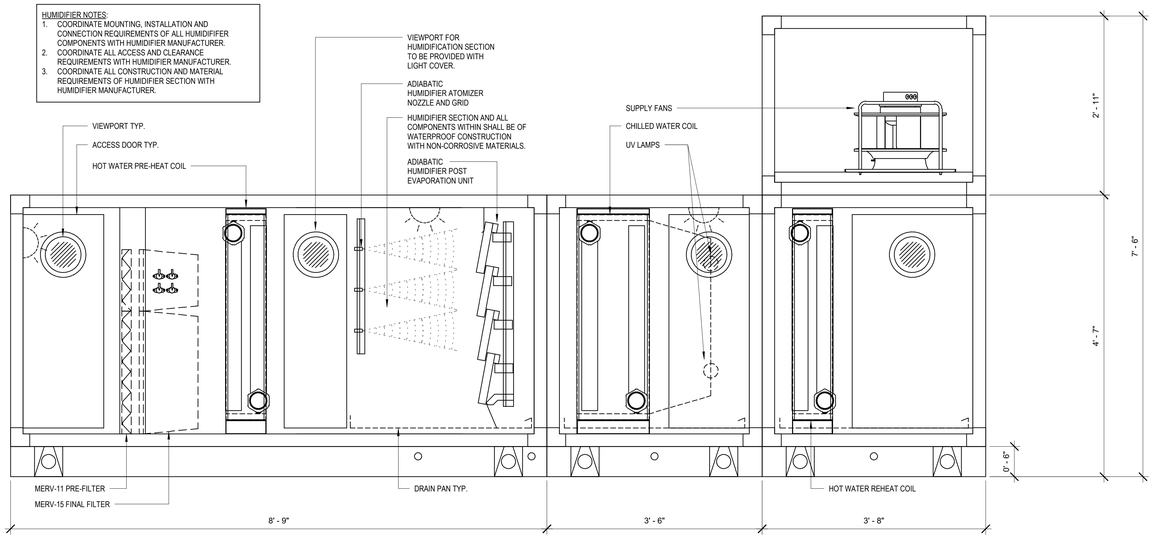
DRAWING TITLE

DETAILS - MECHANICAL

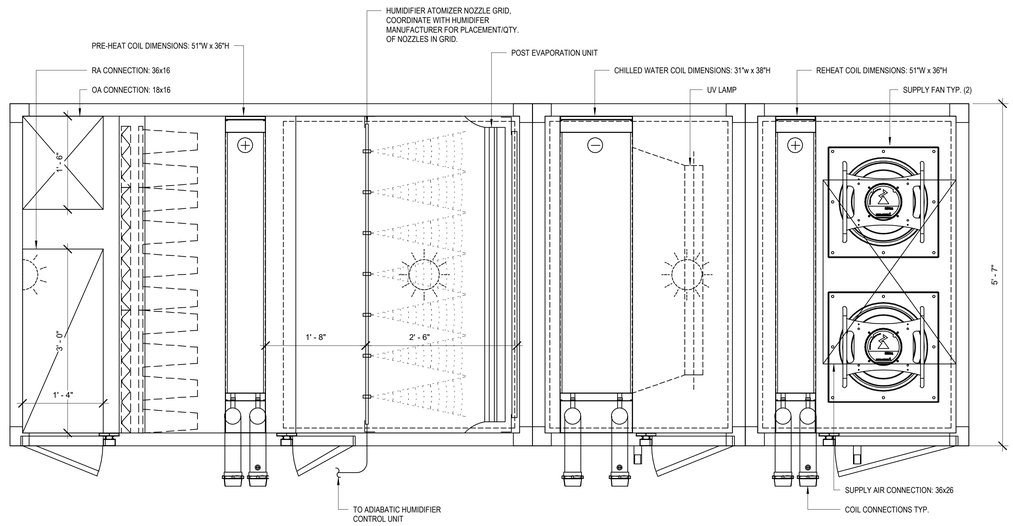
SCALE	NOT TO SCALE
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

M600.00

HUMIDIFIER NOTES:
1. COORDINATE MOUNTING, INSTALLATION AND CONNECTION REQUIREMENTS OF ALL HUMIDIFIER COMPONENTS WITH HUMIDIFIER MANUFACTURER.
2. COORDINATE ALL ACCESS AND CLEARANCE REQUIREMENTS WITH HUMIDIFIER MANUFACTURER.
3. COORDINATE ALL CONSTRUCTION AND MATERIAL REQUIREMENTS OF HUMIDIFIER SECTION WITH HUMIDIFIER MANUFACTURER.



1 M601.00 AHU-31-F SECTION VIEW
SCALE: 1" = 1'-0"



2 M601.00 AHU-31-F PLAN VIEW
SCALE: 1" = 1'-0"

10/17/2025 9:39:52 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

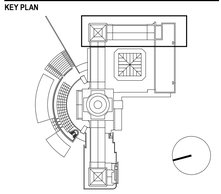
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
	10/17/25	100% DD

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

DETAILS - MECHANICAL

SCALE	1" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

M601.00

GENERAL NOTES

GENERAL:

1. WHEN A CONFLICT BETWEEN THE DRAWINGS, NOTES AND/OR SPECIFICATIONS OCCUR, THE MORE STRINGENT, AND/OR LARGER QUANTITY AND/OR MORE EXPENSIVE SHALL APPLY. THE REQUIREMENTS LISTED WITHIN NOTES OR SPECIFICATIONS SHALL BE REQUIRED, PROVIDED AND INSTALLED WHETHER SPECIFICALLY INDICATED ON THE DRAWINGS OR NOT.
2. THE DRAWINGS AND SPECIFICATIONS ARE DIVIDED INTO SECTIONS TO MEET THE NEEDS OF THE ARCHITECT, THE ENGINEERS, AND THE DESIGN CONSULTANTS. THEY ARE NOT PREPARED AS INSTRUCTIONS TO THE CONTRACTOR FOR HOW TO BUY OUT OR SUBCONTRACT THE WORK. THE CONTRACTOR IS RESPONSIBLE FOR ALL THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS, REGARDLESS OF WHERE IT IS SHOWN. FOR EXAMPLE, ELECTRICAL WORK IS SHOWN ON FP-SERIES DRAWINGS AS WELL AS ON M-SERIES DRAWINGS AND E-SERIES DRAWINGS. MISCELLANEOUS METALS AND STRUCTURAL ELEMENTS ARE SHOWN ON A-SERIES DRAWINGS AS WELL AS ON S-SERIES DRAWINGS. STRUCTURAL SUPPORTS ARE REQUIRED BY THE FP-SERIES DRAWINGS. TO AVOID OMITTING ANY COMPONENT OF THE PROJECT, REFER TO ALL THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.
3. REFER TO ARCHITECTURAL DRAWINGS, DETAILS & SPECIFICATIONS FOR EXACT LOCATIONS AND MOUNTING HEIGHTS OF ALL ELECTRICAL DEVICES.
4. ALL RECEPTACLES SHALL BE TAMPER RESISTANT TYPE.

WIRING & RACEWAY:

1. THE DRAWINGS SHOW THE GENERAL LAYOUT AND TYPICAL DETAILS. PROVIDE COMPLETE SYSTEMS. DRAWINGS ARE BASED ON THE SPECIFIED EQUIPMENT. RACEWAY LAYOUTS, BOXES, AND WIRING OF THE SYSTEMS ARE SUBJECT TO APPROVED SHOP DRAWINGS.
2. ENSURE THAT ITEMS TO BE FURNISHED FIT THE SPACE AVAILABLE. MAKE NECESSARY FIELD MEASUREMENTS TO ASCERTAIN SPACE REQUIREMENTS, INCLUDING THOSE FOR CONNECTIONS, AND PROVIDE SUCH SIZES AND SHAPES OF EQUIPMENT THAT FINAL INSTALLATION SHALL SATISFY THE INTENT OF THE DRAWINGS AND SPECIFICATIONS.
3. LOCATIONS OF OUTLETS, SWITCHES, APPLIANCES, ETC. AS SHOWN ON ELECTRICAL PLANS ARE APPROXIMATE; COORDINATE WITH ARCHITECTURAL AND MECHANICAL PLANS AND DETAILS, AND WITH JOB CONDITIONS. INSTALL SWITCHES WITH "OFF" POSITION DOWN. INSTALL RECEPTACLES WITH GROUNDING POLE IN THE UP POSITION FOR VERTICAL MOUNTING AND AT LEFT FOR HORIZONTAL MOUNTING.
4. LOCATE AND INSTALL ELECTRICAL EQUIPMENT, JUNCTION AND PULL BOXES, PANELBOARDS, SWITCHES, CONTROLS, AND OTHER APPARATUS REQUIRING MAINTENANCE, INSPECTION, AND OPERATION SO AS TO BE READILY ACCESSIBLE.

RACEWAY INSTALLATION:

1. IN ALL ARCHITECTURALLY FINISHED SPACES, CONDUITS AND CABLES SHALL BE RUN CONCEALED IN HUNG OR FURRED CEILINGS, SLABS, MASONRY, AND PARTITIONS UNLESS OTHERWISE INDICATED. SAW CUTTING AND FINISHED PATCHING SHALL BE REQUIRED IN EXISTING SLABS AND MASONRY WALLS. IN UNFINISHED SPACES, RACEWAYS MAY BE RUN EXPOSED.
2. UNLESS OTHERWISE INDICATED, EXACT ROUTING OF RACEWAYS SHALL BE DETERMINED BY THE CONTRACTOR TO SUIT PROJECT REQUIREMENTS AND FIELD CONDITIONS.
3. PROVIDE SEPARATE RACEWAYS, JUNCTION BOXES, PULL BOXES AND WIREWAYS FOR ALL EMERGENCY SYSTEM WIRING.

WIRING INSTALLATION:

1. DO NOT USE WIRE SMALLER THAN NO. 12 AWG FOR ANY POWER OR LIGHTING CIRCUIT. USE LARGER SIZES WHERE INDICATED, AS REQUIRED BY CODES, AND AS FOLLOWS:

   30 AMPERE CIRCUIT: NO. 10
   40 AMPERE CIRCUIT: NO. 8
   50 AMPERE CIRCUIT: NO. 6
   60 AMPERE CIRCUIT: NO. 4

   A. MINIMUM HOMERUN AND BRANCH CIRCUIT WIRING SIZES AND MAXIMUM HOMERUN CONDUIT FILL FOR 120 VOLT, 20 AMPERE CIRCUITS SHALL BE AS FOLLOWS:

LENGTH	CIRCUIT WIRE SIZE	HOME RUN WIRE SIZE	CONDUIT SIZE (8 WIRES/CONDUIT)
0' TO 50'	#12	#12	3/4"
51' TO 100'	#12	#10	3/4"
101' TO 200'	#10	#8	1"

   GREATER THAN 200' - REQUEST DIRECTION FROM ENGINEER.

   NOTE: PROVIDE DERATING PER CODE WHEN INSTALLING MORE THAN 3 CURRENT CARRYING CONDUCTORS IN CONDUIT.

   B. HOME RUNS AND BRANCH CIRCUIT WIRING FOR 277 VOLT, 20 AMPERE CIRCUITS SHALL BE AS FOLLOWS:

LENGTH	CIRCUIT WIRE SIZE	HOME RUN WIRE SIZE	CONDUIT SIZE (8 WIRES/CONDUIT)
0' TO 100'	#12	#12	3/4"
100' TO 200'	#12	#10	3/4"

   GREATER THAN 200' - REQUEST DIRECTION FROM ENGINEER.

   NOTE: PROVIDE DERATING PER CODE WHEN INSTALLING MORE THAN 3 CURRENT CARRYING CONDUCTORS IN CONDUIT.

2. DO NOT USE WIRE SMALLER THAN NO. 14 AWG FOR CONTROL CIRCUITS UNLESS OTHERWISE RECOMMENDED BY THE EQUIPMENT OR SYSTEM MANUFACTURER ON WIRING SHOP DRAWINGS, AND SO APPROVED BY THE ENGINEER.
3. WHERE GREATER THAN THREE (3) CURRENT-CARRYING CONDUCTORS ARE INSTALLED IN ANY ONE CONDUIT OR CABLE, CONDUCTORS MUST BE DERATED AND SIZES INCREASED, IF NEEDED, TO ACCOMMODATE CONDUCTOR DERATING AS REQUIRED BY NEC ARTICLE 310.
4. CONDUCTORS SHALL BE COMPLETELY INSTALLED AND CONNECTED. PROVIDE ALL TERMINALS, LUGS, AND CONNECTORS TO SUIT THE APPLICATION, AND IN COMPLIANCE WITH EQUIPMENT MANUFACTURERS' RECOMMENDATIONS.
5. UNDER NO CIRCUMSTANCES SHALL ANY SWITCH OR CIRCUIT BREAKER BREAK A NEUTRAL CONDUCTOR.
6. THE CIRCUIT NUMBERS INDICATED ON THE DRAWINGS ARE INTENDED AS A GUIDE FOR PROPER CONNECTION OF CIRCUITS AT PANELBOARDS; HOWEVER, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE FINAL CIRCUITING WORK FULFILLS THE FOLLOWING CONDITIONS:

   A. LOADS ON PANELBOARD BUSSES SHALL BE PHASE-BALANCED AS EVENLY AS POSSIBLE.

7. PROVIDE SEPARATE NEUTRALS FOR EACH CIRCUIT. WHERE MULTIPLE CIRCUITS ARE INSTALLED IN THE SAME RACEWAY OR ENCLOSURE, IDENTIFY NEUTRALS WITH CORRESPONDING BRANCH CIRCUIT PHASE CONDUCTOR NUMBERS.

GROUNDING INSTALLATION:

1. EQUIPMENT GROUNDING

A. INSTALL AN INSULATED GROUND CONDUCTOR, RUN IN THE RACEWAY WITH THE PHASE CONDUCTORS, FOR EACH FEEDER SERVING: PANELBOARDS, LIGHTING DIMMER BOARDS, MOTOR CONTROL CENTERS, MOTORS, EQUIPMENT AND APPLIANCES UNLESS OTHERWISE NOTED.

B. INCLUDE AN INSULATED GROUND CONDUCTOR IN ALL CONDUIT RUNS CONTAINING SECTIONS OF FLEXIBLE CONDUIT UNLESS OTHERWISE NOTED.

C. INCLUDE AN INSULATED GROUND CONDUCTOR IN ALL BRANCH CIRCUIT RACEWAYS OR CABLES UNLESS OTHERWISE NOTED.

2. TELECOMMUNICATIONS CLOSET GROUNDING

A. PROVIDE A #4 AWG GROUND CONDUCTOR RISER IN 1" EMT CONDUIT TO EACH TELECOMMUNICATIONS CLOSET GROUNDING BUSBAR (TGB) FROM THE TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB), AND TO MAIN SERVICE GROUNDING ELECTRODE SYSTEM.

B. CONNECT THE GROUND RISER TO TMGB AND TGB'S PER ANSI/TIA/EIA STANDARD 607-B - 2011.

C. PROVIDE ADDITIONAL #4 AWG GROUND CABLE CONNECTIONS FROM EACH TMGB AND TGB TO THE CLOSEST BUILDING STEEL AND TO THE GROUND BUS IN THE ELECTRICAL PANELBOARD FEEDING THE OUTLETS AND EQUIPMENT IN THE ASSOCIATED TELECOMMUNICATIONS ROOM/CLOSET.

3. GROUND EACH TELECOMMUNICATIONS, FIRE ALARM, SECURITY, AND BMS SYSTEM EQUIPMENT AND CONTROL PANEL WITHIN EACH TELECOMMUNICATIONS ROOM/CLOSET TO THE ASSOCIATED CLOSET TMGB OR TGB WITH A #4 AWG CONDUCTOR PER ANSI/TIA/EIA STANDARD 607-B - 2011.

SHORT CIRCUIT, COORDINATION, AND ARC FLASH STUDIES

1. CONTRACTOR SHALL PROVIDE A SHORT CIRCUIT, ARC FLASH, AND COORDINATION STUDY (REFER TO SPECIFICATIONS). TO ACCURATELY PERFORM THE STUDIES, STUDIES SHALL INCLUDE, BUT ARE NOT LIMITED TO, THE EXISTING UTILITY TRANSFORMER, EXISTING GENERATOR, EXISTING SWITCHBOARDS, EXISTING PANELBOARDS, EXISTING BUSWAYS, EXISTING CONDUIT AND WIRE, AND EXISTING MOTOR LOADS WHERE INDICATED ON SINGLE LINE / RISER DIAGRAM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING EQUIPMENT MANUFACTURERS, THE UTILITY COMPANY, AND OWNER FOR INFORMATION ON EXISTING EQUIPMENT REQUIRED BY THE STUDIES.

PANELBOARD NOMENCLATURE CODING:

NOTE: PANELBOARD NOMENCLATURE CODING SHALL BE CONFIRMED WITH FACILITY MANAGEMENT.

PPM-1-1

- SEQUENCE # (IF MORE THAN ONE ON FLOOR)
- FLOOR DESIGNATION
- PANELBOARD TYPE

(M)DP = (MAIN) DISTRIBUTION PANELBOARD
PPM(E)(S) = (EMER.) (STANDBY) MECHANICAL POWER PANELBOARD
RP(E)(S) = (EMER.) (STANDBY) RECEPTACLE PANELBOARD
LPL(E)(S) = (EMER.) (STANDBY) 208/120V LIGHTING PANELBOARD
LPH(E)(S) = (EMER.) (STANDBY) 480/277V LIGHTING PANELBOARD
EQ(E)(S) = (EMER.) (STANDBY) EQUIPMENT PANELBOARD
CR = CRITICAL EQUIPMENT PANELBOARD
AP = APARTMENT PANELBOARD
INV = EMERGENCY LIGHTING INVERTER

MECHANICAL EQUIPMENT WIRING:

1. UNLESS OTHERWISE INDICATED OR SPECIFIED HEREIN, ALL MOTORS, MOTOR STARTERS, MOTOR CONTROLLERS, VARIABLE SPEED/FREQUENCY DRIVES, AND ASSOCIATED CONTROL DEVICES ARE FURNISHED UNDER OTHER DIVISIONS AND INSTALLED UNDER THIS DIVISION. COORDINATE INSTALLATION AND LOCATIONS WITH OTHER DIVISION CONTRACTORS.
2. POWER WIRING FROM THE INDICATED SOURCE TO THE STARTER/CONTROLLER/DRIVE UNIT, AND FROM THE STARTER/CONTROLLER/DRIVE UNIT TO THE MOTOR, INCLUDING ANY LOCAL DISCONNECT SWITCHES PROVIDED AND INSTALLED BY THIS DIVISION, AND ALL ASSOCIATED LUGS, TERMINALS, AND CONNECTIONS, IS THE WORK OF THIS DIVISION.
3. CONTROL CIRCUIT WIRING IS GENERALLY FURNISHED AND INSTALLED UNDER OTHER DIVISIONS, EXCEPT THAT ANY SUCH WIRING SHOWN ON ELECTRICAL DRAWINGS IS WORK OF THIS DIVISION.
4. PROVIDE 120 VOLT POWER TO ALL TEMPERATURE CONTROL PANELS (TCP'S) SUPPLIED AND INSTALLED BY DIVISION 23. USE EMERGENCY POWER SOURCES WHEN AVAILABLE. COORDINATE ALL POWER REQUIREMENTS AND PANEL LOCATIONS WITH DIVISION 23 TEMPERATURE CONTROLS CONTRACTOR.
5. COOPERATE AND COORDINATE WITH THE OTHER TRADES IN THE INSTALLATION, CONNECTION, AND TESTING OF MECHANICAL EQUIPMENT. PERFORM WORK OF THIS SECTION IN ACCORDANCE WITH EQUIPMENT MANUFACTURERS' INSTRUCTIONS.
6. EACH ELECTRICAL BRANCH CIRCUIT IDENTIFIED ON DRAWINGS FOR TERMINAL BOXES SHALL BE USED TO ENERGIZE UP TO 20 TERMINAL BOXES. PROVIDE CONDUIT AND WIRE FROM JUNCTION BOX SHOWN ON DRAWINGS TO EACH TERMINAL BOX. SUPPLEMENT WITH ADDITIONAL BRANCH CIRCUITS AS REQUIRED. REFER TO M-SERIES DRAWINGS FOR ALL TERMINAL BOX LOCATIONS AND DETAILS.
7. EACH ELECTRICAL BRANCH CIRCUIT IDENTIFIED FOR SMOKE OR FIRE SMOKE DAMPERS ON DRAWINGS SHALL BE USED TO ENERGIZE UP TO 20 SMOKE AND FIRE SMOKE DAMPERS. PROVIDE CONDUIT AND WIRE FROM JUNCTION BOX SHOWN ON DRAWINGS TO EACH DAMPER. REFER TO M-SERIES DRAWINGS FOR ALL SMOKE AND FIRE SMOKE DAMPER LOCATIONS.
8. REFER TO M-SERIES DRAWINGS FOR ALL DUCT SMOKE DETECTOR LOCATIONS. FURNISH AND INSTALL ALL DUCT SMOKE DETECTORS SHOWN, U.O.N. ALL DUCT SMOKE DETECTORS SHALL BE CONNECTED TO THE FIRE ALARM SYSTEM. PROVIDE CONDUIT AND WIRE TO EACH DETECTOR AS IDENTIFIED ON FIRE ALARM RISER DIAGRAM.

COORDINATION DRAWINGS:

1. DEVELOP AND SUBMIT COORDINATION DRAWINGS AS OUTLINED.

A. SHEET METAL, PLUMBING AND FIRE PROTECTION SHOP DRAWINGS THAT HAVE BEEN COORDINATED WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO ENGINEER FOR REVIEW. DRAWINGS MUST BE RETURNED FROM ENGINEER EITHER "REVIEWED" OR "FURNISH AS CORRECTED" PRIOR TO BEING USED AS BASIS FOR COORDINATION DRAWINGS.

B. AFTER SHEET METAL AND PIPING DRAWINGS HAVE BEEN REVISED PER ENGINEERS COMMENTS, REPRODUCIBLE COPIES SHALL BE SENT TO THE TRADES IN THE FOLLOWING SEQUENCE FOR THE INCLUSION OF THEIR WORK:

-MECHANICAL SHEET METAL
-PLUMBING PIPING
-MECHANICAL PIPING
-SPRINKLER PIPING
-ELECTRICAL WORK

2. AFTER ALL TRADES HAVE INCLUDED THEIR WORK ON THE COORDINATION DRAWING AND NOTED CONFLICTS, ALL TRADES SHALL MEET TO RESOLVE CONFLICTS AND AGREE TO ACCEPTABLE SOLUTIONS. EACH TRADE SHALL SIGN COORDINATION DRAWINGS. ITEMS NOT SHOWN ON COORDINATION DRAWING IS RESPONSIBILITY OF OMITTING CONTRACTOR AND CONTRACTOR IS SUBJECT TO ADDITIONAL COSTS INCURRED BY OTHER TRADES.

3. THE ARCHITECT AND ENGINEER ARE NOT PART OF THE COORDINATION DRAWING PROCESS. THE ENGINEER WILL PROVIDE ASSISTANCE FOR NOTED CONFLICTS ONLY. COORDINATION DRAWINGS ARE NOT TO BE CONSIDERED PIPING OR DUCT SHOP DRAWINGS. THE CONTRACTOR IS REQUIRED TO SUBMIT INDIVIDUAL PIPING AND DUCTWORK SHOP DRAWINGS FOR REVIEW BY THE ENGINEER. PIPING AND DUCTWORK SHOP DRAWINGS SHALL FOLLOW THE DESIGN INTENT OF THE CONTRACT DOCUMENTS.

4. SUBMIT FINAL SIGNED COORDINATION DRAWING TO ENGINEER FOR REVIEW. ENGINEER WILL REVIEW COORDINATION DRAWINGS FOR GENERAL ARRANGEMENT AND FOR NOTED CONFLICTS ONLY. SPECIFIC INSTALLATION REQUIREMENTS WILL BE REVIEWED ONLY IN INDIVIDUAL TRADE SHOP DRAWINGS.

5. ANY WORK FABRICATED OR INSTALLED PRIOR TO SIGN OFF BY ALL TRADES WHICH IS DEEMED TO BE IN CONFLICT WITH COORDINATION DRAWINGS SHALL BE REMOVED AND RE-INSTALLED IN CONFORMANCE WITH COORDINATION DRAWINGS.

6. EACH CONTRACTOR (MENTIONED ABOVE) IS RESPONSIBLE FOR THE COORDINATION OF HIS SUB- CONTRACTORS.

7. THE OVERALL COORDINATION OF THE COORDINATION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER IS NOT RESPONSIBLE FOR THE COORDINATION PROCESS. THE ENGINEER WILL RESPOND TO QUESTIONS THAT ARISE FROM THE COORDINATION PROCESS. DRAWINGS SUBMITTED WILL BE REVIEWED FOR CLEARLY IDENTIFIED CONFLICTS ONLY. SOLUTIONS TO CONFLICTS WILL NOT BEAR ADDITIONAL COST.

AS BUILT DRAWINGS:

1. PROVIDE A COMPLETE SET OF AS-BUILT DRAWINGS REFLECTING AS INSTALLED CONDITIONS. AS-BUILT DRAWINGS SHALL INDICATE ALL INSTALLED CONDITIONS OF SYSTEMS WITHIN THIS DISCIPLINE. DRAWINGS SHALL BE OF SIMILAR SCALE AS THE CONSTRUCTION DOCUMENTS AND INCLUDE DETAILS AS NECESSARY TO CLEARLY REFLECT THE INSTALLED CONDITION. DRAWINGS SHALL BE BOUND IN A COMPLETE AND CONSECUTIVE SET. SUPPLEMENTAL SKETCHES AND LOOSE PAPERWORK WILL NOT BE ACCEPTABLE AND WILL BE RETURNED FOR REVISION. THE CONTRACTOR SHALL COMPLY WITH THE ENGINEERS COMMENTS TO PRODUCE A CLEAR AND CONCISE SET OF DRAWINGS. DRAWINGS SHALL BE SUBMITTED IN BOTH HARD COPY AND ELECTRONIC (AUTO-CAD VERSION AS REQUIRED BY THE OWNER) VERSION. NUMBER OF COPIES OF EACH AS REQUESTED BY THE OWNER.
2. PROVIDE "AS-BUILT DRAWINGS" INDICATING IN A NEAT AND ACCURATE MANNER A COMPLETE RECORD OF ALL REVISIONS OF THE ORIGINAL DESIGN OF THE WORK. INDICATE THE FOLLOWING INSTALLED CONDITIONS:

A. INCLUDE ALL CHANGES AND AN ACCURATE RECORD, ON REPRODUCTIONS OF THE CONTRACT DRAWINGS OR APPROPRIATE SHOP DRAWINGS, OF ALL DEVIATIONS, BETWEEN THE WORK SHOWN AND WORK INSTALLED.

B. EQUIPMENT LOCATIONS (EXPOSED AND CONCEALED), DIMENSIONED FROM PROMINENT BUILDING LINES.

C. APPROVED SUBSTITUTIONS, CONTRACT MODIFICATIONS, AND ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

D. CONTRACT MODIFICATIONS, ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

E. SUBMIT FOR REVIEW BOUND SETS OF THE REQUIRED DRAWINGS, MANUALS AND OPERATING INSTRUCTIONS.

F. SUBMIT A COMPLETE MAINTENANCE MANUAL OF ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT.

G. SUBMIT AND PROVIDE TO OWNER AN 11" X 17" LAMINATED RISER DIAGRAM / SINGLE LINE DIAGRAM INDICATING ALL ELECTRICAL EQUIPMENT AMPACITIES AND VOLTAGES.

DEMOLITION AND REMOVALS

1. THE EXISTING FACILITY WILL BE OCCUPIED AND IN OPERATION DURING THE PERFORMANCE OF THE WORK.
2. WHEN NECESSARY TO TEMPORARILY DISCONNECT ANY EXISTING FEEDER OR BRANCH CIRCUIT SUPPLYING OCCUPIED FACILITIES, CONFER WITH THE OWNER, AND SCHEDULE A MUTUALLY AGREEABLE PERIOD OF INTERRUPTION.
3. WHERE REPLACEMENT, RELOCATION OR MODIFICATION OF EXISTING EQUIPMENT IS INDICATED, PROVIDE AND MAINTAIN ALL TEMPORARY FEEDERS, CONNECTIONS, CIRCUIT PROTECTION, AND ANY OTHER MATERIALS AND APPURTENANCES REQUIRED TO MAINTAIN SERVICES TO OCCUPIED AREAS.
4. NO WORK SHALL BE LEFT INCOMPLETE, NOR ANY HAZARDOUS SITUATION CREATED, WHICH WILL AFFECT THE LIFE OR SAFETY OF THE PUBLIC AND/OR BUILDING OCCUPANTS. AT NO TIME SHALL THE WORK INTERFERE WITH OR CUT OFF ANY OF THE EXISTING SERVICES WITHOUT THE OWNER'S PRIOR WRITTEN PERMISSION.
5. THE OWNER RESERVES THE RIGHT TO OPERATE ALL EXISTING ELECTRICAL AND MECHANICAL EQUIPMENT NOT INCLUDED IN THIS WORK, AND TO PERFORM ALL REQUIRED SERVICING AND REPAIRS TO SAME, AT ALL TIMES.
6. IT IS REQUIRED THAT THE WORK INDICATED AND/OR SPECIFIED SHALL BE CARRIED OUT WITH MINIMUM INTERFERENCE TO THE ESTABLISHED OPERATIONS OF THE BUILDING.
7. REMOVE, ABANDON, REROUTE, OR RELOCATE ANY CONDUIT, WIRING, LIGHTING FIXTURES, OUTLETS, AND OTHER ELECTRICAL ITEMS, WHICH ARE LAID BARE IN THE COURSE OF, OR INTERFERE WITH, THE ALTERATIONS. REMOVE ALL EXPOSED OUTLETS, CONDUIT, AND BRANCH CIRCUIT WORK, WHICH INTERFERE WITH THE ALTERATIONS.
8. IT IS THE INTENTION OF THESE SPECIFICATIONS TO PROVIDE FOR THE CONTINUANCE OF ALL ELECTRICAL SERVICES PRESENTLY INSTALLED IN THE UNALTERED AREAS. PROVIDE ALL CONDUIT, WIRING, AND DEVICES NECESSARY TO MAINTAIN SERVICES TO THESE AREAS.
9. COMPARE THE PLANS WITH THE EXISTING CONDITIONS TO DETERMINE THE AMOUNT OF WORK AFFECTED. REMOVE ALL UNUSED EXPOSED CIRCUIT WORK, OUTLETS, FIXTURES AND THE LIKE NOT REQUIRED BY THE ALTERATIONS.
10. ALL MATERIALS REQUIRED TO BE REMOVED AND NOT REINSTALLED UNDER THIS DIVISION OF THE WORK, UNLESS OTHERWISE INDICATED, SHALL BECOME THE PROPERTY OF THE CONTRACTOR, AND SHALL BE REMOVED FROM THE SITE.
11. WHERE FEEDERS AND BRANCH CIRCUITS OR DEVICES AND EQUIPMENT ARE INDICATED TO BE REMOVED, CONDUCTORS AND CABLES SHALL BE COMPLETELY REMOVED BACK TO THEIR SOURCE, OR IF APPLICABLE, BACK TO UPSTREAM ETR DEVICE. EXPOSED OR ACCESSIBLE CONDUITS SHALL BE REMOVED COMPLETELY; CONDUITS EMBEDDED IN CONCRETE OR MASONRY SHALL BE CUT OFF FLUSH AND THE SURFACE PATCHED SMOOTH AND LEVEL.
12. WHERE DEVICES AND/OR EQUIPMENT ARE INDICATED TO BE RELOCATED, CONDUCTORS AND RACEWAY SHALL BE EXTENDED TO THE NEW LOCATION AND RECONNECTED TO PROVIDE A COMPLETE WORKING SYSTEM. IF THERE ARE ASSOCIATED DEVICES WITH THE RELOCATED EQUIPMENT THEY SHALL BE RELOCATED AS WELL, UNLESS OTHERWISE NOTED, AND CONNECTED INTO THE SYSTEM.
13. REMOVED MATERIALS SHALL BE DISPOSED OF USING LICENSED CARTING SERVICE.
14. HAZARDOUS MATERIALS - CONTAINING PCB'S (BALLASTS), AND THE LIKE SHALL BE DISPOSED OF BY AN EPA APPROVED, LICENSED DISPOSAL SERVICE. CONTRACTOR SHALL OBTAIN AND HAVE ON FILE, AFFIDAVIT, AND RECEIPTS STATING HOW AND WHERE THE WASTE WAS DISPOSED OF OR CONVERTED.
15. CONTRACTOR SHALL REMOVE ALL ELECTRICAL EQUIPMENT IN OR ON WALLS THAT ARE TO BE REMOVED - MAINTAIN CONTINUITY OF ALL EXISTING BRANCH CIRCUITRY TO EXISTING ROOMS NOT BEING RENOVATED. REWIRE ALL EXISTING BRANCH CIRCUITS (THAT ARE TO REMAIN) AS REQUIRED. REFER TO ARCHITECTURAL DEMOLITION DRAWINGS FOR WALLS BEING REMOVED.
16. CONDUIT IN EXISTING OR NEW CEILINGS THAT IS NOT INTENDED FOR REUSE SHALL BE REMOVED BACK TO THE PANEL FROM WHICH IT ORIGINATES.
17. CONDUCTORS THAT ARE NOT DEEMED REUSABLE SHALL BE REMOVED BACK TO THE NEAREST JUNCTION BOX. WHERE THE ENTIRE CIRCUIT IS TO BE REMOVED, THE CONDUCTORS SHALL BE REMOVED BACK TO THE PANEL FROM WHICH THEY ORIGINATE.
18. CONTRACTOR SHALL COORDINATE ALL SCHEDULED POWER SHUTDOWNS WITH BASE BUILDING AND NO SHUTDOWN SHALL COMMENCE WITHOUT WRITTEN APPROVAL. BASE BUILDING SHALL BE GIVEN 2 WEEKS NOTICE PRIOR TO SCHEDULE SHUTDOWN.
19. CONTRACTOR TO MAINTAIN CONTINUITY AND ACCESSIBILITY OF ALL EXISTING SYSTEMS AND SYSTEM EQUIPMENT FEEDERS WHICH MAY BE DISRUPTED FOR WORK OF ANY TRADE.
20. CONTRACTOR TO MAINTAIN CONTINUITY AND ACCESSIBILITY OF ALL EXISTING ELECTRICAL (POWER, LIGHTING, AND SIGNAL) SYSTEMS, EQUIPMENT FEEDERS AND BRANCH CIRCUITS ON FLOORS OR AREAS THAT ARE NOT AFFECTED BY DEMOLITION OR NEW CONSTRUCTION - REFER TO CONSTRUCTION SCHEDULE FOR ADDITIONAL INFORMATION.
21. ANY EXISTING ELECTRICAL WORK WHICH IS PULLED OUT OR CUT AWAY SHALL BE REMOVED FROM THE SITE AS DIRECTED BY THE GENERAL CONTRACTOR AND THE OWNER.
22. EXISTING ELECTRICAL EQUIPMENT WHICH IS NOT TO BE REUSED SHALL BE REMOVED FROM DRYWALL PARTITIONS. ANY OPENING IN EXISTING PARTITIONS LEFT BY REMOVAL OF EXISTING ELECTRICAL EQUIPMENT SHALL BE PATCHED BY THIS CONTRACTOR WITH MATERIALS TO MATCH EXISTING.
23. FOR PURPOSES OF THE CONTRACT, WHAT IS NOTED OR SHOWN ON DRAWINGS INDICATES THE SCOPE OF WORK REQUIRED AND QUALITY OF MATERIALS REQUIRED.
24. CONTRACTOR TO EXAMINE ALL CONTRACT DOCUMENTS AND PERFORM ALL DEMOLITION BOTH FOR AREAS BEING RENOVATED AND FOR AREAS WHICH MUST BE REWORKED TO PERMIT THE INSTALLATION OF WORK BY THE VARIOUS TRADES.
25. CONTRACTOR SHALL VISIT THE SITE AND VERIFY THE EXTENT OF DEMOLITION AND REMOVALS PRIOR TO THE SUBMISSION OF BIDS. NO CONSIDERATION SHALL BE GIVEN FOR FAILURE TO VISIT THE SITE.
26. CONTRACTOR SHALL UTILIZE ALL THE CIRCUIT BREAKERS IN THE EXISTING PANELS THAT BECOME AVAILABLE WHEN BRANCH CIRCUITS ASSOCIATED WITH THEM ARE DISCONNECTED AND REMOVED DUE TO DEMOLITION OF THE ELECTRICAL WORK.

FIRE ALARM DEVICE NOTES

1. EXISTING FIRE ALARM DEVICES INDICATED TO BE REMOVED OR DEMOLISHED ON THE E-SERIES DRAWINGS SHALL BE TURNED OVER TO BKM FACILITIES TEAM FOR THEIR STORAGE AND ATTIC STOCK MANAGEMENT. CONTRACTOR SHALL COORDINATE WITH BKM FACILITIES TEAM FOR WHERE AND WITH WHOM TO LEAVE EXISTING DEINSTALLED DEVICES.
2. EXISTING FIRE ALARM DEVICES TO BE REMOVED, DEMOLISHED OR RELOCATED SHALL BE HANDLED WITH CARE DURING DEMOLITION AND DEINSTALLATION, WITH THE INTENT THAT THEY ARE ABLE TO BE REUSED. ALL DEVICES SHALL BE CLEANED PRIOR TO TURNING OVER TO OWNER.

ELECTRICAL SYMBOLS

A #a	LIGHTING FIXTURE, UPPERCASE LETTER = TYPE, # = CIRCUIT, LOWERCASE LETTER = LIGHTING ZONE (TYP)
A EM #a	EMERGENCY LIGHTING FIXTURE ENERGIZED FROM ALTERNATE SOURCE
S_a	SINGLE POLE SWITCH, LETTER = LIGHTING ZONE (TYP)
S_3	THREE WAY SWITCH
S_M	DISCONNECT SWITCH - TOGGLE TYPE, MOTOR RATED, 1HP, 20A, 1P., U.O.N.
S_{M2}	DISCONNECT SWITCH - TOGGLE TYPE, MOTOR RATED, 1HP, 20A, 2P., U.O.N.
S_{MP}	DOUBLE GANG BACKBOX FOR MOTORIZED PARTITION CONTROL DEVICE
S^a_{MS}	DOUBLE GANG BACKBOX FOR MOTORIZED SHADE CONTROL DEVICE, LETTER = ZONE
$S_{R/L}$	DOUBLE GANG BACKBOX FOR RAISE/LOWER CONTROL DEVICE
S_{LV}	LOW VOLTAGE SWITCH
S_{LV_X}	LOW VOLTAGE SWITCH (MODEL #: SATCO 87-504)
$S_{LV,D}$	LOW VOLTAGE DIMMER SWITCH
S_{OS}	OCCUPANCY SENSOR SWITCH
$S_{OS,D}$	OCCUPANCY SENSOR DIMMER SWITCH
S_{VS}	VACANCY SENSOR SWITCH
$S_{VS,D}$	VACANCY SENSOR DIMMER SWITCH
OS	CEILING MOUNTED DUAL TECHNOLOGY 360° OCCUPANCY SENSOR
VS	CEILING MOUNTED DUAL TECHNOLOGY 360° VACANCY SENSOR
OS_X	WIRELESS CEILING MOUNTED DUAL TECHNOLOGY 360° OCCUPANCY SENSOR (MODEL #: SATCO 87-305; REFER TO E600 FOR MORE INFORMATION)
RD	EMERGENCY LIGHTING DIMMING BYPASS RELAY (MODEL #: SATCO 87-203; REFER TO E600 FOR MORE INFORMATION)
DS	CEILING MOUNTED DAYLIGHT SENSOR
	DUPLEX CONVENIENCE RECEPTACLE - 18" AFF U.O.N.
B	DUPLEX CONVENIENCE RECEPTACLE - MOUNTED ON BASEBOARD
S	HALF SWITCHED DUPLEX RECEPTACLE (TYP, U.O.N.)
GFI	DUPLEX GROUND FAULT INTERRUPTING RECEPTACLE - 18" AFF U.O.N.
REF	DUPLEX REFRIGERATOR RECEPTACLE - 48" AFF U.O.N.
TV	DUPLEX TELEVISION RECEPTACLE - 72" AFF U.O.N.
	DUPLEX CONVENIENCE RECEPTACLE - MOUNTED ABOVE COUNTER
GFI	DUPLEX GROUND FAULT INTERRUPTING RECEPTACLE - MOUNTED ABOVE COUNTER
	QUAD CONVENIENCE RECEPTACLE - 18" AFF U.O.N.
	QUAD CONVENIENCE RECEPTACLE - MOUNTED ABOVE COUNTER
	CEILING MOUNTED DUPLEX OR QUAD RECEPTACLE
# #	DUPLEX OR QUAD RECEPTACLE FLOOR BOX, # = QUANTITY OF GANGS
#PT #PT	DUPLEX OR QUAD RECEPTACLE POKE-THROUGH, # = QUANTITY OF GANGS
J	WALL MOUNTED JUNCTION BOX
J DC	WALL MOUNTED JUNCTION BOX FOR DISPLAY CASE
J	CEILING MOUNTED JUNCTION BOX
J^a_{MS}	CEILING MOUNTED JUNCTION BOX FOR MOTORIZED SHADE, LETTER = ZONE
J	FLOOR MOUNTED JUNCTION BOX
# -	NON-FUSED DISCONNECT SWITCH, # = SWITCH SIZE
# #	FUSED DISCONNECT SWITCH, # = SWITCH SIZE / # = FUSE SIZE
F	FIRE ALARM MANUAL PULL STATION - 48" AFF U.O.N.
	FIRE ALARM SPEAKER/STROBE - 80" AFF U.O.N.
C	CEILING MOUNTED FIRE ALARM SPEAKER/STROBE
	FIRE ALARM SPEAKER - 80" AFF U.O.N.
C	CEILING MOUNTED FIRE ALARM SPEAKER
	FIRE ALARM STROBE LIGHT - 80" AFF U.O.N.
C	CEILING MOUNTED FIRE ALARM STROBE LIGHT
B TR	BEAM SMOKE DETECTOR, TRANSMITTER & RECEIVER
B RF	BEAM SMOKE DETECTOR, REFLECTOR
S	SMOKE DETECTOR
S CO	COMBINATION SMOKE AND CARBON MONOXIDE DETECTOR
H	HEAT DETECTOR
C	CARBON MONOXIDE DETECTOR
TS	TAMPER SWITCH
FS	FLOW SWITCH
FSD	FIRE SMOKE DAMPER (REFER TO M-SERIES DRAWINGS)
SD	SMOKE DAMPER (REFER TO M-SERIES DRAWINGS)
S D	DUCT MOUNTED SMOKE DETECTOR (REFER TO M-SERIES DRAWINGS)
M	MAGNETIC DOOR HOLDER
MM	FIRE ALARM MONITORING MODULE
CM	FIRE ALARM CONTROL MODULE
	END OF LINE RESISTOR
	PANELBOARD AND CLEARANCE
	CONDUCTOR/CONDUIT
X/#	BRANCH CIRCUIT HOMERUN (X = PANELBOARD, # = CIRCUIT NO.)
LA	CASAMBI MESH ROOM CONTROLLER; XNAPPK DALI-0-10V-1CH-CAS REFER TO E600 FOR MORE INFORMATION
LB	CASAMBI BLUETOOTH RELAY RECEIVER/REPEATER; FDLR05BPD-CAS REFER TO E600 FOR MORE INFORMATION
LC	CASAMBI 0-10V CONTROLLER WITH RELAY; CBU-ARP-LR REFER TO E600 FOR MORE INFORMATION
LD	CASAMBI GATEWAY WITH POWER SUPPLY UNIT; CGW-001-PSU REFER TO E600 FOR MORE INFORMATION
LS	SATCO WIRELESS ZONE CONTROLLER; MODEL #: SATCO 87-202 REFER TO E600 FOR MORE INFORMATION

ELECTRICAL DRAWING LIST

ELECTRICAL ABBREVIATIONS

A	AMPERES
AFF	ABOVE FINISHED FLOOR
C	CONDUIT
C/B	CIRCUIT BREAKER
CC	CONTACTOR CONTROLLED DEVICE
CKT	CIRCUIT
COP	COPIER
DGP	FIRE ALARM DATA GATHERING PANEL
E	EXISTING
E.C.	ELECTRICAL CONTRACTOR
EM	EMERGENCY
ER	EXISTING RELOCATED
ERRCS	EMERGENCY RESPONDER RADIO COMMUNICATIONS SERVICE
ETBR	EXISTING TO BE RELOCATED
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
FAA	FIRE ALARM ANNUNCIATOR WITH VOICE EVAC MICROPHONE
FACP	FIRE ALARM CONTROL PANEL WITH VOICE EVAC MIRCROPHONE
FBO	FURNISHED BY OTHERS
G	GROUND
GFP	GROUND FAULT PROTECTION
HD	HAND DRYER
IG	ISOLATED GROUND
JB	JUNCTION BOX
M/B	MAIN BREAKER
MCB	MAIN CIRCUIT BREAKER
MD	MOTORIZED DOOR
MLO	MAIN LUG ONLY
MP	MOTORIZED PARTITION
MS	MOTORIZED SHADE
MTD	MOUNTED
MW	MICROWAVE
N	NEW
OHD	OVERHEAD
PNL	PANEL
PROJ	PROJECTOR
PS	PROJECTOR SCREEN
R	EXISTING TO BE REMOVED
RAT	FIRE ALARM RADIO ALARM TRANSMITTER
REF	REFRIGERATOR
SPD	SURGE PROTECTION DEVICE
TB	TERMINAL BOX
TCP	TEMPERATURE CONTROL PANEL (BY DIV. 23)
TW/SH	TWISTED SHIELD
U.O.N.	UNLESS OTHERWISE NOTED
V	VOLTS
VA	VOLT-AMPERES
VFD	VARIABLE FREQUENCY DRIVE (BY DIV. 23)
WP	WEATHER PROOF
XFMR	TRANSFORMER

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

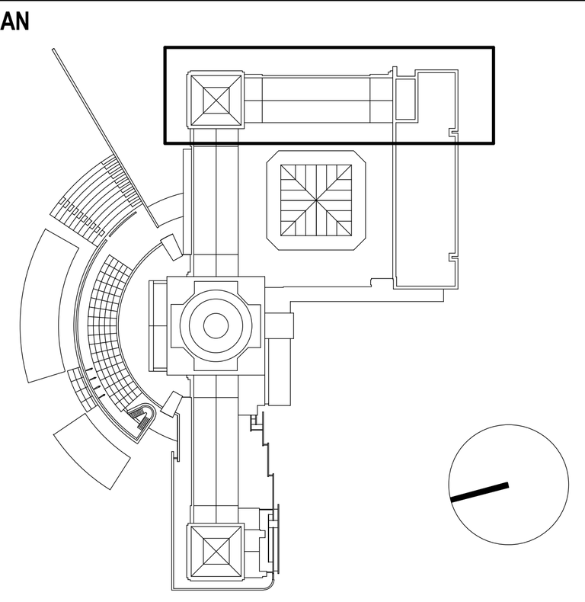
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

COVER SHEET - ELECTRICAL

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

E001.00

10/17/2025 3:36:23 PM

LIGHTING FIXTURE SCHEDULE

TYPE	LAMP	VOLTAGE	WATTAGE	DRIVER / BALLAST	MOUNTING	DESCRIPTION
DL01	LED	120V	14W	NON-DIM	RECESSED	RECESSED, ROUND LED DOWNLIGHT
PR01	LED	120V	23W	CASAMBI	TRACK	CYLINDRICAL ADJUSTABLE LED PROJECTOR
PR01-FR	LED	120V	23W	CASAMBI	TRACK	CYLINDRICAL ADJUSTABLE LED FRAMING PROJECTOR
PR02	LED	120V	23W	CASAMBI	TRACK	CYLINDRICAL ADJUSTABLE LED PROJECTOR
PR02-FR	LED	120V	23W	CASAMBI	TRACK	CYLINDRICAL ADJUSTABLE LED FRAMING PROJECTOR
PR03	LED	120V	23W	0-10V (VIA CASAMBI)	SURFACE	CYLINDRICAL ADJUSTABLE LED PROJECTOR
PR04	LED	120V	23W	ELV (VIA CASAMBI)	RECESSED	CYLINDRICAL ADJUSTABLE LED PROJECTOR E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
PR05	LED	120V	23W	0-10V (VIA CASAMBI)	RECESSED	CYLINDRICAL ADJUSTABLE LED PROJECTOR
PR05-FR	LED	120V	23W	CASAMBI	TRACK	CYLINDRICAL ADJUSTABLE LED FRAMING PROJECTOR
ST01	LED	120V	4W	ELV (VIA CASAMBI)	SURFACE	LINEAR LED UPLIGHT FIXTURE E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
TR01	-	120V	-	-	RECESSED	DUAL-CIRCUIT, LINEAR FIXTURE TRACK E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
TR02	-	120V	-	-	RECESSED	DUAL-CIRCUIT, LINEAR FIXTURE TRACK E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
TR03	-	120V	-	-	RECESSED	RECESSED JACK-MOUNT E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
TR04	-	120V	-	ELV (VIA CASAMBI)	RECESSED	ARCHITECTURAL SLOT WITH 6-1/2" OPENING, SLOT TO HAVE INTEGRAL LINEAR FIXTURE TRACK E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
TR05	-	120V	-	-	RECESSED	RECESSED JACK-MOUNT E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.
WW01	LED	120V	23W	CASAMBI	TRACK	ADJUSTABLE LED WALL WASHER
WW04	LED	120V	23W	ELV (VIA CASAMBI)	TRACK	ADJUSTABLE LED WALL WASHER E.C. TO COORDINATE EXACT LOCATION OF REMOTE DRIVER WITH ARCHITECT & PER MANUFACTURER REQUIREMENTS.

NOTES:

1. LIGHTING FIXTURE SCHEDULE IS FOR REFERENCE ONLY. ALL LIGHT FIXTURES ARE SPECIFIED BY OTHERS. REFER TO ARCHITECTURAL AND LIGHTING CONSULTANT DOCUMENTS FOR MORE INFORMATION.

LIGHTING CONTROLS FUNCTIONALITY MATRIX

SPACE TYPE	LOCAL MANUAL CONTROL	REMOTE OVERRIDE	OCCUPANT SENSOR O OR V	DIMMING M OR P	RECEPTACLE CONTROL	LOAD SHEDDING (TITLE 24)	SCHEDULING	via BMS INTEGRATION (BACnet IP)		
								SCHEDULING	OCCUPANCY STATUS	ENERGY REPORTING
GALLERY		●		M, P	●	●	●	TBD		
STUDIO	●		O	P		●	●			
GREEN ROOM	●		O	P		●				
RESTROOM	●		O	P		●				
ELECTRICAL, MECH. & TECHNOLOGY CLOSET	●					●				

LEGEND		
LETTER	DEFINITION	DESCRIPTION
O	OCCUPANCY SENSOR	AUTOMATIC ON / AUTOMATIC OFF AFTER 20 MINUTES NYC[15 MINUTES] OF INACTIVITY
V	VACANCY SENSOR	MANUAL ON / AUTOMATIC OFF AFTER 20 MINUTES NYC[15 MINUTES] OF INACTIVITY
D	DIMMING	1% - 100% CONTINUOUS DIMMING DEPENDENT ON LIGHTING FOOT-CANDLE LEVEL / OCCUPANCY
S	STEP DIMMING	SET DIMMING LEVELS DEPENDENT ON LIGHTING FOOT-CANDLE LEVEL / OCCUPANCY
M	MANUAL	MANUALLY ADJUSTED DIMMING LEVEL
P	PROGRAM	PRESET, SELECTABLE DIMMING SCENES

LIGHTING FIXTURE SCHEDULE (KR SPECIFIED)

TYPE	LAMP	VOLTAGE	LUMENS	COLOR TEMP.	DIMMING	MOUNTING	DESCRIPTION
	LED	120/277V	-	-	-	WALL SURFACE	MUD-IN LED EXIT SIGN, STEEL HOUSING, RED STANDARD LETTER COLOR, SINGLE FACE, PROVIDE CHEVRONS AS INDICATED ON LIGHTING PLANS, BATTERY BACKUP CONCEALITE CONEAL X SERIES #EXR-R-EM2-SD-NYC
	(2) 2W LED	120/277V	-	-	-	WALL SURFACE	DUAL HEAD EMERGENCY LIGHTING BATTERY PACK, WHITE THERMOPLASTIC HOUSING, SPECTRON SELF-DIAGNOSTICS DUAL-LITE #EV4
KR1	31W LED	120/277V	4,000LM	4,000K	1% 0-10V	CEILING CHAIN	4' INDUSTRIAL PENDANT FIXTURE, 80 CRI, WIRE GUARD, CHAIN HANGER SET, 5 YEAR WARRANTY PHILIPS DAY-BRITE CFI #FSI
KR2	100W LED	120V	-	-	-	WALL SURFACE	4 LIGHT - 24" RACETRACK VANITY NUVO #60-301
KR3	14.5W LED	120/277V	1,020LM	4,000K	0-10V	CEILING SURFACE	4" COMMERCIAL LED DOWNLIGHT SATCO #S11810

LIGHTING FIXTURE NOTES

1. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL LIGHTING FIXTURES COMPLETE WITH MOUNTING HARDWARE, LAMPS, DRIVERS, TRANSFORMERS, ETC.
2. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS AND ARCHITECTURAL INTERIOR ELEVATIONS FOR EXACT LOCATIONS AND MOUNTING HEIGHTS OF ALL LIGHT FIXTURES. REFER TO LIGHTING CONSULTANT DRAWINGS & SPECIFICATIONS FOR LIGHTING FIXTURE SCHEDULE & CUT SHEETS.
3. THE ELECTRICAL CONTRACTOR SHALL VERIFY ALL CEILING TYPES AND/OR COORDINATE ALL FIXTURE TRIMS PRIOR TO PURCHASE OF LIGHT FIXTURES.
4. WHERE DRIVERS AND CONTROL MODULES ARE TO BE MOUNTED REMOTE FROM FIXTURE, CONTRACTOR SHALL PROVIDE ALL CONDUIT, WIRE, BOXES AND MOUNTING HARDWARE FOR SUCH EQUIPMENT. CONTRACTOR SHALL COORDINATE LOCATION WITH FINISHES AND MILLWORK IN SPACE. SUCH REMOTE MOUNTED EQUIPMENT SHALL BE NOTED ON SUBMITTAL AND PROPOSED LOCATION INDICATED ON MARKED-UP LAYOUT DRAWING FOR REVIEW BY ARCHITECT AND ENGINEER.
5. FIXTURES SCHEDULED TO BE FURNISHED WITH CONTROLS INTEGRATED INTO THE HOUSING AND/OR DIRECT WIRED TO THE DRIVER SHALL BE IDENTIFIED AS SUCH ON BOTH FIXTURE SUBMITTALS AND IN THE CONTROL SUBMITTALS USING THE COMMON DESIGNATION FOR THE FIXTURE TYPE.

LIGHTING CONTROL NOTES

1. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO FURNISH AND INSTALL ALL LIGHTING FIXTURES, LIGHTING CONTROL DEVICES, LIGHTING CONTROL PANELS, LOW-VOLTAGE & 120V/277V WIRING, RACEWAYS, TRANSFORMERS, ETC. REFER TO LIGHTING CONSULTANT DRAWINGS, [THEATRE CONSULTANT] DRAWINGS & [INSERT LIGHTING CONTROL VENDOR] WIRING DIAGRAM ON DRAWING EXXX. FOR ALL REQUIREMENTS AND SPECIFICATIONS ON LIGHT FIXTURES, EQUIPMENT, DEVICES AND WIRING TO BE PROVIDED.
2. LIGHTING CONTROL FOR ALL FIXTURES SHALL BE BY A [INSERT LIGHTING CONTROL VENDOR] LIGHTING CONTROL SYSTEM PER WIRING DIAGRAM ON DRAWING EXXX, U.O.N. REFER TO LIGHTING PLANS FOR CONTROL ZONES WHERE REFERENCED ON WIRING DIAGRAM & DETAILS.
3. FIXTURES DESIGNATED FOR USE AS EMERGENCY LIGHTING SHALL BE PROVIDED WITH ALL CONTROLS AND WIRING NECESSARY FOR AUTOMATIC ACTIVATION UPON LOSS OF POWER TO LIGHTING SERVING THE AREA. WHERE A LOCALIZED OR FULL BUILDING CONTROL SYSTEM IS IN PLACE, SUCH FIXTURES SHALL ALSO BE ABLE TO BE ACTIVATED SYSTEM WIDE. THE CONTROL MECHANISMS FOR ALL EMERGENCY LIGHTING FIXTURES SHALL BE ACCESSIBLE FROM FLOOR FOR MAINTENANCE, TESTING, AND VISUAL INDICATION OF STATUS OF EMERGENCY SYSTEM OPERATION. THE LOCATION OF SUCH DEVICES SHALL BE COORDINATED WITH THE ARCHITECT AND ENGINEER PRIOR TO INSTALLATION. SUBMIT LAYOUT DRAWING FOR REVIEW.
4. ALL LIGHTING CONTROL STATIONS SHALL BE PROVIDED WITH ENGRAVED BUTTONS. ELECTRICAL CONTRACTOR SHALL CONFIRM ENGRAVING WITH LIGHTING CONSULTANT AND OWNER PRIOR TO PROCUREMENT.
5. CONTRACTOR SHALL ENGAGE LIGHTING CONTROL MANUFACTURER'S TRAINED PERSONNEL TO PROVIDE A MINIMUM 8 HOURS OF TRAINING TO OWNER.
6. PROVIDE 2#16 FROM ALL LIGHTING CONTROL DEVICES TO ALL 0-10V DIMMABLE LIGHTING FIXTURES, REGARDLESS IF A DIMMABLE CONTROL DEVICE IS SHOWN OR NOT. FOR FORWARD PHASE OR REVERSE PHASE DIMMABLE LIGHTING FIXTURES, PROVIDE 0-10V CONVERSION HARDWARE TO SUPPORT DIMMING OF LIGHTING FIXTURES. LOCATE CONVERSION HARDWARE ADJACENT TO ASSOCIATED ROOM'S LIGHTING ROOM CONTROLLER.
7. PROVIDE DMX CABLE, LUTRON #GRX-CBL-DMX, OR EQUIVALENT FOR DIMMING DMX CONTROLLED LIGHTING FIXTURES.
8. ALL LIGHTING FIXTURE LIGHT LEVELS SHALL BE ADJUSTED IN COORDINATION WITH THE LIGHTING CONSULTANT AND/OR ARCHITECT'S REQUIREMENTS FOR TARGET FOOT CANDLE LEVELS PER SPACE.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

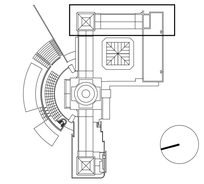
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

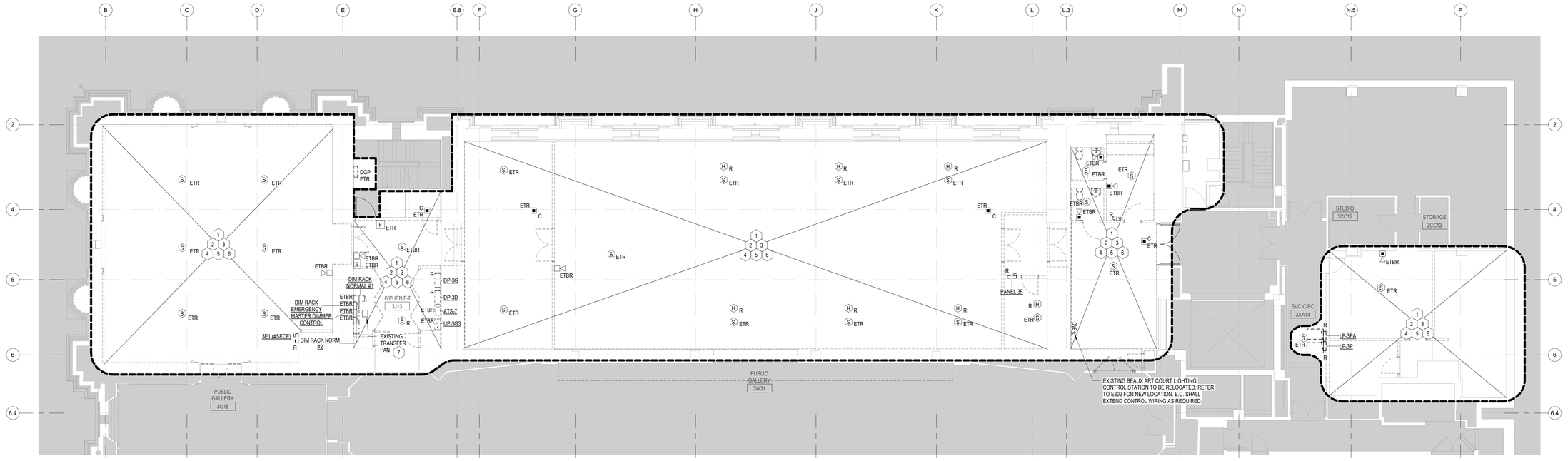
COVER SHEET - ELECTRICAL

SCALE	NONE
DATE	10/17/2025
PROJECT NUMBER	163A

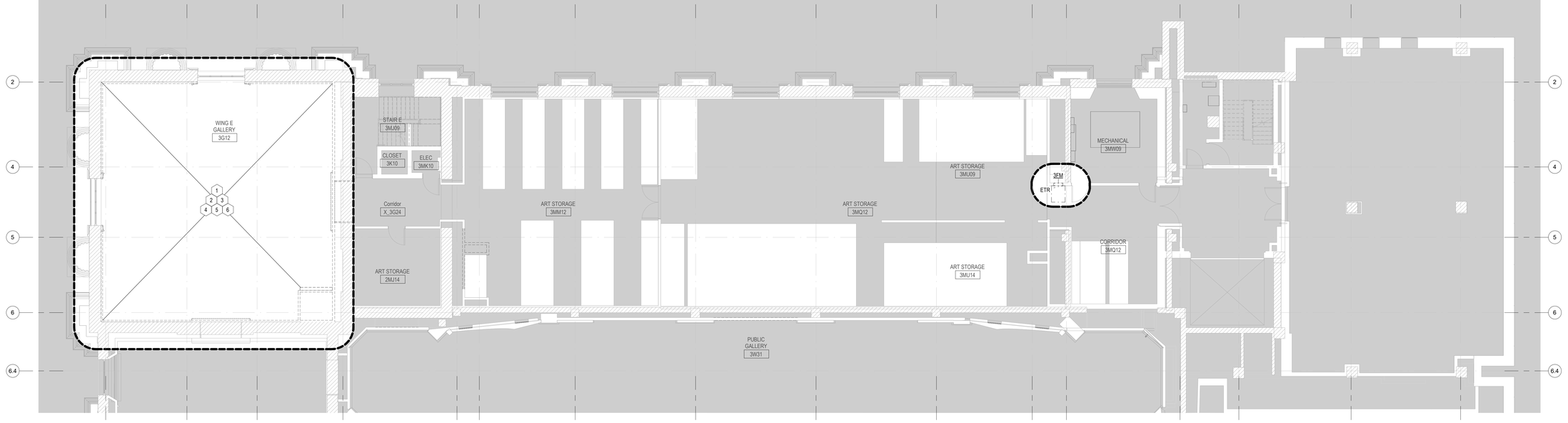
DRAWING NUMBER

E002.00

10/17/2025 3:36:24 PM



1 E102.00 THIRD FLOOR DEMO PLAN
SCALE: 1/8" = 1'-0"



2 E102.00 THIRD FLOOR MEZZ DEMO PLAN
SCALE: 1/8" = 1'-0"

DEMOLITION KEY NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT EXTENT OF DEMOLITION WORK.
2. DISCONNECT AND REMOVE ALL EXISTING INTERIOR LIGHTING FIXTURES, SWITCHES, BACKBOXES, CONDUIT AND WIRING BACK TO PANEL OR UPSTREAM ETR LIGHTING FIXTURE (TYPICAL FOR ALL AREAS).
3. DISCONNECT AND REMOVE ALL EXISTING RECEPTACLES, BACKBOXES, CONDUIT AND WIRING BACK TO PANEL OR UPSTREAM ETR DEVICE (TYPICAL FOR ALL AREAS).
4. DISCONNECT AND REMOVE ALL FINAL CONNECTIONS, DISCONNECT SWITCHES, OUTLETS, BACKBOXES, CONDUIT AND WIRING FOR OWNER'S EQUIPMENT BACK TO RESPECTIVE PANEL (TYPICAL FOR ALL EQUIPMENT TO BE REMOVED).
5. DISCONNECT AND REMOVE ALL FINAL CONNECTIONS, DISCONNECT SWITCHES, OUTLETS, CONDUIT AND WIRING FOR PLUMBING EQUIPMENT BACK TO PANEL (TYPICAL FOR ALL EQUIPMENT TO BE REMOVED).
6. ELECTRICAL CONTRACTOR SHALL MAINTAIN/RECONNECT ALL EXISTING BRANCH CIRCUIT WIRING DISTURBED DURING CONSTRUCTION BUT OUTSIDE OF NEW CONSTRUCTION AREA.
7. DISCONNECT AND REMOVE ALL FINAL CONNECTIONS, DISCONNECT SWITCHES, OUTLETS, CONDUIT AND WIRING FOR HVAC EQUIPMENT BACK TO PANEL (TYPICAL FOR ALL EQUIPMENT TO BE REMOVED).

10/17/2025 3:36:28 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

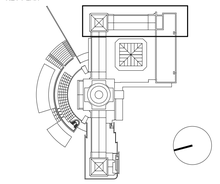
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

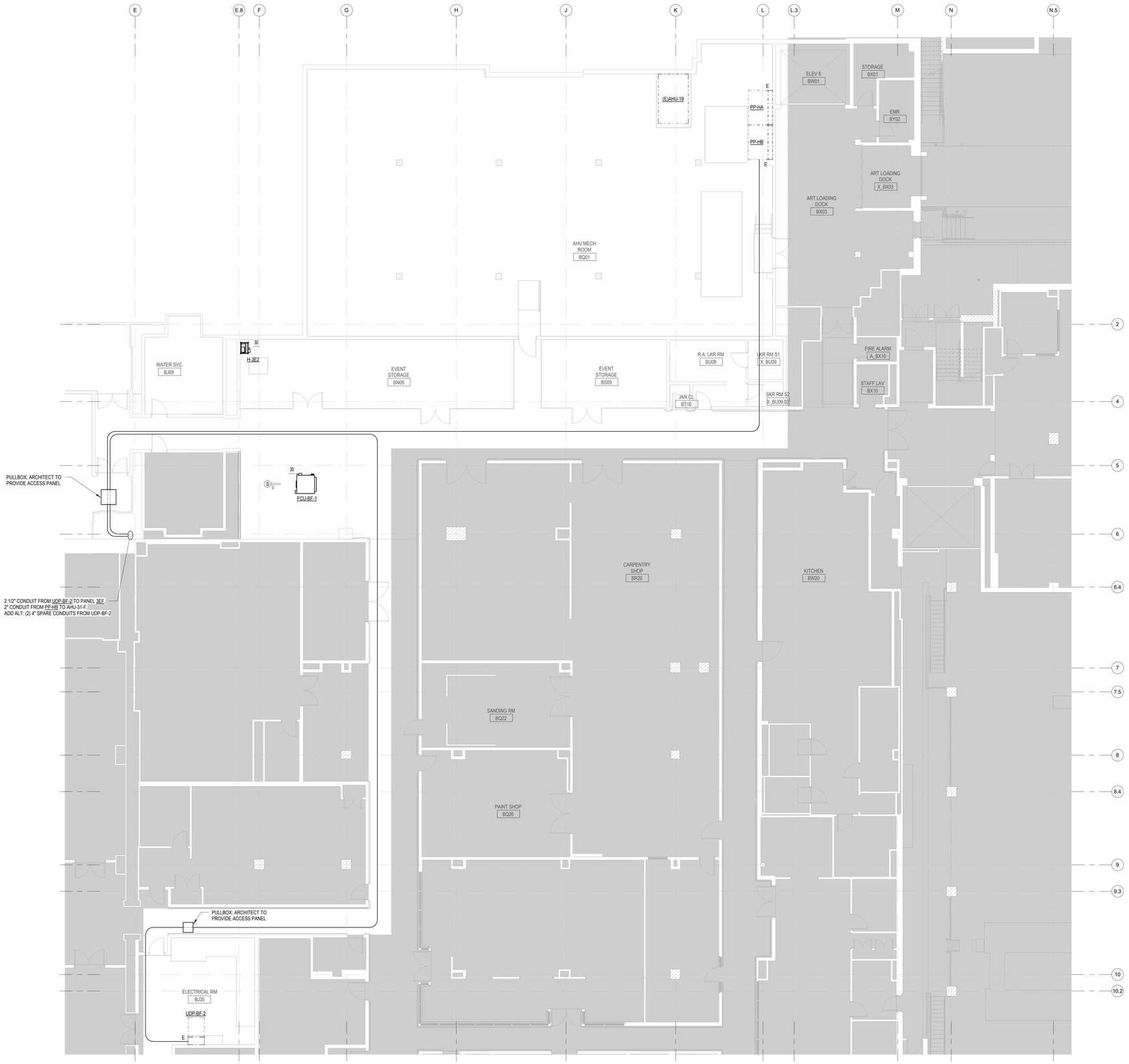
DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ DEMO PLANS - ELECTRICAL

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

E102.00



1 BASEMENT FLOOR PLAN
E200.00 SCALE: 1/8" = 1'-0"

10/17/2025 3:36:30 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

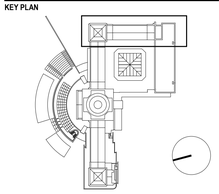
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

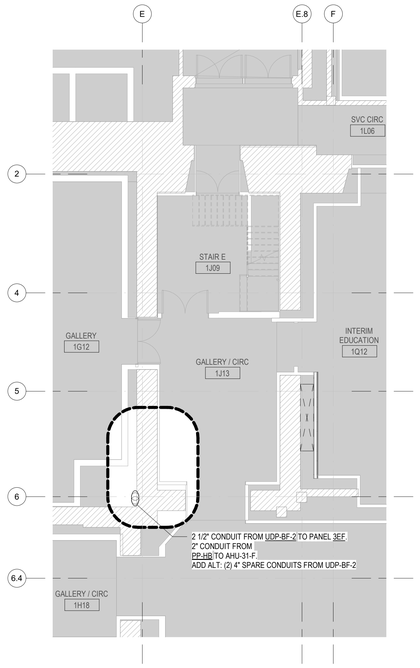
DRAWING TITLE

BASEMENT FLOOR PLAN - ELECTRICAL

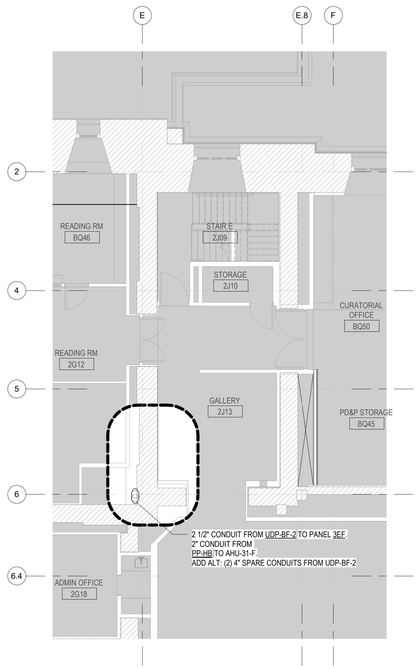
SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

E200.00



1 E201.00 FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"



2 E201.00 SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

10/17/2025 3:36:31 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

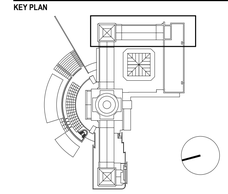
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

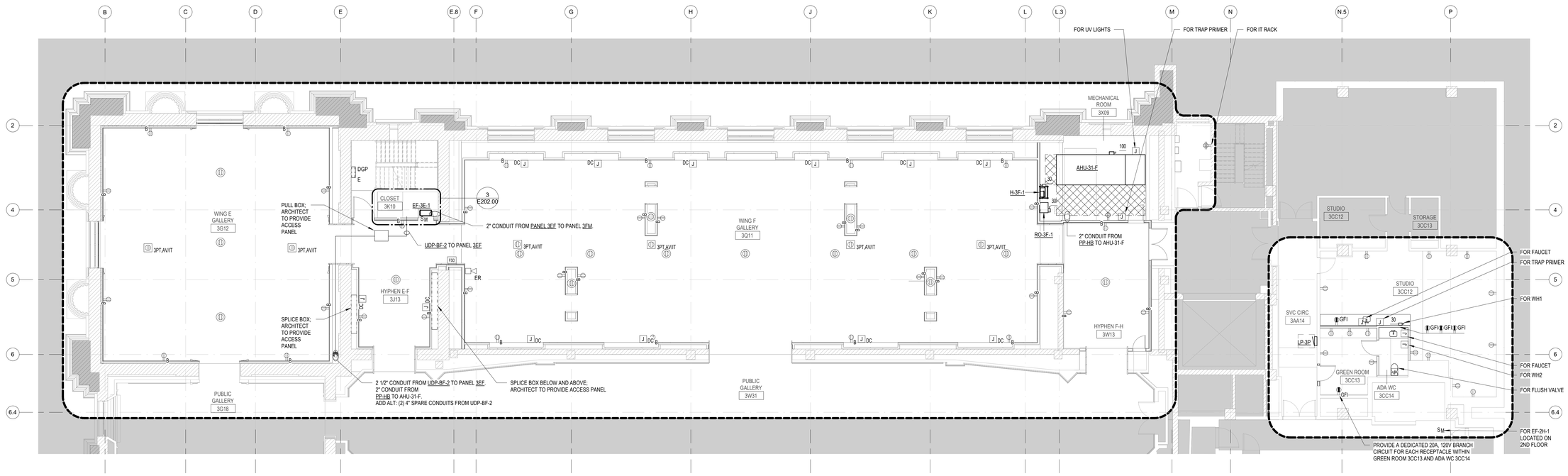
DRAWING TITLE

FIRST AND SECOND FLOOR PLANS - ELECTRICAL

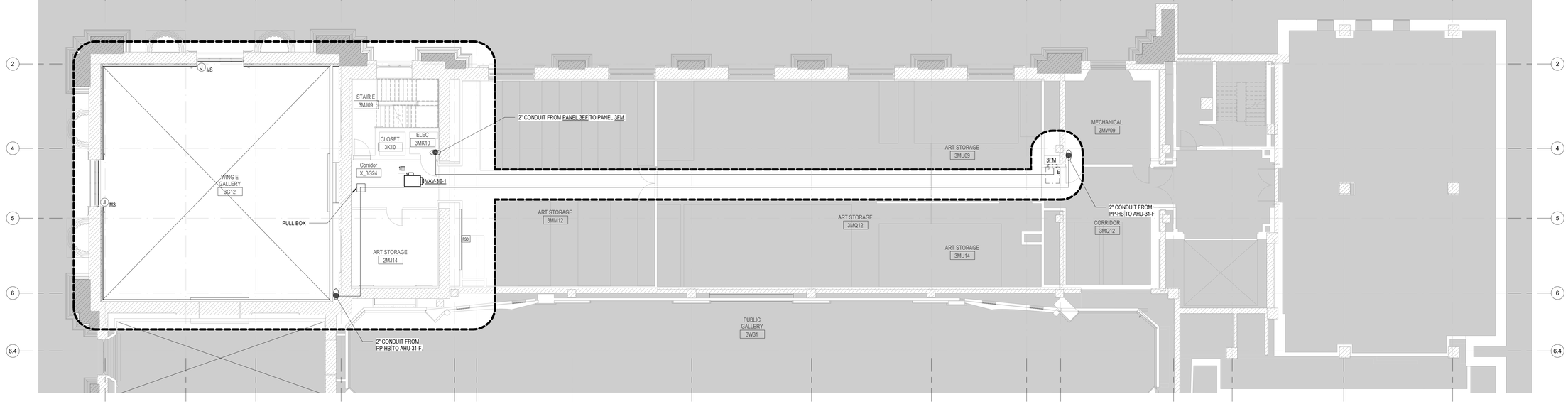
SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

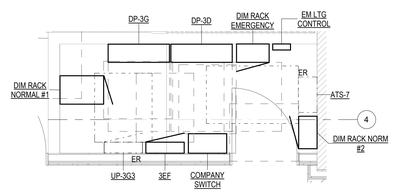
E201.00



1 THIRD FLOOR PLAN
E202.00 SCALE: 1/8" = 1'-0"



2 THIRD FLOOR MEZZ PLAN
E202.00 SCALE: 1/8" = 1'-0"



3 CLOSET 3K10 PART PLAN
E202.00 SCALE: 3/8" = 1'-0"

10/17/2025 3:36:33 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

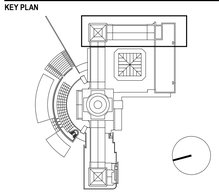
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

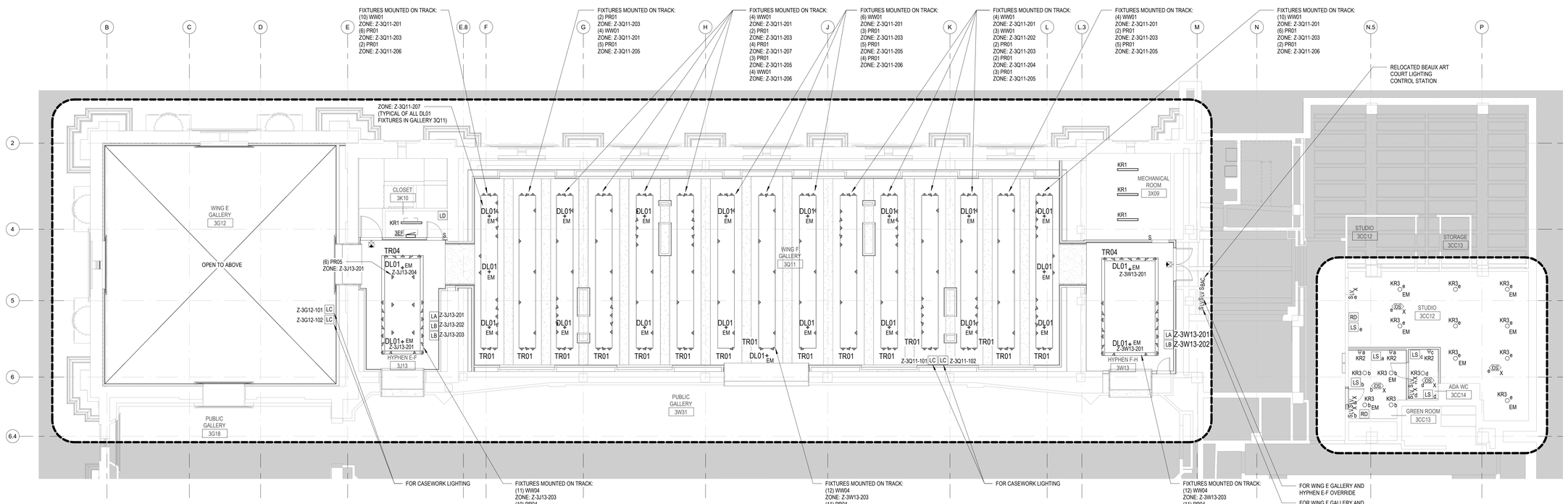
DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ PLANS - ELECTRICAL

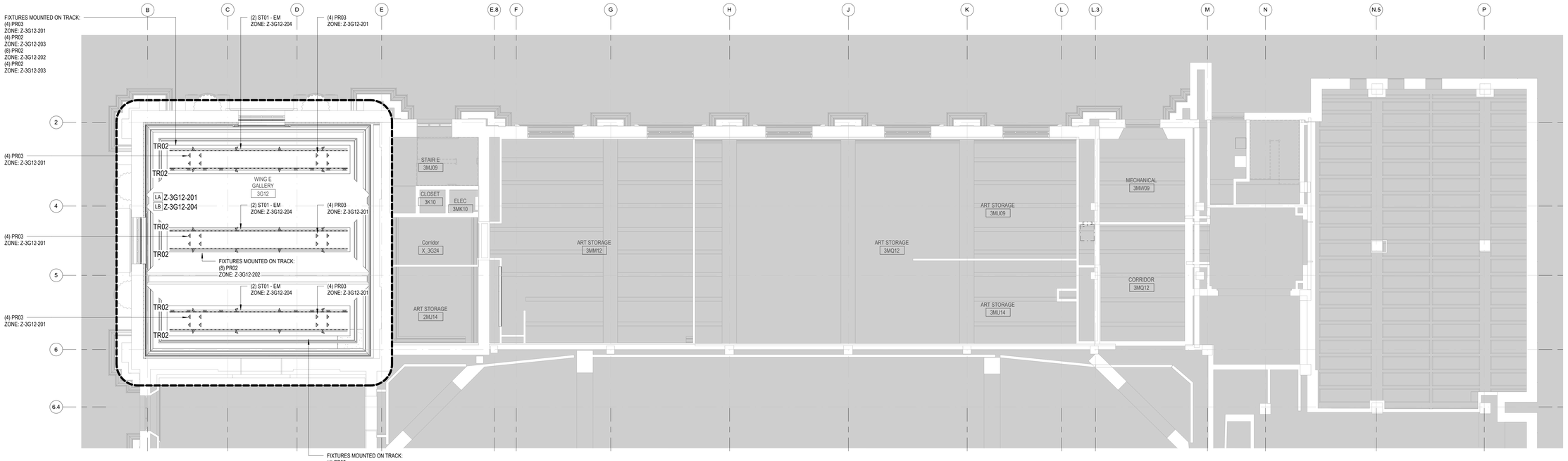
SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

E202.00



1 THIRD FLOOR CEILING PLAN
E302.00 SCALE: 1/8" = 1'-0"



2 THIRD FLOOR MEZZ CEILING PLAN
E302.00 SCALE: 1/8" = 1'-0"

10/17/2025 3:36:37 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

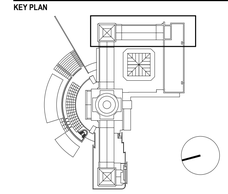
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

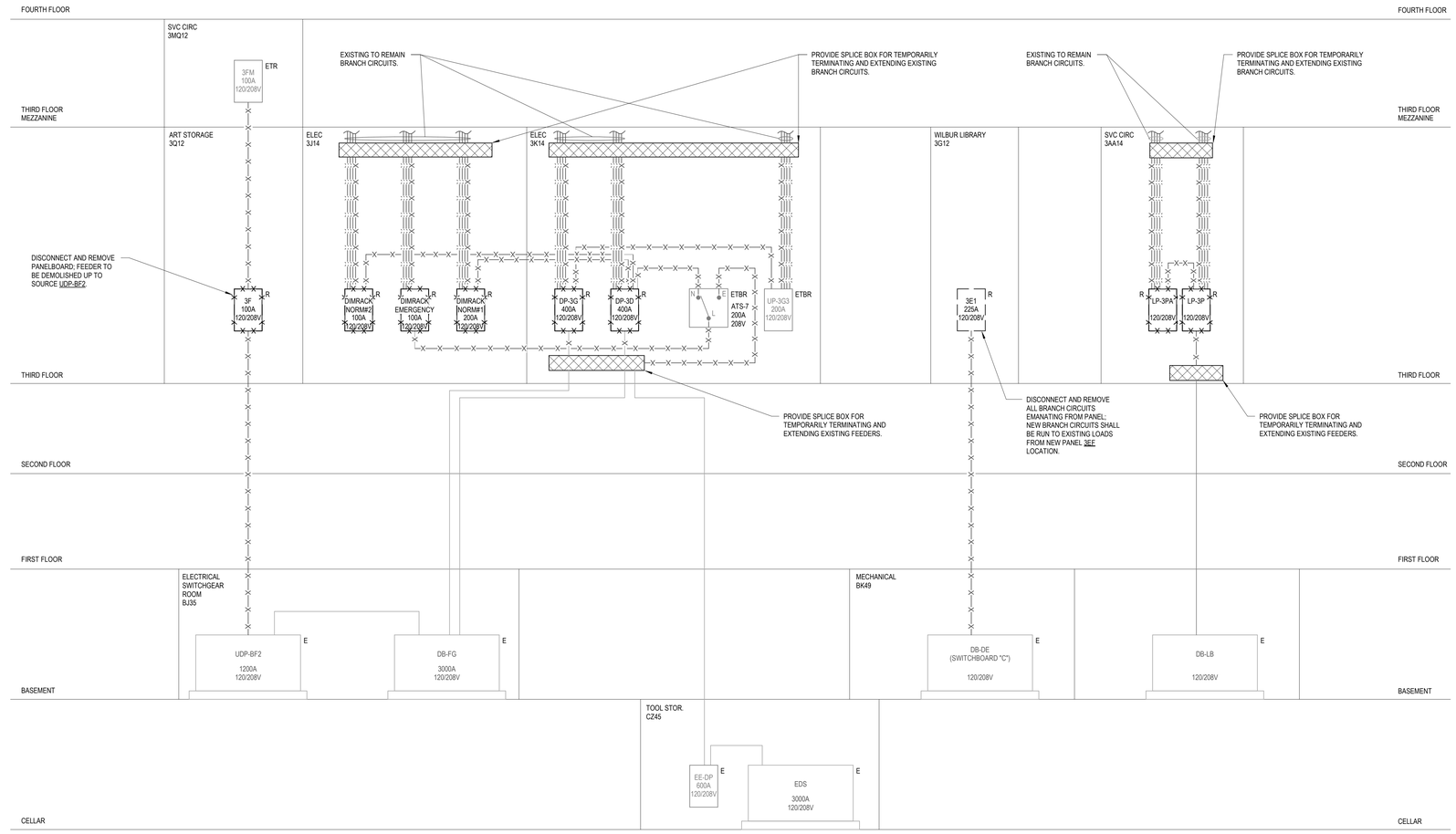
DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ CEILING PLAN - LIGHTING

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

E302.00



1 EXISTING RISER DIAGRAM
E400.00 SCALE: NONE

10/17/2025 3:36:38 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

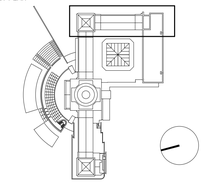
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

EXISTING RISER DIAGRAM - ELECTRICAL

SCALE	NONE
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

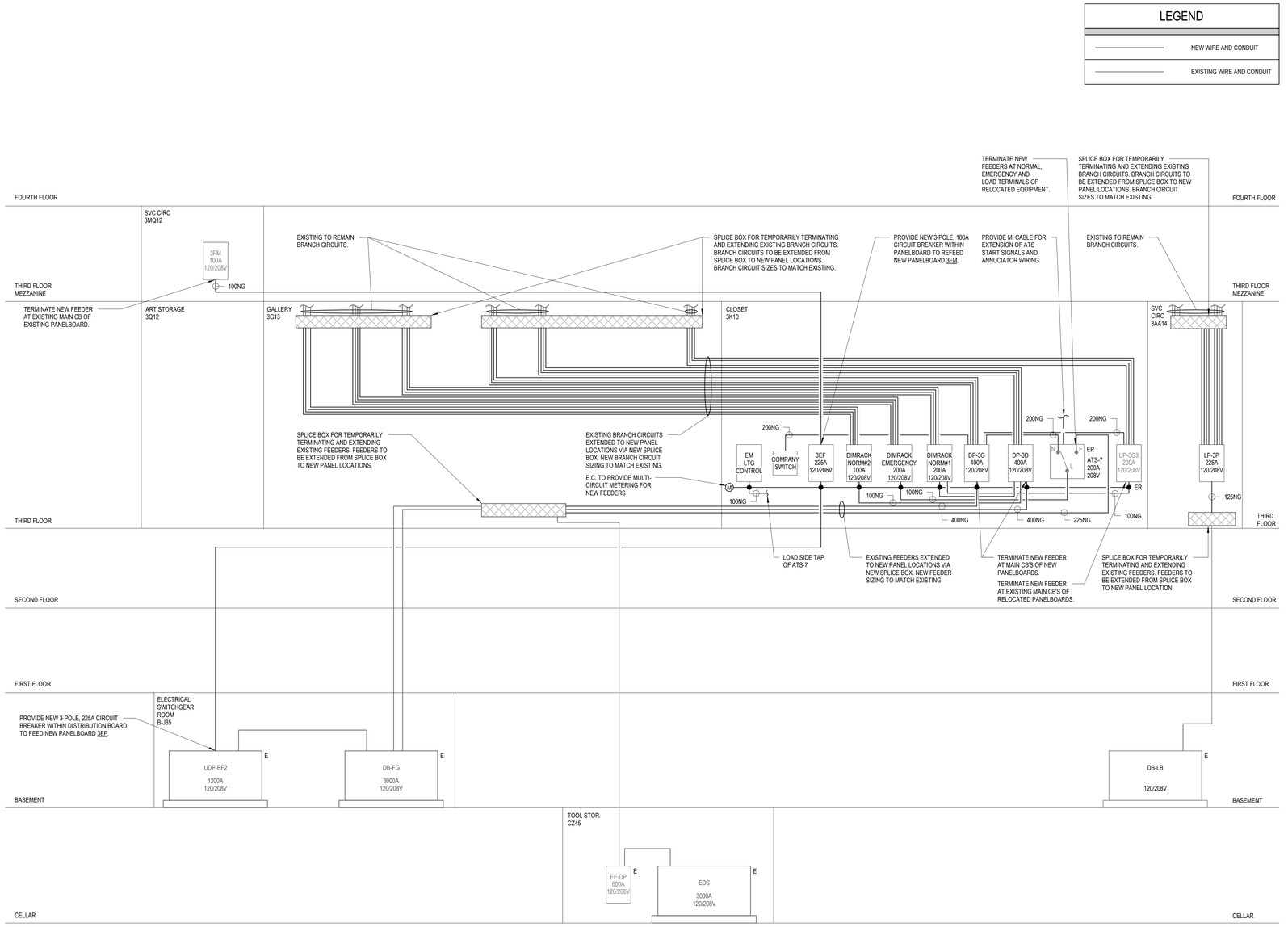
E400.00

CONDUCTOR SIZE CIRCUIT SCHEDULE

(TYPE THHN AND THWN AWG OR KCMIL @ 75°C)

COPPER FEEDER AND CONDUIT SCHEDULE

NOMINAL AMPERE RATING	RACEWAY SIZE CONDUIT	CONDUCTORS (3 PHASE, 4 WIRE) WITH GROUND	RACEWAY SIZE CONDUIT	CONDUCTORS (3 PHASE, 3 WIRE) WITH GROUND	FEEDER SYMBOL
20			3/4"	3#12 & #12G.	20G
	3/4"	4#12 & #12G.			20NG
30			3/4"	3#10 & #10G.	30G
	3/4"	4#10 & #10G.			30NG
40			3/4"	3#8 & #10G.	40G
	3/4"	4#8 & #10G.			40NG
50			1"	3#6 & #10G.	50G
	1"	4#6 & #10G.			50NG
60			1 1/4"	3#4 & #10G.	60G
	1 1/4"	4#4 & #10G.			60NG
80			1 1/4"	3#3 & #8G.	80G
	1 1/4"	4#3 & #8G.			80NG
90			1 1/2"	3#2 & #8G.	90G
	1 1/2"	4#2 & #8G.			90NG
100			2"	3#1 & #8G.	100G
	2"	4#1 & #8G.			100NG
125			2"	3#1 & #6G.	125G
	2"	4#1 & #6G.			125NG
150			2"	3#1/0 & #6G.	150G
	2"	4#1/0 & #6G.			150NG
175			2"	3#2/0 & #6G.	175G
	2"	4#2/0 & #6G.			175NG
200			2 1/2"	3#3/0 & #6G.	200G
	2 1/2"	4#3/0 & #6G.			200NG
225			2 1/2"	3#4/0 & #4G.	225G
	2 1/2"	4#4/0 & #4G.			225NG
250			2 1/2"	3#250 KCMIL & #4G.	250G
	2 1/2"	4#250 KCMIL & #4G.			250NG
300			3"	3#350 KCMIL & #4G.	300G
	3"	4#350 KCMIL & #4G.			300NG
350			3 1/2"	3#500 KCMIL & #3G.	350G
	3 1/2"	4#500 KCMIL & #3G.			350NG
400			4"	3#600 KCMIL & #3G.	400G
	4"	4#600 KCMIL & #3G.			400NG
500			(2) 3"	2 SETS OF 3#250 KCMIL & #2G.	500G
	(2) 3"	2 SETS OF 4#250 KCMIL & #2G.			500NG
600			(2) 3"	2 SETS OF 3#350 KCMIL & #1G.	600G
	(2) 3"	2 SETS OF 4#350 KCMIL & #1G.			600NG



1 E401.00 NEW RISER DIAGRAM
SCALE: NONE

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

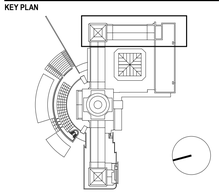
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

NEW RISER DIAGRAM - ELECTRICAL

SCALE	N.T.S.
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

E401.00

10/17/2025 3:36:39 PM

Branch Panel: DP-3D

Location: CLOSET 3K10
Supply From: DB-FG
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 208/120 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22,000
Mains Type: MCB
Mains Rating: 400 A
MCB Rating: 400 A

Notes:

CKT	Circuit Description	Wire & Conduit	Trip	Poles	A	B	C	Poles	Trip	Wire & Conduit	Circuit Description	CKT
1												2
3												4
5												6
7												8
9												10
11												12
13												14
15												16
17												18
19												20
21												22
23												24
25												26
27												28
29												30
31												32
33												34
35												36
37												38
39												40
41												42
			Total Load:		0 VA	0 VA	0 VA					
			Total Amps:		0 A	0 A	0 A					

Legend:

	Panel Totals
Total Conn. Load:	0 VA
Total Conn. Current:	0 A

Branch Panel: DP-3G

Location: CLOSET 3K10
Supply From: DB-FG
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 208/120 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22,000
Mains Type: MCB
Mains Rating: 400 A
MCB Rating: 400 A

Notes:

CKT	Circuit Description	Wire & Conduit	Trip	Poles	A	B	C	Poles	Trip	Wire & Conduit	Circuit Description	CKT
1												2
3												4
5												6
7												8
9												10
11												12
13												14
15												16
17												18
19												20
21												22
23												24
25												26
27												28
29												30
31												32
33												34
35												36
37												38
39												40
41												42
			Total Load:		0 VA	0 VA	0 VA					
			Total Amps:		0 A	0 A	0 A					

Legend:

	Panel Totals
Total Conn. Load:	0 VA
Total Conn. Current:	0 A

Branch Panel: 3EF

Location: CLOSET 3K10
Supply From: UDP-BF2
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 208/120 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22,000
Mains Type: MCB
Mains Rating: 225 A
MCB Rating: 225 A

Notes:

CKT	Circuit Description	Wire & Conduit	Trip	Poles	A	B	C	Poles	Trip	Wire & Conduit	Circuit Description	CKT
1												2
3												4
5												6
7												8
9												10
11												12
13												14
15												16
17												18
19												20
21												22
23												24
25												26
27												28
29												30
31												32
33												34
35												36
37												38
39												40
41												42
43												44
45												46
47												48
49												50
51												52
53												54
55												56
57												58
59												60
61												62
63												64
65												66
67												68
69												70
71												72
			Total Load:		0 VA	0 VA	0 VA					
			Total Amps:		0 A	0 A	0 A					

Legend:

	Panel Totals
Total Conn. Load:	0 VA
Total Conn. Current:	0 A

Branch Panel: LP-3P

Location: SVC CIRC 3AA14
Supply From: DB-LB
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 208/120 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22,000
Mains Type: MCB
Mains Rating: 100 A

Notes:

CKT	Circuit Description	Wire & Conduit	Trip	Poles	A	B	C	Poles	Trip	Wire & Conduit	Circuit Description	CKT
1												2
3												4
5												6
7												8
9												10
11												12
13												14
15												16
17												18
19												20
21												22
23												24
25												26
27												28
29												30
31												32
33												34
35												36
37												38
39												40
41												42
			Total Load:		0 VA	0 VA	0 VA					
			Total Amps:		0 A	0 A	0 A					

Legend:

	Panel Totals
Total Conn. Load:	0 VA
Total Conn. Current:	0 A

PANEL SCHEDULES ON THIS DRAWING:
DP-3D 3EF
DP-3G LP-3P

10/17/2025 3:36:40 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

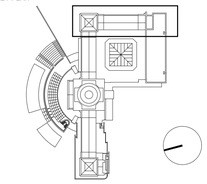
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

SCHEDULES - ELECTRICAL

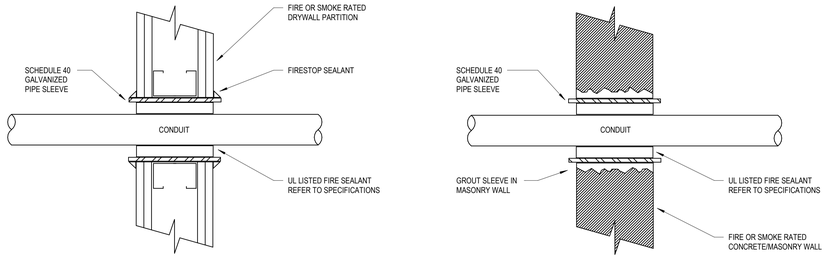
SCALE

DATE 10/17/2025

PROJECT NUMBER 163A

DRAWING NUMBER

E500.00



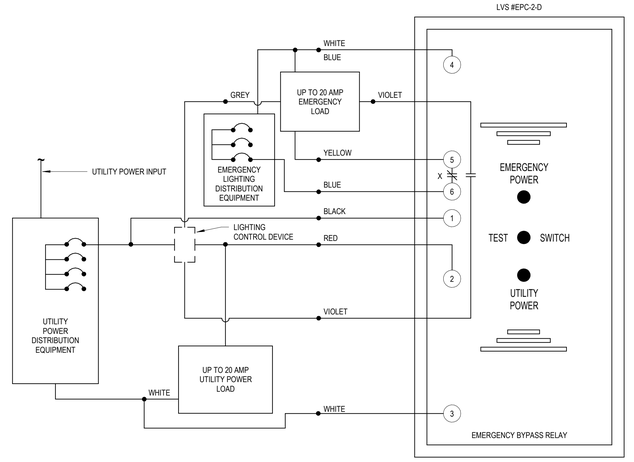
NOTES:

1. PROVIDE UL LISTED FIRE/SMOKE PENETRATION ASSEMBLY IN ACCORDANCE W/ UL1479, ASTM E814 REQUIREMENTS FOR WALL TYPE, RATING, PIPE SIZE INSTALLED.
2. FIRE STOPPING SHALL HAVE A RATING EQUAL TO OR GREATER THAN THE WALL BEING PENETRATED - SEE SPECIFICATIONS. REFER TO ARCHITECTURAL DRAWINGS FOR WALL RATINGS AND LOCATIONS.

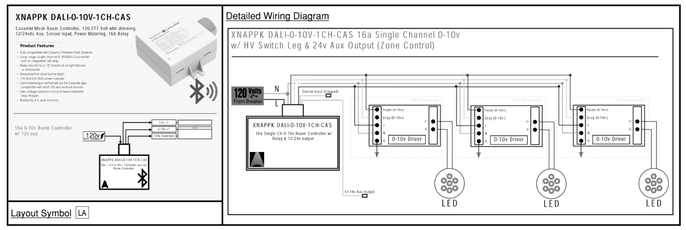
1 E600.00 WALL PENETRATION WITH FIRE-SMOKE SEAL DETAIL
SCALE: NONE

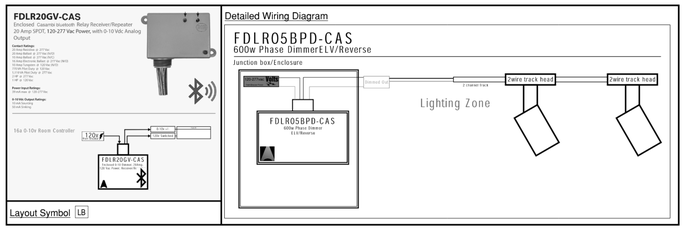
NOTES

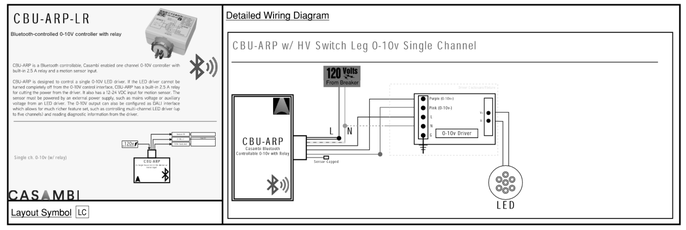
1. CIRCUIT # ④ ⑤ ⑥ MONITOR EMERGENCY POWER. ANY INTERRUPTION OF THE EMERGENCY POWER WILL GENERATE AN AUDIBLE ALARM AT THE BYPASS RELAY.
2. CIRCUIT # ① ③ MONITORS UTILITY POWER AND PROVIDES POWER TO THE AUDIBLE DEVICE. ANY INTERRUPTION WILL CLOSE CONTACT X.
3. CIRCUIT # ② SENSES WHEN ROOM LIGHTING CONTROL DEVICE IS ON AND THEN CLOSES CONTACT X, PROVIDING POWER TO THE EMERGENCY LOAD.
4. (1) BYPASS RELAY SHALL BE PROVIDED PER LIGHTING ZONE WITH EMERGENCY LIGHTING FIXTURES. REFER TO LIGHTING PLANS FOR LIGHTING ZONES (TYP).
5. EXTEND 0-10V WIRING FROM LOCAL LIGHTING CONTROL DEVICE TO BYPASS RELAY AND TO EMERGENCY LIGHTING FIXTURES (TYP).

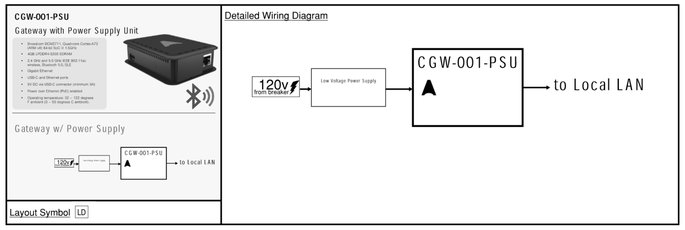


2 E600.00 EMERGENCY LIGHTING BYPASS RELAY WIRING DIAGRAM
SCALE: NONE

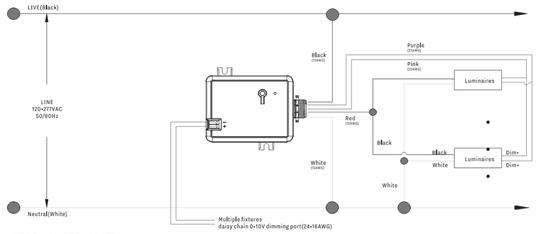






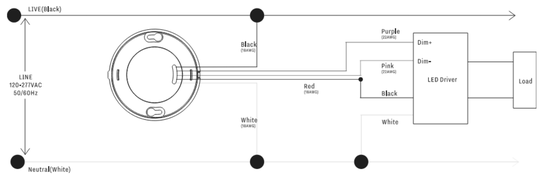


3 E600.00 CASAMBI LIGHTING CONTROL DIAGRAMS
SCALE: NONE



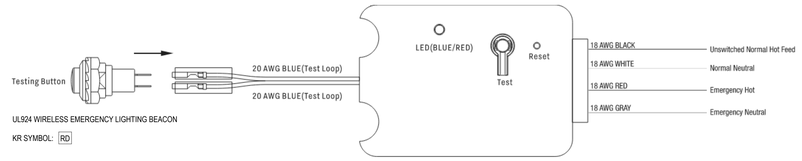
WIRELESS ZONE CONTROLLER

KR SYMBOL: LS



DUAL TECH WIRELESS CEILING SENSOR

KR SYMBOL: (OS) X



UL924 WIRELESS EMERGENCY LIGHTING BEACON

KR SYMBOL: RD

4 E600.00 SATCO LIGHTING CONTROL DIAGRAMS
SCALE: NONE

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

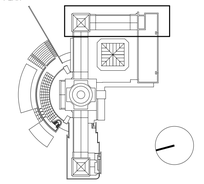
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

DETAILS - ELECTRICAL

SCALE	NONE
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

E600.00

10/17/2025 3:36:41 PM

FIRE ALARM NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE BUILDING, FIRE, ELECTRICAL, AND ASSOCIATED CODES AND ADOPTED RULES, LAWS, AND REGULATIONS OF THE JURISDICTION. WHERE MATERIALS AND QUANTITIES SPECIFIED ARE IN CONFLICT WITH LOCAL JURISDICTION REQUIREMENTS, THE CONTRACTOR SHALL ASK FOR AND OBTAIN A WRITTEN CLARIFICATION FROM THE ARCHITECT PRIOR TO SUBMITTING HIS BID. OTHERWISE THE ITEMS OR ARRANGEMENTS OF SUPERIOR QUALITY, GREATER QUANTITY OR HIGHER COST SHALL PREVAIL AND BE INCLUDED IN THE CONTRACT PRICE.
2. ALL FIRE ALARM CONTROL PANELS SHALL BE APPROVED FOR USE IN THE JURISDICTION WHERE WORK IS TAKING PLACE.
3. ALL FIRE ALARM EQUIPMENT SHALL BE INSTALLED WITH AESTHETICS IN MIND. CABINETS SHALL BE SEMI FLUSH MOUNTED AND CABLE TRAYS SHALL BE HIDDEN.
4. WHERE CONFLICTS OCCUR BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT, THE CONTRACTOR SHALL ASK FOR AND OBTAIN A WRITTEN CLARIFICATION FROM THE ARCHITECT PRIOR TO SUBMITTING HIS BID. OTHERWISE, THE ITEMS OR ARRANGEMENTS OF SUPERIOR QUALITY, GREATER QUANTITY OR HIGHER COST SHALL PREVAIL AND BE INCLUDED IN THE CONTRACT PRICE.
5. ALL FIRE ALARM CIRCUITS SHALL BE SIZED TO A MAXIMUM OF 80% OF CAPACITY AND ENOUGH SPACE FOR THE ADDITION OF 10 FUTURE DEVICES PER LOOP.
6. CLASS AND STYLE OF WIRE: ALL FIRE ALARM INITIATING AND SIGNALING CIRCUITS SHALL BE NFPA CLASS A. ALL FIRE ALARM CIRCUIT RISERS SHALL BE NFPA CLASS X. ALL NOTIFICATION CIRCUITS SHALL BE NFPA CLASS B AND SPLIT A/B. SPLIT A/B CIRCUITS SHALL BE WIRED SO THAT EVERY OTHER DEVICE IS WIRED ON AN ALTERNATE CIRCUIT. ALL FIRE ALARM SPEAKER CIRCUIT WIRING FOR ONE-WAY VOICE IN R2 APARTMENT BUILDINGS SHALL BE NFPA CLASS A.
7. LEVEL OF SURVIVABILITY: VERTICAL RISER CABLE FOR ALL SYSTEMS THAT INCLUDE PARTIAL EVACUATION, HIGHRISES, LARGE AREA BUILDINGS AND PLACES OF ASSEMBLY (ANYTHING OTHER THAN A GENERAL ALARM SEQUENCE) SHALL INCLUDE A PATHWAY SURVIVABILITY LEVEL 2 (NOT FULLY SPRINKLERED) OR 3 (FULLY SPRINKLERED) AND A 2 HOUR RATED SHAFT OR RISER CABLE SYSTEM. IN SYSTEMS WITHOUT PARTIAL ACTIVATION, ALL RISERS AND EQUIPMENT PANEL INTERCONNECT WIRING SHALL BE IN EMT. PROVIDE RMC WHERE EMT IS NOT PERMITTED BY ARTICLE 760, INCLUDING BUT NOT LIMITED TO EQUIPMENT ROOMS AND AREAS SUBJECT TO PHYSICAL DAMAGE.
8. WHERE SEPARATION OF THE IN-BUILDING EMERGENCY VOICE/ALARM CONTROL EQUIPMENT OCCURS, THE REMOTE EQUIPMENT SHALL BE LOCATED IN A 2 HOUR RATED ROOM OR ENCLOSURE.
9. ALL FIRE ALARM CABINETS AND JUNCTION BOXES SHALL BE PAINTED FIRE DEPARTMENT RED. ALL FIRE ALARM CABINETS SHALL BE CLEARLY LABELED WITH A NYC APPROVED LAMINATE ENGRAVED LABEL.
10. ALL FIRE ALARM WIRE SHALL BE CLEARLY LABELED IN JUNCTION BOXES AND CABINETS. ALL TERMINALS SHALL BE NUMBERED AND LABELED. ALL CONNECTIONS SHALL BE EITHER SOLDERED, APPROVED TERMINAL STRIPS, APPROVED WIRE NUTS (APPROVED TEMPERATURE), OR SCOTCH LOCKS.
11. ALL 120V FIRE ALARM POWER CONDUCTORS SHALL BE INSTALLED IN RMC THROUGHOUT THE BUILDING, UNLESS OTHERWISE NOTED.
12. ALL LOW VOLTAGE FIRE ALARM CONDUCTORS AND PRIMARY / SECONDARY TELECOMMUNICATION CONDUCTORS SHALL BE INSTALLED IN MINIMUM 3/4" RACEWAY. PROVIDE RMC WHERE EMT IS NOT PERMITTED BY ARTICLE 760, INCLUDING BUT NOT LIMITED TO LOADING DOCKS, GARAGES, SUPPRESSION AND EXTINGUISHING SYSTEM WIRING, MECHANICAL AND ELECTRICAL ROOMS AND OTHER LOCATIONS SUBJECT TO MECHANICAL DAMAGE. ALL RACEWAYS SHALL BE FACTORY PAINTED RED. FIELD PAINTING SHALL NOT BE PERMITTED.
13. FIRE ALARM CABLES SHALL NOT BE MIXED WITH NON FIRE ALARM CABLING. LOW VOLTAGE FIRE ALARM CABLING SHALL NOT BE MIXED OR WIRED NEAR ANY AC CIRCUIT.
14. ALL LOW VOLTAGE WIRING, WITH EXCEPTION OF RISER CABLE PARTIAL EVACUATION AND HIGH-RISE APPLICATIONS, SHALL BE TYPE FPLP NYC [150 DEGREE C NYC CERTIFIED WIRE]. ALL NOTIFICATION CIRCUITS SHALL BE A MINIMUM OF 14 AWG AND ALL OTHER LOW VOLTAGE FIRE ALARM CIRCUITS SHALL BE 16 AWG MINIMUM.
15. IN ALL BUILDINGS THAT HAVE SYSTEMS TO SUPPORT PARTIAL EVACUATION (I.E. HIGH-RISES AND LARGE AREA BUILDINGS), ALL WIRING THAT RUNS THROUGH ONE EVACUATION AREA TO SERVE ANOTHER EVACUATION AREA AND WIRING THAT RUNS FLOOR TO FLOOR MUST BE PROTECTED TO ENSURE A FIRE IN ONE AREA DOES NOT AFFECT THE FUNCTION OF EQUIPMENT SERVING OTHER AREAS. SUCH WIRING SHALL BE 2-HOUR FPLR-CIC CABLE IN RIGID METAL CONDUIT CONSTRUCTED TO THE STANDARDS APPROVED FOR USE IN THE LOCAL JURISDICTION.
16. POLARITY SHALL BE OBSERVED ON ALL CIRCUITS. T-TAPPING SHALL NOT BE ALLOWED ON ANY NOTIFICATION CIRCUITS (HORN, STROBE OR SPEAKER). T-TAPPING SHALL NOT BE PERMITTED ON ADDRESSABLE CIRCUITS WITHOUT THE EXPRESS PERMISSION OF THE ENGINEER.
17. ALL WIRING SHALL BE INSPECTED TO ASSURE THERE ARE NO OPENS, SHORTS OR EARTH GROUNDS.
18. SHIELDED CONDUCTORS OR RUNNING IN SEPARATE RACEWAY SHALL BE AS INSTRUCTED BY THE FIRE ALARM MANUFACTURER'S DOCUMENTATION. ALL NON-POWER LIMITED WIRING, INCLUDING CIRCUITS FOR NON POWER LIMITED CENTRALIZED AMPLIFIERS SHALL BE RUN IN A SEPARATE RACEWAY.
19. BOOSTER POWER SUPPLIES SHALL BE PROVIDED AS NECESSARY FOR STROBE CIRCUIT DRAW AND LENGTHY STROBE CIRCUIT RUNS. PROVIDE A SEPARATE 120V POWER FEED FOR EACH BOOSTER AS WELL AS A SMOKE DETECTOR MOUNTED DIRECTLY ABOVE EACH BOOSTER POWER SUPPLY.
20. ALL REMOTE FIRE ALARM CONTROL CABINETS (DATA GATHERING PANELS (DGP), TTBS ETC.) SHALL INCLUDE AN INTERNAL TAMPER SWITCH. EACH SHALL ALSO INCLUDE A SMOKE DETECTOR MOUNTED ON THE CEILING DIRECTLY ABOVE IT SHOULD ONE OR MORE NOT ALREADY BE SHOWN ON THE PLANS IN THE ROOM THAT IT IS MOUNTED IN.
21. ALL CEILING MOUNT DEVICES MUST BE SECURELY FASTENED TO BUILDING CONSTRUCTION.
22. DEVICE LOCATIONS MUST BE READILY ACCESSIBLE TO ALLOW FOR MAINTENANCE AND REPAIR.
23. ALL AREA OR DUCT MOUNTED SMOKE DETECTORS SHALL BE PHOTO-ELECTRIC TYPE.
24. SMOKE DETECTORS MUST BE MOUNTED AT LEAST 3 FT AWAY FROM ANY AIR REGISTER.
25. PROVIDE FAN SHUT DOWN CAPABILITY FOR FANS WITH A RATING LARGER THAN 2,000 CFM. SHUT DOWN SHALL BE ACCOMPLISHED BY ONE OR MORE OUTPUT CONTROL POINTS FROM THE FIRE ALARM SYSTEM TO RELAYS FOR SHUTDOWN. PROVIDE CONTROL AND MONITORING FOR ALL RELAYS.
26. DUCT MOUNTED SMOKE DETECTORS SHALL BE FURNISHED AND INSTALLED BY THE ELECTRICAL CONTRACTOR ALONG WITH FURNISHING OF THE SAMPLING TUBES. DUCTWORK MODIFICATIONS AND INSTALLATION OF SAMPLING TUBES SHALL BE BY THE MECHANICAL CONTRACTOR. FOR FANS RATED LARGER THAN 2,000 CFM PROVIDE DUCT MOUNTED SMOKE DETECTOR IN SUPPLY AND RETURN DUCT.
27. DUCT MOUNTED SMOKE DETECTORS SHALL BE MOUNTED ON THE DUCTWORK IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
28. ALL DUCT MOUNTED SMOKE DETECTORS AND SMOKE DETECTORS NOT READILY VISIBLE FROM FINISHED FLOOR SHALL BE PROVIDED WITH A REMOTE LED MOUNTED IN A READILY VISIBLE LOCATION. THE DEVICE SHALL BE LABELED IDENTIFYING THE LOCATION OF THE DETECTOR ABOVE CEILING. THE LOCATIONS OF REMOTE LEDS SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW PRIOR TO INSTALLATION.
29. CARBON MONOXIDE (CO) AND COMBINATION SMOKE AND CO DETECTORS SHALL BE FULLY ADDRESSABLE AND INCLUDE A SOUNDER BASE. MANUFACTURERS THAT DO NOT OFFER AN ADDRESSABLE CO OR SMOKE/CO TYPE DEVICE SHALL INCLUDE SEPARATE CO AND SMOKE DETECTORS, EACH WITH AN INTERNAL SYNCHRONIZED TEMPORAL 3 AND 4 SOUNDERS, AND THE NECESSARY MONITORING DEVICES SO THAT THE FIRE ALARM SYSTEM MAY MONITOR BOTH TYPES SEPARATELY. IF POWERED SEPARATELY (24VDC), POWER TO THE DEVICE SHALL ALSO BE SUPERVISED.
30. MANUAL STATIONS SHALL BE MOUNTED 48 INCHES ABOVE THE FINISHED FLOOR TO THE HANDLE OF THE STATION AND SHALL BE PAINTED FIRE DEPARTMENT RED. ALL MANUAL STATIONS SHALL BE INSTALLED SO THAT THEY ARE KEPT UNOBSTRUCTED FROM OTHER BUILDING CONSTRUCTION.
31. ALL STROBE LIGHTS SHALL BE XENON STROBE LIGHTS WITH UL-1971 APPROVED/LISTED. THE MINIMUM CANDELA IS 75 UNLESS OTHERWISE NOTED. FLASHING SHALL BE IN A TEMPORAL PATTERN, SYNCHRONIZED WITH OTHER UNITS.
32. VISUAL NOTIFICATION DEVICES THAT INCLUDE A STROBE SHALL BE MOUNTED SUCH THAT THE ENTIRE LENS IS NOT LESS THAN 80 IN. AND NOT GREATER THAN 96 IN. ABOVE THE FINISHED FLOOR, NOT NECESSARILY THE ELECTRICAL BOX.
33. WALL MOUNTED AUDIBLE ONLY NOTIFICATION DEVICES (SPEAKERS, HORNS, BELLS) SHALL HAVE THE TOP OF THE DEVICE MOUNTED 90 IN. ABOVE FINISHED FLOOR, HOWEVER NO CLOSER THAN 6 IN. FROM THE CEILING. ANY CONDITION THAT MAY REQUIRE VARIANCE FROM THIS CRITERIA SHALL BE BROUGHT TO THE ENGINEER'S AND ARCHITECT'S ATTENTION PRIOR TO INSTALLATION. SUCH CONDITION WILL BE SUBJECT TO MEETING THE SOUND PRESSURE LEVEL CRITERIA APPLICABLE TO THE SPACE WHICH IT WOULD BE MOUNTED AND ALSO REQUIRE ADDITIONAL REVIEW BY THE AHJ FOR APPROVAL.
34. SPEAKER DESIGN CRITERIA: GUEST ROOMS ½ WATT, CORRIDORS, STAIRS, LOW AMBIENT NOISE LEVELS, AND OPEN OFFICES - 1 WATT, HIGH AMBIENT NOISE LEVELS - 2 WATTS, EXTREME HIGH AMBIENT NOISE LEVELS - 8 WATTS. ALL SPEAKERS (EXCEPT EXTREME HIGH AMBIENT) SHALL BE HIGH FIDELITY AND 520 HZ UL COMPATIBILITY LISTED.
35. SPEAKERS AND STROBES SHALL BE WIRED ON ALTERNATING A/B CIRCUITING IN ALL AREAS.
36. ALL INITIATION AND NOTIFICATION APPLIANCES SHALL BE LISTED AS SUITABLE FOR THE ENVIRONMENT THEY ARE LOCATED. STANDARD INDOOR DEVICES LOCATED OUTDOORS IN AUXILIARY WEATHER PROOF ENCLOSURES WILL NOT BE ACCEPTED. EXTERIOR LISTED DEVICES SHALL BE PROVIDED WITH PROTECTIVE SHIELD ACCESSORIES TO ENSURE PROPER OPERATION, SUCH AS PULL STATIONS, TO PREVENT INTRUSION OF DIRT AND ICE.
37. ALL AUXILIARY RELAYS FOR FAN SHUTDOWN, DOOR RELEASE, DAMPER CONTROL, ELEVATOR CONTROL, ETC SHALL BE WIRED A MAXIMUM OF 3 FT FROM THE CONTROLLED DEVICE. THE AUXILIARY RELAY SHALL FUNCTION WITHIN THE REQUIRED VOLTAGE AND CURRENT OF THE CONTROLLED DEVICE. SLAVE OR INTERPOSING RELAYS SHALL BE INCLUDED AND POWERED BY THE FIRE ALARM CONTROL PANEL IN A FAIL-SAFE (FIRE FUNCTION) POSITION. POWER TO THE INTERPOSING RELAY SHALL BE MONITORED BY THE FIRE ALARM SYSTEM.
38. PROVIDE POWER, CONTROL RELAYS, MONITORING AND WIRING FOR ALL FIRE/SMOKE DAMPERS. DAMPER MONITORING SHALL BE FROM END SWITCHES ON THE DAMPER VIA RELAYS. REFER TO HVAC PLANS AND SPECIFICATIONS FOR REQUIRED FIRE MODE OPERATION OF ASSOCIATED DAMPERS AND FANS.
39. PROVIDE FIRE ALARM CONNECTIONS TO ALL BMS CONTROL PANELS.
40. TABS MUST BE BROKEN ON CMX WHEN USED AS A RELAY. FAILURE TO DO SO WILL CAUSE DAMAGE TO EQUIPMENT.
41. REFER TO PLANS FOR EXACT QUANTITIES AND LOCATIONS OF ALL DEVICES.
42. RISER DIAGRAM INDICATES TYPICAL WIRING REQUIREMENTS ONLY, REFER TO SPECIFICATIONS AND MANUFACTURER'S INSTALLATION REQUIREMENTS FOR EXACT REQUIREMENTS.
43. THE AUTHORITY HAVING JURISDICTION SHALL APPROVE THE PLANS PRIOR TO THE BEGINNING OF ANY WORK.
44. LOCATIONS OF ALL FIRE ALARM EQUIPMENT SHALL BE SUBJECT TO THE BUILDING, ELECTRICAL, MECHANICAL, FUEL GAS, ELEVATOR CODES AND NFPA REGULATIONS ADOPTED BY THE JURISDICTION AT TIME OF FILING, INCLUDING ALL APPLICABLE LAWS AND ADDENDA PUT IN AFFECT AFTER ADOPTION OF THE CODE APPLICABLE CODE. NO CHANGE OR MODIFICATION TO THE SYSTEM OR PLANS SHALL BE PERMITTED WITHOUT WRITTEN APPROVAL FROM THE ENGINEER OF RECORD. WHERE A CONFLICT IN THE APPROVED PLANS ARISES WITH REQUEST FROM AHJ OR OTHER ISSUED REGULATION, THE CONTRACTOR SHALL BRING TO THE ATTENTION OF THE ENGINEER.
45. THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR THE FIRE ALARM SYSTEM. THIS INCLUDES FLOOR PLANS AND RISER DIAGRAMS DOCUMENTING ALL DEVICE, PANEL, POWER SOURCE, AND EQUIPMENT LOCATIONS FOR COMPONENTS PART OF THE FIRE ALARM SYSTEM, AND SYSTEMS MONITORED OR OPERATED BY THE FIRE ALARM SYSTEM AND SMOKE CONTROL SYSTEM. THE DOCUMENTS SHALL INCLUDE LEGEND OF SYMBOLS, ROOM NAMES/NUMBERS, EQUIPMENT DESIGNATIONS (I.E. AHU-2A, GENERATOR G-1), PART NUMBERS, AND WIRING DIAGRAMS. EQUIPMENT COMPONENT PRODUCT DATA SHEETS SHALL BE SUBMITTED UNDER SEPARATE HEADING, AT THE SAME TIME AS THE INITIAL SYSTEM DRAWINGS SUBMITTAL.
46. THE CONTRACTOR SHALL PROVIDE THE NECESSARY DOCUMENTS REQUIRED FOR INSPECTION AND TO OBTAIN A FINAL LETTER OF APPROVAL FROM THE AHJ. THIS SHALL INCLUDE 11X17 AS-BUILT DRAWING(S), AN NFPA PROGRAMMING MATRIX, AND BOTH THE STATEMENT OF OPERATION AND THE CONTRACTORS A-433 FORM SIGNED AND SEALED BY THE ELECTRICAL CONTRACTOR. THESE DOCUMENTS SHALL BE SUBMITTED AS NECESSARY TO THE NYC FIRE DEPARTMENT TO OBTAIN A FIRE ALARM INSPECTION. IF A LETTER OF DEFECT IS ISSUED, THE CONTRACTOR SHALL CORRECT ALL ITEMS AND SUBMIT A SIGNED AND SEALED CERTIFICATE OF CORRECTION TO THE NYC FIRE DEPARTMENT TO OBTAIN A FINAL LETTER OF APPROVAL AT NO ADDITIONAL COST.
47. THE CONTRACTOR SHALL PROVIDE COMPLETE AS-BUILT DOCUMENTATION FOR THE SYSTEM AS PART OF CLOSE OUT AFTER ACCEPTANCE OF SYSTEM BY THE AHJ. THIS INCLUDES FLOOR PLANS AND RISER DIAGRAMS DOCUMENTING ALL DEVICE, PANEL, POWER SOURCE, AND EQUIPMENT LOCATIONS FOR COMPONENTS PART OF THE FIRE ALARM SYSTEM, AND SYSTEMS MONITORED OR OPERATED BY THE FIRE ALARM SYSTEM AND SMOKE CONTROL SYSTEM. THE DOCUMENTS SHALL INCLUDE LEGEND OF SYMBOLS, ROOM NAMES/NUMBERS, EQUIPMENT DESIGNATIONS (I.E. AHU-2A, GENERATOR G-1), PART NUMBERS, AND WIRING DIAGRAMS. THE SEQUENCE OF OPERATIONS SHALL BE INDICATED ON DRAWINGS INCLUDING THE SYSTEM RISER DIAGRAM AND SHALL BE SITE SPECIFIC. THE DOCUMENTATION SHALL ALSO BE FURNISHED WITH COMPLETE PACKAGE OF EQUIPMENT SUBMITTAL SHEETS, USER MANUALS, AND WARRANTIES.
48. THE CONTRACTOR SHALL TRAIN THE USER IN THE OPERATION OF THE SYSTEM AND PROVIDE THEM WITH AN OPERATION AND MAINTENANCE MANUAL TAILORED FOR THE SYSTEM INSTALLED AND GENERAL TESTING AND MAINTENANCE SCHEDULES IN ACCORDANCE WITH THE LOCAL JURISDICTION FIRE AND BUILDING CODES. THIS INCLUDES THE CREATION OF LOG SHEETS AND BINDERS AND COMPLETING THE FIRST ROUND OF TEST AND SERVICE AS PART OF CLOSEOUT.
49. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY AND ALL ABANDONED FIRE ALARM CABINETS, DEVICES, AND WIRE. PAINT, PATCH AND CLEANUP SHALL ALSO BE INCLUDED.
50. FOR APPLICATIONS REQUIRING A FIRE ALARM SYSTEM REPLACEMENT (FCS, FACP, OR SCP, SSCP ETC), THE CONTRACTOR SHALL BE RESPONSIBLE FOR INTERFACING THE NEW SYSTEM WITH THE OLD SYSTEM SO THAT THEY ACT AS ONE. ONCE SYSTEM APPROVAL IS GRANTED, THE CONTRACTOR SHALL THEN BE RESPONSIBLE FOR REMOVING THE OLD SYSTEM INCLUDING REMOVING OLD WIRE AND CONDUIT, PATCH, PAINT, AND CLEANUP. FIRE WATCH, IF NECESSARY, SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
51. AFTER DATE OF SUBSTANTIAL COMPLETION, CONTRACTOR SHALL TEST THE FIRE ALARM SYSTEM COMPLYING WITH TESTING AND VISUAL INSPECTION REQUIREMENTS IN NFPA 72. CONTRACTOR SHALL SUPPLEMENT AUDIBLE DEVICES TO MEET CODE SOUND LEVELS.
52. STROBE SYNCHRONIZATION SHALL BE PROVIDED FOR EACH FLOOR. WHERE WORK INDICATES DEVICES CONNECTED TO EXISTING SYSTEM, OR EXISTING DEVICE LOCATIONS TO BE RELOCATED OR RE-USED IN AREA OF WORK, STROBES SHALL BE SYNCHRONIZED. REPLACE EXISTING STROBES, PROVIDE ALL HARDWARE AND WIRING NECESSARY TO PROVIDE STROBE SYNCHRONIZATION IN SPACE. REPLACEMENT EQUIPMENT SHALL BE COMPATIBLE WITH EXISTING SYSTEM.
53. UNIT PRICING: THE CONTRACTOR SHALL PROVIDE A COMPLETED TABLE OF UNIT COSTS AT TIME OF BID ASSOCIATED WITH THE INSTALLATION OF FOLLOWING WORK. THIS PRICING WILL BE HELD FOR THE DURATION OF THE PROJECT. MATERIALS UTILIZED SHALL BE IN ADDITION TO ANY EQUIPMENT SPECIFIED AS "SPARE PARTS" IN DRAWINGS AND SPECIFICATIONS. SUCH WORK SHALL INCLUDE BOTH FURNISH AND INSTALL OF ALL ASSOCIATED EQUIPMENT, XX' OF FIRE ALARM BRANCH CIRCUIT, AND PROGRAMING TO MAKE COMPLETE SYSTEM, AND TO BE COMPLETED PRIOR TO SYSTEM APPROVAL AND AS-BUILT DOCUMENTATION. PATCH AND PAINT WORK SHALL NOT BE INCLUDED IN THE ELECTRICAL CONTRACTOR'S UNIT PRICE VALUES. FIRE STOPPING PENETRATIONS SHALL BE INCLUDED.
    - A. DUCT MOUNTED SMOKE DETECTOR
    - B. FIRE SMOKE DAMPER CONTROL MODULE
    - C. DUAL PURPOSE FIRE SMOKE/PURGE DAMPER CONTROL MODULE
    - D. AREA SMOKE DETECTOR
    - E. HEAT DETECTOR
    - F. STROBE
    - G. SPEAKER/STROBE
    - H. SPEAKER
    - I. PULL STATION
    - J. WARDEN STATION
    - K. WATERFLOW, TAMPER, AND PRESSURE SWITCH MONITORING MODULE
54. AUDIBLE NOTIFICATION DESIGN GOALS FOR THIS PROJECT ARE AS FOLLOWS:

AUDIBLE NOTIFICATION DEVICES - DESIGN CRITERIA	AMBIENT LEVEL	DESIGN GOAL
OFFICES	55dBA	> 70dBA
CORRIDORS	55dBA	> 70dBA
MECHANICAL ROOMS	85dBA	> 100dBA

BROOKLYN MUSEUM OF ART SPECIAL CLASS E FIRE ALARM SYSTEM INPUT/OUTPUT MATRIX

INPUTS	Piezo	Alarm LED	Supervisory LED	Trouble LED	Flashing Fire Sign (above FCS)	Print Info	Manual Signal to CS	Automatic Detector Signal to CS	Water Flow Signal to CS	Supervisory Signal to CS	Trouble Signal to CS	Alarm Tone on All floor Speakers FA Lists 80, 267, 268	Strobes Actvation all Floors FA List 13
FA List 18													
Manual Pull Station (Autocall, SImplex)	x	x			x	x	x					x	x
FA Lists 18, 260													
Smoke Detectors(Autocall, Simplex, System Sensor, BRK, ESL)	x	x			x	x		x				x	x
Heat Detectors (Autocall, Simplex)	x	x			x	x		x				x	x
Duct Detectors (Autocall, Simplex, System Sensor, BRK)	x	x			x	x		x				x	x
Smoke/Heats Detectors Combo (Simplex)	x	x			x	x		x				x	x
Beam Detector	x	x			x	x		x				x	x
Manual Door Release Switch at FCS				x		x				x			
Rangehood systems Alarm	x	x			x	x		x				x	x
FA Lists 18, 260,301													
Elevator Lobby Smoke Detector (Autocall, Simplex, Systrem Sensor, BRK, ESL)	x	x			x	x		x				x	x
Waterflow Switch	x	x			x	x			x			x	x
Pre-Action Panel Alarm	x	x			x	x			x			x	x
Fire Pump Run	x	x			x	x			x			x	x
Supervisory													
Phase 1 Elevator Input						x				x			
Generator Run	x		x			x				x			
Generator Fail	x		x			x				x			
Fire Pump Power Fail	x		x			x				x			
Fire Pump Phase Reversal	x		x			x				x			
Tamper Switch	x		x			x				x			
Low Air,	x		x			x				x			
Pre-Action Panel Supervisory	x		x			x				x			
Manual Door Unlock (Via FCS)			x			x							
Phase 1 Door Unlock/Release						x							
System Trouble	x			x		x					x		
Pre-Action Panel Trouble	x			x		x					x		
Direct Manual Station to Central Station							x						

INPUTS	Fan Shut Down AC-B-1, FA List 259	Fan Shut Down AHU-1-A-2, FA List 259	Fan Shut Down AHU-2, FA List 259	Fan Shut Down AHU-3, FA List 259	Fan Shut Down AHU-3M, FA List 259	Fan Shut Down AHU-6, FA List 259	Fan Shut Down AHU-7, FA List 259	Fan Shut Down AHU-7A, FA List 259	Fan Shut Down AHU-7B, FA List 259	Fan Shut Down AHU-8, FA List 259	Fan Shut Down AHU-9, FA List 259	Fan Shut Down AHU-10, FA List 259	Fan Shut Down AC-11, FA List 259	Fan Shut Down AC-12, FA List 259	Fan Shut Down HVAC-13, FA List 259	Fan Shut Down HVAC-14, FA List 259	Fan Shut Down AHU-15, FA List 259	Fan Shut Down AHU-16, FA List 259	Fan Shut Down HVAC-17, FA List 259	Fan Shut Down AHU-18, FA List 259	Fan Shut Down AHU-19, FA List 259	Fan Shut Down AHU-20, FA List 259	Fan Shut Down AHU-21, FA List 259	Fan Shut Down RF-21, FA List 259	Fan Shut Down AHU-22, FA List 259	Fan Shut Down RF-22, FA List 259	Fan Shut Down AHU-23, FA List 259	Fan Shut Down RF-23, FA List 259	Fan Shut Down AHU-24, FA List 259	Fan Shut Down AHU-25, FA List 259
FA List 18																														
Manual Pull Station (Autocall, SImplex)																														
FA Lists 18, 260																														
Smoke Detectors(Autocall, Simplex, System Sensor, BRK, ESL)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Heat Detectors (Autocall, Simplex)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Duct Detectors (Autocall, Simplex, System Sensor, BRK)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smoke/Heats Detectors Combo (Simplex)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Beam Detector	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Manual Door Release Switch at FCS																														
Rangehood systems Alarm	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
FA Lists 18, 260,301																														
Elevator Lobby Smoke Detector (Autocall, Simplex, Systrem Sensor, BRK, ESL)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Waterflow Switch	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pre-Action Panel Alarm	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fire Pump Run	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Supervisory																														
Phase 1 Elevator Input																														
Generator Run																														
Generator Fail																														
Fire Pump Power Fail																														
Fire Pump Phase Reversal																														
Tamper Switch																														
Low Air,																														
Pre-Action Panel Supervisory																														
Manual Door Unlock (Via FCS)																														
Phase 1 Door Unlock/Release																														
System Trouble																														
Pre-Action Panel Trouble																														
Direct Manual Station to Central Station																														

INPUTS	Recall All Elevators, FA List 262	Close Magnetic Held Fire Doors, FA List 261	Release Electrical Door Locks, FA List 261	Display Device/Zone on Graphic	Display Text Only Message at PC Annundator
FA List 18					
Manual Pull Station (Autocall, SImplex)				x	x
FA Lists 18, 260					
Smoke Detectors(Autocall, Simplex, System Sensor, BRK, ESL)		x	x	x	x
Heat Detectors (Autocall, Simplex)		x	x	x	x
Duct Detectors (Autocall, Simplex, System Sensor, BRK)		x	x	x	x
Smoke/Heats Detectors Combo (Simplex)		x	x	x	x
Beam Detector		x	x	x	x
Manual Door Release Switch at FCS			x		
Rangehood systems Alarm		x	x	x	x
FA Lists 18, 260,301					
Elevator Lobby Smoke Detector (Autocall, Simplex, Systrem Sensor, BRK, ESL)	x	x	x	x	x
Waterflow Switch	x	x	x	x	x
Pre-Action Panel Alarm	x	x	x	x	x
Fire Pump Run	x	x	x	x	x
Supervisory					
Phase 1 Elevator Input	x				
Generator Run				x	x
Generator Fail				x	x
Fire Pump Power Fail				x	x
Fire Pump Phase Reversal				x	x
Tamper Switch				x	x
Low Air,				x	x
Pre-Action Panel Supervisory				x	x
Manual Door Unlock (Via FCS)					x
Phase 1 Door Unlock/Release					x
System Trouble				x	x
Pre-Action Panel Trouble				x	x
Direct Manual Station to Central Station					

1 FA001.00 FIRE ALARM I/O MATRIX
SCALE: NONE

FIRE ALARM DRAWING LIST

DRAWING NUMBER	DRAWING DESCRIPTION
FA001.00	COVER SHEET - FIRE ALARM
FA202.00	THIRD FLOOR & THIRD FLOOR MEZZ PLANS - FIRE ALARM

FIRE ALARM SYMBOLS

F	FIRE ALARM MANUAL PULL STATION - 48" AFF U.O.N.
	FIRE ALARM SPEAKER/STROBE - 80" AFF U.O.N.
C	CEILING MOUNTED FIRE ALARM SPEAKER/STROBE
	FIRE ALARM SPEAKER - 80" AFF U.O.N.
C	CEILING MOUNTED FIRE ALARM SPEAKER
	FIRE ALARM STROBE LIGHT - 80" AFF U.O.N.
C	CEILING MOUNTED FIRE ALARM STROBE LIGHT
S	SMOKE DETECTOR
H	HEAT DETECTOR
TS	TAMPER SWITCH
FS	FLOW SWITCH
FSD	FIRE SMOKE DAMPER (REFER TO M-SERIES DRAWINGS)
SD	SMOKE DAMPER (REFER TO M-SERIES DRAWINGS)
S D	DUCT MOUNTED SMOKE DETECTOR (REFER TO M-SERIES DRAWINGS)
M	MAGNETIC DOOR HOLDER
MM	FIRE ALARM MONITORING MODULE
CM	FIRE ALARM CONTROL MODULE
	END OF LINE RESISTOR

FIRE ALARM ABBREVIATIONS

A	AMPERES
AFF	ABOVE FINISHED FLOOR
C	CONDUIT
DGP	FIRE ALARM DATA GATHERING PANEL
E	EXISTING
E.C.	ELECTRICAL CONTRACTOR
ER	EXISTING RELOCATED
ETBR	EXISTING TO BE RELOCATED
ETR	EXISTING TO REMAIN
FAA	FIRE ALARM ANNUNCIATOR WITH VOICE EVAC MICROPHONE
FACP	FIRE ALARM CONTROL PANEL WITH VOICE EVAC MIRCROPHONE
FBO	FURNISHED BY OTHERS
G	GROUND
OHD	OVERHEAD
R	EXISTING TO BE REMOVED
RAT	FIRE ALARM RADIO ALARM TRANSMITTER
SPD	SURGE PROTECTION DEVICE
TW/SH	TWISTED SHIELD
U.O.N.	UNLESS OTHERWISE NOTED
V	VOLTS
WP	WEATHER PROOF

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

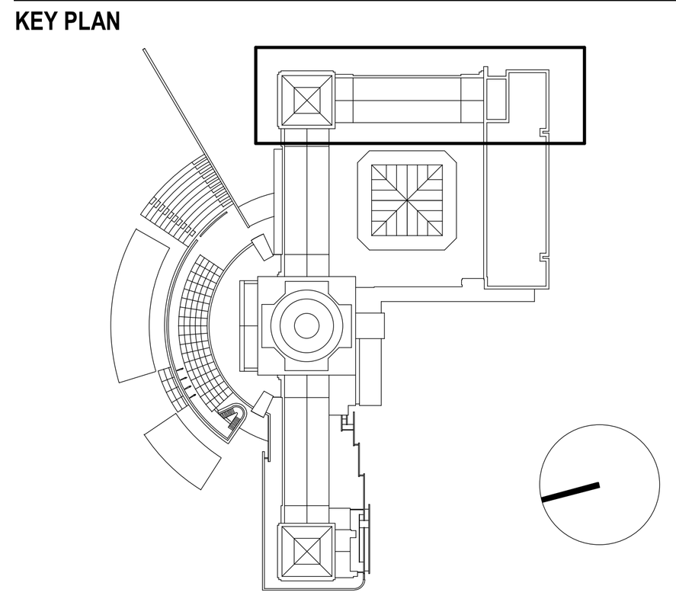
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO DATE DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

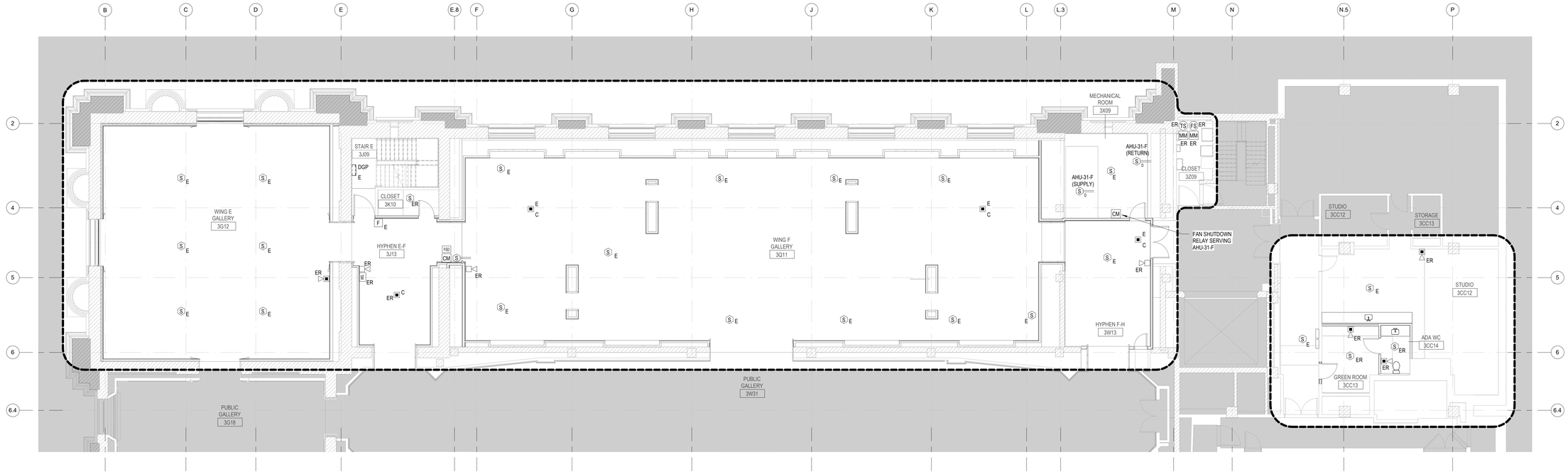
DRAWING TITLE

COVER SHEET - FIRE ALARM

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

FA001.00

10/17/2025 10:10:51 AM



1 THIRD FLOOR PLAN
FA202.00 SCALE: 1/8" = 1'-0"

2 THIRD FLOOR MEZZ PLAN
FA202.00 SCALE: 1/8" = 1'-0"

10/17/2025 3:38:39 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

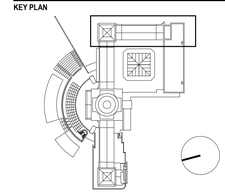
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ PLANS - FIRE ALARM

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

FA202.00

GENERAL PLUMBING NOTES

GENERAL

LEAD-FREE STATEMENT
SEVERAL PLUMBING FIXTURES DESCRIBED IN THIS SECTION FALL UNDER JURISDICTION OF THE FEDERAL REDUCTION OF LEAD IN DRINKING WATER ACT (42 USC 300G) WHICH MANDATES THAT EFFECTIVE JANUARY 4, 2014 THE WETTED SURFACES OF ANY VALVE, FITTING OR FIXTURE THAT COMES IN CONTACT WITH POTABLE WATER MUST HAVE A WEIGHTED-AVERAGE LEAD CONTENT OF NO MORE THAN 0.25 PERCENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING PRODUCTS THAT ARE LEAD-FREE PRODUCTS AND MEET THE REQUIREMENTS OF SAFE DRINKING WATER ACT SECTION 1417 (E) (SECTION 9 OF NSF/ANSI STANDARD 61) AND AUTHORITIES HAVING JURISDICTION.

WHEN A CONFLICT BETWEEN THE DRAWINGS, NOTES AND/OR SPECIFICATIONS OCCUR, THE MORE STRINGENT, AND/OR LARGER QUANTITY AND/OR MORE EXPENSIVE SHALL APPLY. THE REQUIREMENTS LISTED WITHIN NOTES OR SPECIFICATIONS SHALL BE REQUIRED, PROVIDED AND INSTALLED WHETHER SPECIFICALLY INDICATED ON THE DRAWINGS OR NOT.

IT IS THE INTENTION OF THE SPECIFICATIONS AND DRAWINGS TO PROVIDE FOR FINISHED WORK, TESTED AND READY FOR OPERATION.

ITEMS AND SERVICES NOT SHOWN ON DRAWINGS OR SPECIFICATIONS BUT REQUIRED TO RENDER THE WORK COMPLETE AND READY FOR OPERATION, SHALL BE PROVIDED WITHOUT ADDITIONAL COST.

WORK OF THIS SECTION SHALL BE GOVERNED BY THE CONTRACT DOCUMENTS. PROVIDE MATERIALS, LABOR, EQUIPMENT AND SERVICES NECESSARY TO FURNISH, DELIVER AND INSTALL ALL WORK AS SPECIFIED AND AS REQUIRED BY JOB CONDITIONS. WHERE A CONFLICT EXISTS BETWEEN THESE NOTES, THE DRAWINGS AND THE SPECIFICATIONS, THE MORE STRINGENT REQUIREMENT SHALL APPLY.

DRAWINGS ARE DIAGRAMMATIC AND INDICATE A GENERAL ARRANGEMENT OF WORK AND ARE NOT TO BE CONSIDERED SUB-CONTRACTOR DOCUMENTS. IT IS THE INTENT OF THESE DOCUMENTS TO INCLUDE THE PROVISION AND INSTALLATION OF ALL NECESSARY WORK AND MATERIALS FOR COMPLETE, OPERATIONAL AND CODE COMPLIANT SYSTEMS BY THE CONTRACTOR. GENERAL DESIGN CONCEPTS INDICATED MUST BE FOLLOWED OR BETTERED. THE BID SHALL INCLUDE OFFSETS, ADDITIONAL PIPING, VALVES AND EQUIPMENT AND COMPONENTS AS REQUIRED TO MEET CONSTRUCTION CONDITIONS FOR PROPER OPERATION. DO NOT SCALE DRAWINGS. CONSULT ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR SPACE CONDITIONS AND ADDITIONAL REQUIREMENTS.

PERFORM THE WORK IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT GENERAL CONDITIONS AND WITH THE PROVISIONS OF ALL APPLICABLE LOCAL, STATE, AND FEDERAL CODES AND LAWS.

WORK SHALL INCLUDE ALL INCIDENTALS, LABOR, MATERIAL, EQUIPMENT, APPLIANCES, SERVICES, HOISTING, SCAFFOLDING, SUPPORTS, TOOLS, CONSUMABLE ITEMS, FEES, LICENSES, AND ADMINISTRATIVE TASKS REQUIRED TO COMPLETE AND MAKE OPERABLE WORK SHOWN ON THE DRAWINGS, SPECIFIED HEREIN AND AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM..

STORE MATERIALS INSIDE AND PROTECTED FROM DEBRIS, WEATHER AND MOISTURE.

THIS CONTRACTOR SHALL PROVIDE AND INSTALL ALL POWER AND CONTROL WIRING REQUIRED FOR EQUIPMENT OPERATION REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM. THIS CONTRACTOR SHALL PROVIDE MOTOR STARTERS FOR INSTALLATION. COORDINATE REQUIREMENTS.

PROVIDE AND INSTALL ALL MAKE-UP WATER DISTRIBUTION TO HVAC EQUIPMENT INCLUDING BACKFLOW PREVENTER.

PROVIDE AND INSTALL INDIRECT CONDENSATE WASTE PIPING AND TRAP TO FLOOR DRAIN OR DRAIN RECEPTOR FROM ALL HVAC EQUIPMENT. PROVIDE ADDITIONAL FLOOR DRAINS WITH TRAP PRIMERS OR DRAIN RECEPTORS AS REQUIRED.

PLUMBING DEVICES, FAUCETS, VALVES AND FITTINGS REQUIRED FOR SPECIALTY SERVICE EQUIPMENT (IE. KITCHEN, LAB,ETC) SHALL BE PROVIDED BY THIS CONTRACTOR UNLESS OTHERWISE SPECIFIED. THIS CONTRACTOR SHALL PROVIDE AND INSTALL PIPING, CONNECTIONS, DEVICES, VALVES AND EQUIPMENT REQUIRED FOR PROPER OPERATION. COORDINATE REQUIREMENTS.

KITCHENS, LABS AND SIMILAR SPECIALTY AREAS: ALL EXPOSED PIPING, STOPS, COCKS, AND WASTES WHICH ARE VISIBLE SHALL BE CHROME PLATED.

ALTERATION WORK AND DEMOLITION

ALL EQUIPMENT, FIXTURES, PIPING, ETC. TO BE REMOVED, SHALL BE DISPOSED OF, TURNED OVER TO THE OWNER, OR SALVAGED AS DIRECTED BY THE OWNER. EQUIPMENT, FIXTURES, PIPING, DEVICES, ETC. SHALL NOT BE REMOVED FROM THE PREMISES WITHOUT THE OWNER'S APPROVAL.

UPON COMPLETION OF REMOVALS AND MODIFICATIONS, ALL PIPING TO REMAIN SHALL BE PROPERLY PLUGGED, VALVED, CAPPED AND/OR BY PASSED SUCH THAT UPON COMPLETION OF WORK ALL SYSTEMS TO REMAIN, REMAIN OPERATIONAL.

NO DEAD ENDS SHALL BE LEFT ON ANY PIPING SYSTEMS UPON COMPLETION OF WORK.

EXISTING EXPOSED PIPING SYSTEMS NOT TO BE REUSED, AND NOT SPECIFICALLY NOTED FOR REMOVAL SHALL BE COMPLETELY REMOVED.

ALL SYSTEMS SHALL BE LEFT IN WORKING ORDER TO THE SATISFACTION OF THE OWNER UPON COMPLETION OF ALL NEW WORK.

ALL EXISTING EXPOSED, UNNECESSARY PIPING RELATED TO NEW WORK SHALL BE COMPLETELY REMOVED.

RE-ROUTE OR REMOVE ALL EXISTING PIPING AND SYSTEMS WHERE NECESSARY TO AVOID NEW EQUIPMENT, STRUCTURAL, OR MASONRY WORK AS REQUIRED BY THE PROPOSED ALTERATIONS.

COORDINATION DRAWINGS

DEVELOP AND SUBMIT COORDINATION DRAWINGS AS OUTLINED.

SHEET METAL, PLUMBING AND FIRE PROTECTION SHOP DRAWINGS THAT HAVE BEEN COORDINATED WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO ENGINEER FOR REVIEW. DRAWINGS MUST BE RETURNED FROM ENGINEER EITHER "REVIEWED" OR "FURNISH AS CORRECTED" PRIOR TO BEING USED AS BASIS FOR COORDINATION DRAWINGS.

AFTER SHEET METAL AND PIPING DRAWINGS HAVE BEEN REVISED PER ENGINEERS COMMENTS, REPRODUCIBLE COPIES SHALL BE SENT TO THE TRADES IN THE FOLLOWING SEQUENCE FOR THE INCLUSION OF THEIR WORK:

-MECHANICAL SHEET METAL
-PLUMBING PIPING
-MECHANICAL PIPING
-SPRINKLER PIPING
-ELECTRICAL WORK

AFTER ALL TRADES HAVE INCLUDED THEIR WORK ON THE COORDINATION DRAWING AND NOTED CONFLICTS, ALL TRADES SHALL MEET TO RESOLVE CONFLICTS AND AGREE TO ACCEPTABLE SOLUTIONS. EACH TRADE SHALL SIGN COORDINATION DRAWINGS. ITEMS NOT SHOWN ON COORDINATION DRAWING IS RESPONSIBILITY OF OMITTING CONTRACTOR AND CONTRACTOR IS SUBJECT TO ADDITIONAL COSTS INCURRED BY OTHER TRADES.

THE ARCHITECT AND ENGINEER ARE NOT PART OF THE COORDINATION DRAWING PROCESS. THE ENGINEER WILL PROVIDE ASSISTANCE FOR NOTED CONFLICTS ONLY. COORDINATION DRAWINGS ARE NOT TO BE CONSIDERED PIPING OR DUCT SHOP DRAWINGS. THE CONTRACTOR IS REQUIRED TO SUBMIT INDIVIDUAL PIPING AND DUCTWORK SHOP DRAWINGS FOR REVIEW BY THE ENGINEER. PIPING AND DUCTWORK SHOP DRAWINGS SHALL FOLLOW THE DESIGN INTENT OF THE CONTRACT DOCUMENTS.

SUBMIT FINAL SIGNED COORDINATION DRAWING TO ENGINEER FOR REVIEW. ENGINEER WILL REVIEW COORDINATION DRAWINGS FOR GENERAL ARRANGEMENT AND FOR NOTED CONFLICTS ONLY. SPECIFIC INSTALLATION REQUIREMENTS WILL BE REVIEWED ONLY IN INDIVIDUAL TRADE SHOP DRAWINGS.

ANY WORK FABRICATED OR INSTALLED PRIOR TO SIGN OFF BY ALL TRADES WHICH IS DEEMED TO BE IN CONFLICT WITH COORDINATION DRAWINGS SHALL BE REMOVED AND RE-INSTALLED IN CONFORMANCE WITH COORDINATION DRAWINGS.

EACH CONTRACTOR (MENTIONED ABOVE) IS RESPONSIBLE FOR THE COORDINATION OF HIS SUB-CONTRACTORS.

THE OVERALL COORDINATION OF THE COORDINATION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER IS NOT RESPONSIBLE FOR THE COORDINATION PROCESS. THE ENGINEER WILL RESPOND TO QUESTIONS THAT ARISE FROM THE COORDINATION PROCESS. DRAWINGS SUBMITTED WILL BE REVIEWED FOR CLEARLY IDENTIFIED CONFLICTS ONLY. SOLUTIONS TO CONFLICTS WILL NOT BEAR ADDITIONAL COST.

SHOP DRAWINGS

CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO BE APPROVED, REVISED, OR RESUBMITTED AS PER THE ENGINEERS COMMENTS, PRIOR TO CONSTRUCTION. INCLUDING BUT NOT LIMITED TO THE FOLLOWING:

-PLUMBING FIXTURES	-CLEAN OUTS	-DRAINS
-PIPING	-PIPE SEALS	-FITTINGS
-BRAZING	-HANGERS/SUPPORTS	-INSULATION
-THERMOSTATIC MIXING VALVES	-VALVES	-PUMPS
-WATER HEATERS		

AS BUILT DRAWINGS

PROVIDE A COMPLETE SET OF AS-BUILT DRAWINGS REFLECTING AS INSTALLED CONDITIONS. AS-BUILT DRAWINGS SHALL INDICATE ALL INSTALLED CONDITIONS OF SYSTEMS WITHIN THIS DISCIPLINE. DRAWINGS SHALL BE OF SIMILAR SCALE AS THE CONSTRUCTION DOCUMENTS AND INCLUDE DETAILS AS NECESSARY TO CLEARLY REFLECT THE INSTALLED CONDITION. DRAWINGS SHALL BE BOUND IN A COMPLETE AND CONSECUTIVE SET. SUPPLEMENTAL SKETCHES AND LOOSE PAPERWORK WILL NOT BE ACCEPTABLE AND WILL BE RETURNED FOR REVISION. THE CONTRACTOR SHALL COMPLY WITH THE ENGINEERS COMMENTS TO PRODUCE A CLEAR AND CONCISE SET OF DRAWINGS. DRAWINGS SHALL BE SUBMITTED IN BOTH HARD COPY AND ELECTRONIC (AUTO-CAD VERSION AS REQUIRED BY THE OWNER) VERSION. NUMBER OF COPIES OF EACH AS REQUESTED BY THE OWNER.

PROVIDE "AS-BUILT DRAWINGS" INDICATING IN A NEAT AND ACCURATE MANNER A COMPLETE RECORD OF ALL REVISIONS OF THE ORIGINAL DESIGN OF THE WORK. INDICATE THE FOLLOWING INSTALLED CONDITIONS:

INCLUDE ALL CHANGES AND AN ACCURATE RECORD, ON REPRODUCTIONS OF THE CONTRACT DRAWINGS OR APPROPRIATE SHOP DRAWINGS, OF ALL DEVIATIONS, BETWEEN THE WORK SHOWN AND WORK INSTALLED.

MAINS AND BRANCHES OF PIPING SYSTEMS, WITH VALVES AND CONTROL DEVICES LOCATED AND NUMBERED, CONCEALED UNIONS LOCATED, AND WITH ITEMS REQUIRING MAINTENANCE LOCATED (I.E., TRAPS, STRAINERS, EXPANSION COMPENSATORS, TANKS, ETC.). VALVE LOCATION DIAGRAMS, COMPLETE WITH VALVE TAG CHART.

EQUIPMENT LOCATIONS (EXPOSED AND CONCEALED), DIMENSIONED FROM PROMINENT BUILDING LINES.

APPROVED SUBSTITUTIONS, CONTRACT MODIFICATIONS, AND ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

CONTRACT MODIFICATIONS, ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

SUBMIT FOR REVIEW BOUND SETS OF THE REQUIRED DRAWINGS, MANUALS AND OPERATING INSTRUCTIONS.

SUBMIT A COMPLETE MAINTENANCE MANUAL OF ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT.

HOUSEKEEPING PADS

PROVIDE CONCRETE HOUSEKEEPING PADS FOR FLOOR-MOUNTED EQUIPMENT. COORDINATE EXACT LOCATIONS, DIMENSIONS, PIPING LOCATIONS, AND ANCHOR BOLT REQUIREMENTS. PROVIDE CONCRETE HOUSEKEEPING PADS UNDER ALL FLOOR MOUNTED EQUIPMENT. PADS SHALL BE CONSTRUCTED OF 3,000 PSI CONCRETE. PADS SHALL BE 4 INCHES HIGH, AND 4 INCHES WIDER THAN THE EQUIPMENT IN BOTH DIRECTIONS.

COORDINATE FLOOR DRAIN LOCATIONS WITH RESPECT TO EQUIPMENT HOUSEKEEPING PADS. PLACE DRAINS SUCH THAT EDGE OF THE FLOOR GRATE EXTENDS NO FURTHER THAN 2 INCHES FROM THE SIDE OF THE PAD.

HANGERS AND SUPPORT

SEISMIC RESTRAINT: PROVIDE SEISMIC RESTRAINT AND EXPANSION OF ALL PLUMBING EQUIPMENT AND SYSTEMS IN ACCORDANCE WITH STATE AND FEDERAL BUILDING CODE REQUIREMENTS. SUBMIT SHOP DRAWINGS SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF THE PROJECT INDICATING ALL NECESSARY COMPONENT CUTS, PLAN LOCATIONS AND CALCULATIONS FOR A COMPLETE SYSTEM.

PROVIDE ALL NECESSARY STRUCTURAL MEMBERS INCLUDING ADDITIONAL STRUCTURAL SUPPORT TO SUPPORT PIPING AND EQUIPMENT. HANGERS AND SUPPORTS SHALL BE OF AN APPROVED DESIGN NECESSARY TO SUPPORT PIPING, EQUIPMENT AND TO KEEP PIPING IN PROPER ALIGNMENT AND PREVENT TRANSMISSION OF INJURIOUS THRUSTS AND VIBRATIONS. IN ALL CASES WHERE HANGERS, BRACKETS, ETC., ARE SUPPORTED FROM CONCRETE CONSTRUCTION, DO NOT WEAKEN CONCRETE OR PENETRATE WATERPROOFING. ALL HANGERS AND SUPPORTS SHALL BE CAPABLE OF SCREW ADJUSTMENT AFTER PIPING IS ERECTED. HANGERS SUPPORTING PIPING EXPANDING INTO LOOPS, BENDS AND OFFSETS SHALL BE SECURED TO THE BUILDING STRUCTURE IN SUCH A MANNER THAT HORIZONTAL ADJUSTMENT PERPENDICULAR TO THE RUN OF PIPING SUPPORTED MAY BE MADE TO ACCOMMODATE DISPLACEMENT DUE TO EXPANSION. ALL SUCH HANGERS SHALL BE FINALLY ADJUSTED BOTH IN THE VERTICAL AND HORIZONTAL DIRECTION, AS REQUIRED. HANGERS IN CONTACT WITH COPPER OR BRASS PIPE SHALL BE DIELECTRIC, COMPATIBLE WITH COPPER AND BRASS ALLOY OR PROVIDED WITH FELT SLEEVE.

PROVIDE ADDITIONAL SUPPORT FOR PIPING AND EQUIPMENT WHEN DECK IS NOT CAPABLE OF SUPPORT.

BEAM CLAMPS - HANGERS SUPPORTED FROM STEEL SHALL BE CENTER LOADING BEAM CLAMPS FOR HANGERS SUPPORTING PIPING 2 INCHES. FOR PIPING 2-L/2 INCHES AND LARGER, I BEAM CLAMPS SHALL BE FORGED STEEL. "C" CLAMPS ARE NOT TO BE USED.

PROVIDE AND INSTALL EXPANSION COMPENSATION FOR ALL PIPING. SUBMIT PLANS, CALCULATIONS AND EQUIPMENT DATA.

PIPE SEALS

SEAL ALL PIPING PASSING THROUGH ALL FIRE AND/OR SMOKE RATED PARTITIONS AND WALLS WITH A UL LISTED, APPROVED AND TESTED FIRE AND/OR SMOKE SEALING MATERIAL INSTALLED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

ALL PIPING PENETRATING A SLAB ON GRADE OR FOUNDATION WALL BELOW GRADE AND IN CONTACT WITH EARTH SHALL BE PROVIDED WITH A POURED IN PLACE SCHEDULE 80 GALVANIZED STEEL WATER TIGHT SLEEVE WITH INTEGRAL WATER STOP AND SEAL EQUAL TO "LINK SEAL".

FURNISH AND SET STEEL PIPE SLEEVES OF SCHEDULE 40 BLACK STEEL FOR ALL LOCATIONS OF INTERIOR PARTITIONS, WALLS AND FLOORS PROVIDING AT LEAST 1/2" CLEARANCE BETWEEN PIPE INSULATION AND SLEEVE OR PIPE AND SLEEVE. WALL SLEEVES SHALL BE SMOOTH CUT AND SET FLUSH WITH FINISHED WALLS. FLOOR SLEEVES SHALL EXTENDED 2" ABOVE THE FINISHED FLOOR.

ALL PIPING THROUGH WALLS, FLOORS OR CEILINGS SHALL HAVE SLEEVES AND ESCUTCHEONS. PROVIDE A TWO PIECE CHROME ESCUTCHEON WHERE PIPING PASSES THROUGH WALLS OR FLOORS OF FINISHED SPACES.

PLUMBING FIXTURES

PLUMBING FIXTURES SHALL BE NEW, COMPLETE WITH TRIMMINGS AND FITTINGS, INCLUDING FAUCETS, CARRIERS, SUPPLIES, STOPS, TRAPS, TAILPIECES, WASTE PLUGS, CASINGS, HANGERS, PLATES, BRACKETS, ANCHORS, SUPPORTS, HARDWARE AND FASTENING DEVICES. NOTE: ALL FIXTURES SHALL BE OF SAME MANUFACTURER. TRIMMINGS AND FITTINGS SHALL BE CONSTRUCT OF FORGED, CAST, ROLLED OR EXTRUDED BRASS OR BRONZE WITH MONEL AND OTHER SUITABLE NON-CORROSIVE PARTS: DESIGNED WITH EASILY RENEWABLE PARTS THAT ARE SUBJECT TO WEAR OR DETERIORATION. NO DIE CASTINGS AND STAMPINGS OTHER THAN BRASS OR STAINLESS STEEL. PROVIDE PLUMBING FIXTURES AND TRIM WITH ALL NECESSARY TRIM, DEVICES AND ACCESSORIES REQUIRED FOR PROPER OPERATIONS SPECIFICALLY NOTED OR NOT

ESCUTCHEONS SHALL BE ONE-PIECE CHROME PLATED CAST BRASS OR STAINLESS STEEL.

P-TRAPS SHALL BE ONE PIECE CHROME PLATED CAST BRASS WITH CLEANOUT PLUG.

EXAMINE ROUGHING-IN WORK OF POTABLE WATER AND WASTE PIPING SYSTEMS TO VERIFY ACTUAL LOCATIONS OF PIPING CONNECTIONS PRIOR TO INSTALLING FIXTURES. CORRECT ANY INCORRECT LOCATION OF PIPING, AND OTHER UNSATISFACTORY CONDITIONS FOR INSTALLATION OF PLUMBING FIXTURES. DO NOT PROCEED WITH WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED IN A MANNER ACCEPTABLE TO THE ENGINEER. ALL ROUGH-IN TO PLUMBING FIXTURES SHALL CONFORM TO FIXTURE MANUFACTURER PUBLISHED ROUGH-IN DIMENSIONS, AND REQUIREMENTS.

UPON COMPLETION OF INSTALLATION OF PLUMBING FIXTURES AND AFTER UNITS ARE WATER PRESSURIZED, TEST FIXTURES TO DEMONSTRATE CAPABILITY AND COMPLIANCE WITH REQUIREMENTS. CORRECT MALFUNCTIONING UNITS AT SITE, THEN RETEST TO DEMONSTRATE COMPLIANCE; OTHERWISE, REMOVE AND REPLACE WITH NEW UNITS AND PROCEED WITH RETESTING.

CLEAN PLUMBING FIXTURES, TRIM, AND STRAINERS OF DIRT AND DEBRIS UPON COMPLETION OF INSTALLATION.

ADJUST WATER PRESSURE AT DRINKING FOUNTAINS, FAUCETS, SHOWER VALVES, AND FLUSH VALVES TO PROVIDE PROPER FLOW STREAM AND SPECIFIED GPM.

SET FIXTURES LEVEL AND UNIFORMLY, WITH CONNECTIONS AT RIGHT ANGLES TO WALL AND PROPERLY CENTERED. LAY OUT ROUGHING ACCURATELY AND IN COORDINATION WITH SPACE AND FINISH REQUIREMENTS.

LOCATE WASTE OUTLETS AND WATER SUPPLIES AT CONSTANT HORIZONTAL LEVELS, WITH WASTE OUTLET CENTERED ON FIXTURE DRAIN CONNECTION AND WATER SUPPLIES SPACED EQUALLY TO RIGHT AND LEFT.

DRAINS AND CLEANOUTS

PROVIDE ALL POURED IN PLACE DRAINS AND CLEANOUTS WITH 24" X 24" FLASHING.

PROVIDE A MANUFACTURED BRONZE OUTLET FITTING FOR ALL SECONDARY ROOF DRAIN OUTLETS.

INSTALL EXTERIOR CLEANOUTS WITH A 18" SQUARE X 6" THICK CONCRETE APRON.

COORDINATE FLOOR DRAIN LOCATIONS WITH RESPECT TO EQUIPMENT HOUSEKEEPING PADS. PLACE DRAINS SUCH THAT EDGE OF THE FLOOR GRATE EXTENDS NO FURTHER THAN 2 INCHES FROM THE SIDE OF THE PAD. CLEANOUT PLUGS SHALL BE BRASS OR PLASTIC, OR OTHER APPROVED MATERIALS. BRASS CLEANOUT PLUGS SHALL BE UTILIZED WITH METALLIC DRAIN, WASTE AND VENT PIPING ONLY, AND SHALL CONFORM TO ASTM A 74, ASME A112.3.1 OR ASME A112.36.2M. CLEANOUTS WITH PLATE-STYLE ACCESS COVERS SHALL BE FITTED WITH CORROSION-RESISTING FASTENERS. PLUGS SHALL HAVE RAISED SQUARE OR COUNTERSUNK SQUARE HEADS. COUNTERSUNK HEADS SHALL BE INSTALLED WHERE RAISED HEADS ARE A TRIP HAZARD. CLEANOUT PLUGS WITH BOROSILICATE GLASS SYSTEMS SHALL BE OF BOROSILICATE GLASS.

CLEANOUTS SHALL BE LOCATED AT MINIMUM INTERVALS OF 50 FEET FOR PIPING NPS 4 AND SMALLER AND 100 FEET FOR LARGER PIPING.

BUILDING SEWERS SHALL BE PROVIDED WITH CLEANOUTS LOCATED NOT MORE THAN 100 FEET APART MEASURED FROM THE UPSTREAM ENTRANCE OF THE CLEANOUT. FOR BUILDING SEWERS 8 INCHES AND LARGER, MANHOLES SHALL BE PROVIDED AND LOCATED NOT MORE THAN 200 FEET FROM THE JUNCTION OF THE BUILDING DRAIN AND BUILDING SEWER, AT EACH CHANGE IN DIRECTION AND AT INTERVALS OF NOT MORE THAN 400 FEET APART. MANHOLES AND MANHOLE COVERS SHALL BE OF AN APPROVED TYPE.

CLEANOUTS SHALL BE INSTALLED AT EACH CHANGE OF DIRECTION OF THE BUILDING DRAIN OR HORIZONTAL WASTE OR SOIL LINES GREATER THAN 45 DEGREES (INCLUDING P-TRAPS). WHERE MORE THAN ONE CHANGE OF DIRECTION OCCURS IN A RUN OF PIPING, ONLY ONE CLEANOUT SHALL BE REQUIRED FOR EACH 40 FEET OF DEVELOPED LENGTH OF THE DRAINAGE PIPING.

A CLEANOUT SHALL BE PROVIDED AT THE BASE OF EACH WASTE OR SOIL STACK.

THERE SHALL BE A CLEANOUT NEAR THE JUNCTION OF THE BUILDING DRAIN AND THE BUILDING SEWER. THE CLEANOUT SHALL BE EITHER INSIDE OR OUTSIDE THE BUILDING WALL AND SHALL BE BROUGHT UP TO THE FINISHED GROUND LEVEL OR TO THE BASEMENT FLOOR LEVEL. AN APPROVED TWO-WAY CLEANOUT IS ALLOWED TO BE USED AT THIS LOCATION TO SERVE AS A REQUIRED CLEANOUT FOR BOTH THE BUILDING DRAIN AND BUILDING SEWER. THE CLEANOUT AT THE JUNCTION OF THE BUILDING DRAIN AND BUILDING SEWER SHALL NOT BE REQUIRED IF THE CLEANOUT ON A 3-INCH OR LARGER DIAMETER SOIL STACK IS LOCATED WITHIN A DEVELOPED LENGTH OF 10 FEET OF THE BUILDING DRAIN AND BUILDING SEWER CONNECTION.

CONCEALED PIPING. CLEANOUTS ON CONCEALED PIPING OR PIPING UNDER A FLOOR SLAB OR IN A CRAWL SPACE OF LESS THAN 24 INCHES IN HEIGHT OR A PLENUM SHALL BE EXTENDED THROUGH AND TERMINATE FLUSH WITH THE FINISHED WALL, FLOOR OR GROUND SURFACE OR SHALL BE EXTENDED TO THE OUTSIDE OF THE BUILDING. CLEANOUT PLUGS SHALL NOT BE COVERED WITH CEMENT, PLASTER OR ANY OTHER PERMANENT FINISH MATERIAL. WHERE IT IS NECESSARY TO CONCEAL A CLEANOUT OR TO TERMINATE A CLEANOUT IN AN AREA SUBJECT TO VEHICULAR TRAFFIC, THE COVERING PLATE, ACCESS DOOR OR CLEANOUT SHALL BE OF AN APPROVED TYPE DESIGNED AND INSTALLED FOR THIS PURPOSE.

PROVIDE AND INSTALL DRIP PANS WITH WATER DETECTOR AND DRAIN FOR PIPING REQUIRED BY ACTUAL FIELD CONDITIONS WHERE PIPING PASSES OVER INCLUDING AREA WITHIN 3'-0" OF ELECTRICAL EQUIPMENT.

DO NOT INSTALL AIR GAP BACKFLOW PREVENTERS IN CONCEALED SPACES OR IN AREAS WHERE SPLASHING WATER WILL DAMAGE FINISHES. PROVIDE AND INSTALL AN OVERSIZED COPPER FUNNEL WITH AIR GAP DIRECTLY BELOW RPD PRESSURE RELIEF PORT. PIPE FUNNEL TO SPILL AS AN INDIRECT WASTE TO AN APPROVED DRAIN LOCATION.

INSTALL ELECTRONIC TRAP PRIMERS SERVING ALL DRAINS. INSTALL ALL TRAP PRIMER VALVES IN AN ACCESSIBLE LOCATION. PROVIDE AND INSTALL ACCESS PANELS AND DOORS WHERE REQUIRED TO GAIN ACCESS IN CONCEALED CONSTRUCTION.

PIPING GENERAL

NO PIPING SHALL BE COVERED UNTIL TESTED APPROVED BY THE AUTHORITIES HAVING JURISDICTION.

ALL PIPING SHALL BE RUN PERPENDICULAR AND/OR PARALLEL TO FLOORS, INTERIOR WALLS, ETC. PIPING AND VALVES SHALL BE GROUPED NEATLY AND SHALL BE RUN AS TO MAXIMIZE HEADROOM OR PASSAGE CLEARANCE. ALL VALVES, CONTROLS AND ACCESSORIES CONCEALED IN FURRED SPACES AND REQUIRING ACCESS FOR OPERATION AND MAINTENANCE SHALL BE ARRANGED TO ASSURE THE USE OF A MINIMUM NUMBER OF ACCESS DOORS.

ALL PIPE LINES MADE WITH SCREWED FITTINGS MUST BE PROVIDED WITH A SUFFICIENT NUMBER OF FLANGES AND/OR UNIONS TO ALLOW FOR EASY AND CONVENIENT DISMANTLING OF THE SYSTEM WITHOUT BREAKING FITTINGS.

ALL PIPING SHALL RUN CONCEALED IN FURRED SPACES OF OCCUPIED AREAS OR CHASES. CONTRACTOR SHALL OBTAIN PERMISSION TO RUN ANY EXPOSED PIPES.

CAP ALL PIPE AND EQUIPMENT OUTLETS DURING CONSTRUCTION AND KEEP LINES AND INSIDE OF EQUIPMENT FREE OF FOREIGN MATERIALS.

PROVIDE FOR EXPANSION WITHOUT WARPING OR DISLOCATING LINES OR STRAINING CONNECTED EQUIPMENT. INSTALL PIPING TO CLEAR BUILDING CONSTRUCTION AND TO AVOID INTERFERENCE WITH OTHER WORK. THE CONTRACTOR SHALL PROVIDE AND INSTALL COMPLETE PIPING EXPANSION SYSTEM (INCLUDING SEISMIC JOINT EXPANSION) AND DEVICES AS REQUIRED FOR PROPER EXPANSION COMPENSATION STAMPED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF THE PROJECT.

THE DRAWINGS INDICATE SCHEMATICALLY THE SIZE AND LOCATION OF PIPING. PIPING SHALL BE SET UP AND DOWN AND OFFSET AS REQUIRED TO MEET CONSTRUCTION CONDITIONS.

THIS CONTRACTOR SHALL INFORM HIMSELF FROM THE GENERAL CONSTRUCTION SPECIFICATIONS AND PLANS, OF THE EXACT DIMENSION OF FINISHED WORK AND OF THE HEIGHT OF FINISHED CEILINGS IN ALL ROOMS WHERE EQUIPMENT OR PIPES ARE TO BE PLACED AND ARRANGE HIS WORK IN ACCORDANCE WITH THE SCHEDULE OF INTERIOR FINISHES, AS INDICATED ON THE ARCHITECTURAL DRAWINGS.

WATER PIPING SHALL BE RUN FREE OF TRAPS AND UNNECESSARY BENDS. ANY TRAPS FORMED SHALL BE PROVIDED WITH HOSE END DRAIN VALVES WITH THREADED CAP AND CHAIN TO COMPLETELY DRAIN THE SYSTEM.

PROVIDE SECTION CUT-OFF VALVES ON ALL MAINS AND BRANCHES. PITCH AND VALVE ALL WATER PIPING FOR CONVENIENT DRAINAGE.

WHEREVER DISSIMILAR METALS ARE JOINED TOGETHER AN APPROVED DIELECTRIC FITTING SHALL BE USED. THE DIELECTRIC FITTING SHALL BE A LISTED ASSEMBLY.

RUN ALL SOIL, WASTE AND VENT PIPING SHOWN OR REQUIRED BY LOCAL CODES. PIPING SHOWN IS MINIMUM AND IN ACCORDANCE WITH STATE AND FEDERAL CODES. IF LOCAL CODES REQUIRE ADDITIONAL VENTING OR LARGER SIZES, PROVIDE AS REQUIRED.

MAKE ALL CONNECTIONS THROUGH TRAPS. EACH TRAP TO BE VENTED, EITHER BY CIRCUIT, LOOP, OR INDIVIDUAL VENT, AS REQUIRED, BUT NOT LESS THAN SHOWN, OR AS REQUIRED BY LOCAL CODE.

ALL UNDERGROUND PIPING SHALL BE LAID ON 6" SAND AND BACKFILLED WITH CLEAN FINE EARTH COMPACTED TO 12" ABOVE PIPE. COMPLETE BACKFILL WITH AVAILABLE EARTH FREE OF LARGE BOULDERS AND SHARP ROCKS. TAMP BACKFILL IN 6" ELEVATIONS AND OVERFILL TO ALLOW FOR SETTLEMENT.

SET AND PROPERLY CONNECT ALL FIXTURES WITH HOT AND COLD WATER, VENT AND DRAINAGE PIPING, AS REQUIRED AND PROTECT FIXTURES UNTIL ACCEPTANCE AND TEST. CLEAN ALL FLUSH VALVES AFTER TWO WEEKS OF OPERATION.

INSTALL THRUST BLOCKS FOR UNDERGROUND WATER PIPING AT ALL CHANGES IN DIRECTION BOTH HORIZONTALLY AND VERTICALLY. THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED EARTH OR EARTH. THRUST BLOCKS SHALL BE INSTALLED IN ACCORDANCE WITH THE DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA) MANUAL "THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE" AND LOCAL UTILITY COMPANY REQUIREMENTS.
MINIMUM SIZE. CLEANOUTS SHALL BE THE SAME NOMINAL SIZE AS THE PIPE THEY SERVE UP TO 4 INCHES. FOR PIPES LARGER THAN 4 INCHES NOMINAL SIZE, THE MINIMUM SIZE OF THE CLEANOUT SHALL BE 4 INCHES.

CAST-IRON CLEANOUT SIZING SHALL BE IN ACCORDANCE WITH ASTM A 74 FOR HUB AND SPIGOT FITTINGS OR ASTM A 888 OR CISPI 301 FOR HUBLESS FITTINGS.

ACCESS SHALL BE PROVIDED TO ALL CLEANOUTS.

MISCELLANEOUS SPECIALTIES

PROVIDE AND INSTALL ACCESS DOORS FOR EACH VALVE, CLEANOUT OR PLUMBING DEVICE REQUIRING ACCESS. ACCESS DOORS SHALL BE RIGID CONSTRUCTION WITH TWO HINGES AND A LATCH. IN PLENUM CEILINGS, PROVIDE FELT BETWEEN THE DOOR AND FRAME TO MAKE AN AIR TIGHT SEAL. ACCESS DOORS SHALL BE RATED TO THE SAME OR GREATER RATING OF THE PARTITION IN WHICH THEY ARE INSTALLED. ACCESS DOORS SHALL BE FLUSH MOUNTED, PRIME COATED WITH RUST INHIBITIVE PAINT, CONCEALED FRAME, FLUSH SCREW DRIVER OPERATED LOCKS WITH METAL CAMS AND ANCHORS AS REQUIRED.

ACCESS DOOR SIZES SHALL BE:
12" X 12" AT EASILY ACCESSIBLE ITEMS
16" X 16" WHERE PARTIAL BODY ACCESS IS REQUIRED
24" X 24" WHERE FULL BODY ACCESS IS REQUIRED

2022 NEW YORK CITY BUILDING DEPARTMENT PLUMBING NOTES

THE PLUMBING SYSTEMS (SANITARY, STORM, VENT, WATER DISTRIBUTION AND GAS) AND ALL ASSOCIATED EQUIPMENT WILL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE FULL REQUIREMENTS OF THE 2022 BUILDING CODE OF THE CITY OF NEW YORK AS CITED IN THE 2022 NEW YORK CITY PLUMBING CODE (NYCPC), CHAPTER 15 REFERENCED STANDARDS OF THE NYCPC AND THE 2022 NEW YORK CITY FUEL GAS CODE (NYCFGC), CHAPTER 8 REFERENCED STANDARDS OF THE NYCFGC.

1. THE SANITARY SYSTEM SHALL BE IN FULL ACCORDANCE WITH THE GENERAL PROVISIONS OF SECTION PC 301.
2. THE MATERIALS USED IN THE PLUMBING SYSTEM SHALL BE PROVIDED IN FULL ACCORDANCE WITH SECTIONS PC 302 AND PC 303.
3. EQUIPMENT HOOK-UP AND THE JOINING OF PIPING SHALL BE IN FULL COMPLIANCE WITH SECTIONS PC 605 AND PC 705.
4. THE INSTALLATION OF FIXTURES SHALL BE IN FULL ACCORDANCE WITH SECTION PC 405.
5. TRAPS FOR FIXTURES AND DRAIN LINES SHALL BE PROVIDED AND CLEANOUTS INSTALLED IN FULL ACCORDANCE WITH SECTIONS PC412, PC 708 AND CHAPTER 10.
6. VERTICAL AND HORIZONTAL PIPING SHALL BE HUNG AND SUPPORTED AS DIRECTED IN SPECIFICATIONS AND IN THE FULL COMPLIANCE WITH SECTION PC 308.
7. THE WATER SUPPLY SYSTEM OF THE SUBJECT BUILDING SHALL BE INSTALLED AND MAINTAINED IN FULL COMPLIANCE WITH CHAPTER 6.
8. THE SANITARY DRAINAGE SYSTEM OF THE SUBJECT BUILDING SHALL BE INSTALLED IN FULL COMPLIANCE WITH CHAPTER 7.
9. THE VENT PIPING FOR THE SANITARY DRAINAGE SYSTEM OF THE SUBJECT BUILDING SHALL BE INSTALLED IN FULL COMPLIANCE WITH SECTION PC 702 AND CHAPTER 9.
10. THE STORM DRAINAGE SYSTEM OF THE SUBJECT BUILDING SHALL BE INSTALLED IN FULL COMPLIANCE WITH CHAPTER 11.
11. GAS PIPING AND EQUIPMENT SHALL BE INSTALLED IN FULL COMPLIANCE WITH THE NEW YORK CITY FUEL GAS CODE.
12. ALL TRENCHING SHALL BE DONE IN FULL COMPLIANCE WITH THE REQUIREMENTS OF SECTION PC 306.
13. TEMPORARY TOILET FACILITIES SHALL BE PROVIDED FOR WORKERS AS PER SECTION PC 311.
14. RODENT PROOFING SHALL BE DONE IN ACCORDANCE WITH SECTION PC 304.
15. CHANGES IN DIRECTION IN DRAINAGE PIPING SHALL BE MADE WITH APPROPRIATE USE OF 45 DEGREE WYES, LONG SWEEPS, SHORT SWEEPS, SIXTH, EIGHT OR SIXTEENTH BENDS OR BY A COMBINATION OF THESE OR EQUIVALENT FITTINGS. FOR LIMITATIONS ON FITTINGS SEE SECTION PC 706.3 AND TABLE 706.3.
16. SANITARY TEES MAY BE USED IN DRAINAGE LINES ONLY WHERE THE DIRECTION OF FLOW IS FROM THE HORIZONTAL TO THE VERTICAL. FOR LIMITATIONS ON DOUBLE SANITARY TEES SEE SECTION PC 706.3.
17. SHORT SWEEPS AND QUARTER BENDS WILL BE PERMITTED IN DRAINAGE PIPING 3 INCH DIAMETER OR LARGER AND FIXTURE DRAINS 2 INCH DIAMETER AND SMALLER FOR ANY OFFSETS EITHER HORIZONTAL OR VERTICAL. HORIZONTAL TO HORIZONTAL CONNECTIONS WILL BE PERMITTED FOR 2 INCH DIAMETER OR SMALLER FIXTURE DRAINS SEE SECTION TABLE 706.3.
18. POTABLE WATER SHALL NOT BE PERMITTED FOR USES AS PER PC 428.

2022 NYC PROGRESS INSPECTIONS

PROGRESS INSPECTIONS ARE REQUIRED IN ACCORDANCE WITH APPLICABLE SECTIONS OF THE 2022 NYC BUILDING CODE ARE LISTED IN THE FOLLOWING TABLES.

2020 NYCECC ENERGY INSPECTION ITEMS:
PIPING INSULATION (INSULATION PLACEMENT AND R VALUES)

GENERAL DEMOLITION NOTES

1. ALL EQUIPMENT, FIXTURES, PIPING ETC. TO BE REMOVED SHALL BE DISPOSED OF, TURNED OVER TO THE OWNER, OR SALVAGED AS DIRECTED BY THE OWNER. EQUIPMENT, FIXTURES, PIPING, DEVICES, ETC. SHALL NOT BE REMOVED FROM THE PREMISES WITH OUT THE OWNER'S APPROVAL.
2. ALL ABANDONED PIPING TO REMAIN SHALL BE PROPERLY PLUGGED, VALVED, CAPPED AND/OR BY PASSED SUCH THAT UPON COMPLETION OF WORK ALL ABANDONED SYSTEMS ARE PROPERLY CONCEALED, AND THAT EXISTING SYSTEMS TO REMAIN, REMAIN OPERATIONAL.
3. NO DEAD ENDS SHALL BE LEFT ON ANY PIPING SYSTEMS UPON COMPLETION OF WORK.
4. EXISTING EXPOSED PIPING SYSTEMS NOT TO BE REUSED, AND NOT SPECIFICALLY NOTED FOR REMOVAL SHALL BE COMPLETELY REMOVED. CONTRACTOR SHALL VERIFY PRIOR TO REMOVAL.
5. ALL SYSTEMS SHALL BE LEFT IN PERFECT WORKING ORDER UPON COMPLETION OF ALL NEW WORK.
6. ALL EXISTING EXPOSED, UNNECESSARY PIPING RELATED TO NEW WORK SHALL BE COMPLETELY REMOVED.
7. REROUTE OR REMOVE ALL EXISTING PIPING, AND SYSTEMS WHERE NECESSARY TO AVOID NEW EQUIPMENT, STRUCTURAL, OR MASONRY WORK AS REQUIRED BY THE PROPOSED ALTERATIONS.
8. COORDINATE PLUMBING SERVICES SHUT DOWNS (H&CW, GAS, WASTE, VENT & STORM SYSTEMS) WITH THE BUILDING MANAGER AND UTILITY COMPANY.

PLUMBING LEGEND

SYMBOL OR ABBREVIATION	DESCRIPTION
G	GAS PIPING
S	SANITARY PIPING ABOVE FINISH FLOOR
S/UG	SANITARY PIPING BELOW FINISH FLOOR
W	WASTE PIPING ABOVE FINISH FLOOR
W/UG	WASTE PIPING BELOW FINISH FLOOR
IW	INDIRECT WASTE
AW	ACID WASTE PIPING
ST	STORM PIPING ABOVE FINISH FLOOR
ST/UG	STORM PIPING BELOW FINISH FLOOR
V	VENT PIPING
AWV	ACID WASTE VENT PIPING
CW	DOMESTIC COLD WATER PIPING
HW	DOMESTIC HOT WATER PIPING
HWC	DOMESTIC HOT WATER RECIRCULATUION PIPING
CA	COMPRESSED AIR
	BALL VALVE
	CHECK VALVE
	BALANCING VALVE (CIRCUIT SETTER)
	SANITARY TEE
	PIPE TEE
	ELBOW UP
	ELBOW DOWN
	P-TRAP
	GATE VALVE
	REDUCED PRESSURE BACKFLOW PREVENTER
	Y-PATTERN STRAINER
	WATER METER
	COMBINATION WYE AND 1/8 BEND
1i	PLUMBING FIXTURE TAG
D# (XXXX SQ.FT.)	ROOF DRAIN TAG WITH AREA SERVICED
1 MEPFP-1 SIM	DETAIL / CALLOUT DESIGNATION
1 / A101	VIEW REFERENCE
	PIPE / VIEW BREAK LINE

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
C.I.	CAST IRON	L#	PIPE TYPE
CO	CLEANOUT	M#	MOP SINK - TYPE
BLDG	BUILDING	S#	SINK - TYPE
CONN	CONNECT	W#	WATER CLOSET - TYPE
DPCO	DECK PLATE CLEANOUT	STK	STACK
DR	DRAIN	U#	URINAL - TYPE
D#	DRAIN - TYPE	VTR / V.T.R.	VENT THROUGH ROOF
EWC#	ELECTIC WATER COOLER - TYPE	TYP	TYPICAL
GALV	GALVANIZED	TP / T.P.	TRAP PRIMER

PLUMBING DRAWING LIST

DRAWING NUMBER	DRAWING DESCRIPTION
P001.00.00	COVER SHEET - PLUMBING
P102.00.00	EXISTING SECOND FLOOR PLAN - PLUMBING
P103.00.00	THIRD FLOOR DEMO PLANS - PLUMBING
P201.00.00	SECOND FLOOR PLAN - PLUMBING
P202.00.00	THIRD FLOOR PLAN - PLUMBING
P300.00.00	PART PLANS & RISER DIAGRAMS - PLUMBING
P500.00.00	SCHEDULES - PLUMBING
P600.00.00	DETAILS - PLUMBING

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

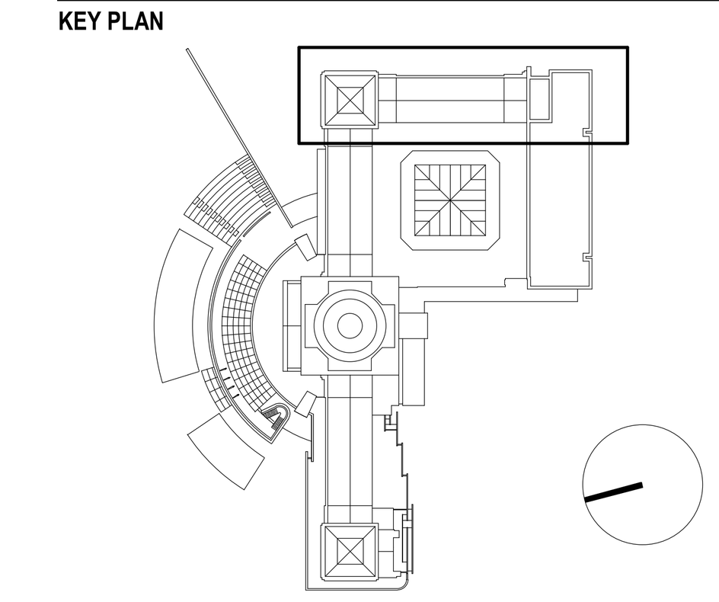
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

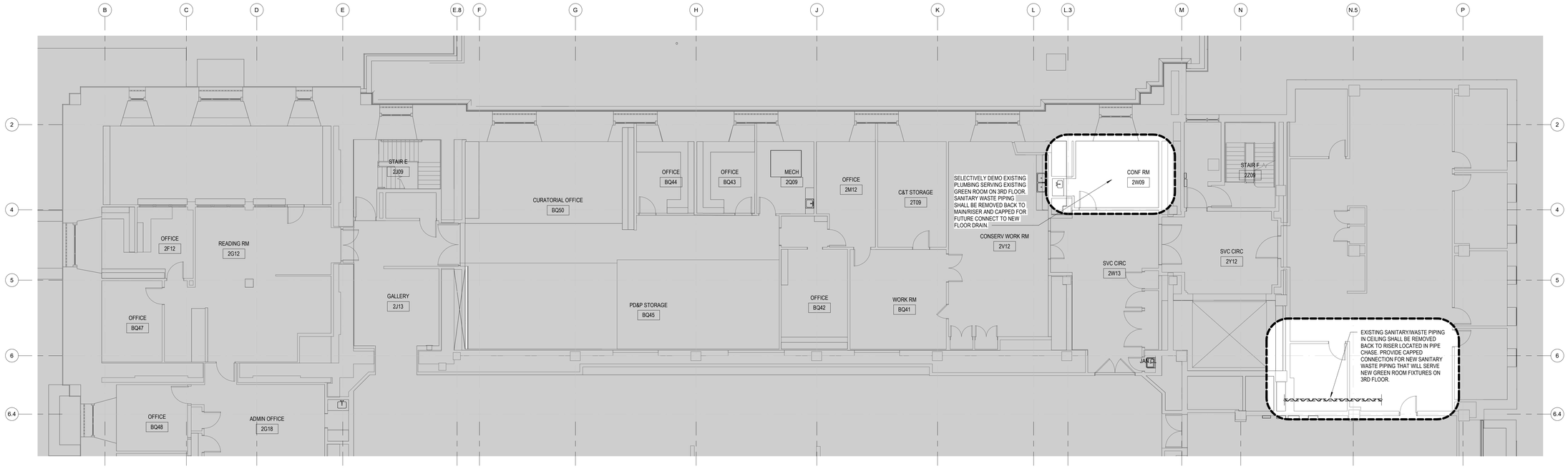
DRAWING TITLE

COVER SHEET - PLUMBING

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

P001.00

10/14/2025 5:11:17 PM



1 P102.00 SECOND FLOOR EXISTING PLAN
SCALE: 1/8" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

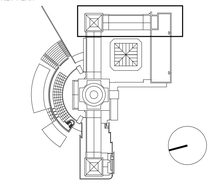
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

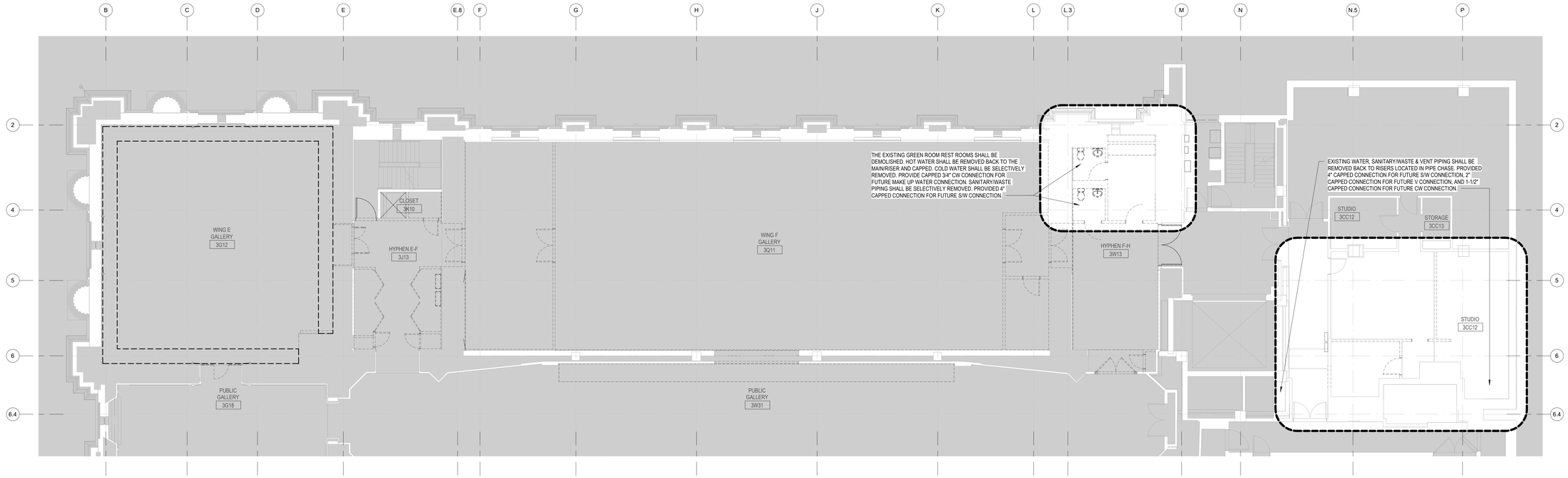
EXISTING SECOND FLOOR PLAN - PLUMBING

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

P102.00

10/14/2025 5:11:19 PM



1 P103.00 THIRD FLOOR DEMO PLAN
SCALE: 1/8" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

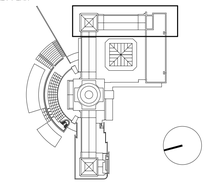
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

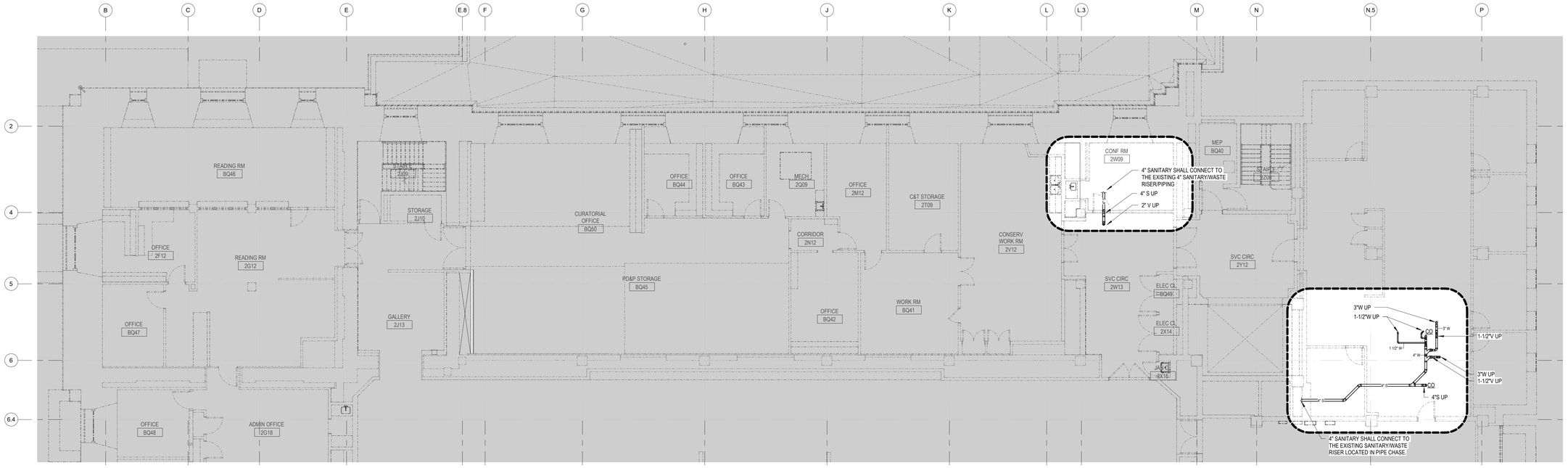
THIRD FLOOR DEMO PLANS - PLUMBING

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

P103.00

10/14/2025 5:11:21 PM



2 SECOND FLOOR PLAN
P201.00 SCALE: 1/8" = 1'-0"

10/14/2025 5:11:22 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

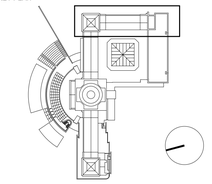
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

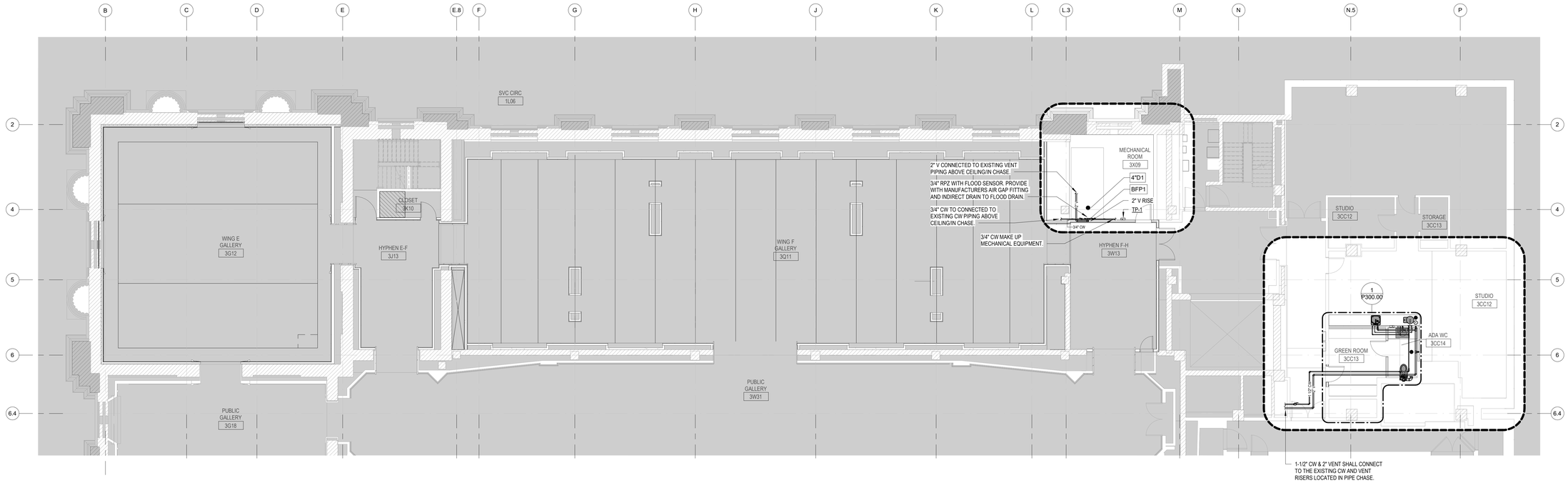
DRAWING TITLE

SECOND FLOOR PLAN - PLUMBING

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

P201.00



1 P202.00 THIRD FLOOR PLAN
SCALE: 1/8" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

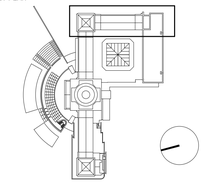
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

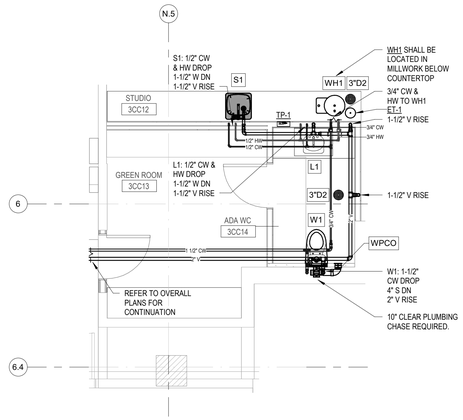
THIRD FLOOR PLAN - PLUMBING

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

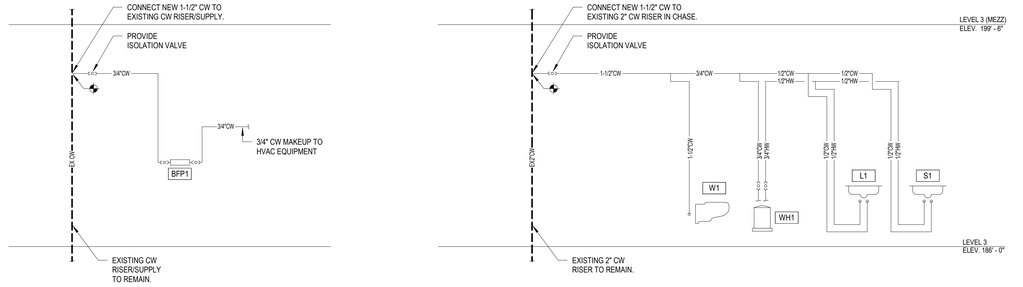
DRAWING NUMBER

P202.00

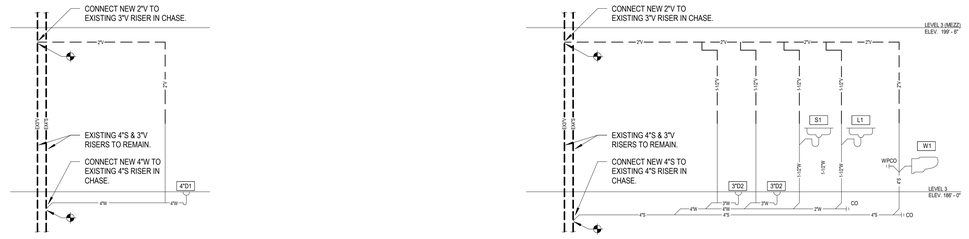
10/14/2025 5:11:25 PM



1 P300.00 PARTIALTHIRD FLOOR PLAN
SCALE: 1/4" = 1'-0"



2 P300.00 DOMESTIC WATER RISER DIARAM
SCALE: NOT TO SCALE



3 P300.00 SANITARY RISER DIARAM
SCALE: NOT TO SCALE

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

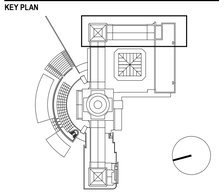
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

PART PLANS & RISER
DIAGRAMS - PLUMBING

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

P300.00

10/14/2025 5:11:26 PM

PLUMBING DRAIN SCHEDULE

FIXTURE TAG	FIXTURE TYPE	FIXTURE MANUFACTURER MODEL, MODEL NO.	MATERIAL	DESCRIPTION	SUPPLY SIZE	TRAP SIZE	MINIMUM BRANCH SIZES WASTE/ SANITARY	VENT	COLD WATER	HOT WATER	REMARKS
D1	9" ROUND FLOOR DRAIN MECHANICAL ROOMS	JOSAM 32100-TG SERIES JR SMITH 2120Y-CI-P050 MIFAB F1324-C SERIES WADE 1310 SERIES WATTS FD-320-Y ZURN Z-508 SERIES	CAST IRON	HEAVY DUTY WITH CAST IRON BODY, BOTTOM OUTLET, 9" DIAMETER CAST IRON TOP, TRAP PRIMER CONNECTION, SEEPAGE PAN AND COMBINATION MEMBRANE FLASHING CLAMP	--	AS NOTED ON DWG.	--	--	--	--	
D2	6" SQUARE FLOOR DRAIN TOILET ROOMS	JOSAM 30000-S SERIES JR SMITH 2005-B06NB-P050 MIFAB F1100-C-S SERIES WADE 1100-G SERIES WATTS FD-100-M6-7 ZURN Z415S SERIES	CAST IRON	CAST IRON BODY, BOTTOM OUTLET, 6" X 6" SQUARE NICKEL BRONZE TOP, TRAP PRIMER CONNECTION, SEEPAGE PAN AND COMBINATION MEMBRANE FLASHING CLAMP	--	AS NOTED ON DWG.	--	--	--	--	

NOTE: PROVIDE TRAP PRIMERS FOR ALL FLOOR DRAINS.

INSULATION SCHEDULE

SYSTEM	PIPE SIZE	PIPE INSULATION TYPE	PIPE INSULATION THICKNESS	FITTINGS, VALVES, FLANGES - INSULATION TYPE	REMARKS
DOMESTIC COLD WATER	ALL	MINERAL FIBER, ASJ, SSL	1"	MOLDED, PRE-FORMED MINERAL FIBER PVC JACKET	TYPE I
DOMESTIC HOT & HOT RECIRC WATER 105º THRU 140º	1-1/4" & LESS	MINERAL FIBER, ASJ, SSL	1"	MOLDED, PRE-FORMED MINERAL FIBER PVC JACKET	TYPE I
DOMESTIC HOT & HOT RECIRC WATER 105º THRU 140º	1-1/2" & LARGER	MINERAL FIBER, ASJ, SSL	1-1/2"	MOLDED, PRE-FORMED MINERAL FIBER PVC JACKET	TYPE I
CONDENSATE DRAINS	ALL	MINERAL FIBER, ASJ, SSL	1"	MOLDED, PRE-FORMED MINERAL FIBER PVC JACKET	TYPE I
SANITARY FD TRAP IN MECH. ROOM	ALL	MINERAL FIBER, ASJ, SSL	1"	MOLDED, PRE-FORMED MINERAL FIBER PVC JACKET	TYPE I - INCLUDE 10 FT HORIZONTAL RUN
DOMESTIC HOT, COLD, RECIRC., SANITARY, STORM	ALL	SOUNDFAB AS MANUFACTURED BY SOUNDCOAT			

1. FIBERGLASS INSULATION: THERMAL CONDUCTIVITY .22 TO .28 BTU x IN./H x FT x °F W/ 100°F MEAN TEMP.THICKNESS BASED ON [ASHRAE 90.1, 2010 OR 2013] OR [IECC 2012 OR 2015]
2. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS
3. ALL EXPOSED INDOOR PIPING/TUBING AND FITTINGS WITHIN OCCUPIED SPACES, CORRIDORS, MECHANICAL ROOMS AND OTHER NON-CONCEALED LOCATIONS SHALL BE FITTED WITH PVC FITTING COVERS AND PVC PIPE COVERS FROM THE FLOOR LEVEL TO 12' ABOVE THE FINISHED FLOORS, PLATFORMS, AND MEZZANINES. PVC FITTING AND PIPE COVERS SHALL BE 25/50 FLAME AND SMOKE SPREAD RATED. COVERS AND JACKETING COLOR TO BE SELECTED BY ARCHITECT. PROVIDE TEMPLATE OF JACKET COLORS FOR THE ARCHITECT'S REVIEW.
4. ELBOWS, TEES AND FITTINGS: CONCEALED OR EXPOSED, SHALL BE INSULATED WITH PRE-MOLDED, FACTORY FORMED FIBROUS GLASS WITH 3.5 PCF MINIMUM DENSITY AS MANUFACTURED BY HAMFAB OR APPROVED EQUAL. ALL ELBOWS, TEES AND FITTINGS; CONCEALED OR EXPOSED, SHALL BE COVERED WITH PVC FITTING COVERS. PVC FITTING COVERS SHALL BE 25/50 FLAME AND SMOKE SPREAD RATED. SUBMIT COLOR CHART FOR SELECTION BY FACILITY. COLOR OF THE PVC JACKET SHALL BE DIFFERENT FOR EACH SYSTEM TYPE.
5. DIAPER AND LOOSE FILL STYLE INSULATION ON PIPE FITTINGS IS NOT ACCEPTABLE. ELBOWS WITHOUT PVC COVERS ARE NOT ACCEPTABLE.

VALVE SCHEDULE

DESCRIPTION	SIZE	TYPE: GATE	GLOBE	CHECK	BALL	PLUG	BALAN.	CLASS	REMARKS
DOMESTIC COLD WATER	2" AND SMALLER	GVT	GLVT	CVT	BVT	--	--	125 PSI	--
DOMESTIC HOT WATER	2" AND SMALLER	GVT	GLVT	CVT	BVT	--	CBV	125 PSI	--
BACKFLOW PREVENTER	3/4" TO 2"	--	--	--	BVT	--	--	125 PSI	--

ABBREVIATIONS

ABB.	DESCRIPTION
BVT	BALL VALVE THREADED - 2-PIECE, FULL PORT, 400PSI, BRONZE
CBV	CALIBRATED BALANCING VALVE, BRONZE
CVT	CHECK VALVE THREADED - BRONZE
GVT	GATE VALVE THREADED - BRONZE
GLVT	GLOBE VALVE THREADED - BRONZE

PRODUCTS INCLUDED IN THIS SECTION SHALL BE "LEAD FREE" IN ACCORDANCE WITH THE REQUIREMENTS OF THE "REDUCTION OF LEAD IN DRINKING WATER ACT".

DOMESTIC WATER HEATER SCHEDULE

UNIT NO.	STORAGE (GAL.)	RECOVERY	TEMP. RISE (°F)	MIXING VALVE	GAS: GAS PRESS.	GAS: MBH INPUT	OIL: GPH	OIL: MBH INPUT	ELECTRICAL: VOLTAGE	ELECTRICAL: PHASE	ELECTRICAL: KW	INDIRECT: HEATING BTUH	INDIRECT: BOILER GPM	INDIRECT: BOILER TEMP. IN/OUT °F	MANUFACTURER: MODEL NO.	REMARKS
WH1	5	25 GPH	100	TMV1	--	--	--	---	240	1	6	--	--	--	AO SMITH DSE-5A	

PIPE AND FITTING SCHEDULE

DESCRIPTION	SIZE	PIPE: TYPE	PIPE: SCHEDULE	FITTING: TYPE	FITTING: RATING	REMARKS
SOIL, WASTE AND VENT ABOVE GROUND	ALL	CI - NH-SD	SV	CI	SV	-
DOMESTIC COLD WATER WITHIN BUILDING	2-1/2" AND BELOW	COPPER	TYPE L	CUS	STD	HARD TEMPERED
DOMESTIC HOT WATER PIPING	2-1/2" AND BELOW	COPPER	TYPE L	CUS	STD	HARD TEMPERED
INDIRECT WASTE AND CONDENSATE PIPING	ALL	COPPER	TYPE L	CUS	STD	HARD TEMPERED
TRAP PRIMER PIPING	ALL	PEX				NO JOINTS ALLOWED BELOW SLAB

ABBREV.	DESCRIPTION
AWWA	AMERICAN WATER WORKS ASSOCIATION
CI	CAST IRON
CUS	WROUGHT COPPER SOLDER (95/5)
NH	NO-HUB COUPLING (REFER TO SPECIFICATIONS)
NH-SD	HUSKY SD 4000 SUPER DUTY NO-HUB COUPLING
NH-CR	HUSKY CR 7000 SUPER DUTY CORROSION RESISTANT 316 S.S NO-HUB COUPLING
PEX	PEX PIPING
STD	STANDARD
SV	SERVICE WEIGHT

NOTE: NO-HUB OR TRANSITION COUPLINGS ARE NOT PERMITTED BELOW GRADE, BELOW SLABS OR BURIED IN CONTACT WITH EARTH.

PLUMBING EQUIPMENT/FIXTURE SCHEDULE

FIXTURE TAG	FIXTURE TYPE	FIXTURE MANUFACTURER MODEL, MODEL NO.	MATERIAL	DESCRIPTION	SUPPLY SIZE	TRAP SIZE	MINIMUM BRANCH SIZES WASTE/ SANITARY	VENT	COLD WATER	HOT WATER	REMARKS
W1	WATER CLOSET WALL HUNG FLUSH VALVE	WATER CLOSET: AMERICAN STANDARD AFWALL MODEL# 2257.101 FLUSH VALVE: SLOAN MODEL# 111 ESS SEAT: CHURCH MODEL# 295CT	VITREOUS CHINA COLOR: AS SELECTED BY ARCHITECT	A.D.A. COMPLIANT, 1.28 GPF HIGH EFFICIENCY, SIPHON JET, VITREOUS CHINA, ELONGATED RIM, CONCEALED TRAP WAY, WITH 1-1/2" TOP. ADA COMPLIANT, 1.28 GPF, HARDWIRED, HIGH EFFICIENCY, EXPOSED, SENSOR OPERATED, FLUSH VALVE WITH TRUE MECHANICAL OVERIDE. SEAT: HEAVY DUTY SOLID PLASTIC ELONGATED OPEN FRONT.	1"	--	4"	2"	1-1/2"	--	--
L1	LAVATORY WALL MOUNTED	LAVATORY: KOHLER PINOIR MODEL# K-2035-4 FAUCET: SLOAN MODEL# ETF-80-4-BOX-BDT-CP-0.5GPM-MLM-FCT SHROUD KIT: KOHLER PINOIR MODEL# K-2057	VITREOUS CHINA COLOR: AS SELECTED BY ARCHITECT	ADA COMPLIANT, 22" X 18" WALL MOUNT, OVAL BASIN, WITH OVERFLOW DRAIN & 4" CENTERSET HOLES, 1-1/2" CHROME PLATED CAST BRASS P-TRAP WITH CLEANOUT PLUG, CHROME PLATED BRASS ANGLE STOPS WITH LOOSE KEY OPERATOR, AND GRID DRAIN. SENSOR FAUCET: ADA COMPLIANT, BLUETOOTH, 4" TRIM PLATE, BOX TRANSFORMER POWER SUPPLY, ASSE 1070 BELOW DECK THERMOSTATIC MIXING VALVE, POLISHED CHROME FINISH, 0.5 GPM MULTI-LAMINAR SPRAY, INFRARED SENSOR, DECK MOUNTED, MID BODY FAUCET.	3/8"	1-1/2"	1-1/2"	1-1/2"	--	1/2"THW	INSULATE TRAP & WATER PIPING BELOW LAVATORY WITH INSULATION KIT. MAXIMUM WATER CONSUMPTION REQUIREMENT: 0.5 GPM FLOW RESTRICTOR
S1	SINGLE COMP. SINK	SINK BASIN: ELKAY LUSTERTONE MODEL# LRAD1716655PD-1 FAUCET: SLOAN MODEL# EAF-700-HLT-ISM-CP-1.5GPM-LAM-IQ-FCT INSULATION KIT: TRUEBRO LAV GUARD2	18 GAUGE TYPE 304 STAINLESS STEEL	A.D.A. COMPLIANT, 17" X 16" X 6-1/2" DEEP, DROP-IN SINK, W/ PERFECT DRAINSTRAINER ASSEMBLY, CENTER DRAIN PLACMENT, WITH BOTTOM PADS ONLY. PROVIDE WITH REAR OFFSET DRAIN.1-1/2" CHROME PLATED OFFSET CAST BRASS P-TRAP WITH CLEANOUT PLUG, CHROME PLATED BRASS ANGLE STOPS WITH LOOSE KEY OPERATOR. SENSOR FAUCET: ADA COMPLIANT, BLUETOOTH ADAPTOR, HARDWIRED LESS TRANSFORMER POWER SUPPLY, INTEGRATED SIDE MIXER, POLISHED CHROME FINSH, 1.5 GPM, LAMINAR SPRAY, INFRARED SENSOR, DECK MOUNT, GOOSENECK BODY FAUCET. INSULATE WASTE & WATER BELOW SINK WITH INSULATION KIT.	1/2"	1-1/2"	1-1/2"	1-1/2"	1/2"	1/2"	COORDINATE LOCATION OF OFFSET DRAIN & TRAP WITH ARCHITECT MAXIMUM WATER CONSUMPTION REQUIREMENT: 1.5 GPM
HB	HOSE BIBB	WOODFORD MODEL B24 W/ VACUUM BREAKER STANDARD	CHROME	WALL FAUCET SHALL BE FOR NON-FREEZING AREAS WITH ANTI-SIPHON VACUUM BREAKER. ASSE STANDARD 1011 APPROVED. 3/4" HOSE CONNECTION. LOOSE TEE KEY TO BE FURNISHED WITH EACH FAUCET.	--	--	--	--	3/4"	--	--
TP-1	ELECTRONIC TRAP PRIMER (FOR SERVING 1-4 FLOOR DRAINS)	PRECISION PLUMBING PRODUCTS "MINI-PRIME" MODEL MP/MPB-500 PROVIDE WITH CABINET & ACCESS DOOR BASED ON WALL CONDITIONS. COORDINATE ACCESS PANEL FINISH WITH ARCHITECT.	--	ELECTRONIC TRAP PRIMER ASSEMBLY DESIGNED FOR USE WITH 1 TO 4 FLOOR DRAINS. RECYCLE TIMER BOX: PRE-SET TIMER OPENS ONCE FOR 6 SECONDS EVERY 24 HRS. DIMENSIONS - (L) 7 5/8" X (W) 4 5/8" X (D) 2 3/8" INLET: 1/2"NPT MALE. ANSI/ASME B1.20.1. OUTLET: 1/2"NPT FEMALE. ANSI/ASME B1.20.1 PROVIDE WITH DISTRIBUTION UNIT DU-4 IF SERVING 2-4 DRAINS	--	--	--	--	1"	--	*NOTE: RECESSED OR SURFACE MOUNTED CABINET TYPE BASED ON WALL CONDITIONS. CONTRACTOR TO COORDINATE WITH ARCHITECT. INCLUDE ACCESS DOORS/PANELS.

REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING HEIGHTS OF A.D.A. FIXTURES

BACKFLOW PREVENTER SCHEDULE

UNIT TAG	SIZE	LOCATION	SERVICE	BODY MATERIAL	TEMPERATURE RANGE	MAXIMUM WORKING PRESSURE	MANUFACTURER: MODEL	REMARKS
BFP1	3/4"	3RD FLOOR MECHANICAL RM	HVAC SYATEMMAKE UP WATER	BRONZE	33F - 180F	175 PSI	WATTS 009M2-QT-S-FS	PROVIDE WITH SENTRY PLUS ALERT FLOOD SENSOR CONNECTION KIT. KIT CODE 88003056. PROVIDE WITH BMS CONNECTION

PLUMBING CLEANOUT SCHEDULE

FIXTURE TAG	FIXTURE TYPE	FIXTURE MANUFACTURER MODEL, MODEL NO.	DESCRIPTION	GENERAL CLEANOUT NOTES
DPCO	FLOOR CLEANOUT	JOSAM 55000-1-SD-22-41-VP SMITH 4100-NB-FC SERIES WATTS CO-200-RX-C-6 ZURN ZN-1400-HD-KC SERIES	ALL INTERIOR AREAS (EXCEPT CARPETED AREAS) ADJUSTABLE ROUND SCORIATED HEAVY DUTY NICKEL BRONZE SECURED TOP WITH FRAME, CAST IRON BODY, FLASHING FLANGE AND CLAMP, BRONZE PLUG. PROVIDE WITH VANDAL PROOF SCREWS. PROVIDE NICKEL BRONZE FRAME IN WET AREAS.	• INSTALL EXTERIOR CLEANOUTS WITH AN 18" SQUARE X 6' THICK CONCRETE APRON. • CLEANOUTS SHALL BE LOCATED AT MINIMUM INTERVALS OF 50 FEET FOR PIPING NPS 4 AND SMALLER AND 100 FEET FOR LARGER PIPING. • BUILDING SEWERS SHALL BE PROVIDED WITH CLEANOUTS LOCATED NOT MORE THAN 100 FEET APART MEASURED FROM THE UPSTREAM ENTRANCE OF THE CLEANOUT. • CLEANOUTS SHALL BE INSTALLED AT EACH CHANGE OF DIRECTION OF THE BUILDING DRAIN OR HORIZONTAL WASTE OR SOIL LINES GREATER THAN 45 DEGREES (INCLUDING P-TRAPS). WHERE MORE THAN ONE CHANGE OF DIRECTION OCCURS IN A RUN OF PIPING, ONLY ONE CLEANOUT SHALL BE REQUIRED FOR EACH 40 FEET OF DEVELOPED LENGTH OF THE DRAINAGE PIPING. • A CLEANOUT SHALL BE PROVIDED AT THE BASE OF EACH WASTE OR SOIL STACK. • THERE SHALL BE A CLEANOUT NEAR THE JUNCTION OF THE BUILDING DRAIN AND THE BUILDING SEWER. THE CLEANOUT SHALL BE EITHER INSIDE OR OUTSIDE THE BUILDING WALL AND SHALL BE BROUGHT UP TO THE FINISHED GROUND LEVEL OR TO THE ASSOCIATED FLOOR LEVEL. • MINIMUM SIZE: CLEANOUTS SHALL BE THE SAME NOMINAL SIZE AS THE PIPE THEY SERVE UP TO 4 INCHES. FOR PIPES LARGER THAN 4 INCHES NOMINAL SIZE, THE MINIMUM SIZE OF THE CLEANOUT SHALL BE 4 INCHES. • CLEARANCES: CLEANOUTS ON 6-INCH AND SMALLER PIPES SHALL BE PROVIDED WITH A CLEARANCE OF NOT LESS THAN 18 INCHES FOR RODDING. CLEANOUTS ON 8-INCH AND LARGER PIPES SHALL BE PROVIDED WITH A CLEARANCE OF NOT LESS THAN 36 INCHES FOR RODDING. • PROVIDE CLEANOUTS ON ALL HORIZONTAL RUNS GREATER THAN 3 FEET. FLOOR DRAINS, ROOF DRAINS AND FLOOR SINKS ARE NOT CONSIDERED AN ACCEPTABLE CLEANOUT.
DPCO	FLOOR CLEANOUT	JOSAM 55000-1-SD-14-22-41-VP SMITH 4100-NB-FC-Y SERIES WATTS CO-200-RC-6 ZURN ZN-1400-HD-KC-CM SERIES	CARPETED AREAS, ADJUSTABLE ROUND SCORIATED HEAVY DUTY NICKEL BRONZE SECURED TOP WITH FRAME, CARPET MARKER, CAST IRON BODY, FLASHING FLANGE AND CLAMP, BRONZE PLUG. PROVIDE WITH VANDAL PROOF SCREWS	
WPCO	WALL PLATE CLEANOUT COVER	JOSAM 58640-CO (*)-VP SERIES SMITH 4730-NB-U SERIES WATTS CO-300-S7-6 ZURN ZANB-1460-VP SERIES	PROVIDE AT CAST IRON CLEANOUTS WITH TAPERED BRONZE PLUG A 6" X 6" (OR 7" X 7") POLISHED NICKEL BRONZE SQUARE FRAME AND COVER SECURED WITH VANDAL PROOF SCREWS. *MATCH CLEANOUT TO FILED CONDITIONS, USE "-COT" OPTION, IF NECESSARY. MAKE ACCESS COVER SIZE APPROPRIATE TO CLEANOUT.	

EXPANSION TANK SCHEDULE

UNIT TAG	LOCATION	SERVICE	TYPE	INITIAL FILL PRESSURE (PSI)	CAPACITIES AND CHARACTERISTICS: GALLONS	HEIGHT	DIAMETER	MANUFACTURER: MODEL	REMARKS
ET1	--	DOMESTIC HOT WATER HEATER	DIAPHRAM, IN-LINE	55 PSIG	2	14"	8"	AMTROL ST-5C-DD	--

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

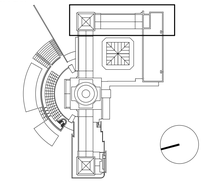
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

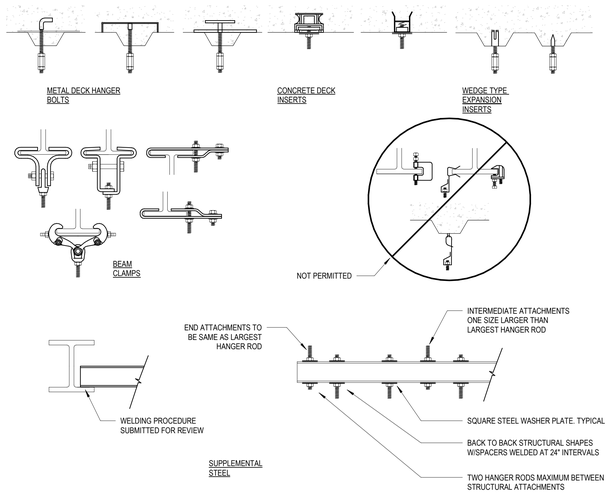
SCHEDULES - PLUMBING

SCALE	N.T.S.
DATE	10/17/2025
PROJECT NUMBER	163A

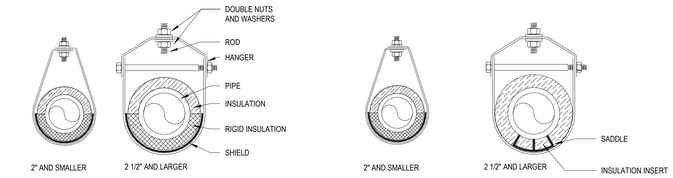
DRAWING NUMBER

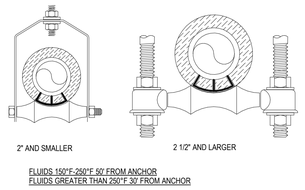
P500.00

10/14/2025 5:11:27 PM



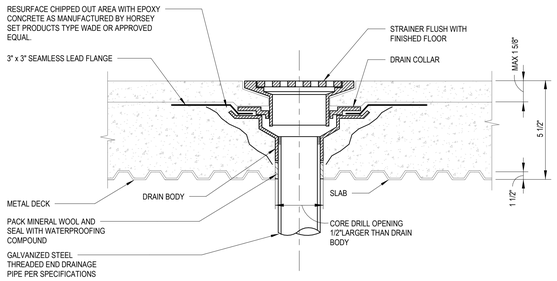
1 P600.00 PIPE HANGER ATTACHMENT - AOA
SCALE: 12" = 1'-0"





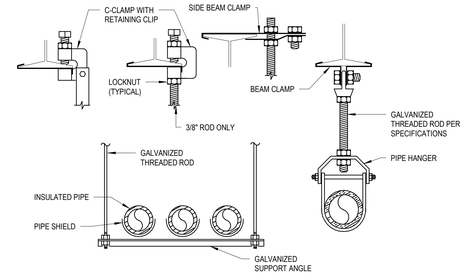
HANGER SCHEDULE		
PIPE SIZE	ROD SIZE	MAX. SPACING
UP TO 1 1/4"	3/8" DIA.	8' STEEL
UP TO 1 1/4"	3/8" DIA.	6' COPPER & BRASS
1 1/2" & 2"	3/8" DIA.	10'
2 1/2" & 3"	1/2" DIA.	10'
4" & 5"	5/8" DIA.	10'
6"	3/4" DIA.	10'
8", 10", 12"	7/8" DIA.	10'
14" & 16"	1" DIA.	10'
18"	1 1/8" DIA.	10'
20" & 24"	1 1/4" DIA.	10'

2 P600.00 PIPE HANGER DETAIL - AOA
SCALE: N.T.S.



NOTES
1. WATERPROOF EXISTING FLOOR OF ROOM WHERE FLOOR DRAIN IS TO BE LOCATED USING THOROSEAL SEALANT OR APPROVED EQUAL. FLOOR DRAIN SHOWN IS BASED
2. ON JAY R. SMITH 2010 WITH THREADED OUTLET. ACTUAL SELECTION OF THE FLOOR DRAIN SHALL BE BASED ON INTENDED APPLICATION.

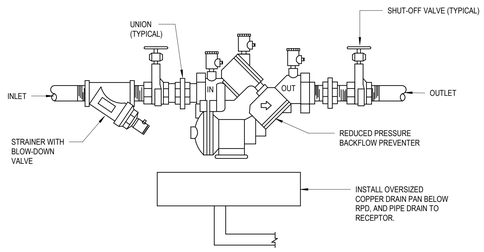
3 P600.00 FLOOR DRAIN DETAIL
SCALE: N.T.S.



PIPE SIZE	ROD DIA.	SUPPORT ANGLE OR EQUIV. CHANNEL	MAX SPACING STEEL PIPE	MAX SPACING COPPER PIPE	MAXIMUM AREA *
1/2" TO 1"	3/8"	1 1/2" X 1 1/2" X 1/8"	8'-0" O.C.	6'-0" O.C.	4 SQ. FT.
1 1/4" TO 2"	3/8"	1 1/2" X 1 1/2" X 1/8"	10'-0" O.C.	8'-0" O.C.	10 SQ. FT.
2 1/2" TO 4"	1/2"	2" X 2" X 1/4"	12'-0" O.C.	10'-0" O.C.	10 SQ. FT.

* REDUCE SPACING TO NEXT SMALLER INTERVAL IF PIPE AREA EXCEEDS MAXIMUM

4 P600.00 PIPE SUPPORT DETAIL AOA
SCALE: N.T.S.



5 P600.00 BACKFLOW PREVENTER DETAIL (2" AND SMALLER) - AOA
SCALE: N.T.S.

10/14/2025 5:11:28 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

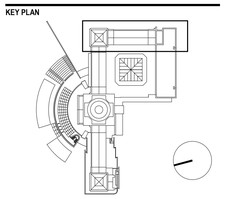
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

DETAILS - PLUMBING

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

P600.00

GENERAL FIRE PROTECTION NOTES

GENERAL

FIRE PROTECTION PLANS ARE INTENDED TO INDICATE TOTAL COVERAGE AND MAY OR MAY NOT INDICATE ALL SPRINKLER HEADS, PIPING, ETC.. SPRINKLER HEADS INDICATED ON DRAWINGS ARE DIAGRAMMATIC AND SHALL NOT BE COUNTED FOR BID. THE CONTRACTOR SHALL PROVIDE A COMPLETE SPRINKLER SYSTEM WITH COMPLETE SPRINKLER COVERAGE, INDICATED OR NOT. ITEMS AND SERVICES NOT SHOWN ON DRAWINGS OR SPECIFICATIONS BUT REQUIRED TO RENDER THE WORK COMPLETE, IN ACCORDANCE WITH NFPA, INSURANCE COMPANY REQUIREMENTS AND OWNERS. SYSTEM(S) SHALL BE READY FOR OPERATION, ALL NECESSARY EQUIPMENT SHALL BE PROVIDED AND INSTALLED.

THE DRAWINGS AND SPECIFICATIONS ARE DIVIDED INTO SECTIONS TO MEET THE NEEDS OF THE ARCHITECT, THE ENGINEERS, AND THE DESIGN CONSULTANTS. THEY ARE NOT PREPARED AS INSTRUCTIONS TO THE CONTRACTOR FOR HOW TO BUY OUT OR SUBCONTRACT THE WORK. THE CONTRACTOR IS RESPONSIBLE FOR ALL THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS, REGARDLESS OF WHERE IT IS SHOWN. FOR EXAMPLE, ELECTRICAL WORK IS SHOWN ON FP-SERIES DRAWINGS AS WELL AS ON M-SERIES DRAWINGS AND E-SERIES DRAWINGS. MISCELLANEOUS METALS AND STRUCTURAL ELEMENTS ARE SHOWN ON A-SERIES DRAWINGS AS WELL AS ON S-SERIES DRAWINGS. STRUCTURAL SUPPORTS ARE REQUIRED BY THE FP DRAWINGS. TO AVOID OMITTING ANY COMPONENT OF THE PROJECT, REFER TO ALL THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.

DRAWINGS ARE DIAGRAMMATIC AND INDICATE A GENERAL ARRANGEMENT OF WORK AND ARE NOT TO BE CONSIDERED SUBCONTRACTOR DOCUMENTS. IT IS THE INTENT OF THESE DOCUMENTS TO INCLUDE THE PROVISION AND INSTALLATION OF ALL NECESSARY WORK AND MATERIALS FOR COMPLETE, OPERATIONAL AND CODE COMPLIANT SYSTEMS BY THE CONTRACTOR. GENERAL DESIGN CONCEPTS INDICATED MUST BE FOLLOWED OR BETTERED. THE BID SHALL INCLUDE OFFSETS, ADDITIONAL PIPING, VALVES AND EQUIPMENT AND COMPONENTS AS REQUIRED TO MEET CONSTRUCTION CONDITIONS FOR PROPER OPERATION. DO NOT SCALE DRAWINGS. CONSULT ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR SPACE CONDITIONS AND ADDITIONAL REQUIREMENTS.

FIRE PUMPS: PROVIDE AND INSTALL COMPONENTS AS REQUIRED BY NFPA 20.

WHEN A CONFLICT BETWEEN THE DRAWINGS, NOTES AND/OR SPECIFICATIONS OCCUR, THE MORE STRINGENT, AND/OR LARGER QUANTITY AND/OR MORE EXPENSIVE SHALL APPLY. THE REQUIREMENTS LISTED WITHIN NOTES OR SPECIFICATIONS SHALL BE REQUIRED, PROVIDED AND INSTALLED WHETHER SPECIFICALLY INDICATED ON THE DRAWINGS OR NOT.

IT IS THE INTENTION OF THE SPECIFICATIONS AND DRAWINGS TO PROVIDE FOR FINISHED WORK, TESTED AND READY FOR OPERATION.

THE DESIGN OF ALL FIRE SUPPRESSION SYSTEMS WILL BE IN ACCORDANCE WITH NFPA 13, LOCAL, STATE AND THE OWNER'S INSURANCE COMPANY REQUIREMENTS. USE ONLY UL/FM APPROVED SPRINKLERS, MATERIALS AND DEVICES, UNLESS NOTED OTHERWISE.

THE SPRINKLER CONTRACTOR IS REQUIRED TO VISIT THE SITE AT THE TIME OF BID, TO EXAMINE CONDITIONS AND BECOME FAMILIAR WITH THE JOB, NOTING DEGREE OF DIFFICULTY IN GETTING EQUIPMENT (INCLUDING LIFTS AND SCAFFOLDS) IN AND OUT OF THE BUILDING. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT OR ENGINEER IN WRITING PRIOR TO SUBMITTING A BID.

NOTIFY PROPER AUTHORITIES (INCLUDING BUT NOT LIMITED TO: THE LOCAL A.H.J., INSURANCE COMPANY, ETC.) OF ANY FIRE PROTECTION "SHUT DOWNS". SCHEDULE ALL WORK TO MINIMIZE THE LENGTH OF TIME THAT THE FIRE PROTECTION SYSTEM(S) WILL BE OUT OF SERVICE. RETURN THE SPRINKLER SYSTEM BACK IN SERVICE AT THE END OF EACH WORKING DAY. IF A FIRE WATCH IS REQUIRED BY THE LOCAL A.H.J. BUILDING MANAGER, ETC. IT SHALL BE PROVIDED BY THE GENERAL CONTRACTOR. FIRE WATCH SCHEDULING AND PERSONNEL SHALL BE COORDINATED WITH THE LOCAL A.H.J., BUILDING MANAGER AND INSURANCE COMPANY.

ARRANGE PIPING TO FACILITATE FLUSHING. PROVIDE READILY ACCESSIBLE DRAIN AND FLUSHING CONNECTIONS AS REQUIRED BY NFPA 13. PROVIDE AND INSTALL AUXILIARY DRAINS WITH PROVISIONS FOR COMPLETE DRAINAGE. PIPE ALL DRAINS TO AN APPROVED LOCATION.

INSPECTOR'S TEST CONNECTIONS, DRAIN VALVES AND CONTROL VALVES SHALL BE READILY ACCESSIBLE AND INSTALLED NOT OVER +/-7'-0" ABOVE THE FINISHED FLOOR. PROVIDE ALL VALVES WITH IDENTIFICATION SIGNS. SUPERVISORY SWITCHES SHALL BE ON ALL CONTROL VALVES.

INSTALL A PRESSURE GAUGE WITH A BLEEDER MAINTENANCE VALVE AT THE TOP OF ALL RISERS.

DO NOT SCALE DRAWINGS FOR DIMENSIONS NOT INDICATED. REFER TO ARCHITECT FOR RESOLUTION FOR ANY DIMENSIONS NOT INDICATED.

PROVIDE A HEAD GUARD ON SPRINKLERS IN AREAS SUBJECT TO MECHANICAL DAMAGE (I.E. SPRINKLERS IN: MECHANICAL ROOMS, ETC.)

THE CONTRACTOR SHALL COORDINATE SPRINKLER WORK WITH THE OWNER'S PHASING SCHEDULE PRIOR TO COMMENCEMENT OF ANY WORK. ALL PHASED SECTIONS OF WORK SHALL COMPLY WITH THE OWNERS SCHEDULE AND BE TESTED, INSPECTED, READY FOR OPERATION IN ACCORDANCE WITH NFPA, OWNERS INSURANCE COMPANY AND A.H.J. REQUIREMENTS.

THE CONTRACTOR SHALL PROVIDE COMPLETE SIGNED AND SEALED DRAWINGS AND HYDRAULIC CALCULATIONS (BY A LICENSED P.E.) INDICATING ALL PIPING AND SPRINKLER HEADS.

INSTALL SPRINKLERS BELOW DUCTS, AND/OR COMBINATIONS OF DUCTS/EQUIPMENT IN ACCORDANCE WITH THE OBSTRUCTION REQUIREMENTS OF NFPA 13.

PROVIDE SPRINKLER PROTECTION IN ORDER TO AVOID ALL OBSTRUCTIONS IN ACCORDANCE WITH NFPA 13, INCLUDING: LIGHTING, CEILING FIXTURES, STRUCTURAL MEMBERS, ETC. WITHIN ALL HAZARD OCCUPANCIES.

ALL DRAIN PIPING AND ANY PIPING SUBJECT TO ALTERNATE WETTING AND DRYING SHALL BE GALVANIZED.

THE CONTRACTOR SHALL SEAL AROUND ALL NEW PENETRATIONS THROUGHOUT THE BUILDING WITH SEALANT OF FIRE AND/OR SMOKE RETARDANT TYPE EQUAL IN FIRE RATING TO THE STRUCTURE BEING PENETRATED. SEALANT SHALL BE A UL LISTED ASSEMBLY.

WORK OF THIS SECTION SHALL BE GOVERNED BY THE CONTRACT DOCUMENTS. PROVIDE MATERIALS, LABOR, EQUIPMENT AND SERVICES NECESSARY TO FURNISH, DELIVER AND INSTALL ALL WORK AS SPECIFIED AND AS REQUIRED BY JOB CONDITIONS. WHERE A CONFLICT EXISTS BETWEEN THESE NOTES, THE DRAWINGS AND THE SPECIFICATIONS, THE MORE STRINGENT REQUIREMENT SHALL APPLY.

PERFORM THE WORK IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT GENERAL CONDITIONS AND WITH THE PROVISIONS OF ALL APPLICABLE LOCAL, STATE, AND FEDERAL CODES AND LAWS.

WORK SHALL INCLUDE ALL INCIDENTALS, LABOR, MATERIAL, EQUIPMENT, APPLIANCES, SERVICES, HOISTING, SCAFFOLDING, SUPPORTS, TOOLS, CONSUMABLE ITEMS, FEES, LICENSES, AND ADMINISTRATIVE TASKS REQUIRED TO COMPLETE AND MAKE OPERABLE WORK SHOWN ON THE DRAWINGS, SPECIFIED HEREIN AND AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM..

STORE MATERIALS INSIDE AND PROTECTED FROM DEBRIS, WEATHER AND MOISTURE.

THIS CONTRACTOR SHALL PROVIDE AND INSTALL ALL POWER AND CONTROL WIRING REQUIRED FOR EQUIPMENT OPERATION NOT SPECIFICALLY PROVIDED BY OTHERS BUT REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM. THIS CONTRACTOR SHALL PROVIDE MOTOR STARTERS FOR INSTALLATION BY OTHERS. COORDINATE REQUIREMENTS.

ALTERATION WORK AND DEMOLITION

EXISTING PIPING AND SPRINKLERS SHOWN DO NOT NECESSARILY REFLECT EXACT FIELD CONDITIONS. FIELD VERIFY EXTENT AND LOCATION OF WORK TO BE REMOVED.

ALL EQUIPMENT, PIPING, ETC. TO BE REMOVED, SHALL BE DISPOSED OF, TURNED OVER TO THE OWNER, OR SALVAGED AS DIRECTED BY THE OWNER. EQUIPMENT, PIPING, DEVICES, ETC. SHALL NOT BE REMOVED FROM THE PREMISES WITHOUT THE OWNER'S APPROVAL.

NO EXISTING PIPE MAY BE CUT OR DAMAGED WHEN ENCOUNTERED ALONG THE ROUTE DESIGNED FOR NEW SERVICE. ANY EXISTING PIPING SEVERED OR DAMAGED SHALL BE REPLACED INCLUDING DAMAGED AREAS.

UPON COMPLETION OF REMOVALS AND MODIFICATIONS, ALL PIPING TO REMAIN SHALL BE PROPERLY PLUGGED, VALVED, CAPPED AND/OR BY PASSED SUCH THAT UPON COMPLETION OF WORK ALL SYSTEMS TO REMAIN, REMAIN OPERATIONAL.

REMOVE & REPLACE ANY EXISTING SPRINKLER PIPING WHICH DOES NOT PASS THE REQUIRED HYDROSTATIC PRESSURE TESTS CONDUCT VISUAL INTERNAL INSPECTIONS ON AT LEAST 5% OF ANY EXISTING PIPING TO REMAIN.

NO DEAD ENDS SHALL BE LEFT ON ANY PIPING SYSTEMS UPON COMPLETION OF WORK.

EXISTING EXPOSED PIPING SYSTEMS NOT TO BE REUSED, AND NOT SPECIFICALLY NOTED FOR REMOVAL SHALL BE COMPLETELY REMOVED.

ALL SYSTEMS SHALL BE LEFT IN WORKING ORDER TO THE SATISFACTION OF THE OWNER UPON COMPLETION OF ALL NEW WORK.

ALL EXISTING EXPOSED, UNNECESSARY PIPING RELATED TO NEW WORK SHALL BE COMPLETELY REMOVED.

RE-ROUTE OR REMOVE ALL EXISTING PIPING AND SYSTEMS WHERE NECESSARY TO AVOID NEW EQUIPMENT, STRUCTURAL, OR MASONRY WORK AS REQUIRED BY THE PROPOSED ALTERATIONS.

SHOP DRAWINGS

CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO BE APPROVED, REVISED, OR RESUBMITTED AS PER THE ENGINEERS COMMENTS, PRIOR TO CONSTRUCTION. SUBMIT SHOP DRAWINGS SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF THE PROJECT INDICATING ALL NECESSARY COMPONENT CUTS, PLAN LOCATIONS AND CALCULATIONS FOR A COMPLETE SYSTEM.

COORDINATION DRAWINGS

DEVELOP AND SUBMIT COORDINATION DRAWINGS AS OUTLINED.

SHEET METAL, PLUMBING AND FIRE PROTECTION SHOP DRAWINGS THAT HAVE BEEN COORDINATED WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO ENGINEER FOR REVIEW. DRAWINGS MUST BE RETURNED FROM ENGINEER EITHER "REVIEWED" OR "FURNISH AS CORRECTED" PRIOR TO BEING USED AS BASIS FOR COORDINATION DRAWINGS.

AFTER SHEET METAL AND PIPING DRAWINGS HAVE BEEN REVISED PER ENGINEERS COMMENTS, REPRODUCIBLE COPIES SHALL BE SENT TO THE TRADES IN THE FOLLOWING SEQUENCE FOR THE INCLUSION OF THEIR WORK:

-MECHANICAL SHEET METAL
-PLUMBING PIPING
-MECHANICAL PIPING
-SPRINKLER PIPING
-ELECTRICAL WORK

AFTER ALL TRADES HAVE INCLUDED THEIR WORK ON THE COORDINATION DRAWING AND NOTED CONFLICTS, ALL TRADES SHALL MEET TO RESOLVE CONFLICTS AND AGREE TO ACCEPTABLE SOLUTIONS. EACH TRADE SHALL SIGN COORDINATION DRAWINGS. ITEMS NOT SHOWN ON COORDINATION DRAWING IS RESPONSIBILITY OF OMITTING CONTRACTOR AND CONTRACTOR IS SUBJECT TO ADDITIONAL COSTS INCURRED BY OTHER TRADES.

THE ARCHITECT AND ENGINEER ARE NOT PART OF THE COORDINATION DRAWING PROCESS. THE ENGINEER WILL PROVIDE ASSISTANCE FOR NOTED CONFLICTS ONLY. COORDINATION DRAWINGS ARE NOT TO BE CONSIDERED PIPING OR DUCT SHOP DRAWINGS. THE CONTRACTOR IS REQUIRED TO SUBMIT INDIVIDUAL PIPING AND DUCTWORK SHOP DRAWINGS FOR REVIEW BY THE ENGINEER. PIPING AND DUCTWORK SHOP DRAWINGS SHALL FOLLOW THE DESIGN INTENT OF THE CONTRACT DOCUMENTS.

SUBMIT FINAL SIGNED COORDINATION DRAWING TO ENGINEER FOR REVIEW. ENGINEER WILL REVIEW COORDINATION DRAWINGS FOR GENERAL ARRANGEMENT AND FOR NOTED CONFLICTS ONLY. SPECIFIC INSTALLATION REQUIREMENTS WILL BE REVIEWED ONLY IN INDIVIDUAL TRADE SHOP DRAWINGS.

ANY WORK FABRICATED OR INSTALLED PRIOR TO SIGN OFF BY ALL TRADES WHICH IS DEEMED TO BE IN CONFLICT WITH COORDINATION DRAWINGS SHALL BE REMOVED AND RE-INSTALLED IN CONFORMANCE WITH COORDINATION DRAWINGS.

EACH CONTRACTOR (MENTIONED ABOVE) IS RESPONSIBLE FOR THE COORDINATION OF HIS SUB-CONTRACTORS.

THE OVERALL COORDINATION OF THE COORDINATION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER IS NOT RESPONSIBLE FOR THE COORDINATION PROCESS. THE ENGINEER WILL RESPOND TO QUESTIONS THAT ARISE FROM THE COORDINATION PROCESS. DRAWINGS SUBMITTED WILL BE REVIEWED FOR CLEARLY IDENTIFIED CONFLICTS ONLY. SOLUTIONS TO CONFLICTS WILL NOT BEAR ADDITIONAL COST.

AS BUILT DRAWINGS

PROVIDE A COMPLETE SET OF AS-BUILT DRAWINGS REFLECTING AS INSTALLED CONDITIONS. AS-BUILT DRAWINGS SHALL INDICATE ALL INSTALLED CONDITIONS OF SYSTEMS WITHIN THIS DISCIPLINE. DRAWINGS SHALL BE OF SIMILAR SCALE AS THE CONSTRUCTION DOCUMENTS AND INCLUDE DETAILS AS NECESSARY TO CLEARLY REFLECT THE INSTALLED CONDITION. DRAWINGS SHALL BE BOUND IN A COMPLETE AND CONSECUTIVE SET. SUPPLEMENTAL SKETCHES AND LOOSE PAPERWORK WILL NOT BE ACCEPTABLE AND WILL BE RETURNED FOR REVISION. THE CONTRACTOR SHALL COMPLY WITH THE ENGINEERS COMMENTS TO PRODUCE A CLEAR AND CONCISE SET OF DRAWINGS. DRAWINGS SHALL BE SUBMITTED IN BOTH HARD COPY AND ELECTRONIC (AUTO-CAD VERSION AS REQUIRED BY THE OWNER) VERSION. NUMBER OF COPIES OF EACH AS REQUESTED BY THE OWNER.

PROVIDE "AS-BUILT DRAWINGS" INDICATING IN A NEAT AND ACCURATE MANNER A COMPLETE RECORD OF ALL REVISIONS OF THE ORIGINAL DESIGN OF THE WORK. INDICATE THE FOLLOWING INSTALLED CONDITIONS:

INCLUDE ALL CHANGES AND AN ACCURATE RECORD, ON REPRODUCTIONS OF THE CONTRACT DRAWINGS OR APPROPRIATE SHOP DRAWINGS, OF ALL DEVIATIONS, BETWEEN THE WORK SHOWN AND WORK INSTALLED.

MAINS AND BRANCHES OF PIPING SYSTEMS, WITH VALVES AND CONTROL DEVICES LOCATED AND NUMBERED, CONCEALED UNIONS LOCATED, AND WITH ITEMS REQUIRING MAINTENANCE LOCATED (I.E., TRAPS, STRAINERS, EXPANSION COMPENSATORS, TANKS, ETC.). VALVE LOCATION DIAGRAMS, COMPLETE WITH VALVE TAG CHART.

EQUIPMENT LOCATIONS (EXPOSED AND CONCEALED), DIMENSIONED FROM PROMINENT BUILDING LINES.

APPROVED SUBSTITUTIONS, CONTRACT MODIFICATIONS, AND ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

CONTRACT MODIFICATIONS, ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

SUBMIT FOR REVIEW BOUND SETS OF THE REQUIRED DRAWINGS, MANUALS AND OPERATING INSTRUCTIONS.

SUBMIT A COMPLETE MAINTENANCE MANUAL OF ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT.

HOUSEKEEPING PADS

PROVIDE CONCRETE HOUSEKEEPING PADS FOR FLOOR-MOUNTED EQUIPMENT. COORDINATE EXACT LOCATIONS, DIMENSIONS, PIPING LOCATIONS, AND ANCHOR BOLT REQUIREMENTS. PROVIDE CONCRETE HOUSEKEEPING PADS UNDER ALL FLOOR MOUNTED EQUIPMENT. PADS SHALL BE CONSTRUCTED OF 3,000 PSI CONCRETE. PADS SHALL BE 4 INCHES HIGH, AND 4 INCHES WIDER THAN THE EQUIPMENT IN BOTH DIRECTIONS.

ACCESS DOORS

PROVIDE AND INSTALL ACCESS DOORS FOR EACH VALVE, DRAIN, OR FIRE PROTECTION DEVICE REQUIRING ACCESS. ACCESS DOORS SHALL BE RIGID CONSTRUCTION WITH TWO HINGES AND A LATCH. IN PLENUM CEILINGS, PROVIDE FELT BETWEEN THE DOOR AND FRAME TO MAKE AN AIR TIGHT SEAL. ACCESS DOORS SHALL BE RATED TO THE SAME OR GREATER RATING OF THE PARTITION IN WHICH THEY ARE INSTALLED. ACCESS DOORS SHALL BE FLUSH MOUNTED, PRIME COATED WITH RUST INHIBITIVE PAINT, CONCEALED FRAME, FLUSH SCREW DRIVER OPERATED LOCKS WITH METAL CAMS AND ANCHORS AS REQUIRED.

ACCESS DOOR SIZES SHALL BE:
12" X 12" AT EASILY ACCESSIBLE ITEMS
16" X 16" WHERE PARTIAL BODY ACCESS IS REQUIRED
24" X 24" WHERE FULL BODY ACCESS IS REQUIRED

HANGERS AND SUPPORT

SEISMIC RESTRAINT: PROVIDE SEISMIC RESTRAINT AND EXPANSION OF ALL FIRE PROTECTION EQUIPMENT AND SYSTEMS IN ACCORDANCE WITH APPLICABLE NFPA STANDARDS, OWNERS INSURANCE COMPANY, STATE, FEDERAL AND LOCAL BUILDING CODE REQUIREMENTS.

PROVIDE ALL NECESSARY STRUCTURAL MEMBERS INCLUDING ADDITIONAL STRUCTURAL SUPPORT TO SUPPORT PIPING AND EQUIPMENT. HANGERS AND SUPPORTS SHALL BE OF AN APPROVED DESIGN NECESSARY TO SUPPORT PIPING, EQUIPMENT AND TO KEEP PIPING IN PROPER ALIGNMENT AND PREVENT TRANSMISSION OF INJURIOUS THRUSTS AND VIBRATIONS. IN ALL CASES WHERE HANGERS, BRACKETS, ETC., ARE SUPPORTED FROM CONCRETE CONSTRUCTION, DO NOT WEAKEN CONCRETE OR PENETRATE WATERPROOFING. ALL HANGERS AND SUPPORTS SHALL BE CAPABLE OF SCREW ADJUSTMENT AFTER PIPING IS ERECTED. HANGERS SUPPORTING PIPING EXPANDING INTO LOOPS, BENDS AND OFFSETS SHALL BE SECURED TO THE BUILDING STRUCTURE IN SUCH A MANNER THAT HORIZONTAL ADJUSTMENT PERPENDICULAR TO THE RUN OF PIPING SUPPORTED MAY BE MADE TO ACCOMMODATE DISPLACEMENT DUE TO EXPANSION. ALL SUCH HANGERS SHALL BE FINALLY ADJUSTED BOTH IN THE VERTICAL AND HORIZONTAL DIRECTION, AS REQUIRED.

PROVIDE ADDITIONAL SUPPORT FOR PIPING AND EQUIPMENT WHEN DECK IS NOT CAPABLE OF SUPPORT.

BEAM CLAMPS - HANGERS SUPPORTED FROM STEEL SHALL BE CENTER LOADING BEAM CLAMPS FOR HANGERS SUPPORTING PIPING 2-1/2 INCHES AND LARGER. FOR PIPING 2 INCHES AND SMALLER, I BEAM CLAMPS, WITH RETAINING STRAPS, SHALL BE FORGED STEEL. "C" CLAMPS ARE NOT TO BE USED.

PROVIDE AND INSTALL EXPANSION COMPENSATION FOR ALL PIPING. SUBMIT PLANS, CALCULATIONS AND EQUIPMENT DATA.

FIRE PROTECTION DEMOLITION NOTES

1. NOTIFY PROPER AUTHORITIES (INCLUDING BUT NOT LIMITED TO: THE LOCAL A.H.J., INSURANCE COMPANY, ETC.) OF ANY FIRE PROTECTION "SHUT DOWNS". SCHEDULE ALL WORK TO MINIMIZE THE LENGTH OF TIME THAT THE FIRE PROTECTION SYSTEM(S) WILL BE OUT OF SERVICE. RETURN THE SPRINKLER SYSTEM BACK IN SERVICE AT THE END OF EACH WORKING DAY.
2. THIS JOB IS A RENOVATION OF AN EXISTING FACILITY.
3. THE CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH ALL EXISTING CONDITIONS. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY ASSUMPTIONS, OMISSIONS, OR ERRORS HE MAKES AS A RESULT OF HIS FAILURE TO BECOME FULLY FAMILIAR WITH EXISTING CONDITIONS.
4. THE SPRINKLER CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL EXISTING SPRINKLER PIPING, HANGERS, HEADS, ETC. AS INDICATED (VERIFY IN FIELD). CAP ANY UNUSED OUTLETS.
5. THE CONTRACTOR SHALL PROPERLY CAP AND TERMINATE ANY UNUSED DRAIN AND FIRE PROTECTION WATER SUPPLIES (IN ACCORDANCE WITH LOCAL WATER AUTHORITY REQUIREMENTS).

FM GLOBAL NOTES

ALL HYDRAULIC CALCULATIONS SHALL INCLUDE A MINIMUM "CUSHION" (GAP) OF 20 PSI BETWEEN REQUIRED AND AVAILABLE WATER SUPPLY.

THE FM GLOBAL CUSTOMER SERVICE DESK AT 888-606-4570 SHOULD BE NOTIFIED WHEN ANY AUTOMATIC SPRINKLER CONTROL VALVE IS SHUT, NO MATTER WHAT THE DURATION IS. THE FM GLOBAL RED TAG PERMIT SYSTEM SHOULD ALSO BE USED BY FIRE PROTECTION INSTALLATION PERSONNEL DURING ALL VALVE CLOSURES, WHICH IMPAIR EXISTING FIRE PROTECTION

ALL DRAWINGS, SPECIFICATIONS, EQUIPMENT, ETC. SHALL BE SUBMITTED AND REVIEWED BY FM GLOBAL PRIOR TO INSTALLATION. CONTRACTOR SHALL INCORPORATE ALL COMMENTS INTO PROJECT AT NO ADDITIONAL COST

THE SPRINKLER CONTRACTOR SHALL OBTAIN AND DOCUMENT NEW WATERFLOW DATA FOR SHOP DRAWING SUBMISSION/INSTALLATION AND SUBMIT RESULTS IN WRITING. WATERFLOW TEST SHALL BE LESS THEN 1 YEAR OLD

ALL FIRE PROTECTION EQUIPMENT SHALL BE FM APPROVED AND UL LISTED. EQUIPMENT SHALL CONFORM TO THE CORRESPONDING FM GLOBAL DATA SHEETS

DESIGN CRITERIA

THE FIRE PROTECTION WATER SERVICE SHALL BE CONNECTED TO AN EXISTING SPRINKLER FIRE MAIN. THE FIRE PROTECTION CONTRACTOR SHALL CONDUCT A CURRENT FLOW TEST FOR USE IN THE HYDRAULIC CALCULATIONS AND DOCUMENT THE RESULTS.

SYSTEM PRESSURE IS SUPPLIED BY THE EXISTING BUILDING'S FIRE PROTECTION SYSTEM. CONTRACTOR SHALL DOCUMENT IN SCHEMATIC WAY IN WHICH RENOVATED AREA IS SUPPLIED INCLUDING PIPE SIZES, OVERALL LENGTH OF PIPING, ETC. AS NECESSARY TO PERFORM HYDRAULIC CALCULATIONS.

SPRINKLER SYSTEMS SHALL BE HYDRAULICALLY CALCULATED BASED ON THE FOLLOWING CRITERIA. INCLUDE ANY/ALL FIRE MARSHAL, FM GLOBAL AND OWNER REQUIREMENTS:

FIRE PROTECTION WATER SERVICE SHALL BE CONNECTED TO A NEW SPRINKLER STANDPIPE FIRE MAIN. THE FIRE PROTECTION CONTRACTOR SHALL CONDUCT A CURRENT FLOW TEST FOR USE IN THE HYDRAULIC CALCULATIONS AND DOCUMENT THE RESULTS. USE THE FOLLOWING FOR BID:

CONTRACTOR RESPONSIBLE FOR DOCUMENTING SIZE AND LENGTH OF EXISTING FIRE PROTECTION WATER SUPPLY INCLUDING VALVING, ETC. AS NECESSARY TO PERFORM HYDRAULIC CALCULATIONS

USE THE FOLLOWING FOR BID:

DATE: 0900, 5/9/06, BY MDC
LOCATION: FARMINGTON AVENUE
STATIC: 82 PSI
RESIDUAL:78 PSI
FLOW: 1140 GPM

STANDPIPE DESIGN CRITERIA::

FIRE STANDPIPE SYSTEM SHALL BE CONSIDERED A MANUAL WET TYPE SYSTEM, EXACT PRESSURE AND FLOW CALCULATIONS WAIVED PER NFPA 14, A.5.4

CONTRACTOR SHALL PROVIDE A SIGN ON THE FIRE DEPARTMENT CONNECTION INDICATING THE PRESSURE REQUIRED AT THE INLETS TO DELIVER THE SYSTEM DEMAND IN ACCORDANCE WITH NFPA 14.

STANDPIPE DESIGN CRITERIA:

HYDRAULICALLY DESIGNED STANDPIPE SYSTEMS SHALL BE DESIGNED TO PROVIDE THE WATERFLOW RATE REQUIRED BY NFPA 14, LOCAL CODES AND OWNER'S INSURANCE COMPANY REQUIREMNTS. A MINIMUM RESIDUAL PRESSURE OF 100 PSI (6.9 BAR) AT THE OUTLET OF THE HYDRAULICALLY MOST REMOTE 65-MM (2½-IN.) HOSE CONNECTION..

THE MINIMUM FLOW RATE FOR THE HYDRAULICALLY MOST REMOTE STANDPIPE SHALL BE (500 GPM), AND THE CALCULATION PROCEDURE SHALL BE IN ACCORDANCE WITH NFPA 14

STANDPIPES SHALL BE (250 GPM) PER STANDPIPE, WITH THE TOTAL NOT TO EXCEED 1000 GPM FOR BUILDINGS SPRINKLERED THROUGHOUT.

CONTRACTOR IS RESPONSIBLE TO PROVIDE PRESSURE REGULATING DEVICES AND THREADED DRAIN OUTLETS / RISERS FOR TESTING PURPOSES AND AS REQUIRED BY NFPA 14.

CONTRACTOR SHALL PROVIDE A SIGN ON THE FIRE DEPARTMENT CONNECTION INDICATING THE PRESSURE REQUIRED AT THE INLETS TO DELIVER THE SYSTEM DEMAND.

FM GLOBAL DESIGN CRITERIA

SPRINKLER DESIGN DENSITY, SPACING, MATERIALS ETC. SHALL BE IN ACCORDANCE WITH FM GLOBAL'S DATA SHEETS INCLUDING 3-26

HAZARD CLASS 1 (HC-1):
SEMINAR ROOMS, OFFICES, STUDIOS, AND COMMON AREAS: MINIMUM DENSITY OF 0.10 GPM/SQ.FT. OVER THE MOST REMOTE 1500 SQ.FT. PLUS 250 GPM FOR HOSE DEMAND. MAXIMUM COVERAGE PER SPRINKLER HEAD IS 196 SQ.FT.

HAZARD CLASS 2 (HC-2):
UTILITY AND EQUIPMENT ROOMS, ETC. MINIMUM DENSITY OF 0.2 GPM/SQ.FT OVER THE MOST REMOTE 2500 SQ.FT. PLUS 250 GPM FOR HOSE DEMAND. MAXIMUM COVERAGE PER SPRINKLER HEAD IS 130 SQ.FT. SPRINKLERS SHALL HAVE A "K" FACTOR OF 8.0 .

HAZARD CLASS 3 (HC-3):
LOADING DOCKS, PLASTICS, ETC. MINIMUM DENSITY OF 0.30 GPM/SQ.FT. OVER THE MOST REMOTE 2500 SQ.FT. PLUS 500 GPM FOR HOSE DEMAND. MAXIMUM COVERAGE PER SPRINKLER HEAD IS 130 SQ.FT. SPRINKLERS SHALL HAVE A "K" FACTOR OF 11.2

STANDARD COVERAGES SPRINKLER DESIGN DEMANDS FOR HAZARD CATEGORIES

HAZARD CATEGORY	CEILING HEIGHT UP TO 30 FT		CEILING HEIGHT UP TO 30 - 45 FT		CEILING HEIGHT UP TO 45 - 60 FT		CEILING HEIGHT UP TO 60 - 100 FT	
	WET	DRY	WET	DRY	WET	DRY	WET	DRY
HC-1	0.1/1500	0.1/1500	0.2/2500	0.2/3500	0.2/2500	0.2/3500	SEE TABLE 2a	NOT AN OPTION
HC-2	0.2/2500	0.2/3500	0.2/2500	0.2/3500	0.2/2500	0.2/3500	SEE TABLE 2a	NOT AN OPTION
HC-3	0.3/2500	0.3/3500	0.3/3600	0.3/4600	0.5/3000	0.5/4000	SEE TABLE 2a	NOT AN OPTION

TABLE 1. HAZARD CATEGORIES BASED ON OCCUPANY

OCCUPANCY	DESCRIPTION OF OCCUPANCY	EXCEPTIONS	HAZARD CATEGORY
- KITCHENS - LIBRARIES - MEETING ROOMS - OFFICES	LIGHTLY LOADED NONSTORAGE AND NONMANUFACTURING AREAS WITH ORDINARY COMBUSTIBLES.	-	HC-1
- DISPLAY HALLS - THEATER & AUDITORIUMS - UTILITY AND EQUIPMENT ROOMS	LIGHTLY AND MODERATELY LOADED NONSTORAGE, NONMANUFACTURING, AND MANUFACTURING AREAS WITH ORDINARY COMBUSTIBLES.	-	HC-2
- REPAIR GARAGES - INTERIOR LOADING DOCKS - PLASTICS PROCESSING	HEAVILY LOADED AREAS WITH OR WITHOUT PLASTICS.	-	HC-3

TABLE 3. HOSE DEMAND AND DURATION

HAZARD CATEGORY	HOSE DEMAND, GPM		DURATION, MIN
	CEILINGS UNDER 60 FT	CEILINGS OVER 60 FT	
HC-1	250	500	60
HC-2	250	500	60
HC-3	500	500	90

TABLE 2.5.2.1.1 (b) RECOMMENDED MINIMUM ALLOWABLE NONSTORAGE PENDENT AND UPRIGHT SPRINKLER K FACTORS

RECOMMENDED DENSITY FROM OCCUPANCY-SPECIFIC DATA SHEET, GPM/SQ.FT.	MINIMUM RECOMMENDED STANDARD COVERAGE CEILING SPRINKLER K - FACTOR	MINIMUM RECOMMENDED EXTENDED COVERAGE CEILING SPRINKLER K - FACTOR
DENSITY </= 0.10	5.6	5.6
0.10 <DENSITY OR</ = 0.30	5.6	11.2
DENSITY > 0.30	11.2	25.2

CONTRACTOR SHALL SUBMIT CALCULATIONS FOR ALL SPRINKLER SYSTEMS, INCLUDING ALL HAZARD AREAS (I.E. WET, DRY LIGHT HAZARD, ORDINARY HAZARD, ETC.)

THE CONTRACTOR SHALL PROVIDE SPRINKLER COVERAGE OF ALL SPACES FORMED OF CONCEALED COMBUSTIBLE CONSTRUCTION.

THE CONTRACTOR SHALL COMPLY WITH THE OWNERS INSURANCE INSTALLATION DETAILS, DESIGN CRITERIA, AND PLAN APPROVAL SUBMISSION (INCLUDING COMMENTS). ANY DEVIATIONS AS A RESULT OF THE OWNERS INSURANCE COMPANIES REQUIREMENTS SHALL BE PROVIDED AT NO ADDITIONAL COST.

ALL HYDRAULIC CALCULATIONS SHALL INCLUDE A MINIMUM "CUSHION" (GAP) OF 10 PSI BETWEEN REQUIRED AND AVAILABLE WATER SUPPLY.

AREA OF SPRINKLER OPERATION SELECTED FOR HYDRAULIC CALCULATION SHALL BE MOST DEMANDING AND CANNOT INCLUDE ANY UNSPRINKLERED AREAS. ALL SPRINKLERS IN REMOTE AREA MUST OPERATE, INCLUDING "SMALL ROOMS AND CLOSETS".

FOR AREAS HAVING UNSPRINKLERED COMBUSTIBLE CONCEALED SPACES (AS DESCRIBED IN NFPA 13,) THE MINIMUM AREA OF SPRINKLER PROTECTION SHALL BE 3000 SQ.FT.

IF ROLLED GROOVED PIPING IS USED, ADDITIONAL PRESSURE LOSS IN COUPLINGS AND FITTINGS, DUE TO REDUCED CROSS SECTION AT GROOVES, SHALL BE REFLECTED IN HYDRAULIC CALCULATIONS.

IN EACH SYSTEM CALCULATION, TOTAL SPRINKLER DEMAND SHALL BE BROUGHT BACK TO THE FIRE SERVICE CONNECTION AT THE WATER MAIN. RESULTS OF EACH CALCULATION SHALL BE PLOTTED ON N (1.85) GRAPH, ALONG WITH WATER SUPPLY INFORMATION.

HYDRAULIC SUMMARY DATA SHALL BE INCLUDED ON SHOP DRAWINGS, INCLUDING PSI & GPM REQUIRED AND PSI & GPM AVAILABLE.

USE OF LINE SPACING OFF WALL IN EXCESS OF 7'-6", REDUCTION OF HYDRAULIC REMOTE AREA, AND USE OF (4) SPRINKLER HEAD DESIGN ETC (AS NOTED IN NFPA 13) IS NOT PERMITTED

PROVIDE MAKES AND MODELS OF ALL DEVICES AND MATERIALS ON ALL SHOP DRAWINGS. INCLUDE DEFINITION/DESCRIPTION OF SPRINKLER IDENTIFICATION FOR ALL SPRINKLERS ON SHOP DRAWINGS FOR REPLACEMENT PURPOSES.

CONTRACTOR TO SUBMIT UNIT COST PER SPRINKLER HEAD INSTALLED AND OPERATIONAL WITH BID IN ACCORDANCE WITH THE GENERAL CONDITIONS (INCLUDING: PIPING, FITTINGS, HANGERS, SPRINKLER HEAD, LABOR, ETC.).

2022 NYC SPRINKLER NOTES

1. THE SPRINKLER SYSTEM INCLUDING BUT NOT LIMITED TO INSTALLATION, COMPONENTS, SIZING, SPACING, LOCATION, CLEARANCES AND SYSTEM'S TYPE SHALL CONFORM TO NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q101, Q102 AND NFPA 13 EDITION 2016.
2. ONLY APPROVED MATERIALS SHALL BE USED PER NYC BUILDING CODE CHAPTER 9 BC 903.2, 903.3, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 6.
3. DIRECT CONNECTION OF SPRINKLERS TO THE PUBLIC WATER SYSTEM SHALL CONFORM TO NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 24.
4. SPRINKLERS WILL BE PROTECTED AGAINST FREEZING AND INJURY AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 6.2.8, 7.2.5, 7.3.1, 7.4.4, 7.9.2, 8.14, 8.15, 8.16, 10.4.2.
5. INSPECTIONS AND TESTS OF SPRINKLERS SHALL BE CONDUCTED AS PER NYC BUILDING CODE CHAPTERS 9 & 17, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 10.10, AND CHAPTER 26.
6. THE OCCUPANCY OF THE AREAS TO BE SPRINKLERED IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9 BC 903.2, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 5.
7. WATER TEST PIPING, CONNECTIONS AND DEVICES WILL BE PROVIDED PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTERS 8, 25.
8. PIPING, FITTINGS, SPECIFICATIONS, SCHEDULES, SYSTEM TEST PIPES, PROTECTION AGAINST CORROSION DAMAGE, VALVES, HANGERS, SPRINKLERS, GUARDS AND SHIELDS SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTERS 6, 9, 10 AND 24.
9. STOCK OF SPARE SPRINKLERS AND SPECIAL SPRINKLER WRENCHES SHALL BE FURNISHED PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTION 6.2.9.
10. SPRINKLER ALARMS WILL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 6.8 AND 8.17.
11. ALL CONCEALED SPACES ENCLOSED WHOLLY OR PARTIALLY BY EXPOSED COMBUSTIBLE CONSTRUCTION SHALL BE PROTECTED BY SPRINKLERS IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTION 8.3, 8.6, 8.15, 11.2.3.1, 12.7, 12.9, 23.4 AND 26.4.
12. ALL PIPING PASSING THROUGH RATED WALLS AND HORIZONTAL ASSEMBLIES SHALL COMPLY WITH NYC BUILDING CODE CHAPTER 7 BC 711.
13. DISTANCE OF SPRINKLERS FROM HEAT SOURCES SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTION 8.3.2.5.
14. DEPARTMENT OF WATER SUPPLY (NYC DEP) LETTER WITH FLOW TEST DATA SHALL BE PROVIDED IF A DIRECT CONNECTION TO THE STREET WATER SUPPLY IS PRESENT PER NYC BUILDING CODE CHAPTER 9 BC 903.1.2.5,
15. ALL PIPING PASSING THROUGH FOUNDATION WALLS SHALL BE PROTECTED AS REQUIRED BY NYC PLUMBING CODE CHAPTER 3 PC 305.3
16. ALL VALVES SHALL BE IDENTIFIED AS REQUIRED BY NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 6.6.4 AND 8.16.
17. DRAINAGE SHALL CONFORM TO NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 6.6.3, 6.6.4, 6.8.5, 7.4.4, 7.6.2, 7.7.4, 8.16.2, 8.17.2, 25.2.3.4, 26.4.11.
18. HYDRAULICALLY CALCULATED SPRINKLER SYSTEMS DESIGNS SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 23.
19. ALL FITTINGS SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 6.
20. A ONE PIECE REDUCING FITTING SHOULD BE USED WHEREVER A CHANGE IN THE SIZE OF PIPE AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTION 6.4.7
21. ALL VALVES ON CONNECTIONS TO WATER SUPPLY AND IN SUPPLY PIPES SHALL BE APPROVED AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTERS 6, 7, 8, 10, 11, 24 AND 25.
22. DRAIN AND TEST VALVES SHALL BE APPROVED AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 6.6.3, 6.6.4, 6.8.5, 7.4.4, 7.6, 7.7.4, 8.16.2, 8.17.2, 25.2.3.4, 26.4.11.
23. HANGING, BRACING AND RESTRAIN OF SYSTEM PIPING SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 9.
24. PROVISIONS SHALL BE MADE TO FACILITATE FLUSHING SYSTEM PIPING AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTIONS 8.16, 10.10.2 AND 22.17,
25. SPRINKLERS SHALL BE AN APPROVED TYPE AND TEMPERATURE RATING AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTION 6.2.
26. PROVIDE CLEARANCE BETWEEN THE SPRINKLER DEFLECTOR AND THE TOP OF THE STORAGE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 8
27. SIAMESE CONNECTIONS SHALL COMPLY WITH NYC BUILDING CODE CHAPTER 9 BC 912, APPENDIX Q BC Q105 AND NFPA 13 EDITION 2016 CHAPTER 8.
28. SPRINKLERS SHALL BE QUICK RESPONSE TYPE FOR LIGHT HAZARD OCCUPANCIES AS PER NYC BUILDING CODE CHAPTER 9 BC 903.3,2
29. DRY SYSTEMS SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 SECTION 7.2.
30. NEW SPRINKLER BRANCH PIPES SHALL BE A MINIMUM OF 1 INCH SIZE AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q102 AND NFPA 13 EDITION 2016 CHAPTER 8.

TENANT SAFETY NOTES

1. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH THE NEW YORK CITY BUILDING CODE, ARTICLE 19, AND REGULATIONS OF ALL OTHER AGENCIES HAVING JURISDICTION.
2. ALL EXISTING MEANS OF EGRESS FOR TENANTS OF THE BUILDING ARE TO BE MAINTAINED CLEAR AND FREE OF ALL OBSTRUCTIONS.
3. ALL BUILDING MATERIALS IN THE CONSTRUCTION AREA ARE TO BE SECURED IN A LOCKED AREA. THE OWNER ASSUMES NO RESPONSIBILITY FOR THE SAFE KEEPING OF BUILDING MATERIALS.
4. CONTRACTOR TO PROVIDE ADEQUATE TEMPORARY SHORING AND BRACING WHEREVER STRUCTURAL WORK IS REQUIRED.
5. CONSTRUCTION OPERATIONS SHALL NOT INVOLVE INTERRUPT ION OF HEATING, WATER, ELECTRICAL WITHOUT PROPER PRIOR CONSENT.

N.Y.C. SPECIAL INSPECTIONS

SPECIAL INSPECTIONS AND PROGRESS INSPECTIONS ARE REQUIRED IN ACCORDANCE WITH APPLICABLE SECTIONS OF THE BUILDING CODE ARE LISTED IN THE FOLLOWING TABLES.

SPECIAL INSPECTION ITEMS:	CODE SECTION:
FIRE-RESISTANT PENETRATIONS AND JOINTS (FIRESTOP)	BC 1705.17
SPRINKLER SYSTEMS	BC 1705.29
ALTERNATIVE MATERIALS - OTCR BUILDINGS BULLETIN	BC 1705.1.1
TENANT PROTECTION PLAN COMPLIANCE INSPECTION	BC 1705.26
POST - INSTALLED ANCHORS (BB # 2014 - 018, 2014 - 019)	BC 1705.37
STANDPIPE SYSTEMS	BC 1705.30

THE OWNER SHALL ENGAGE THE SERVICES OF A PROFESSIONAL ENGINEER TO PROVIDE THE REQUIRED SPECIAL INSPECTIONS AND TESTS

A. UPON COMPLETION OF THE FIRE PROTECTION SYSTEM SCOPE OF WORK:
   1. A TEST SHALL BE CONDUCTED IN THE PRESENCE OF A LICENSED PROFESSIONAL ENGINEER QUALIFIED TO CONDUCT SUCH TESTS. THE TESTS SHALL SHOW COMPLIANCE WITH THE CODE REQUIREMENTS PER SECTIONS BC 901.5, BC 903.5, BC 904.1 AND BC 905.1 BEFORE THE SYSTEM IS APPROVED.
   2. THE LICENSED PROFESSIONAL ENGINEER WHO CONDUCTS THE TESTS SHALL FILE A CERTIFICATE AS TO WHETHER THE SYSTEM COMPLIES WITH THE APPLICABLE LAWS. THEY SHALL ALSO FILE WITH THIS CERTIFICATION A REPORT OF THE TEST. THE TEST AND REPORT SHALL BE MADE IN A MANNER SATISFACTORY TO THE OWNER.

JOB SCOPE OF WORK DESCRIPTION:

INSTALL NEW SPRINKLER SYSTEM IN CONJUNCTION WITH BUILDING ALTERATION.

SYMBOLS AND ABBREVIATIONS

SYMBOL OR ABBREVIATION	DESCRIPTION
—FP—	SPRINKLER MAIN PIPING
—DR—	GALVANIZED DRAIN PIPING
—FDC—	FIRE DEPARTMENT CONNECTION PIPING
—SPK—	SPRINKLER PIPING
	ELBOW UP OR DOWN
	PIPING RISER UP
	BOTTOM TAP
	TOP TAP
	CONTROL VALVE WITH TAMPER SWITCH
	CHECK VALVE
	DIRECTIONAL WATERFLOW INDICATOR
	WATER FLOW SWITCH
	BACKFLOW PREVENTER
	6" ALARM BELL
	2-1/2" x 2-1/2" x 4" SIAMESE FIRE DEPARTMENT CONNECTION (FDC)
	WET RISER CHECK VALVE ASSEMBLY (RCVA)
	DRY PIPE VALVE ASSEMBLY (DPVA)
	SPRINKLER CONTROL ASSEMBLY WITH 2 1/2" FIRE DEPARTMENT VALVE WITH 2 1/2" x 1 1/2" REDUCER CAP & CHAIN IN CABINET
XX	HYDRAULIC REFERENCE POINT
1 / A101 SIM	DETAIL / CALLOUT DESIGNATION
1 / A101	VIEW REFERENCE
	PIPE / VIEW BREAK LINE

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
VIF	VERIFY IN FIELD	AFF	ABOVE FINISH FLOOR
TS	TAMPER SWITCH	FS	FLOW SWITCH
UNO	UNLESS NOTED OTHERWISE	SPK	SPRINKLER
STP	STANDPIPE	SCA	SPRINKLER CONTROL ASSEMBLY

2022 NEW YORK CITY BUILDING DEPARTMENT STANDPIPE NOTES

1. THE COMPLETE STANDPIPE SYSTEM SHALL COMPLY WITH THE FULL REQUIREMENTS OF NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016.
2. STANDPIPE SYSTEM COMPONENTS AND HARDWARE SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4.
3. STANDPIPE SYSTEMS SHALL BE INSTALLED WHERE REQUIRED BY NYC BUILDING CODE CHAPTER 9, SECTIONS 905.3, 905.4, 905.5 AND 905.6; THE NYC FIRE CODE AND NFPA 14 EDITION 2016.
4. STANDPIPE SYSTEMS ARE PERMITTED TO BE COMBINED WITH SPRINKLER SYSTEMS PER NYC BUILDING CODE CHAPTER 9, BC 905.3 APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016.
5. STANDPIPE SYSTEMS ARE REQUIRED DURING CONSTRUCTION, ALTERATION AND DEMOLITION OPERATIONS AND SHALL BE PROVIDED AS PER NYC BUILDING CODE CHAPTER 33.
6. THE MAXIMUM PRESSURE AT ANY POINT IN THE STANDPIPE SYSTEM SHALL NOT EXCEED 350 PSI AS PER NYC BUILDING CODE APPENDIX Q BC Q105, SECTION 7.2.2.
7. ANY PART OF THE STANDPIPE SUBJECT TO FREEZE SHALL COMPLY WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 SECTION 6.1.2.3.
8. THE PIPING FOR THE STANDPIPE SYSTEM SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4.
9. FITTINGS FOR THE STANDPIPE SYSTEM SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4
10. HOSE OUTLETS SHALL BE PROVIDED WHERE REQUIRED PER NYC BUILDING CODE CHAPTER 9 BC 905.3, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4.
11. VALVES AND RELATED PRODUCTS SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4
12. RISER CONTROL VALVES SHALL BE LOCATED AND INSTALLED IN ACCORDANCE WITH WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105 4.5.1 AND 6.3.2, THE NYC FIRE CODE AND NFPA 14 EDITION SECTION 5.2.3.5.
13. CHECK VALVES SHALL BE LOCATED AND INSTALLED IN ACCORDANCE WITH WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2007 CHAPTER 6.
14. PIPING, DEVICES AND EQUIPMENT FOR STANDPIPE SYSTEMS SHALL BE SUPPORTED BY CLAMPS, HANGERS OR ANY APPROVED SUPPORTING DEVICE AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4.
15. AT THE TOP OF THE HIGHEST STANDPIPE RISER, ABOVE THE MAIN ROOF LEVEL, THERE SHALL BE A THREE WAY MANIFOLD WITH THREE TWO AND ONE HALF INCH HOSE VALVES, CHAINS AND CAPS AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105 SECTION 7.3.2.1.
16. SIAMESE CONNECTIONS SHALL BE DESIGNED, CONSTRUCTED AND LOCATED IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105 SECTION 4.8.2.
17. SIAMESE CONNECTIONS SHALL BE INSTALLED BETWEEN 18 INCHES AND 36 INCHED AFF IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105 SECTION 4.8.2.2.
18. SIAMESE CONNECTIONS SHALL BE PROVIDED WITH CAPS, CHAINS AND PAINTED AS PER NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105 SECTION 4.8.3.
19. SIAMESE CONNECTION MARKING SHALL BE IN ACCORDANCE WITH NYC BUILDING CODE CHAPTER 9, APPENDIX Q BC Q105 SECTION 6.4.5.2.
20. STANDPIPE SIGNAL SYSTEMS SHALL COMPLY WITH NYC BUILDING CODE CHAPTER 9 BC 907, APPENDIX Q BC Q107, THE NYC FIRE CODE AND NFPA 14 EDITION 2016 CHAPTER 4.
21. FIRE PUMP INSTALLATION SHALL COMPLY WITH NYC BUILDING CODE APPENDIX Q BC Q106.

SPRINKLER DRAWING LIST

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

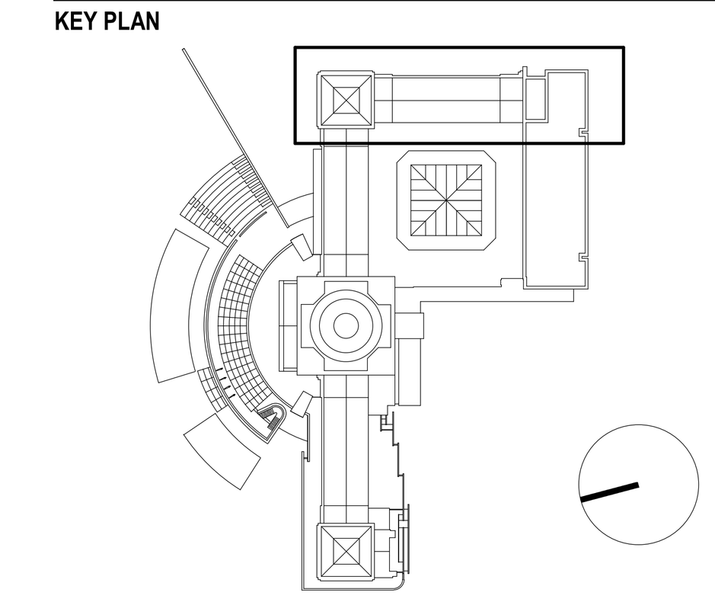
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

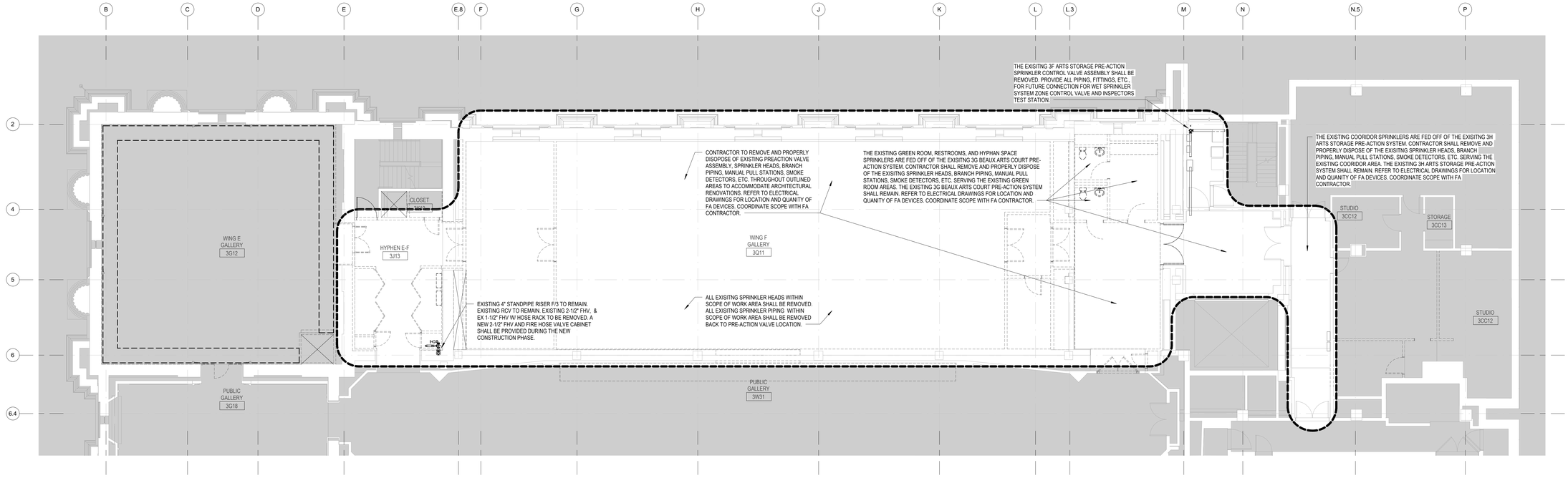
DRAWING TITLE

COVER SHEET - SPRINKLER

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

FP001.00

10/14/2025 5:23:46 PM



1 FP103.00 03-THIRD FLOOR DEMO PLAN - SPRINKLER
SCALE: 1/8" = 1'-0"

NOTE:
1. EXISTING FIRE ALARM DEVICES INDICATED TO BE REMOVED OR DEMOLISHED ON THE E-SERIES DRAWINGS SHALL BE TURNED OVER TO BKM FACILITIES TEAM FOR THEIR STORAGE AND ATTIC STOCK MANAGEMENT. CONTRACTOR SHALL COORDINATE WITH BKM FACILITIES TEAM FOR WHERE AND WITH WHOM TO LEAVE EXISTING DEINSTALLED DEVICES.

2. EXISTING FIRE ALARM DEVICES TO BE REMOVED, DEMOLISHED OR RELOCATED SHALL BE HANDLED WITH CARE DURING DEMOLITION AND DEINSTALLATION, WITH THE INTENT THAT THEY ARE ABLE TO BE REUSED. ALL DEVICES SHALL BE CLEANED PRIOR TO TURNING OVER TO OWNER.

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

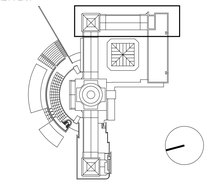
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

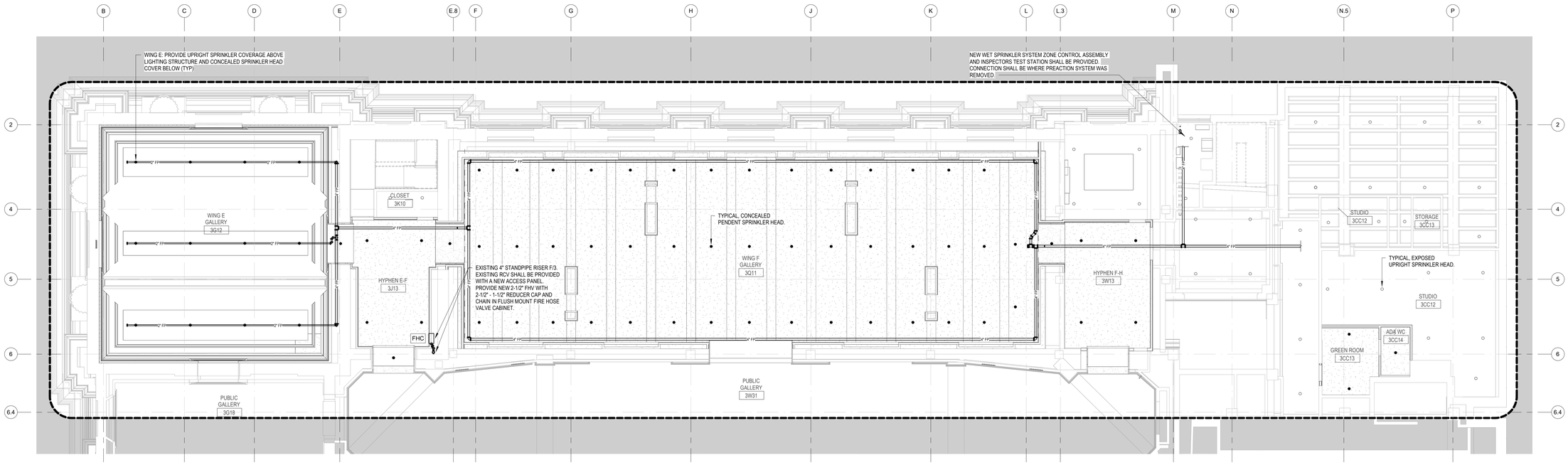
THIRD FLOOR DEMO PLAN - SPRINKLER

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

FP103.00

10/14/2025 5:23:47 PM



1 THIRD FLOOR CEILING PLAN
FP202.00 SCALE: 1/8" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

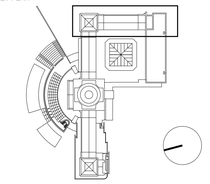
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

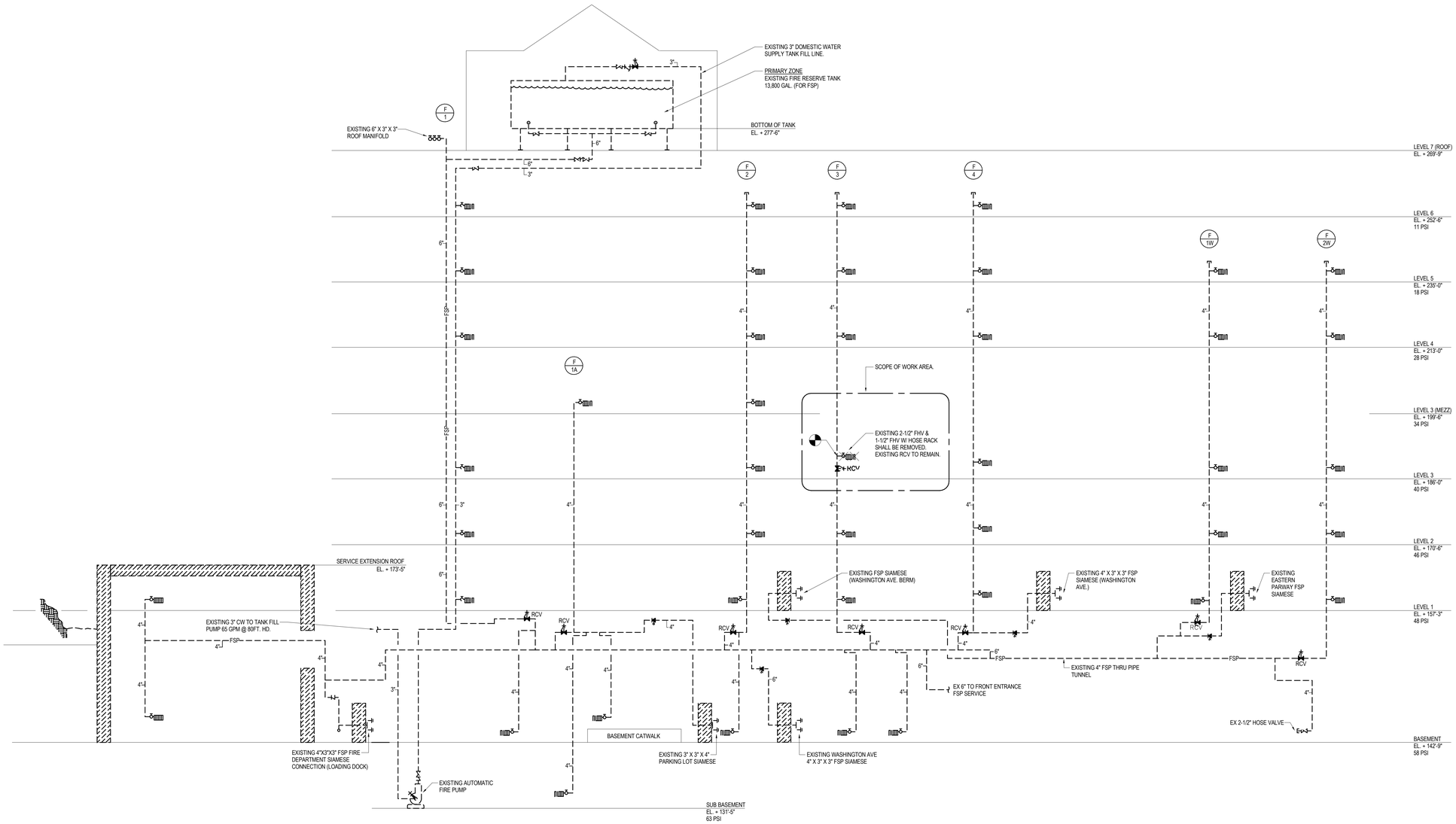
THIRD FLOOR PLAN - SPRINKLER

SCALE	1/8" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

FP202.00

10/14/2025 5:23:48 PM



EXISTING FIRE STANDPIPE RISER DIAGRAM
NOT TO SCALE

1 EXISTING FIRE STANDPIPE RISER DIAGRAM
FP400.00 SCALE: 12" = 1'-0"

10/14/2025 5:23:49 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

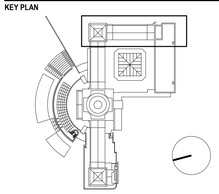
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS
SUBMITTAL

DESIGN DEVELOPMENT

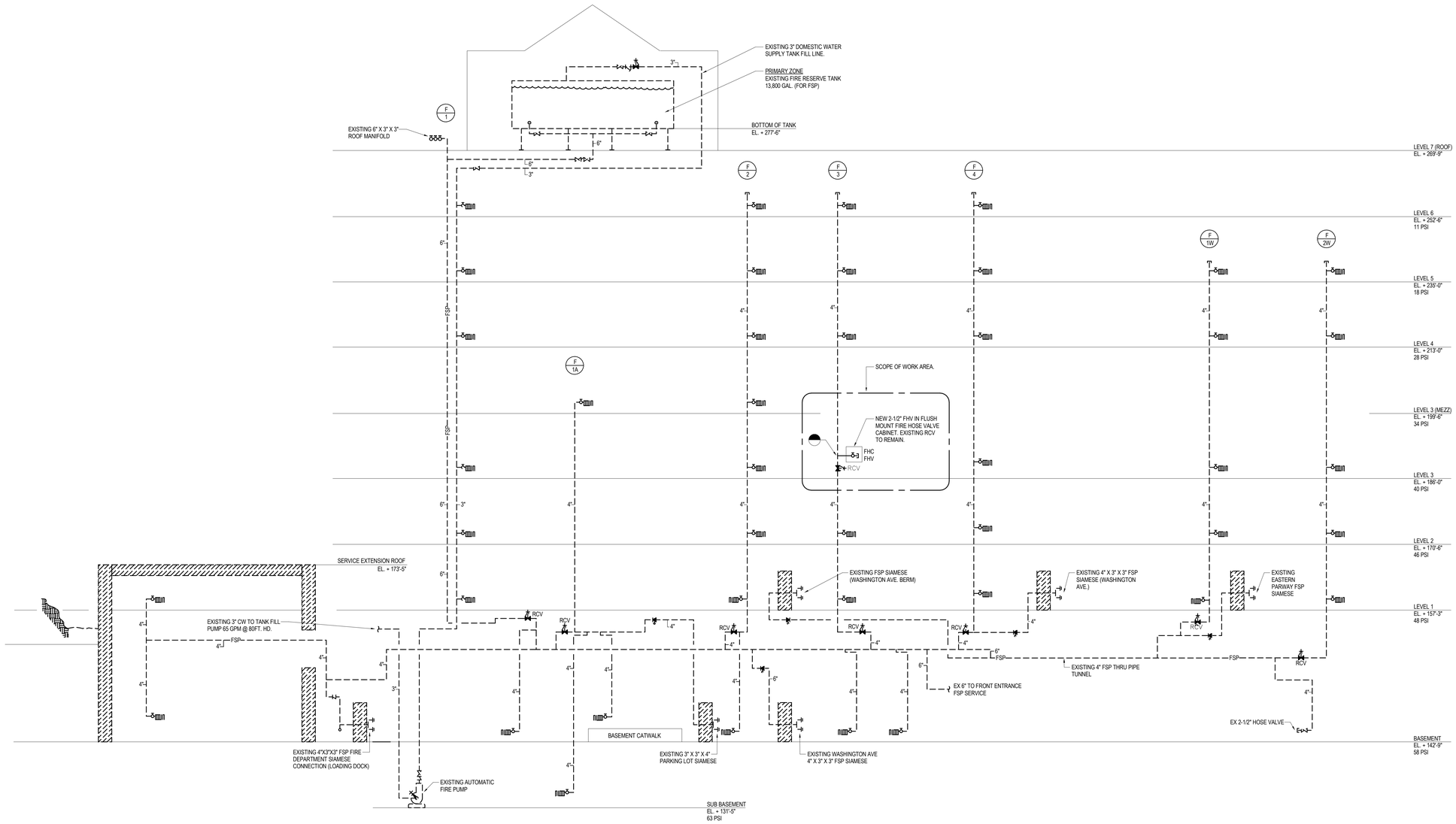
PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

EXISTING FIRE STANDPIPE RISER DIAGRAM- SPRINKLER

SCALE	12" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A
DRAWING NUMBER	

FP400.00



NEW FIRE STANDPIPE RISER DIAGRAM
NOT TO SCALE

1 FP401.00 NEW FIRE STANDPIPE RISER DIAGRAM
SCALE: 12" = 1'-0"

10/14/2025 5:23:50 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

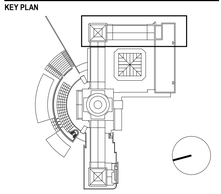
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

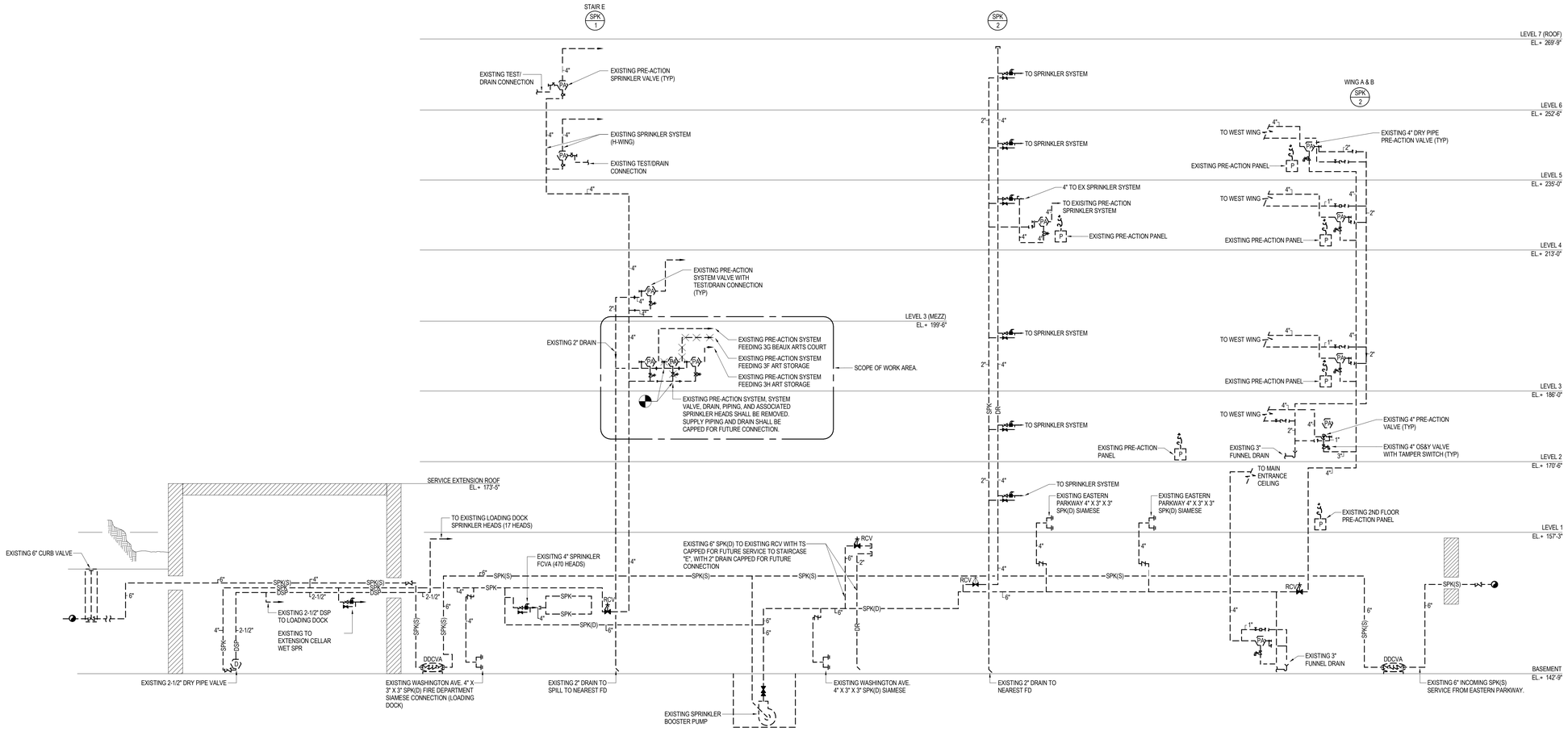
DRAWING TITLE

NEW FIRE STANDPIPE RISER DIAGRAM- SPRINKLER

SCALE	12" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

FP401.00



EXISTING SPRINKLER RISER DIAGRAM
NOT TO SCALE

1 FP402.00 EXISTING SPRINKLER RISER DIAGRAM
SCALE: 12" = 1'-0"

10/14/2025 5:23:51 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

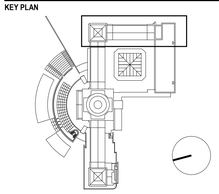
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

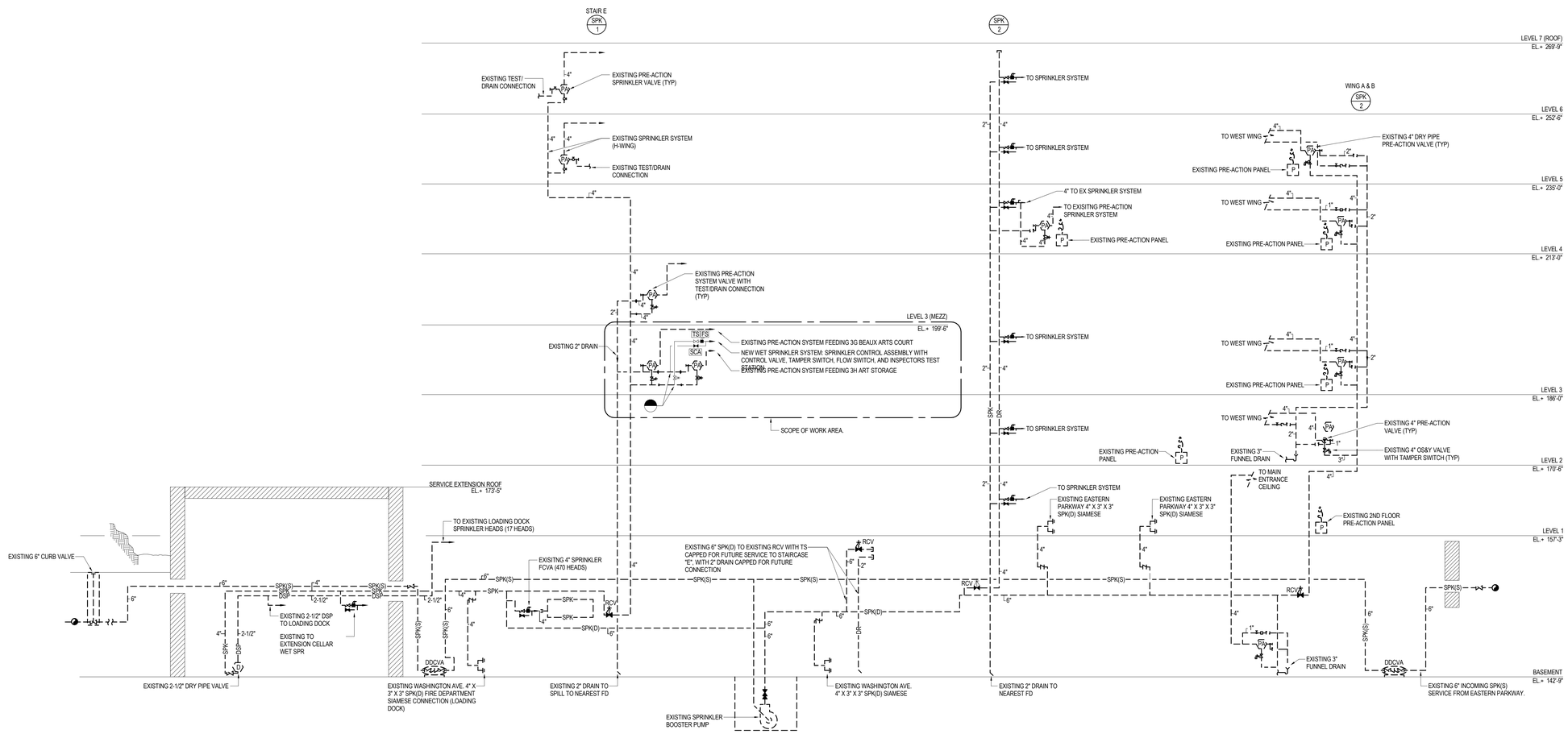
DRAWING TITLE

EXISTING SPRINKLER RISER DIAGRAM - SPRINKLER

SCALE	12" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

FP402.00



NEW SPRINKLER RISER DIAGRAM NOT TO SCALE

1 FP403.00 NEW SPRINKLER RISER DIAGRAM
SCALE: 12" = 1'-0"

10/14/2025 5:23:51 PM

BROOKLYN MUSEUM

ARTS OF AFRICA

200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE

37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

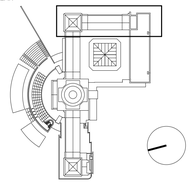
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

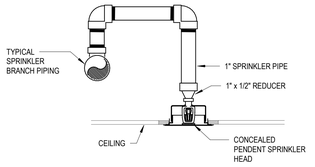
DRAWING TITLE

NEW SPRINKLER RISER DIAGRAM - SPRINKLER

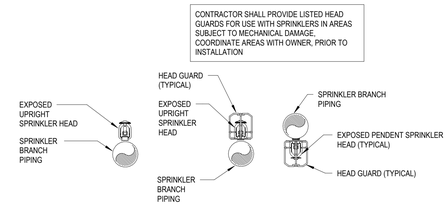
SCALE	12" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

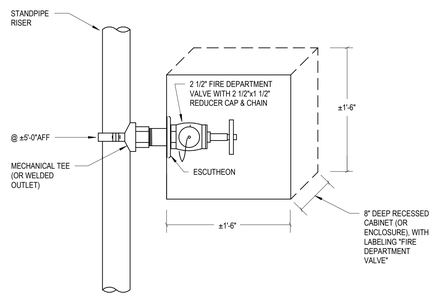
FP403.00



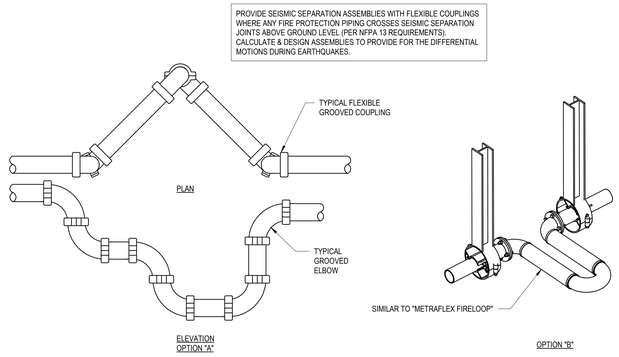
1 FP500.00 TYPICAL CONCEALED SPRINKLER HEAD DETAIL - AOA
SCALE: N.T.S.



2 FP500.00 EXPOSED SPRINKLER HEADS - AOA
SCALE: N.T.S.



7 FP500.00 TYPICAL 2-1/2" (FDV) FIRE DEPARTMENT VALVE - AOA
SCALE: N.T.S.



4 FP500.00 SEISMIC SEPARATION ASSEMBLY - AOA
SCALE: N.T.S.

FIRE PROTECTION PIPE AND FITTING SCHEDULE

DESCRIPTION	SIZE	PIPE TYPE	PIPE SCHEDULE	FITTING TYPE	FITTING RATING	REMARKS
WET SPRINKLER PIPING	2" AND BELOW	STL-BLK	40	MIT/DIT	STD	--
WET SPRINKLER PIPING	2-1/2" AND LARGER	STL-BLK	40	GRV	STD	--
DRAIN PIPING	ALL	GALV.	40	MIT/GRV	STD	ALL FITTINGS TO BE GALVANIZED

ABBREVIATIONS

ABB.	DESCRIPTION
STL-BLK	BLACK STEEL
CLDI	CEMENT-LINED DUCTILE IRON
DIMJ	DUCTILE IRON MECHANICAL JOINT
STD	STANDARD
MIT	MALLEABLE IRON THREADED
GRV	GROOVED JOINT SYSTEM FITTINGS/COUPLINGS
GALV	GALVANIZED STEEL
DIT	DUCTILE IRON THREADED

SPRINKLER HEAD SCHEDULE

SYMBOL	TYPE	STYLE	RESPONSE	COVERAGE	STANDARD COLORS REFER TO REMARKS	DISCHARGE COEFFICIENT (K)	ORIFICE	TEMPERATURE	MANUFACTURER MODEL	MANUFACTURER SIN	REMARKS
●	PENDENT	CONCEALED	QUICK	STANDARD	WHITE	5.6 K	1/2"	155 F°	VICTAULIC V38	V3802	--
○	UPRIGHT	EXPOSED	QUICK	STANDARD	BRASS	5.6 K	1/2"	155 F°	VICTAULIC V27	V2704	--
◁	SIDEWALL	EXPOSED	QUICK	STANDARD	WHITE	5.6 K	1/2"	155 F°	VICTAULIC V27	V2710	--
◉	PENDENT	EXPOSED	QUICK	STANDARD	BRASS	5.6 K	1/2"	155 F°	VICTAULIC V27	V2708	--

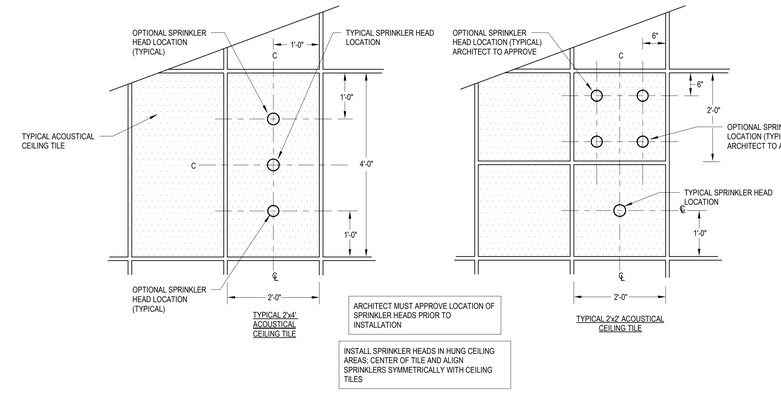
NOTE:
FINAL COLOR SELECTION TO BE APPROVED BY ARCHITECT PRIOR TO INSTALLATION
SPRINKLER TEMPERATURE RATING SHALL BE IN ACCORDANCE WITH NFPA 13, 6.2.5.1

VALVE SCHEDULE

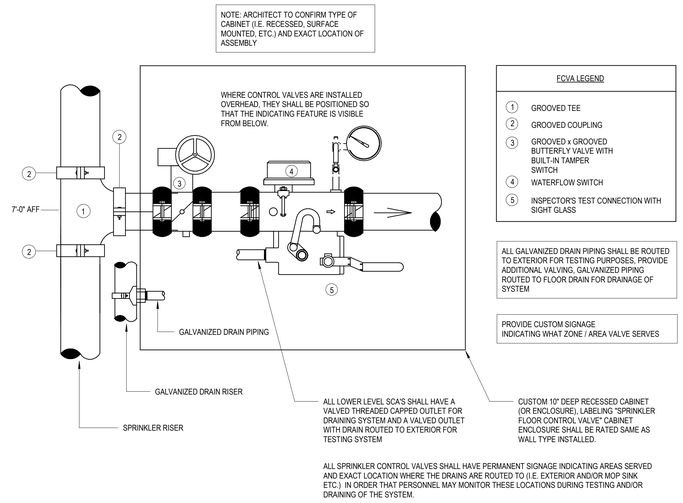
DESCRIPTION	SIZE	TYPE OS&Y	TYPE BUTTERFLY	TYPE CHECK	TYPE BALL	CLASS	REMARKS
WET SPRINKLER PIPING	2" AND BELOW	OS&YT	BFVT	CVT	BVT	175 PSI	--
WET SPRINKLER PIPING	2-1/2" AND LARGER	OS&YG	BFVG	CVG	BVG	175 PSI	--
DRAIN PIPING	ALL	--	--	--	BVT	175 PSI	--

ABBREVIATIONS

ABB.	DESCRIPTION
BFVG	BUTTERFLY VALVE GROOVED
BFVT	BUTTERFLY VALVE THREADED
BVG	BALL VALVE GROOVED - FULL PORT
BVT	BALL VALVE THREADED - 2-PIECE, FULL PORT, 400PSI
CVG	CHECK VALVE GROOVED
CVT	CHECK VALVE THREADED
OS&YG	OS&Y RISING STEM VALVE GROOVED
OS&YT	OS&Y RISING STEM VALVE THREADED



5 FP500.00 TYPICAL ACOUSTICAL TILE SPRINKLER HEAD LOCATION - AOA
SCALE: N.T.S.



3 FP500.00 SPRINKLER CONTROL ASSEMBLY
SCALE: N.T.S.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

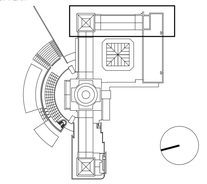
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

SCHEDULES & DETAILS - SPRINKLER

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

FP500.00

10/14/2025 5:23:53 PM

IT ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
APPROX	APPROXIMATE
AV	AUDIOVISUAL
BDF	BUILDING DISTRIBUTION FRAME
BET	BUILDING ENTRANCE TERMINAL (LIGHTNING PROTECTION)
C	CONDUIT(S)
CAT3	TIA CATEGORY 3 RATED
CAT5	TIA CATEGORY 5 RATED
CAT5E	TIA CATEGORY 5E RATED
CAT6	TIA CATEGORY 6 RATED
CAT6A	TIA CATEGORY 6A RATED
CLG	CEILING
CM	CONSTRUCTION MANAGER
CP	CONSOLIDATION POINT
CPP	COPPER PATCH PANEL
D	DEEP
DAS	DISTRIBUTED ANTENNA SYSTEM
EC	ELECTRICAL CONTRACTOR
ELEC	ELECTRIC / ELECTRICAL
EQ	EQUAL
EQPT	EQUIPMENT
ER	EQUIPMENT ROOM
ERO	EXISTING - RELOCATED
ETBR	EXISTING - TO BE RELOCATED
ETR	EXISTING - TO REMAIN
F&I	FURNISH AND INSTALL / FURNISHED AND INSTALLED
FO	FIBER OPTIC
FPP	FIBER PATCH PANEL
FT	FOOT/FEET
FTP	FOIL TWISTED PAIR
GC	GENERAL CONTRACTOR
GND	GROUND
H	HIGH
I.D.	INSIDE DIAMETER
LAN	LOCAL AREA NETWORK
LOMMF	LASER OPTIMIZED MULTIMODE FIBER OPTIC
MC	MAIN CROSS CONNECT
MDF	MAIN DISTRIBUTION FRAME
MECH	MECHANICAL
MH	MANHOLE
MM	MULTIMODE
MMF	MULTIMODE FIBER OPTIC
MPO	MULTIPLE FIBER PUSH-ON
MTD	MOUNTED
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
O.D.	OUTSIDE DIAMETER
OFE	OWNER FURNISHED EQUIPMENT
OSP	OUTSIDE PLANT
PB	PULLBOX
PBB	PRIMARY BONDING BUSBAR
PBX	PRIVATE BRANCH EXCHANGE
POE	POINT OF ENTRY
PoE	POWER OVER ETHERNET
PR	PAIR
RGB	RACK GROUNDING BUSBAR
RMU	RACK MOUNTING UNIT (1RMU=1.75")
RW	RACEWAY
SBB	SECONDARY BONDING BUSBAR
SM	SINGLEMODE
SMF	SINGLEMODE FIBER OPTIC
STP	SHIELDED TWISTED PAIR
TEMP	TEMPORARY
TR	TELECOMMUNICATIONS ROOM
TSER	TELECOMMUNICATIONS SERVICE ENTRANCE ROOM
TYP	TYPICAL
U	RACK UNIT (1U=1.75")
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
VOIP	VOICE OVER INTERNET PROTOCOL
W	WIDE
W/	WITH
W/O	WITHOUT
WAN	WIDE AREA NETWORK
WAP	WIRELESS ACCESS POINT
WP	WATERPROOF
WS	WORKSTATION
WW	WIREWAY

IT GENERAL NOTES

GENERAL

1. REFER TO CSI SPECIFICATIONS DIVISION 26 - ELECTRICAL FOR SPECIFICATIONS AND INSTALLATION INSTRUCTIONS FOR CONDUITS, FLOORBOXES, JUNCTION BOXES, METAL ENCLOSURES, ELECTRICAL PANELBOARDS AND CIRCUITING.
2. INSTALL FIRESTOP WITHIN ALL SLAB AND WALL PENETRATIONS PROVIDED FOR THE INSTALLATION OF IT CABLE AS REQUIRED TO MAINTAIN FIRE RATING OR SLAB OR WALL. REVIEW ARCHITECT'S PLANS FOR PARTITION TYPES AND RATINGS.
3. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WORK REQUIRED FOR DEMOLITION AND INSTALLATION, INCLUDING ALL CUTTING, PATCHING, AND SEALING REQUIRED FOR THIS CONTRACTOR'S SCOPE-OF-WORK TO MEET JOB COMPLETION CRITERIA.
4. THE DRAWINGS AND SPECIFICATIONS ARE DIVIDED INTO SECTIONS TO MEET NEEDS OF THE ARCHITECT, THE ENGINEERS, AND THE DESIGN CONSULTANTS. THEY ARE NOT PREPARED AS INSTRUCTIONS TO THE CONTRACTOR FOR HOW TO BUY OUT OR SUBCONTRACT THE WORK. THE CONTRACTOR IS RESPONSIBLE FOR ALL THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS, REGARDLESS OF WHERE IT IS SHOWN. FOR EXAMPLE, ELECTRICAL WORK IS SHOWN ON FP-SERIES DRAWINGS AS WELL AS ON M-SERIES DRAWINGS AND E-SERIES DRAWINGS. MISCELLANEOUS METALS AND STRUCTURAL ELEMENTS ARE SHOWN ON A-SERIES DRAWINGS AS WELL AS ON S-SERIES DRAWINGS. STRUCTURAL SUPPORTS ARE REQUIRED BY THE FP DRAWINGS. TO AVOID OMITTING ANY COMPONENT OF THE PROJECT, REFER TO ALL THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.

CABLING

1. PROVIDE TYPED IDENTIFICATION LABELS FOR ALL CABLES AT BOTH ENDS.
2. PROVIDE TYPED DESIGNATION LABELS FOR ALL TERMINATION BLOCKS, PATCH PANELS, AND WORKSTATION OUTLET FACEPLATES.
3. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR LOCATIONS AND HEIGHTS OF ALL IT OUTLETS.
4. INSTALL CONDUIT AND LADDER RACK FOR IT WIRING TO MAINTAIN A MINIMUM OF 5" SEPARATION FROM FLUORESCENT LIGHTING.
5. INSTALL EACH CABLE SET INDICATED BY THE SYMBOL LIST (IT LEGEND) FROM THE OUTLET LOCATION BACK TO THE RESPECTIVE SERVING TELECOMMUNICATIONS ROOM (TR).
6. IF CONFLICTS ARE FOUND BETWEEN THE IT DRAWINGS AND ANY OTHER DRAWINGS ASSOCIATED WITH THE PROJECT, NOTIFY THE CONSTRUCTION MANAGER AT ONCE AND HAVE THE LOCATION VERIFIED BEFORE OUTLETS ARE INSTALLED. ANY REASONABLE CHANGE IN LOCATION OF OUTLETS PRIOR TO ROUGHING SHALL NOT INVOLVE ADDITIONAL EXPENSE TO THE OWNER. THE TERM "REASONABLE" SHALL BE INTERPRETED AS MOVING OUTLET LOCATIONS A MAXIMUM OF 6'-0" IN ANY DIRECTION FROM THE LOCATION INDICATED ON THE DRAWINGS.
7. FOLLOW MANUFACTURERS GUIDELINES FOR BEND RADIUS AND PULLING TENSIONS FOR ALL CABLE.

PATHWAYS

1. COORDINATE INSTALLATION OF CONDUITS AND CABLE TRAYS WITH ALL OTHER COMPONENTS INSTALLED WITHIN THE CEILING. PREPARE COORDINATED SHOP DRAWINGS TO DEMONSTRATE AND ENSURE PROPER INSTALLATION OF ALL COMPONENTS PRIOR TO INSTALLATION.
2. MAINTAIN MINIMUM BEND RADIUS OF 10X O.D. FOR CONDUITS GREATER THAN 2" DIAMETER. MAINTAIN MINIMUM BEND RADIUS OF 6X O.D. FOR CONDUITS EQUAL TO OR LESS THAN 2" DIAMETER.
3. PROVIDE PULL BOXES (SIZE AS NOTED) AFTER EVERY 100' OF HORIZONTAL CONDUIT RUN OR AFTER EVERY 180° OF BEND OR AFTER EVERY 50' OF VERTICAL RUN.
4. DO NOT INSTALL PULL BOXES IN LIEU OF A BEND.
5. REAM AND BUSH THE ENDS OF ALL CONDUITS.
6. FURNISH AND INSTALL A PULL STRING WITHIN EACH EMPTY CONDUIT
7. STUB UP CONDUIT SLEEVES THROUGH SLABS A MINIMUM OF 3" ABOVE FINISHED FLOOR.
8. PROVIDE HANGERS, ANCHORS, MOUNTING HARDWARE, GROUND LUGS AND STRAPS AS REQUIRED TO ENSURE PROPER INSTALLATION OF PATHWAY COMPONENTS. INSTALL ALL COMPONENTS AS PER MANUFACTURERS RECOMMENDATIONS AND PER ALL APPLICABLE CODES.
9. GROUND ALL CONDUITS, SLEEVES, CABLE TRAY, AND LADDER RACK PER MANUFACTURER'S RECOMMENDATIONS AND PER ALL APPLICABLE CODES.
10. PROVIDE FOR ALL LADDER RACK AND CABLE TRAY : RUNWAY DROPOFFS, SPLICE HARDWARE, GROUND STRAPS, THERMAL EXPANSION PLATES, TERMINATION KITS, END SUPPORT KITS AND CEILING SUPPORT HARDWARE.
11. FOR ALL WIRE MESH BASKET TYPE CABLE TRAY, PROVIDE CONNECTION HARDWARE, GROUND STRAPS, THERMAL EXPANSION PLATES, SUPPORT BRACKETS AND CEILING SUPPORT HARDWARE.
12. REFER TO DISTRIBUTION PLANS FOR REQUIREMENTS OF JUNCTION BOXES AND CONDUITS TO SUPPORT WORKSTATION OUTLETS.
13. WHERE CABLE IS RUN ABOVE NON-ACCESSIBLE (I.E. GYPSUM BOARD) OR EXPOSED CEILING CONSTRUCTION, CONDUIT AND PULLBOXES MUST BE INSTALLED TO PROPERLY ROUTE CABLE. PULLBOXES MUST BE LOCATED SO THAT THEY ARE ACCESSIBLE. PROVIDE ACCESS PANEL(S) IN CEILING AS REQUIRED. COORDINATE LOCATIONS AND HEIGHTS WITH ARCHITECTURAL DRAWINGS.
14. PROVIDE J-HOOKS AND CABLE STRAPS TO SUPPORT CABLE ABOVE ALL ACCESSIBLE CEILING CONSTRUCTION, EXCEPT IN AREAS WHERE CABLE TRAY OR CONDUIT IS INDICATED.
15. ANY CABLES INSTALLED IN CONDUIT EITHER IN, OR BELOW CONCRETE SLAB-ON-GRADE CONSTRUCTION, MUST UTILIZE OSP OR INDOOR/OUTDOOR RATED CABLE WITH PROPER ENTRANCE PROTECTORS, AND TRANSITION TO INDOOR CABLE AS REQUIRED BY CODE FOR OSP CABLES.
16. ALL ENTRANCE CONDUITS TO BE INSTALLED WITH GROUNDING BUSHINGS, AND ARE TO BE BONDED TO THE PBB. IN ALL TELECOM ROOMS, ALL EQUIPMENT RACKS, LADDER RACKS, ARMORED CABLES, ENTRANCE PROTECTORS, ETC. ARE TO BE PROPERLY GROUNDED TO THE PBB/SBB.

LABELING

1. CABLE ADMINISTRATION:
   - A. PROPERLY LABEL ALL CABLES, RECEPTACLES, CONNECTION BLOCKS AND PATCH PANELS IN ACCORDANCE WITH TIA-606-B UON BY CLIENT'S PREFERRED LABELING STANDARD.
   - B. REPORT ANY CABLE THAT EXCEEDS 250' TO THE DESIGN TEAM. THE CABLE SHALL BE CLEARLY MARKED WITH RED TAPE AT BOTH ENDS OF EACH CABLE INDICATING THE EXACT CABLE LENGTH AND NOTED IN THE REQUIRED AS-BUILT LABEL REPORT.
   - C. PRIOR TO SYSTEM ACCEPTANCE, THE CONTRACTOR SHALL SUBMIT AN AS-BUILT LABEL REPORT PROVIDING THE ROOM NUMBERS AND CABLE LENGTHS FOR EACH OF THE INSTALLED CABLES.
2. LABEL REQUIREMENTS
   - A. PROVIDE WHITE LABEL WITH TYPE WRITTEN LEGIBLE CHARACTERS, PRINTED WITH NON-SMEAR INK. HANDWRITTEN LABELS ARE NOT PERMITTED.
   - B. PROVIDE LABELS WITH INDUSTRIAL GRADE SELF-ADHESIVE BACKING.
   - C. PROVIDE LABELS FOR CABLES WITH PROTECTIVE WRAP-AROUND PLASTIC TRANSPARENT COVER WHICH WILL SERVE TO PROTECT THE INK FROM SMEARING AND SECURE THE LABEL TO THE CABLE.
   - D. PROVIDE LABELS FOR CABLES WIDE ENOUGH FOR 23 CHARACTERS IN A SINGLE ROW.
   - E. BACKBONE/RISER AND TIE CABLE JACKETS SHALL BE CLEARLY LABELED WITHIN EACH TELECOM ROOM, AND AT 50' INTERVALS OUTSIDE TELECOM ROOMS ABOVE CEILINGS

IT DRAWING LIST

DEMOLITION AND REMOVALS

1. THE EXISTING FACILITY WILL BE OCCUPIED AND IN OPERATION DURING THE PERFORMANCE OF THE WORK.
2. WHEN NECESSARY TO TEMPORARILY DISCONNECT ANY EXISTING DEVICE WITHIN OCCUPIED FACILITIES, CONFER WITH THE OWNER, AND SCHEDULE A MUTUALLY AGREEABLE PERIOD OF INTERRUPTION.
3. WHERE REPLACEMENT, RELOCATION OR MODIFICATION OF EXISTING EQUIPMENT IS INDICATED, PROVIDE AND MAINTAIN ALL TEMPORARY CONNECTIONS AND ANY OTHER MATERIALS AND APPURTENANCES REQUIRED TO MAINTAIN SERVICES TO OCCUPIED AREAS.
4. NO WORK SHALL BE LEFT INCOMPLETE, NOR ANY HAZARDOUS SITUATION CREATED, WHICH WILL AFFECT THE LIFE OR SAFETY OF THE PUBLIC AND/OR BUILDING OCCUPANTS. AT NO TIME SHALL THE WORK INTERFERE WITH OR CUT OFF ANY OF THE EXISTING SERVICES WITHOUT THE OWNER'S PRIOR WRITTEN PERMISSION.
5. THE OWNER RESERVES THE RIGHT TO OPERATE ALL EXISTING IT EQUIPMENT NOT INCLUDED IN THIS WORK, AND TO PERFORM ALL REQUIRED SERVICING AND REPAIRS TO SAME, AT ALL TIMES.
6. IT IS REQUIRED THAT THE WORK INDICATED AND/OR SPECIFIED SHALL BE CARRIED OUT WITH A MINIMUM OF INTERFERENCE TO THE ESTABLISHED OPERATIONS OF THE BUILDING.
7. IT IS THE INTENTION OF THESE SPECIFICATIONS TO PROVIDE FOR THE CONTINUANCE OF ALL IT SERVICES PRESENTLY INSTALLED IN THE UNALTERED AREAS. PROVIDE ALL CONDUIT, WIRING, AND DEVICES NECESSARY TO MAINTAIN SERVICES TO THESE AREAS.
8. COMPARE THE PLANS WITH THE EXISTING CONDITIONS TO DETERMINE THE AMOUNT OF WORK AFFECTED. REMOVE ALL ABANDONED CABLES AND OUTLETS NOT REQUIRED BY THE ALTERATIONS.
9. ALL MATERIALS REQUIRED TO BE REMOVED AND NOT REINSTALLED UNDER THIS DIVISION OF THE WORK, UNLESS OTHERWISE INDICATED, SHALL BECOME THE PROPERTY OF THIS CONTRACTOR, AND SHALL BE REMOVED FROM THE SITE. EXCEPTION SHALL BE MADE FOR EXISTING WIRELESS ACCESS POINTS WHICH SHOULD BE REMOVED AND RETURNED TO THE OWNER.
10. WHERE OUTLETS OR DEVICES AND EQUIPMENT ARE INDICATED TO BE REMOVED, CONDUCTORS AND CABLES SHALL BE COMPLETELY REMOVED BACK TO THEIR SOURCE. EXPOSED OR ACCESSIBLE CONDUITS SHALL BE REMOVED COMPLETELY; CONDUITS EMBEDDED IN CONCRETE OR MASONRY SHALL BE CUT OFF FLUSH AND THE SURFACE PATCHED SMOOTH AND LEVEL.
11. REMOVED MATERIALS SHALL BE DISPOSED OF USING A LICENSED CARTING SERVICE.
12. CONDUIT AND CABLE IN EXISTING OR NEW CEILINGS THAT IS NOT INTENDED FOR REUSE SHALL BE REMOVED BACK TO THE PANEL/IDF FROM WHICH IT ORIGINATES.
13. THIS CONTRACTOR TO MAINTAIN CONTINUITY AND ACCESSIBILITY OF ALL EXISTING SYSTEMS AND SYSTEM EQUIPMENT WHICH MAY BE DISRUPTED FOR WORK OF ANY TRADE.
14. THIS CONTRACTOR TO MAINTAIN CONTINUITY AND ACCESSIBILITY OF ALL EXISTING IT SYSTEMS, ON FLOORS OR AREAS THAT ARE NOT AFFECTED BY DEMOLITION OR NEW CONSTRUCTION - REFER TO CONSTRUCTION SCHEDULE FOR ADDITIONAL INFORMATION.
15. ANY EXISTING IT WORK WHICH IS PULLED OUT OR CUT AWAY SHALL BE REMOVED FROM THE SITE.
16. EXISTING IT CABLE WHICH IS NOT TO BE REUSED SHALL BE REMOVED FROM DRYWALL PARTITIONS. ANY OPENING IN EXISTING PARTITIONS LEFT BY REMOVAL OF EXISTING CABLE OR EQUIPMENT SHALL BE PATCHED BY THIS CONTRACTOR WITH MATERIALS TO MATCH EXISTING.
17. FOR PURPOSES OF THE CONTRACT, WHAT IS NOTED OR SHOWN ON DRAWINGS INDICATES THE SCOPE OF WORK REQUIRED AND QUALITY OF MATERIALS REQUIRED.
18. THIS CONTRACTOR TO EXAMINE ALL CONTRACT DOCUMENTS AND PERFORM ALL DEMOLITION BOTH FOR AREAS BEING RENOVATED AND FOR AREAS WHICH MUST BE REWORKED TO PERMIT THE INSTALLATION OF WORK BY THE VARIOUS TRADES.
19. THIS CONTRACTOR SHALL VISIT THE SITE AND VERIFY THE EXTENT OF DEMOLITION AND REMOVALS PRIOR TO THE SUBMISSION OF BIDS. NO CONSIDERATION SHALL BE GIVEN FOR FAILURE TO VISIT THE SITE.

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

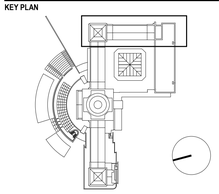
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

COVER SHEET - IT

SCALE	NONE
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TN001.00

10/17/2025 11:16:47 AM

IT LEGEND

SYMBOLS & ABBREVIATIONS	DESCRIPTION	CABLE	ELECTRICAL INFRASTRUCTURE	REMARKS
(X)	FLOOR MOUNTED OUTLET	(X) CAT 6A UTP TO DESIGNATED TR; (X) DENOTES QUANTITY OF CABLES	(1) 1" C. TO MULTI-SERVICE FLOOR BOX	-
(X)	CEILING MOUNTED OUTLET	(X) CAT 6A UTP TO DESIGNATED TR; (X) DENOTES QUANTITY OF CABLES	(1) 1" C. TO MULTI-SERVICE CEILING BOX	-
(X)	WALL MOUNTED OUTLET	(X) CAT 6A UTP TO DESIGNATED TR; (X) DENOTES QUANTITY OF CABLES	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	INSTALL IN MULTI-SERVICE WALL BOX IN GALLERY SPACES.
A	ANALOG/POTS LINE OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
AVI	AV INTERFACE FLOOR MOUNTED OUTLET	(3) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. TO MULTI-SERVICE FLOOR BOX	-
AVI	AV INTERFACE CEILING MOUNTED OUTLET	(3) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. TO MULTI-SERVICE CEILING BOX	-
AVC	AV CONTROL PANEL OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO CUSTOM BACKBOX	-
AVD	AV DISPLAY OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO CUSTOM BACKBOX	-
AVI	AV INTERFACE OUTLET	(3) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. TO MULTI-SERVICE WALL BOX	-
AVR	AV EQUIPMENT RACK OUTLET	(6) CAT 6A UTP AND (1) RG6 COAXIAL TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
BMS	BUILDING MANAGEMENT SYSTEM OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
BR	BROADCAST VIDEO OUTLET	(1) RG11 COAX. AND 6-STRAND SMF. TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	
CAM	IP VIDEO SURVEILLANCE CAMERA OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
CAM	IP VIDEO SURVEILLANCE CAMERA OUTLET - CEILING MOUNTED	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
CL	IP CLOCK OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
CR	CARD READER OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
DCP	DOOR CONTROLLER PANEL OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
DAS	DAS OUTLET - CEILING MOUNTED	(2) CAT 6A UTP TO DESIGNATED TR	ERICO BACKBOX PART NO. 512HD	-
DL	DOOR LOCK OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
DS	DIGITAL SIGNAGE DISPLAY OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
F	FURNITURE SYSTEM MOUNTED OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	N/A	-
FA	FIRE ALARM PANEL OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
FO	FIBER OPTIC CEILING MOUNTED OUTLET	(1) 2-STRAND OS2 TO DESIGNATED TR	(1) 1" C. TO MULTI-SERVICE CEILING BOX	-
FO	FIBER OPTIC OUTLET	(1) 2-STRAND OS2 TO DESIGNATED TR	(1) 1" C. TO MULTI-SERVICE WALL BOX	-
IC	INTERCOM DOOR STATION OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	CUSTOM BACKBOX FROM MANUFACTURER	-
IDS	INTRUSION DETECTION SYSTEM OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
IWB	INTERACTIVE WHITE BOARD OUTLET	(2) CAT 6A UTP TO DESIGNATED TR.	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
KP	ALARM SYSTEM KEYPAD OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
LCP	LIGHTING CONTROL PANEL OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
MS	INTERCOM MASTER STATION OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
P	PROJECTOR OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
P	PROJECTOR OUTLET - CEILING MOUNTED	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
PC	PEOPLE COUNTER OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
POS	POINT-OF-SALE OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
PR	PRINTER OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
R	RACEWAY MOUNTED OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 2" C. STUB-UP ELECTRIFIED RACEWAY (DUAL CHANNEL)	-
RFID	RADIO FREQUENCY IDENTIFICATION SYSTEM OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
SB	SMARTBOARD OUTLET	-	-	-
TC	TIME CLOCK OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
TCP	TEMPERATURE CONTROL PANEL OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
TS	TEACHER STATION OUTLET	(2) CAT 6A UTP TO DESIGNATED TR.	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
TV	TELEVISION CATV CONVERTER BOX OUTLET	(2) CAT 6A UTP AND (1) RG6 COAX TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
VC	VIDEOCONFERENCE WEBCAM OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
W	WALL-MOUNTED TELEPHONE OUTLET	(1) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
WAP	WIRELESS ACCESS POINT OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
WAP	WIRELESS ACCESS POINT OUTLET-CEILING MOUNTED	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
WP	WEATHER PROOF OUTLET	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	-
AV	COMBINATION OUTLET (FLOOR MOUNTED)	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO MULTI-SERVICE FLOOR BOX	-
AV	COMBINATION OUTLET (WALL MOUNTED)	(2) CAT 6A UTP TO DESIGNATED TR	(1) 1-1/4" C. STUB-UP TO MULTI-SERVICE WALL BOX	-
J	FURNITURE SYSTEM INFEED - CEILING MOUNTED	PROVIDE SPLIT-LOOM FOR CABLE BUNDLE	(1) 2" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH GROMMETED OPENING	-
J	FURNITURE SYSTEM INFEED - FLOOR MOUNTED	PROVIDE SPLIT-LOOM FOR CABLE BUNDLE	(1) 2" C. STUB-UP TO FLOOR BOX WITH GROMMETED OPENING	-
J	FURNITURE SYSTEM INFEED - WALL MOUNTED	PROVIDE SPLIT-LOOM FOR CABLE BUNDLE	(1) 2" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH GROMMETED OPENING	-
SP#	LOUDSPEAKER - WALL MOUNTED	-	-	-
SP#	LOUDSPEAKER - CEILING MOUNTED	-	-	-
AMP	IN-WALL AMPLIFIER	-	(2) 1-1/4"C TO 3-GANG WALL BOX	-
CS	CALL STATION	-	(1) 1"C TO DBL-GANGBOX - SINGLE-GANG TRIM RING	-
	CONDUIT/SLEEVE DOWN THROUGH SLAB	SIZE AS INDICATED	-	-
	CONDUIT/SLEEVE UP THROUGH SLAB	SIZE AS INDICATED	-	-
	CONDUIT STUB WITH BUSHING	SIZE AS INDICATED	-	-
	CONDUIT TURNING DOWN THROUGH SLAB	SIZE AS INDICATED	-	-
	CONDUIT TURNING UP THROUGH SLAB	SIZE AS INDICATED	-	-
	CONDUIT SLEEVE	SIZE AS INDICATED	-	-
	NEW CONDUIT	SIZE AS INDICATED	-	-
C C C	CABLE PATHWAY IN CEILING	-	-	SUPPORTED BY J-HOOKS AND/OR CABLE STRAPS
	CABLE TRAY	SIZE AS INDICATED	-	-
	LADDER RACK	SIZE AS INDICATED	-	-
	RACK/CABINET MOUNTED POWER STRIP	-	-	-
PBB	PRIMARY BONDING BUSBAR	-	-	-
SBB	SECONDARY BONDING BUSBAR	-	-	-
VIEW # SHEET #	DETAIL CALLOUT	N/A	N/A	N/A
VIEW # SHEET #	ELEVATION CALLOUT	N/A	N/A	N/A

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

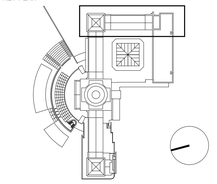
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

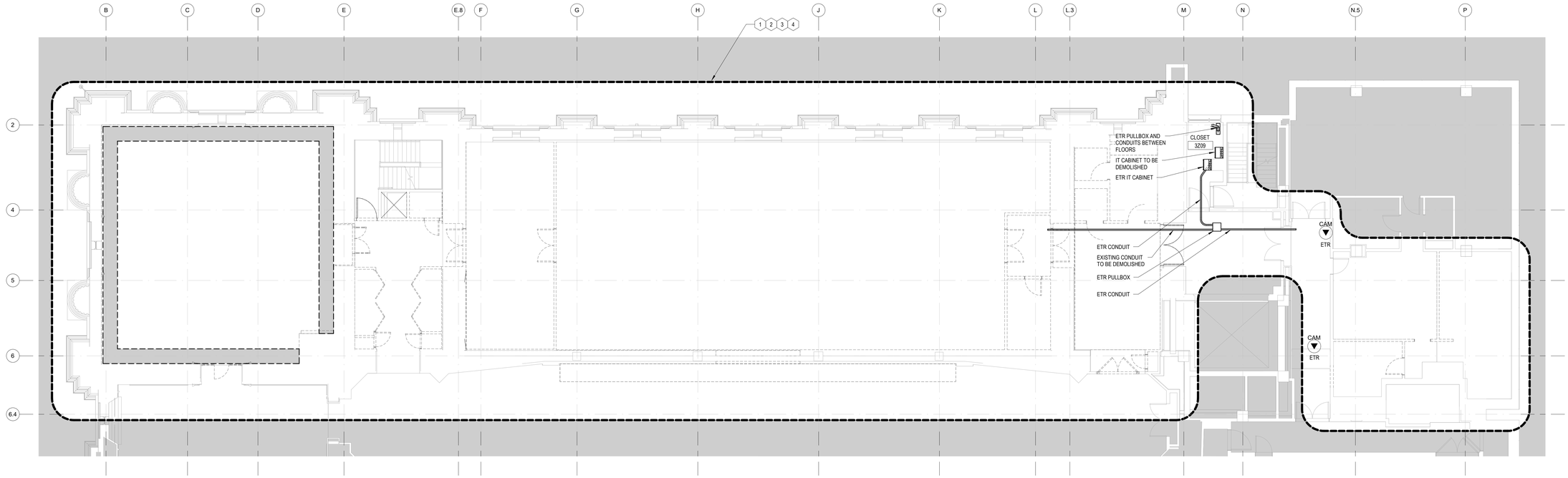
SYMBOL LIST - IT

SCALE	NONE
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TN002.00

10/17/2025 11:16:48 AM



1 THIRD FLOOR DEMO PLAN
TND103.00 SCALE: 1/8" = 1'-0"

DEMOLITION AND REMOVALS

1. REFER TO THE ARCHITECTURAL SET FOR EXACT EXTENT OF DEMOLITION SCOPE.
2. ALL IT OUTLETS AND EQUIPMENT SHALL BE DEMOLISHED EXCEPT THOSE LABELED "ETR" AND "ETBR".
3. REMOVE ALL DEMOLISHED IT OUTLETS AND CABLES BACK TO SERVING TELECOM ROOM INCLUDING COPPER PATCH CORDS, ALL VOICE CABLES, COPPER BACKBONE CABLES AND ALL TERMINATION HARDWARE INCLUDING JACKS, FACEPLATES AND BACKBOXES.
4. REMOVE ALL DEMOLISHED ACTIVE IT EQUIPMENT AND RETURN TO OWNER.

LEGEND

SCOPE OF WORK

10/17/2025 11:16:49 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

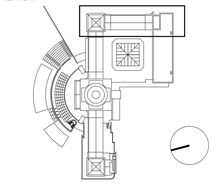
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

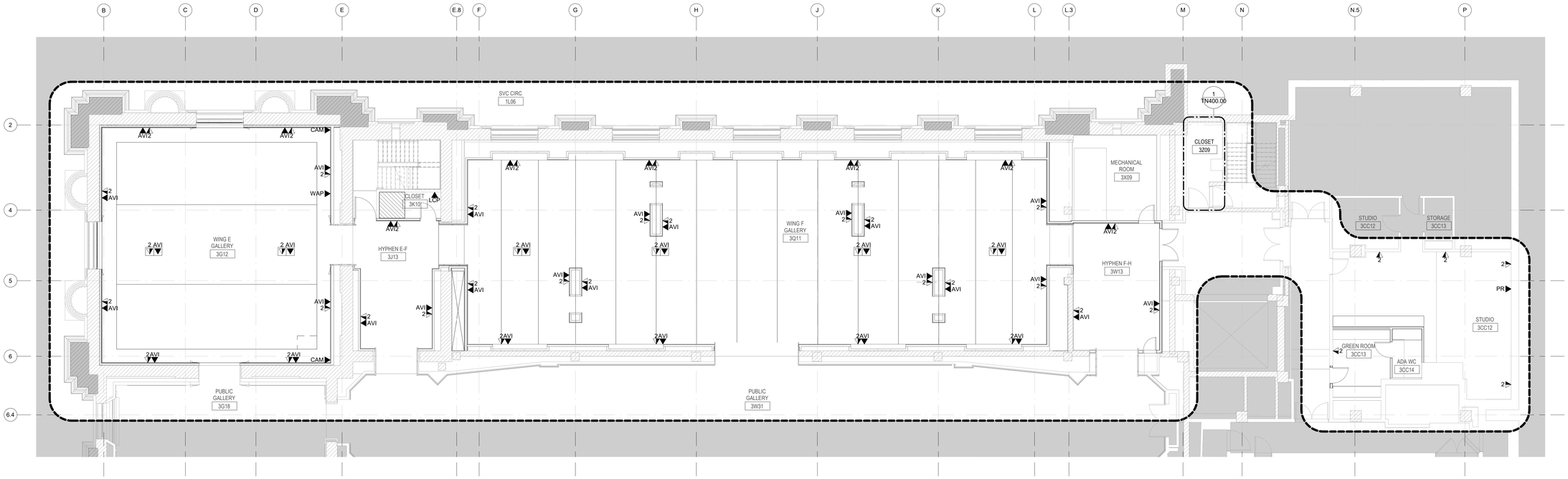
DRAWING TITLE

THIRD FLOOR DEMO PLAN - IT

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TND103.00



1 THIRD FLOOR PLAN
TN202.00 SCALE: 1/8" = 1'-0"

IT NOTES

1. HOME RUN ALL NEW IT DISTRIBUTION CABLES ON THIRD FLOOR TO WALL MOUNTED IT CABINET ON THIRD FLOOR IN CLOSET 3209 BY STAIR F.
2. ALL CABLES SHALL BE INSTALLED IN CONDUIT.
3. ROUTE CABLES THROUGH NEAREST PULLBOX IN GALLERY SPACES.

10/17/2025 11:16:50 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

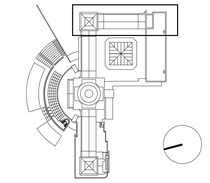
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

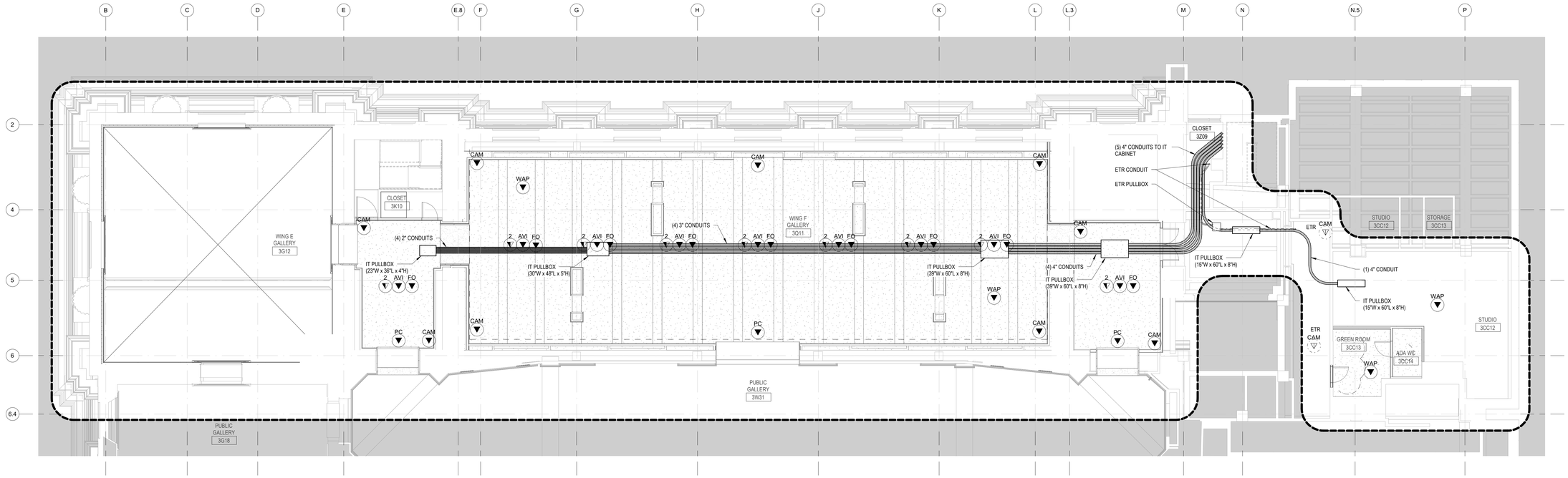
DRAWING TITLE

THIRD FLOOR PLAN - IT

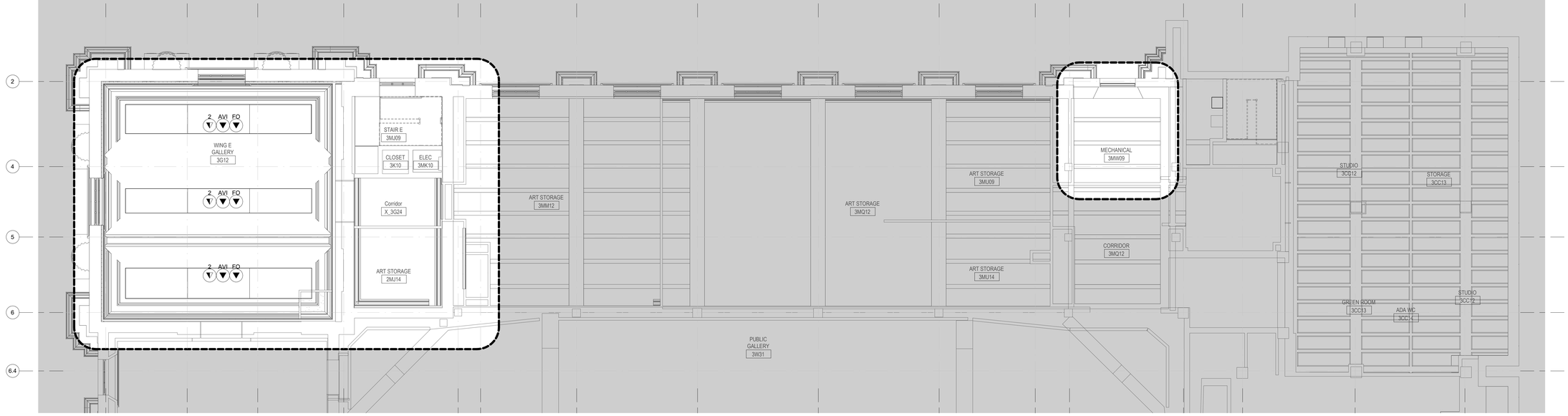
SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TN202.00



1 THIRD FLOOR CEILING PLAN
TN302.00 SCALE: 1/8" = 1'-0"



2 THIRD FLOOR MEZZ CEILING PLAN
TN302.00 SCALE: 1/8" = 1'-0"

IT NOTES

1. HOME RUN ALL NEW IT DISTRIBUTION CABLES ON THIRD FLOOR TO WALL MOUNTED IT CABINET ON THIRD FLOOR IN CLOSET 3209 BY STAIR F.
2. ALL CABLES SHALL BE INSTALLED IN CONDUIT.
3. ROUTE CABLES THROUGH NEAREST PULLBOX IN GALLERY SPACES.

10/17/2025 11:16:53 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

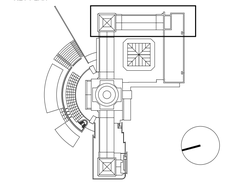
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

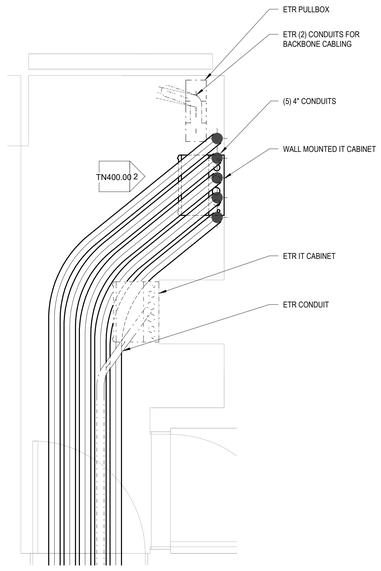
DRAWING TITLE

THIRD FLOOR & THIRD FLOOR MEZZ CEILING PLANS - IT

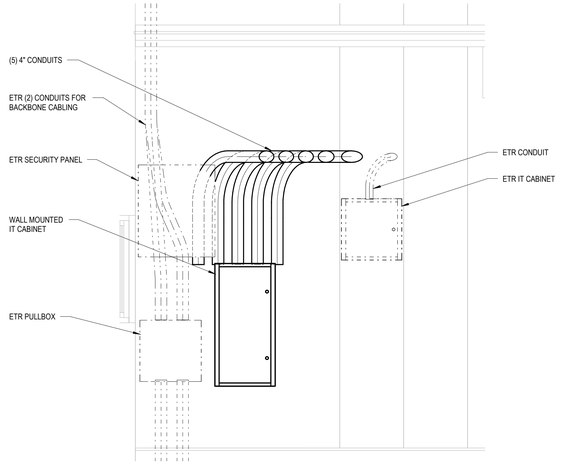
SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TN302.00



1 CLOSET 3Z09 PARTIAL PLAN
TN400.00 SCALE: 1/2" = 1'-0"



2 CLOSET 3Z09 ELEVATION
TN400.00 SCALE: 1/2" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

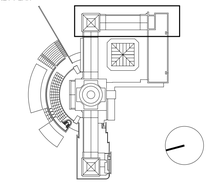
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

PARTIAL PLANS - IT

SCALE	1/2" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TN400.00

10/17/2025 11:16:54 AM

INTRUSION ALARM SYSTEM DEVICE LEGEND

SYMBOLS & ABBREVIATIONS	DESCRIPTION	TYPICAL CABLE REQUIRED (COORDINATE WITH SPECIFIC DEVICE MANUFACTURER'S REQUIREMENTS)	ELECTRICAL INFRASTRUCTURE	REMARKS
	AUDIO SENSOR	16 AWG / 2 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
AS	AUDIBLE SIREN	16 AWG / 2 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
C	DOOR CONTACT	22 AWG / 2 CONDUCTOR	3/4" CONDUIT TO DOOR FRAME. (COORDINATE WITH DOOR HARDWARE VENDOR)	CONTACT IS RECESSED. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
C OH	DOOR CONTACT - OVERHEAD DOOR	22 AWG / 2 CONDUCTOR	3/4" CONDUIT TO CONTACT LOCATION	CONTACT IS SURFACE-MOUNTED. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
GB	GLASS BREAK DETECTOR	22 AWG / 4 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
IDS	INTRUSION DETECTION SYSTEM PANEL	N/A	N/A	MOUNT TO PLYWOOD BACKBOARD. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
KP	ALARM SYSTEM KEYPAD	22 AWG / 6 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
M	MOTION SENSOR	22 AWG / 4 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
M	MOTION SENSOR - 360°	22 AWG / 4 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
P	PANIC BUTTON	22 AWG / 4 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
RFID	RADIO FREQUENCY IDENTIFICATION SYSTEM ANTENNA	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
SS	SIREN/STROBE	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
WC	WINDOW CONTACT	22 AWG / 2 CONDUCTOR	N/A	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.

ACCESS CONTROL SYSTEM DEVICE LEGEND

SYMBOLS & ABBREVIATIONS	DESCRIPTION	TYPICAL CABLE REQUIRED (COORDINATE WITH SPECIFIC DEVICE MANUFACTURER'S REQUIREMENTS)	ELECTRICAL INFRASTRUCTURE	REMARKS
C	DOOR CONTACT	22 AWG / 2 CONDUCTOR	3/4" CONDUIT TO DOOR FRAME. (COORDINATE WITH DOOR HARDWARE VENDOR)	CONTACT IS RECESSED. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
C OH	DOOR CONTACT - OVERHEAD DOOR	22 AWG / 2 CONDUCTOR	3/4" CONDUIT TO CONTACT LOCATION	CONTACT IS SURFACE-MOUNTED. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
CR	PROXIMITY CARD READER	18 AWG / 6 CONDUCTOR OVERALL SHIELDED	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
CR GT	PROXIMITY CARD READER - GUARD TOUR SYSTEM	18 AWG / 6 CONDUCTOR OVERALL SHIELDED	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
CR K	PROXIMITY CARD READER/ PIN KEYPAD COMBINATION	18 AWG / 8 CONDUCTOR OVERALL SHIELDED	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
DCP	DOOR CONTROLLER PANEL	CATEGORY 6 CABLE BY IT CONTRACTOR. RS-485 BETWEEN PANELS.	N/A	MOUNT TO PLYWOOD BACKBOARD. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
DR	DOOR RELEASE BUTTON	18 AWG / 2 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
EL	ELECTRIFIED LOCK	18 AWG / 2 CONDUCTOR	3/4" CONDUIT TO DOOR FRAME. (COORDINATE WITH DOOR HARDWARE VENDOR)	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
ES	ELECTRIC STRIKE	18 AWG / 2 CONDUCTOR	3/4" CONDUIT TO DOOR FRAME. (COORDINATE WITH DOOR HARDWARE VENDOR)	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
GC	GATE CONTROLLER	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
IC	INTERCOM DOOR STATION	CATEGORY 6 CABLE BY IT CONTRACTOR. SEE IT DRAWINGS	(1) 1" C. STUB-UP TO MANUFACTURER'S CUSTOM BACKBOX.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
KS	KEY SWITCH	18 AWG / 2 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
KX	KNOX BOX	18 AWG / 2 CONDUCTOR FROM TAMPER SWITCHES TO IDS	N/A	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
ML	MAGNETIC LOCK	18 AWG / 2 CONDUCTOR	3/4" CONDUIT TO DOOR FRAME. (COORDINATE WITH DOOR HARDWARE VENDOR)	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
MS	INTERCOM MASTER STATION	CATEGORY 6 CABLE BY IT CONTRACTOR. SEE IT DRAWINGS	(1) 1" C. STUB-UP TO MANUFACTURER'S CUSTOM BACKBOX.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
NK	NUMERIC KEYPAD	COORDINATE WITH MANUFACTURER'S REQUIREMENTS	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
REX	REQUEST TO EXIT MOTION SENSOR	22 AWG / 4 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
RTE	REQUEST TO EXIT BUTTON	22 AWG / 4 CONDUCTOR	(1) 3/4" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.

VIDEO SURVEILLANCE SYSTEM DEVICE LEGEND

SYMBOLS & ABBREVIATIONS	DESCRIPTION	TYPICAL CABLE REQUIRED (COORDINATE WITH SPECIFIC DEVICE MANUFACTURER'S REQUIREMENTS)	ELECTRICAL INFRASTRUCTURE	REMARKS
MON	VSS MONITOR/MONITORING STATION	SEE IT DRAWINGS	SEE IT DRAWINGS	SEE IT DRAWINGS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
	WALL MOUNTED CAMERA	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
WP	WALL MOUNTED CAMERA - WEATHER PROOF	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
180°	WALL MOUNTED CAMERA - 180°	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
PTZ	WALL MOUNTED CAMERA - PAN, TILT, ZOOM	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
WP LP	WEATHER PROOF LIGHT POLE MOUNTED CAMERA	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE POE EXTENDER SYSTEM AS REQUIRED. IF DISTANCE BETWEEN LIGHT POLE AND SERVING TELECOM ROOM IS GREATER THAN 295-FEET. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
ELEV	ELEVATOR CAMERA - CORNER MOUNT	(1) CAT.6 UTP TO ELEVATOR MACHINE ROOM WITH IP/ANALOG CONVERTER TO (1) RG6 COAXIAL AND (1) 16 AWG / 2 CONDUCTOR POWER CABLES IN ELEVATOR TRAVELING CABLE.	N/A	COORDINATE INSTALLATION WITH ELEVATOR CONTRACTOR. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
IR	WALL MOUNTED CAMERA - INFRARED	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
	CEILING MOUNTED CAMERA	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
180°	CEILING MOUNTED CAMERA - 180°	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
360°	CEILING MOUNTED CAMERA - 360°	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
PTZ	CEILING MOUNTED CAMERA - PAN, TILT, ZOOM	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
IR	CEILING MOUNTED CAMERA - INFRARED	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
CM	WALL MOUNTED CAMERA - CORNER MOUNT (HOLDING CELLS)	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
	CEILING MOUNTED CAMERA - DUAL LENS (SYMBOL'S TRIANGLE LOCATION DESIGNATES LENS' FIELD-OF-VIEW)	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
WP	CEILING MOUNTED CAMERA - DUAL LENS - WEATHER PROOF. (SYMBOL'S TRIANGLE LOCATION DESIGNATES LENS' FIELD-OF-VIEW)	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
WP	WALL MOUNTED CAMERA - QUAD LENS - WEATHER PROOF. (SYMBOL'S TRIANGLE LOCATION DESIGNATES LENS' FIELD-OF-VIEW)	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.
360°	CEILING MOUNTED CAMERA - QUAD LENS (SYMBOL'S TRIANGLE LOCATION DESIGNATES LENS' FIELD-OF-VIEW)	(1) CATEGORY 6 UTP - SEE IT DRAWINGS	(1) 1" C. STUB-UP TO DOUBLE-GANG ELEC. BACKBOX WITH SINGLE-GANG TRIM RING. COORDINATE WITH MANUFACTURER'S MOUNTING REQUIREMENTS.	PROVIDE HOMERUN CONDUIT TO TELECOM ROOM IF CABLE PATH IS ABOVE HARD AND EXPOSED CEILING AREAS. SECURITY DEVICES F&I BY OWNER'S SECURITY VENDOR.

SECURITY GENERAL NOTES

GENERAL

1. REFER TO CSI SPECIFICATIONS DIVISION 26 - ELECTRICAL FOR SPECIFICATIONS AND INSTALLATION INSTRUCTIONS FOR CONDUITS, FLOORBOXES, JUNCTION BOXES, METAL ENCLOSURES, ELECTRICAL PANELBOARDS AND CIRCUITING.
2. INSTALL FIRESTOP WITHIN ALL SLAB AND WALL PENETRATIONS PROVIDED FOR THE INSTALLATION OF TELECOMMUNICATIONS CABLE AS REQUIRED TO MAINTAIN FIRE RATING OR SLAB OR WALL. REVIEW ARCHITECT'S PLANS FOR PARTITION TYPES AND RATINGS.
3. PROVIDE, INSTALL, LABEL, PROGRAM, AND TEST A COMPLETE AND OPERATING SECURITY SYSTEM, INCLUDING SOFTWARE, HARDWARE, CABLES AND CONNECTORS, MOUNTING DEVICES, POWER SUPPLIES, AND ACCESSORIES.
4. WORK SHALL COMPLY WITH THE MOST RECENT REVISION OF THE NATIONAL ELECTRIC CODE, OSHA, MANUFACTURER'S INSTALLATION INSTRUCTIONS, CONSTRUCTION STANDARDS, ALL APPLICABLE LOCAL CODES, INDUSTRY STANDARDS AND BEST PRACTICES. IN THE EVENT OF CONFLICT BETWEEN OR AMONG SUCH CODE/REQUIREMENTS, THE MORE STRINGENT SHALL APPLY.
5. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE. VERIFY FIELD CONDITIONS BEFORE STARTING THE INSTALLATION. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONSTRUCTION MANAGER.
6. ANY DEPARTURE FROM CONCEPT SHOWN ON THE CONTRACT DRAWINGS SHALL BE SUBMITTED FOR APPROVAL.
7. THE DRAWINGS AND SPECIFICATIONS ARE DIVIDED INTO SECTIONS TO MEET NEEDS OF THE ARCHITECT, THE ENGINEERS, AND THE DESIGN CONSULTANTS. THEY ARE NOT PREPARED AS INSTRUCTIONS TO THE CONTRACTOR FOR HOW TO BUY OUT OR SUBCONTRACT THE WORK. THE CONTRACTOR IS RESPONSIBLE FOR ALL THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS, REGARDLESS OF WHERE IT IS SHOWN. FOR EXAMPLE, ELECTRICAL WORK IS SHOWN ON FP-SERIES DRAWINGS AS WELL AS ON M-SERIES DRAWINGS AND E-SERIES DRAWINGS. MISCELLANEOUS METALS AND STRUCTURAL ELEMENTS ARE SHOWN ON A-SERIES DRAWINGS AS WELL AS ON S-SERIES DRAWINGS. STRUCTURAL SUPPORTS ARE REQUIRED BY THE FP DRAWINGS. TO AVOID OMITTING ANY COMPONENT OF THE PROJECT, REFER TO ALL THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.

PATHWAY AND WIRING NOTES

1. CONDUITS, SLEEVES, BACKBOXES AND PULL BOXES THROUGHOUT THE FACILITY WILL BE PROVIDED AS PART OF THE ELECTRICAL SCOPE. THEY ARE SHOWN ON THE SECURITY DRAWINGS FOR REFERENCE ONLY.
2. FLEXIBLE CONDUIT SHALL NOT BE USED, UNLESS SPECIFICALLY NOTED.
3. CONDUIT STUB-UPS SHALL BE EXTENDED TO THE NEAREST ACCESSIBLE CEILING, JUNCTION BOX OR TELECOMMUNICATIONS ROOM.
4. COORDINATE WITH OTHER TRADE DRAWINGS, FURTHERMORE, SURVEY THE FACILITY TO LOCATE ALL BACKBOXES, CONDUITS, STUB-UPS, AND OTHER WIREWAYS PROVIDED BY OTHERS OR EXISTING AND DESIGNATED FOR SECURITY CABLES AS SHOWN ON THE SECURITY DRAWINGS.
5. ALL CONDUITS, SLEEVES AND OTHER OPENINGS DESIGNATED FOR SECURITY USE, WHETHER THEY ARE UTILIZED OR NOT, SHALL BE FIRESTOPPED PER CODE REQUIREMENTS. RE-ESTABLISH THE FIRE RATING OF ALL PENETRATIONS MADE BY THE CONTRACTOR THROUGH FIRE RATED FLOORS OR WALLS.
6. PROVIDE CONDUITS IN ALL EXPOSED AND INACCESSIBLE WALLS AND CEILINGS FOR THE PURPOSES OF INSTALLING SECURITY CABLES.
7. ALL METALLIC CONDUITS, AND EQUIPMENT SHALL BE PROPERLY GROUNDED.
8. ALL CABLE PATHWAYS SHALL BE CONCEALED IN FLOOR, WALL AND CEILING SPACES WHERE POSSIBLE UNLESS OTHERWISE NOTED.
9. ALL CABLE PATHWAYS SHALL BE RUN PARALLEL OR ORTHOGONAL TO WALLS, FLOORS AND CEILINGS.
10. ALL CONDUITS SHALL BE DEBURRED, CLEANED, CAPPED, TAGGED AND FURNISHED WITH PULL WIRES.
11. PROVIDE PLASTIC BUSHINGS AT ALL SLEEVE AND OPEN CONDUIT ENDS.
12. THE MINIMUM BEND RADIUS FOR A CONDUIT THAT IS 2" OR LESS IN DIAMETER SHALL BE 6 TIMES THE INTERNAL CONDUIT DIAMETER. IF THE CONDUIT IS LARGER THAN 2" THE BEND RADIUS SHOULD BE 10 TIMES THE INTERNAL CONDUIT DIAMETER
13. PROVIDE A PULLBOX IN CONDUIT RUNS SUCH THAT:
    A. MAXIMUM CONTINUOUS CONDUIT RUN SHALL NOT EXCEED 100FT.
    B. NO MORE THAN TWO 90 DEGREE BENDS EXIST IN A CONTINUOUS CONDUIT RUN.
    C. ALL PULLBOXES ARE ACCESSIBLE AND HAVE REMOVABLE COVERS.
14. ALL CABLES RUN IN CEILINGS IN AREAS WHERE CABLE TRAYS OR OTHER SIMILAR SUPPORT IS NOT SPECIFIED SHALL BE PROPERLY SUPPORTED AT MINIMUM OF 5' INTERVALS ABOVE CEILING TILES. NO CABLES SHALL REST ON OR TOUCH CEILING TILES, DUCTWORK, CONDUIT OR PLUMBING.
15. INSTALL SECURITY CABLES UTILIZING THE ASSIGNED PATHWAYS. WHEN USING SHARED PATHWAYS, THE SECURITY CABLES SHALL BE INSTALLED USING J-HOOKS OR SIMILAR SUPPORT AND SHALL BE SUPPORTED AT INTERVALS AT MAXIMUM 5'. WITHIN ACCESSIBLE FLOORS, CABLES SHALL BE GROUPED AND TIED TOGETHER.
16. LABEL ALL SECURITY CABLES AT BOTH ENDS, PULLING POINTS AND EVERY 50'.

LABELING NOTES

1. CABLE ADMINISTRATION
    A. PROPERLY LABEL ALL CABLES, RECEPTACLES, CONNECTION BLOCKS AND PATCH PANELS IN ACCORDANCE WITH TIA-606-B UON BY CLIENT'S PREFERRED LABELING STANDARD.
    B. REPORT ANY CABLE THAT EXCEEDS 250' TO THE DESIGN TEAM. THE CABLE SHALL BE CLEARLY MARKED WITH RED TAPE AT BOTH ENDS OF EACH CABLE INDICATING THE EXACT CABLE LENGTH AND NOTED IN THE REQUIRED AS-BUILT LABEL REPORT.
    C. PRIOR TO SYSTEM ACCEPTANCE, THE CONTRACTOR SHALL SUBMIT AN AS-BUILT LABEL REPORT PROVIDING THE ROOM NUMBERS AND CABLE LENGTHS FOR EACH OF THE INSTALLED CABLES.
2. LABEL REQUIREMENTS
    A. PROVIDE WHITE LABEL WITH TYPE WRITTEN LEGIBLE CHARACTERS, PRINTED WITH NON-SMEAR INK. HANDWRITTEN LABELS ARE NOT PERMITTED.
    B. PROVIDE LABELS WITH INDUSTRIAL GRADE SELF-ADHESIVE BACKING.
    C. PROVIDE LABELS FOR CABLES WITH PROTECTIVE WRAP-AROUND PLASTIC TRANSPARENT COVER WHICH WILL SERVE TO PROTECT THE INK FROM SMEARING AND SECURE THE LABEL TO THE CABLE.
    D. PROVIDE LABELS FOR CABLES WIDE ENOUGH FOR 23 CHARACTERS IN A SINGLE ROW.
    E. BACKBONE/RISER AND TIE CABLE JACKETS SHALL BE CLEARLY LABELED WITHIN EACH TELECOM ROOM, AND AT 50' INTERVALS OUTSIDE TELECOM ROOMS ABOVE CEILINGS.

EQUIPMENT INSTALLATION NOTES

1. FINISHES AND MOUNTING DETAILS OF EXPOSED EQUIPMENT SHALL MATCH THE FINISHES OF THE ROOM THEY ARE INSTALLED AND SHALL BE APPROVED BY ARCHITECT VIA SUBMITTALS.
2. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT DIMENSIONAL LOCATIONS AND MOUNTING HEIGHTS OF DEVICES.
3. DOOR HARDWARE FOR NEW DOORS ARE PROVIDED AS PART OF THE DOOR HARDWARE EQUIPMENT PACKAGE. PROVIDE AND INSTALL ALL REQUIRED WIRING, INPUT/OUTPUT BOARDS AND OTHER REQUIRED EQUIPMENT AND ACCESSORIES FOR MONITORING AND CONTROLLING THE DOOR DEVICES. REFER TO DOOR SCHEDULE AND DOOR HARDWARE SCHEDULE FOR DETAIL OF DOOR TYPES AND HARDWARE INCLUDED FOR EACH DOOR. COORDINATE WITH FINISH HARDWARE PROVIDER
4. INSTALLATION AND TESTING PROCEDURES FOR ALL SECURITY EQUIPMENT AND DEVICES SHALL BE IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.
5. SUPPLY, INSTALL, TERMINATE, CONNECT, ADJUST AND TEST ALL EQUIPMENT AND REQUIREMENTS EXPRESSED IN THESE DRAWINGS AND ACCOMPANYING SPECIFICATIONS DOCUMENTS.
6. ELECTROMAGNETIC LOCKS SHALL BE TIED INTO THE BUILDING FIRE ALARM SYSTEM.

SECURITY DRAWING LIST

DRAWING NUMBER	DRAWING DESCRIPTION
TY001.00	COVER SHEET - SECURITY
TYD103.00	THIRD FLOOR DEMO PLAN - SECURITY
TY202.00	THIRD FLOOR PLAN - SECURITY

SECURITY ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ACAMS	ACESS CONTROL AND ALARM MONITORING SYSTEM
ADA	AMERICANS WITH DISABILITIES
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
APPROX	APPROXIMATE
AWG	AMERICAN WIRE GAUGE
C	CONDUIT(S)
CCTV	CLOSED CIRCUIT TELEVISION
CLG	CEILING
D	DEEP
DPDT	DOUBLE-POLE, DOUBLE THROW
EAC	ELECTRONIC ACCESS CONTROL
EC	ELECTRICAL CONTRACTOR
ELEC.	ELECTRIC/ELECTRICAL
EQ	EQUAL
EQPT	EQUIPMENT
ERO	EXISTING - RELOCATED
ETBR	EXISTING - TO BE RELOCATED
ETR	EXISTING - TO REMAIN
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FT	FOOT/FEET
F&I	FURNISH & INSTALL / FURNISHED & INSTALLED
GND	GROUND
H	HIGH
I.D.	INSIDE DIAMETER
ISMS	INTEGRATED SECURITY MANAGEMENT SYSTEM
JB	JUNCTION BOX
LAN	LOCAL AREA NETWORK
MECH	MECHANICAL
MTD	MOUNTED
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OFE	OWNER FURNISHED EQUIPMENT
PB	PULLBOX
PoE	POWER OVER ETHERNET
PR	PAIR
STP	SHIELDED TWISTED PAIR
TEMP	TEMPORARY
TR	TELECOMMUNICATIONS ROOM
TYP	TYPICAL
U	RACK UNIT
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
VOIP	VOICE OVER INTERNET PROTOCOL
VSS	VIDEO SURVEILLANCE SYSTEM
W	WIDE
W/	WITH
W/O	WITHOUT
WAN	WIDE AREA NETWORK
WAP	WIRELESS ACCESS POINT
WP	WATERPROOF
WS	WORKSTATION
WW	WIREWAY

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

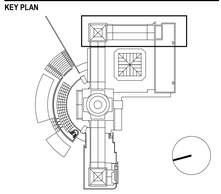
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

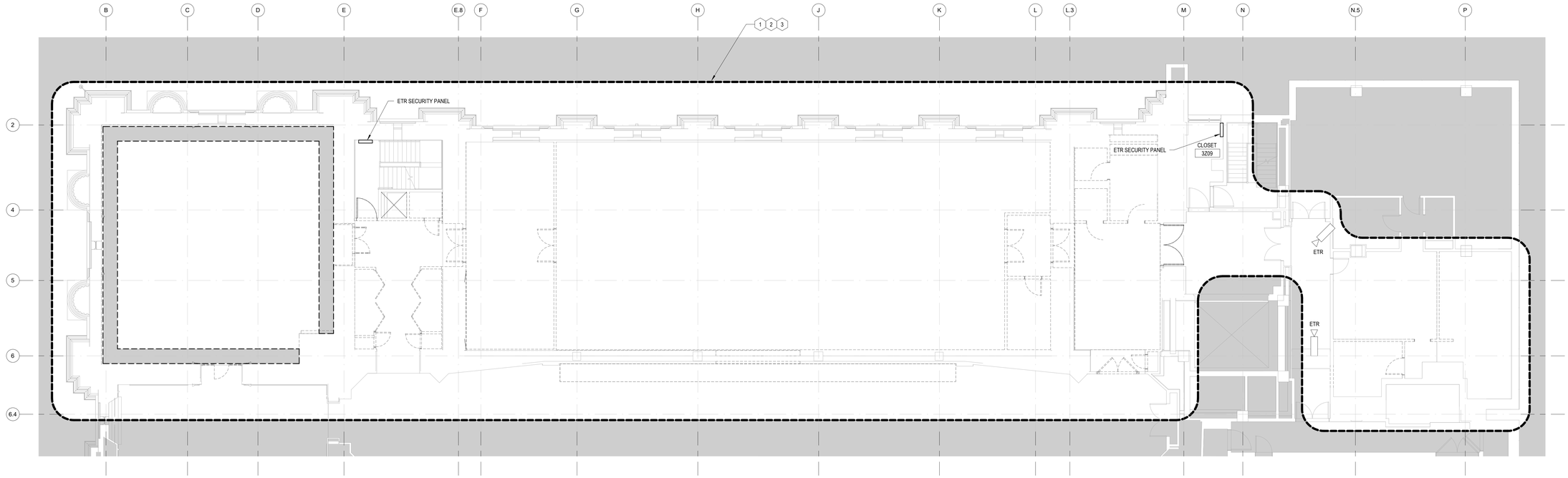
COVER SHEET - SECURITY

SCALE	NONE
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TY001.00

10/17/2025 11:20:43 AM



1 THIRD FLOOR DEMO PLAN
TYD103.00 SCALE: 1/8" = 1'-0"

DEMOLITION AND REMOVALS

1. REFER TO THE ARCHITECTURAL SET FOR EXACT EXTENT OF DEMOLITION SCOPE.
2. ALL SECURITY CABLES AND EQUIPMENT SHALL BE DEMOLISHED EXCEPT THOSE LABELED "ETR" AND "ETBR".
3. REMOVE ALL DEMOLISHED ACTIVE SECURITY EQUIPMENT AND RETURN TO OWNER.

LEGEND

SCOPE OF WORK

10/17/2025 11:20:44 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

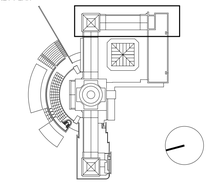
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

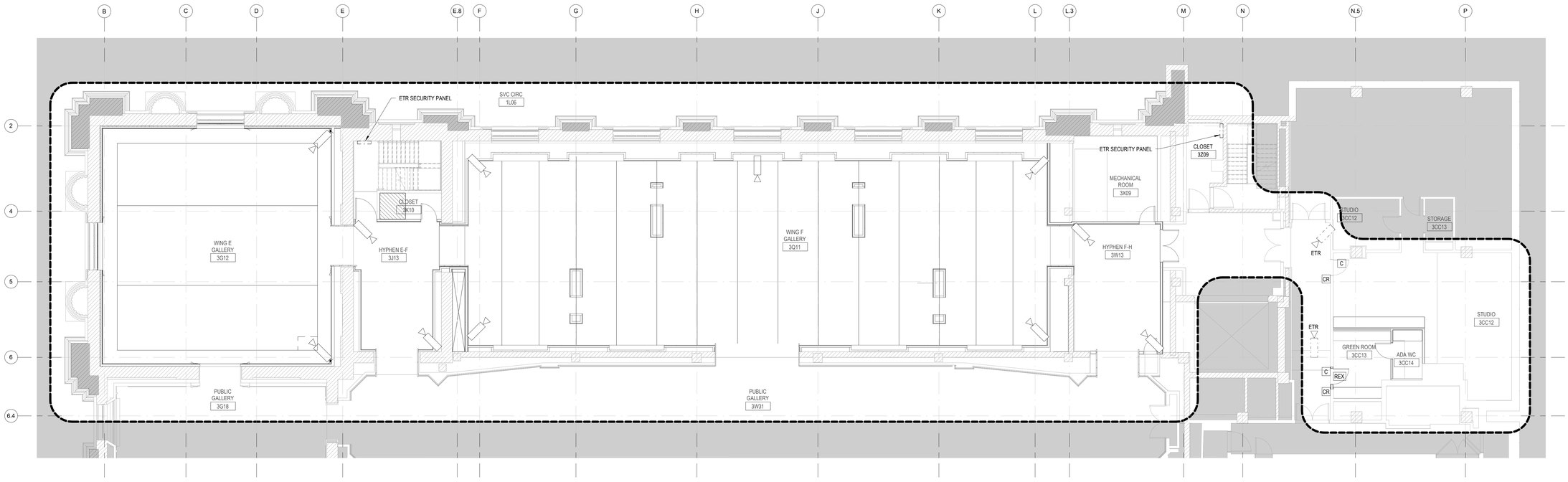
DRAWING TITLE

THIRD FLOOR DEMO PLAN - SECURITY

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TYD103.00



1 THIRD FLOOR PLAN
TY202.00 SCALE: 1/8" = 1'-0"

SECURITY NOTES

1. HOME RUN ALL NEW SECURITY CABLES ON THIRD FLOOR TO ETR WALL MOUNTED SECURITY CABINET ON THIRD FLOOR IN CLOSET 3Z09 BY STAIR F.
2. ALL CABLES SHALL BE INSTALLED IN CONDUIT.
3. ROUTE CABLES THROUGH NEAREST PULLBOX IN GALLERY SPACES.

10/17/2025 11:20:45 AM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
32 Old Slip, New York, NY 10005

MEP | FAFP ENGINEER
Kohler Rohnan
102 Madison Avenue, New York, NY 10016

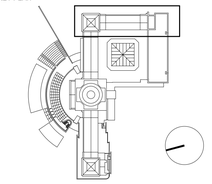
LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

ENVELOPE
WJE Engineers and Architects, PC
1350 Broadway, Suite 910, New York, NY 10018

HISTORIC PRESERVATION
Beyer Blinder Belle
120 Broadway, New York, NY 10271

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

DESIGN DEVELOPMENT

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR PLAN - SECURITY

SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	163A

DRAWING NUMBER

TY202.00

ARCHITECTURAL NOTES

1 VERIFY SIZES, DIMENSIONS, AND WITH ARCHITECTURAL AND INTERIORS DRAWINGS. WHERE CONFLICTS OCCUR, ARCHITECTURAL DRAWINGS TAKE PRECEDENCE.

2 WHERE EXACT DIMENSIONS ARE NOT CALLED FOR, VERIFY WITH ARCHITECT PRIOR TO INSTALLATION.

3 WHERE EXACT DIMENSIONS ARE INDICATED WITHIN THIS DRAWING SET, THE REFERENCE SURFACE SHALL BE THE FINAL FINISHED SURFACE, INCLUDING ANY ACOUSTIC FINISHES.

4 WHERE METAL OR PLASTIC LOUDSPEAKER GRILLES ARE SHOWN INSTALLED IN PAINTED CEILING OR WALL SURFACES, THE GENERAL CONTRACTOR SHALL PAINT THE GRILLES TO MATCH THE ADJACENT SURFACE PRIOR TO ASSEMBLY AND INSTALLATION.

ELECTRICAL NOTES

1 VERIFY SIZES, DIMENSIONS, AND LOCATIONS WITH THE ARCHITECTURAL AND INTERIOR DRAWINGS. WHERE CONFLICTS OCCUR, ARCHITECTURAL DRAWINGS TAKE PRECEDENCE.

2 ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH NATIONAL, LOCAL, AND OTHER APPLICABLE CODES.

3 ALL AUDIOVISUAL (AV) SYSTEM EQUIPMENT IS FOR REFERENCE ONLY. SUCH EQUIPMENT WILL BE PROVIDED AND INSTALLED BY THE AV INTEGRATOR, NOT THE ELECTRICAL CONTRACTOR. ALL OTHER CONSTRUCTION WORK ON THESE DRAWINGS IS BY THE GENERAL CONTRACTOR, IT CONTRACTOR, OR ELECTRICAL CONTRACTOR, UNLESS OTHERWISE NOTED.

4 WHERE EXACT DIMENSIONS ARE NOT CALLED FOR, VERIFY WITH ARCHITECT PRIOR TO INSTALLATION.

5 WHERE EXACT DIMENSIONS ARE INDICATED WITHIN THIS DRAWING SET, THE REFERENCE SURFACE SHALL BE THE FINAL FINISHED SURFACE, INCLUDING ANY ACOUSTIC FINISHES.

6 WHERE POWER, COMMUNICATION,AND/OR AV JUNCTION BOXES MUST COORDINATE WITH FIXED MILLWORK OR ARCHITECTURAL FEATURES, REFER TO THE ARCHITECTURAL DRAWINGS FOR EXACT DIMENSIONS AND DETAILS AND VERIFY WITH ARCHITECT PRIOR TO INSTALLATION.

7 WHERE POWER, COMMUNICATION, AND/OR AV JUNCTION BOXES ARE GROUPED TOGETHER AT THE SAME LOCATION AND ELEVATION, INSTALL AS CLOSE TOGETHER AS PHYSICALLY POSSIBLE WITH SUFFICIENT SEPARATION FOR INDIVIDUAL DEVICE COVER PLATES.

8 POWER SOCKET OUTLETS SHOWN ON THESE DRAWINGS ARE SHOWN FOR REFERENCE ONLY AND DEDICATED FOR USE WITH SPECIFIC AV EQUIPMENT. ADDITIONAL UTILITY SOCKET OUTLETS MAY BE INDICATED ON ARCHITECTURAL DRAWINGS OR REQUIRED BY CODE.

9 ALL AV SYSTEM POWER CIRCUITS SHALL BE PROTECTED BY 20AMP BREAKERS UNLESS OTHERWISE NOTED.

10 WHERE DUPLEX AND QUAD POWER SOCKET OUTLETS ARE SHOWN ON THESE DRAWINGS WITHOUT REFERENCE TO A SPECIFIC CIRCUIT, PANEL OR ISOLATED EARTH, THESE SOCKET OUTLETS MAY BE POWERED FROM STANDARD BUILDING POWER PANELS AND MAY BE COMBINED WITH OTHER CIRCUITS AND CONVENIENCE SOCKET OUTLETS AS CODES AND GOOD ENGINEERING PRACTICE ALLOW.

11 WHERE POWER CIRCUITS ARE SHOWN TERMINATING IN JUNCTION BOXES WITHOUT RECEPTACLES, THE WIRES SHALL BE TAPED AND THE BOXES COVERED. THESE WILL BE CONNECTED BY THE ELECTRICAL CONTRACTOR DURING THE INSTALLATION OF SPECIAL AV EQUIPMENT, TO BE COORDINATED WITH THE AV CONTRACTOR.

12 AV SYSTEM POWER CIRCUITS SHALL BE KEPT ISOLATED FROM LIGHTING DIMMERS, LARGE MOTORIZED EQUIPMENT, AND OTHER INDUCTIVE OR 'NOISY' ELECTRICAL LOADS.

13 EMPTY CONDUIT RUNS SHOWN ON THESE DRAWINGS SHOW ONLY INTERCONNECTIONS BETWEEN TERMINATION POINT. THE EXACT PATH OF THE CONDUIT SHALL BE COORDINATED ON SITE.

14 WHERE POSSIBLE, EMPTY CONDUIT RUNS FOR AV SIGNAL CIRCUITS SHALL BE KEPT MIN. 3' FROM PARALLEL POWER CIRCUITS IN RUNS UNDER 80', AND MIN. 6' IN RUNS OVER 80'. AV WIRING, RACEWAYS, AND CONDUIT MUST NOT RUN PARALLEL TO POWER MAINS OF POTENTIAL IN EXCESS OF 600V.

15 ALL EMPTY CONDUIT SHALL BE 3/4" UNLESS OTHERWISE NOTED. ALL CONDUIT SHALL BE EMT, DEBURRED, CLEANED, CAPPED, TAGGED, AND FURNISHED WITH PULL STRINGS.

16 THERE SHALL BE A MINIMUM OF ONE (1) PULL BOX FOR EVERY 100' OF STRAIGHT EMPTY CONDUIT, AND EXTRA PULL BOXES FOR EVERY TWO (2) 90 DEGREE BENDS IN A CONDUIT RUN.

17 THE METHOD OF INSTALLATION OF BOXES AND THE PASSAGE OF CONDUIT THROUGH ACOUSTICALLY SENSITIVE WALLS SHALL BE COORDINATED WITH THE ACOUSTIC CONSULTANT.

18 ELECTRICAL JUNCTION BOXES RECESSED INTO ACOUSTICALLY SENSITIVE WALLS SHALL HAVE THEIR BACKS SEALED WITH AIRTIGHT ADHESIVE OUTLET PADS.

19 ELECTRICAL JUNCTION BOXES PLACED BACK-TO-BACK ON ACOUSTICALLY SENSITIVE WALLS SHALL NOT SHARE THE SAME STUD CAVITY.

20 THERE SHALL BE NO DRILLING OF STRUCTURAL BEAMS OR COLUMNS. SIZE AND LOCATION OF DRILLING STUDS IS PER STRUCTURAL AND ANY VARIANCE OTHER THAN WHAT IS NOTED IN THESE DOCUMENTS SHOULD BE REVIEWED WITH STRUCTURAL PRIOR TO ON SITE DRILLING.

AUDIOVISUAL SHEET LIST

AUDIOVISUAL INFRASTRUCTURE SCHEDULE

INFRASTRUCTURE MARK	DESCRIPTION	SPECIFICATION	MOUNTING HEIGHT (AFF)	FLUSH/SURFACE	CONDUIT	POWER	DATA	HEAT
AV-1	Back Box for Gallery AV (Wall)	2-Gang	0' 3"	Flush	(1) 1" to CB-1	Refer to Electrical Drawings	Refer to IT Drawings	N/A
AV-2	Back Box for Gallery AV (Ceiling)	1-Gang	In Finished Ceiling	Flush	(1) 1" to CB-1	Refer to Electrical Drawings	Refer to IT Drawings	N/A
CB-1	Collector Box (TBC, coordinate with EC)	NEMA Type 1 Size As Required	1' 6"	Surface	(1) 1" to FACP	(2) Quad, 20A Dedicated	Refer to IT Drawings	N/A
D-1	Back Box for Relocation of Existing Intercom	4-11/16" Square, 3-1/4" Deep Box with 2-Gang Mud Ring	4' 0"	Flush	(1) 1" Stub-up to Corridor Ceiling or Existing Pathway	N/A	N/A	N/A
V1.3	Back Box for Relocation of Existing Video Plug Box	4-11/16" Square, 3-1/4" Deep Box with 2-Gang Mud Ring	1' 6"	Flush	(1) 1" Stub-up to Corridor Ceiling or Existing Pathway	N/A	N/A	N/A

AUDIOVISUAL EQUIPMENT SCHEDULE

TAG	EQUIPMENT DESCRIPTION
AVR-6	Placeholder AV Equipment Rack, 6U - Future Coordination Required to Determine if Integrated within IT Racks

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

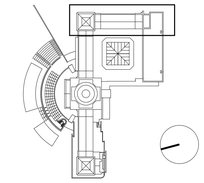
STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
212.777.7800

MEP FAFP ENGINEER
Kohler Ronan
171 Madison Avenue, New York, NY 10016

LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

KEY PLAN



STAMP

NO	DATE	DESCRIPTION
0		

REVISIONS

SUBMITTAL

100% DD

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

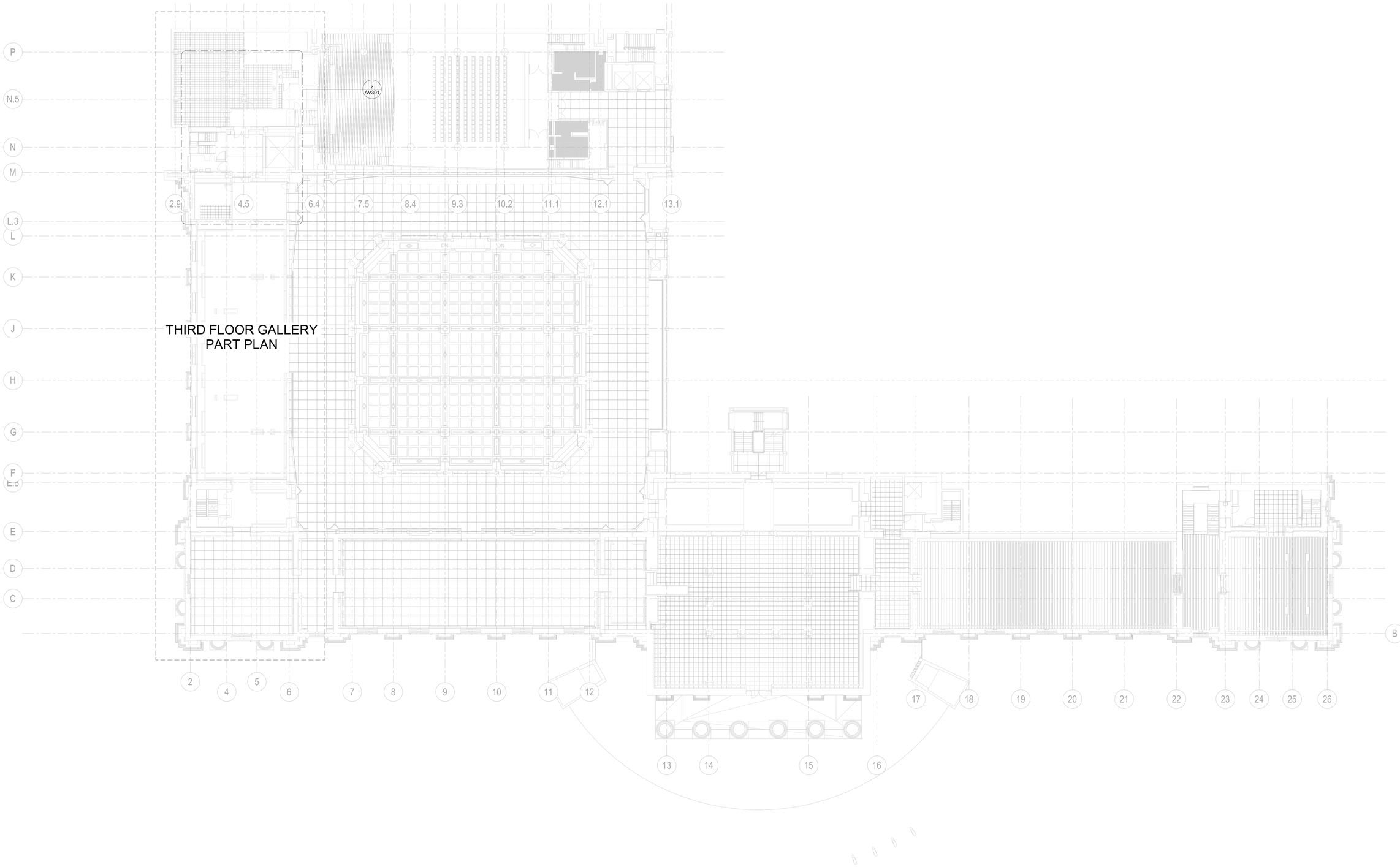
DRAWING TITLE

GENERAL NOTES - AUDIOVISUAL

SCALE	
DATE	10/17/2025
PROJECT NUMBER	3031
DRAWING NUMBER	

AV001

10/17/2025 2:00:11 PM



THIRD FLOOR GALLERY
PART PLAN

10/17/2025 2:00:13 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON
RICH
OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

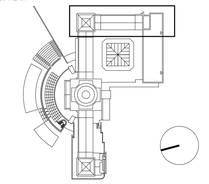
STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
212.777.7800

MEP FAFP ENGINEER
Kohler Ronan
171 Madison Avenue, New York, NY 10016

LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

100% DD

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

KEY PLAN - AUDIOVISUAL

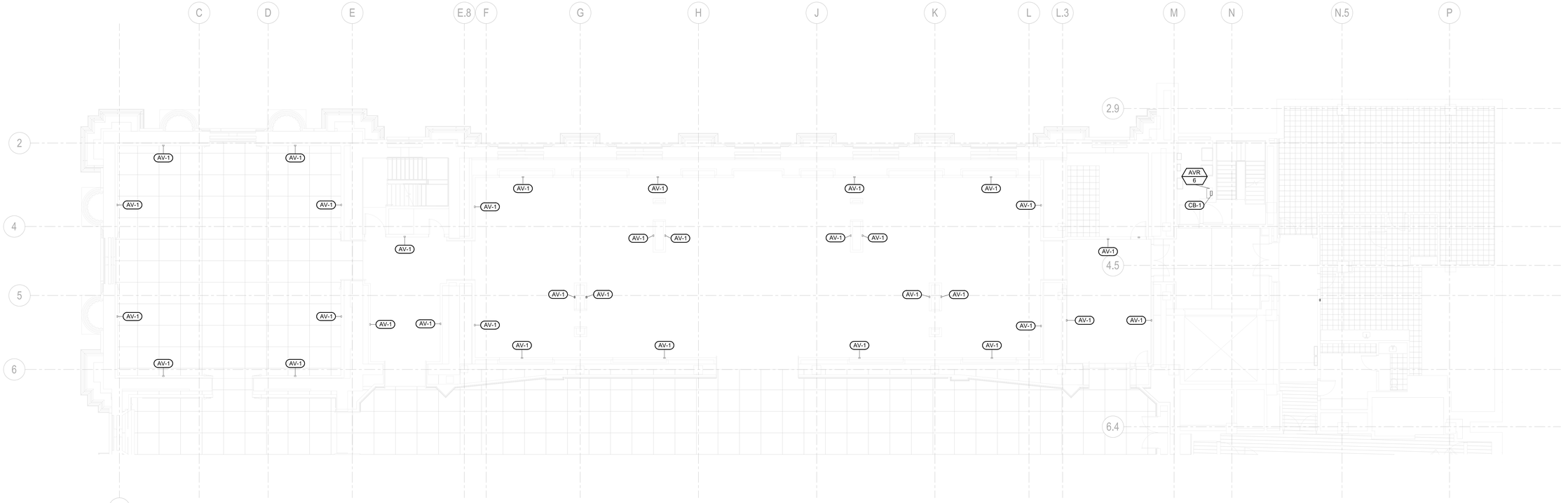
SCALE	1/16" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	3031

DRAWING NUMBER

AV010

AUDIOVISUAL INFRASTRUCTURE KEY	
TAG	INFRASTRUCTURE DESCRIPTION
AV-1	Back Box for Gallery AV (Wall)
CB-1	Collector Box (TBC, coordinate with EC)
V1.3	Back Box for Relocation of Existing Video Plug Box

SYMBOL	DESCRIPTION
XX	AV INFRASTRUCTURE (BACKBOX) SYMBOL
YYY ### NOTE / ZONE	AV EQUIPMENT SYMBOL



3 THIRD FLOOR GALLERY PART PLAN - AUDIOVISUAL
1/8" = 1'-0"

10/17/2025 2:00:14 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

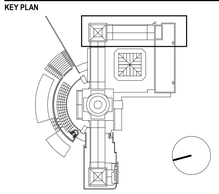
STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
212.777.7800

MEP FAFP ENGINEER
Kohler Ronan
171 Madison Avenue, New York, NY 10016

LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

100% DD

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR PART PLAN - AUDIOVISUAL

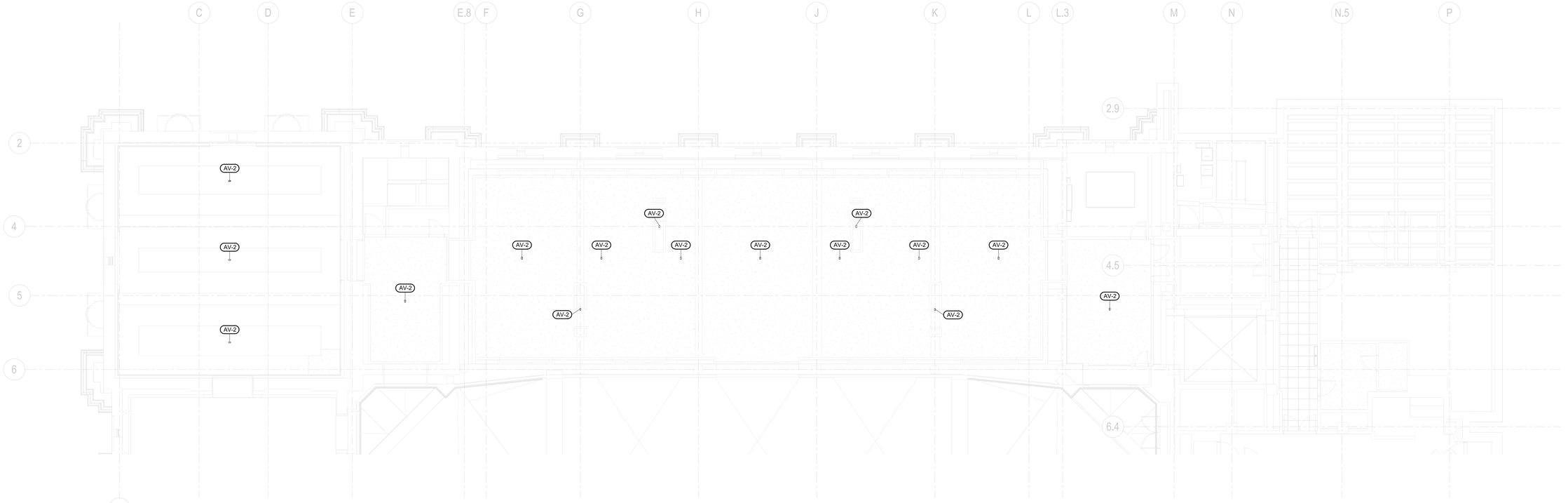
SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	3031

DRAWING NUMBER

AV201

AUDIOVISUAL INFRASTRUCTURE KEY	
TAG	INFRASTRUCTURE DESCRIPTION
AV-2	Back Box for Gallery AV (Ceiling)

SYMBOL	DESCRIPTION
XX	AV INFRASTRUCTURE (BACKBOX) SYMBOL
YYY NOTE ### /US ZONE	AV EQUIPMENT SYMBOL



3 THIRD FLOOR GALLERY PART REFLECTED CEILING PLAN - AUDIOVISUAL
1/8" = 1'-0"

10/17/2025 2:00:14 PM

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

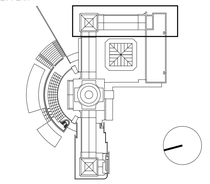
STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
212.777.7800

MEP FAFP ENGINEER
Kohler Ronan
171 Madison Avenue, New York, NY 10016

LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

100% DD

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR PART RCP - AUDIOVISUAL

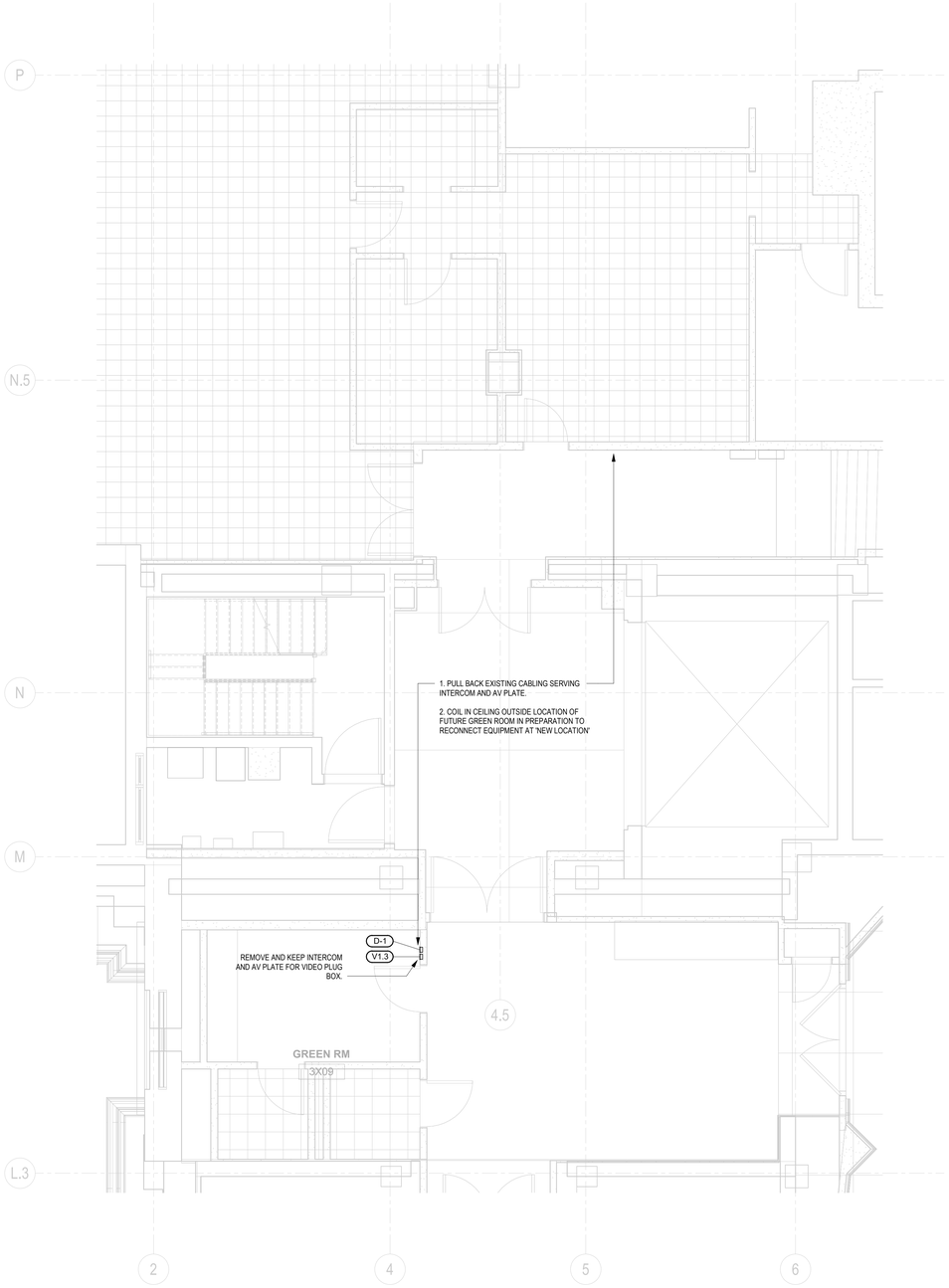
SCALE	As indicated
DATE	10/17/2025
PROJECT NUMBER	3031

DRAWING NUMBER

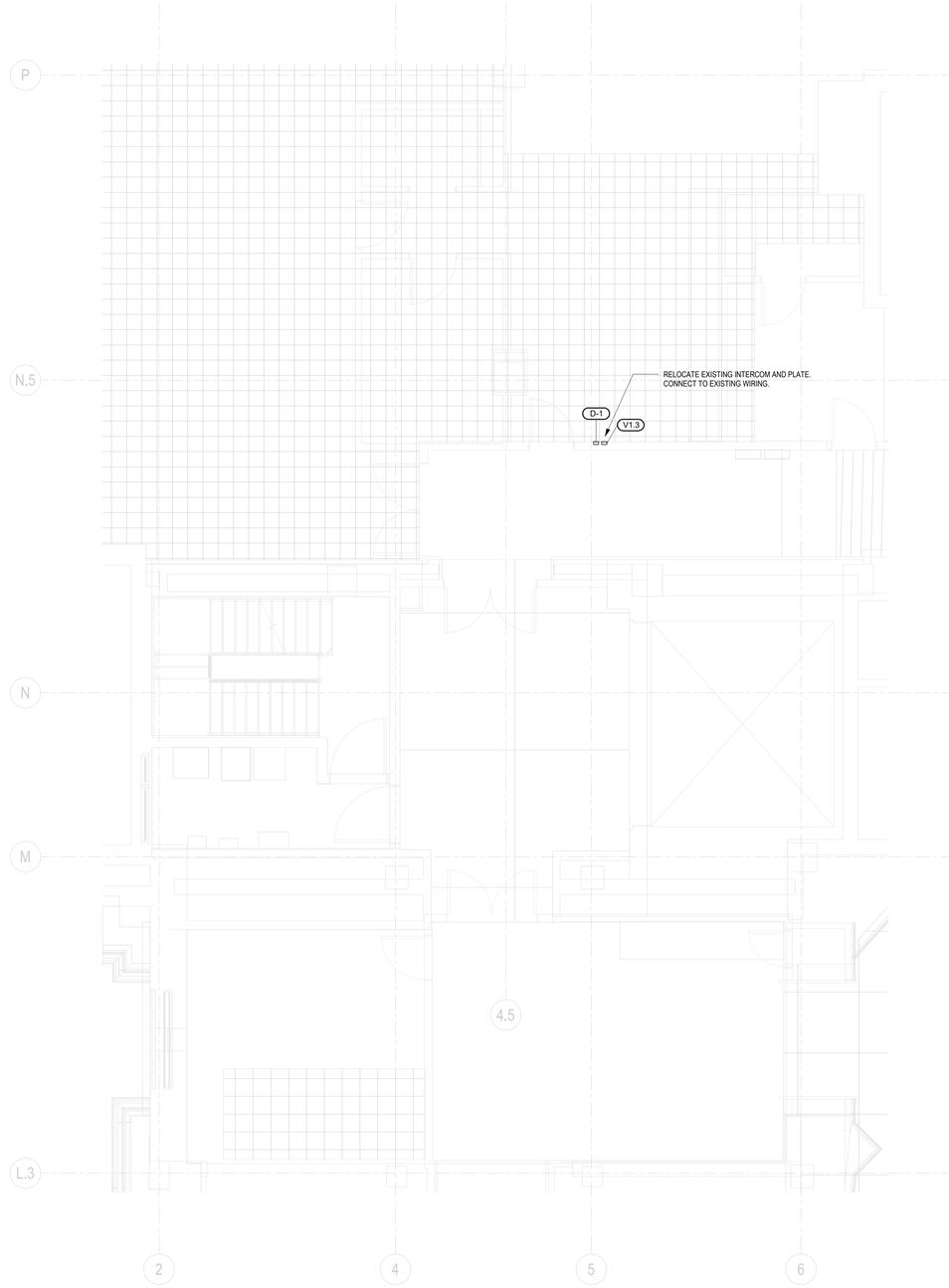
AV202

AUDIOVISUAL INFRASTRUCTURE KEY	
TAG	INFRASTRUCTURE DESCRIPTION
D-1	Back Box for Relocation of Existing Intercom
V1.3	Back Box for Relocation of Existing Video Plug Box

SYMBOL	DESCRIPTION
XX	AV INFRASTRUCTURE (BACKBOX) SYMBOL
YYY NOTE ### A/S ZONE	AV EQUIPMENT SYMBOL



1 ENLARGED PLAN - L3 GREEN ROOM - EXISTING/DEMO SCOPE
1/4" = 1'-0"



2 ENLARGED PLAN - L3 GREEN ROOM - NEW
1/4" = 1'-0"

BROOKLYN MUSEUM

ARTS OF AFRICA
200 Eastern Parkway, Brooklyn, NY 11238

PETERSON RICH OFFICE
37A 9th Street
Brooklyn, NY 11215
212 390 1504

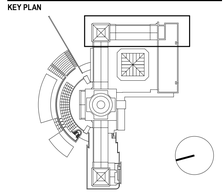
STRUCTURAL ENGINEER
T.Y.Lin International Engineering and Architecture
212.777.7800

MEP FAFP ENGINEER
Kohler Ronan
171 Madison Avenue, New York, NY 10016

LIGHTING DESIGN
L'Observatoire International
120 Walker Street, Suite 7E, New York, NY 10013

AUDIOVISUAL & ACOUSTICS
LSTN Consultants
76 Beaver Street, Floor 2, New York, NY 10005

KEY PLAN



STAMP

NO	DATE	DESCRIPTION

REVISIONS

SUBMITTAL

100% DD

PROGRESS PRINT / INTERIM REVIEW ONLY
NOT FOR CONSTRUCTION, REGULATORY APPROVAL OR PERMITTING

DRAWING TITLE

THIRD FLOOR ENLARGED PLAN - AUDIOVISUAL

SCALE	1/4" = 1'-0"
DATE	10/17/2025
PROJECT NUMBER	3031

DRAWING NUMBER

AV301

10/17/2025 2:00:15 PM

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

CLIENT:
THE BROOKLYN MUSEUM

ARCHITECT:
PETERSON RICH OFFICE

SECOND ISSUE

LIGHTING SPECIFICATIONS

100% DESIGN DEVELOPMENT
17 OCTOBER 2025

L'OBSERVATOIRE INTERNATIONAL
120 WALKER STREET 7E | NEW YORK NY 10013
T: +1 212 255 4463 | E: INFO@LOBSINTL.COM

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

LIGHTOLIER
by signify

Downlighting

Calculite LED 1.75"

C2L09 Downlight, 900lm

Add detail and style to any space with Calculite LED 1.75" aperture downlights and optional Micro Vetro elements.

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

Complete luminaire = Frame + Trim or Micro Vetro (optional)
+ Installation Accessories (if required)

Frame

example: C2L09DL927RE1

Series	Lumen	Installation	CCT / CRI	Installation	Input voltage
C2L	**09**				
C2L Calculite LED 1.75"	**09** 900lm	**DL** Downlight	**927** 90CRI / 2700K **930** 90CRI / 3000K **935** 90CRI / 3500K **940** 90CRI / 4000K	**R** Install from below	**E1** 120V **Z10U** Universal with 0-10V dimming

Trim

(25°, 30°, 40° and 50° beam optics included with frame)

example: C2LDLBKP

Series	Style	Finish	Flange
C2L			
C2L Calculite LED 1.75" round	**DL** Downlight (50° cutoff) **DLLS** Downlight (75° cutoff) with linear spread lens **LW** Lensed wall washer[1]	**BK** Black (painted) **CCD** Comfort clear diffuse **CCZ** Champagne bronze **WH** White (painted)	**P** Aperture-matching **FT** Flush mount[2] (except for white finish) **W** White (painted)
C2X2L Calculite LED 1.75" square	**DL** Downlight (50° cutoff) **LW** Lensed wall washer[1]	**BK** Black (painted) **WH** White (painted)	**FT** Flush mount[2] **W** White (painted)

Micro Vetro decorative elements

(Trim above not required when ordered)

example: D2LR01

Series	Aperture	
D2L		
D2L Decorative LED 1.75" Micro Vetro elements	**R01** Round acrylic w/aluminum insert **R02** Round acrylic **R03** Round glass **S01** Square acrylic **S02** Square glass	Installs into standard C2L frame. Comfort clear diffuse reflector is standard. Other finishes are available. Please contact factory.

Installation accessories[3]

C2LIC	IC frame (new construction)
C2LMP	New construction mounting pan
CA2FMR	Round aperture flush-mount mud-in ring
CA2X2FMR	Square aperture flush-mount mud-in ring

1. The 25° beam spread is recommended (A).
2. Requires flush-mount mud-in ring (CA2FMR or CA2X2FMR).
3. Recommended for specific applications, see page 2 for details.

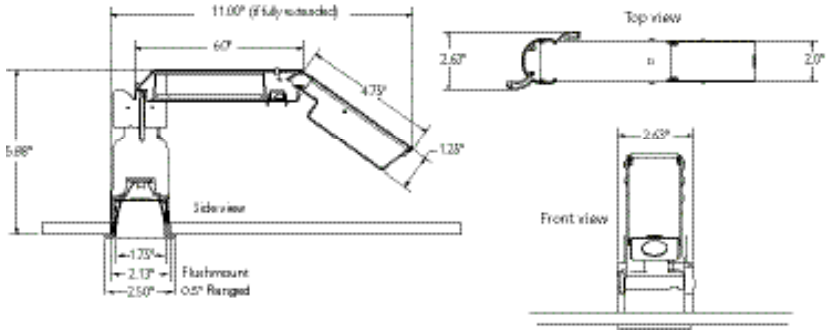
L'OBSERVATOIRE INTERNATIONAL
120 WALKER STREET | 7E | NEW YORK, NY 10013 | T: +1 212 255 4463

FIXTURE TYPE: **DL01**

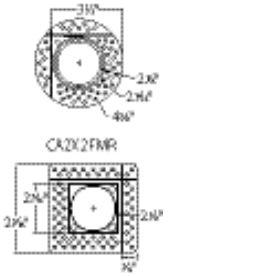
C2L09 Calculite LED 1.75''

Downlight, 900lm

New Construction (N)



Flangeless mud-in ring (CA2FMR) accessory

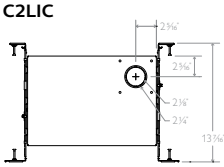


Flush-mount mud-in rings are required for gypsum applications.

Optional installation accessories

The standard C2L product offering is Non-IC, wet location listed* with no additional "frame-in kit" required. Listed below are additional frame options.

C2LIC



IC frame (new construction). Certified for use in Chicago Plenum applications. Includes bar hangers with preset screws which accommodate 12"-24" joist spacing. Bars also attach to T-bar ceilings.
- Width (min): 13 7/16",
- Length: 14 9/16",
- Depth: 9 5/16".

C2LMP

New construction mounting pan provides ability to prelocate wiring for easy below-ceiling access. Includes bar hangers with preset screws which accommodate 12"-24" joist spacing. Bars also attach to T-bar ceilings. Width: 5.5", Length (min): 13.12"

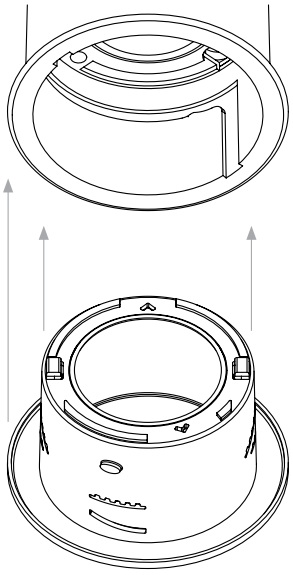
CA2FMR

Round aperture flush-mount mud-in ring. Recommended for gypsum applications. Perforated flange allows installation only 1.4" from vertical structure, including corners.

CA2X2FMR

Square aperture flush-mount mud-in ring. Recommended for gypsum applications. Perforated flange allows installation only 1.4" from vertical structure, including corners. Square plate secures magnetically to mud-in ring. Tether included.

Reflector can be rotated 90° to ensure proper alignment. Friction-fit design maintains installation integrity.



Wall washer and Linear spread trim

For wall washer & linear spread options, lenses are factory-assembled into specified reflector.

L'OBSERVATOIRE INTERNATIONAL
120 WALKER STREET | 7E | NEW YORK, NY 10013 | T: +1 212 255 4463

FIXTURE TYPE: **DL01**

C2L09 Calculite LED 1.75''

Downlight, 900lm

Features

Aperture: 1.75" (44 mm) I.D., 2.50" (63mm) O.D.
Input power: 13.9W
Fixture output: Aluminum. Self-flanged.
Provides 50° cutoff to source and source image.

Beam Spread options

Beam spread	Spacing criterion	Delivered lumens	Efficacy	CBCP
25°	0.4	1186 lm	85.3 lm/W	5537
30°	0.5	955 lm	68.7 lm/W	3451
45°	0.7	964 lm	69.4 lm/W	1848
50°	0.8	935 lm	67.3 lm/W	1268

Field replaceable optics: 4 TIR optics included for field installation and replacement (25°, 30°, 45° and 50° beams included).
Reflector cone: Aluminum. Provides 50° cutoff to source and source image. Twist and lock installation within frame ensures snug fit to ceiling.
Reflector flange: Thickness is 0.09" (2.4 mm).
Width is (flanged) 0.37" (9.5 mm) and is (flush-mounted) 0.19" (4.8 mm).
Required depth: 6" (150 mm) plenum depth required for Non-IC installs.
Ceiling cutout: 2.13" (54mm).
Thick ceiling capability: 0.38" - 2" (9.7 mm - 51 mm).
Fixture weight: 1.8 lbs.
Installation: Hinged design allows fixture installation from below ceiling. Two screws actuate pivoting installation arms. Vertical installation only (as shown in above drawings).
Field accessibility: Driver is field interchangeable/replaceable.

Electrical

Power connection: Integral connection between driver and LED array
Junction box: UL listed for 6 No 12 AWG, 90°C through branch circuit connectors. Allows inspection from below. Compatible with 2-1 conduit connector for daisy chaining.
Minimum starting temperature: -20°C
Maximum operating temperature: 60°C
Input voltage: 120/277V 0-10V; 120V ELV
Input frequency: 60Hz
Input current: ELV - 0.117A, 0-10V - 0.124A (120V), 0.06A (277V)
LED drive current: 1A
Power Factor: >0.9 **THD:** <20%
FCC rating: Part 15 / Class B driver

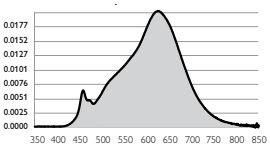
ENERGY STAR®

C2L09DL930E1 / C2LDLCCD*	C2LIC / C2L09DL930E1 / C2LDLCCD*
C2L09DL930E1 / C2LDLWH*	C2LIC / C2L09DL930E1 / C2LDLWH*
C2L09DL935E1 / C2LDLCCD*	C2LIC / C2L09DL935E1 / C2LDLCCD*
C2L09DL935E1 / C2LDLWH*	C2LIC / C2L09DL935E1 / C2LDLWH*
C2L09DL940E1 / C2LDLCCD*	C2LIC / C2L09DL940E1 / C2LDLCCD*
C2L09DL940E1 / C2LDLWH*	C2LIC / C2L09DL940E1 / C2LDLWH*
C2L09DL930RZ10U / C2LDLCCD*	C2LIC / C2L09DL930RZ10U / C2LDLCCD*
C2L09DL930RZ10U / C2LDLWH*	C2LIC / C2L09DL930RZ10U / C2LDLWH*
C2L09DL935RZ10U / C2LDLCCD*	C2LIC / C2L09DL935RZ10U / C2LDLCCD*
C2L09DL935RZ10U / C2LDLWH*	C2LIC / C2L09DL935RZ10U / C2LDLWH*
C2L09DL940RZ10U / C2LDLCCD*	C2LIC / C2L09DL940RZ10U / C2LDLCCD*
C2L09DL940RZ10U / C2LDLWH*	C2LIC / C2L09DL940RZ10U / C2LDLWH*

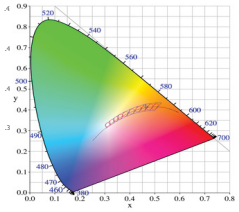
Technology

LES Array: Cree CoB
Photometric performance: Tested in accordance to IESNA LM-79-2008
Color consistency: 2 SDCM (max.)

Spectral power distribution



Chromaticity Diagram



Color Rendering Index: 90 min, 92 typical

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
95.2	98.4	99.0	95.1	95.3	98.0	91.9	82.6	62.7	95.7	97.5	88.1	96.3	99.4

Dimming capability: ELV: Lightolier SR400RPC120 - Dims to 1%
Lutron DVELV-300P-WH - Dims to 1%, 0-10V - Dims to 5%

Rated life

LES (Light Emmiting Source): L90 at 90,700 hours
(90% lumen maintenance). Based on IESNA LM-80-2008.
Driver: 50,000 hours

Labels and Listings

cULus, AirSeal, suitable for wet location.
ENERGY STAR® certified and Title 24 rated.

Quick-ship: Lightolier is committed to providing customers with the products they need when they need them.

Warranty

5 year warranty on complete system.

Complete warranty available at: http://images.philips.com/is/content/PhilipsConsumer/PDFDownloads/United%20States/ODLI20150930_003-UPD-en_US-Philips-warranty-indoor-PLS-us.pdf

Title 24 JA8

C2LIC / C2L09DL9**E1 / C2LDLCCD*	C2LIC / C2L09DL9**RZ10U / C2LDLCCD*
C2LIC / C2L09DL9**E1 / C2LDLWH*	C2LIC / C2L09DL9**RZ10U / C2LDWH*
C2LIC / C2L09DL9**E1 / C2LDCCZ*	C2LIC / C2L09DL9**RZ10U / C2LCCZ*

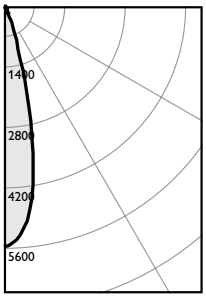
L'OBSERVATOIRE INTERNATIONAL
120 WALKER STREET | 7E | NEW YORK, NY 10013 | T: +1 212 255 4463

C2L09 Calculite LED 1.75"

Downlight, 900lm

Narrow Spot beam, 900 lm Engine, 85 lm/W at 14 W

Candela Curve



Frame: **C2L09DL935RE1**
Trim: **C2LDLCCDP**

Output lumens:	1186 lms
Input watts:	13.9 W
CRI:	90 min
CCT[1]:	3500K
Spacing Crit.:	0.4
Beam Angle:	26°

Zonal summary

Zone	Lumens	%Luminaire
0-30	1119	94.4%
0-40	1172	98.8%
0-60	1184	99.8%
0-90	1186	100.0%

Angle	Mean CP	Lumens
0	5537	
5	5144	450
10	3827	
15	1945	532
20	678	
25	256	137
30	148	
35	84	53
40	37	
45	9	10
50	4	
55	2	2
60	2	
65	1	1
70	1	
75	1	1
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	221	2.0'
6'	154	2.4'
7'	113	2.8'
8'	87	3.2'
9'	68	3.6'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	56.6	0.62
6'	37.1	0.40
7'	26.5	0.29
8'	22.1	0.24
9'	17.7	0.19

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 85.3 lm/w
Report[2]: 1445GFR

Adjustment factors

Finish	CCT
CCD = 100%	90CRI 4000K = 100%
CCZ = 88%	90CRI 3500K = 100%
WH = 95%	90CRI 3000K = 93%
BK = 00%	90CRI 2700K = 87%

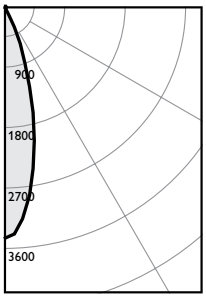
Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	115	113	111	109	111	108	107	104	103	101	97
2	111	108	105	103	106	101	103	99	100	97	94
3	108	103	100	97	102	96	100	95	97	93	91
4	105	100	96	93	99	92	97	91	95	90	88
5	102	96	92	89	95	89	94	88	92	87	85
6	99	93	89	86	92	86	91	85	90	85	83
7	96	90	86	83	89	83	88	83	87	82	81
8	94	87	83	81	87	81	86	80	85	80	79
9	91	85	81	78	85	78	84	78	83	78	77
10	89	83	79	76	82	76	82	76	81	76	75

Room Cavity Ratio

Spot beam, 900 lm Engine, 69 lm/W at 14 W

Candela Curve



Frame: **C2L09DL935RE1**
Trim: **C2LDLCCDP**

Output lumens:	955 lms
Input watts:	13.9 W
CRI:	90 min
CCT[1]:	3500K
Spacing Crit.:	0.5
Beam Angle:	29°

Zonal summary

Zone	Lumens	%Luminaire
0-30	903	94.5%
0-40	936	98.0%
0-60	952	99.6%
0-90	955	100.0%

Angle	Mean CP	Lumens
0	3451	
5	3155	278
10	2451	
15	1628	445
20	912	
25	347	179
30	106	
35	47	33
40	27	
45	15	12
50	6	
55	4	4
60	3	
65	2	2
70	2	
75	1	1
80	1	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	138	2.5'
6'	96	3.0'
7'	70	3.5'
8'	54	4.0'
9'	43	4.5'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	45.2	0.62
6'	29.7	0.40
7'	21.2	0.29
8'	17.7	0.24
9'	14.1	0.19

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 68.7 lm/w
Report[2]: 1446GFR

Adjustment factors

Finish	CCT
CCD = 100%	90CRI 4000K = 100%
CCZ = 88%	90CRI 3500K = 100%
WH = 95%	90CRI 3000K = 93%
BK = 00%	90CRI 2700K = 87%

Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	115	113	111	109	110	107	106	104	103	101	96
2	111	107	104	101	105	100	102	98	99	96	92
3	107	102	98	95	101	94	98	93	96	92	89
4	103	98	93	90	97	90	95	89	93	88	86
5	100	94	89	86	93	86	91	85	90	84	82
6	97	90	86	83	89	82	88	82	87	81	80
7	94	87	82	79	86	79	85	79	84	78	77
8	91	84	80	77	83	76	82	76	82	76	74
9	88	81	77	74	81	74	80	74	79	73	72
10	86	79	74	72	78	71	78	71	77	71	70

Room Cavity Ratio

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

L'OBSERVATOIRE INTERNATIONAL
120 WALKER STREET | 7E | NEW YORK, NY 10013 | T: +1 212 255 4463

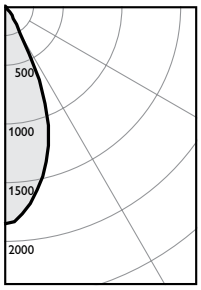
FIXTURE TYPE: **DL01**

C2L09 Calculite LED 1.75"

Downlight, 900lm

Narrow Flood beam, 900 lm Engine, 69 lm/W at 14 W

Candela Curve



Frame: **C2L09DL935RE1**
Trim: **C2LDLCCDP**

Output lumens:	964 lms
Input watts:	13.9 W
CRI:	90 min
CCT[1]:	3500K
Spacing Crit.:	0.7
Beam Angle:	44°

Zonal summary

Zone	Lumens	%Luminaire
0-30	842	87.4%
0-40	932	96.7%
0-60	958	99.4%
0-90	964	100.0%

Angle	Mean CP	Lumens
0	1848	
5	1769	163
10	1583	
15	1366	376
20	1078	
25	692	303
30	271	
35	135	90
40	68	
45	18	20
50	9	
55	7	6
60	5	
65	3	4
70	2	
75	2	2
80	1	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	74	3.5'
6'	51	4.2'
7'	38	4.9'
8'	29	5.6'
9'	23	6.3'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	44.8	0.62
6'	29.4	0.40
7'	21.0	0.29
8'	17.5	0.24
9'	14.0	0.19

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 69.3 lm/w
Report[2]: 1447GFR

Adjustment factors

Finish	CCT
CCD = 100%	90CRI 4000K = 100%
CCZ = 88%	90CRI 3500K = 100%
WH = 95%	90CRI 3000K = 93%
BK = 00%	90CRI 2700K = 87%

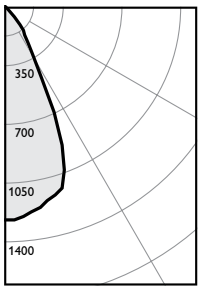
Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	114	112	109	107	110	106	105	102	102	99	95
2	109	105	101	98	103	97	100	95	97	93	90
3	105	99	95	91	98	91	95	89	93	88	85
4	100	94	89	85	93	85	91	84	89	83	81
5	96	89	84	80	88	80	86	79	85	79	77
6	92	85	80	76	84	76	83	75	81	75	73
7	89	81	75	72	80	72	79	71	78	71	69
8	85	77	72	68	76	68	75	68	74	68	66
9	82	74	69	65	73	65	72	65	71	65	63
10	79	70	65	62	70	62	69	62	69	62	60

Room Cavity Ratio

Flood beam, 900 lm Engine, 69 lm/W at 14 W

Candela Curve



Frame: **C2L09DL935RE1**
Trim: **C2LDLCCDP**

Output lumens:	935 lms
Input watts:	13.9 W
CRI:	90 min
CCT[1]:	3500K
Spacing Crit.:	0.8
Beam Angle:	51°

Zonal summary

Zone	Lumens	%Luminaire
0-30	747	80.0%
0-40	884	94.6%
0-60	928	99.3%
0-90	935	100.0%

Angle	Mean CP	Lumens
0	1268	
5	1250	118
10	1207	
15	1155	323
20	1032	
25	693	306
30	326	
35	212	136
40	143	
45	25	37
50	11	
55	8	7
60	6	
65	4	4
70	3	
75	2	2
80	1	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	51	4.0'
6'	35	4.8'
7'	26	5.6'
8'	20	6.4'
9'	16	7.2'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	43.0	0.62
6'	28.2	0.40
7'	20.1	0.29
8'	16.8	0.24
9'	13.4	0.19

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 68.7 lm/w
Report[2]: 1448GFR

Adjustment factors

Finish	CCT
CCD = 100%	90CRI 4000K = 100%
CCZ = 88%	90CRI 3500K = 100%
WH = 95%	90CRI 3000K = 93%
BK = 00%	90CRI 2700K = 87%

Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	114	111	109	107	109	105	105	102	101	99	94
2	109	104	100	97	102	96	99	94	96	92	88
3	104	97	93	89	96	88	94	87	91	86	83
4	99	92	86	83	91	82	88	81	86	80	78
5	94	86	81	77	85	77	84	76	82	75	73
6	90	82	76	72	81	72	79	71	78	71	69
7	86	77	72	68	77	67	75	67	74	67	65
8	82	73	68	64	73	64	72	63	71	63	62
9	79	70	64	60	69	60	68	60	67	60	58
10	75	66	61	57	66	57	65	57	64	57	55

Room Cavity Ratio

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

Signify

Signify North America Corporation
200 Franklin Square Drive,
Somerset, NJ 08873
Telephone 855-486-2216

Signify Canada Ltd.
281 Hillmount Road,
Markham, ON, Canada L6C 2S3
Telephone 800-668-9008

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

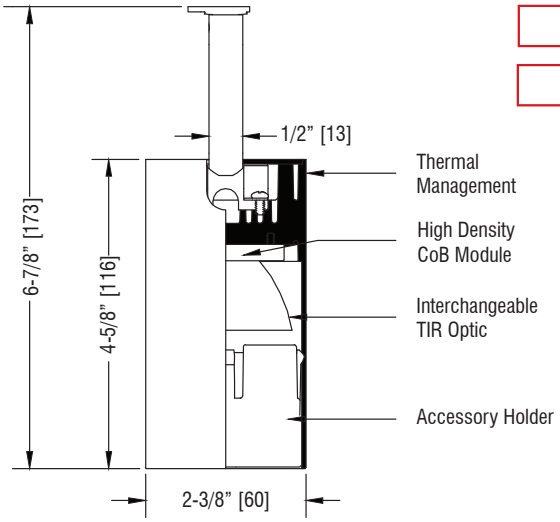
Static White
Fixed Object

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1600/1450 Lumens	120VAC/0.2A/23W
	240VAC/0.2A/23W
	277VAC/0.1A/23W

Enter Catalog Number Sequentially from Left to Right

C20 - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI	CCT
C20	L16 1600/92	27 2700
	L14 1450/98	30 3000
		35 3500
		40 4000

Adaptor	Dimming	Level
9TC BusRun Clipless	E ELV	1 1%
9TD BusRun Deep		
9TS BusRun Shallow		
9HC BusRun Clipless w/ Driverbox	E ELV	0 10%
9HD BusRun Deep w/ Driverbox	W Wireless	C Casambi
9HS BusRun Shallow w/ Driverbox		A Avi-On
		T Athena RF
ST2 2-Circuit Stucchi	E ELV	0 10%
ST3 3-Circuit Stucchi	Z 0-10	1 1%
3L 5" Canopy	M DMX	D Dark
5L 3.5" QC Canopy	D DALI	
7L 2" QC Canopy (Remote Driver Only)		

Options

P* Potentiometer
R** Rotation Lock
SP* Switch w/ Potentiometer
SR** Switch w/ Rotation Lock

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Voltage

A 120
D 240
F* 240 (2-Circuit)
C 277

Finish

P White
MB Black
BR Brushed
CP Custom

Enter RAL or Other Finish Code

Optics

1 15°
2 25°
3 35°

Optics

☐ 15°	OL-RS-ILONA-50-KIT
☐ 25°	OL-M-ILONA-50-KIT
☐ 35°	OL-W-ILONA-50-KIT

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 6*

☐ OL-DF-a	Beam Softening Film
☐ OL-TD-a	Beam Softening Lens
☐ OL-10x40-a	Linear Spread Lens
☐ OL-10x60-a	Linear Spread Lens
☐ OL-30x60-a	Universal Spread Lens
☐ LVH/a	Hexell Louver
☐ CHB/a-2	Crosshair Baffle

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL Intertek

C20

Static White
Fixed Object

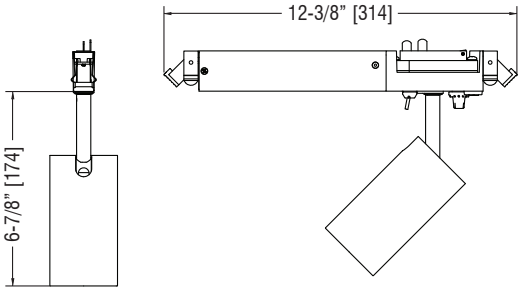
Project Name

Type

Clear Form

Fitter Guide

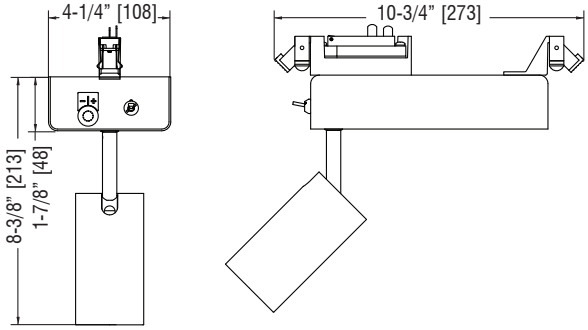
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



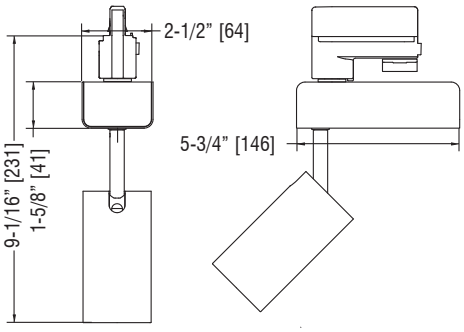
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%.

Switch not available for 277 V.

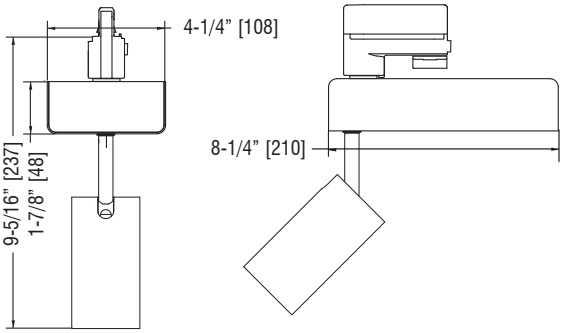
9H - Wireless Control Fitter for BusRun



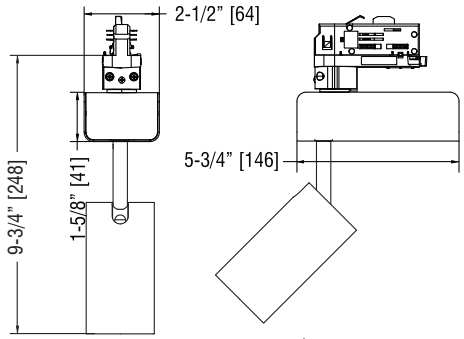
Stucchi - 2-Circuit ELV Dimmable Fitter



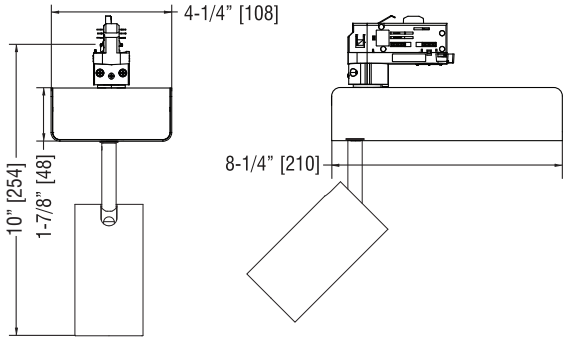
Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



Stucchi - 3-Circuit ELV Dimmable Fitter



Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

C20

Static White
Fixed Object

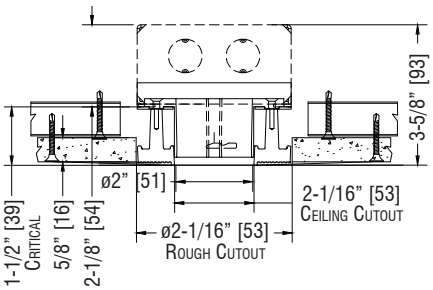
Project Name

Type

Clear Form

Fitter Guide

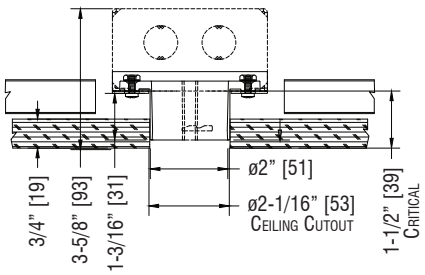
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

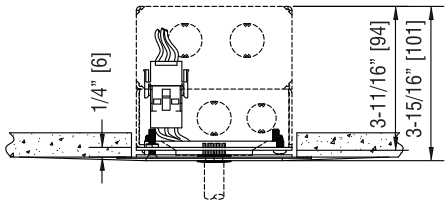


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

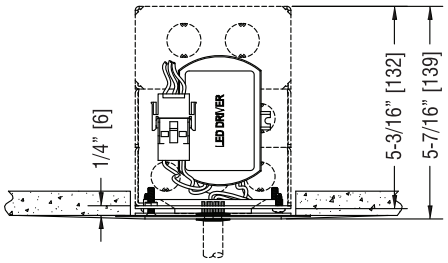
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

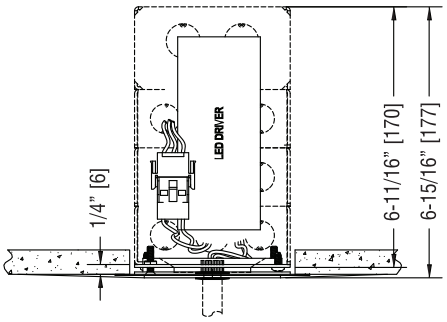
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

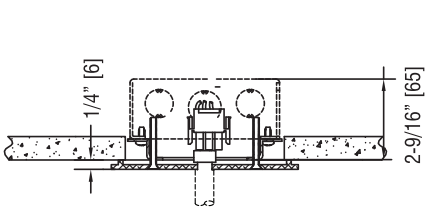


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

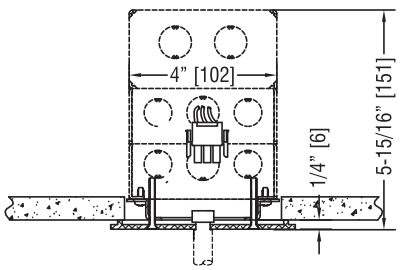


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

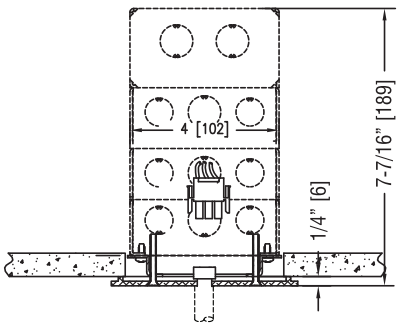
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L16 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	294.0 f.c. / 3,164.6 lux	1.6' / 0.5m
8.0' / 2.4m	165.4 f.c. / 1,780.4 lux	2.1' / 0.6m
10.0' / 3.0m	105.9 f.c. / 1,139.9 lux	2.6' / 0.8m
12.0' / 3.7m	73.5 f.c. / 791.1 lux	3.2' / 1.0m
14.0' / 4.3m	54.0 f.c. / 581.3 lux	3.7' / 1.1m
16.0' / 4.9m	41.3 f.c. / 444.5 lux	4.2' / 1.3m

CBCP:	10,585 Cd
Efficacy:	62.6 lm/w
Delivered Lumens:	820 lm

C20-L16 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	104.4 f.c. / 1,123.8 lux	2.6' / 0.8m
8.0' / 2.4m	58.7 f.c. / 6318 lux	3.4' / 1.0m
10.0' / 3.0m	37.6 f.c. / 404.7 lux	4.3' / 1.3m
12.0' / 3.7m	26.1 f.c. / 280.9 lux	5.1' / 1.6m
14.0' / 4.3m	19.2 f.c. / 206.7 lux	6.0' / 1.8m
16.0' / 4.9m	14.7 f.c. / 158.2 lux	6.8' / 2.1m

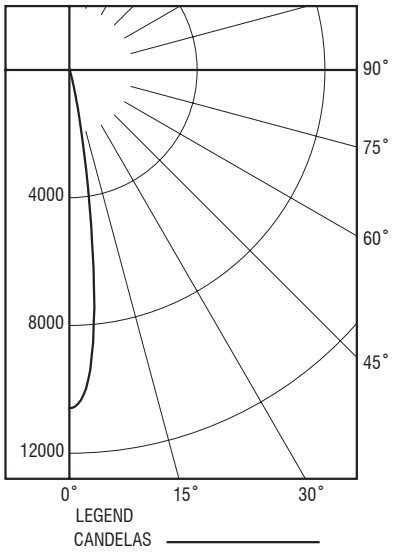
CBCP:	3757 Cd
Efficacy:	57.0 lm/w
Delivered Lumens:	747 lm

C20-L16 35° Optic (OL-W-ILONA-50MM)

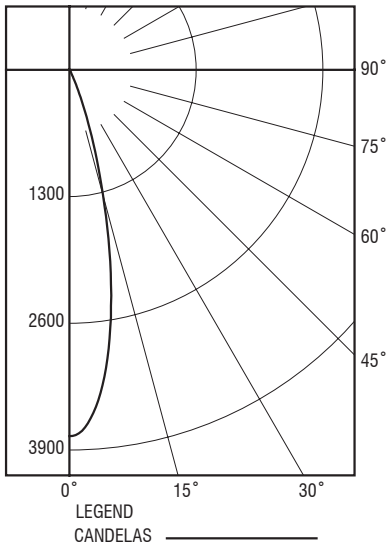
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	51.5 f.c. / 554.3 lux	3.5' / 1.1m
8.0' / 2.4m	29.0 f.c. / 312.2 lux	4.7' / 1.4m
10.0' / 3.0m	18.5 f.c. / 199.1 lux	5.0' / 1.5m
12.0' / 3.7m	12.9 f.c. / 138.9 lux	7.1' / 2.2m
14.0' / 4.3m	9.5 f.c. / 102.3 lux	8.2' / 2.5m
16.0' / 4.9m	7.2 f.c. / 77.5 lux	9.4' / 2.9m

CBCP:	1853 Cd
Efficacy:	50.1 lm/w
Delivered Lumens:	656 lm

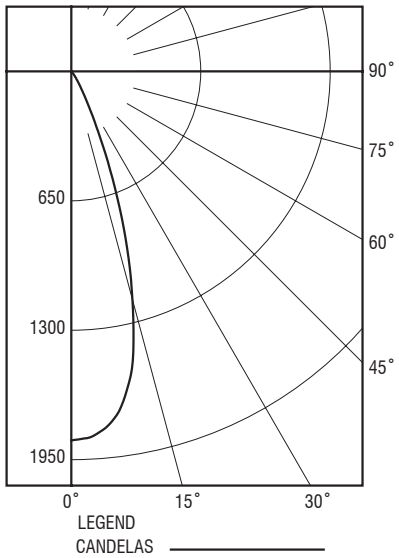
C20-L16 15° Optic - Polar Diagram



C20-L16 25° Optic - Polar Diagram



C20-L16 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L14 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	256.6 f.c. / 2,762.0 lux	1.6' / 0.5m
8.0' / 2.4m	144.3 f.c. / 1,556.8 lux	2.1' / 0.6m
10.0' / 3.0m	92.4 f.c. / 994.6 lux	2.7' / 0.8m
12.0' / 3.7m	64.1 f.c. / 690.0 lux	3.2' / 1.0m
14.0' / 4.3m	47.1 f.c. / 507.0 lux	3.7' / 1.1m
16.0' / 4.9m	36.1 f.c. / 388.6 lux	4.3' / 1.3m

CBCP:	9,237 Cd
Efficacy:	50.9 lm/w
Delivered Lumens:	728 lm

C20-L14 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	96.7 f.c. / 1,040.9 lux	2.5' / 0.8m
8.0' / 2.4m	54.4 f.c. / 585.6 lux	3.3' / 1.0m
10.0' / 3.0m	34.8 f.c. / 374.6 lux	4.2' / 1.3m
12.0' / 3.7m	24.2 f.c. / 260.5 lux	5.0' / 1.5m
14.0' / 4.3m	17.8 f.c. / 191.6 lux	5.9' / 1.8m
16.0' / 4.9m	13.6 f.c. / 146.4 lux	6.7' / 2.0m

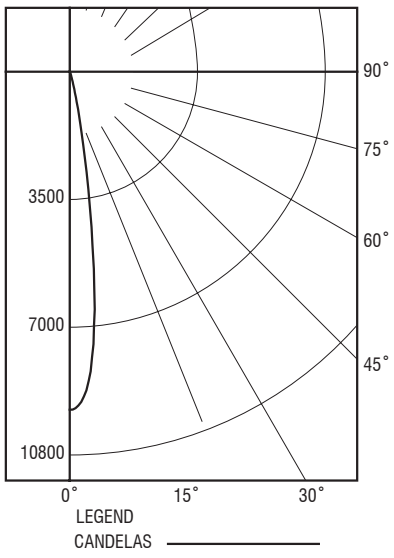
CBCP:	3481 Cd
Efficacy:	47.1 lm/w
Delivered Lumens:	673 lm

C20-L1435° Optic (OL-W-ILONA-50MM)

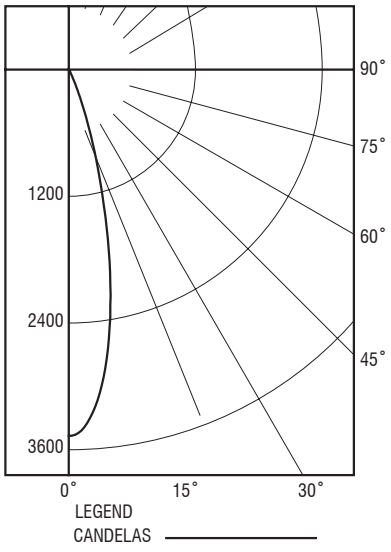
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	46.0 f.c. / 495.1 lux	3.5' / 1.1m
8.0' / 2.4m	25.9 f.c. / 278.8 lux	4.7' / 1.4m
10.0' / 3.0m	16.6 f.c. / 178.7 lux	5.0' / 1.5m
12.0' / 3.7m	11.5 f.c. / 123.8 lux	7.0' / 2.1m
14.0' / 4.3m	8.5 f.c. / 91.5 lux	8.2' / 2.5m
16.0' / 4.9m	6.5 f.c. / 70.0 lux	9.4' / 2.9m

CBCP:	1657 Cd
Efficacy:	40.5 lm/w
Delivered Lumens:	583 lm

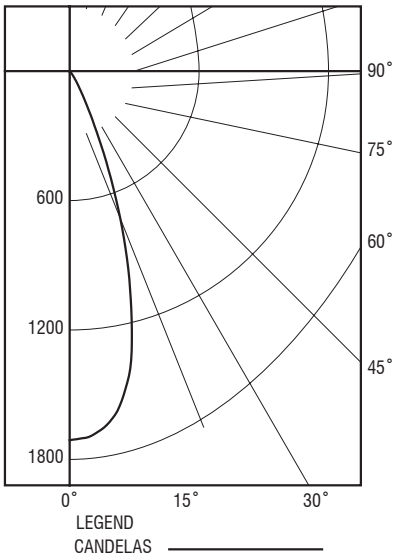
C20-L14 15° Optic - Polar Diagram



C20-L14 25° Optic - Polar Diagram



C20-L14 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

Static White
Fixed Object

Project Name

Type

Clear Form

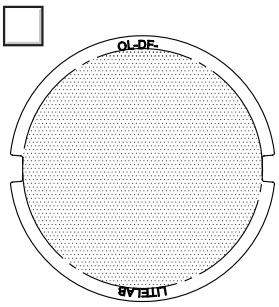
Accessories

FIXTURE SIZE CODE (A): Ø1.95" [50mm]

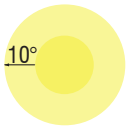
CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

OL-DF-A (DIFFUSION FILM)

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES (FOR USE WITH MULTIPLE MEDIA)

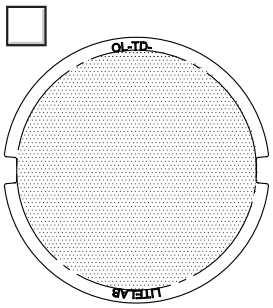


DISTRIBUTION DIAGRAM

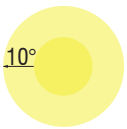


OL-TD-A (POLYCARBONATE DIFFUSION LENS)

DIFFUSION FILM: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES (FOR STANDALONE USE)

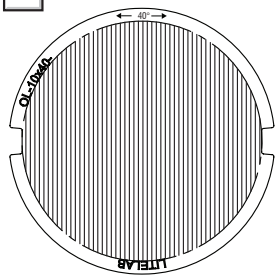


DISTRIBUTION DIAGRAM

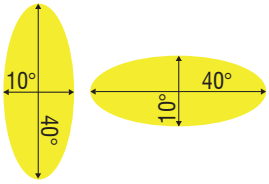


OL-10x40-A (LINEAR SPREAD LENS)

40° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

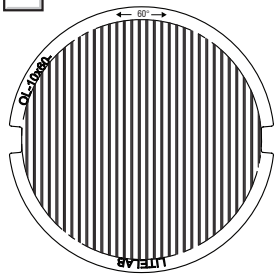


DISTRIBUTION DIAGRAM

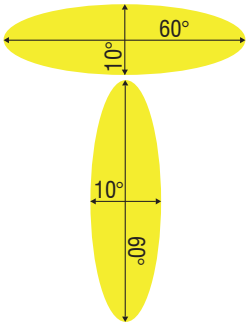


OL-10x60-A (LINEAR SPREAD LENS)

60° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

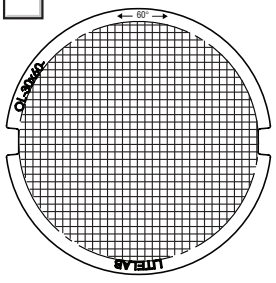


DISTRIBUTION DIAGRAM

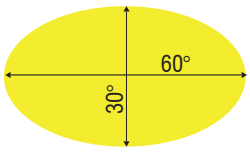


OL-30x60-A (UNIVERSAL SPREAD LENS - INCLUDED)

UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

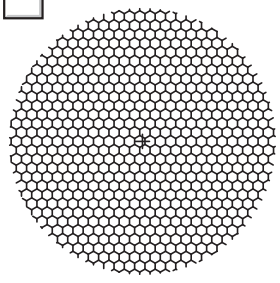


DISTRIBUTION DIAGRAM



LVH/A (HEXCELL LOUVER)

HEXCELL LOUVER: 3MM (0.1") MATTE BACK FINISH, 45° GLARE CUTOFF FOR VISUAL COMFORT



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

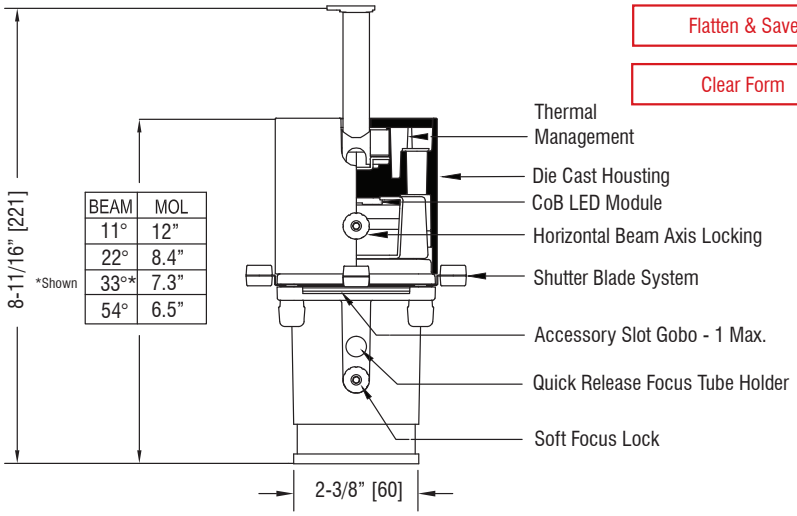
Static White Framing Projector

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1800/1550 Lumens	120VAC/0.19A/23W
	240VAC/0.12A/25W
	277VAC/0.10A/25W
1300/1100 Lumens	120VAC/0.15A/19W
	240 VAC/0.08A/19W
	277 VAC/0.07A/19W

Enter Catalog Number Sequentially from Left to Right

C3P - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI		CCT	
C3P	L18	1800/92	27	2700
	L15	1550/98	30	3000
	L13	1300/92	35	3500
	L11	1100/98	40	4000

Adaptor		Dimming		Level	
9TC	BusRun Clipless	E	ELV	1	1%
9TD	BusRun Deep				
9TS	BusRun Shallow				
9HC	BusRun Clipless w/ Driverbox	E	ELV	0	10%
9HD	BusRun Deep w/ Driverbox	W	Wire-less	C	Casambi
9HS	BusRun Shallow w/ Driverbox			A	Avi-On
				T	Athena RF
ST2	2-Circuit Stucchi	E	ELV	0	10%
ST3	3-Circuit Stucchi	Z	0-10	1	1%
3L	5" Canopy	M	DMX	D	Dark
5L	3.5" QC Canopy	D	DALI		
7L	2" QC Canopy (Remote Driver Only)				

Options	
P*	Potentiometer
R**	Rotation Lock
SP*	Switch w/ Potentiometer
SR**	Switch w/ Rotation Lock

Voltage	
A	120
D	240
F*	240 (2-Circuit)
C	277

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Finish		Optics	
P	White	1	11°
MB	Black	2	22°
BR	Brushed	3	33°
CP	Custom	5	54°

Enter RAL or Other Finish Code

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 5*

☐	64506	11° Focusing Tube
☐	64506-01	22° Focusing Tube
☐	64506-02	33° Focusing Tube
☐	64506-03	54° Focusing Tube
☐	64522-KIT	Gobo Pin Spot Kit
☐	64514	Gobo Carrier

Gobo Carrier accepts 0.37 - 0.5mm Gobos

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C3P

Static White Framing Projector

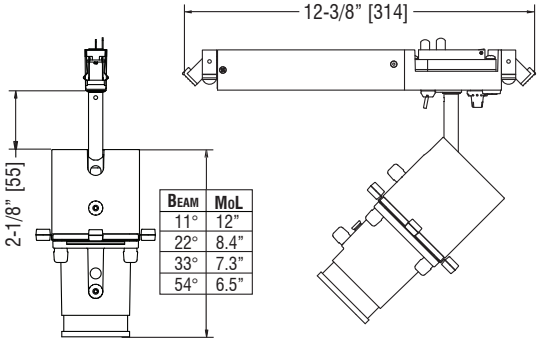
Project Name

Type

Clear Form

Fitter Guide - All fixtures shown with 33° Focusing Tube

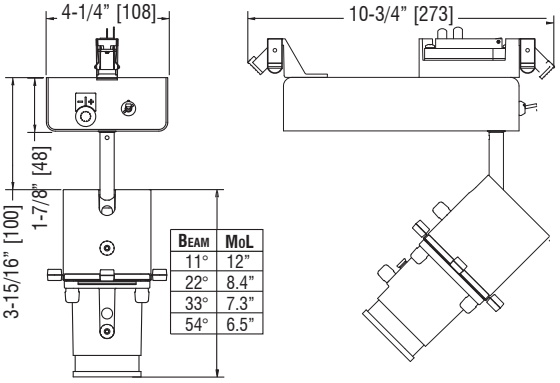
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

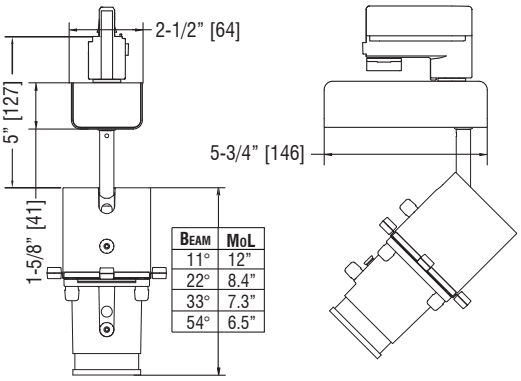
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%. Switch not available for 277 V.

9H - Wireless Control Fitter for BusRun



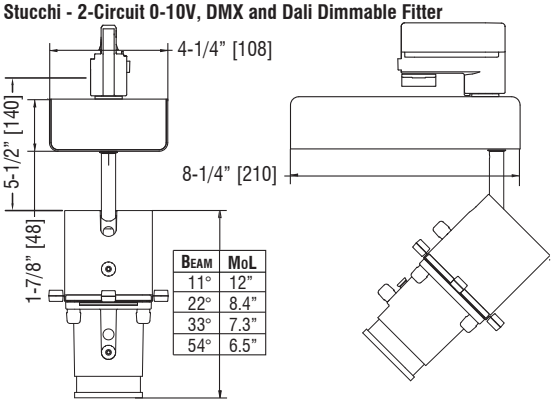
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 2-Circuit ELV & 0-10V Dimmable Fitter



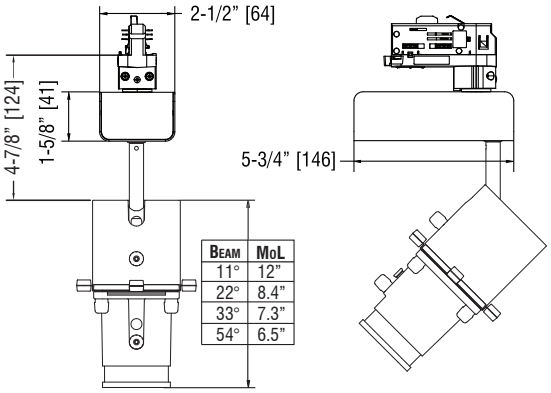
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



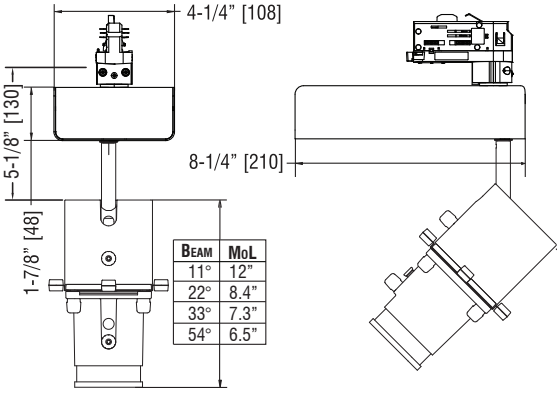
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 3-Circuit ELV & 0-10V Dimmable Fitter



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

Static White Framing Projector

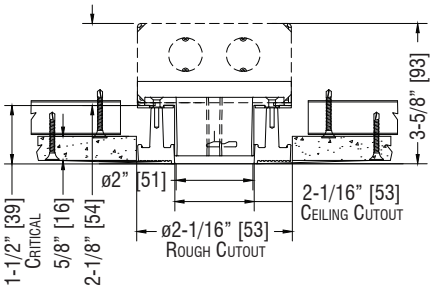
Project Name

Type

Clear Form

Fitter Guide

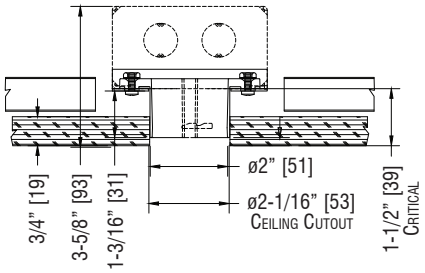
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

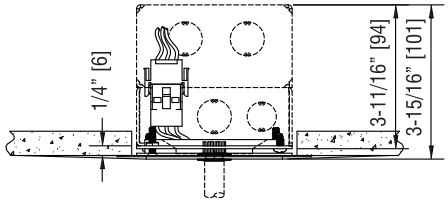


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

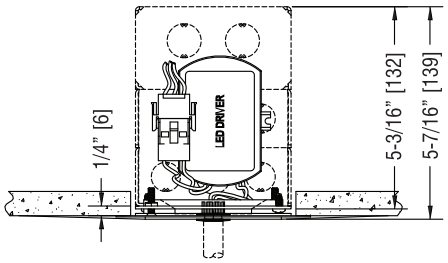
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

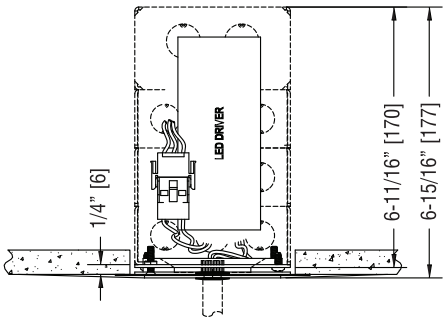
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

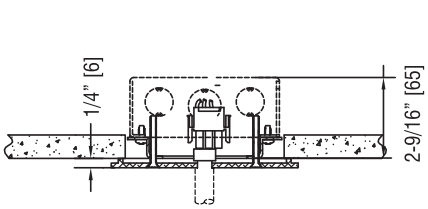


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

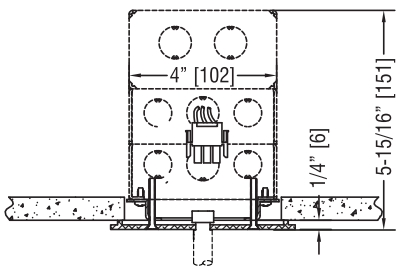


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

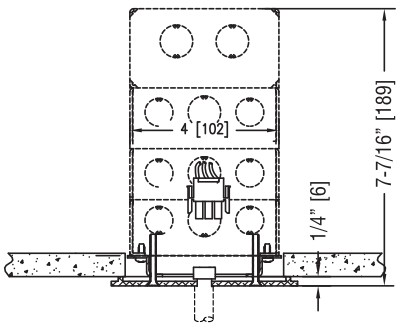
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C3P

Static White Framing Projector

Photometrics

Project Name

Type

Clear Form

C3P-L18 11° Focusing Tube (64506)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	733.8 f.c. / 7,898.6 lux	1.2' / 0.4m
8.0' / 2.4m	412.8 f.c. / 4,443.3 Lux	1.6' / 0.5m
10.0' / 3.0m	264.2 f.c. / 2,843.8 lux	2.0' / 0.6m
12.0' / 3.7m	183.4 f.c. / 1,974.1 lux	2.4' / 0.7m
14.0' / 4.3m	134.8 f.c. / 1,451.0 lux	2.8' / 0.9m
16.0' / 4.9m	103.2 f.c. / 1,110.8 lux	3.2' / 1.0m

CBCP:	26,416 Cd
Efficacy:	36.1 lm/w
Delivered Lumens:	881lm

C39-L18 22° Focusing Tube (64506-01)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	296.4 f.c. / 3,190.4 lux	2.3' / 0.7m
8.0' / 2.4m	166.8 f.c. / 1,795.4 lux	3.1' / 0.9m
10.0' / 3.0m	106.7 f.c. / 1,148.5 lux	3.9' / 1.2m
12.0' / 3.7m	74.1 f.c. / 797.6 lux	4.7' / 1.4m
14.0' / 4.3m	54.4 f.c. / 585.6 lux	5.5' / 1.7m
16.0' / 4.9m	41.7 f.c. / 448.9 lux	6.2' / 1.9m

CBCP:	10,672 Cd
Efficacy:	45.5 lm/w
Delivered Lumens:	1109lm

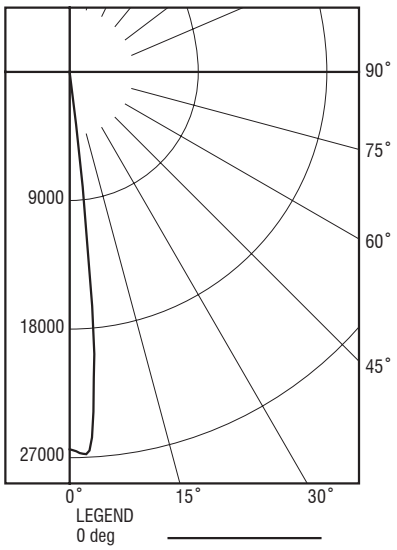
C3P-L18 33° Focusing Tube (64506-02)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	161.2 f.c. / 1,735.1 lux	3.2' / 1.0m
8.0' / 2.4m	90.7 f.c. / 976.3 lux	4.3' / 1.3m
10.0' / 3.0m	58.0 f.c. / 624.3 lux	5.4' / 1.6m
12.0' / 3.7m	40.3 f.c. / 433.8 lux	6.4' / 2.0m
14.0' / 4.3m	29.6 f.c. / 318.6 lux	7.5' / 2.3m
16.0' / 4.9m	22.7 f.c. / 244.3 lux	8.6' / 2.6m

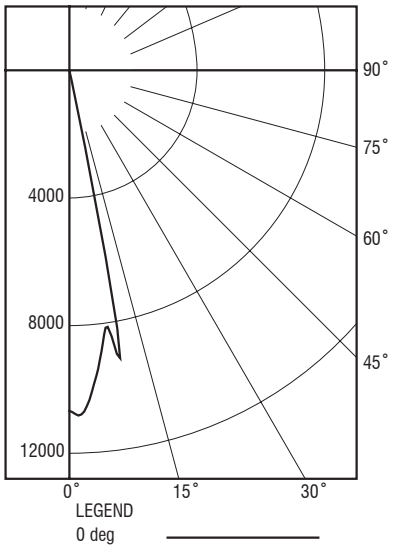
CBCP:	5,803 Cd
Efficacy:	45.7 lm/w
Delivered Lumens:	1115lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

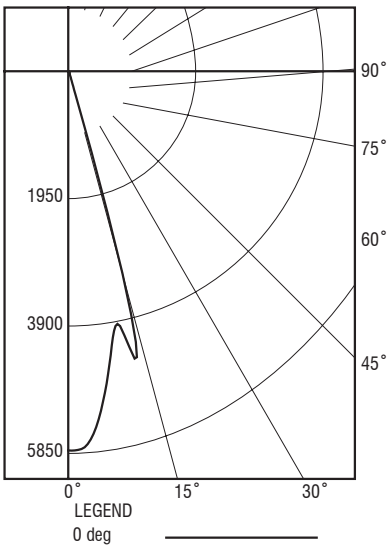
C3P-L18 11° Focusing Tube - Polar Diagram



C3P-L18 22° Focusing Tube - Polar Diagram



C3P-L18 33° Focusing Tube - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C3P

Static White Framing Projector

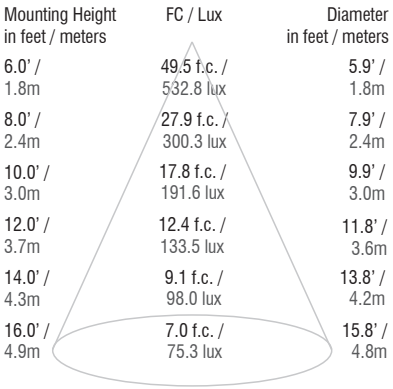
Project Name

Type

Clear Form

Photometrics

C3P-L18 54° Focusing Tube (64506-03)



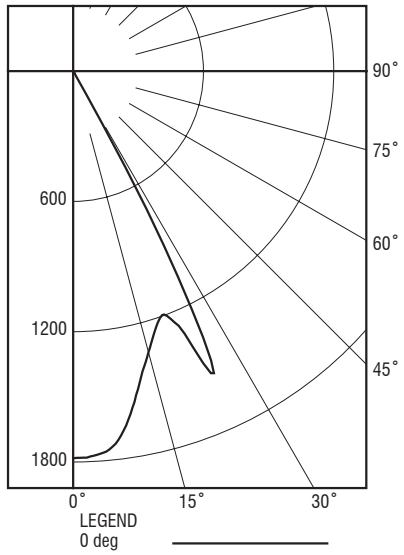
CBCP:	1,783 Cd
Efficacy:	42.4 lm/w
Delivered Lumens:	1039lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

LL P/N	∅ Aperture	LL# 64506 11° Focus Tube	LL# 64506-01 22° Focus Tube	LL# 64506-02 33° Focus Tube	LL# 64506-03 54° Focus Tube
64522-KIT	Includes all listed apertures				
64522-12	∅ 0.125"	1°	2°	2°	5°
64522-25	∅ 0.25"	2°	3°	5°	10°
64522-37	∅ 0.375"	3°	5°	7°	14°
64522-50	∅ 0.50"	3.5°	7°	10°	19°
64522-62	∅ 0.625"	4°	9°	13°	24°
64522-75	∅ 0.75"	5°	10°	15°	28°
64522-87	∅ 0.875"	6°	12°	18°	33°
64522-10	∅ 1.0"	7°	14°	20°	37°
64522-1.12	∅ 1.125"	7.5°	15°	23°	41°
64522-1.25	∅ 1.25"	8°	17°	25°	45°
64522-1.37	∅ 1.375"	9°	19°	27°	48°
64522-1.50	∅ 1.5"	10°	21°	30°	52°

Optical Gobo Carrier (LL P/N 64514) accepts 37.5mm Gobos, Rosco Size (E)

C3P-L18 54° Focusing Tube - Polar Diagram



Foot Candle Chart

Distance	Focus Tube	Foot Candles	Largest Square (in.)
3'	11°	4450	4.9 x 4.9
	22°	1740	9.8 x 9.8
	33°	752	15 x 15
	54°	221	17.3 x 17.3
4'	11°	2205	6.5 x 6.5
	22°	872	13 x 13
	33°	360	20 x 20
	54°	118	26 x 26
5'	11°	1360	8 x 8
	22°	530	16.4 x 16.4
	33°	239	25 x 25
	54°	73	34.5 x 34.5
6'	11°	895	9.8 x 9.8
	22°	348	19.7 x 19.7
	33°	163	30 x 30
	54°	50	43.2 x 43.2
7'	11°	631	11.4 x 11.4
	22°	248	23 x 23
	33°	110	35 x 35
	54°	37	52.2 x 52.2

Distance	Focus Tube	Foot Candles	Largest Square (in.)
8'	11°	481	13 x 13
	22°	187	26.3 x 26.3
	33°	90	40.2 x 40.2
	54°	30	60.5 x 60.5
9'	11°	372	14.7 x 14.7
	22°	144	29.6 x 29.6
	33°	69	45.2 x 45.2
	54°	22	69 x 69
10'	11°	292	16.3 x 16.3
	22°	117	32.9 x 32.9
	33°	56	50.2 x 50.2
	54°	18	75.4 x 75.4
11'	11°	239	17.9 x 17.9
	22°	96	36.2 x 36.2
	33°	45	55.2 x 55.2
	54°	15	86.4 x 86.4
12'	11°	199	19.6 x 19.6
	22°	80	39.5 x 39.5
	33°	38	60.3 x 60.3
	54°	12	95 x 95

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

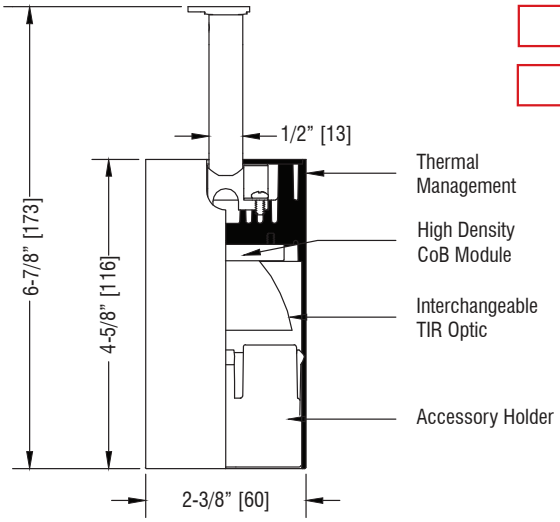
Static White
Fixed Object

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1600/1450 Lumens	120VAC/0.2A/23W
	240VAC/0.2A/23W
	277VAC/0.1A/23W

Enter Catalog Number Sequentially from Left to Right

C20 - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI	CCT
C20	L16 1600/92	27 2700
	L14 1450/98	30 3000
		35 3500
		40 4000

Adaptor	Dimming	Level
9TC BusRun Clipless	E ELV	1 1%
9TD BusRun Deep		
9TS BusRun Shallow		
9HC BusRun Clipless w/ Driverbox	E ELV	0 10%
9HD BusRun Deep w/ Driverbox	W Wire-less	C Casambi
9HS BusRun Shallow w/ Driverbox		A Avi-On
		T Athena RF
ST2 2-Circuit Stucchi	E ELV	0 10%
ST3 3-Circuit Stucchi	Z 0-10	1 1%
3L 5" Canopy	M DMX	D Dark
5L 3.5" QC Canopy	D DALI	
7L 2" QC Canopy (Remote Driver Only)		

Options
P* Potentiometer
R** Rotation Lock
SP* Switch w/ Potentiometer
SR** Switch w/ Rotation Lock

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Voltage
A 120
D 240
F* 240 (2-Circuit)
C 277

Finish	Optics
P White	1 15°
MB Black	2 25°
BR Brushed	3 35°
CP Custom	

Enter RAL or Other Finish Code

Optics

- ☐ 15° — OL-RS-ILONA-50-KIT
- ☐ 25° — OL-M-ILONA-50-KIT
- ☐ 35° — OL-W-ILONA-50-KIT

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 6*

- ☐ OL-DF-a — Beam Softening Film
- ☐ OL-TD-a — Beam Softening Lens
- ☐ OL-10x40-a — Linear Spread Lens
- ☐ OL-10x60-a — Linear Spread Lens
- ☐ OL-30x60-a — Universal Spread Lens
- ☐ LVH/a — Hexell Louver
- ☐ CHB/a-2 — Crosshair Baffle

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL Intertek

C20

Static White
Fixed Object

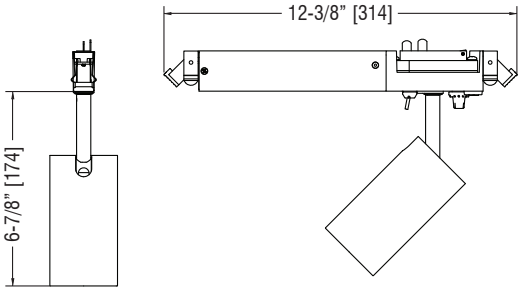
Project Name

Type

Clear Form

Fitter Guide

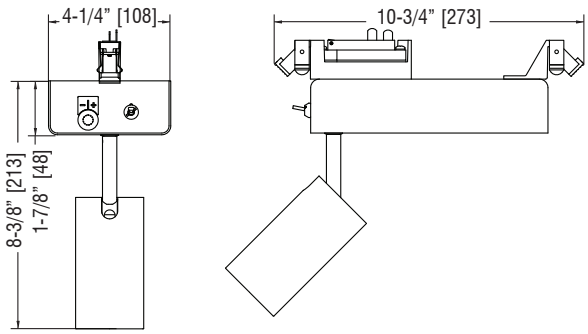
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



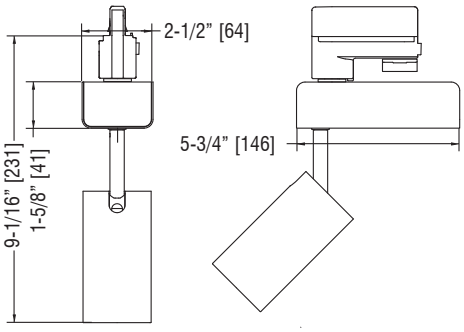
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%.

Switch not available for 277 V.

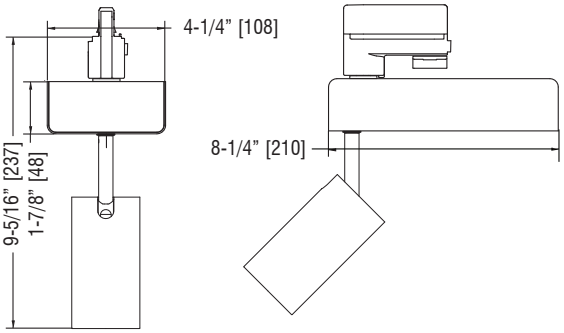
9H - Wireless Control Fitter for BusRun



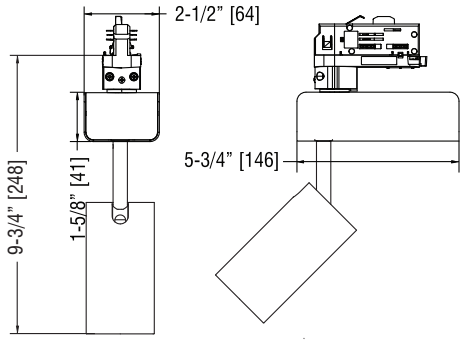
Stucchi - 2-Circuit ELV Dimmable Fitter



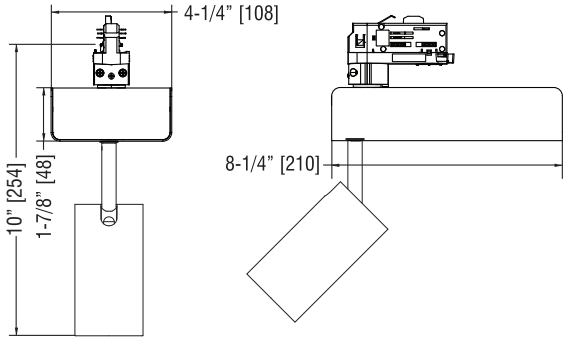
Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



Stucchi - 3-Circuit ELV Dimmable Fitter



Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

Static White
Fixed Object

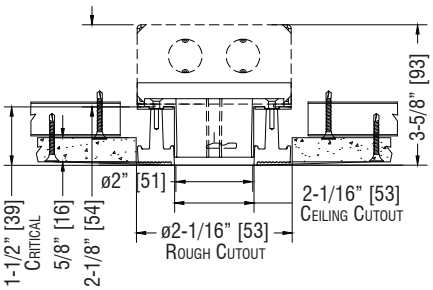
Project Name

Type

Clear Form

Fitter Guide

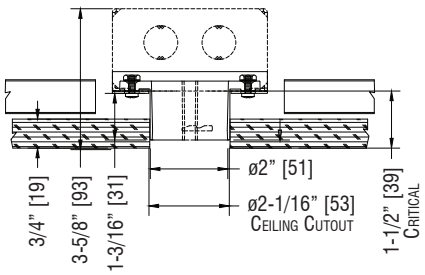
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

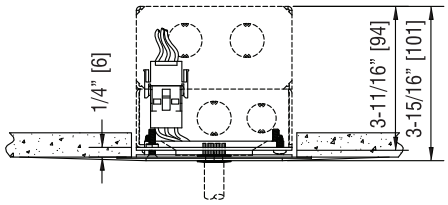


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

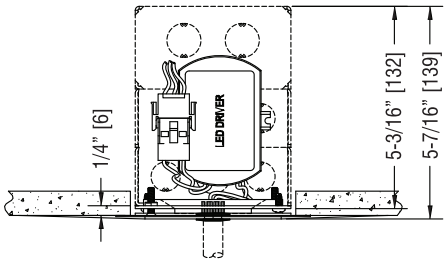
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

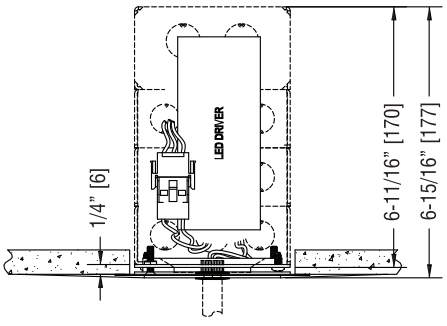
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

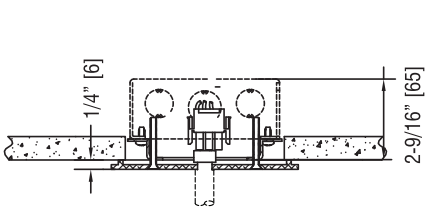


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

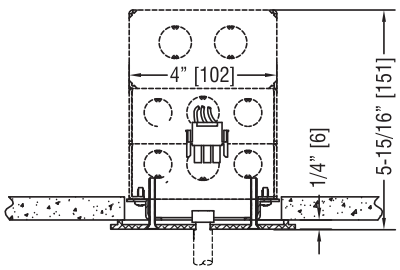


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

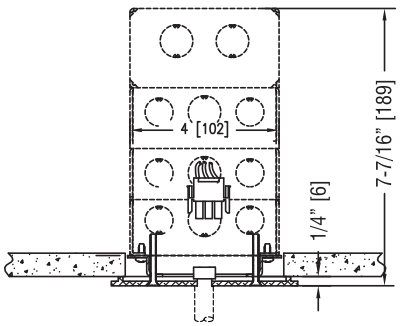
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L16 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	294.0 f.c. / 3,164.6 lux	1.6' / 0.5m
8.0' / 2.4m	165.4 f.c. / 1,780.4 lux	2.1' / 0.6m
10.0' / 3.0m	105.9 f.c. / 1,139.9 lux	2.6' / 0.8m
12.0' / 3.7m	73.5 f.c. / 791.1 lux	3.2' / 1.0m
14.0' / 4.3m	54.0 f.c. / 581.3 lux	3.7' / 1.1m
16.0' / 4.9m	41.3 f.c. / 444.5 lux	4.2' / 1.3m

CBCP:	10,585 Cd
Efficacy:	62.6 lm/w
Delivered Lumens:	820 lm

C20-L16 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	104.4 f.c. / 1,123.8 lux	2.6' / 0.8m
8.0' / 2.4m	58.7 f.c. / 6318 lux	3.4' / 1.0m
10.0' / 3.0m	37.6 f.c. / 404.7 lux	4.3' / 1.3m
12.0' / 3.7m	26.1 f.c. / 280.9 lux	5.1' / 1.6m
14.0' / 4.3m	19.2 f.c. / 206.7 lux	6.0' / 1.8m
16.0' / 4.9m	14.7 f.c. / 158.2 lux	6.8' / 2.1m

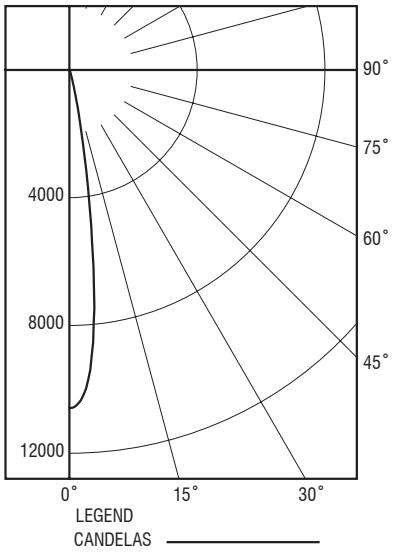
CBCP:	3757 Cd
Efficacy:	57.0 lm/w
Delivered Lumens:	747 lm

C20-L16 35° Optic (OL-W-ILONA-50MM)

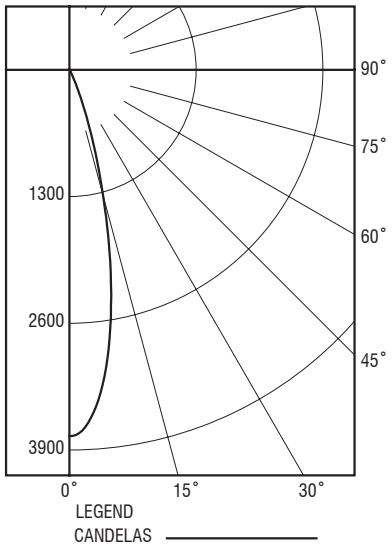
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	51.5 f.c. / 554.3 lux	3.5' / 1.1m
8.0' / 2.4m	29.0 f.c. / 312.2 lux	4.7' / 1.4m
10.0' / 3.0m	18.5 f.c. / 199.1 lux	5.0' / 1.5m
12.0' / 3.7m	12.9 f.c. / 138.9 lux	7.1' / 2.2m
14.0' / 4.3m	9.5 f.c. / 102.3 lux	8.2' / 2.5m
16.0' / 4.9m	7.2 f.c. / 77.5 lux	9.4' / 2.9m

CBCP:	1853 Cd
Efficacy:	50.1 lm/w
Delivered Lumens:	656 lm

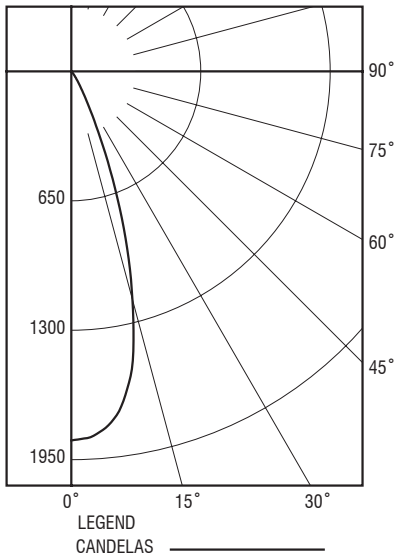
C20-L16 15° Optic - Polar Diagram



C20-L16 25° Optic - Polar Diagram



C20-L16 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L14 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	256.6 f.c. / 2,762.0 lux	1.6' / 0.5m
8.0' / 2.4m	144.3 f.c. / 1,556.8 lux	2.1' / 0.6m
10.0' / 3.0m	92.4 f.c. / 994.6 lux	2.7' / 0.8m
12.0' / 3.7m	64.1 f.c. / 690.0 lux	3.2' / 1.0m
14.0' / 4.3m	47.1 f.c. / 507.0 lux	3.7' / 1.1m
16.0' / 4.9m	36.1 f.c. / 388.6 lux	4.3' / 1.3m

CBCP:	9,237 Cd
Efficacy:	50.9 lm/w
Delivered Lumens:	728 lm

C20-L14 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	96.7 f.c. / 1,040.9 lux	2.5' / 0.8m
8.0' / 2.4m	54.4 f.c. / 585.6 lux	3.3' / 1.0m
10.0' / 3.0m	34.8 f.c. / 374.6 lux	4.2' / 1.3m
12.0' / 3.7m	24.2 f.c. / 260.5 lux	5.0' / 1.5m
14.0' / 4.3m	17.8 f.c. / 191.6 lux	5.9' / 1.8m
16.0' / 4.9m	13.6 f.c. / 146.4 lux	6.7' / 2.0m

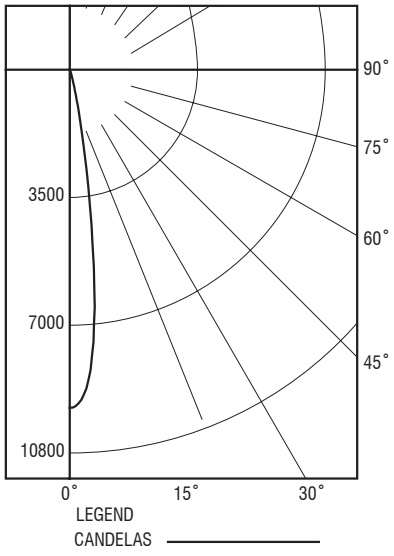
CBCP:	3481 Cd
Efficacy:	47.1 lm/w
Delivered Lumens:	673 lm

C20-L1435° Optic (OL-W-ILONA-50MM)

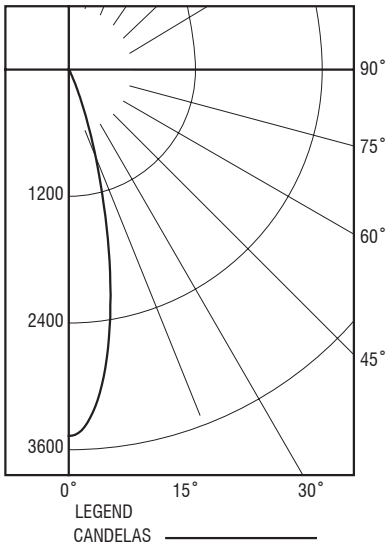
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	46.0 f.c. / 495.1 lux	3.5' / 1.1m
8.0' / 2.4m	25.9 f.c. / 278.8 lux	4.7' / 1.4m
10.0' / 3.0m	16.6 f.c. / 178.7 lux	5.0' / 1.5m
12.0' / 3.7m	11.5 f.c. / 123.8 lux	7.0' / 2.1m
14.0' / 4.3m	8.5 f.c. / 91.5 lux	8.2' / 2.5m
16.0' / 4.9m	6.5 f.c. / 70.0 lux	9.4' / 2.9m

CBCP:	1657 Cd
Efficacy:	40.5 lm/w
Delivered Lumens:	583 lm

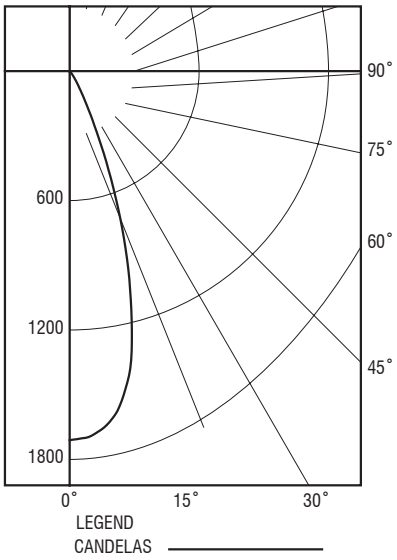
C20-L14 15° Optic - Polar Diagram



C20-L14 25° Optic - Polar Diagram



C20-L14 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

Static White
Fixed Object

Project Name

Type

Clear Form

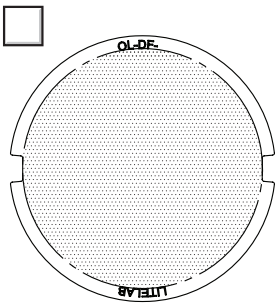
Accessories

FIXTURE SIZE CODE (A): Ø1.95" [50mm]

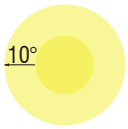
CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

OL-DF-A (DIFFUSION FILM)

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES (FOR USE WITH MULTIPLE MEDIA)

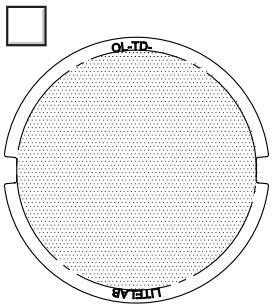


DISTRIBUTION DIAGRAM

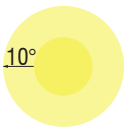


OL-TD-A (POLYCARBONATE DIFFUSION LENS)

DIFFUSION FILM: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES (FOR STANDALONE USE)

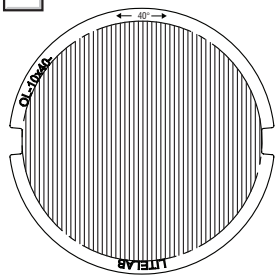


DISTRIBUTION DIAGRAM

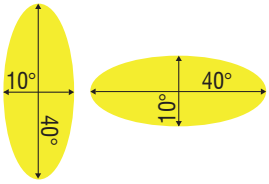


OL-10x40-A (LINEAR SPREAD LENS)

40° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

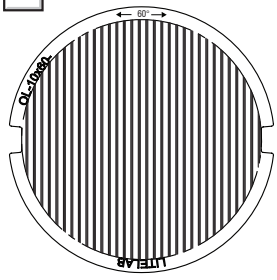


DISTRIBUTION DIAGRAM

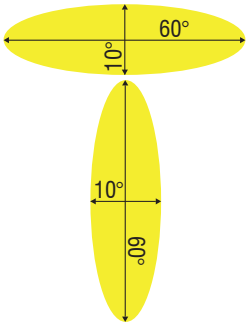


OL-10x60-A (LINEAR SPREAD LENS)

60° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

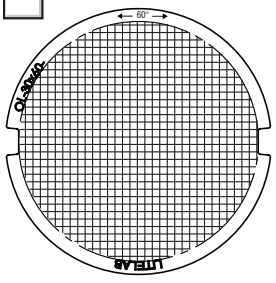


DISTRIBUTION DIAGRAM

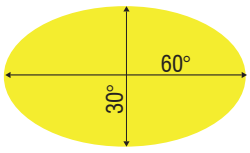


OL-30x60-A (UNIVERSAL SPREAD LENS - INCLUDED)

UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

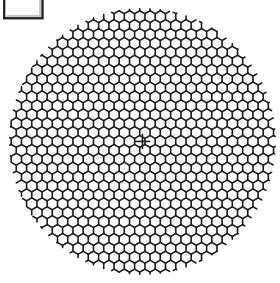


DISTRIBUTION DIAGRAM



LVH/A (HEXCELL LOUVER)

HEXCELL LOUVER: 3MM (0.1") MATTE BACK FINISH, 45° GLARE CUTOFF FOR VISUAL COMFORT



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

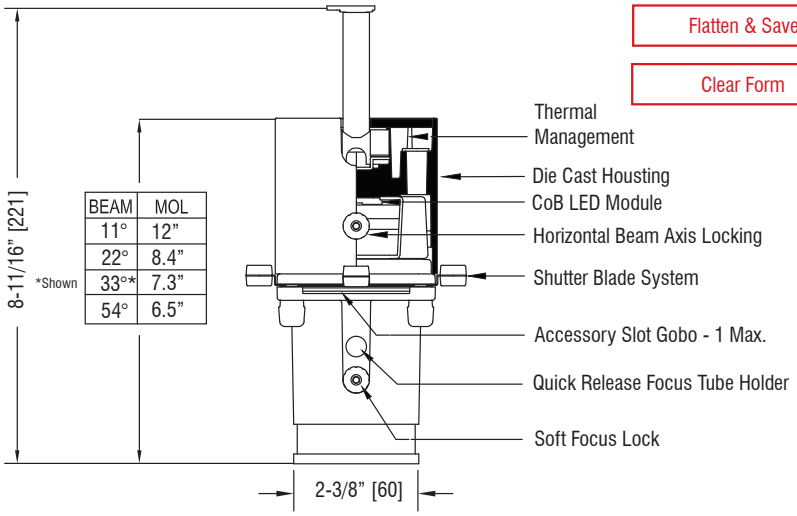
Static White Framing Projector

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1800/1550 Lumens	120VAC/0.19A/23W
	240VAC/0.12A/25W
	277VAC/0.10A/25W
1300/1100 Lumens	120VAC/0.15A/19W
	240 VAC/0.08A/19W
	277 VAC/0.07A/19W

Enter Catalog Number Sequentially from Left to Right

C3P - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI		CCT	
C3P	L18	1800/92	27	2700
	L15	1550/98	30	3000
	L13	1300/92	35	3500
	L11	1100/98	40	4000

Adaptor		Dimming		Level	
9TC	BusRun Clipless	E	ELV	1	1%
9TD	BusRun Deep				
9TS	BusRun Shallow				
9HC	BusRun Clipless w/ Driverbox	E	ELV	0	10%
9HD	BusRun Deep w/ Driverbox	W	Wire-less	C	Casambi
9HS	BusRun Shallow w/ Driverbox			A	Avi-On
				T	Athena RF
ST2	2-Circuit Stucchi	E	ELV	0	10%
ST3	3-Circuit Stucchi	Z	0-10	1	1%
3L	5" Canopy	M	DMX	D	Dark
5L	3.5" QC Canopy	D	DALI		
7L	2" QC Canopy (Remote Driver Only)				

Options	
P*	Potentiometer
R**	Rotation Lock
SP*	Switch w/ Potentiometer
SR**	Switch w/ Rotation Lock

Voltage	
A	120
D	240
F*	240 (2-Circuit)
C	277

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Finish		Optics	
P	White	1	11°
MB	Black	2	22°
BR	Brushed	3	33°
CP	Custom	5	54°

Enter RAL or Other Finish Code

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 5*

☐	64506	11° Focusing Tube
☐	64506-01	22° Focusing Tube
☐	64506-02	33° Focusing Tube
☐	64506-03	54° Focusing Tube
☐	64522-KIT	Gobo Pin Spot Kit
☐	64514	Gobo Carrier

Gobo Carrier accepts 0.37 - 0.5mm Gobos

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL Intertek

C3P

Static White Framing Projector

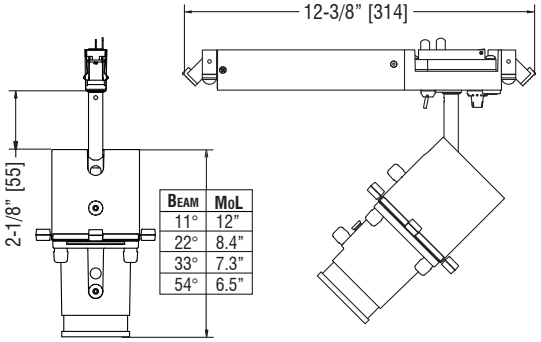
Project Name

Type

Clear Form

Fitter Guide - All fixtures shown with 33° Focusing Tube

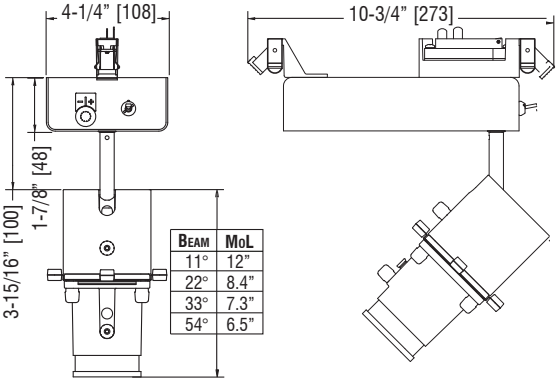
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

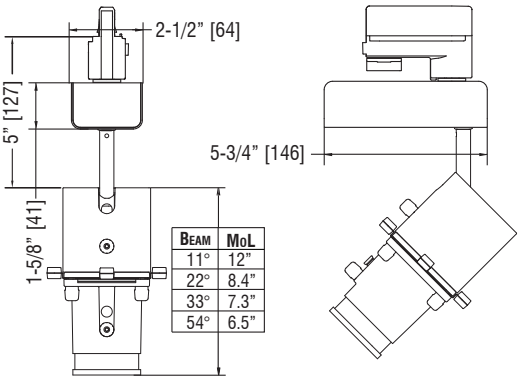
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%. Switch not available for 277 V.

9H - Wireless Control Fitter for BusRun



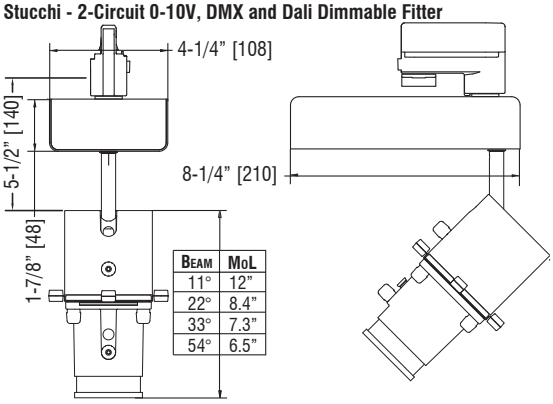
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 2-Circuit ELV & 0-10V Dimmable Fitter



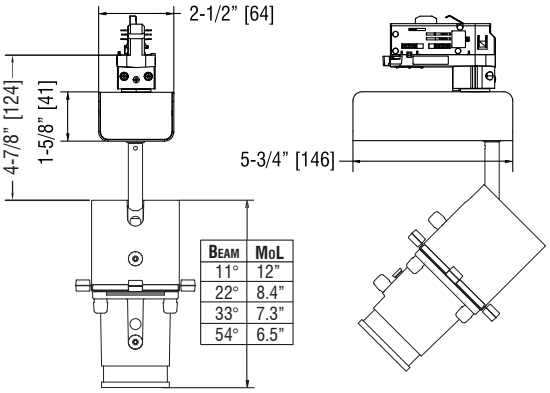
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



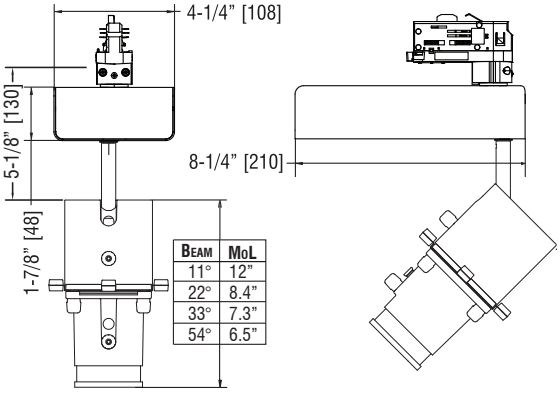
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 3-Circuit ELV & 0-10V Dimmable Fitter



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

Static White Framing Projector

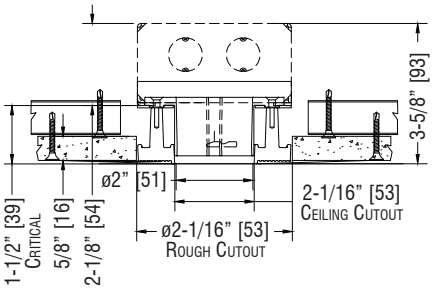
Project Name

Type

Clear Form

Fitter Guide

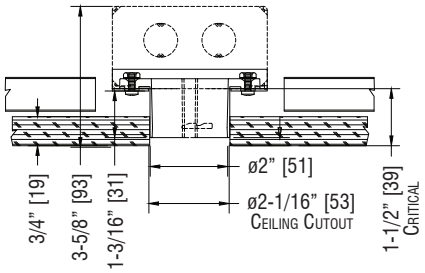
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

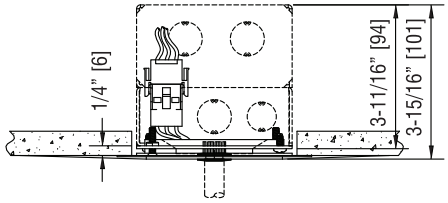


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

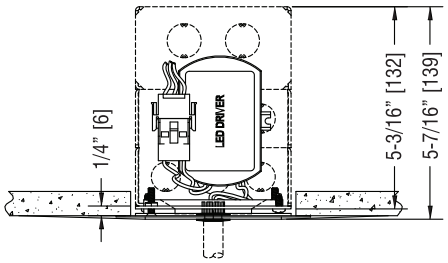
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

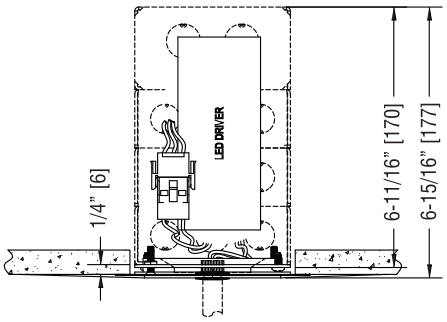
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

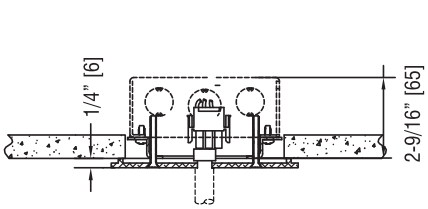


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

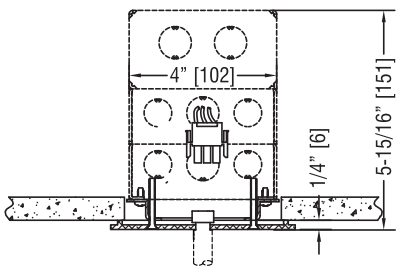


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

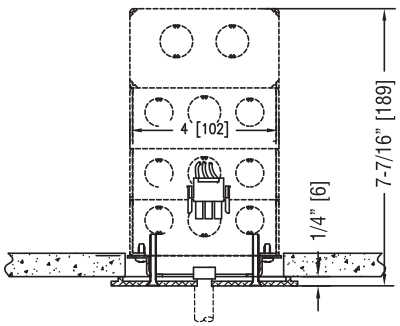
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C3P

Static White Framing Projector

Photometrics

Project Name

Type

Clear Form

C3P-L18 11° Focusing Tube (64506)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	733.8 f.c. / 7,898.6 lux	1.2' / 0.4m
8.0' / 2.4m	412.8 f.c. / 4,443.3 Lux	1.6' / 0.5m
10.0' / 3.0m	264.2 f.c. / 2,843.8 lux	2.0' / 0.6m
12.0' / 3.7m	183.4 f.c. / 1,974.1 lux	2.4' / 0.7m
14.0' / 4.3m	134.8 f.c. / 1,451.0 lux	2.8' / 0.9m
16.0' / 4.9m	103.2 f.c. / 1,110.8 lux	3.2' / 1.0m

CBCP:	26,416 Cd
Efficacy:	36.1 lm/w
Delivered Lumens:	881lm

C39-L18 22° Focusing Tube (64506-01)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	296.4 f.c. / 3,190.4 lux	2.3' / 0.7m
8.0' / 2.4m	166.8 f.c. / 1,795.4 lux	3.1' / 0.9m
10.0' / 3.0m	106.7 f.c. / 1,148.5 lux	3.9' / 1.2m
12.0' / 3.7m	74.1 f.c. / 797.6 lux	4.7' / 1.4m
14.0' / 4.3m	54.4 f.c. / 585.6 lux	5.5' / 1.7m
16.0' / 4.9m	41.7 f.c. / 448.9 lux	6.2' / 1.9m

CBCP:	10,672 Cd
Efficacy:	45.5 lm/w
Delivered Lumens:	1109lm

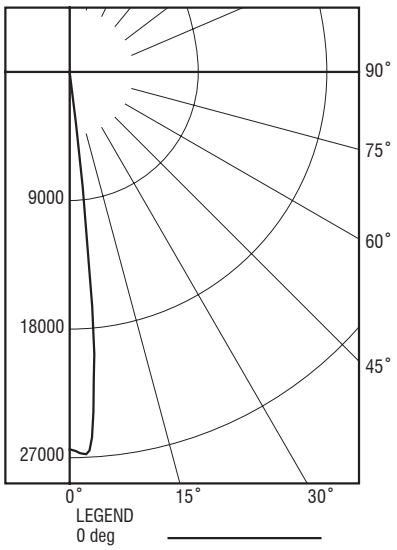
C3P-L18 33° Focusing Tube (64506-02)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	161.2 f.c. / 1,735.1 lux	3.2' / 1.0m
8.0' / 2.4m	90.7 f.c. / 976.3 lux	4.3' / 1.3m
10.0' / 3.0m	58.0 f.c. / 624.3 lux	5.4' / 1.6m
12.0' / 3.7m	40.3 f.c. / 433.8 lux	6.4' / 2.0m
14.0' / 4.3m	29.6 f.c. / 318.6 lux	7.5' / 2.3m
16.0' / 4.9m	22.7 f.c. / 244.3 lux	8.6' / 2.6m

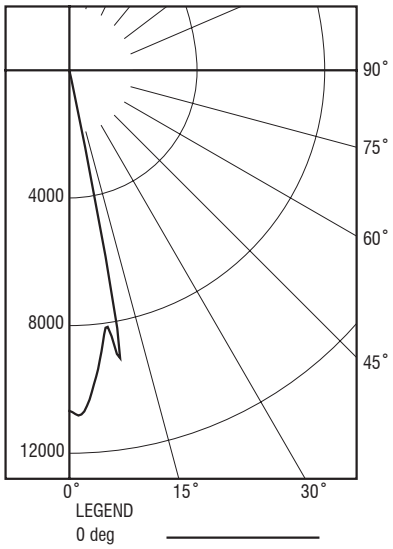
CBCP:	5,803 Cd
Efficacy:	45.7 lm/w
Delivered Lumens:	1115lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

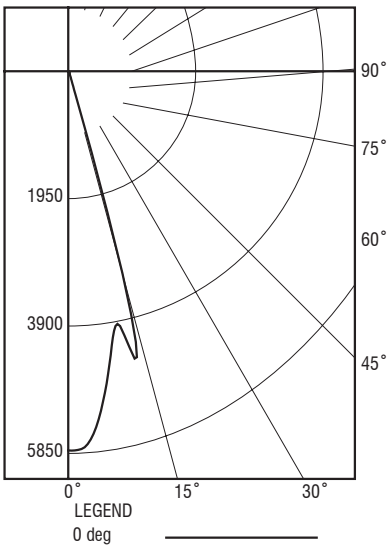
C3P-L18 11° Focusing Tube - Polar Diagram



C3P-L18 22° Focusing Tube - Polar Diagram



C3P-L18 33° Focusing Tube - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C3P

Static White Framing Projector

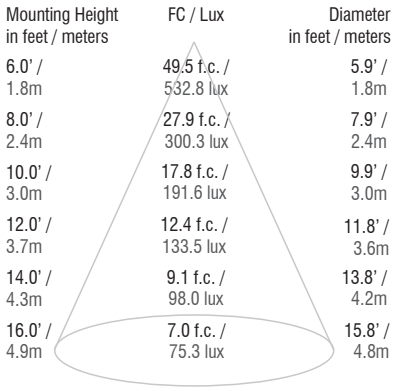
Project Name

Type

Clear Form

Photometrics

C3P-L18 54° Focusing Tube (64506-03)



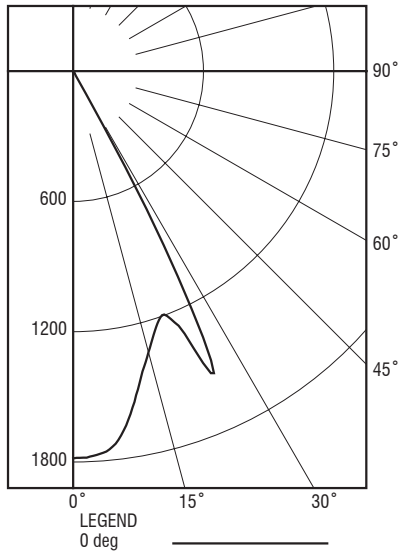
CBCP:	1,783 Cd
Efficacy:	42.4 lm/w
Delivered Lumens:	1039lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

LL P/N	∅ Aperture	LL# 64506 11° Focus Tube	LL# 64506-01 22° Focus Tube	LL# 64506-02 33° Focus Tube	LL# 64506-03 54° Focus Tube
64522-KIT	Includes all listed apertures				
64522-12	∅ 0.125"	1°	2°	2°	5°
64522-25	∅ 0.25"	2°	3°	5°	10°
64522-37	∅ 0.375"	3°	5°	7°	14°
64522-50	∅ 0.50"	3.5°	7°	10°	19°
64522-62	∅ 0.625"	4°	9°	13°	24°
64522-75	∅ 0.75"	5°	10°	15°	28°
64522-87	∅ 0.875"	6°	12°	18°	33°
64522-10	∅ 1.0"	7°	14°	20°	37°
64522-1.12	∅ 1.125"	7.5°	15°	23°	41°
64522-1.25	∅ 1.25"	8°	17°	25°	45°
64522-1.37	∅ 1.375"	9°	19°	27°	48°
64522-1.50	∅ 1.5"	10°	21°	30°	52°

Optical Gobo Carrier (LL P/N 64514) accepts 37.5mm Gobos, Rosco Size (E)

C3P-L18 54° Focusing Tube - Polar Diagram



Foot Candle Chart

Distance	Focus Tube	Foot Candles	Largest Square (in.)
3'	11°	4450	4.9 x 4.9
	22°	1740	9.8 x 9.8
	33°	752	15 x 15
	54°	221	17.3 x 17.3
4'	11°	2205	6.5 x 6.5
	22°	872	13 x 13
	33°	360	20 x 20
	54°	118	26 x 26
5'	11°	1360	8 x 8
	22°	530	16.4 x 16.4
	33°	239	25 x 25
	54°	73	34.5 x 34.5
6'	11°	895	9.8 x 9.8
	22°	348	19.7 x 19.7
	33°	163	30 x 30
	54°	50	43.2 x 43.2
7'	11°	631	11.4 x 11.4
	22°	248	23 x 23
	33°	110	35 x 35
	54°	37	52.2 x 52.2

Distance	Focus Tube	Foot Candles	Largest Square (in.)
8'	11°	481	13 x 13
	22°	187	26.3 x 26.3
	33°	90	40.2 x 40.2
	54°	30	60.5 x 60.5
9'	11°	372	14.7 x 14.7
	22°	144	29.6 x 29.6
	33°	69	45.2 x 45.2
	54°	22	69 x 69
10'	11°	292	16.3 x 16.3
	22°	117	32.9 x 32.9
	33°	56	50.2 x 50.2
	54°	18	75.4 x 75.4
11'	11°	239	17.9 x 17.9
	22°	96	36.2 x 36.2
	33°	45	55.2 x 55.2
	54°	15	86.4 x 86.4
12'	11°	199	19.6 x 19.6
	22°	80	39.5 x 39.5
	33°	38	60.3 x 60.3
	54°	12	95 x 95

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

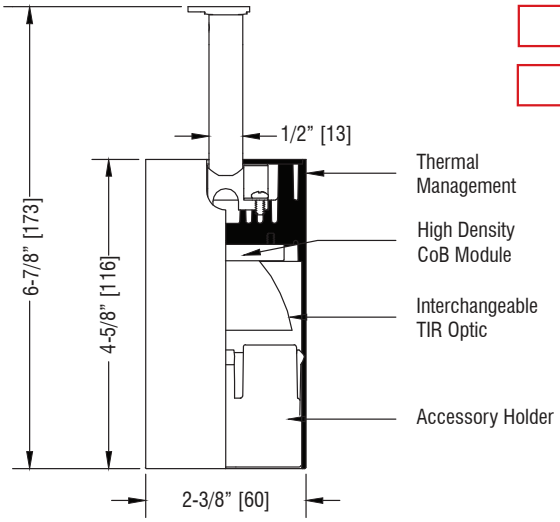
Static White
Fixed Object

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1600/1450 Lumens	120VAC/0.2A/23W
	240VAC/0.2A/23W
	277VAC/0.1A/23W

Enter Catalog Number Sequentially from Left to Right

C20 - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI	CCT
C20	L16 1600/92	27 2700
	L14 1450/98	30 3000
		35 3500
		40 4000

Adaptor	Dimming	Level
9TC BusRun Clipless	E ELV	1 1%
9TD BusRun Deep		
9TS BusRun Shallow		
9HC BusRun Clipless w/ Driverbox	E ELV	0 10%
9HD BusRun Deep w/ Driverbox	W Wire-less	C Casambi
9HS BusRun Shallow w/ Driverbox		A Avi-On
		T Athena RF
ST2 2-Circuit Stucchi	E ELV	0 10%
ST3 3-Circuit Stucchi	Z 0-10	1 1%
3L 5" Canopy	M DMX	D Dark
5L 3.5" QC Canopy	D DALI	
7L 2" QC Canopy (Remote Driver Only)		

Options
P* Potentiometer
R** Rotation Lock
SP* Switch w/ Potentiometer
SR** Switch w/ Rotation Lock

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Voltage
A 120
D 240
F* 240 (2-Circuit)
C 277

Finish	Optics
P White	1 15°
MB Black	2 25°
BR Brushed	3 35°
CP Custom	

Enter RAL or Other Finish Code

Optics

- ☐ 15° — OL-RS-ILONA-50-KIT
- ☐ 25° — OL-M-ILONA-50-KIT
- ☐ 35° — OL-W-ILONA-50-KIT

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 6*

- ☐ OL-DF-a — Beam Softening Film
- ☐ OL-TD-a — Beam Softening Lens
- ☐ OL-10x40-a — Linear Spread Lens
- ☐ OL-10x60-a — Linear Spread Lens
- ☐ OL-30x60-a — Universal Spread Lens
- ☐ LVH/a — Hexell Louver
- ☐ CHB/a-2 — Crosshair Baffle

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL Intertek

C20

Static White
Fixed Object

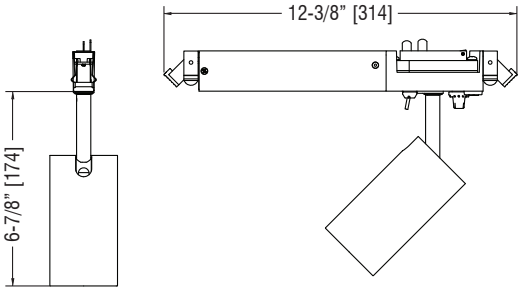
Project Name

Type

Clear Form

Fitter Guide

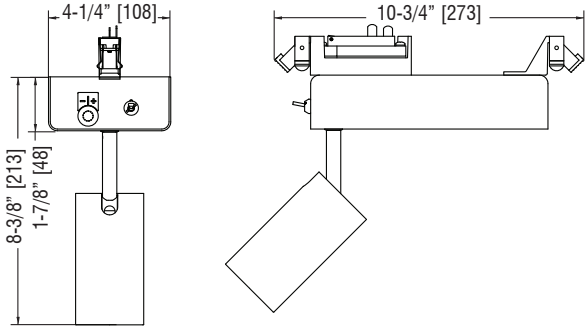
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



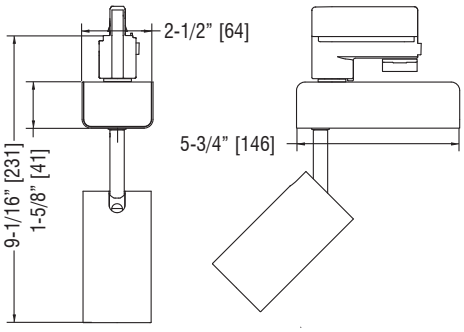
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%.

Switch not available for 277 V.

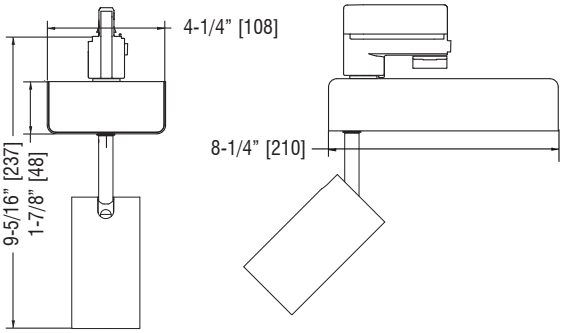
9H - Wireless Control Fitter for BusRun



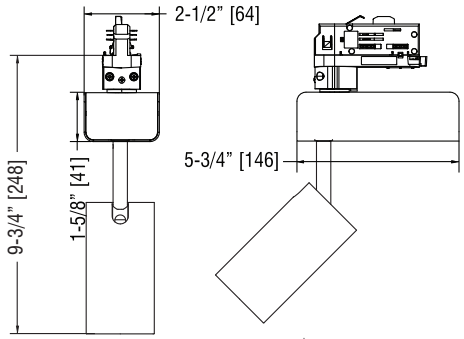
Stucchi - 2-Circuit ELV Dimmable Fitter



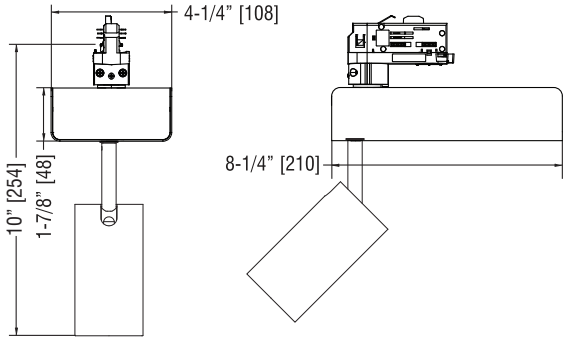
Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



Stucchi - 3-Circuit ELV Dimmable Fitter



Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

Static White
Fixed Object

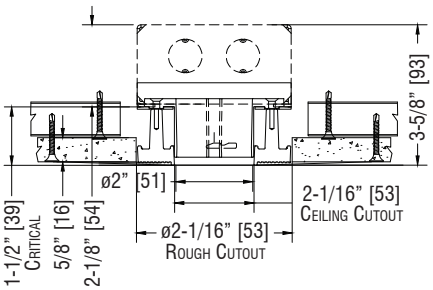
Project Name

Type

Clear Form

Fitter Guide

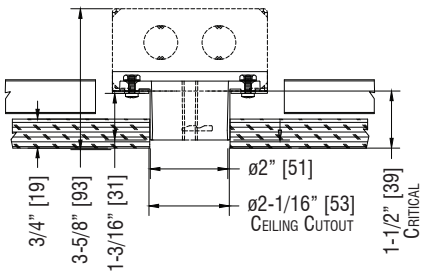
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

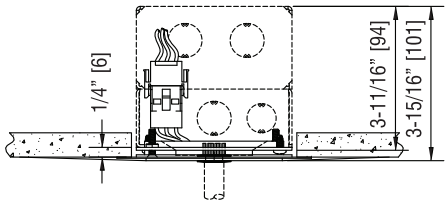


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

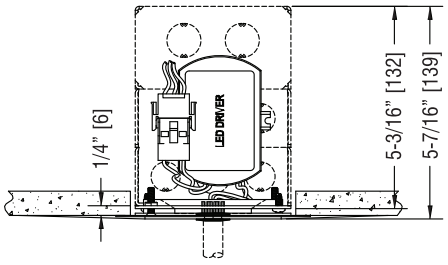
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

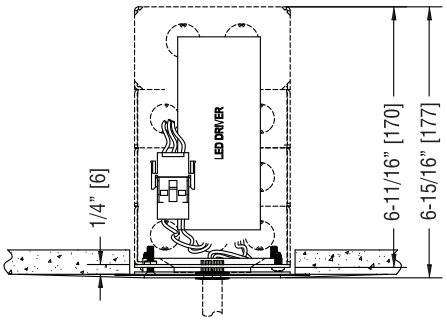
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

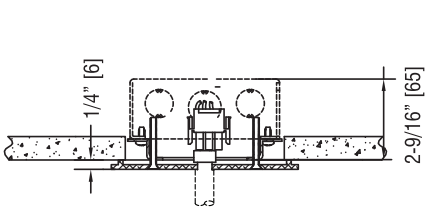


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

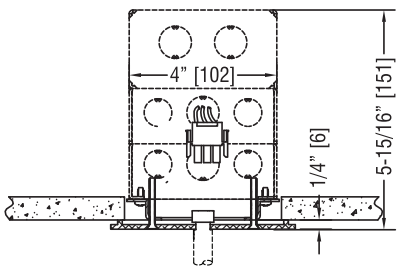


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

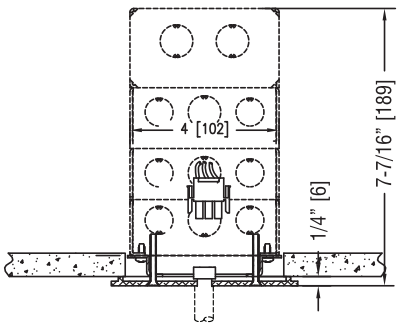
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L16 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	294.0 f.c. / 3,164.6 lux	1.6' / 0.5m
8.0' / 2.4m	165.4 f.c. / 1,780.4 lux	2.1' / 0.6m
10.0' / 3.0m	105.9 f.c. / 1,139.9 lux	2.6' / 0.8m
12.0' / 3.7m	73.5 f.c. / 791.1 lux	3.2' / 1.0m
14.0' / 4.3m	54.0 f.c. / 581.3 lux	3.7' / 1.1m
16.0' / 4.9m	41.3 f.c. / 444.5 lux	4.2' / 1.3m

CBCP:	10,585 Cd
Efficacy:	62.6 lm/w
Delivered Lumens:	820 lm

C20-L16 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	104.4 f.c. / 1,123.8 lux	2.6' / 0.8m
8.0' / 2.4m	58.7 f.c. / 6318 lux	3.4' / 1.0m
10.0' / 3.0m	37.6 f.c. / 404.7 lux	4.3' / 1.3m
12.0' / 3.7m	26.1 f.c. / 280.9 lux	5.1' / 1.6m
14.0' / 4.3m	19.2 f.c. / 206.7 lux	6.0' / 1.8m
16.0' / 4.9m	14.7 f.c. / 158.2 lux	6.8' / 2.1m

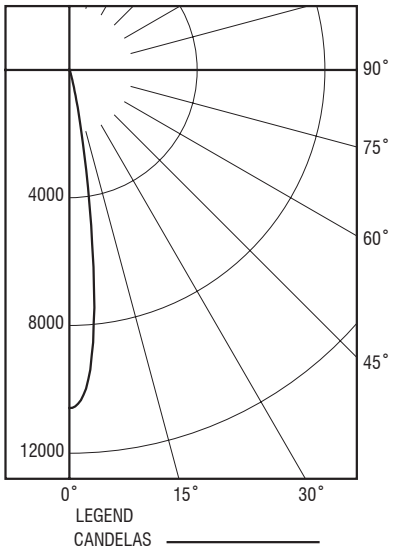
CBCP:	3757 Cd
Efficacy:	57.0 lm/w
Delivered Lumens:	747 lm

C20-L16 35° Optic (OL-W-ILONA-50MM)

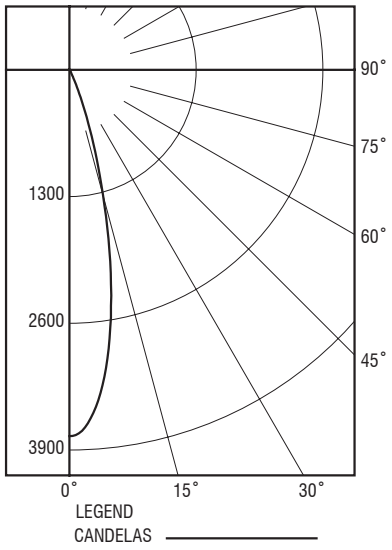
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	51.5 f.c. / 554.3 lux	3.5' / 1.1m
8.0' / 2.4m	29.0 f.c. / 312.2 lux	4.7' / 1.4m
10.0' / 3.0m	18.5 f.c. / 199.1 lux	5.0' / 1.5m
12.0' / 3.7m	12.9 f.c. / 138.9 lux	7.1' / 2.2m
14.0' / 4.3m	9.5 f.c. / 102.3 lux	8.2' / 2.5m
16.0' / 4.9m	7.2 f.c. / 77.5 lux	9.4' / 2.9m

CBCP:	1853 Cd
Efficacy:	50.1 lm/w
Delivered Lumens:	656 lm

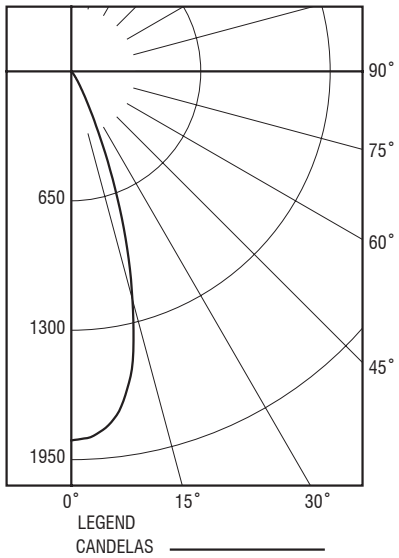
C20-L16 15° Optic - Polar Diagram



C20-L16 25° Optic - Polar Diagram



C20-L16 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L14 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	256.6 f.c. / 2,762.0 lux	1.6' / 0.5m
8.0' / 2.4m	144.3 f.c. / 1,556.8 lux	2.1' / 0.6m
10.0' / 3.0m	92.4 f.c. / 994.6 lux	2.7' / 0.8m
12.0' / 3.7m	64.1 f.c. / 690.0 lux	3.2' / 1.0m
14.0' / 4.3m	47.1 f.c. / 507.0 lux	3.7' / 1.1m
16.0' / 4.9m	36.1 f.c. / 388.6 lux	4.3' / 1.3m

CBCP:	9,237 Cd
Efficacy:	50.9 lm/w
Delivered Lumens:	728 lm

C20-L14 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	96.7 f.c. / 1,040.9 lux	2.5' / 0.8m
8.0' / 2.4m	54.4 f.c. / 585.6 lux	3.3' / 1.0m
10.0' / 3.0m	34.8 f.c. / 374.6 lux	4.2' / 1.3m
12.0' / 3.7m	24.2 f.c. / 260.5 lux	5.0' / 1.5m
14.0' / 4.3m	17.8 f.c. / 191.6 lux	5.9' / 1.8m
16.0' / 4.9m	13.6 f.c. / 146.4 lux	6.7' / 2.0m

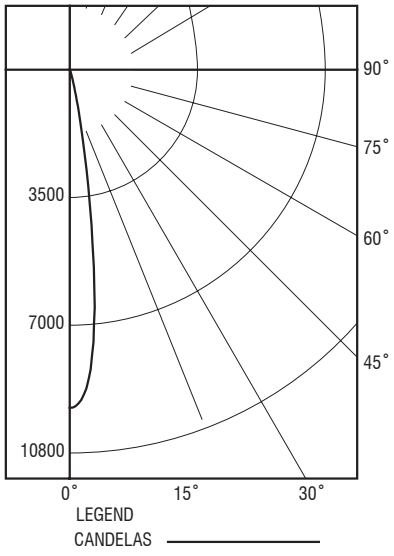
CBCP:	3481 Cd
Efficacy:	47.1 lm/w
Delivered Lumens:	673 lm

C20-L1435° Optic (OL-W-ILONA-50MM)

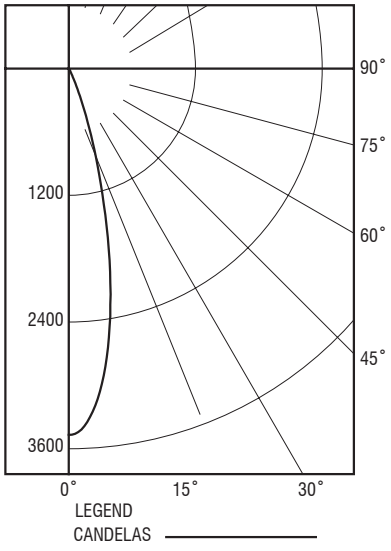
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	46.0 f.c. / 495.1 lux	3.5' / 1.1m
8.0' / 2.4m	25.9 f.c. / 278.8 lux	4.7' / 1.4m
10.0' / 3.0m	16.6 f.c. / 178.7 lux	5.0' / 1.5m
12.0' / 3.7m	11.5 f.c. / 123.8 lux	7.0' / 2.1m
14.0' / 4.3m	8.5 f.c. / 91.5 lux	8.2' / 2.5m
16.0' / 4.9m	6.5 f.c. / 70.0 lux	9.4' / 2.9m

CBCP:	1657 Cd
Efficacy:	40.5 lm/w
Delivered Lumens:	583 lm

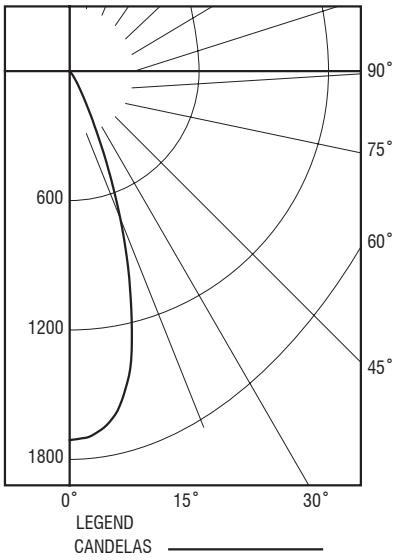
C20-L14 15° Optic - Polar Diagram



C20-L14 25° Optic - Polar Diagram



C20-L14 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

Static White
Fixed Object

Project Name

Type

Clear Form

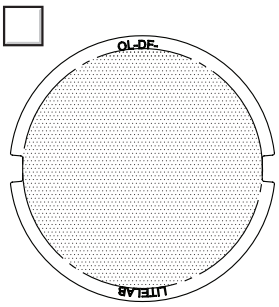
Accessories

FIXTURE SIZE CODE (A): Ø1.95" [50mm]

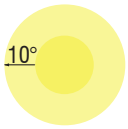
CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

OL-DF-A (DIFFUSION FILM)

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES (FOR USE WITH MULTIPLE MEDIA)

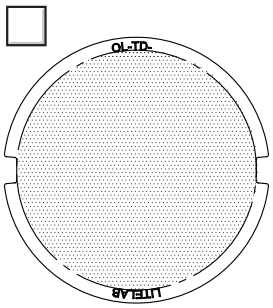


DISTRIBUTION DIAGRAM

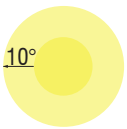


OL-TD-A (POLYCARBONATE DIFFUSION LENS)

DIFFUSION FILM: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES (FOR STANDALONE USE)

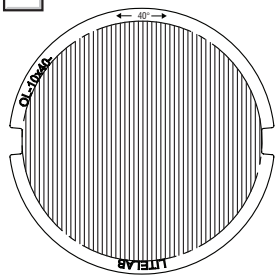


DISTRIBUTION DIAGRAM

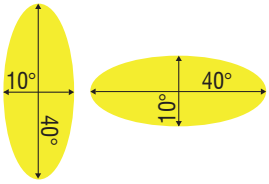


OL-10x40-A (LINEAR SPREAD LENS)

40° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

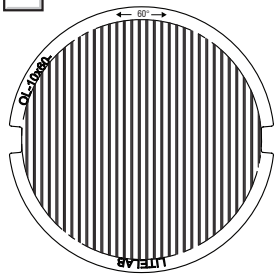


DISTRIBUTION DIAGRAM

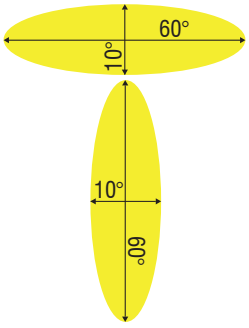


OL-10x60-A (LINEAR SPREAD LENS)

60° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

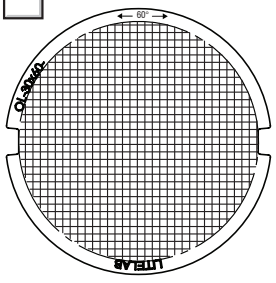


DISTRIBUTION DIAGRAM

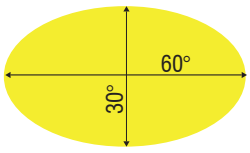


OL-30x60-A (UNIVERSAL SPREAD LENS - INCLUDED)

UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

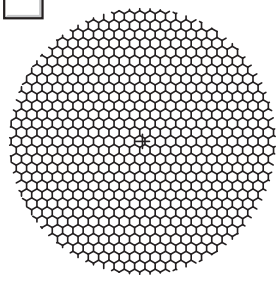


DISTRIBUTION DIAGRAM



LVH/A (HEXCELL LOUVER)

HEXCELL LOUVER: 3MM (0.1") MATTE BACK FINISH, 45° GLARE CUTOFF FOR VISUAL COMFORT



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

DRAWING SHEETS FOR QUICK-CONNECT CANOPY REFERENCE ONLY

MODEL NUMBER:	FIXTURE TYPE:	SCALE:	FILE NUMBER:	DATE:	NO.	REVISIONS DESCRIPTION	BY	DATE
C2W-L[LMS][CRI][CCT]-5LE1[OPT][V]-[YY]-M2	X.X.X.	3/8"=1"	C:\Users\spaulding\Dropbox\Litelab_DB\PRODUCT\FIXTURES\MUSEUM-LINE\INTEGRAL-LED\C-80_Series	6/24/25	2	UPDATED TO GENERIC SUBMITTAL	Z.L.T.S.	05/01/25
PROJECT NAME:	APPROX. WEIGHT: XXlbs./XXKg	DRAWN BY: Z.L.T.S.	CK'D BY: X.X.X.	FIXTURE DESCRIPTION: CYLINDER SERIES: C82 WW. FIXTURE W/ REVERSE BARREL FOR WALL APPLICATIONS				

LED PERFORMANCE		
CRI	WATTAGE	LUMENS (NOM.)
92–MIN.	19W	1550
98–MIN.	19W	1375
TOLERANCE: ± 7%-FLUX | ± 2%-CRI | LMS @ 30°K		

LUMEN MULTIPLIERS BY CCT		
CCT	CRI	MULTIPLIER*
27°K	92–MIN.	0.95
	98–MIN.	0.93
30°K	92–MIN.	1.00
	98–MIN.	1.00
35°K	92–MIN.	1.06
	98–MIN.	1.00
40°K	92–MIN.	1.10
	98–MIN.	1.07
*MULTIPLY BASE LEVELS BY MULTP. VALUES		

INPUT REQUIREMENTS: (V) IN CAT#
(A): 120V/60Hz/0.2 AMPS
(D): 240V/60Hz/0.2 AMPS
(C): 277V/60Hz/0.1 AMPS

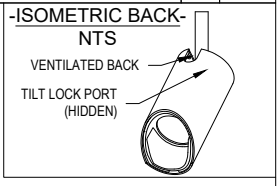
AVAILABLE FINISHES: (SELECT ONE)
(BR): BRUSHED ALUMINUM
(MB): MATTE BLACK
(P): WHITE
(CP*): CUSTOM PAINT
*PLEASE ALLOW FOR ADDED LEAD–TIME IF CP OPTION IS SELECTED

OPTICS: (BEAM) IN CAT# / FWHM VALUE
(X1-PROVIDED)
(35): 35° FL–OPTIC

ACCESSORIES: SIZE-a = Ø1.95" [49.5mm]
(STACK 2 MAX) | (PROVIDED)
OL-30"x60"-a UNIVERSAL SPREAD

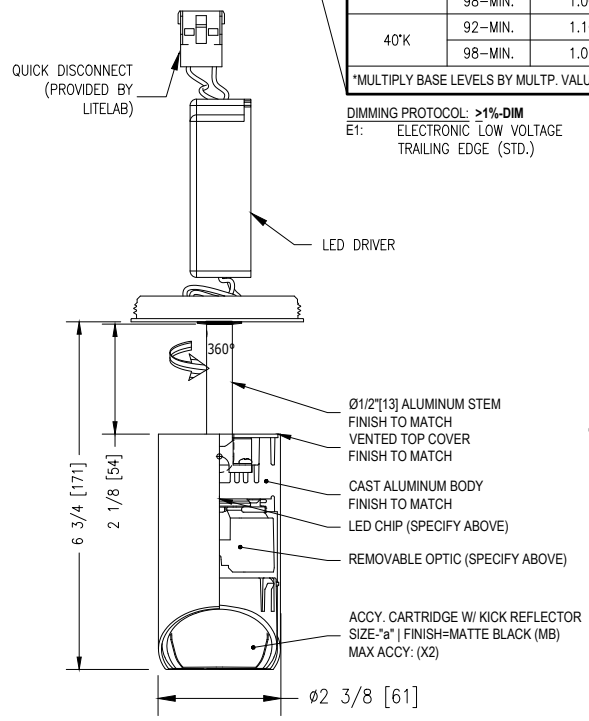
MODIFICATION NOTES: (LIST BELOW)
MOD-2: REVERSE BARREL

-ISOMETRIC BACK-
NTS



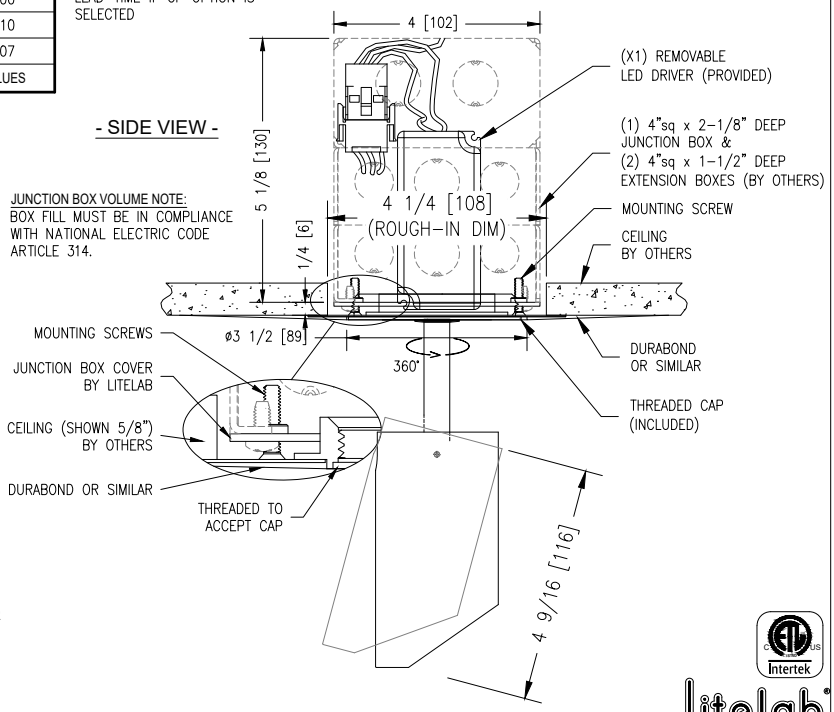
DIMMING PROTOCOL: **>1%-DIM**
E1: ELECTRONIC LOW VOLTAGE TRAILING EDGE (STD.)

- FRONT VIEW -



- SIDE VIEW -

JUNCTION BOX VOLUME NOTE:
BOX FILL MUST BE IN COMPLIANCE WITH NATIONAL ELECTRIC CODE ARTICLE 314.



Litelab Corp. 251 Elm Street Buffalo, NY 14203, USA | (T): +01 (716) 856-4491 | (W): www.litelab.com

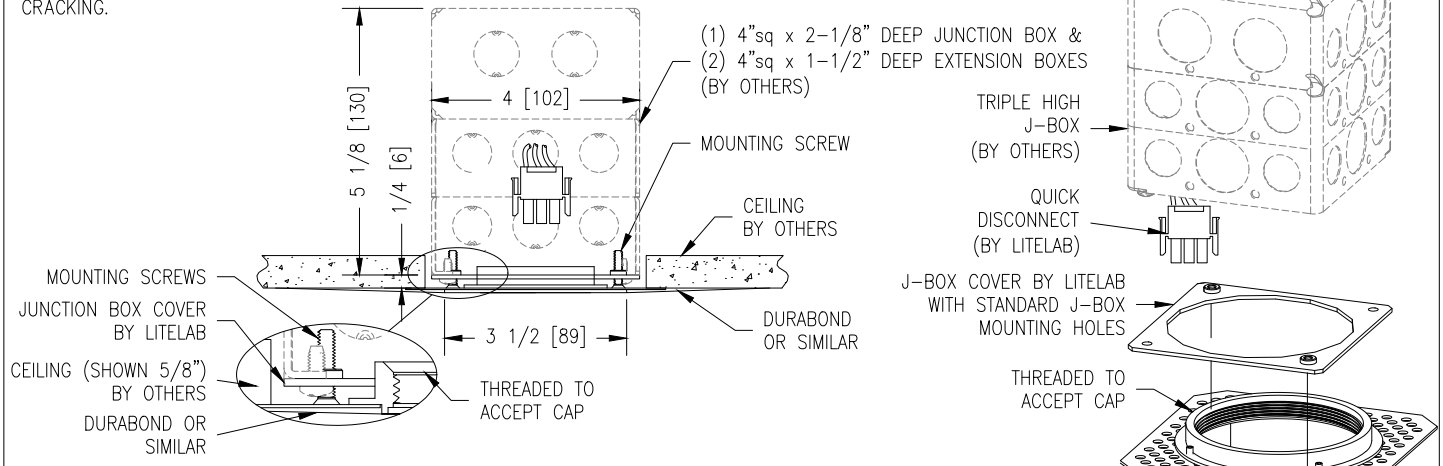
DRAWING SHEETS FOR QUICK-CONNECT CANOPY REFERENCE ONLY

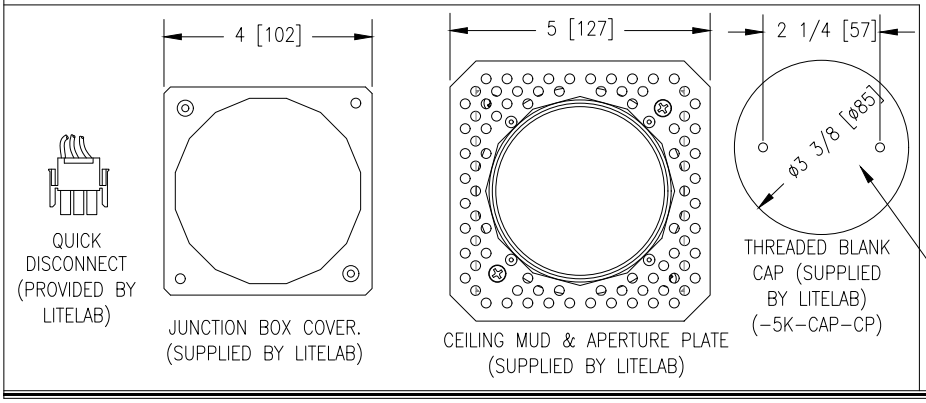
SH: 2OF2

MODEL NUMBER:	FIXTURE TYPE:	SCALE:	FILE NUMBER:	DATE:	NO.	REVISIONS DESCRIPTION	BY	DATE
QC–5K–(FINISH TO MATCH FIXT.)	[X.X.X.]	3/8"=1"	G:\ZLTS\ZLTS Master File\Fixtures_Photometric Data\CSERIES_IES	6/21/18				
PROJECT NAME:	APPROX. WEIGHT:	DRAWN BY:	CK'D BY:	FIXTURE DESCRIPTION:				
	XXlbs./XXKg	Z.L.T.S.	X.X.X.	QUICK CONNECT CANOPY FLANGE KIT				

JUNCTION BOX MOUNTING NOTE:
JUNCTION BOX MUST BE RIGIDLY MOUNTED TO PREVENT PLASTER CRACKING.

JUNCTION BOX VOLUME NOTE:
BOX FILL MUST BE IN COMPLIANCE WITH NATIONAL ELECTRIC CODE ARTICLE 314.





PIN SPANNER WRENCH TOOL
MCMASTER–CARR PT# 5794A16
OR SIMILAR NEEDED TO REMOVE
BLANK CAP
(BY OTHERS OR ORDERED
SEPARATELY)

Litelab Corp. 251 Elm Street Buffalo, NY 14203 (716) 856–4491 (716) 856–4300 fax: (716) 856–0156

M30

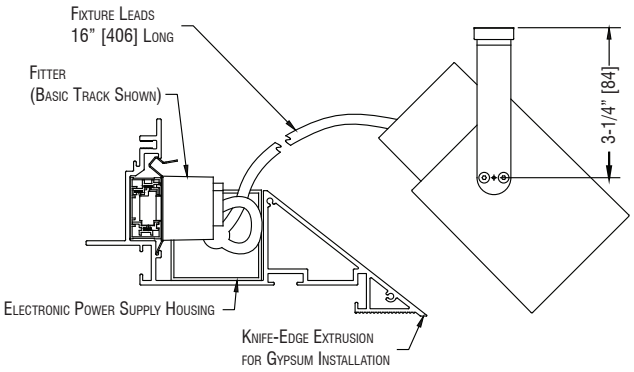
Static White
Fixed Object

Project Name

Type

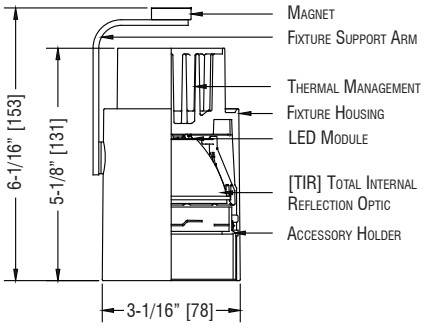
Flatten & Save

Clear Form



Input Requirements

1800/1550 Lumens	120VAC/0.19A/23W
	240VAC/0.12A/25W
1300/1100 Lumens	120VAC/0.15A/19W
	240 VAC/0.08A/19W



Enter Catalog Number Sequentially from Left to Right

M30	-	Lumens	CRI	CCT	-	Adaptor	Dimming	Level	Voltage	-	Finish	Optic

Model	Lumens/CRI	CCT	Adaptor	Dimming	Level	Options	Voltage	Finish	Optics
M30	L18 1800/92	27 2700	BT Basic Track	E ELV	0 10%	N/A	A 120	P White	1 10°
	L15 1550/98	30 3000					D 240	MB Black	2 20°
	L13 1300/92	35 3500	ST2 2-Circuit Stucchi	Z 0-10	D Dark		C 277	CP Custom	3 30°
	L11 1100/98	40 4000	ST3 3-Circuit Stucchi	M DMX					
				D DALI					

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: ***See Page 4***

☐	OL-DF-g	Beam Softening Film
☐	OL-TD-g	Beam Softening Lens
☐	OL-10x40-g	Linear Spread Lens
☐	OL-10x60-g	Linear Spread Lens
☐	OL-30x60-g	Universal Spread Lens
☐	LVH/g	Hexell Louver

Optics:

☐	10°	OL-NB-70MM-KIT
☐	20°	OL-MB-70MM-KIT
☐	30°	OL-WB-70MM-KIT

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

M30

Static White
Fixed Object

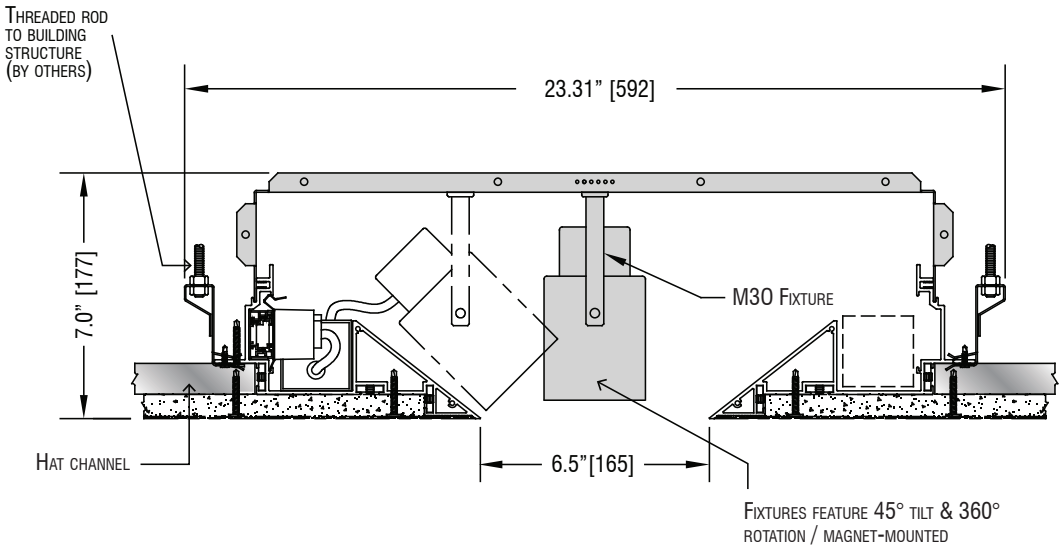
Project Name

Type

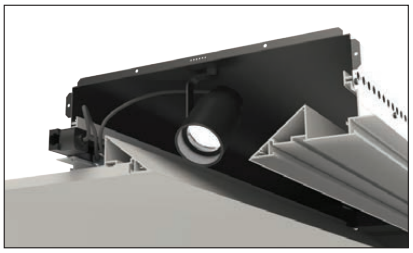
Clear Form

Details

M30 Fixture shown in H06 Housing



FIXTURES FEATURE 45° TILT & 360°
ROTATION / MAGNET-MOUNTED



M30 FIXTURE SHOWN
IN H06 HOUSING

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

M30

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

M30-L18 10° Optic (OL-NB-70MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	1,047.8 f.c. / 11,278.5 lux	1.1' / 0.34m
8.0' / 2.4m	589.4 f.c. / 6,344.2 lux	1.4' / 0.43m
10.0' / 3.0m	377.2 f.c. / 4,060.1 lux	1.8' / 0.55m
12.0' / 3.7m	261.9 f.c. / 2,819.1 lux	2.1' / 0.64m
14.0' / 4.3m	192.4 f.c. / 2,071 lux	2.5' / 0.76m
16.0' / 4.9m	147.3 f.c. / 1,585.5 lux	2.8' / 0.85m

CBCP:	37,719 Cd
Efficacy:	66.1 lm/w
Delivered Lumens:	1442lm

M30-L18 20° Optic (OL-MB-70MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	250.8 f.c. / 2,700.0 lux	2.3'/ 0.70m
8.0' / 2.4m	141.1 f.c. / 1,518.8 lux	3.1' / 0.94m
10.0' / 3.0m	90.3 f.c. / 972.0 lux	3.8' / 1.2m
12.0' / 3.7m	62.7 f.c. / 674.9 lux	4.6' / 1.4m
14.0' / 4.3m	46.1 f.c. / 496.2 lux	5.4' / 1.6m
16.0' / 4.9m	35.3 f.c. / 380.0 lux	6.1' / 1.9m

CBCP:	9,030 Cd
Efficacy:	65.9 lm/w
Delivered Lumens:	1431lm

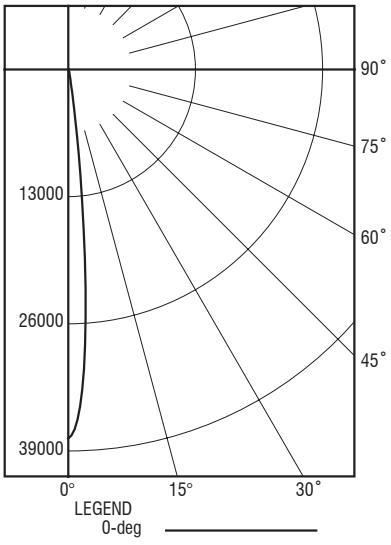
M30-L18 30° Optic (OL-WB-70MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	102.5 f.c. / 1,103.3 lux	3.4' / 1.0m
8.0' / 2.4m	57.7 f.c. / 621.1 lux	4.5' / 1.4m
10.0' / 3.0m	36.9 f.c. / 397.2 lux	5.6' / 1.7m
12.0' / 3.7m	25.6 f.c / 276.0 lux	6.8' / 2.1m
14.0' / 4.3m	18.8 f.c. / 202.4 lux	7.9' / 2.4m
16.0' / 4.9m	14.4 f.c. / 155.0 lux	9.0' / 2.7m

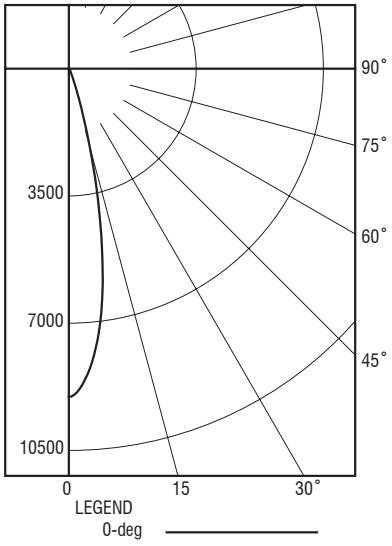
CBCP:	3,690 Cd
Efficacy:	155.0 lm/w
Delivered Lumens:	1235lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

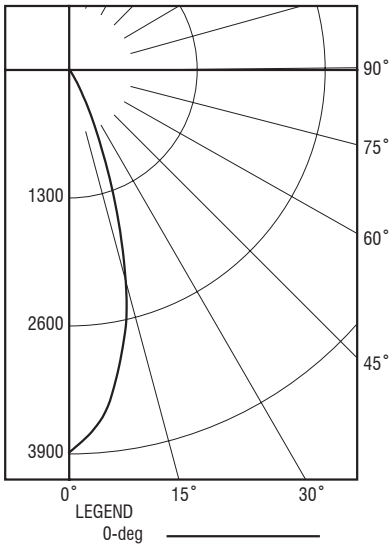
M30-L18 10° Optic - Polar Diagram



M30-L18 20° Optic - Polar Diagram



M30-L18 30° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

M30

Static White
Fixed Object

Project Name

Type

Clear Form

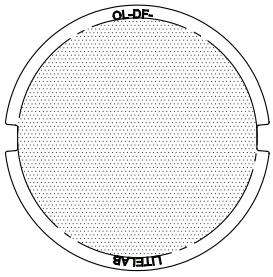
Accessories

CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

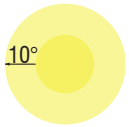
SIZE CODE G: 2.529" [64MM]

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES

OL-DF-G (DIFFUSION FILM) ☐

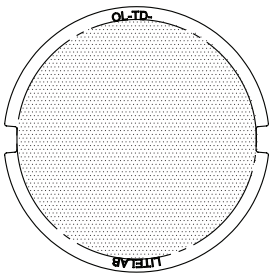


DISTRIBUTION DIAGRAM

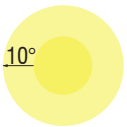


TEXTURED DIFFUSION LENS: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES

OL-TD-G (POLYCARBONATE DIFFUSION LENS) ☐

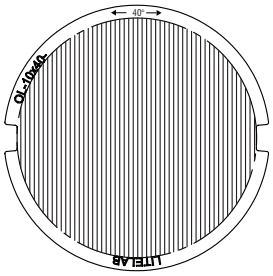


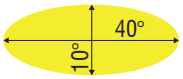
DISTRIBUTION DIAGRAM



40° LINEAR SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT LINEARLY FOR LONG OBJECTS

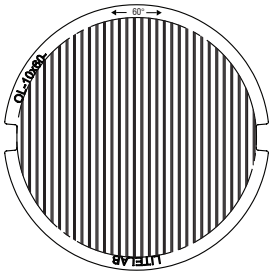
OL-10x40-G (LINEAR SPREAD LENS) ☐

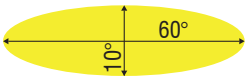




60° LINEAR SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT LINEARLY FOR LONG OBJECTS

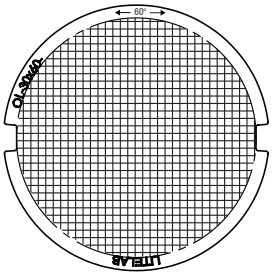
OL-10x60-G (LINEAR SPREAD LENS) ☐

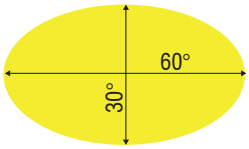




UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

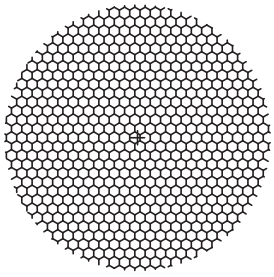
OL-60x30-G (UNIVERSAL SPREAD LENS) ☐





HEXCELL LOUVER: REDUCES HIGH-ANGLE GLARE TO PROVIDE COMFORTABLE LIGHTING

LVH/G (HEXCELL LOUVER) ☐



Litelab®
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL Intertek

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

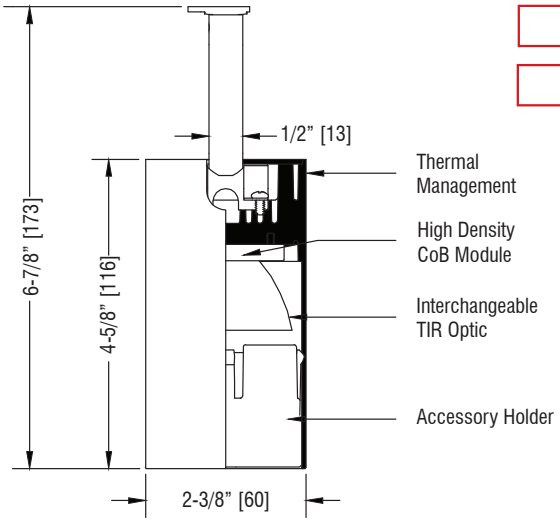
Static White
Fixed Object

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1600/1450 Lumens	120VAC/0.2A/23W
	240VAC/0.2A/23W
	277VAC/0.1A/23W

Enter Catalog Number Sequentially from Left to Right

C20 - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI	CCT
C20	L16 1600/92	27 2700
	L14 1450/98	30 3000
		35 3500
		40 4000

Adaptor	Dimming	Level	Options	Voltage
9TC BusRun Clipless	E ELV	1 1%	P* Potentiometer	A 120
9TD BusRun Deep			R** Rotation Lock	D 240
9TS BusRun Shallow			SP* Switch w/ Potentiometer	F* 240 (2-Circuit)
9HC BusRun Clipless w/ Driverbox	E ELV	0 10%	SR** Switch w/ Rotation Lock	C 277
9HD BusRun Deep w/ Driverbox	W Wire-less	C Casambi		
9HS BusRun Shallow w/ Driverbox		A Avi-On		
		T Athena RF		
ST2 2-Circuit Stucchi	E ELV	0 10%		
ST3 3-Circuit Stucchi	Z 0-10	1 1%		
3L 5" Canopy	M DMX	D Dark		
5L 3.5" QC Canopy	D DALI			
7L 2" QC Canopy (Remote Driver Only)				

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Finish	Optics
P White	1 15°
MB Black	2 25°
BR Brushed	3 35°
CP Custom	

Enter RAL or Other Finish Code

Optics

- ☐ 15° OL-RS-ILONA-50-KIT
- ☐ 25° OL-M-ILONA-50-KIT
- ☐ 35° OL-W-ILONA-50-KIT

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 6*

- ☐ OL-DF-a Beam Softening Film
- ☐ OL-TD-a Beam Softening Lens
- ☐ OL-10x40-a Linear Spread Lens
- ☐ OL-10x60-a Linear Spread Lens
- ☐ OL-30x60-a Universal Spread Lens
- ☐ LVH/a Hexell Louver
- ☐ CHB/a-2 Crosshair Baffle

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

Static White
Fixed Object

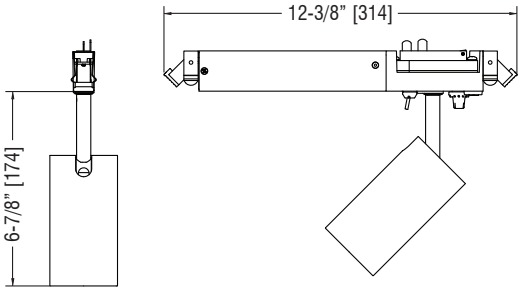
Project Name

Type

Clear Form

Fitter Guide

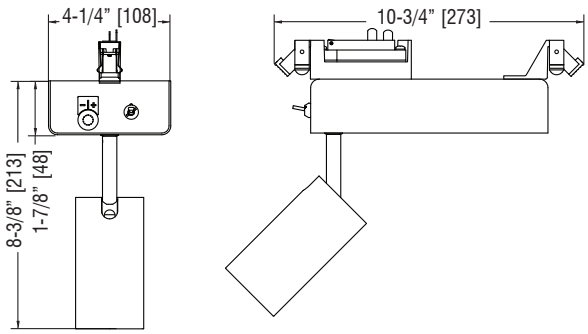
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



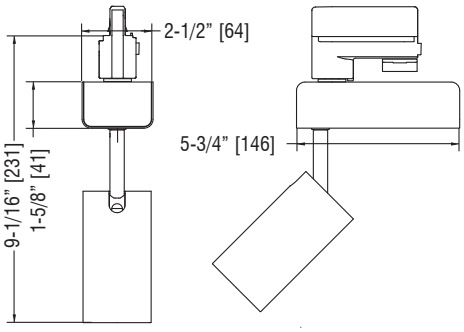
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%.

Switch not available for 277 V.

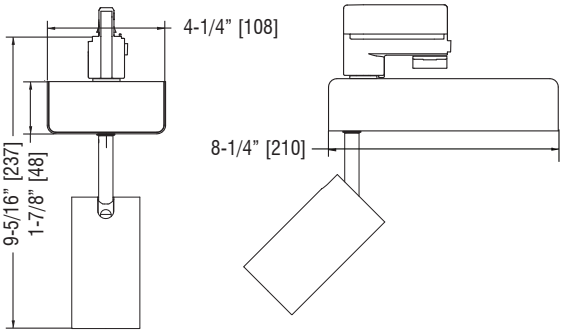
9H - Wireless Control Fitter for BusRun



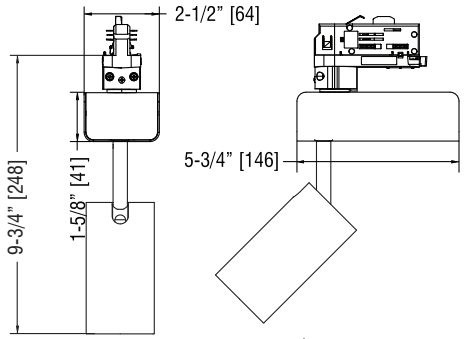
Stucchi - 2-Circuit ELV Dimmable Fitter



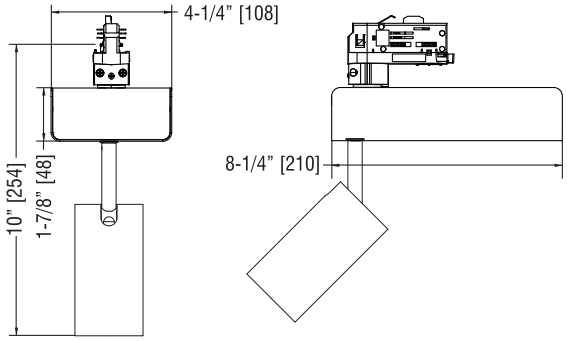
Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



Stucchi - 3-Circuit ELV Dimmable Fitter



Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

Static White
Fixed Object

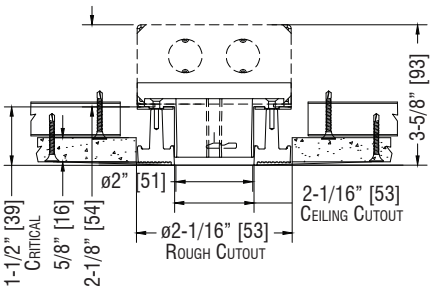
Project Name

Type

Clear Form

Fitter Guide

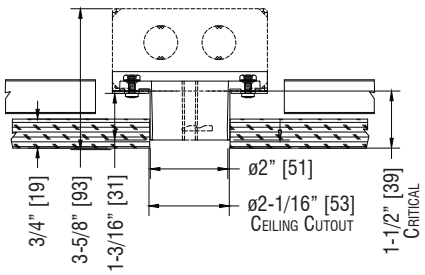
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

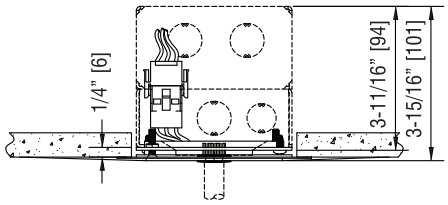


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

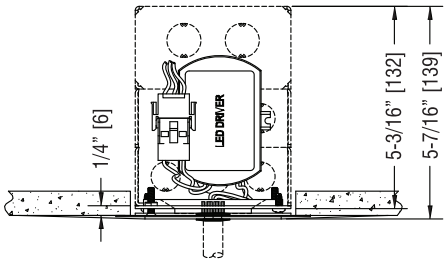
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

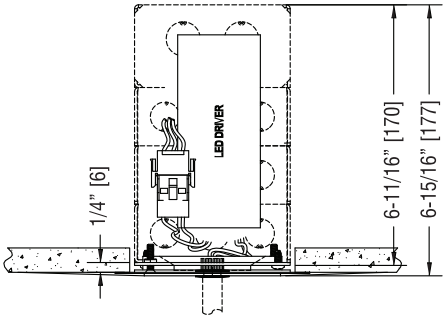
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

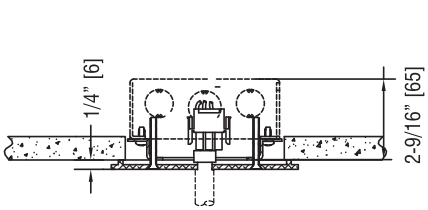


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

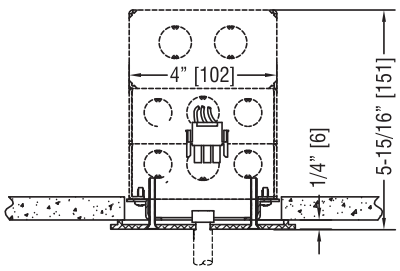


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

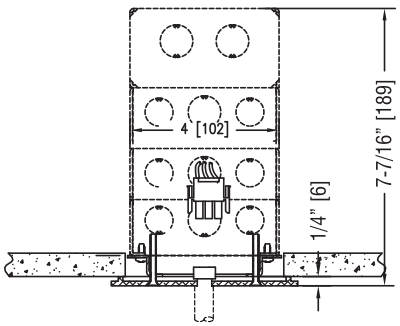
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L16 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	294.0 f.c. / 3,164.6 lux	1.6' / 0.5m
8.0' / 2.4m	165.4 f.c. / 1,780.4 lux	2.1' / 0.6m
10.0' / 3.0m	105.9 f.c. / 1,139.9 lux	2.6' / 0.8m
12.0' / 3.7m	73.5 f.c. / 791.1 lux	3.2' / 1.0m
14.0' / 4.3m	54.0 f.c. / 581.3 lux	3.7' / 1.1m
16.0' / 4.9m	41.3 f.c. / 444.5 lux	4.2' / 1.3m

CBCP:	10,585 Cd
Efficacy:	62.6 lm/w
Delivered Lumens:	820 lm

C20-L16 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	104.4 f.c. / 1,123.8 lux	2.6' / 0.8m
8.0' / 2.4m	58.7 f.c. / 6318 lux	3.4' / 1.0m
10.0' / 3.0m	37.6 f.c. / 404.7 lux	4.3' / 1.3m
12.0' / 3.7m	26.1 f.c. / 280.9 lux	5.1' / 1.6m
14.0' / 4.3m	19.2 f.c. / 206.7 lux	6.0' / 1.8m
16.0' / 4.9m	14.7 f.c. / 158.2 lux	6.8' / 2.1m

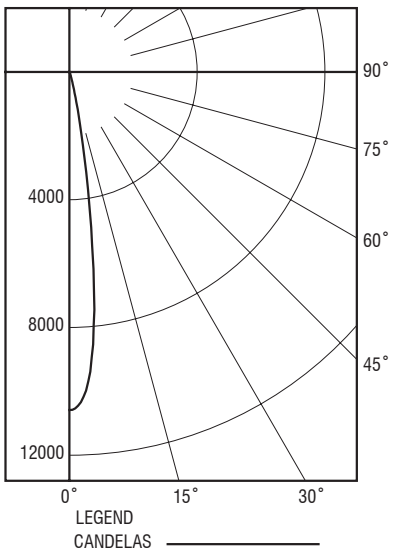
CBCP:	3757 Cd
Efficacy:	57.0 lm/w
Delivered Lumens:	747 lm

C20-L16 35° Optic (OL-W-ILONA-50MM)

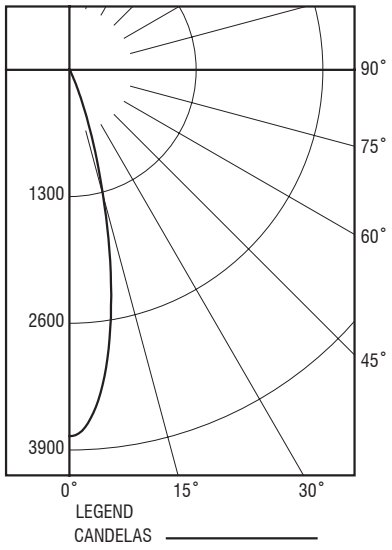
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	51.5 f.c. / 554.3 lux	3.5' / 1.1m
8.0' / 2.4m	29.0 f.c. / 312.2 lux	4.7' / 1.4m
10.0' / 3.0m	18.5 f.c. / 199.1 lux	5.0' / 1.5m
12.0' / 3.7m	12.9 f.c. / 138.9 lux	7.1' / 2.2m
14.0' / 4.3m	9.5 f.c. / 102.3 lux	8.2' / 2.5m
16.0' / 4.9m	7.2 f.c. / 77.5 lux	9.4' / 2.9m

CBCP:	1853 Cd
Efficacy:	50.1 lm/w
Delivered Lumens:	656 lm

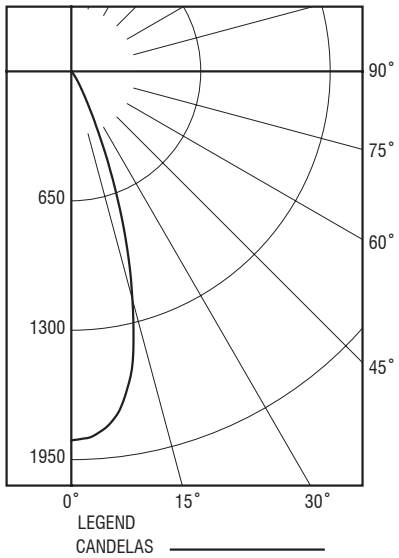
C20-L16 15° Optic - Polar Diagram



C20-L16 25° Optic - Polar Diagram



C20-L16 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C20

Static White
Fixed Object

Project Name

Type

Clear Form

Photometrics

C20-L14 15° Optic (OL-RS-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	256.6 f.c. / 2,762.0 lux	1.6' / 0.5m
8.0' / 2.4m	144.3 f.c. / 1,556.8 lux	2.1' / 0.6m
10.0' / 3.0m	92.4 f.c. / 994.6 lux	2.7' / 0.8m
12.0' / 3.7m	64.1 f.c. / 690.0 lux	3.2' / 1.0m
14.0' / 4.3m	47.1 f.c. / 507.0 lux	3.7' / 1.1m
16.0' / 4.9m	36.1 f.c. / 388.6 lux	4.3' / 1.3m

CBCP:	9,237 Cd
Efficacy:	50.9 lm/w
Delivered Lumens:	728 lm

C20-L14 25° Optic (OL-M-ILONA-50MM)

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	96.7 f.c. / 1,040.9 lux	2.5' / 0.8m
8.0' / 2.4m	54.4 f.c. / 585.6 lux	3.3' / 1.0m
10.0' / 3.0m	34.8 f.c. / 374.6 lux	4.2' / 1.3m
12.0' / 3.7m	24.2 f.c. / 260.5 lux	5.0' / 1.5m
14.0' / 4.3m	17.8 f.c. / 191.6 lux	5.9' / 1.8m
16.0' / 4.9m	13.6 f.c. / 146.4 lux	6.7' / 2.0m

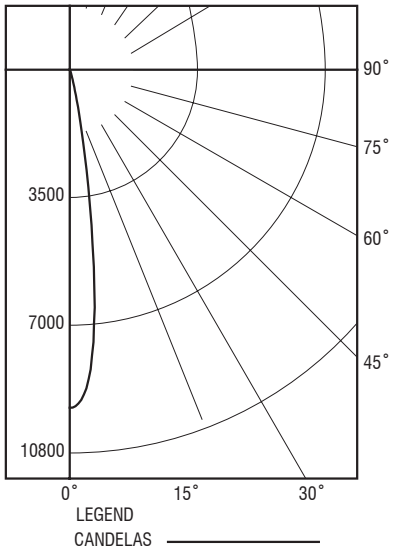
CBCP:	3481 Cd
Efficacy:	47.1 lm/w
Delivered Lumens:	673 lm

C20-L1435° Optic (OL-W-ILONA-50MM)

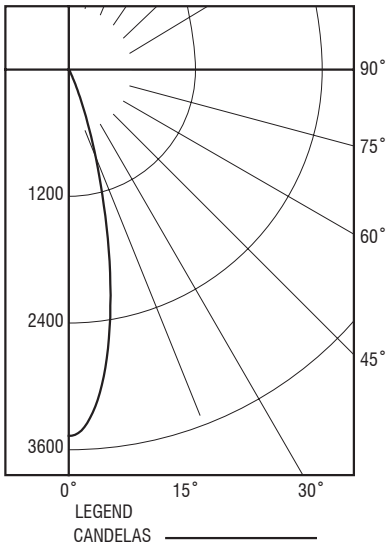
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	46.0 f.c. / 495.1 lux	3.5' / 1.1m
8.0' / 2.4m	25.9 f.c. / 278.8 lux	4.7' / 1.4m
10.0' / 3.0m	16.6 f.c. / 178.7 lux	5.0' / 1.5m
12.0' / 3.7m	11.5 f.c. / 123.8 lux	7.0' / 2.1m
14.0' / 4.3m	8.5 f.c. / 91.5 lux	8.2' / 2.5m
16.0' / 4.9m	6.5 f.c. / 70.0 lux	9.4' / 2.9m

CBCP:	1657 Cd
Efficacy:	40.5 lm/w
Delivered Lumens:	583 lm

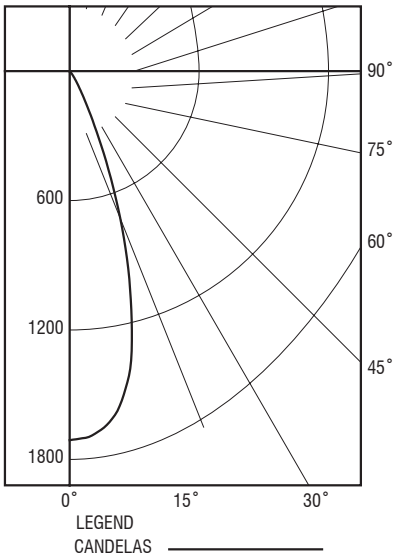
C20-L14 15° Optic - Polar Diagram



C20-L14 25° Optic - Polar Diagram



C20-L14 35° Optic - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C20

Static White
Fixed Object

Project Name

Type

Clear Form

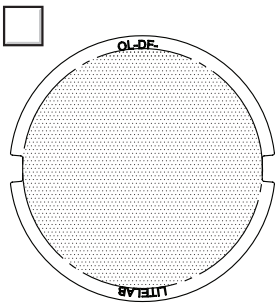
Accessories

FIXTURE SIZE CODE (A): Ø1.95" [50mm]

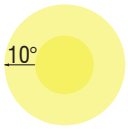
CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

OL-DF-A (DIFFUSION FILM)

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES (FOR USE WITH MULTIPLE MEDIA)

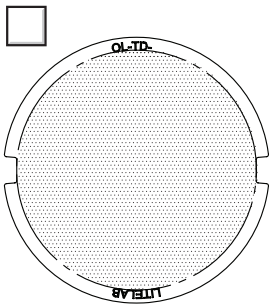


DISTRIBUTION DIAGRAM

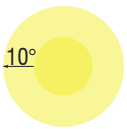


OL-TD-A (POLYCARBONATE DIFFUSION LENS)

DIFFUSION FILM: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES (FOR STANDALONE USE)

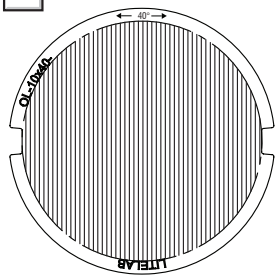


DISTRIBUTION DIAGRAM

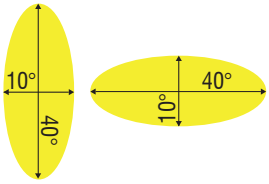


OL-10x40-A (LINEAR SPREAD LENS)

40° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

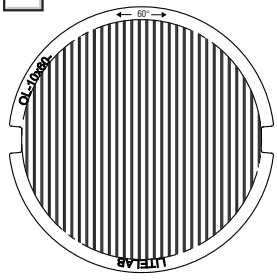


DISTRIBUTION DIAGRAM

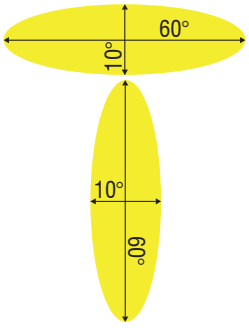


OL-10x60-A (LINEAR SPREAD LENS)

60° LINEAR SPREAD LENS: 3MM (0.1") ELLIPTICAL SPREAD FOR LONG / LINEAR OBJECTS

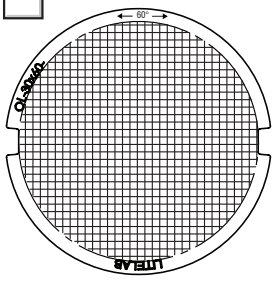


DISTRIBUTION DIAGRAM

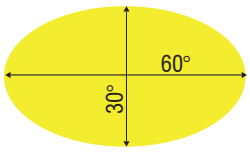


OL-30x60-A (UNIVERSAL SPREAD LENS - INCLUDED)

UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

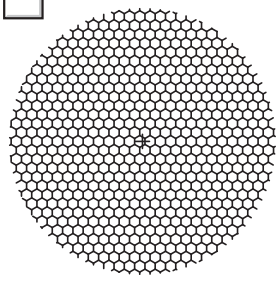


DISTRIBUTION DIAGRAM



LVH/A (HEXCELL LOUVER)

HEXCELL LOUVER: 3MM (0.1") MATTE BACK FINISH, 45° GLARE CUTOFF FOR VISUAL COMFORT



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

DRAWING SHEETS FOR QUICK-CONNECT CANOPY REFERENCE ONLY

MODEL NUMBER:	FIXTURE TYPE:	SCALE:	FILE NUMBER:	DATE:	NO.	REVISIONS DESCRIPTION	BY	DATE
C2W-L[LMS][CRI][CCT]-5LE1[OPT][V]-[YY]-M2	X.X.X.	3/8"=1"	C:\Users\spaulding\Dropbox\Litelab_DB\PRODUCT\FIXTURES\MUSEUM-LINE\INTEGRAL-LED\C-80_Series	6/24/25	2	UPDATED TO GENERIC SUBMITTAL	Z.L.T.S.	05/01/25
PROJECT NAME:	APPROX. WEIGHT: XXlbs./XXKg	DRAWN BY: Z.L.T.S.	CK'D BY: X.X.X.	FIXTURE DESCRIPTION: CYLINDER SERIES: C82 WW. FIXTURE W/ REVERSE BARREL FOR WALL APPLICATIONS				

LED PERFORMANCE		
CRI	WATTAGE	LUMENS (NOM.)
92–MIN.	19W	1550
98–MIN.	19W	1375
TOLERANCE: ± 7%-FLUX | ± 2%-CRI | LMS @ 30°K		

LUMEN MULTIPLIERS BY CCT		
CCT	CRI	MULTIPLIER*
27°K	92–MIN.	0.95
	98–MIN.	0.93
30°K	92–MIN.	1.00
	98–MIN.	1.00
35°K	92–MIN.	1.06
	98–MIN.	1.00
40°K	92–MIN.	1.10
	98–MIN.	1.07
*MULTIPLY BASE LEVELS BY MULTP. VALUES		

DIMMING PROTOCOL: **>1%-DIM**
E1: ELECTRONIC LOW VOLTAGE TRAILING EDGE (STD.)

INPUT REQUIREMENTS: (V) IN CAT#
(A): 120V/60Hz/0.2 AMPS
(D): 240V/60Hz/0.2 AMPS
(C): 277V/60Hz/0.1 AMPS

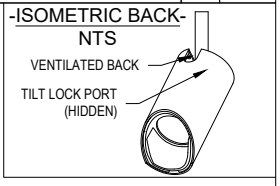
AVAILABLE FINISHES: (SELECT ONE)
(BR): BRUSHED ALUMINUM
(MB): MATTE BLACK
(P): WHITE
(CP*): CUSTOM PAINT
*PLEASE ALLOW FOR ADDED LEAD–TIME IF CP OPTION IS SELECTED

OPTICS: (BEAM) IN CAT# / FWHM VALUE
(X1-PROVIDED)
(35): 35° FL–OPTIC

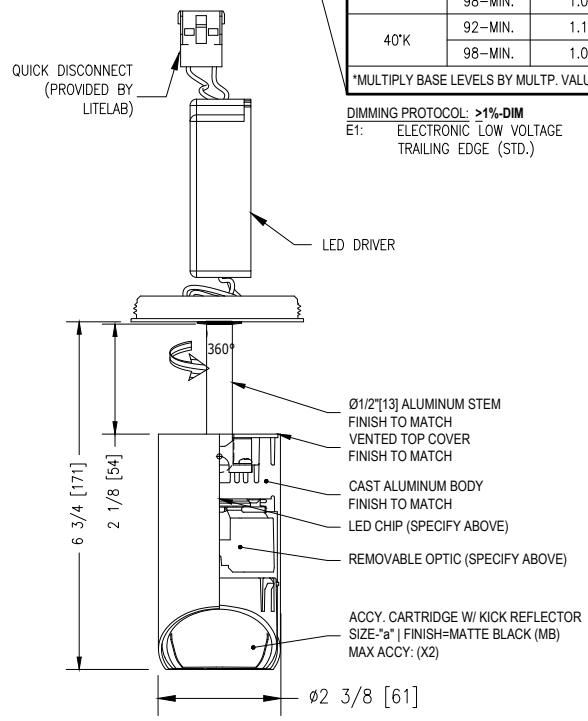
ACCESSORIES: SIZE-a = Ø1.95" [49.5mm]
(STACK 2 MAX) | (PROVIDED)
OL-30"x60"-a UNIVERSAL SPREAD

MODIFICATION NOTES: (LIST BELOW)
MOD-2: REVERSE BARREL

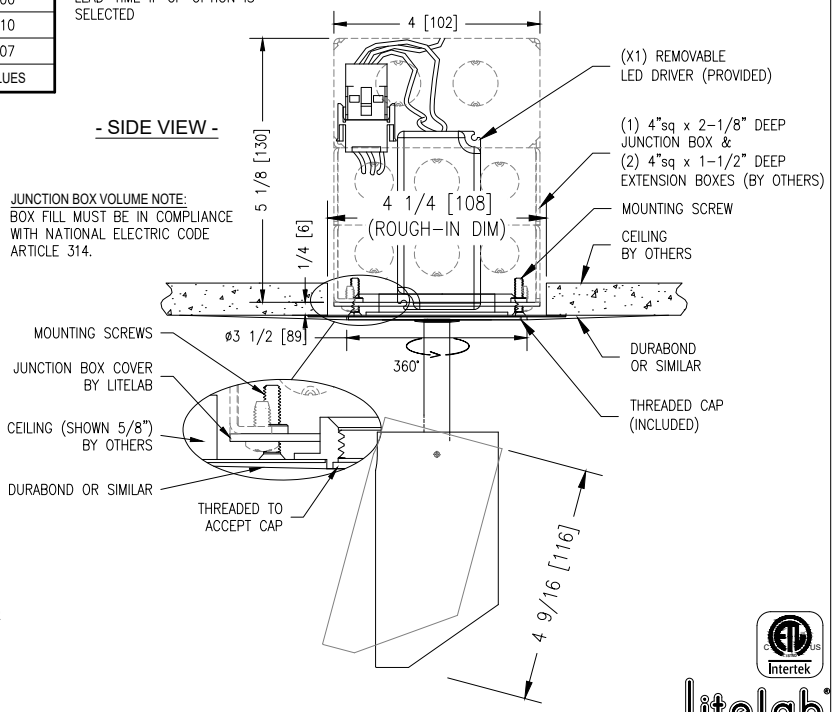
-ISOMETRIC BACK-
NTS



- FRONT VIEW -



- SIDE VIEW -



JUNCTION BOX VOLUME NOTE:
BOX FILL MUST BE IN COMPLIANCE WITH NATIONAL ELECTRIC CODE ARTICLE 314.

Litelab Corp. 251 Elm Street Buffalo, NY 14203, USA | (T): +01 (716) 856-4491 | (W): www.litelab.com

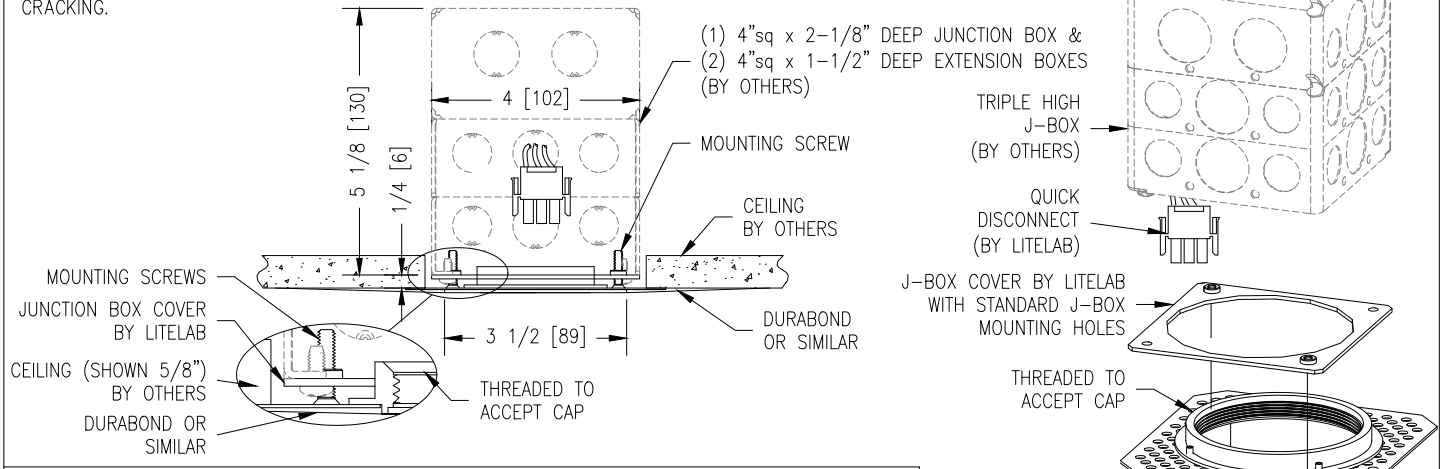
DRAWING SHEETS FOR QUICK-CONNECT CANOPY REFERENCE ONLY

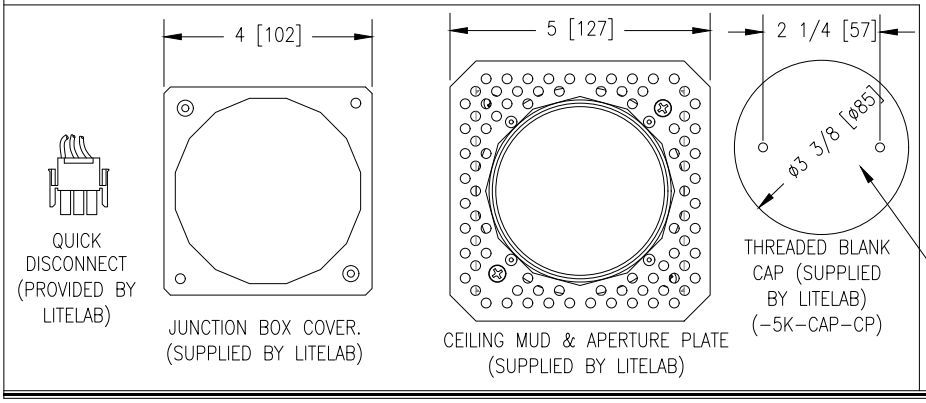
SH: 2OF2

MODEL NUMBER:	FIXTURE TYPE:	SCALE:	FILE NUMBER:	DATE:	NO.	REVISIONS DESCRIPTION	BY	DATE
QC–5K–(FINISH TO MATCH FIXT.)	[X.X.X.]	3/8"=1"	G:\ZLTS\ZLTS Master File\Fixtures_Photometric Data\CSERIES_IES	6/21/18				
PROJECT NAME:	APPROX. WEIGHT:	DRAWN BY:	CK'D BY:	FIXTURE DESCRIPTION:				
	XXlbs./XXKg	Z.L.T.S.	X.X.X.	QUICK CONNECT CANOPY FLANGE KIT				

JUNCTION BOX MOUNTING NOTE:
JUNCTION BOX MUST BE RIGIDLY MOUNTED TO PREVENT PLASTER CRACKING.

JUNCTION BOX VOLUME NOTE:
BOX FILL MUST BE IN COMPLIANCE WITH NATIONAL ELECTRIC CODE ARTICLE 314.





PIN SPANNER WRENCH TOOL
MCMASTER–CARR PT# 5794A16
OR SIMILAR NEEDED TO REMOVE
BLANK CAP
(BY OTHERS OR ORDERED
SEPARATELY)

Litelab Corp. 251 Elm Street Buffalo, NY 14203 (716) 856–4491 (716) 856–4300 fax: (716) 856–0156

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

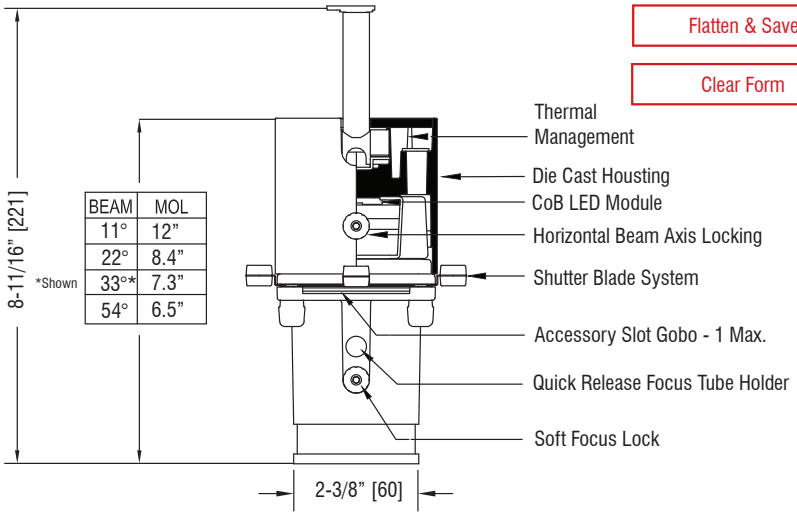
Static White Framing Projector

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1800/1550 Lumens	120VAC/0.19A/23W
	240VAC/0.12A/25W
	277VAC/0.10A/25W
1300/1100 Lumens	120VAC/0.15A/19W
	240 VAC/0.08A/19W
	277 VAC/0.07A/19W

Enter Catalog Number Sequentially from Left to Right

C3P - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish Optic

Model	Lumens/CRI		CCT	
C3P	L18	1800/92	27	2700
	L15	1550/98	30	3000
	L13	1300/92	35	3500
	L11	1100/98	40	4000

Adaptor		Dimming		Level	
9TC	BusRun Clipless	E	ELV	1	1%
9TD	BusRun Deep				
9TS	BusRun Shallow				
9HC	BusRun Clipless w/ Driverbox	E	ELV	0	10%
9HD	BusRun Deep w/ Driverbox	W	Wire-less	C	Casambi
9HS	BusRun Shallow w/ Driverbox			A	Avi-On
				T	Athena RF
ST2	2-Circuit Stucchi	E	ELV	0	10%
ST3	3-Circuit Stucchi	Z	0-10	1	1%
3L	5" Canopy	M	DMX	D	Dark
5L	3.5" QC Canopy	D	DALI		
7L	2" QC Canopy (Remote Driver Only)				

Options	
P*	Potentiometer
R**	Rotation Lock
SP*	Switch w/ Potentiometer
SR**	Switch w/ Rotation Lock

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Voltage	
A	120
D	240
F*	240 (2-Circuit)
C	277

Finish		Optics	
P	White	1	11°
MB	Black	2	22°
BR	Brushed	3	33°
CP	Custom	5	54°

Enter RAL or Other Finish Code

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 5*

☐ 64506	11° Focusing Tube
☐ 64506-01	22° Focusing Tube
☐ 64506-02	33° Focusing Tube
☐ 64506-03	54° Focusing Tube
☐ 64522-KIT	Gobo Pin Spot Kit
☐ 64514	Gobo Carrier

Gobo Carrier accepts 0.37 - 0.5mm Gobos

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

Static White Framing Projector

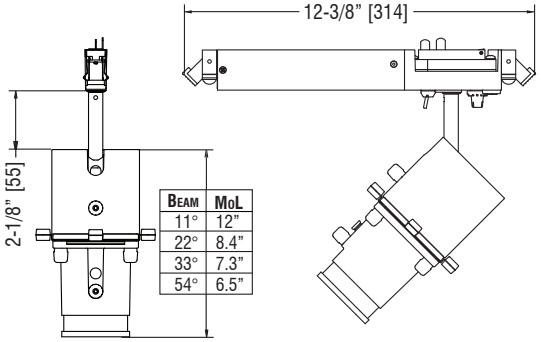
Project Name

Type

Clear Form

Fitter Guide - All fixtures shown with 33° Focusing Tube

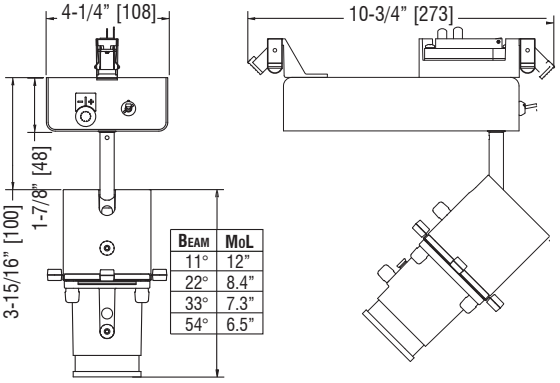
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

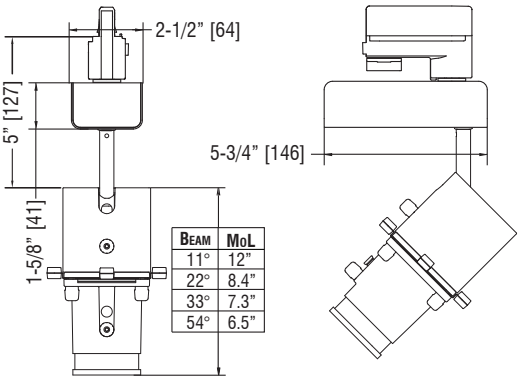
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%. Switch not available for 277 V.

9H - Wireless Control Fitter for BusRun



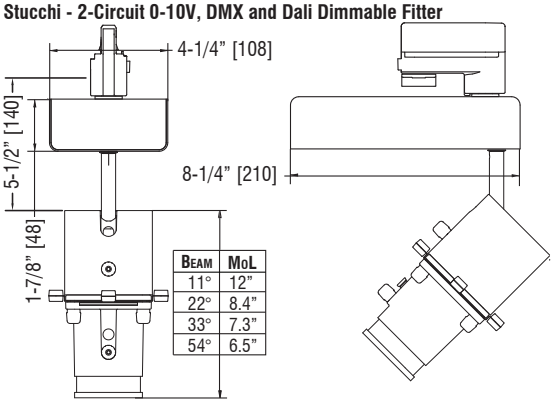
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 2-Circuit ELV & 0-10V Dimmable Fitter



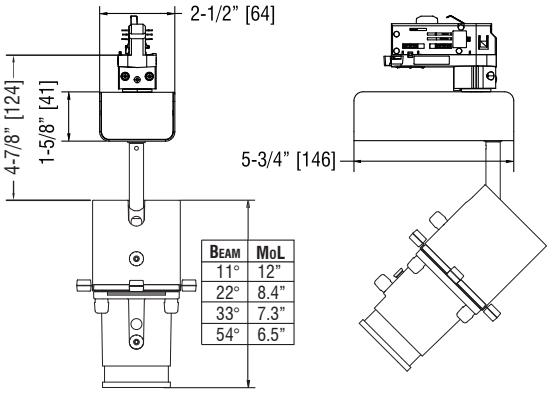
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



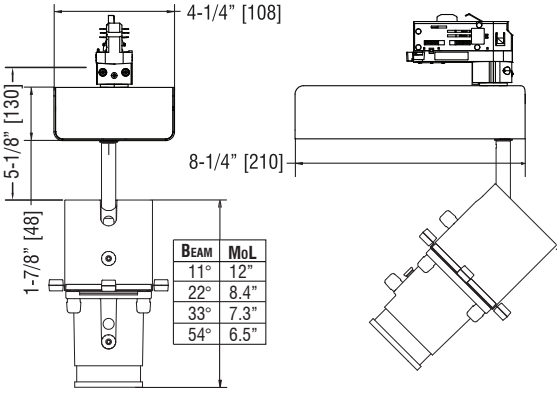
Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 3-Circuit ELV & 0-10V Dimmable Fitter



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

Stucchi - 3-Circuit 0-10V, DMX and Dali Dimmable Fitter



Beam	MoL
11°	12"
22°	8.4"
33°	7.3"
54°	6.5"

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

C3P

Static White Framing Projector

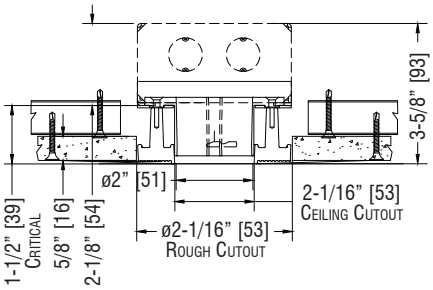
Project Name

Type

Clear Form

Fitter Guide

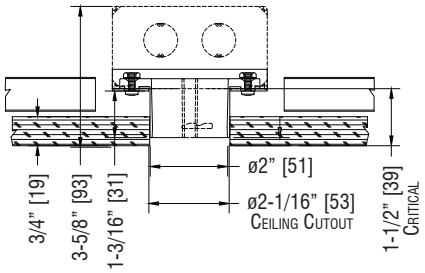
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

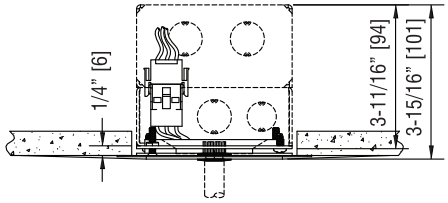


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

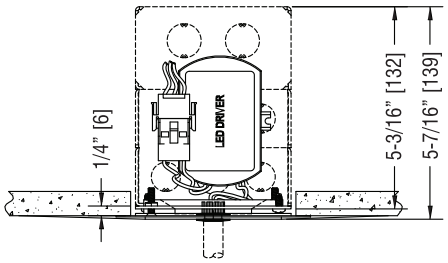
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

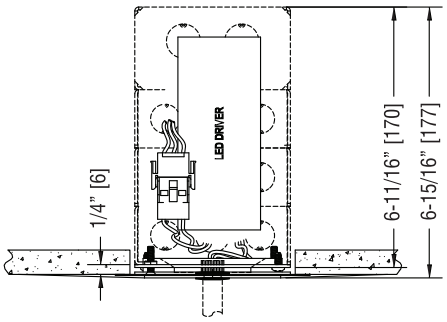
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

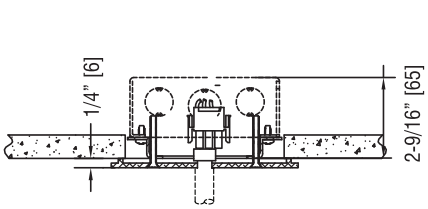


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

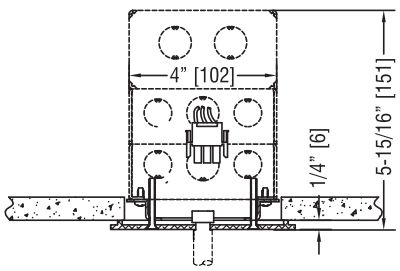


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

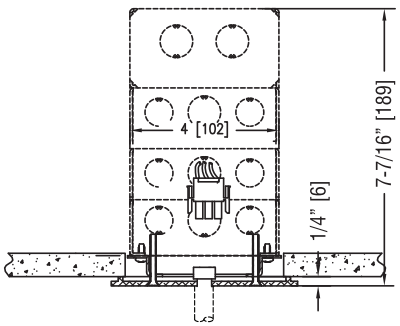
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C3P

Static White Framing Projector

Photometrics

Project Name

Type

Clear Form

C3P-L18 11° Focusing Tube (64506)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	733.8 f.c. / 7,898.6 lux	1.2' / 0.4m
8.0' / 2.4m	412.8 f.c. / 4,443.3 Lux	1.6' / 0.5m
10.0' / 3.0m	264.2 f.c. / 2,843.8 lux	2.0' / 0.6m
12.0' / 3.7m	183.4 f.c. / 1,974.1 lux	2.4' / 0.7m
14.0' / 4.3m	134.8 f.c. / 1,451.0 lux	2.8' / 0.9m
16.0' / 4.9m	103.2 f.c. / 1,110.8 lux	3.2' / 1.0m

CBCP:	26,416 Cd
Efficacy:	36.1 lm/w
Delivered Lumens:	881lm

C39-L18 22° Focusing Tube (64506-01)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	296.4 f.c. / 3,190.4 lux	2.3' / 0.7m
8.0' / 2.4m	166.8 f.c. / 1,795.4 lux	3.1' / 0.9m
10.0' / 3.0m	106.7 f.c. / 1,148.5 lux	3.9' / 1.2m
12.0' / 3.7m	74.1 f.c. / 797.6 lux	4.7' / 1.4m
14.0' / 4.3m	54.4 f.c. / 585.6 lux	5.5' / 1.7m
16.0' / 4.9m	41.7 f.c. / 448.9 lux	6.2' / 1.9m

CBCP:	10,672 Cd
Efficacy:	45.5 lm/w
Delivered Lumens:	1109lm

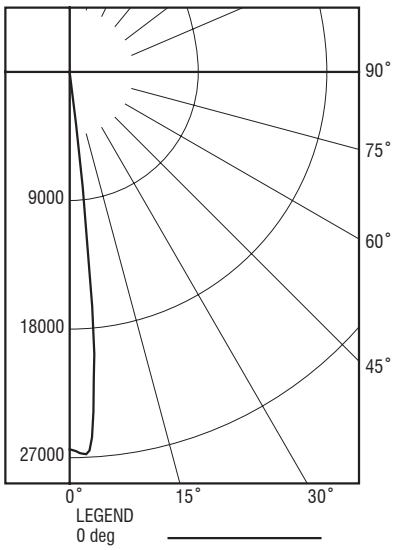
C3P-L18 33° Focusing Tube (64506-02)

Mounting Height in feet/meters	FC/Lux	Diameter in feet/meters
6.0' / 1.8m	161.2 f.c. / 1,735.1 lux	3.2' / 1.0m
8.0' / 2.4m	90.7 f.c. / 976.3 lux	4.3' / 1.3m
10.0' / 3.0m	58.0 f.c. / 624.3 lux	5.4' / 1.6m
12.0' / 3.7m	40.3 f.c. / 433.8 lux	6.4' / 2.0m
14.0' / 4.3m	29.6 f.c. / 318.6 lux	7.5' / 2.3m
16.0' / 4.9m	22.7 f.c. / 244.3 lux	8.6' / 2.6m

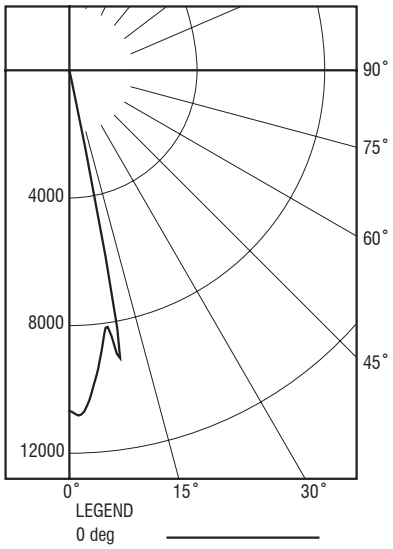
CBCP:	5,803 Cd
Efficacy:	45.7 lm/w
Delivered Lumens:	1115lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

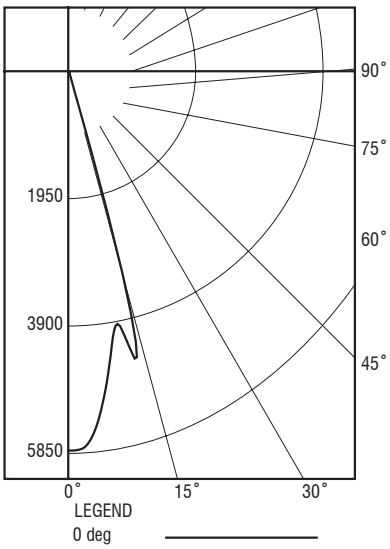
C3P-L18 11° Focusing Tube - Polar Diagram



C3P-L18 22° Focusing Tube - Polar Diagram



C3P-L18 33° Focusing Tube - Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C3P

Static White Framing Projector

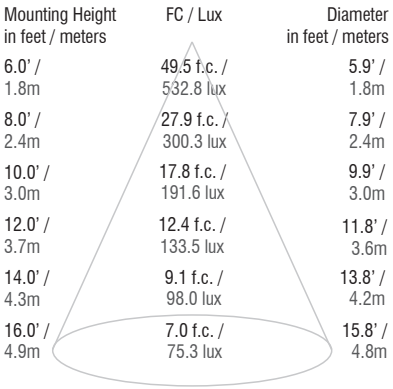
Project Name

Type

Clear Form

Photometrics

C3P-L18 54° Focusing Tube (64506-03)



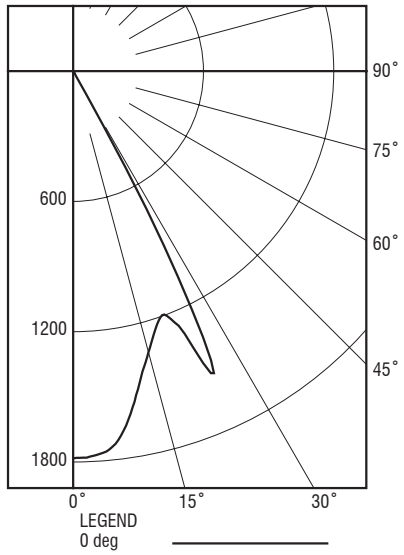
CBCP:	1,783 Cd
Efficacy:	42.4 lm/w
Delivered Lumens:	1039lm

For 1550 Lumen/98 CRI, use a derating value of 0.86

LL P/N	∅ Aperture	LL# 64506 11° Focus Tube	LL# 64506-01 22° Focus Tube	LL# 64506-02 33° Focus Tube	LL# 64506-03 54° Focus Tube
64522-KIT	Includes all listed apertures				
64522-12	∅ 0.125"	1°	2°	2°	5°
64522-25	∅ 0.25"	2°	3°	5°	10°
64522-37	∅ 0.375"	3°	5°	7°	14°
64522-50	∅ 0.50"	3.5°	7°	10°	19°
64522-62	∅ 0.625"	4°	9°	13°	24°
64522-75	∅ 0.75"	5°	10°	15°	28°
64522-87	∅ 0.875"	6°	12°	18°	33°
64522-10	∅ 1.0"	7°	14°	20°	37°
64522-1.12	∅ 1.125"	7.5°	15°	23°	41°
64522-1.25	∅ 1.25"	8°	17°	25°	45°
64522-1.37	∅ 1.375"	9°	19°	27°	48°
64522-1.50	∅ 1.5"	10°	21°	30°	52°

Optical Gobo Carrier (LL P/N 64514) accepts 37.5mm Gobos, Rosco Size (E)

C3P-L18 54° Focusing Tube - Polar Diagram



Foot Candle Chart

Distance	Focus Tube	Foot Candles	Largest Square (in.)
3'	11°	4450	4.9 x 4.9
	22°	1740	9.8 x 9.8
	33°	752	15 x 15
	54°	221	17.3 x 17.3
4'	11°	2205	6.5 x 6.5
	22°	872	13 x 13
	33°	360	20 x 20
	54°	118	26 x 26
5'	11°	1360	8 x 8
	22°	530	16.4 x 16.4
	33°	239	25 x 25
	54°	73	34.5 x 34.5
6'	11°	895	9.8 x 9.8
	22°	348	19.7 x 19.7
	33°	163	30 x 30
	54°	50	43.2 x 43.2
7'	11°	631	11.4 x 11.4
	22°	248	23 x 23
	33°	110	35 x 35
	54°	37	52.2 x 52.2

Distance	Focus Tube	Foot Candles	Largest Square (in.)
8'	11°	481	13 x 13
	22°	187	26.3 x 26.3
	33°	90	40.2 x 40.2
	54°	30	60.5 x 60.5
9'	11°	372	14.7 x 14.7
	22°	144	29.6 x 29.6
	33°	69	45.2 x 45.2
	54°	22	69 x 69
10'	11°	292	16.3 x 16.3
	22°	117	32.9 x 32.9
	33°	56	50.2 x 50.2
	54°	18	75.4 x 75.4
11'	11°	239	17.9 x 17.9
	22°	96	36.2 x 36.2
	33°	45	55.2 x 55.2
	54°	15	86.4 x 86.4
12'	11°	199	19.6 x 19.6
	22°	80	39.5 x 39.5
	33°	38	60.3 x 60.3
	54°	12	95 x 95

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

DRAWING SHEETS FOR QUICK-CONNECT CANOPY REFERENCE ONLY

MODEL NUMBER:	FIXTURE TYPE:	SCALE:	FILE NUMBER:	DATE:	NO.	REVISIONS DESCRIPTION	BY	DATE
C2W-L[LMS][CRI][CCT]-5LE1[OPT][V]-[YY]-M2	X.X.X.	3/8"=1"	C:\Users\spaulding\Dropbox\Litelab_DB\PRODUCT\FIXTURES\MUSEUM-LINE\INTEGRAL-LED\C-80_Series	6/24/25	2	UPDATED TO GENERIC SUBMITTAL	Z.L.T.S.	05/01/25
PROJECT NAME:	APPROX. WEIGHT: XXlbs./XXKg	DRAWN BY: Z.L.T.S.	CK'D BY: X.X.X.	FIXTURE DESCRIPTION: CYLINDER SERIES: C82 WW. FIXTURE W/ REVERSE BARREL FOR WALL APPLICATIONS				

LED PERFORMANCE		
CRI	WATTAGE	LUMENS (NOM.)
92–MIN.	19W	1550
98–MIN.	19W	1375
TOLERANCE: ± 7%-FLUX | ± 2%-CRI | LMS @ 30°K		

LUMEN MULTIPLIERS BY CCT		
CCT	CRI	MULTIPLIER*
27°K	92–MIN.	0.95
	98–MIN.	0.93
30°K	92–MIN.	1.00
	98–MIN.	1.00
35°K	92–MIN.	1.06
	98–MIN.	1.00
40°K	92–MIN.	1.10
	98–MIN.	1.07
*MULTIPLY BASE LEVELS BY MULTP. VALUES		

INPUT REQUIREMENTS: (V) IN CAT#
(A): 120V/60Hz/0.2 AMPS
(D): 240V/60Hz/0.2 AMPS
(C): 277V/60Hz/0.1 AMPS

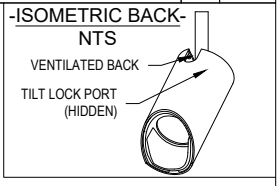
AVAILABLE FINISHES: (SELECT ONE)
(BR): BRUSHED ALUMINUM
(MB): MATTE BLACK
(P): WHITE
(CP*): CUSTOM PAINT
*PLEASE ALLOW FOR ADDED LEAD–TIME IF CP OPTION IS SELECTED

OPTICS: (BEAM) IN CAT# / FWHM VALUE
(X1-PROVIDED)
(35): 35° FL–OPTIC

ACCESSORIES: SIZE-a = Ø1.95" [49.5mm]
(STACK 2 MAX) | (PROVIDED)
OL-30"x60"-a UNIVERSAL SPREAD

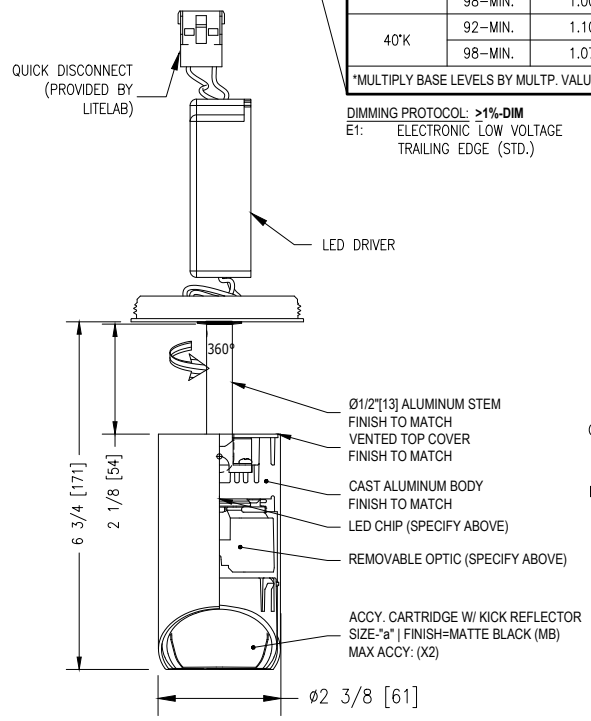
MODIFICATION NOTES: (LIST BELOW)
MOD-2: REVERSE BARREL

-ISOMETRIC BACK-
NTS



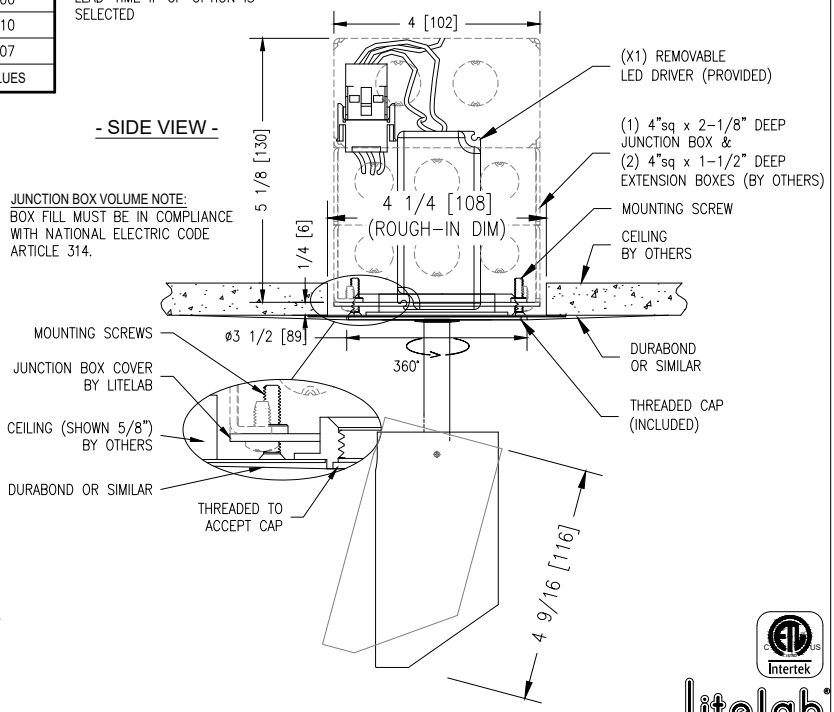
DIMMING PROTOCOL: **>1%-DIM**
E1: ELECTRONIC LOW VOLTAGE TRAILING EDGE (STD.)

- FRONT VIEW -



- SIDE VIEW -

JUNCTION BOX VOLUME NOTE:
BOX FILL MUST BE IN COMPLIANCE WITH NATIONAL ELECTRIC CODE ARTICLE 314.



Litelab Corp. 251 Elm Street Buffalo, NY 14203, USA | (T): +01 (716) 856-4491 | (W): www.litelab.com

PROJECT NAME: **BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168**

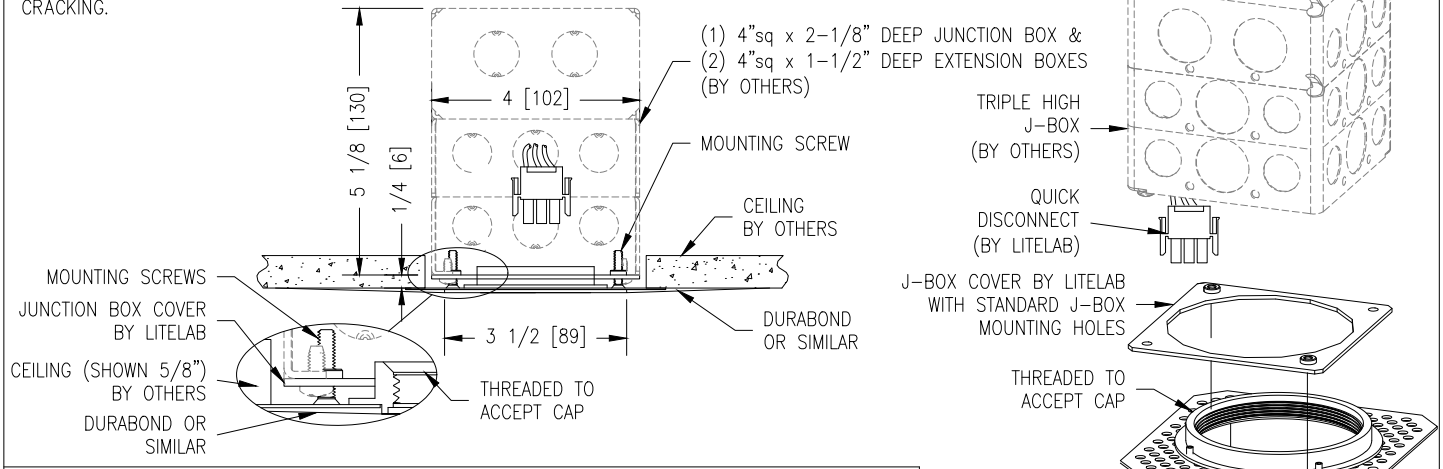
DRAWING SHEETS FOR QUICK-CONNECT CANOPY REFERENCE ONLY

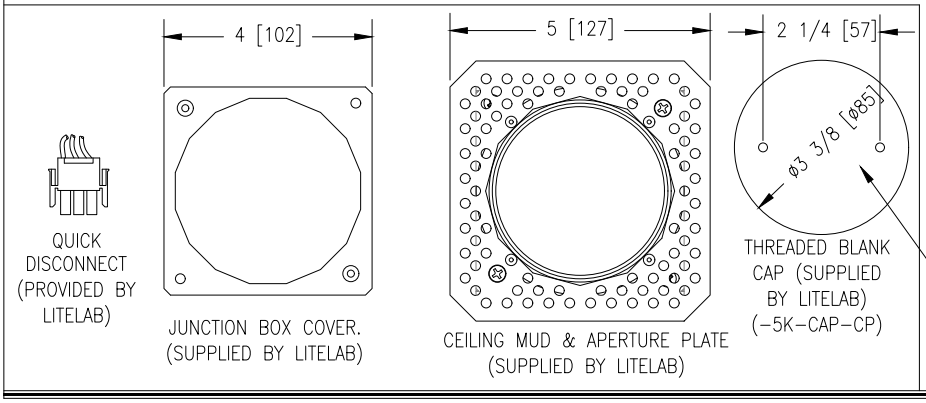
SH: 2OF2

MODEL NUMBER:	FIXTURE TYPE:	SCALE:	FILE NUMBER:	DATE:	NO.	REVISIONS DESCRIPTION	BY	DATE
QC–5K–(FINISH TO MATCH FIXT.)	[X.X.X.]	3/8"=1"	G:\ZLTS\ZLTS Master File\Fixtures_Photometric Data\CSERIES_IES	6/21/18				
PROJECT NAME:	APPROX. WEIGHT:	DRAWN BY:	CK'D BY:	FIXTURE DESCRIPTION:				
	XXlbs./XXKg	Z.L.T.S.	X.X.X.	QUICK CONNECT CANOPY FLANGE KIT				

JUNCTION BOX MOUNTING NOTE:
JUNCTION BOX MUST BE RIGIDLY MOUNTED TO PREVENT PLASTER CRACKING.

JUNCTION BOX VOLUME NOTE:
BOX FILL MUST BE IN COMPLIANCE WITH NATIONAL ELECTRIC CODE ARTICLE 314.





PIN SPANNER WRENCH TOOL
MCMASTER–CARR PT# 5794A16
OR SIMILAR NEEDED TO REMOVE
BLANK CAP
(BY OTHERS OR ORDERED
SEPARATELY)

Litelab Corp. 251 Elm Street Buffalo, NY 14203 (716) 856–4491 (716) 856–4300 fax: (716) 856–0156

TROV®

OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR | **L35**

DATE	PROJECT	FIRM	TYPE

THE L35 INCLUDES A PATENTED OPTICAL DESIGN THAT DELIVERS A 120° BEAM ANGLE OPTION IN AN ULTRA SLIM FORM FACTOR FOR PRECISE COVE LIGHTING APPLICATIONS. EXCLUSIVE FLIP TO FLAT™ HINGE DESIGN PROVIDES FLEXIBILITY WHEN MANAGING SMALL COVE DETAILS. TROV OFFERS SMOOTH, FLICKER FREE DIMMING DOWN TO 0%.

FEATURES :

- DIM TO 0%, ELV REVERSE PHASE
- ULTRA LOW PROFILE
- MULTI-VOLT
- FLIP TO FLAT™
- 7 CCT OPTIONS
- 80+ AND 90+ CRI OPTIONS
- IP54 INTERIOR

MODEL/ SIZE	INTERIOR/ EXTERIOR	LENGTH	POWER	CCT		CRI	VOLTAGE	OPTICS
L35	I	12″ 48″	02 04 06 08 10 12	**WHITE CCT** 27 30 35 40	**MONO COLOR**	80 90**	MULT (120-277V)	120
ON DEMAND SHIPPING								
BUILD TO ORDER SHIPPING				22 25* 50	BL GR**** AM RD***	Blank For Color		

EXAMPLE: L35-I-48-06-30-90-MULT-120 *2500K is not available in 10W or 12W. **90 CRI not available in 2200K, 2500K or 5000K. ***Red is not available in 12W or 10W. ****Green is not available in 12W. See page 2 for cables and accessories.

PERFORMANCE	WATTS	OPTIC	LUMEN OUTPUT	EFFICACY
	2W	120°	140 lm/LF (459 lm/m)	70 lm/W
	4W	120°	407 lm/LF (1336 lm/m)	102 lm/W
	6W	120°	649 lm/LF (2130 lm/m)	108 lm/W
	8W	120°	866 lm/LF (2839 lm/m)	108 lm/W
	10W	120°	1082 lm/LF (3549 lm/m)	108 lm/W
	12W	120°	1273 lm/LF (4176 lm/m)	106 lm/W

ALL LUMEN DATA IS FROM 4000K 80CRI FIXTURES. PLEASE SEE PHOTOMETRY SPEC SHEET FOR ADDITIONAL LUMEN DATA.

COLOR RENDERING INDEX 80+, 90+

COLOR CONSISTENCY 2-STEP MACADAM ELLIPSE

LUMEN DEPRECIATION / RATED LIFE

WATTS	L70 @ 25C	L70 @ 50C	L90 @ 25C	L90 @ 50C
2W-8W	>73,000	>60,000	>22,000	>18,000
10W-12W	>150,000	>70,000	>50,000	>25,000

*CALCULATIONS FOR LED FIXTURES ARE BASED ON MEASUREMENTS THAT COMPLY WITH IES LM-80 TESTING PROCEDURES AND IES TM-21 CALCULATOR

ELECTRICAL

POWER CONSUMPTION 2W*/LF (6.6W/M) ; 4W/LF (13.2W/M) ; 6W/LF (19.8W/M) ; 8W/LF (26.4W/M) ; 10W/LF (33W/M) ; 12W/FL (39.6W/M)
* 3W/LF (9.9W/M) at 220V -277V

MAX FIXTURE RUN LENGTH

	2W/LF		4W/LF		6W/LF		8W/LF		10W/LF		12W/LF	
Volts	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'
120	214	214	186	186	152	152	114	114	91	91	76	76
220	374	392	340	340	277	277	209	209	95	167	95	139
277	374	494	374	428	349	349	263	263	95	190	95	175

NOTE: Information on this Spec Sheet is subject to change, please visit ecosenselighting.com/downloads for the most updated information.

ECOSENSE®

ECOSENSE LIGHTING INC.
837 NORTH SPRING STREET
SUITE 103
LOS ANGELES, CA 90012

SUPPORT@ECOSENSELIGHTING.COM

TROV®

OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR | **L35**

DATE	PROJECT	FIRM	TYPE

	POWER FACTOR	4W, 6W, 8W, 10W, 12W >0.9, 2W<0.9
	OPERATING VOLTAGE	MULTIVOLT: 110-277VAC, 50/60 Hz
	DRIVER	INTEGRAL TO FIXTURE; DE-RATED POWER AND SYNCHRONOUS START-UP AT FULL BRIGHTNESS
	STARTUP TEMPERATURE	-40˚F TO 122˚F (-40˚C TO 50˚C)
	OPERATING TEMPERATURE	-40˚F TO 122˚F (-40˚C TO 50˚C)
	STORAGE TEMPERATURE	-40˚F TO 176˚F (-40˚C TO 80˚C)
CONTROL	**DIMMING**	110-277VAC, ELV TYPE 0.07%-100%, REVERSE PHASE, TRAILING EDGE ETC control systems require 0-10V control using EcoSense LDCM. TROV will not work with ETC phase dimmers.
PHYSICAL		
	HOUSING /LENS	EXTRUDED ALUMINUM; CLEAR POLYCARBONATE; STAINLESS STEEL FASTENERS; PLASTIC ENDCAPS RUBBER OVERMOLD FOR CABLE ASSEMBLY
	WEIGHT	1.2LBS / 0.55KG (1FT) ; 3.95LBS / 1.8KG (4FT)
	CONNECTORS	INTEGRAL MALE/ FEMALE CONNECTORS
	ENVIRONMENT	INDOOR • ETL CERTIFIED FOR DRY/DAMP LOCATIONS IP54
	BEAM ANGLE	COVE
	MOUNTING OPTIONS	INTEGRAL MOUNTING AND ADJUSTABLE AIMING FROM 0˚-180˚ IN 15˚ INCREMENTS
FIXTURE RATING & CERTIFICATIONS	**ETL CERTIFIED** **RoHS COMPLIANT** **ENERGY STAR COMPLIANT** **RCM CERTIFIED**	Intertek · RoHS COMPLIANT · ENERGY STAR · Title 24 JA8-2016 *90 CRI models only
LIMITED WARRANTY	**5 YEARS**	

WIRING OPTIONS (MVOLT): 110-277VAC

Power Cable Assembly, TROV, Leader/Jumper, 10 foot **CBL-3P-L-UNV-10***
Power Cable Assembly, TROV, Leader/Jumper, 50 foot **CBL-3P-L-UNV-50***
Power Cable Assembly, TROV, Jumper, 5 foot **CBL-3P-L-UNV-05****
Power Cable Assembly, TROV, Jumper, 1 foot **CBL-3P-L-UNV-01****
Power Cable Assembly, TROV, Adjustable Jumper, 0" to 7" **CBL-3P-L-UNV-ADJ**
Power Cable Assembly, TROV, Male and Female terminator caps **CBL-3P-L-UNV-CAPS**

*Two (2) terminators are included with the 10' and 50' power cable. One Leader need per circuit/fixture run. Cables are not plenum rated.
** If using the 5' or 1' power cable assembly as a leader to power a run one set of CBL-3P-L-UNV-CAPS will also be need per cable.

0-10V CONTROL OPTIONS

100-120VAC / 277VAC Linear Dimming Control Module 0-10V - Plenum Rated **LDCM-PL-120-277-010V-GR**
All products come standard with ELV dimming capabilities. 0-10V Control options required for operation at 0-10V.

OPTIONAL ACCESSORIES

Mounting

Mounting Track and Clips Set, 48 Inch Track, 8 Clips ..... **MNT-L-TRKCLIP-48** ..... 48" track and clips set will work with one 48" fixture or four 12" fixtures.
Mounting Track and Clips Set, 12 Inch Track, 2 Clips ..... **MNT-L-TRKCLIP-12** ..... 12" track will not work with 48" fixtures.
Mounting Track Clip, TROV, Set of 2 ..... **MNT-L-CLIP** ..... Clips needed = 12" fixtures need 1 set of 2 and 48" fixture needs 2 sets of 2.
90 Degree L bracket, TROV, Set of 2 ..... **MNT-L-LBKT** ..... L-Brackets needed = 12" fixtures need 1 set of 2 and 48" fixture needs 1 set of 2.
Angle Locking Clip, TROV, Pack of 10 ..... **MNT-L-ANGLOCK** ..... Angle Locks needed = 12" fixtures need 1 and 48" fixtures need 2.
Mounting, Fine Adjustment Bracket, TROV ..... **MNT-L-FAB** ..... Fine Adjustment Brackets needed = 12" fixtures need 1 and 48" fixtures need 2.
*Fine Adjustment Bracket is highly recommended for Grazing Optics.
Mounting, Fine Adjustment L-Bracket, TROV ..... **MNT-L-LFAB** ..... Fine Adjustment L-Brackets needed = 12" fixtures need 1 and 48" fixtures need 2.
*Fine Adjustment L-Bracket is recommended for Asymetric Optics when aiming is needed.

Wall Mount Arm

Wall Mount Arm, 6 inch, TROV **WMA-L-CA-06**
Wall Mount Arm, 12 inch, TROV **WMA-L-CA-12**
Wall Mount Arm, 18 inch, TROV **WMA-L-CA-18**
Wall Mount Arm, 24 inch, TROV **WMA-L-CA-24**
Wall Mount Arm End Plate Set, TROV, Includes Left and Right ..... **WMA-L-END**
Wall Mount Arm Joiner Plate, TROV ..... **WMA-L-JNR**

Wall Mount Arms needed = For individual fixture installations two arms and one end set will be needed per fixture. For continuous run installation one endset will be needed per run. Each end set contains one left and one right end plate. One joining set will be needed per joint. One arm per fixture will be need plus one extra arm to complete the run. For example: A 10ft run made with two 4ft and two 1ft fixtures will contain; 1 x WMA-L-END, 3 x WMA-L-JNR, and 5 x WMA-L-CA-12. Leader cables are not included with wall mount arms, end sets, or joiners sets.

Snap-on Lenses

Snap-on Lens, Frosted, 12 inch, L35 ..... **LENS-L35-FROST-12**
Snap-on Lens, Frosted, 48 inch, L35 ..... **LENS-L35-FROST-48**
Snap-on Lens, Clear, 12 inch, L35 ..... **LENS-L35-CLEAR-12**
Snap-on Lens, Clear, 48 inch, L35 ..... **LENS-L35-CLEAR-48**

Snap-on Lenses need = One 12" lens is needed per 12" fixture and one 48" lens is needed per 48" fixture.
Clear lenses can be used to hold colored filters to customize the output color of any TROV fixture, except the ASYM. Color filters supplied by others.

ECOSENSE®

ECOSENSE LIGHTING INC.
837 NORTH SPRING STREET
SUITE 103
LOS ANGELES, CA 90012

SUPPORT@ECOSENSELIGHTING.COM

TROV®

OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR | **L35**

DATE	PROJECT	FIRM	TYPE

Landscape Stake

Landscape Stake, 6 inch, TROV, Set of 2.....LS-L-STK-06
Landscape Stake, 12 inch, TROV, Set of 2.....LS-L-STK-12
Landscape Stake, 18 inch, TROV, Set of 2.....LS-L-STK-18

Landscape Stakes needed = 12" and 48" fixtures both need one set of 2.

Masking Plates

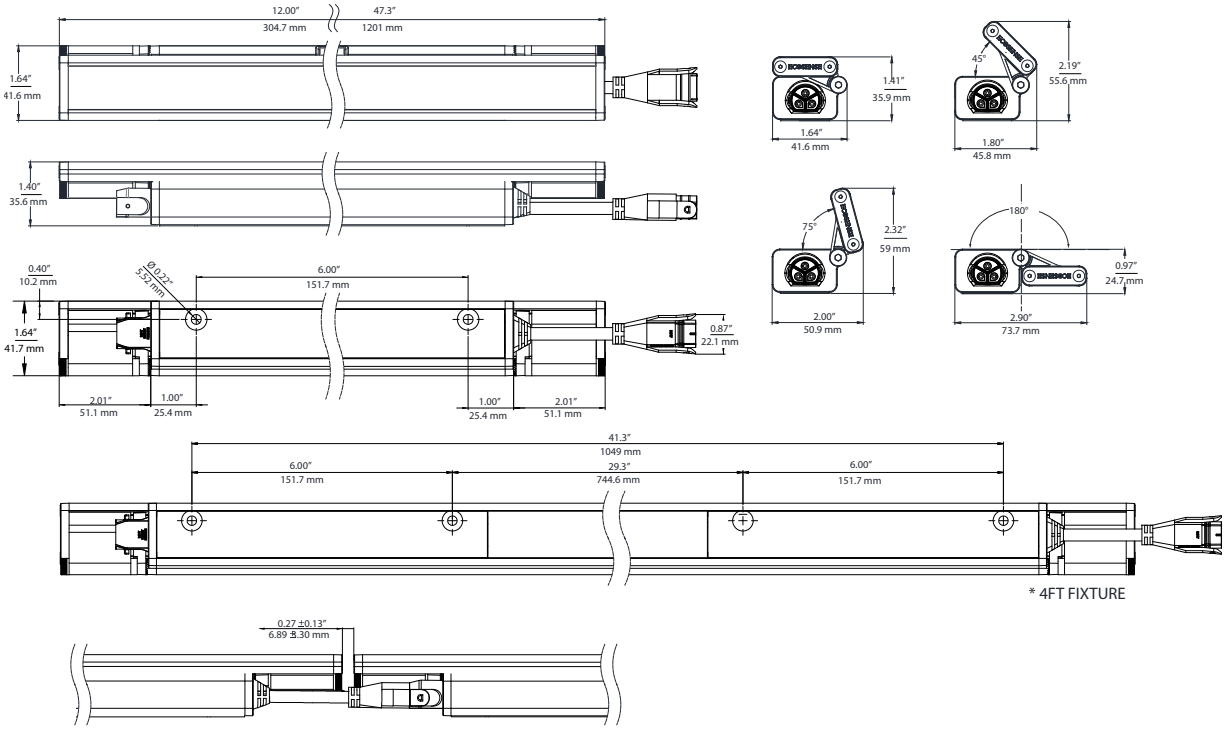
Masking Plate, 3 inch high, 12 inch, L50 & L35.....MP-L50-3H-12
Masking Plate, 3 inch high, 48 inch, L50 & L35.....MP-L50-3H-48

Masking Plates needed = One 12" plate is needed per 12" fixture and one 48" plate is needed per 48" fixture.

Wire Box

Conduit Connection, Wire Box, TROV, Interior Only, L35.....CC-L-WIREBOX

Wire box can be used instead of a leader cable to start a run. 1/2" conduit fitting can attach directly to the box on one end and the fixture to the other.



ECOSENSE®

ECOSENSE LIGHTING INC.
837 NORTH SPRING STREET
SUITE 103
LOS ANGELES, CA 90012

SUPPORT@ECOSENSELIGHTING.COM

BUS-13R

Recessed D-Bar, Trimless

Project Name

Type

Feed	-13R	Voltage	XX	Amps		Finish	

Feed Code	Profile / Mounting	Vinyl / Voltage	Vinyl / Voltage	Amperage	Total Length of Straight Run (in.)*	Finish	Whip (ft.)
BUS CEC EEB SEC EEF TEC SCB SCF SEB SEF TCB TCF TEB TEF		1A 2A 6A 3D 2D 6D 3C 4B 4K	n/a	16A 1A 20A 1.5A 30A 2A 60A 3A 4A 5A 6A 8A 12A		Unfinished UF	

Clear Form

Flatten & Save

Circuiting Chart

1A
1 circ. (120V)
1-hot, 1-neutral

2A
2 circ. (120V)
2-hot, 1-neutral

3D
1 circ. (230V)
1-hot, 1-neutral

2D
2 circ. (240V)
2-hot, 1-neutral

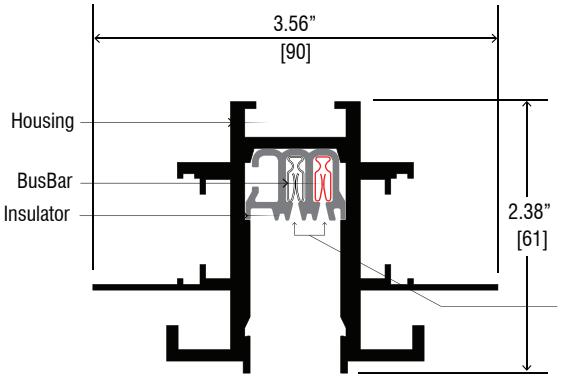
3C
1 circ. (277V)
1-hot, 1-neutral

4B (Consult Factory)
1 circ. (Low Voltage)
1-hot, 1-neutral

4K (Consult Factory)
1 circ. (Low Voltage)
International
1-hot, 1-neutral

6A
1 circ. (120V)
2-hot, 1-neutral
tied hots

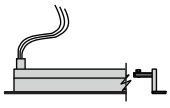
6D
1 circ. (230V)
2-hot, 1-neutral
tied hots



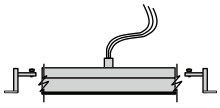
Shown is one circuit BusRun. Refer to chart below for circuiting options.

Feed Options: Standard BusRun feed capacity is 20 Amps (120v) or 16 Amps (230 Volt); 30 and 60 Amp feeds are available

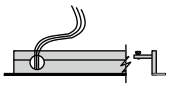
TEF-13R
TEC-13R ((Current Limiter)*
Top End Feed
1/2" NPSM or 20mm Conduit



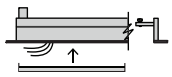
TCF-13R
Top Center Feed
1/2" NPSM or 20mm Conduit



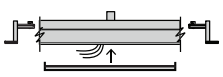
SEF-13R
SEC-13R (Current Limiter)*
Side End Feed
1/2" NPSM or 20mm Conduit



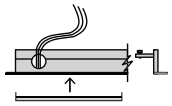
TEB-13R
Top End Splice-Box
30 Amp Max



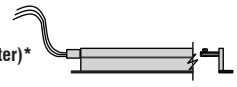
TCB-13R
Top Center Splice Box
30 Amp Max



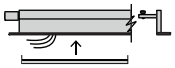
SEB-13R
Side End Splice Box
30 Amp Max



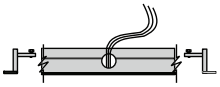
EEF-13R
EEC-13R ((Current Limiter)*
End End Feed
1/2" NPSM or 20mm Conduit



EEB-13R
End End Splice-Box
30 Amp Max



SCF-13R
Side Center Feed
1/2" NPSM or 20mm Conduit



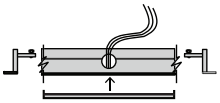
Notes:

1. All Splice Box feeds are 30 Amp maximum load.
2. All feeds are supplied with two end caps.
3. Feeds cannot be field modified.
4. Feeds can be made between 10" - 120".
5. Maximum loads are per circuit.

CL: Current Limiter Values *(120v Only)

1A	120VA	5A	600VA
1.5A	180VA	6A	720VA
2A	240VA	8A	960VA
3A	360VA	12A	1440VA
4A	480VA		

SCB-13R
Side Center Splice Box
30 Amp Max



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

Recessed D-Bar, Trimless

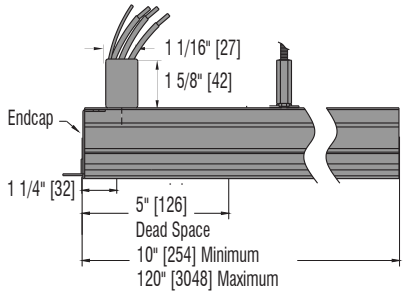
Project Name

Type

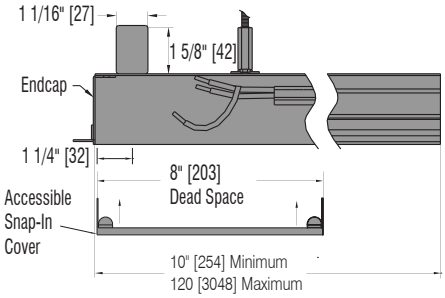
Clear Form

Dimension Chart

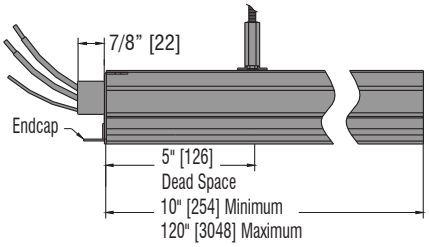
Top End Feed



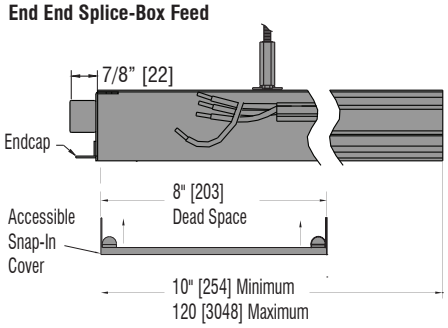
Top End Splice-Box Feed



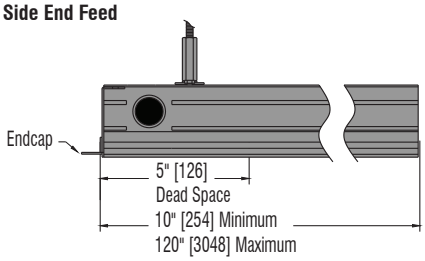
End End Feed



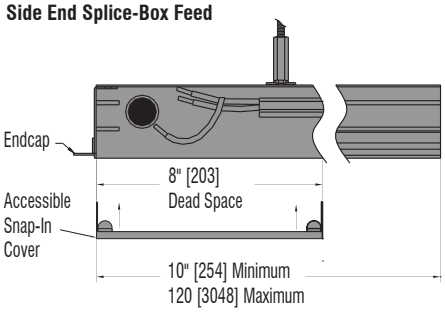
End End Splice-Box Feed



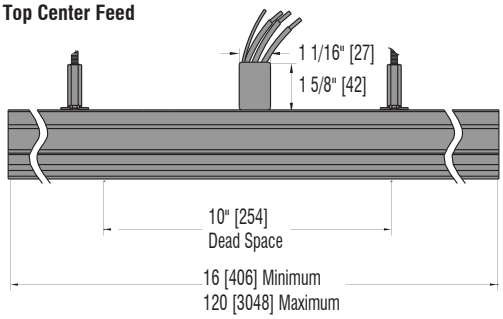
Side End Feed



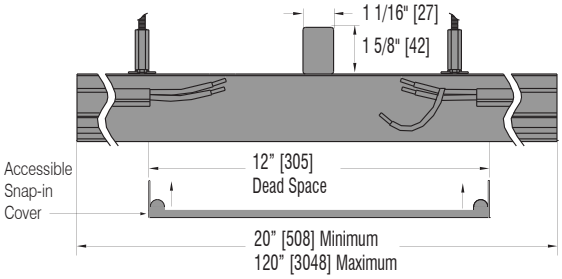
Side End Splice-Box Feed



Top Center Feed



Top Center Splice-Box Feed



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

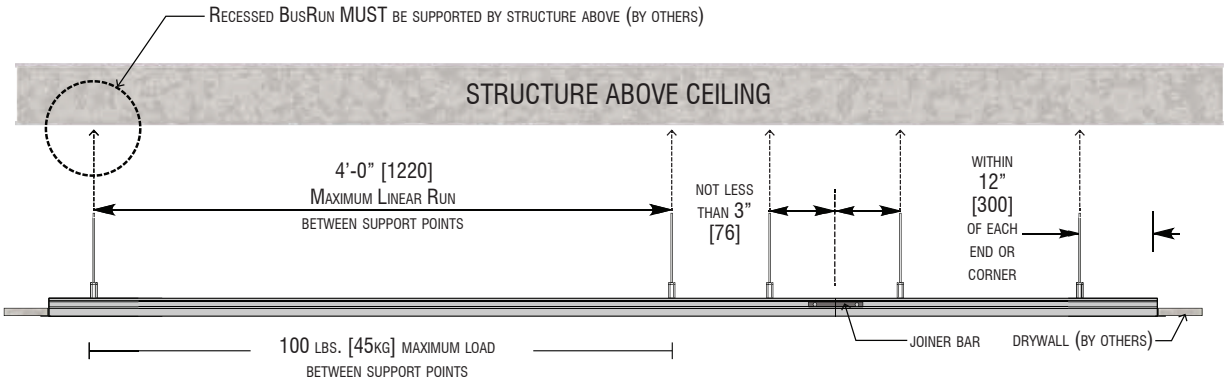
Recessed D-Bar, Trimless

Project Name

Type

Clear Form

Mounting Diagram



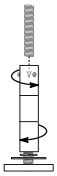
MOUNTING NOTES:

10'0" [3048] RECESSED BUSRUN SECTION REQUIRES 3 SUPPORT POINTS.
8'0" [2438] RECESSED BUSRUN SECTION REQUIRES 3 SUPPORT POINTS.
4'0" [1219] RECESSED BUSRUN SECTION REQUIRES 2 SUPPORT POINTS.

MOUNTING RULES

12" [300]	A SUPPORT POINT MUST BE PROVIDED WITHIN 12" OF EVERY END CORDNER OF THE BUSRUN LAYOUT.
4'-0" [1220]	MAXIMUM DISTANCE BETWEEN SUPPORT POINTS CANNOT EXCEED 4'0" LINEAR FEET OF BUSRUN.
3" [76]	SUPPORT POINTS CANNOT BE WITHIN 3" FROM THE CENTERLINE ON BOTH SIDES OF BUSRUN JOINTS.
100LB [45KG]	BUSRUN BUSWAY AND MOUNTING HARDWARE ARE RATED FOR A TOTAL SUPPORTED WEIGHT UP TO 100 LBS [45KG] BETWEEN SUPPORT POINTS.

MOUNTING OPTIONS

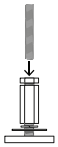


THREADED ROD HANGER

NICKEL-PLATED COUNTER-ROTATING THREADED ROD HANGER AND MOUNTING BAR ENABLE ATTACHMENT AND LEVELING OF BUSRUN TO FIXED THREADED ROD.

☐ B-HHO-TR250
FOR 1/4-20 ROD

☐ B-HHO-TR375
FOR 3/8-16 ROD

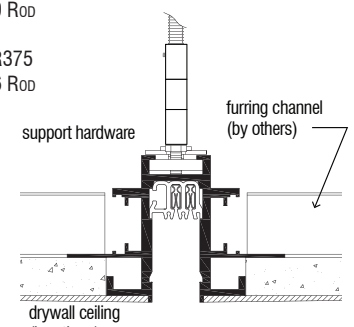


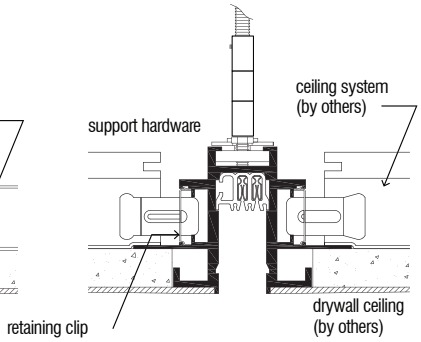
COUPLING NUT
FOR THREADED ROD

☐ B-HHO-CK-M6-01
FOR M6 ROD

RETAINING CLIP
FOR CEILING SYSTEM

☐ TBC-IT-01
(ORDERED SEPARATELY)





Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

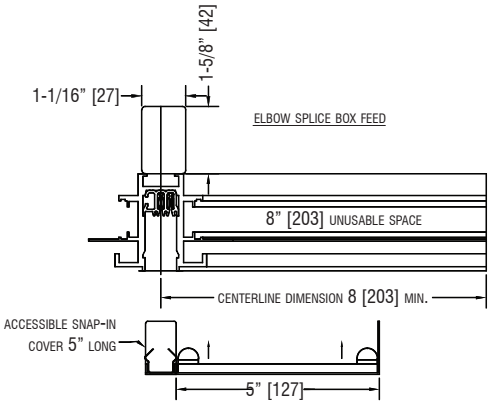
X, T, L Configurations

Project Name

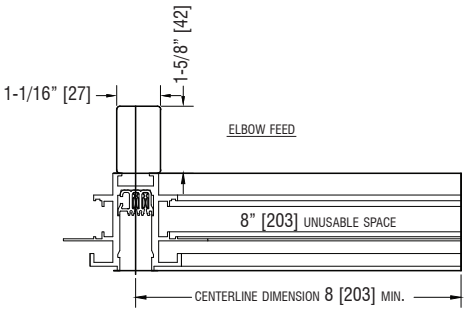
Type

Clear Form

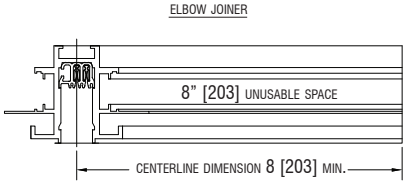
L-Dimensions (Typical):



TUB-13R(VINYL)(VINYL)(AMPS)-E(TYPE)-08-(FINISH)



TUF-13R(VINYL)(VINYL)(AMPS)-E(TYPE)-08-(FINISH)



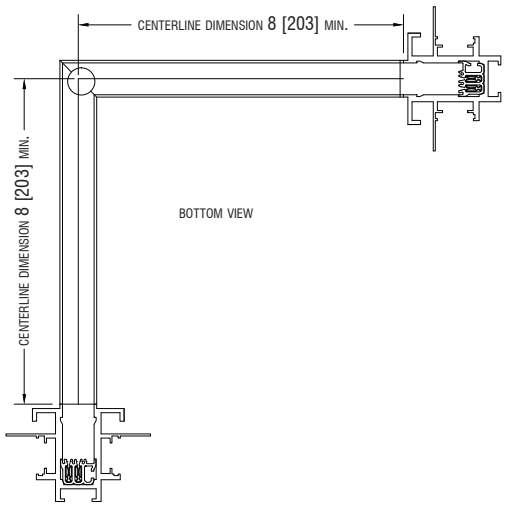
BUS-13R(VINYL)(VINYL)(AMPS)-E(TYPE)-08-(FINISH)

MAXIMUM UNIT LENGTH IS 10' [3048] UNINTERUPTED SPAN. SPLICE KITS TO ADJACENT SECTIONS OCCUPY 4" [102] FOR 16, 20 AND 30 AMP CAPACITY AND 6" FOR 60 AMP CAPACITY. WHEN CALCULATING PLUG-IN SPACE:

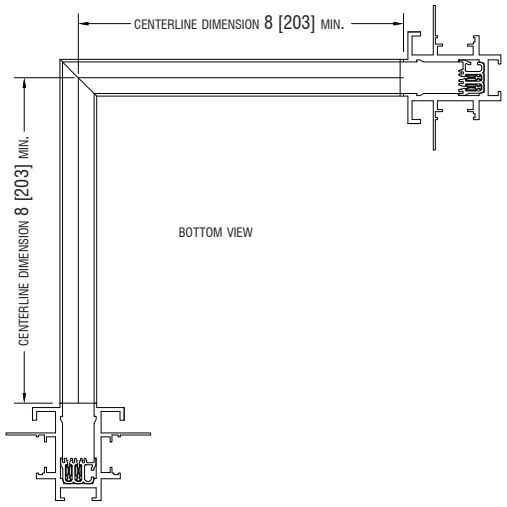
(TOTAL LENGTH OF SECTION) - (FEED) - (SPLICE KIT/2) = TOTAL AVAILABLE PLUG-IN SPACE

FOR FITTER LENGTHS, PLEASE SEE FIXTURE CUTSHEETS.

REFLECTED CEILING PLAN VIEW: **ELBOW SPLICE BOX FEED**
ELBOW FEED



REFLECTED CEILING PLAN VIEW: **JOINER**



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

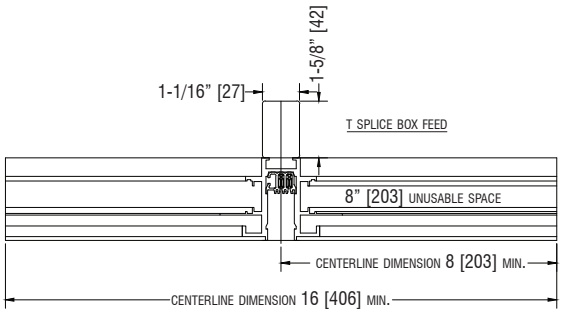
X, T, L Configurations

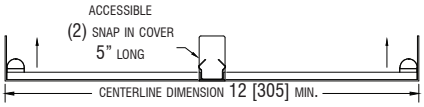
Project Name

Type

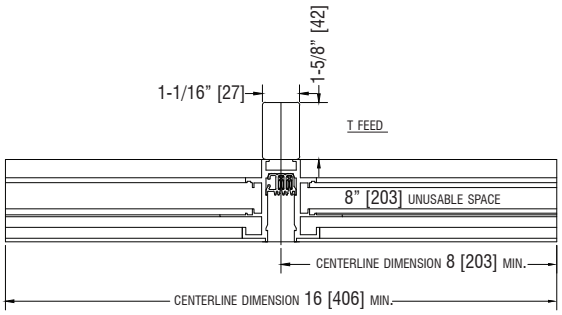
Clear Form

T-Dimensions (Typical):

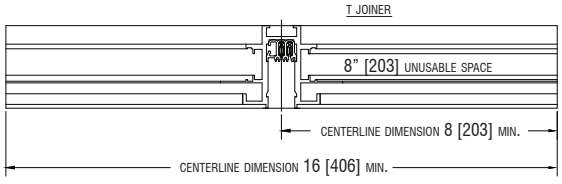




TUB-13R(VINYL)(VINYL)(AMPS)-T(TYPE)-08-(FINISH)



TUF-13R(VINYL)(VINYL)(AMPS)-T(TYPE)-08-(FINISH)



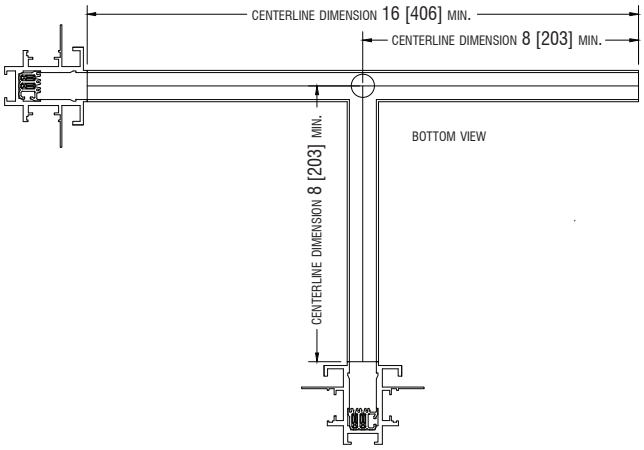
TUF-13R(VINYL)(VINYL)(AMPS)-T(TYPE)-08-(FINISH)

Maximum unit length is 10' [3048] uninterupted span. Splice kits to adjacent sections occupy 4" [102] for 16, 20 and 30 Amp capacity and 6" for 60 Amp capacity. When calculating plug-in space:

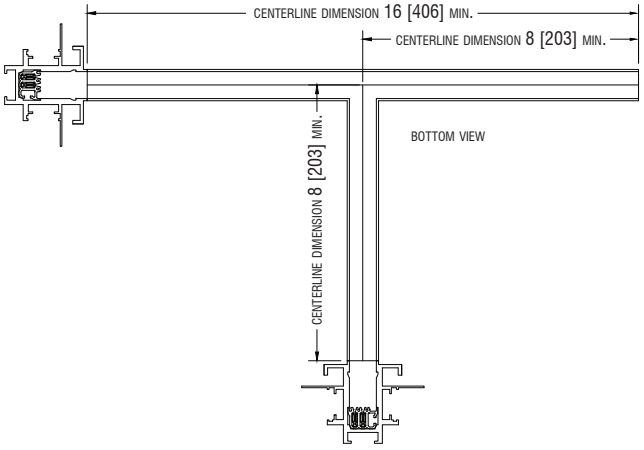
(total length of section) - (feed) - (splice kit/2) = total available plug-in space

For fitter lengths, please see fixture cutsheets.

Reflected ceiling plan view: **Elbow splice box feed**
Elbow feed



Reflected ceiling plan view: **Joiner**



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

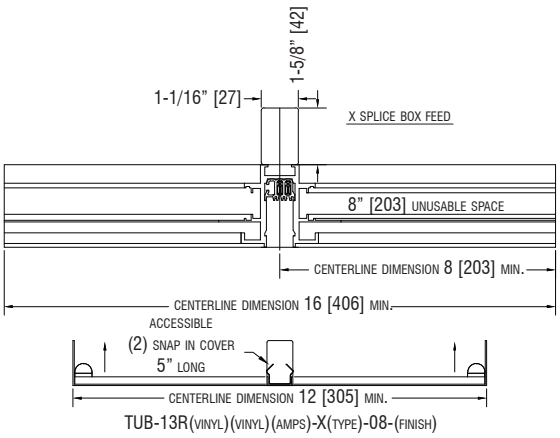
X, T, L Configurations

Project Name

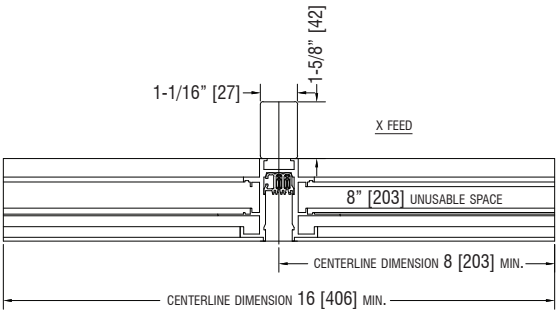
Type

Clear Form

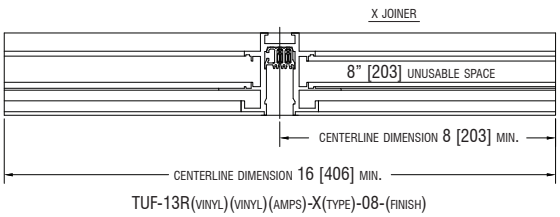
X-Dimensions (Typical):



TUB-13R(VINYL)(VINYL)(AMPS)-X(TYPE)-08-(FINISH)



TUF-13R(VINYL)(VINYL)(AMPS)-X(TYPE)-08-(FINISH)



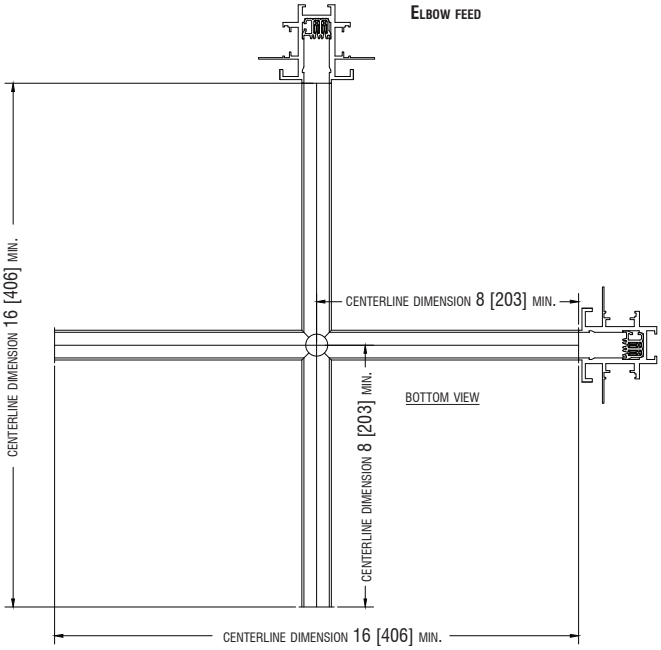
TUF-13R(VINYL)(VINYL)(AMPS)-X(TYPE)-08-(FINISH)

MAXIMUM UNIT LENGTH IS 10' [3048] UNINTERUPTED SPAN. SPLICE KITS TO ADJACENT SECTIONS OCCUPY 4" [102] FOR 16, 20 AND 30 AMP CAPACITY AND 6" FOR 60 AMP CAPACITY. WHEN CALCULATING PLUG-IN SPACE:

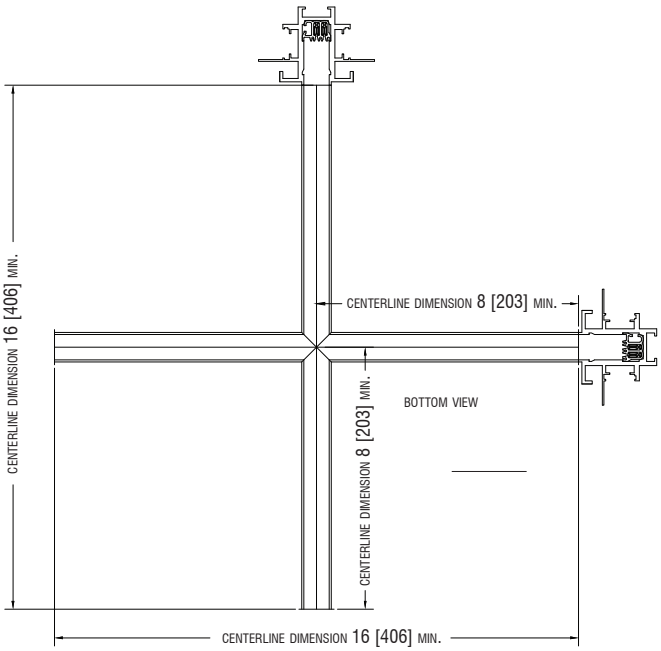
(TOTAL LENGTH OF SECTION) - (FEED) - (SPLICE KIT/2) = TOTAL AVAILABLE PLUG-IN SPACE

FOR FITTER LENGTHS, PLEASE SEE FIXTURE CUTSHEETS.

REFLECTED CEILING PLAN VIEW: ELBOW SPLICE BOX FEED
ELBOW FEED



REFLECTED CEILING PLAN VIEW: JOINER



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

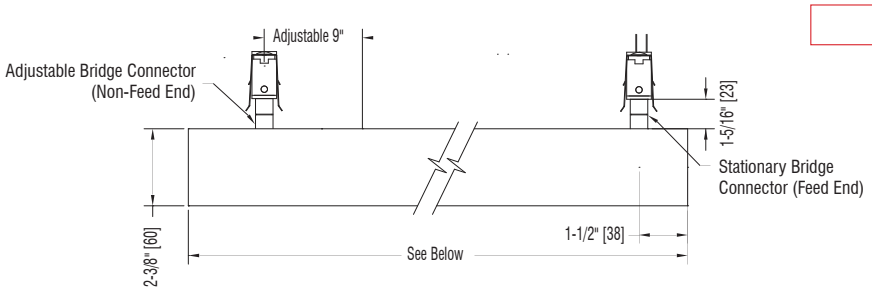
Accessories

Project Name

Type

Clear Form

BusBridge

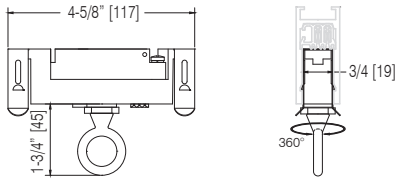


Maximum Load: 40 lbs

Codes		Adaptor/Voltage		Finish
☐ BB1D-054	3'9" [Min. Span] | 4'3" [Max. Span] | 4'6" [Total Length]	☐ 9AD-A	(120 Volts)	☐ P=White
☐ BB1D-102	7'9" [Min. Span] | 8'3" [Max. Span] | 8'6" [Total Length]	☐ 9AD-D	(240 Volts)	☐ MB = Matte Black
☐ BB1D-120	9'0" [Min. Span] | 9'9" [Max. Span] | 10'0" [Total Length]	☐ 9AD-C	(277 Volts)	☐ NT = Brushed
				☐ UF = Unfinished
				☐ ST = Silver Tone

Example: BB1D-102-9AD-A-MB

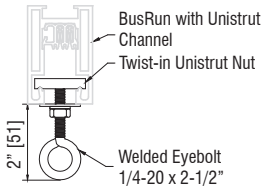
Sign Hanger*



Supports 40lb (18kg) Maximum Static Vertical Load

Code	Adaptor	Finish
☐ BSH	9ED	☐ P=White
		☐ MB = Matte Black
		☐ ST = Silver Tone
		☐ R = Unfinished

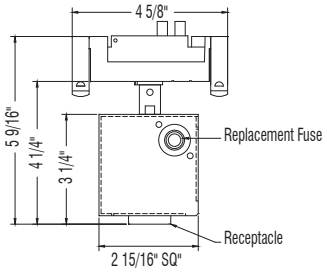
Loadmatic Hanging



Supports up to 100lb [45kg] Maximum Static Vertical Load

Code	Finish
☐ BSH-UNI	☐ P=White
	☐ MB = Matte Black
	☐ R = Unfinished

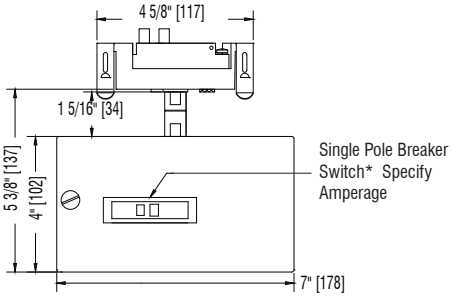
PowerDown Box*



Code/Amperage	Adaptor / Voltage	Finish
3-Prong Edison Plug		☐ P=White
☐ BPT-P15F	☐ 9AD-A (120 Volts)	☐ MB=Matte Black
Twist Lock		☐ ST=Silver Tone
☐ BPT-T15F	☐ 9AD-A (120 Volts)	☐ CP=Custom Finish
☐ BPT-T20F		

NEMA Guide	120 volt	277 volt
BPT-P15F	5-15R	
BPT-T15F	L5-15R	L7-15R
BPT-T20F	L5-20R	L7-20R

PowerDown Breaker*



Code/Amperage	Adaptor / Voltage	Finish
☐ BPT-K15B	9AD (120 Volts)	☐ P=White
☐ BPT-K20B		☐ MB=Matte Black
☐ BPT-K30B		☐ ST=Silver Tone
		☐ CP=Custom Finish

Includes knockouts

** Includes 11" Safety Cable*

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

06.10.2019

BUS-13R

Recessed D-Bar, Trimless

Project Name

Type

Feed	-13R	Voltage	XX	Amps		Finish	

Feed Code	Profile / Mounting	Vinyl / Voltage	Vinyl / Voltage	Amperage	Total Length of Straight Run (in.)*	Finish	Whip (ft.)
BUS CEC EEB SEC EEF TEC SCB SCF SEB SEF TCB TCF TEB TEF		1A 2A 6A 3D 2D 6D 3C 4B 4K	n/a	16A 1A 20A 1.5A 30A 2A 60A 3A 4A 5A 6A 8A 12A		Unfinished UF	

Clear Form

Flatten & Save

Circuiting Chart

1A
1 circ. (120V)
1-hot, 1-neutral

2A
2 circ. (120V)
2-hot, 1-neutral

3D
1 circ. (230V)
1-hot, 1-neutral

2D
2 circ. (240V)
2-hot, 1-neutral

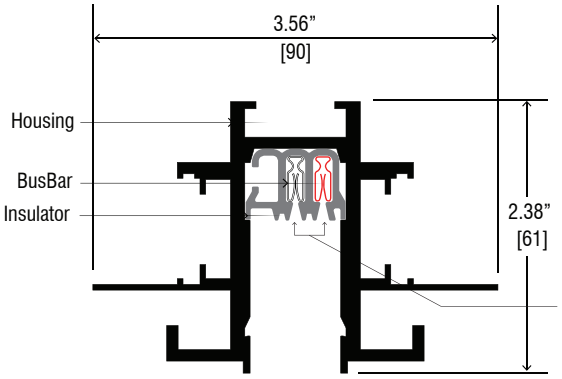
3C
1 circ. (277V)
1-hot, 1-neutral

4B (Consult Factory)
1 circ. (Low Voltage)
1-hot, 1-neutral

4K (Consult Factory)
1 circ. (Low Voltage)
International
1-hot, 1-neutral

6A
1 circ. (120V)
2-hot, 1-neutral
tied hots

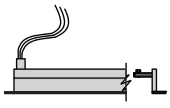
6D
1 circ. (230V)
2-hot, 1-neutral
tied hots



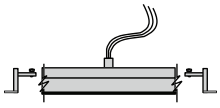
Shown is one circuit BusRun. Refer to chart below for circuiting options.

Feed Options: Standard BusRun feed capacity is 20 Amps (120v) or 16 Amps (230 Volt); 30 and 60 Amp feeds are available

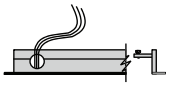
TEF-13R
TEC-13R ((Current Limiter)*
Top End Feed
1/2" NPSM or 20mm Conduit



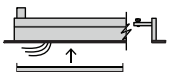
TCF-13R
Top Center Feed
1/2" NPSM or 20mm Conduit



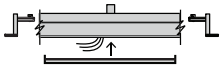
SEF-13R
SEC-13R (Current Limiter)*
Side End Feed
1/2" NPSM or 20mm Conduit



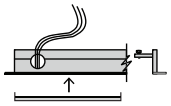
TEB-13R
Top End Splice-Box
30 Amp Max



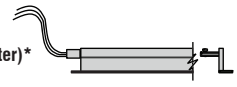
TCB-13R
Top Center Splice Box
30 Amp Max



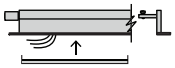
SEB-13R
Side End Splice Box
30 Amp Max



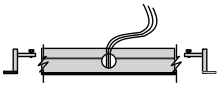
EEF-13R
EEC-13R ((Current Limiter)*
End End Feed
1/2" NPSM or 20mm Conduit



EEB-13R
End End Splice-Box
30 Amp Max



SCF-13R
Side Center Feed
1/2" NPSM or 20mm Conduit



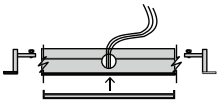
Notes:

1. All Splice Box feeds are 30 Amp maximum load.
2. All feeds are supplied with two end caps.
3. Feeds cannot be field modified.
4. Feeds can be made between 10" - 120".
5. Maximum loads are per circuit.

CL: Current Limiter Values *(120v Only)

1A	120VA	5A	600VA
1.5A	180VA	6A	720VA
2A	240VA	8A	960VA
3A	360VA	12A	1440VA
4A	480VA		

SCB-13R
Side Center Splice Box
30 Amp Max



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

Recessed D-Bar, Trimless

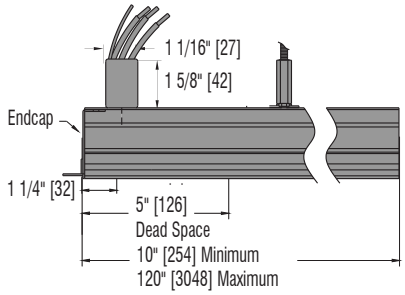
Project Name

Type

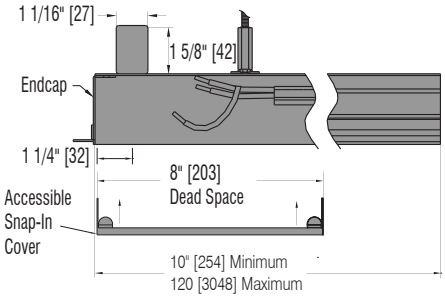
Clear Form

Dimension Chart

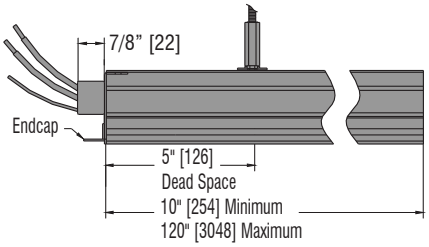
Top End Feed



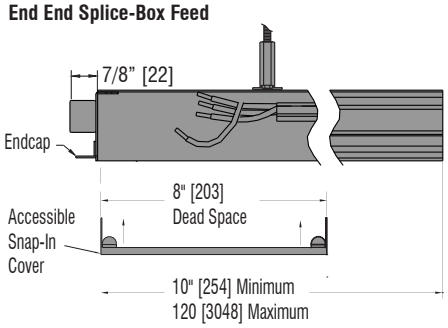
Top End Splice-Box Feed



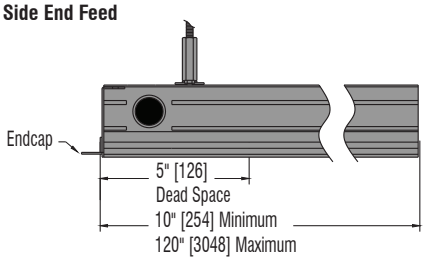
End End Feed



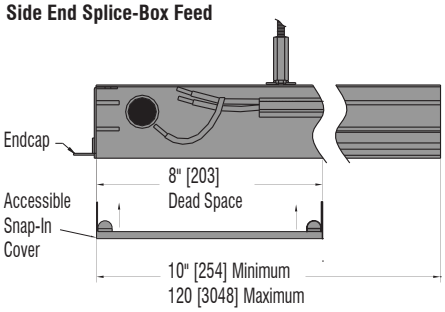
End End Splice-Box Feed



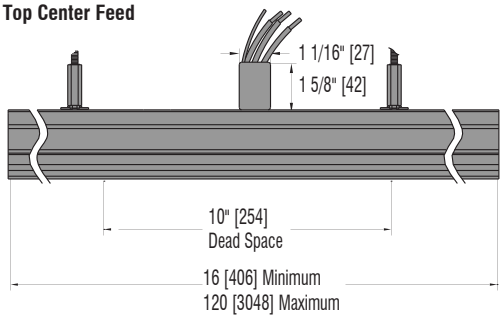
Side End Feed



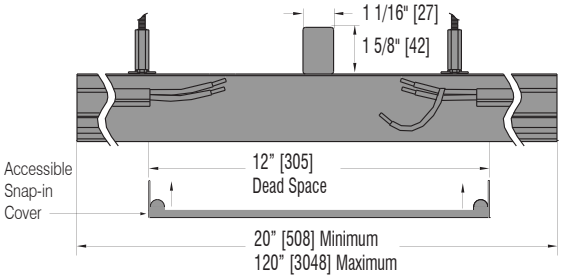
Side End Splice-Box Feed



Top Center Feed



Top Center Splice-Box Feed



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

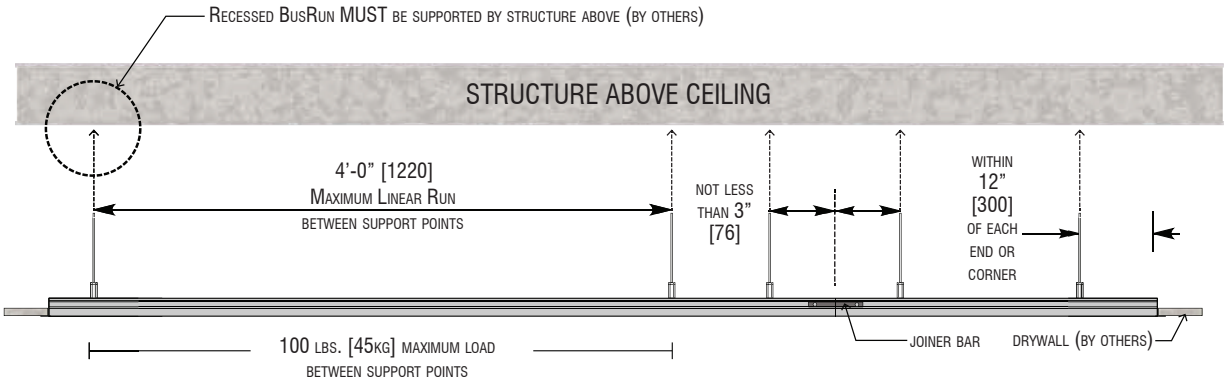
Recessed D-Bar, Trimless

Project Name

Type

Clear Form

Mounting Diagram



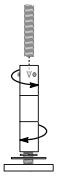
MOUNTING NOTES:

10'0" [3048] RECESSED BUSRUN SECTION REQUIRES 3 SUPPORT POINTS.
8'0" [2438] RECESSED BUSRUN SECTION REQUIRES 3 SUPPORT POINTS.
4'0" [1219] RECESSED BUSRUN SECTION REQUIRES 2 SUPPORT POINTS.

MOUNTING RULES

12" [300]	A SUPPORT POINT MUST BE PROVIDED WITHIN 12" OF EVERY END CORDNER OF THE BUSRUN LAYOUT.
4'-0" [1220]	MAXIMUM DISTANCE BETWEEN SUPPORT POINTS CANNOT EXCEED 4'0" LINEAR FEET OF BUSRUN.
3" [76]	SUPPORT POINTS CANNOT BE WITHIN 3" FROM THE CENTERLINE ON BOTH SIDES OF BUSRUN JOINTS.
100LB [45KG]	BUSRUN BUSWAY AND MOUNTING HARDWARE ARE RATED FOR A TOTAL SUPPORTED WEIGHT UP TO 100 LBS [45KG] BETWEEN SUPPORT POINTS.

MOUNTING OPTIONS

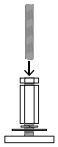


THREADED ROD HANGER

NICKEL-PLATED COUNTER-ROTATING THREADED ROD HANGER AND MOUNTING BAR ENABLE ATTACHMENT AND LEVELING OF BUSRUN TO FIXED THREADED ROD.

☐ B-HHO-TR250
FOR 1/4-20 ROD

☐ B-HHO-TR375
FOR 3/8-16 ROD

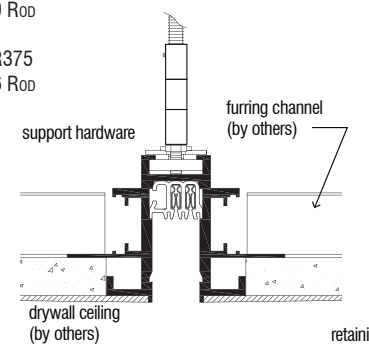


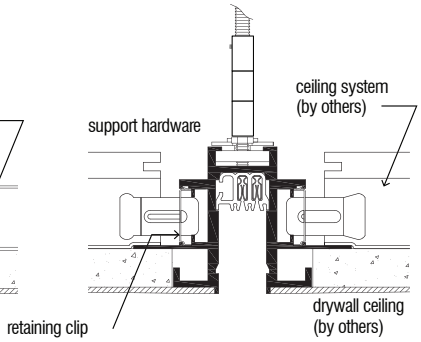
COUPLING NUT
FOR THREADED ROD

☐ B-HHO-CK-M6-01
FOR M6 ROD

RETAINING CLIP
FOR CEILING SYSTEM

☐ TBC-IT-01
(ORDERED SEPARATELY)





Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

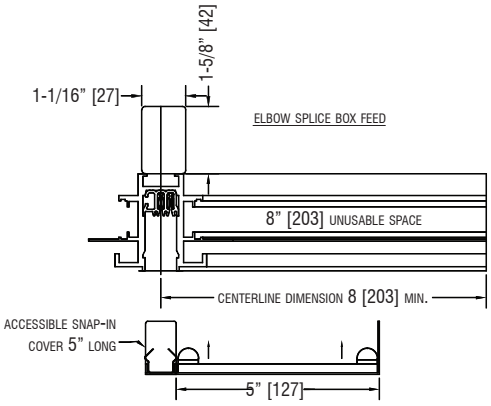
X, T, L Configurations

Project Name

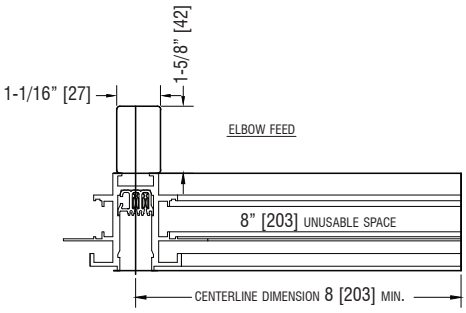
Type

Clear Form

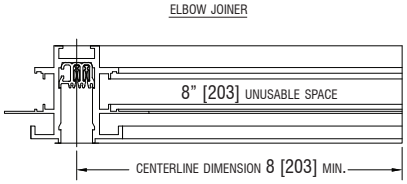
L-Dimensions (Typical):



TUB-13R(VINYL)(VINYL)(AMPS)-E(TYPE)-08-(FINISH)



TUF-13R(VINYL)(VINYL)(AMPS)-E(TYPE)-08-(FINISH)



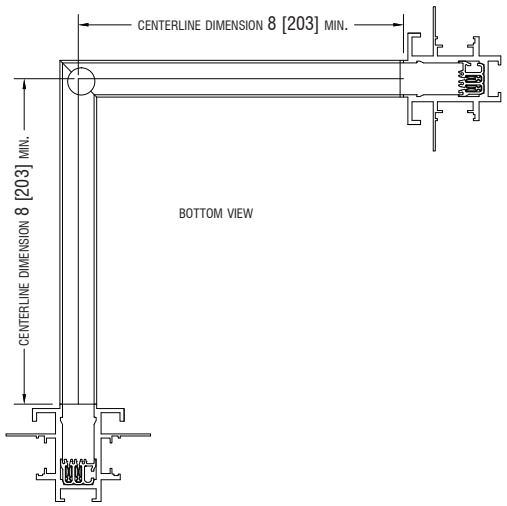
BUS-13R(VINYL)(VINYL)(AMPS)-E(TYPE)-08-(FINISH)

MAXIMUM UNIT LENGTH IS 10' [3048] UNINTERUPTED SPAN. SPLICE KITS TO ADJACENT SECTIONS OCCUPY 4" [102] FOR 16, 20 AND 30 AMP CAPACITY AND 6" FOR 60 AMP CAPACITY. WHEN CALCULATING PLUG-IN SPACE:

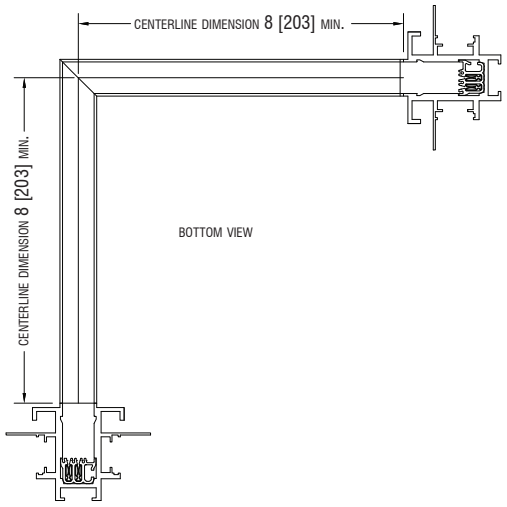
(TOTAL LENGTH OF SECTION) - (FEED) - (SPLICE KIT/2) = TOTAL AVAILABLE PLUG-IN SPACE

FOR FITTER LENGTHS, PLEASE SEE FIXTURE CUTSHEETS.

REFLECTED CEILING PLAN VIEW: **ELBOW SPLICE BOX FEED**
ELBOW FEED



REFLECTED CEILING PLAN VIEW: **JOINER**



litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

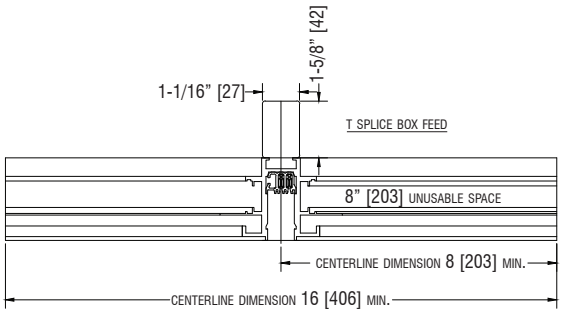
X, T, L Configurations

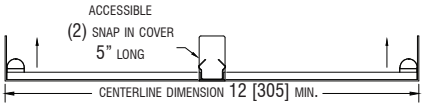
Project Name

Type

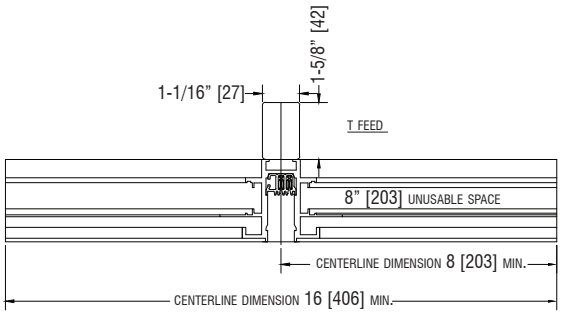
Clear Form

T-Dimensions (Typical):

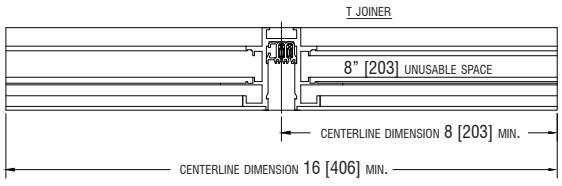




TUB-13R(VINYL)(VINYL)(AMPS)-T(TYPE)-08-(FINISH)



TUF-13R(VINYL)(VINYL)(AMPS)-T(TYPE)-08-(FINISH)



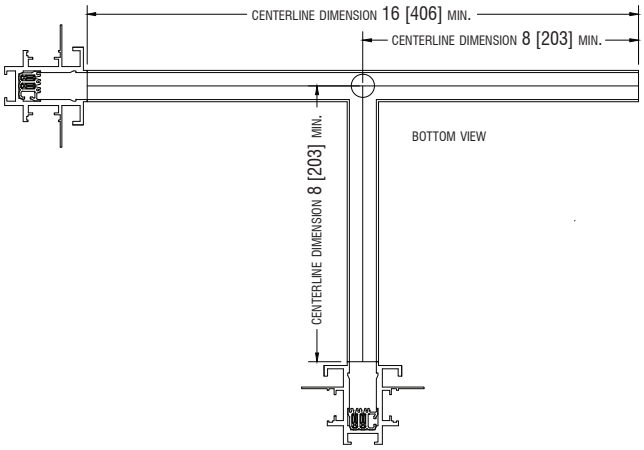
TUF-13R(VINYL)(VINYL)(AMPS)-T(TYPE)-08-(FINISH)

Maximum unit length is 10' [3048] uninterupted span. Splice kits to adjacent sections occupy 4" [102] for 16, 20 and 30 Amp capacity and 6" for 60 Amp capacity. When calculating plug-in space:

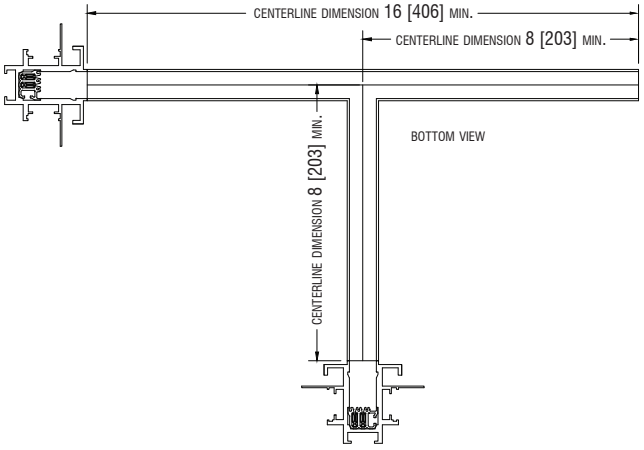
(total length of section) - (feed) - (splice kit/2) = total available plug-in space

For fitter lengths, please see fixture cutsheets.

Reflected ceiling plan view: **Elbow splice box feed**
Elbow feed



Reflected ceiling plan view: **Joiner**



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

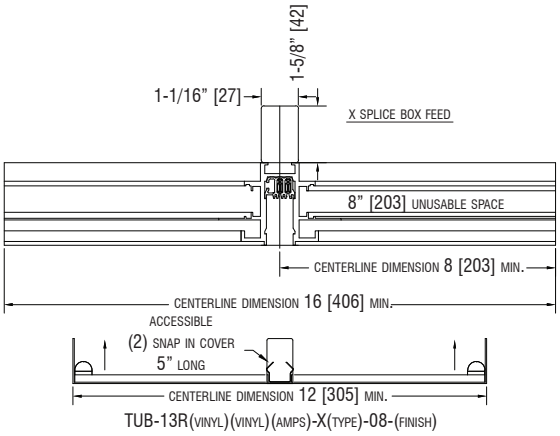
X, T, L Configurations

Project Name

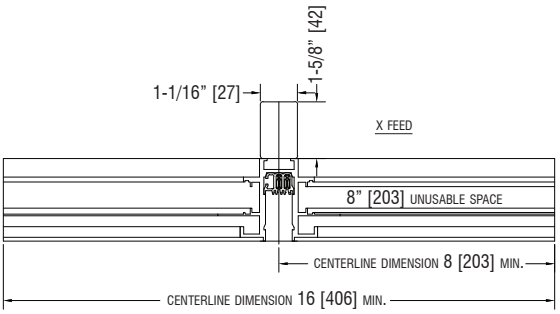
Type

Clear Form

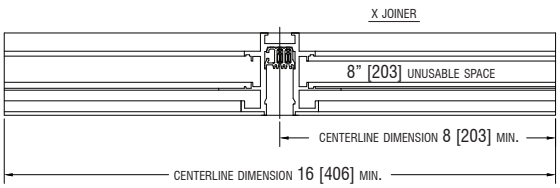
X-Dimensions (Typical):



TUB-13R(VINYL)(VINYL)(AMPS)-X(TYPE)-08-(FINISH)



TUF-13R(VINYL)(VINYL)(AMPS)-X(TYPE)-08-(FINISH)



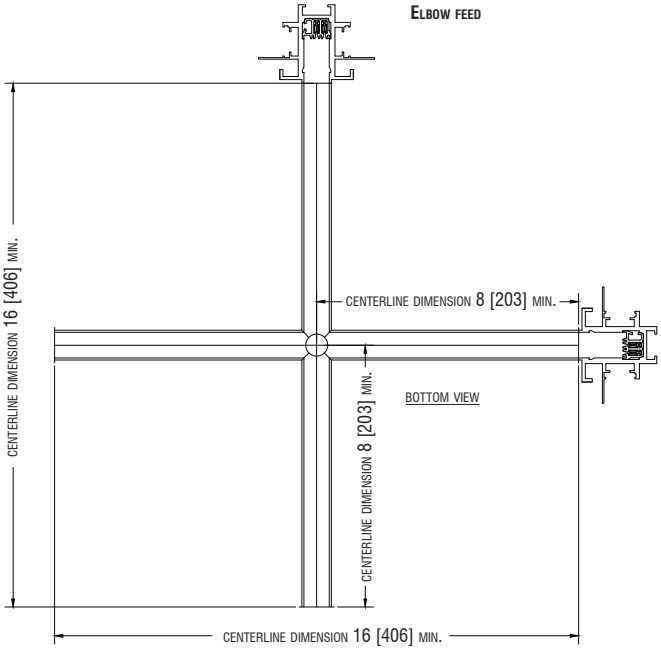
TUF-13R(VINYL)(VINYL)(AMPS)-X(TYPE)-08-(FINISH)

MAXIMUM UNIT LENGTH IS 10' [3048] UNINTERUPTED SPAN. SPLICE KITS TO ADJACENT SECTIONS OCCUPY 4" [102] FOR 16, 20 AND 30 AMP CAPACITY AND 6" FOR 60 AMP CAPACITY. WHEN CALCULATING PLUG-IN SPACE:

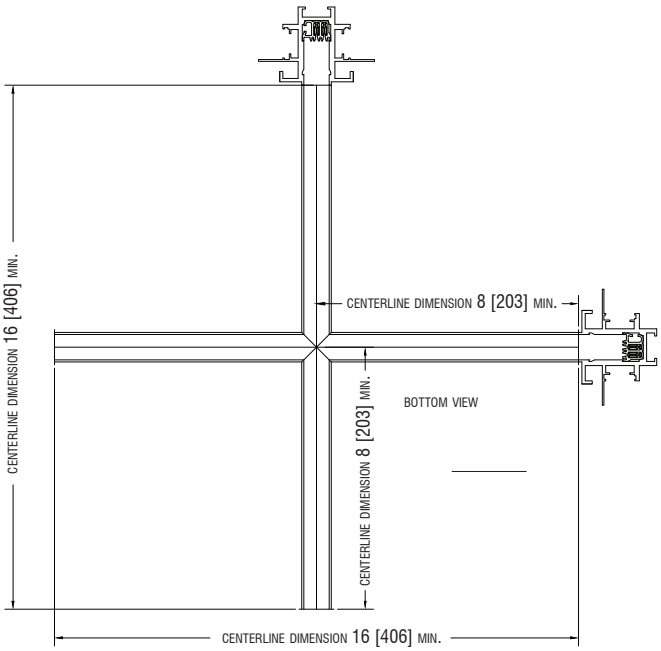
(TOTAL LENGTH OF SECTION) - (FEED) - (SPLICE KIT/2) = TOTAL AVAILABLE PLUG-IN SPACE

FOR FITTER LENGTHS, PLEASE SEE FIXTURE CUTSHEETS.

REFLECTED CEILING PLAN VIEW: ELBOW SPLICE BOX FEED
ELBOW FEED



REFLECTED CEILING PLAN VIEW: JOINER



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BUS-13R

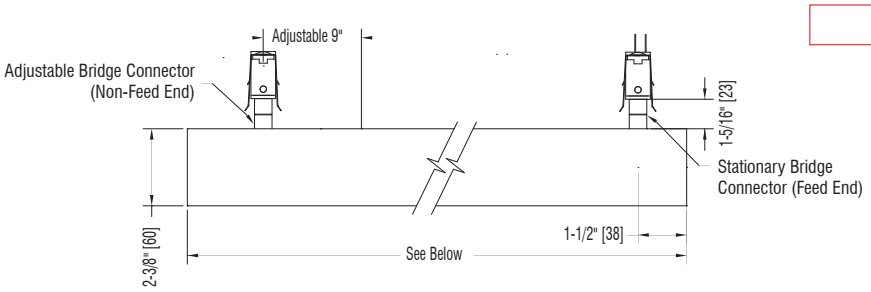
Accessories

Project Name

Type

Clear Form

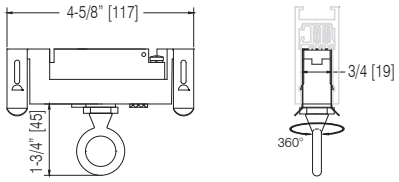
BusBridge



Codes		Adaptor/Voltage		Finish
☐ BB1D-054	3'9" [Min. Span] | 4'3" [Max. Span] | 4'6" [Total Length]	☐ 9AD-A	(120 Volts)	☐ P=White
☐ BB1D-102	7'9" [Min. Span] | 8'3" [Max. Span] | 8'6" [Total Length]	☐ 9AD-D	(240 Volts)	☐ MB = Matte Black
☐ BB1D-120	9'0" [Min. Span] | 9'9" [Max. Span] | 10'0" [Total Length]	☐ 9AD-C	(277 Volts)	☐ NT = Brushed
				☐ UF = Unfinished
				☐ ST = Silver Tone

Example: BB1D-102-9AD-A-MB

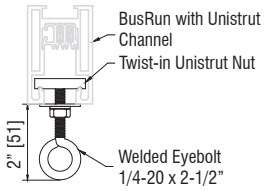
Sign Hanger*



Supports 40lb (18kg) Maximum Static Vertical Load

Code	Adaptor	Finish
☐ BSH	9ED	☐ P=White
		☐ MB = Matte Black
		☐ ST = Silver Tone
		☐ R = Unfinished

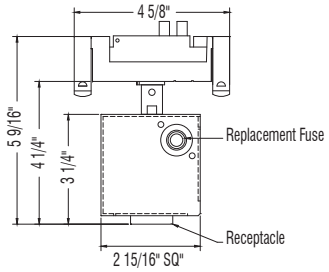
Loadmatic Hanging



Supports up to 100lb [45kg] Maximum Static Vertical Load

Code	Finish
☐ BSH-UNI	☐ P=White
	☐ MB = Matte Black
	☐ R = Unfinished

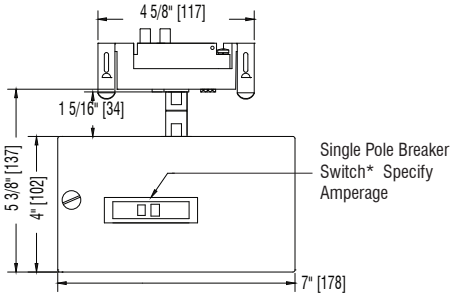
PowerDown Box*



Code/Amperage	Adaptor / Voltage	Finish
3-Prong Edison Plug		☐ P=White
☐ BPT-P15F	☐ 9AD-A (120 Volts)	☐ MB=Matte Black
Twist Lock		☐ ST=Silver Tone
☐ BPT-T15F	☐ 9AD-A (120 Volts)	☐ CP=Custom Finish
☐ BPT-T20F		

NEMA Guide	120 volt	277 volt
BPT-P15F	5-15R	
BPT-T15F	L5-15R	L7-15R
BPT-T20F	L5-20R	L7-20R

PowerDown Breaker*



Code/Amperage	Adaptor / Voltage	Finish
☐ BPT-K15B	9AD (120 Volts)	☐ P=White
☐ BPT-K20B		☐ MB=Matte Black
☐ BPT-K30B		☐ ST=Silver Tone
		☐ CP=Custom Finish

Includes knockouts

** Includes 11" Safety Cable*

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

06.10.2019

ALS-H06

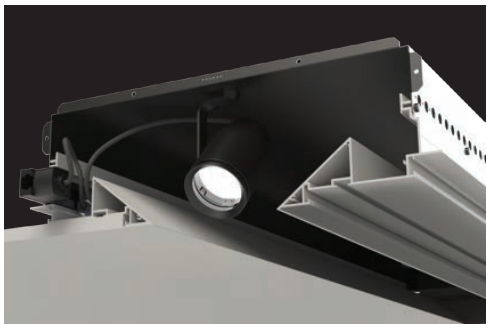
Architectural Light Slot

Project Name

Type

Flatten & Save

Clear Form



Features & Benefits:

- Magnet-mounted fixture for optimal fixture placement
- Field adjustable hanger brackets
- HVAC Supply and Return compatible
- Available for most contemporary ceiling systems

(Consult Factory for Custom Ceilings and Applications)

Compatible with:

M3Z - 10°-30° Zoom
M3W - Wallwash
M3O - Fixed Focus 10°, 22° & 33°
M3S - 6° Very Narrow Spot

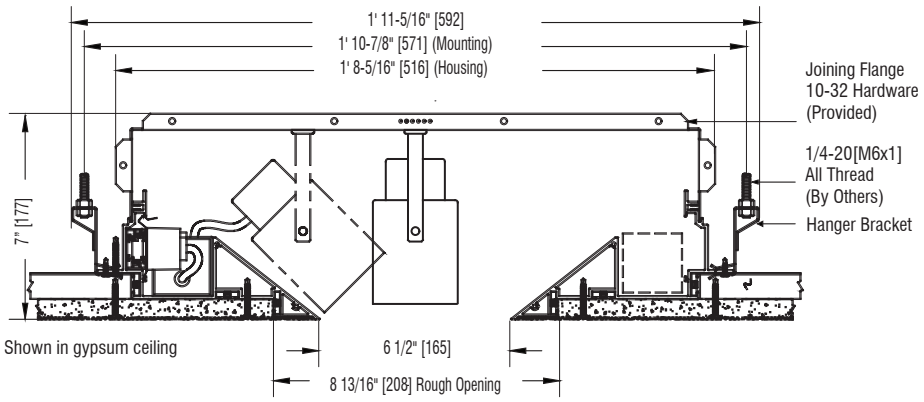
For fixture specifications, visit www.litelab.com

ALS	-	H06	-		-	Voltage	-	E	-	Ceiling Conditi	-	Finish

System	Housing		*Length (in Inches)	Voltage		Dimming Protocol		Ceiling Condition		Finish	
	Backbox by Litelab	H06	* Length refers to the visual opening, not to total system length. See page 3 for backbox length.	120 Volts	A	ELV	E	Gypsum	GP	White	P
				240 Volts	D			Wood	WD	Matte Black	MB
				277 Volts	C			Stone	ST	Custom	CP
								Metal Pan	MP		
								Accoustic	AC		

Ceiling Thickness

Finish Code



Modular Slot Components - Gypsum | Backbox by Litelab

Part Number	*Description*
ALS-12-H06-TL-MB	12" [305mm] Visual Opening - Gypsum Unit
ALS-24-H06-TL-MB	24" [610mm] Visual Opening - Gypsum Unit
ALS-36-H06-TL-MB	36" [914mm] Visual Opening - Gypsum Unit
ALS-48-H06-TL-MB	48" [1219mm] Visual Opening - Gypsum Unit
ALS-72-H06-TL-MB	72" [1829mm] Visual Opening - Gypsum Unit

Part Number	*Description*
ALS-ECL-H06-TL-MB	6" [152mm] Visual Opening - Gypsum End Cap Left
ALS-ECR-H06-TL-MB	6" [152mm] Visual Opening - Gypsum End Cap Right
ALS-EFL-H06-TL-MB	6" [152mm] Visual Opening - Gypsum End Feed Left
ALS-EFL-H06-TL-MB	6" [152mm] Visual Opening - Gypsum End Feed Right
ALS-CR-H06-TL-MB	20" x 20" [508mm x 508mm] Visual Opening - Gypsum Corner

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL

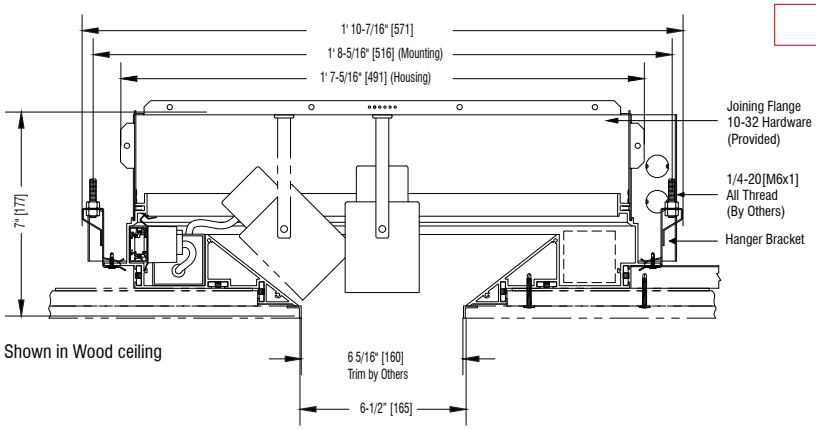
ALS-H06

Architectural Light Slot

Project Name

Type

Clear Form



Modular Slot Components - Wood | Backbox by Litelab

Part Number	*Description*
ALS-12-H06-TR-MB	12" [305mm] Visual Opening - Wood/Metal/Stone/ Accoustic Unit
ALS-24-H06-TR-MB	24" [610mm] Visual Opening - Wood/Metal/Stone/ Accoustic Unit
ALS-36-H06-TR-MB	36" [914mm] Visual Opening - Wood/Metal/Stone/ Accoustic Unit
ALS-48-H06-TR-MB	48" [1219mm] Visual Opening - Wood/Metal/Stone/ Accoustic Unit
ALS-72-H06-TR-MB	72" [1829mm] Visual Opening - Wood/Metal/Stone/ Accoustic Unit

Part Number	*Description*
ALS-ECL-H06-TR-MB	6" [152mm] Visual Opening - Wood/Metal/Stone/ Accoustic End Cap Left
ALS-ECR-H06-TR-MB	6" [152mm] Visual Opening - Wood/Metal/Stone/ Accoustic End Cap Right
ALS-EFL-H06-TR-MB	6" [152mm] Visual Opening - Wood/Metal/Stone/ Accoustic End Feed Left
ALS-EFL-H06-TR-MB	6" [152mm] Visual Opening - Wood/Metal/Stone/ Accoustic End Feed Right
ALS-CR-H06-TR-MB	20" x 20" [508mm x 508mm] Visual Opening - Wood/ Metal/Stone/Accoustic Corner

Power Distribution / Dimming Controls - All Configurations

Power Distribution | ELV / Reverse Phase Dimming

BT-156-P/MB	120 Volt Basic Track Feed - One Feed/Side
BT-104-P/MB	120 Volt Basic Track Joiner - 4'
BT-108-P/MB	120 Volt Basic Track Joiner - 8'
BT-111-P/MB	120 Volt Basic Track Straight Connector
BT-112-P/MB	120 Volt Basic Track L-Connector
BT-126-P/MB	120 Volt Basic Track Flexible Connector

Power Distribution - 120v. 240v, 277v | 0-10v / DMX / DALI / Lutron

(Consult Factory)

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

ALS-H06

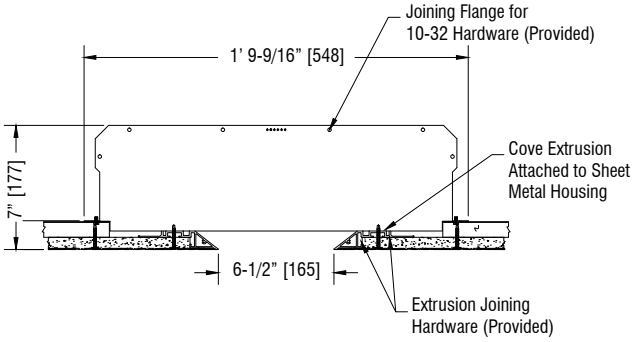
Architectural Light Slot

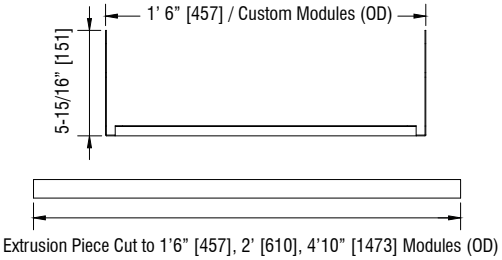
Project Name

Type

Clear Form

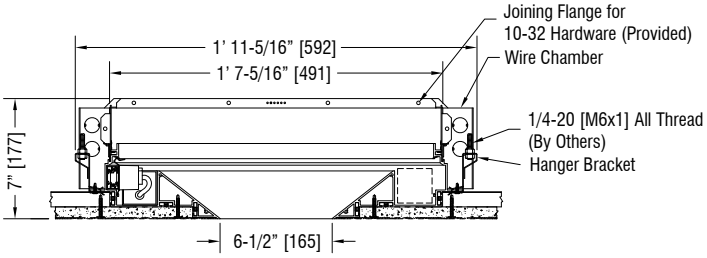
Beam Cover Unit: ALS-BC18-H06
ALS-BCxx-H06

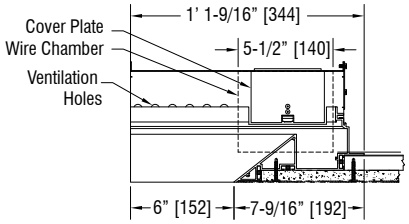




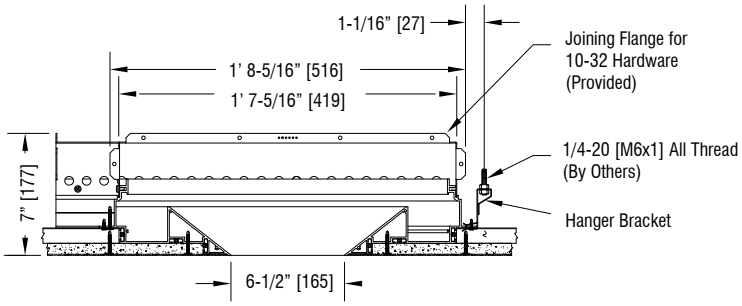
Extrusion Piece Cut to 1'6" [457], 2' [610], 4'10" [1473] Modules (OD)

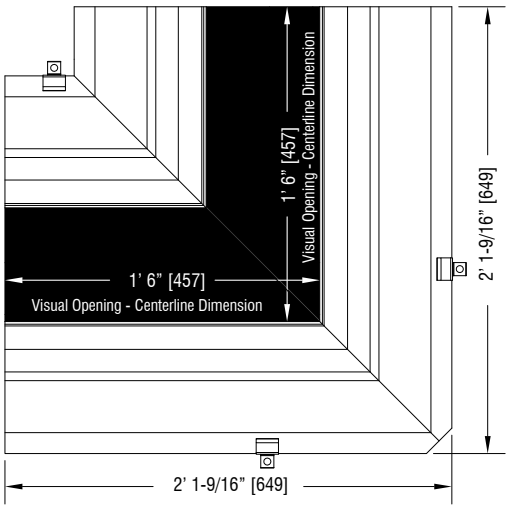
Endcap: ALS-ECR/ECL-H06





90° Corner Unit: ALS-CR-H06





Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL

C2W

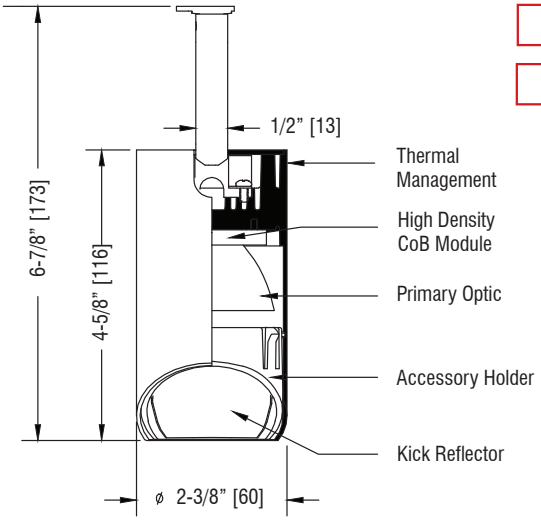
Static White Wallwasher

Project Name

Type

Flatten & Save

Clear Form



Input Requirements

1600/1450 Lumens	120VAC/0.2A/23W 240VAC/0.2A/23W 277VAC/0.1A/23W

Enter Catalog Number Sequentially from Left to Right

C2W - Lumens CRI CCT - Adaptor Dimming Level Options Voltage - Finish

Model	Lumens/CRI	CCT
C2W	L16 1600/92 L14 1450/98	27 2700 30 3000 35 3500 40 4000

Adaptor	Dimming	Level
9TC BusRun Clipless 9TD BusRun Deep **9TS** BusRun Shallow	E ELV	1 1%
9HC BusRun Clipless w/ Driverbox 9HD BusRun Deep w/ Driverbox 9HS BusRun Shallow w/ Driverbox	E ELV W Wire-less	0 10% C Casambi A Avi-On T Athena RF
ST2 2-Circuit Stucchi ST3 3-Circuit Stucchi 3L 5" Canopy 5L 3.5" QC Canopy 7L 2" QC Canopy (Remote Driver Only)	E ELV Z 0-10 M DMX D DALI	0 10% 1 1% D Dark

Options	Voltage
P* Potentiometer R** Rotation Lock SP* Switch w/ Potentiometer SR** Switch w/ Rotation Lock	A 120 D 240 F* 240 (2-Circuit) C 277

* Potentiometers are available on ELV dimmable or non-dimming circuits only.

** Rotation Lock and type "F" voltage are exclusive to 9T fitters. Rotation Lock is not available with Potentiometer.

Finish
P White MB Black BR Brushed CP Custom

Enter RAL or Other Finish Code

Flush Fit BusRun Adaptor

Litelab's flush fit BusRun adaptor recesses entirely inside BusRun to provide a clean aesthetic. It is available with a Switch and Rotation Lock or On-Board Potentiometer for individual fixture dimming. BusRun fitters are available dimmable to 1% and can be dimmed proportionally using an ELV dimming system.

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 5*

- ☐ OL-DF-a Beam Softening Film
- ☐ OL-TD-a Beam Softening Lens
- ☐ OL-30x60-a Universal Spread Lens (Included)

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C2W

Static White Wallwasher

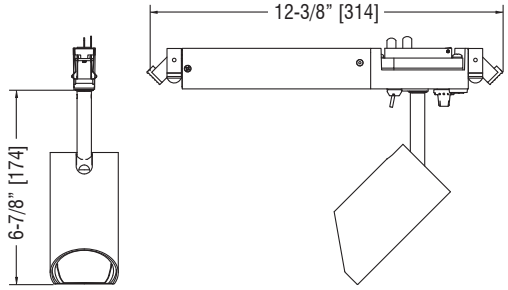
Project Name

Type

Clear Form

Fitter Guide

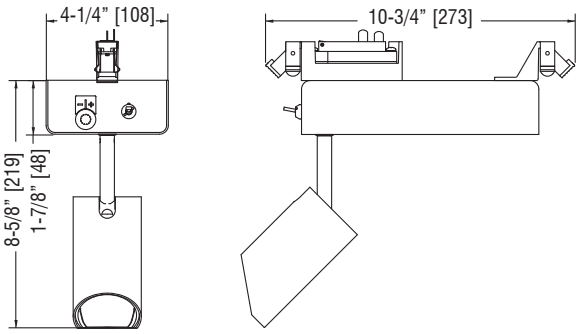
9TC* - 120/240/277v Recessed BusRun Fitter - ELV Dimmable Only - 1%



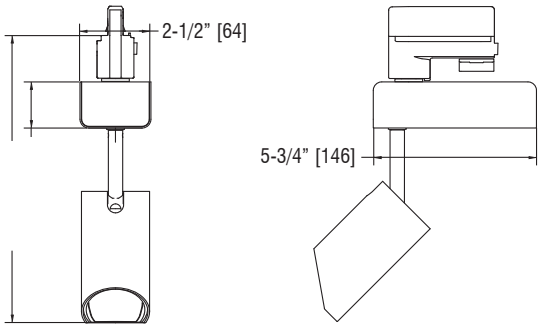
Universal Voltage Fitter, Available with an optional Switch and Rotation Lock or Potentiometer - Dimmable to 1%.

Switch not available for 277 V.

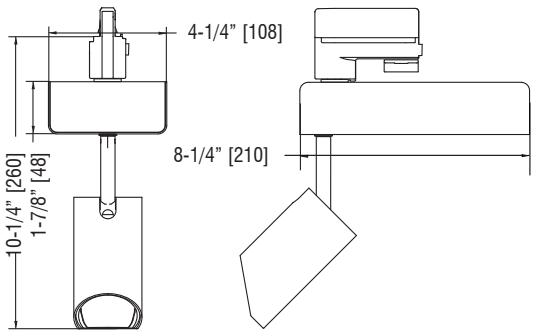
9H - Wireless Control Fitter for BusRun



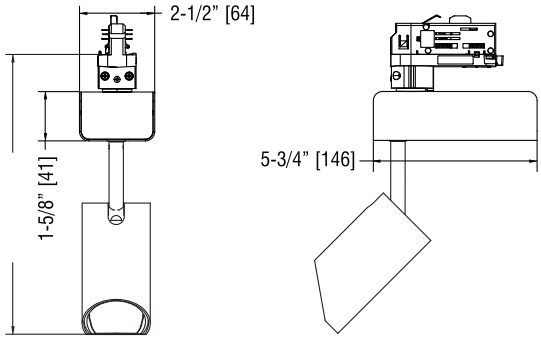
Stucchi - 2-Circuit ELV Dimmable Fitter



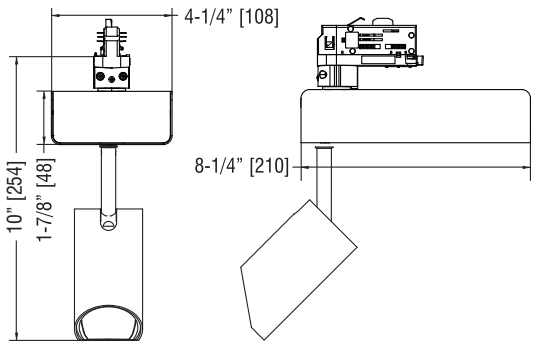
Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



Stucchi - 2-Circuit ELV Dimmable Fitter



Stucchi - 2-Circuit 0-10V, DMX and Dali Dimmable Fitter



Litelab

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Covered under one or more of the following patents: US: 8,740,421 B2, D499, 698, D389,012, Republic of China: D149,379, People's Republic of China: ZL 201130358013.3, European Union: RCD #001920356-0001. Additional patents pending. **See fittings and accessories page for mounting options and accessories.

C2W

Static White Wallwasher

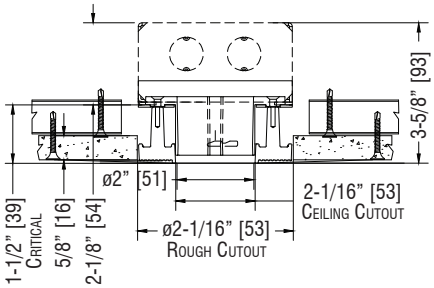
Project Name

Type

Clear Form

Fitter Guide

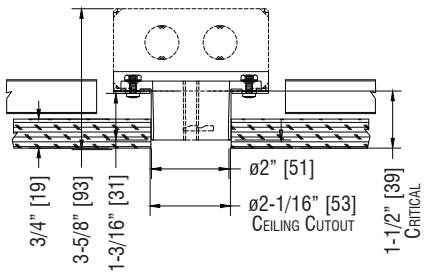
-7L - 2" Dia. Quick Connect Canopy - Gypsum*



-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

* QC-7K-GYP-P/MB Canopy Mount ordered separately.

-7L - 2" Dia. Quick Connect Canopy - Wood**

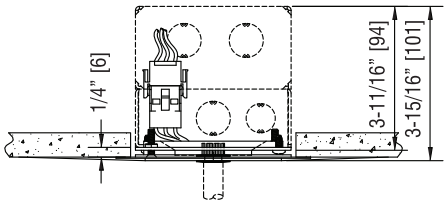


-7 Remote Driver
(1) 4" sq x 2-1/8" J-Box

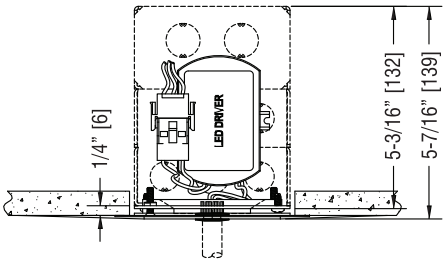
** QC-7K-WD-MB Canopy Mount ordered separately.

-5L - 3-1/2" Dia. Quick Connect Canopy

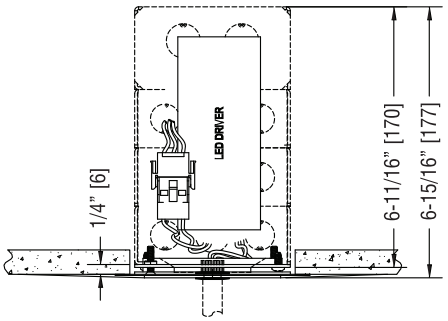
QC-5K-P/MB Canopy Mounted Ordered Separately



-5 Remote Driver
(1) 4" sq x 2-1/8" J-Box
(1) 4" sq x 1-1/2" Extension Box

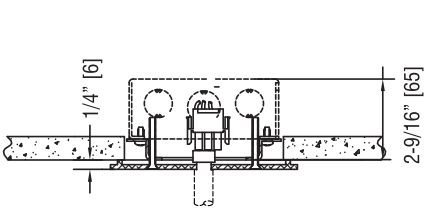


-5L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box

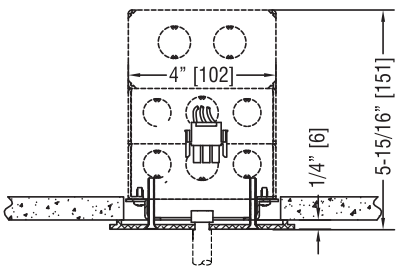


-5L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

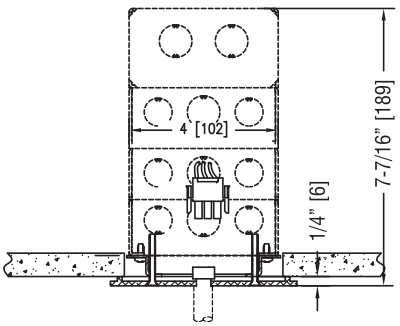
-3L - 5" Dia. x 1/4" H. Machined Canopy



-3 Remote Driver
(1) 4" sq x 1-1/2" Extension Box



-3L ELV Driver
(1) 4" sq x 2-1/8" J-Box
(2) 4" sq x 1-1/2" Extension Box



-3L 0-10v, DALI and DMX Driver
(1) 4" sq x 2-1/8" J-Box
(3) 4" sq x 1-1/2" Extension Box

J-Boxes Supplied by Others

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

* Junction Box Volume Note:Box fill must be in compliance with National Electric Code Article 314. Internal Equipment Supplied by Litelab Equals 25 Cubic Inches.

C2W

Static White Wallwasher

Project Name

Type

Clear Form

Photometrics

C2W-L16 Wallwash

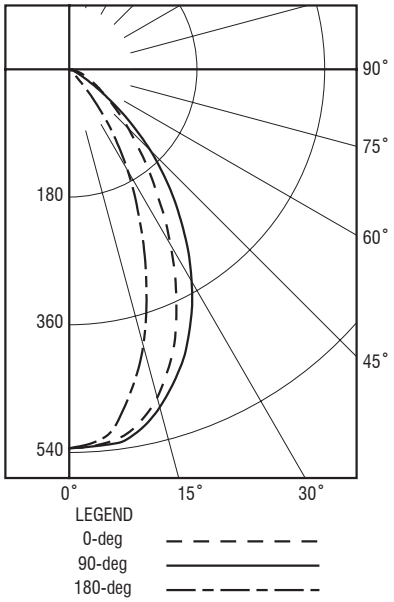
Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	14.8 f.c. / 159.3 lux	5.5' / 1.7m
8.0' / 2.4m	8.3 f.c. / 89.3 lux	7.3' / 2.2m
10.0' / 3.0m	5.3 f.c. / 57.0 lux	9.1' / 2.8m
12.0' / 3.7m	3.7 f.c. / 40.0 lux	11.0' / 3.4m
14.0' / 4.3m	2.7 f.c. / 29.1 lux	12.8' / 3.9m
16.0' / 4.9m	2.1 f.c. / 22.6 lux	14.6' / 4.5m

CBCP:	See Candela Distribution		
Efficacy:	47.9 lm/w		
Delivered Lumens:	623 lm		
Plane:	0°	90°	180°
Spacing Criteria:	0.93	1.03	0.72

CANDELA DISTRIBUTION

	0.0	45.0	90.0	135.0	180.0	FLUX
0	534	534	534	534	534	
5	530	532	532	527	523	50
15	479	500	493	434	403	130
25	357	408	402	292	235	160
35	217	280	283	160	101	137
45	118	162	162	31	9	82
55	59	79	55	3	0	38
65	29	32	13	1	0	16
75	12	11	3	0	0	6
85	5	4	1	0	0	2
90	3	2	0	0	0	0
95	2	2	0	0	0	1
105	1	1	0	0	0	0
115	0	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	0

C2W-L16 Wallwash- Polar Diagram



251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

C2W

Static White Wallwasher

Project Name

Type

Clear Form

Accessories

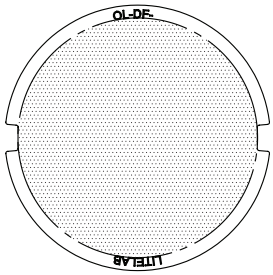
CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

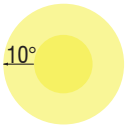
SIZE CODE A: 1.95" [50MM]

OL-DF-G (DIFFUSION FILM)

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES (FOR USE WITH MULTIPLE MEDIA)

☐

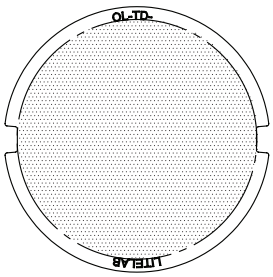


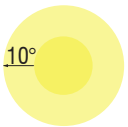


OL-TD-G (POLYCARBONATE DIFFUSION LENS)

DIFFUSION FILM: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES (FOR STANDALONE USE)

☐

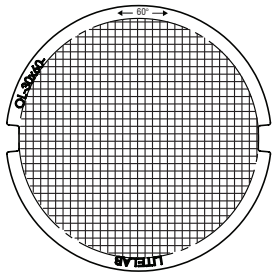


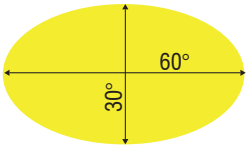


OL-30X60-G (UNIVERSAL SPREAD LENS - INCLUDED)

UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

☐





251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

M3W

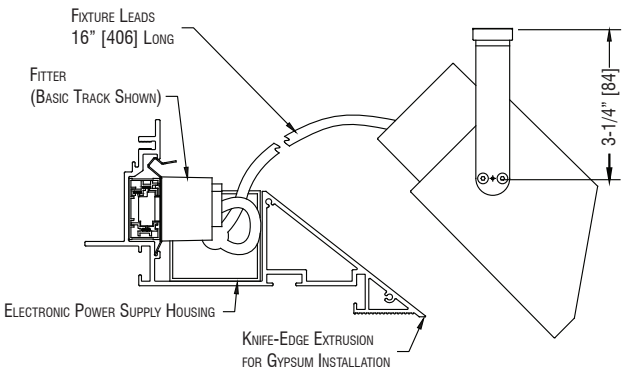
Static White Wallwasher

Project Name

Type

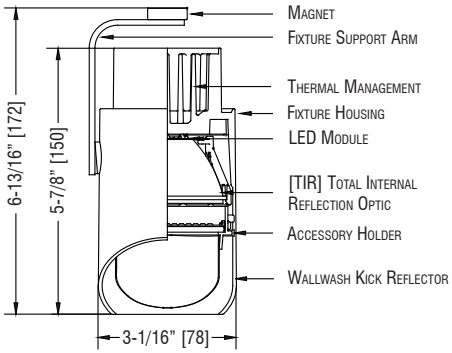
Flatten & Save

Clear Form



Input Requirements

1800/1550 Lumens	120VAC/0.19A/23W
	240VAC/0.12A/25W
1300/1100 Lumens	120VAC/0.15A/19W
	240 VAC/0.08A/19W



Enter Catalog Number Sequentially from Left to Right

M3W - Lumens CRI CCT - Adaptor Dimming Level Voltage - Finish

Model	Lumens/CRI	CCT	Adaptor	Dimming	Level	Options	Voltage	Finish
M3W	L18 1800/92	27 2700	BT Basic Track	E ELV	0 10%	N/A	A 120	P White
	L15 1550/98	30 3000					D 240	MB Black
	L13 1300/92	35 3500	ST2 2-Circuit Stucchi	Z 0-10	D Dark		C 277	CP Custom
	L11 1100/98	40 4000	ST3 3-Circuit Stucchi	M DMX				
				D DALI				

Dimming Note

This fixture is provided with LED Drivers suitable for the dimming protocol specified. Dimming performance may vary based on dimmer model or system being used. If exact dimming performance is required, Litelab recommends testing the Litelab fixture with the specified dimmer.

Accessories: *See Page 4*

- ☐ OL-DF-g Beam Softening Film
- ☐ OL-TD-g Beam Softening Lens
- ☐ OL-30x60-g Universal Spread Lens (Included)

Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

CE ETL Intertek

M3W

Static White
Fixed Object

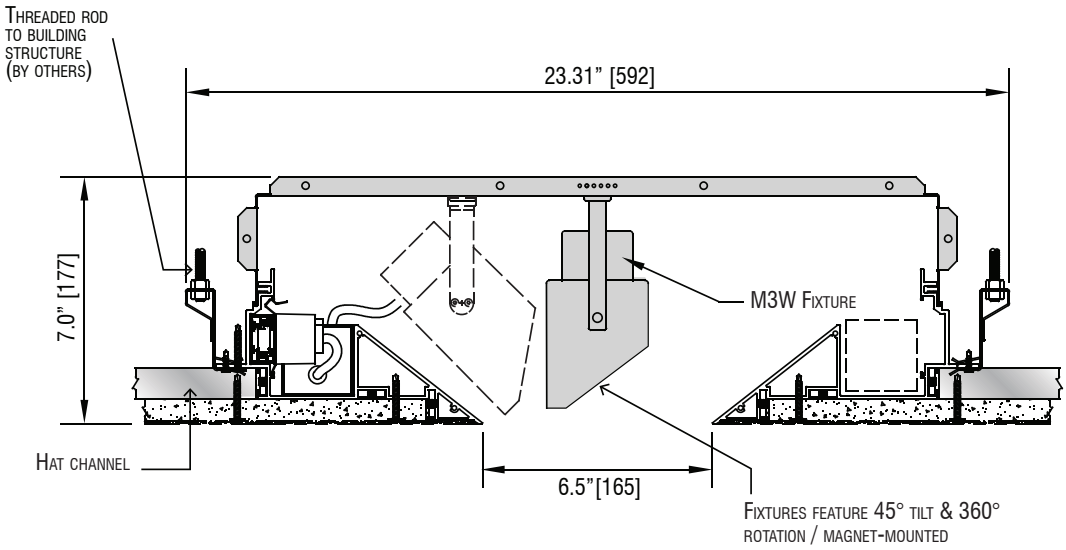
Project Name

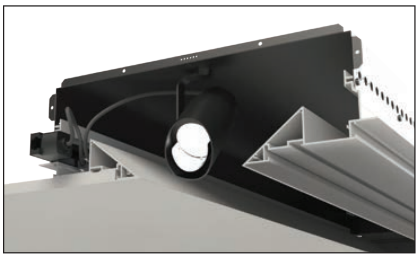
Type

Clear Form

Details

M3W Fixture shown in H06 Housing





M3W FIXTURE SHOWN IN H06 HOUSING

251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

M3W

Static White Wallwasher

Project Name

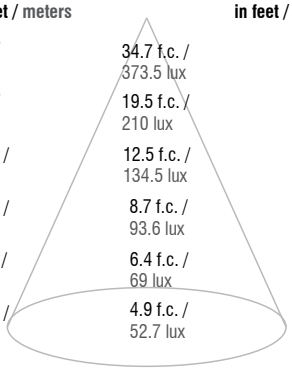
Type

Clear Form

Photometrics

M3W-L18 Wallwash

Mounting Height in feet / meters	FC / Lux	Beam Diameter in feet / meters
6.0' / 1.8m	34.7 f.c. / 373.5 lux	5.3' / 1.6m
8.0' / 2.4m	19.5 f.c. / 210 lux	7.1' / 2.2m
10.0' / 3.0m	12.5 f.c. / 134.5 lux	8.9' / 2.7m
12.0' / 3.7m	8.7 f.c. / 93.6 lux	10.7' / 3.3m
14.0' / 4.3m	6.4 f.c. / 69 lux	12.5' / 3.8m
16.0' / 4.9m	4.9 f.c. / 52.7 lux	14.2' / 4.3m

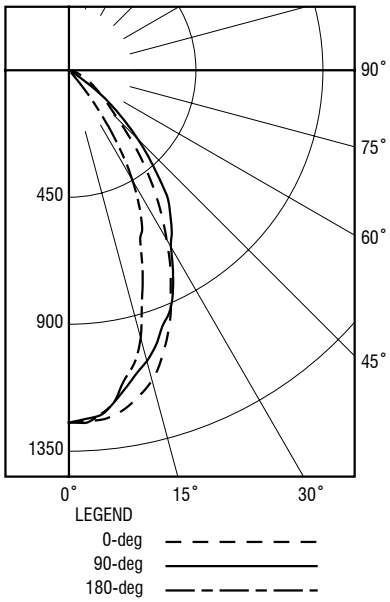


CBCP:	See Candela Distribution		
Efficacy:			66.0 lm/w
Delivered Lumens:			1392 lm
Plane:	0°	90°	180°
Spacing Criteria:	0.95	0.96	0.74

CANDELA DISTRIBUTION

	0.0	45.0	90.0	135.0	180.0	FLUX
0	1248	1248	1248	1248	1248	
5	1244	1242	1229	1226	1227	115
15	1138	1108	1067	1007	982	295
25	853	916	871	631	614	362
35	535	652	627	417	246	321
45	249	364	346	33	0	179
55	122	189	79	1	0	76
65	56	73	8	0	0	28
75	24	21	2	0	0	10
85	10	7	0	0	0	3
90	6	4	0	0	0	0
95	4	2	0	0	0	1
105	2	1	0	0	0	0
115	1	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	0

M3W-L18 Wallwash- Polar Diagram



Litelab
251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

M3W

Static White Wallwasher

Project Name

Type

Clear Form

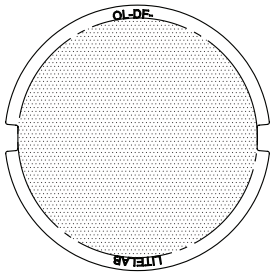
Accessories

CUSTOM DISTRIBUTION FILMS AVAILABE ON REQUEST.

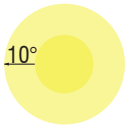
SIZE CODE G: 2.529" [64MM]

DIFFUSION FILM: 0.25MM (0.01") FILM SOFTENS BEAM EDGES

OL-DF-G (DIFFUSION FILM) ☐

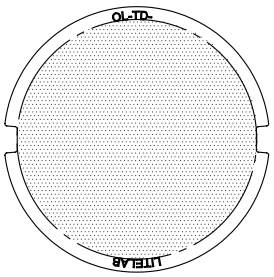


DISTRIBUTION DIAGRAM

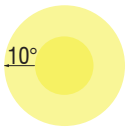


TEXTURED DIFFUSION LENS: 3MM (0.1") TEXTURED LENS SOFTENS BEAM EDGES

OL-TD-G (POLYCARBONATE DIFFUSION LENS) ☐

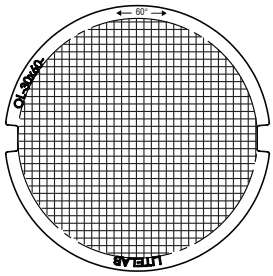


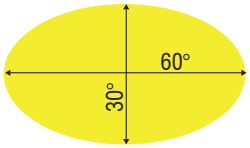
DISTRIBUTION DIAGRAM



UNIVERSAL SPREAD LENS: 3MM (0.1") LENS SPREADS LIGHT UNIVERSALLY FOR WIDER DISTRIBUTION

OL-60X30-G (UNIVERSAL SPREAD LENS - INCLUDED) ☐





251 Elm Street, Buffalo, NY 14203 USA
800-238-4120 | www.litelab.com

BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168
LIGHTING FIXTURE SCHEDULE

GENERAL NOTES:

1. SEE ARCHITECTURAL DRAWINGS FOR MOUNTING CONDITIONS; CONTRACTOR TO COORDINATE FINAL DETAILS WITH ARCHITECTS.
2. FURNISH TRACKS IN LENGTHS AS INDICATED ON ARCHITECTURAL DRAWINGS.
3. CONTRACTOR TO VERIFY ALL CONTINUOUS RUN LENGTHS FOR LINEAR FIXTURES, INCLUDING PENDANTS, LED STRIP LIGHTS, ETC.
4. CONTRACTOR TO COORDINATE LAMP LENGTHS FOR CONTINUOUS ILLUMINATION OF COVE APPLICATIONS. AT TERMINATION OF ARCHITECTURAL COVE/SLOT, DISTANCE BETWEEN END WALL AND START OF FIXTURE RUN SHALL NOT EXCEED 6" (150mm).
5. CEILING THICKNESS IN EXCESS OF 3/4" (20mm) SHALL BE IDENTIFIED IN WRITING BY CONTRACTOR.
6. REFER TO WRITTEN SPECIFICATIONS FOR ALL MATTERS RELATED TO LIGHTING EQUIPMENT.
7. PRIOR TO ORDERING ANY LIGHTING EQUIPMENT, CONTRACTOR TO VERIFY ALL LOCATIONS AND RECESS DEPTHS.
8. ALL LIGHTING EQUIPMENT AND COMPONENTS TO BE IBEW LABELED UNLESS EXEMPTION IS GRANTED BY OWNER.
9. ALL FIXTURES SHALL BE ORDERED WITH THE APPROPRIATE BALLASTS THAT HAVE UL AND CBM LABELS.
10. 1% DIMMING BALLASTS MUST BE LUTRON HI-LUME 1% DIMMING BALLASTS OR APPROVED EQUAL, UNLESS OTHERWISE SPECIFIED.
11. 10% DIMMING BALLASTS MUST BE LUTRON ECO10 10% DIMMING BALLASTS OR APPROVED EQUAL, UNLESS OTHERWISE SPECIFIED.
12. REMOTE LOW VOLTAGE TRANSFORMERS MUST BE Q-TRAN HI-PERFORMANCE TOROIDAL TRANSFORMERS OR APPROVED EQUAL, UNLESS OTHERWISE SPECIFIED.
13. CONTRACTOR TO COORDINATE SIZING OF REMOTE TRANSFORMERS AND APPROPRIATE SECONDARY WIRING TO PREVENT VOLTAGE DROP BELOW 90% OF FULL VOLTAGE.
14. CONTRACTOR TO COORDINATE LOW VOLTAGE TRANSFORMER TYPE (ELECTRONIC OR MAGNETIC) WITH ARCHITECTURAL DIMMING SYSTEM.
15. CONTRACTOR TO VENT REMOTE TRANSFORMERS AND BALLASTS AS REQUIRED.
16. CONTRACTOR TO VERIFY ALL FINISH COLORS WITH ARCHITECT.
17. FURNISH FIXTURES WITH ALL NECESSARY FEEDS, SPLICES, CONNECTIONS, ETC., AS REQUIRED FOR A COMPLETE INSTALLATION. CONTRACTOR TO PROVIDE ALL TRACK ACCESSORIES, FIXTURE MOUNTING HARDWARE AND ACCESSORIES, APPROPRIATE FRAMING, ETC. TO ENSURE A COMPLETE AND FULLY FUNCTIONING LUMINAIRE - EVEN IF NOT SPECIFICALLY IDENTIFIED IN THE CATALOG NUMBERS OR FIXTURE DESCRIPTION IN THE FIXTURE SCHEDULE BELOW.
18. WHERE STATED "CUSTOM COLOR FINISH TO MATCH SAMPLE PROVIDED BY ARCHITECT," SAMPLE TO BE APPROVED BY ARCHITECT.
19. ALL EXTERNAL HARDWARE TO BE STAINLESS STEEL TO PREVENT CORROSION AND RESIST HARSH WEATHER ELEMENTS / MARINE CLIMATE IF APPLICABLE.
20. WHERE A UL LISTING IS DESCRIBED AS A SALIENT FEATURE AND REQUIREMENT OF FIXTURE SPECIFICATION (I.E. UL LISTED FOR WET LOCATION), DESCRIPTION IN THE FIXTURE SCHEDULE BELOW. IP RATING SYSTEM IS ACCEPTABLE.
21. FIXTURES TO BE MOUNTED WITH LAMPS ORIENTED AS INDICATED ON DRAWINGS.
22. CONTRACTOR TO COORDINATE FIXTURES WITH EXISTING AND/OR NEW CEILING SYSTEM.
23. ELECTRICAL CONTRACTOR RESPONSIBLE FOR ALL ELECTRICAL WORK FOR FIXTURES MOUNTED IN CONCRETE WALLS, CEILINGS AND FLOORS.
24. CONTRACTOR TO PROVIDE APPROVED FIRE RATED ENCLOSURES FOR ALL LIGHTING FIXTURES LOCATED IN A FIRE-RATED CEILING.
25. ELECTRICAL CONTRACTOR SHALL VERIFY FINAL VOLTAGES AND CEILING COMPATIBILITY PRIOR TO ORDERING FIXTURES.
26. ALL SPECIFIED LAMP COLOR TEMPERATURES AND BEAM SPREADS TO BE FINALIZED AT TIME OF FOCUSING BY LIGHTING DESIGNER.
27. FINAL LAMP WATTAGE AND BEAM SPREADS TO BE DETERMINED DURING FOCUSING.
28. FOR ALL FIXTURES WITH LED MR16 LAMPING:
    - CONTRACTOR TO PROVIDE HEX-CELL LOUVERS AT TIME OF FINAL FOCUSING FOR 25% OF TOTAL LED MR16 FIXTURES FOR INCLUSION IN FIXTURES AT DISCRETION OF LIGHTING DESIGNER.
    - CONTRACTOR TO PROVIDE "BEAM SOFTENING LENS" OR "SOLITE LENS" AT TIME OF FINAL FOCUSING FOR 25% OF TOTAL LED MR16 FIXTURES FOR INCLUSION IN FIXTURES AT DISCRETION OF LIGHTING DESIGNER.
29. FOR LED AND LOW VOLTAGE FIXTURES, SPECIFIED MANUFACTURER SHALL SUPPLY - AS A SINGLE SYSTEM - ALL CONTROL GEAR REQUIRED FOR NORMAL OPERATION OF LED LIGHT FIXTURES (POWER SUPPLIES, TRANSFORMERS, DIMMING INTERFACES, LED DRIVERS, ETC).
30. CONTRACTOR TO COORDINATE WITH SPECIFIED MANUFACTURER THE FINAL QUANTITY AND CAPACITIES OF LED CONTROL GEAR (POWER SUPPLIES, TRANSFORMERS, DIMMING INTERFACES, LED DRIVERS, ETC.) FOR COMPLETE INSTALLATION OF ALL LED FIXTURES SHOWN ON ARCHITECTURAL DRAWINGS.
31. ELECTRICAL ENGINEER TO COORDINATE VOLTAGE AND DIMMING COMPATIBILITY WITH THE SPECIFIED OR EXISTING LIGHTING CONTROL SYSTEM.
32. ALL EQUIPMENT LOCATED OUTDOORS (INCLUDING LIGHT FIXTURES, BALLASTS, LED DRIVERS, POWER SUPPLIES, AND TRANSFORMERS) SHALL BE RATED FOR -30˚C COLD WEATHER OPERATION UNLESS OTHERWISE SPECIFIED.
33. PROVIDE SUFFICIENT VENTILATION FOR REMOTE TRANSFORMERS / POWER SUPPLIES / CONTROL GEAR TO ENSURE AMBIENT TEMPERATURE WITHIN SUCH COMPARTMENTS DOES NOT EXCEED MANUFACTURER'S RECOMMENDATIONS.
34. FOR LIGHT FIXTURES LOCATED WITHIN MILLWORK / DISPLAY CASES, PROVIDE SUFFICIENT VENTILATION TO ENSURE AMBIENT TEMPERATURE WITHIN MILLWORK / DISPLAY CASES DOES NOT EXCEED MANUFACTURER'S RECOMMENDATIONS. VENT HOLES SHALL BE DESIGNED TO PREVENT LIGHT LEAKS.
35. ALL LED FIXTURES REPRESENT THE MOST CURRENT VERSION AVAILABLE FROM THE SPECIFIED MANUFACTURER AT TIME OF SPECIFICATION. DUE TO THE INEVITABLE DELAY BETWEEN 100%CD SPECIFICATION AND FIXTURE SUBMITTAL BY CONTRACTOR, AND INEVITABLE IMPROVEMENTS IN LED TECHNOLOGY, UPDATES TO THE LED FIXTURES ARE ANTICIPATED. AT TIME OF FIXTURE SUBMITTAL, CONTRACTOR MUST SUBMIT THE MOST CURRENT, UP TO DATE FIXTURE EQUIVALENT OF THE SPECIFIED FIXTURE FROM THE SPECIFIED MANUFACTURER IN ADDITION TO A WORKING FIXTURE SAMPLE. L'OBSERVATOIRE HAS THE RIGHT TO APPROVE EITHER THE ORIGINAL SPECIFIED FIXTURE, OR THE UP-TO-DATE FIXTUREFROM SAME MANUFACTURER AT FAIR MARKET PRICING. ANY COST INCREASES AND/OR CHANGE ORDERS MUST BE JUSTIFIED BY CONTRACTOR WITH UNIT COST COMPARISON BETWEEN THE ORIGINAL SPECIFIED FIXTURE AND THE UP-TO-DATE REPLACEMENT FROM THE SAME MANUFACTURER.

****** FIXTURE SCHEDULE SUBMITTAL HISTORY:**

REVISION #	DATE	PHASE
ISSUE 1	9/23/2025	90% DD - CHECK SET
ISSUE 2	10/17/2025	100% DD

LIGHTING FIXTURES:

FIXTURE TYPE	DESCRIPTION
ST-XX	Exterior Striplight
UL-XX	Exterior Uplight
PR-XX	Exterior Projector
WSE-XX	Exterior Wall Sconce
TSE-XX	Exterior Tile Sheet
ILE-XX	Exterior Illuminator
LB-XX	Exterior Bollard
POE-XX	Exterior Pole
LDE-XX	Decorative (FF&E)
LPE-XX	Decorative - Plug-in (FF&E)

*** CONTROL GEAR:**
ILD= INTEGRAL LED DRIVER
RLD= REMOTE LED DRIVER
PDS= POWER DATA SUPPLY

**** LOAD TYPE:**
CC = COLD CATHODE/ NEON
HID = HIGH INTENSITY DISCHARGE
INC = INCANDESCENT
LED = LIGHT EMITTING DIODE
TRK = LINE VOLTAGE TRACK
M = MOTOR

*****DIMMING PROTOCOL:**
MLV = MAGNETIC LOW VOLTAGE/FORWARD PHASE
ELV = ELECTRONIC LOW VOLTAGE/REVERSE PHASE/TRAILING EDGE
INC = INCANDESCENT/TRIAC/LEADING EDGE
DMX = DATA SIGNAL CONTROL
0-10V
LUTRON HI LUME
LUTRON ECOSYSTEM

L'OBSERVATOIRE INTERNATIONAL LIGHTING DESIGNERS AND CONSULTANTS
120 WALKER STREET, 7th FLOOR EAST. NEW YORK, NY10013 T 212 255 4463 F 212 255 8346 E INFO@LOBSINTL.COM

LOCATION	FIXTURE TYPE	DESCRIPTION	MANUFACTURER/ CATALOG NO.	LAMP QTY.	LAMP TYPE	MATERIALS / FINISH COLOR	CONTROL GEAR *	DIMMING PROTOCOL	LOAD TYPE **	EXTENDED WATTAGE [VA]	UNITS (EACH / PER LF)	VOLTAGE [V]	COMMENTS	ISSUED***
THROUGHOUT	DL01	MOUNTING: RECESSED, ROUND LED DOWNLIGHT. MOUNTING: RECESSED IN GWB CEILING (TBC) DIMENSIONS: 1.75" OPENING, 11" L x 5.88" H (BODY) IP: TBC ACCESSORIES: MOUNTING AND WIRING ACCESSORIES AS NEEDED DIMMING RANGE: 5% INTEGRAL POWER SUPPLY: YES	**LIGHTOLIER (SIGNIFY)** CALCULITE LED 1.75" C2L-09-DL-930-R-E1 (VOLTAGE TBC BY EE) C2L-DL-CCD (TBC)-P (TBC)-INSTALLATION ACCESSORIES AS NEEDED (TBC BY CONTRACTOR) + MOUNTING AND WIRING ACCESSORIES AS NEEDED	N/A	3000K 935 LM 90+ CRI 50-DEGREE BEAM	FINISH TBC BY ARCHITECT	ILD	SWITCHED (NON-DIM)	LED	14	EA	120V (TBC)	FIXTURE SHALL DIM DOWN TO 5%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT AND CONTRACTOR TO VERIFY CEILING THICKNESS. CONTRACTOR TO COORDINATE FIXTURE HOUSING AND TRIM TYPE WITH CEILING TYPE AND THICKNESS. CONTRACTOR TO INSTALL LOUVER AND LENSING ACCESSORIES FOR LIGHTING DESIGNER AT TIME OF FINAL FOCUSING. FIXTURES TO BE TYPICALLY TURNED ON ONLY DURING EMERGENCY LIGHTING CONDITIONS. EMERGENCY LIGHTING REQUIREMENTS TO BE CONFIRMED BY ELECTRICAL ENGINEER.	**2**
WING F (LOWER-CEILING) GALLERY	PR01	MOUNTING: TRACK-MOUNTED, CYLINDRICAL ADJUSTABLE LED PROJECTOR. MOUNTING: ATTACHED TO RECESSED TRACK (TYPE TR01) DIMENSIONS (HEAD): 2-3/8" DIA x 4-5/8" HEIGHT x 6-7/8" OVERALL HEIGHT IP: TBC ACCESSORIES: CROSSHAIR BAFFLE, LINEAR SPREAD LENS, ADDITIONAL BEAM OPTICS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C2O STATIC WHITE, FIXED OBJECT C2O-L14-30K (TBC)-**9HS (ADAPTOR TBC)**-W-**C (TBC)**-VOLTAGE PER EE (TBC)-CP (PER ARCH)-25 (TBC) - **MOD FOR INTEGRAL CASAMBI MODULE** + 15-DEGREE OPTIC: OL-RS-ILONA-50-KIT + 35-DEGREE OPTIC: OL-W-ILONA-50-KIT + LINEAR SPREAD LENS: OL-10x60-A + CROSSHAIR BAFFLE: CHB/A-2	N/A	3000K (TBC) 1450 LM (NOMINAL) 98 CRI 25-DEGREE BEAM	CUSTOM FINISH BY ARCHITECT	ILD	CASAMBI	LED	23	EA	120V (TBC)	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED TRACK INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH CROSSHAIR BAFFLE ACCESSORY PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE REFLECTORS SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**2**
WING F (LOWER-CEILING) GALLERY	PR01-FR	MOUNTING: TRACK-MOUNTED, CYLINDRICAL ADJUSTABLE LED FRAMING PROJECTOR. MOUNTING: ATTACHED TO RECESSED TRACK (TYPE TR01) DIMENSIONS (HEAD): 2-3/8" DIA x 7.3" HEIGHT x 8-11/16" OVERALL HEIGHT IP: TBC ACCESSORIES: FOCUSING TUBES, GOBO PIN SPOT KIT DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C3P STATIC WHITE, FRAMING PROJECTOR C3P-L15-30 (TBC) - **9HS (ADAPTOR TBC)** - W - **C (TBC)** - VOLTAGE PER EE (TBC) - CP (TBC BY ARCHITECT) - 33 + 22-DEGREE FOCUSING TUBE: 64506-01 + 54-DEGREE FOCUSING TUBE: 64506-03 + GOBO PIN SPOT KIT: 64522-KIT	N/A	3000K (TBC) 1550 LM (NOMINAL) 98 CRI 33-DEGREE BEAM (TBC)	CUSTOM FINISH BY ARCHITECT	ILD	CASAMBI	LED	23	EA	120V (TBC)	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED TRACK INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH 33-DEGREE FOCUSING TUBE PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE FOCUSING TUBES SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**

LOCATION	FIXTURE TYPE	DESCRIPTION	MANUFACTURER/ CATALOG NO.	LAMP QTY.	LAMP TYPE	MATERIALS / FINISH COLOR	CONTROL GEAR *	DIMMING PROTOCOL	LOAD TYPE **	EXTENDED WATTAGE [VA]	UNITS (EACH / PER LF)	VOLTAGE [V]	COMMENTS	ISSUED***
WING E (HIGHER-CEILING) GALLERY	PR02	MOUNTING: TRACK-MOUNTED, CYLINDRICAL ADJUSTABLE LED PROJECTOR. MOUNTING: ATTACHED TO RECESSED TRACK (TYPE TR02) DIMENSIONS (HEAD): 2-3/8" DIA x 4-5/8" HEIGHT x 6-7/8" OVERALL HEIGHT IP: TBC ACCESSORIES: CROSSHAIR BAFFLE, LINEAR SPREAD LENS, ADDITIONAL BEAM OPTICS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C2O STATIC WHITE C2O-L14-30K (TBC)-**9HS (ADAPTOR TBC)**-W-C (TBC)-VOLTAGE PER EE (TBC)-CP (PER ARCH)-**15 (TBC) - MOD FOR INTEGRAL CASAMBI MODULE** + 25-DEGREE OPTIC: OL-M-ILONA-50-KIT + 35-DEGREE OPTIC: OL-W-ILONA-50-KIT + LINEAR SPREAD LENS: OL-10x60-A + CROSSHAIR BAFFLE: CHB/A-2	N/A	3000K (TBC) 1450 LM (NOMINAL) 98 CRI **15-DEGREE BEAM (TBC)**	CUSTOM FINISH BY ARCHITECT	ILD	CASAMBI	LED	23	EA	120V	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED TRACK INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH CROSSHAIR BAFFLE ACCESSORY PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE REFLECTORS SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**2**
WING E (HIGHER-CEILING) GALLERY	PR02-FR	MOUNTING: TRACK-MOUNTED, CYLINDRICAL ADJUSTABLE LED FRAMING PROJECTOR. MOUNTING: ATTACHED TO RECESSED TRACK (TYPE TR02) DIMENSIONS (HEAD): 2-3/8" DIA x 7.3" HEIGHT x 8-11/16" OVERALL HEIGHT IP: TBC ACCESSORIES: FOCUSING TUBES, GOBO PIN SPOT KIT DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C3P STATIC WHITE, FRAMING PROJECTOR C3P-L15-30 (TBC) - **9HS (ADAPTOR TBC)** - W - **C (TBC)** - VOLTAGE PER EE (TBC) - CP (TBC BY ARCHITECT) - 33 + 22-DEGREE FOCUSING TUBE: 64506-01 + 54-DEGREE FOCUSING TUBE: 64506-03 + GOBO PIN SPOT KIT: 64522-KIT	N/A	3000K (TBC) 1550 LM (NOMINAL) 98 CRI 33-DEGREE BEAM (TBC)	CUSTOM FINISH BY ARCHITECT	ILD	CASAMBI	LED	23	EA	120V (TBC)	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED TRACK INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH 33-DEGREE FOCUSING TUBE PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE FOCUSING TUBES SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**
WING E (HIGHER-CEILING) GALLERY	PR03	MOUNTING: CYLINDRICAL ADJUSTABLE LED PROJECTOR. MOUNTING: ATTACHED TO RECESSED, FLANGELESS, QUICK-CONNECT CANOPY. DIMENSIONS (HEAD): 2-3/8" DIA x 4-5/8" HEIGHT x 6-7/8" OVERALL HEIGHT IP: TBC ACCESSORIES: CROSSHAIR BAFFLE, LINEAR SPREAD LENS, ADDITIONAL BEAM OPTICS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C2O STATIC WHITE C2O-L14-30K (TBC)-**5L (ADAPTOR TBC)**-Z-D (TBC)-VOLTAGE PER EE (TBC)-CP (PER ARCH)-**25 (TBC)** + 3-1/2" QUICK-CONNECT CANOPY: QC-5K-P/MB (WITH BLANK CAP) + 15-DEGREE OPTIC: OL-RS-ILONA-50-KIT + 35-DEGREE OPTIC: OL-W-ILONA-50-KIT + LINEAR SPREAD LENS: OL-10x60-A + CROSSHAIR BAFFLE: CHB/A-2	N/A	3000K (TBC) 1450 LM (NOMINAL) 98 CRI **25-DEGREE BEAM (TBC)**	CUSTOM FINISH BY ARCHITECT	ILD	0-10V (VIA CASAMBI)	LED	23	EA	120V	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED QUICK-CONNECT CANOPY INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. TOP FIXTURE CANOPY AND QUICK-CONNECT BLANK CAP TO MATCH CEILING FINISH; ARCHITECT TO CONFIRM FINAL CEILING FINISH. CONTRACTOR TO INSTALL ALL FIXTURES WITH CROSSHAIR BAFFLE ACCESSORY PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE REFLECTORS SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**

LOCATION	FIXTURE TYPE	DESCRIPTION	MANUFACTURER/ CATALOG NO.	LAMP QTY.	LAMP TYPE	MATERIALS / FINISH COLOR	CONTROL GEAR *	DIMMING PROTOCOL	LOAD TYPE **	EXTENDED WATTAGE [VA]	UNITS (EACH / PER LF)	VOLTAGE [V]	COMMENTS	ISSUED***
HYPHEN GALLERIES	PR04	MOUNTING: TRACK-MOUNTED, CYLINDRICAL ADJUSTABLE LED PROJECTOR. MOUNTING: ATTACHED TO RECESSED ARCHITECTURAL SLOT (TYPE TR04) DIMENSIONS: (HEAD): 3-1/16" DIA x 5-1/8" HEIGHT x 6-1/16" OVERALL HEIGHT IP: TBC ACCESSORIES: HEXCELL LOUVER, LINEAR SPREAD LENS, ADDITIONAL BEAM OPTICS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO	**LITELAB** M3O STATIC WHITE, FIXED OBJECT M3O-L15-30K (TBC)-**BT (ADAPTOR TBC)-E (TBC)**-D-N/A-VOLTAGE PER EE (TBC)-MB (TBC)-20 + 10-DEGREE OPTIC: OL-NB-70MM-KIT + 30-DEGREE OPTIC: OL-WB-70MM-KIT + LINEAR SPREAD LENS: OL-10x60-G + HEXCELL LOUVER: LVH/G	N/A	3000K (TBC) 1550 LM (NOMINAL) 98 CRI 20-DEGREE	MATTE BLACK (FINISH TBC BY ARCHITECT)	ILD	ELV (VIA CASAMBI)	LED	23	EA	120V	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND ARCHITECTURAL SLOT INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH CROSSHAIR BAFFLE ACCESSORY PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE REFLECTORS SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**
HYPHEN GALLERIES	PR05	MOUNTING: CYLINDRICAL ADJUSTABLE LED PROJECTOR. MOUNTING: ATTACHED TO RECESSED, FLANGELESS, QUICK-CONNECT CANOPY. DIMENSIONS (HEAD): 2-3/8" DIA x 4-5/8" HEIGHT x 6-7/8" OVERALL HEIGHT IP: TBC ACCESSORIES: CROSSHAIR BAFFLE, LINEAR SPREAD LENS, ADDITIONAL BEAM OPTICS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C2O STATIC WHITE C2O-L14-30K (TBC)-**5L (ADAPTOR TBC)**-Z-D (TBC)-VOLTAGE PER EE (TBC)-CP (PER ARCH)-**25 (TBC)** + 3-1/2" QUICK-CONNECT CANOPY: QC-5K-P/MB (WITH BLANK CAP) + 15-DEGREE OPTIC: OL-RS-ILONA-50-KIT + 35-DEGREE OPTIC: OL-W-ILONA-50-KIT + LINEAR SPREAD LENS: OL-10x60-A + CROSSHAIR BAFFLE: CHB/A-2	N/A	3000K (TBC) 1450 LM (NOMINAL) 98 CRI **25-DEGREE BEAM (TBC)**	CUSTOM FINISH BY ARCHITECT	ILD	0-10V (VIA CASAMBI)	LED	23	EA	120V	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED QUICK-CONNECT CANOPY INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. TOP FIXTURE CANOPY AND QUICK-CONNECT BLANK CAP TO MATCH CEILING FINISH; ARCHITECT TO CONFIRM FINAL CEILING FINISH. CONTRACTOR TO INSTALL ALL FIXTURES WITH CROSSHAIR BAFFLE ACCESSORY PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE REFLECTORS SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**
HYPHEN GALLERIES	PR05-FR	MOUNTING: TRACK-MOUNTED, CYLINDRICAL ADJUSTABLE LED FRAMING PROJECTOR. MOUNTING: ATTACHED TO RECESSED, FLANGELESS, QUICK-CONNECT CANOPY. DIMENSIONS (HEAD): 2-3/8" DIA x 7.3" HEIGHT x 8-11/16" OVERALL HEIGHT IP: TBC ACCESSORIES: FOCUSING TUBES, GOBO PIN SPOT KIT DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C3P STATIC WHITE, FRAMING PROJECTOR C3P-L15-30 (TBC) - **5L (ADAPTOR TBC)** - W - **C (TBC)** - VOLTAGE PER EE (TBC) - CP (TBC BY ARCHITECT) - 33 + 22-DEGREE FOCUSING TUBE: 64506-01 + 54-DEGREE FOCUSING TUBE: 64506-03 + GOBO PIN SPOT KIT: 64522-KIT	N/A	3000K (TBC) 1550 LM (NOMINAL) 98 CRI 33-DEGREE BEAM (TBC)	CUSTOM FINISH BY ARCHITECT	ILD	CASAMBI	LED	23	EA	120V (TBC)	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED TRACK INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH 33-DEGREE FOCUSING TUBE PRIOR TO FINAL FOCUSING. ALL OTHER ACCESSORIES AND SPARE FOCUSING TUBES SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**

LOCATION	FIXTURE TYPE	DESCRIPTION	MANUFACTURER/ CATALOG NO.	LAMP QTY.	LAMP TYPE	MATERIALS / FINISH COLOR	CONTROL GEAR *	DIMMING PROTOCOL	LOAD TYPE **	EXTENDED WATTAGE [VA]	UNITS (EACH / PER LF)	VOLTAGE [V]	COMMENTS	ISSUED***
WING E (HIGHER-CEILING) GALLERY	ST01	MOUNTING: SURFACE-MOUNTED LINEAR LED UPLIGHT FIXTURE. MOUNTING: SURFACE-MOUNTED ALONG TOP OF SUSPENDED CEILING PANELS DIMENSIONS: LENGTH PER DRAWINGS x 1.64" W x 1.41" H IP: 54 ACCESSORIES: LEADER CABLES, JUMPER CABLES, MOUNTING AND WIRING ACCESSORIES AS NEEDED DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO	**ECOSENSE** TROV INTERIOR L35 L35-I-LENGTH PER DRAWINGS-04-27K (TBC) 90-MULT-120 + LEADER AND JUMPER CABLES (AS NEEDED): CBL-3P-L-UNV-LENGTH + MOUNTING TRACK (AS NEEDED): MNT-L-TRKCLIP-LENGTH	N/A	2700K (TBC) 407 LM/FT LM (NOMINAL) 90+ CRI 120-DEGREE BEAM	FINISH TBC BY ARCHITECT	ILD	ELV (VIA CASAMBI)	LED	4	LFT	120V	FIXTURE SHALL DIM DOWN TO 1%. ARCHITECT TO VERIFY FIXTURE COVE DETAIL INTEGRATION INTO ARCHITECTURAL CEILING PANEL DETAILS. ARCHITECT AND CONTRACTOR TO VERIFY AND COORDINATE MOUNTING CONDITION. ARCHITECT AND CONTRACTOR TO PROVIDE PROPER VENTILATION FOR FIXTURE. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CONFIRM FIXTURE COMPATIBILITY WITH DIMMING POWER SUPPLY AND CONTROL SYSTEM. CONTRACTOR TO ORDER ALL WIRING ACCESSORIES, MOUNTING ACCESSORIES, AND FIXTURE COMPONENTS TO ENSURE COMPLETE FIXTURE INSTALLATION. CONTRACTOR SHALL ORDER OPTIMAL COMBINATION OF FIXTURE SEGMENTS TO ENSURE FIXTURE COVER ENTIRE FIXTURE RUNS. FIXTURE RUN SHALL BE CENTERED ALONG THE CEILING PANELS. FIXTURE GAPS AT EACH END SHALL NOT EXCEED 3".	**1**
WING F (LOWER-CEILING) GALLERY	TR01	MOUNTING: RECESSED, DUAL-CIRCUIT, LINEAR FIXTURE TRACK, POWERING PROJECTOR TYPES PR01 AND WW01. MOUNTING: RECESSED IN GWB CEILING (TBC) DIMENSIONS: LENGTH PER DRAWINGS x 3.56" W (INCLUDING MUD-IN TRIM) x 2.38" H IP: TBC ACCESSORIES: FEEDS, JOINERS, CONNECTORS, ENDCAPS, MOUNTING AND WIRING ACCESSORIES AS NEEDED DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO	**LITELAB** BUS-13R RECESSED D-BAR, TRIMLESS **TCF (TBC)**- 13R-2A (TBC)-N/A- AMPERAGE-LENGTH AND PATTERN PER DRAWINGS- UF - WHIP LENGTH PER CONTRACTOR + CORNERS AS NEEDED PER LAYOUTS + FEEDS, JOINERS, AND CONNECTORS AS REQUIRED + MOUNTING ACCESSORIES (AS NEEDED)	N/A	-	FINISH TBC BY ARCHITECT	RLD	-	TRK	-	EA	120V	FIXTURE TRACK SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. CONTRACTOR TO VERIFY TRACK MOUNTING ACCESSORIES WITH A STRAIGHT CORD AND LEVELED SUSPENSION. ARCHITECT TO SPECIFY TRACK FINISHES. ARCHITECT AND CONTRACTOR TO COORDINATE TRACK INSTALLATION AND DETAILS WITH OTHER CEILING SYSTEMS, AND SHALL CONFIRM THERE ARE NO CLASHES WITH OTHER CEILING SYSTEMS OR FIELD CONDITIONS PRIOR TO FIXTURE ORDERING AND PURCHASING. ARCHITECT TO CONFIRM CEILING THICKNESS. CONTRACTOR SHALL FURNISH ALL TRACK SEGMENTS, POWER FEEDS, JOINER CABLES, CONNECTOR, CORNER PIECES, AND ANY MOUNTING AND WIRING ACCESSORIES REQUIRED FOR A COMPLETE SYSTEM INSTALLATION.	**1**

LOCATION	FIXTURE TYPE	DESCRIPTION	MANUFACTURER/ CATALOG NO.	LAMP QTY.	LAMP TYPE	MATERIALS / FINISH COLOR	CONTROL GEAR *	DIMMING PROTOCOL	LOAD TYPE **	EXTENDED WATTAGE [VA]	UNITS (EACH / PER LF)	VOLTAGE [V]	COMMENTS	ISSUED***
WING E (HIGHER-CEILING) GALLERY	TR02	MOUNTING: RECESSED, DUAL-CIRCUIT, LINEAR FIXTURE TRACK, POWERING PROJECTOR TYPE PR02. MOUNTING: RECESSED IN SUSPENDED CEILING PANELS; CEILING PANEL MATERIAL TBC. DIMENSIONS: LENGTH PER DRAWINGS x 3.56" W (INCLUDING MUD-IN TRIM) x 2.38" H IP: TBC ACCESSORIES: FEEDS, JOINERS, CONNECTORS, ENDCAPS, MOUNTING AND WIRING ACCESSORIES AS NEEDED DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO	**LITELAB** BUS-13R RECESSED D-BAR, TRIMLESS **TCF (TBC)**- 13R-2A (TBC)-N/A- AMPERAGE-LENGTH AND PATTERN PER DRAWINGS- UF - WHIP LENGTH PER CONTRACTOR + CORNERS AS NEEDED PER LAYOUTS + FEEDS, JOINERS, AND CONNECTORS AS REQUIRED + MOUNTING ACCESSORIES (AS NEEDED)	N/A	-	FINISH TBC BY ARCHITECT	RLD	-	TRK	-	EA	120V	FIXTURE TRACK SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. CONTRACTOR TO VERIFY TRACK MOUNTING ACCESSORIES WITH A STRAIGHT CORD AND LEVELED SUSPENSION. ARCHITECT TO SPECIFY TRACK FINISHES. ARCHITECT AND CONTRACTOR TO COORDINATE TRACK INSTALLATION AND DETAILS WITH OTHER CEILING SYSTEMS, AND SHALL CONFIRM THERE ARE NO CLASHES WITH OTHER CEILING SYSTEMS OR FIELD CONDITIONS PRIOR TO FIXTURE ORDERING AND PURCHASING. ARCHITECT TO CONFIRM CEILING THICKNESS. CONTRACTOR SHALL FURNISH ALL TRACK SEGMENTS, POWER FEEDS, JOINER CABLES, CONNECTOR, CORNER PIECES, AND ANY MOUNTING AND WIRING ACCESSORIES REQUIRED FOR A COMPLETE SYSTEM INSTALLATION.	**1**
WING E (HIGHER-CEILING) GALLERY	TR03	MOUNTING: RECESSED JACK-MOUNT, POWERING PROJECTOR TYPE PR03. MOUNTING: RECESSED IN GWB CEILING (TBC) DIMENSION: TBC IP: TBC ACCESSORIES: DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO		N/A	-	FINISH TBC BY ARCHITECT	RLD		TRK		EA	120V		**1**
HYPHEN GALLERIES	TR04	MOUNTING: RECESSED ARCHITECTURAL SLOT WITH 6-1/2" OPENING. SLOT TO HAVE INTEGRAL LINEAR FIXTURE TRACK, POWERING PROJECTOR TYPES PR04 AND WW04. MOUNTING: RECESSED IN GWB CEILING (TBC) DIMENSIONS: LENGTH PER DRAWINGS x 6-1/2" W (OPENING) x 1'-10-7/16" W (HOUSING) x 7" H IP: TBC ACCESSORIES: FEEDS, JOINERS, CONNECTORS, ENDCAPS, MOUNTING AND WIRING ACCESSORIES AS NEEDED DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO	**LITELAB** ALS-H06 ARCHITECTURAL LIGHT SLOT ALS-H06- LENGTH AND PATTERN PER DRAWINGS-VOLTAGE PER EE (TBC)-**ELV (TBC)**-GP (TBC)-MB (TBC) + END FEEDS (AS NEEDED): ALS-EFL-H06-TL-MB + 90-CORNER UNITS (AS NEEDED): ALS-CR-H06 + BASIC TRACK SEGMENTS (AS NEEDED) (TBC) + FEEDS, JOINERS, AND CONNECTORS AS REQUIRED + MOUNTING AND WIRING ACCESSORIES AS NEEDED	N/A	-	MATTE BLACK (TBC BY ARCHITECT)	RLD	ELV (VIA CASAMBI)	TRK	-	LFT	120V	FIXTURE TRACK WITHIN ARCHITECTURAL LIGHT SLOT SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. CONTRACTOR TO VERIFY ARCHITECTURAL SLOT MOUNTING ACCESSORIES WITH A STRAIGHT CORD AND LEVELED SUSPENSION. ARCHITECT TO SPECIFY ARCHITECTURAL LIGHT SLOT FINISHES. ARCHITECT AND CONTRACTOR TO COORDINATE ARCHITECTURAL LIGHT SLOT INSTALLATION AND DETAILS WITH OTHER CEILING SYSTEMS, AND SHALL CONFIRM THERE ARE NO CLASHES WITH OTHER CEILING SYSTEMS OR FIELD CONDITIONS PRIOR TO FIXTURE ORDERING AND PURCHASING. ARCHITECT TO CONFIRM CEILING THICKNESS. CONTRACTOR SHALL FURNISH ALL ARCHITECTURAL SLOT SEGMENTS, POWER FEEDS, JOINER CABLES, CONNECTOR, CORNER PIECES, AND ANY MOUNTING AND WIRING ACCESSORIES REQUIRED FOR A COMPLETE SYSTEM INSTALLATION.	**1**

LOCATION	FIXTURE TYPE	DESCRIPTION	MANUFACTURER/ CATALOG NO.	LAMP QTY.	LAMP TYPE	MATERIALS / FINISH COLOR	CONTROL GEAR *	DIMMING PROTOCOL	LOAD TYPE **	EXTENDED WATTAGE [VA]	UNITS (EACH / PER LF)	VOLTAGE [V]	COMMENTS	ISSUED***
HYPHEN GALLERIES	TR05	MOUNTING: RECESSED JACK-MOUNT, POWERING PROJECTOR TYPE PR05. MOUNTING: RECESSED IN GWB CEILING (TBC) DIMENSION: TBC IP: TBC ACCESSORIES: DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO		N/A	-	FINISH TBC BY ARCHITECT	RLD		TRK		EA	120V		**1**
WING F (LOWER-CEILING) GALLERY	WW01	MOUNTING: TRACK-MOUNTED ADJUSTABLE LED WALL WASHER. MOUNTING: ATTACHED TO RECESSED TRACK (TYPE TR01) DIMENSIONS (HEAD): 2-3/8" DIA x 4-5/8" HEIGHT x 6-7/8" OVERALL HEIGHT IP: TBC ACCESSORIES: BEAM SOFTENING LENS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: YES	**LITELAB** C2W STATIC WHITE WALLWASHER C2W-L14-30K (TBC)-**9HS (ADAPTOR TBC)**-W-C (TBC)-VOLTAGE PER EE (TBC)-CP (TBC BY ARCH)-**MOD FOR INTEGRAL CASAMBI MODULE** + BEAM SOFTENING LENS: OL-TD-A	N/A	3000K (TBC) 1450 LM (NOMINAL) 98 CRI WALLWASH BEAM OPTIC	CUSTOM FINISH BY ARCHITECT	ILD	CASAMBI	LED	23	EA	120V	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND RECESSED TRACK INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH ACCESSORIES SPECIFIED PRIOR TO FINAL FOCUSING. ANY SPARE ACCESSORIES SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**2**
HYPHEN GALLERIES	WW04	MOUNTING: TRACK-MOUNTED ADJUSTABLE LED WALL WASHER. MOUNTING: ATTACHED TO RECESSED ARCHITECTURAL SLOT (TYPE TR04) DIMENSIONS: (HEAD): 3-1/16" DIA x 5-7/8" HEIGHT x 6-13/16" OVERALL HEIGHT IP: TBC ACCESSORIES: BEAM SOFTENING LENS DIMMING RANGE: 1% INTEGRAL POWER SUPPLY: NO	**LITELAB** M3W STATIC WHITE WALLWASHER M3W-L15-30K (TBC)-**BT (ADAPTOR TBC)-E (TBC)**-D-N/A-VOLTAGE PER EE (TBC)-MB (TBC) + BEAM SOFTENING LENS: OL-TD-G	N/A	3000K (TBC) 1550 LM (NOMINAL) 98 CRI WALLWASH BEAM OPTIC	MATTE BLACK (FINISH TBC BY ARCHITECT)	RLD	ELV (VIA CASAMBI)	LED	23	EA	120V	FIXTURE SHALL DIM DOWN TO 1%. ELECTRICAL ENGINEER TO CONFIRM FIXTURE VOLTAGE. ELECTRICAL ENGINEER TO CHECK COMPATIBILITY WITH CONTROL SYSTEM. ARCHITECT TO SPECIFY CUSTOM FIXTURE FINISH. CONTRACTOR TO COORDINATE FIXTURE MOUNTING AND ARCHITECTURAL SLOT INSTALLATION WITH PROPOSED CEILING SYSTEM AND AVAILABLE CEILING CAVITY. CONTRACTOR TO INSTALL ALL FIXTURES WITH ACCESSORIES SPECIFIED PRIOR TO FINAL FOCUSING. ANY SPARE ACCESSORIES SHALL BE STORED IN A SAFE, ACCESSIBLE LOCATION, AND SHALL BE USED DURING FINAL AIMING AND FOCUSING SESSION.	**1**

BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168
LIGHTING CONTROL SCHEDULE

GENERAL NOTES:

1. CONTRACTOR TO CONFIRM COMPATIBILITY OF FINAL PROJECT DIMMING SYSTEM WITH FINAL PROJECT FLUORESCENT DIMMING BALLASTS.
2. CONTROL SETTINGS & DESCRIPTIONS ARE FOR DESIGN INTENT ONLY AND TO AID IN INITIAL CONTROL PROGRAMMING BY OTHERS. FINAL SETTINGS TO BE MODIFIED ON-SITE DURING COMMISIONING UNDER DIRECTION OF LIGHTING DESIGNER.
3. FIXTURE SUBMITTALS TO BE CONSIDERED FINAL SPECIFICATION FOR DETERMINING LOAD TYPE.
4. REFER TO LIGHTING PLANS FOR FINAL LOCATIONS AND QUANTITIES OF CONTROL ZONES AND TYPES.
5. ALL TIMECLOCK SETTINGS ON DIMMED ZONES TO BE PROGRAMMED FOR 20 MINUTES PRIOR TO THE SPECIFIED TIME WITH A 20 MINUTE FADE.
6. TIMECLOCK SETTINGS TO BE SET AS A MASTER OVERIDE TO ANY USER MODIFIED OR SELECTED SCENES PENDING REVIEW BY OPERATIONS MANAGER.

****** CONTROL SCHEDULE SUBMITTAL HISTORY:**

REVISION #	DATE	PHASE
ISSUE 1	9/23/2025	90% DD - CHECK SET
ISSUE 2	10/17/2025	100% DD

* CONTROL TYPE:
ILD= INTEGRAL LED DRIVER
RLD= REMOTE LED DRIVER
PDS= POWER DATA SUPPLY

** LOAD TYPE:
CC = COLD CATHODE/ NEON
HID = HIGH INTENSITY DISCHARGE
INC = INCANDESCENT
LED = LIGHT EMITTING DIODE
TRK = LINE VOLTAGE TRACK
M = MOTOR

***DIMMING PROTOCOL:
MLV = MAGNETIC LOW VOLTAGE/FORWARD PHASE
ELV = ELECTRONIC LOW VOLTAGE/REVERSE PHASE/TRAILING EDGE
INC = INCANDESCENT/TRIAC/LEADING EDGE
DMX = DATA SIGNAL CONTROL
0-10V
LUTRON HI LUME
LUTRON ECOSYSTEM

L'OBSERVATOIRE INTERNATIONAL LIGHTING DESIGNERS AND CONSULTANTS
120 WALKER STREET, 7th FLOOR EAST. NEW YORK, NY10013 T 212 255 4463 F 212 255 8346 E INFO@LOBSINTL.COM

BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168
LIGHTING CONTROL SCHEDULE

ZONE LOCATION (FLOOR / ROOM #)	CONTROL TYPE *	CONTROL ZONE	FIXTURE TYPE	ZONE DESCRIPTION	LOAD TYPE **	EXTENDED WATTAGE [VA]	QTY	UNITS (EACH / PER LF)	TOTAL LOAD / ZONE [VA]	VOLTAGE [V]	NOTES	DIMMING PROTOCOL***	ISSUED****
WING E GALLERY (3G12) - FLOOR PLAN													
CONTROL ZONE NOT USED		**Z-3G12-101**											**2**
CONTROL ZONE NOT USED		**Z-3G12-102**											**2**
WING E GALLERY (3G12) - REFLECTED CEILING PLAN													
CEILING - MONOPOINT PROJECTORS	DIM	**Z-3G12-201**	PR03	ADJUSTABLE LED SPOTLIGHT	LED	23	24	EA	552	120V		0-10V (VIA CASAMBI)	1
CEILING - TRACK PROJECTORS (DISPLAYS)	DIM	**Z-3G12-202**	PR02	ADJUSTABLE LED SPOTLIGHT	LED	23	24	EA	552	120V		CASAMBI	1
CEILING - TRACK PROJECTORS (WALL)	DIM	**Z-3G12-203**	PR02	ADJUSTABLE LED SPOTLIGHT	LED	23	16	EA	368	120V		CASAMBI	1
CEILING - LINEAR UPLIGHT	DIM	**Z-3G12-204**	ST01	LINEAR LED UPLIGHT	LED	4	198	LFT	792	120V	FINAL COVE FIXTURE LENGTHS TO BE CONFIRMED WITH CEILING PANEL DESIGN	ELV (VIA CASAMBI)	1
HYPHEN E-F (3J13) - REFLECTED CEILING PLAN													
CEILING - MONOPOINT PROJECTORS	DIM	**Z-3J13-201**	PR05	ADJUSTABLE LED SPOTLIGHT	LED	23	6	EA	138	120V		0-10V (VIA CASAMBI)	1
CEILING - TRACK PROJECTORS (DISPLAY)	DIM	**Z-3J13-202**	PR04	ADJUSTABLE LED SPOTLIGHT	LED	23	10	EA	230	120V		ELV (VIA CASAMBI)	1
CEILING - TRACK WALLWASHERS	DIM	**Z-3J13-203**	WW04	ADJUSTABLE LED WALL WASHER	LED	23	11	EA	253	120V		ELV (VIA CASAMBI)	1
CEILING - RECESSED DOWNLIGHTS	SWITCH	**Z-3J13-204**	DL01	ADJUSTABLE LED SPOTLIGHT	LED	14	2	EA	28	120V (TBC)	FIXTURES TO BE TYPICALLY TURNED ON ONLY DURING EMERGENCY LIGHTING CONDITIONS	SWITCHED (NON-DIM)	**2**
WING F GALLERY (3Q11) - FLOOR PLAN													
WALL CASEWORK LIGHTING (ALLOWANCE)	DIM	**Z-3Q11-101**							1500	120V/24V	1500W ALLOWANCE FOR CASEWORK LIGHTING; FINAL LIGHTING LAYERS AND LOADS TBC WITH PENDING		**2**
WALL CASEWORK LIGHTING (ALLOWANCE)	DIM	**Z-3Q11-102**							1500	120V/24V	1500W ALLOWANCE FOR CASEWORK LIGHTING; FINAL LIGHTING LAYERS AND LOADS TBC WITH PENDING		**2**
WING F GALLERY (3Q11) - REFLECTED CEILING PLAN													
CEILING - TRACK WALLWASHERS (PERIMETER WALLS)	DIM	**Z-3Q11-201**	WW01	ADJUSTABLE LED WALL WASHER	LED	23	66	EA	1518	120V		CASAMBI	1
CEILING - TRACK WALLWASHERS (CENTRAL WALLS)	DIM	**Z-3Q11-202**	WW01	ADJUSTABLE LED WALL WASHER	LED	23	24	EA	552	120V		CASAMBI	1
CEILING - TRACK PROJECTORS (PERIMETER WALLS)	DIM	**Z-3Q11-203**	PR01	ADJUSTABLE LED SPOTLIGHT	LED	23	35	EA	805	120V (TBC)		CASAMBI	1
CEILING - TRACK PROJECTORS (CENTRAL WALLS)	DIM	**Z-3Q11-204**	PR01	ADJUSTABLE LED SPOTLIGHT	LED	23	16	EA	368	120V (TBC)		CASAMBI	1
CEILING - TRACK PROJECTORS (CENTRAL FLOATING DISPLAYS)	DIM	**Z-3Q11-205**	PR01	ADJUSTABLE LED SPOTLIGHT	LED	23	49	EA	1127	120V (TBC)		CASAMBI	1
CEILING - TRACK PROJECTORS (ENTRANCES)	DIM	**Z-3Q11-206**	PR01	ADJUSTABLE LED SPOTLIGHT	LED	23	8	EA	184	120V (TBC)		CASAMBI	1
CEILING - RECESSED DOWNLIGHTS	SWITCH	**Z-3Q11-207**	DL01	ADJUSTABLE LED SPOTLIGHT	LED	14	19	EA	266	120V (TBC)	FIXTURES TO BE TYPICALLY TURNED ON ONLY DURING EMERGENCY LIGHTING CONDITIONS	SWITCHED (NON-DIM)	**2**
HYPHEN F-H (3W13) - REFLECTED CEILING PLAN													

BROOKLYN MUSEUM ARTS OF AFRICA | BKM 24168
LIGHTING CONTROL SCHEDULE

ZONE LOCATION (FLOOR / ROOM #)	CONTROL TYPE *	CONTROL ZONE	FIXTURE TYPE	ZONE DESCRIPTION	LOAD TYPE **	EXTENDED WATTAGE [VA]	QTY	UNITS (EACH / PER LF)	TOTAL LOAD / ZONE [VA]	VOLTAGE [V]	NOTES	DIMMING PROTOCOL***	ISSUED****
CEILING - RECESSED DOWNLIGHTS	SWITCH	**Z-3W13-201**	DL01	ADJUSTABLE LED SPOTLIGHT	LED	14	2	EA	28	120V (TBC)	FIXTURES TO BE TYPICALLY TURNED ON ONLY DURING EMERGENCY LIGHTING CONDITIONS	SWITCHED (NON-DIM)	**2**
CEILING - TRACK PROJECTORS (DISPLAY)	DIM	**Z-3W13-202**	PR04	ADJUSTABLE LED SPOTLIGHT	LED	23	11	EA	253	120V		ELV (VIA CASAMBI)	1
CEILING - TRACK WALLWASHERS	DIM	**Z-3W13-203**	WW04	ADJUSTABLE LED WALL WASHER	LED	23	12	EA	276	120V		ELV (VIA CASAMBI)	1

L'OBSERVATOIRE INTERNATIONAL LIGHTING DESIGNERS AND CONSULTANTS
120 WALKER STREET, 7th FLOOR EAST. NEW YORK, NY10013 T 212 255 4463 F 212 255 8346 E INFO@LOBSINTL.COM

Electrical Narrative

TABLE OF CONTENTS

I. GENERAL

This narrative describes the design development electrical scope of work and specifications; refer to architectural, electrical and fire alarm floor plans for additional information including locations and quantities of all equipment and devices.

Comply with all current Federal, State, City and local codes, standards and ordinances, the New York City Building Code including supplements, NFPA, insurance carrier requirements, and local authorities. The Electrical systems will be designed to comply with all state and local codes including the following codes adopted by the authority having jurisdiction:

- 2022 New York City Building Code
- 2020 New York City Energy Conservation Code and all local laws
- 2025 New York City Electric Code (Administrative provisions and 2020 NEC Amendments)
- 2022 New York City Mechanical Code
- 2016 NFPA 72 National Fire Alarm and Signaling Code
- 2010 ADA Standards for Accessible Design
- 2020 New York State Energy Conservation Code

II. SUSTAINABILITY

While the Brooklyn Museum is exempt from the New York City Energy Conservation Code (NYC ECC) due to its historic status, and as the museum is a member of the NYC Cultural Institutions Group and not a covered building under LL97: Building Emissions Cap, the museum's goal is still to meet or exceed the requirements of the NYC ECC.

III. COORDINATION

Coordinate the work, with work of other trades and field conditions. Carefully check space requirements and utilities to ensure all equipment can be installed in the spaces allotted thereto and coordinate all necessary service requirements. Coordinate, protect and schedule work with

work of other trades in line with the required construction sequence. Install all work in accordance with equipment manufacturer's installation instructions.

IV. ELECTRICAL DISTRIBUTION

Disconnect and remove all receptacles, lighting and equipment in areas to be refinished. Provide and install new receptacles and lighting controls in areas undergoing partial renovation, i.e. GREEN ROOM 3MJ11,TOILET MJ13 and STUDIO 3CC12.

Disconnect and relocate one (1) 120/208 volt, 225 amp, 3-phase, 4-wire 42-pole panelboard and one (1) 200 amp automatic transfer switch (ATS) located in electrical closet ELEC 3K14; equipment shall be relocated to new electrical closet adjacent to Stair E. Disconnect and remove one (1) 120/208 volt, 400 amp, 3-phase, 4-wire 24-pole distribution board and one (1) 120/208 volt, 400 amp, 3-phase, 4-wire 9-pole distribution board located in electrical closet ELEC 3K14; equipment shall be replaced in kind and be located within new electrical closet. Disconnect and remove one (1) 200A dimmer rack and two (2) 100A dimmer racks located in electrical closet EJ14; equipment shall be replaced in kind and be located within new electrical closet. Provide temporary termination of existing source feeders for extension to new electrical closet. Provide temporary termination of existing branch circuits leaving electrical equipment for extension to new electrical closet.

Disconnect and remove one (1) 120/208 volt, 225 amp, 3-phase, 4-wire, 42-pole panelboard located in Wilbur Library 3G12.Provide new branch circuits to devices and fixtures located outside scope of work previously fed by this panelboard to new panelboard 3EF located within new electrical closet; new branch circuit wiring shall match existing.

Disconnect and remove one (1) 120/208 volt, 100 amp, 3-phase, 4-wire 18-pole panelboard located in SVC CIRC 3W13. Provide one (1) 120/208 volt, 225 amp, 3-phase, 4-wire 42-pole panelboard located within new electrical closet. Refeed panelboard 3FM, located within SVC CIRC 3MY12, from this new panelboard as it was originally fed by removed panelboard.

Disconnect and remove two (2) 120/208 volt, 100 amp, 3-phase, 4-wire 24-pole panelboards located within SVC CIRC 3AA14. Provide one (1) 120/208 volt, 225 amp, 3-phase, 4-wire 42-pole panelboard in same corridor. Provide new branch circuits to devices and fixtures located outside scope of work previously fed by these removed panelboards to new panelboard LP-3P located within new electrical closet; new branch circuit wiring shall match existing.

Provide one (1) 200A company switch within the new electrical closet.

Receptacle panelboards shall generally be 120/208 volt rated 225A, 42 poles.

Panelboards shall have copper bus and bolt on circuit breakers. All panelboards shall be surface mounted.

V. HVAC WIRING

Provide all necessary disconnects, wiring/raceways for all exhaust fans, pumps, and air units including air conditioning. Motor controllers for HVAC equipment are by mechanical. Provide electrical service to all mechanical control transformers and control panels.

VI. TELEPHONE, DATA, AND AUDIO/VISUAL SYSTEM

Provide raceways and backboxes for all telephone, data, and audio/visual system devices. Provide power to all equipment. Equipment, devices, and low voltage wiring shall be provided by others.

VII. FIRE ALARM SYSTEM

Relocate existing smoke detection devices throughout the space to suit the reconfigured architectural layout. Relocate existing notification devices throughout the space to suit the reconfigured architectural layout. The existing fire alarm system manufacturer is Simplex; contact information is as follows:
Anthony Porpora of Johnson Controls Fire Protection LP.
Phone number: 888-447-4027
Email: anthony.porpora@jci.com

Provide duct detection and fan shutdown relays for AHU-31-F. All new Fire Alarm devices shall be connected to nearest existing to remain FA loops in area.

VIII. RECEPTACLE DEVICES

Provide receptacles to suit architectural programming.

IX. WIRE AND INSULATION APPLICATIONS

Feeders: Type THHN/THWN, in raceway.

Branch Circuits: Type THHN/THWN, in raceway.

Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

Branch circuits and home runs shall not use MC cables.

Fire Alarm Circuits: Type THHN/THWN, in raceway.

Low voltage, 50V maximum, circuits for sound and security systems: Power-limited cable, in raceways.

Shielded Cables: Provide shielded cables where required by the manufacturers. Install in raceways or cable trays as specified.

Plenum Spaces: Use plenum rated cables in plenum spaces.

Class 1 Control Circuits: Type THHN/THWN, in raceway.

Class 2 Control Circuits: Type THHN/THWN, in raceway.

X. CONDUIT APPLICATION

Indoors: Use the following wiring methods:

Exposed areas not subject to physical damage: EMT.

Exposed areas subject to physical damage: RMC.

Areas subject to physical damage include, but not limited to, attic, mechanical rooms, boiler and chiller rooms, sprinkler room and like utility rooms.

Concealed: EMT.

Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.

Damp or Wet Locations: Aluminum.

Plenum Spaces: Wiring methods in plenum spaces shall conform to the requirements of NEC Section 300.22. All conduits shall be metal. Exposed cables, where used, shall be listed and approved for use in plenum.

Boxes and Enclosures: NEMA 250, Type 1, except as follows:

XI. LIGHTING

Scope of lighting work shall include lighting fixtures and controls for all areas. Refer to lighting designer's specifications/narrative for fixture descriptions.

Lighting controls: Provide a networked lighting control system to provide time scheduling, occupancy sensing and dimming control for spaces.

Mechanical rooms, electrical closets and similar spaces shall be manually controlled.

XII. EMERGENCY LIGHTING

Emergency lighting shall be provided by select LED lighting fixtures connected to the emergency distribution system to provide an average of 1 F.C. in all paths of egress. Emergency lighting fixtures shall be controlled in conjunction with the normal lighting fixture via bypass relays so that upon loss of normal power, emergency lighting fixtures shall return to full output.

Exit signs shall be mud-in LED type and connected to the emergency distribution system.

XIII. GROUNDING

Provide a system ground and all necessary bonding as required by the NEC.

Provide separate insulated ground wire with each branch circuit and feeder.

Fire Protection Narrative

TABLE OF CONTENTS

I. GENERAL

This narrative describes the schematic fire protection scope of work and specifications; refer to architectural floor plans for additional information.

This narrative describes the schematic fire protection scope of work and specifications; refer to architectural floor plans for additional information.

Comply with all current Federal, State, City and local codes, standards and ordinances, including supplements, NFPA, utility company standards, insurance carrier requirements, local authorities. The Fire Protection systems will be designed to comply with all state and local codes including the following codes adopted by the authority having jurisdiction:

- 2022 New York City Building Code
- 2022 New York City Plumbing Code
- 2022 New York City Fuel Gas Code
- 2020 New York City Energy Code
- NYCDDC Design Build Requirements - Volumes 4 (Section D20)
- 2022 Fire Code

All equipment shall be in accordance with NFPA 13 14 UL listed, FM approved. FM approved equipment is mandatory for this projects.

The contractor will be responsible to give all necessary notices, obtain all permits and pay all taxes and fees necessary to obtain approvals and complete the work herein. Obtain all required certificates of inspection and deliver same to Owner.

The fire protection systems will be designed to comply with all current State and Local Codes including associated supplements.

The work includes all labor, materials, equipment and services necessary to complete the work as shown on the drawings, specified herein, and that is required to provide complete and functional systems.

II. COORDINATION

Coordinate the work, with work of other trades and field conditions. Carefully check space requirements and utilities to ensure all equipment can be installed in the spaces allotted thereto and coordinate all necessary utility service requirements. Coordinate, protect and schedule work with work of other trades in accordance with the required construction sequence. Install all work in accordance with equipment manufacturer's installation instructions.

III. WARRANTY

The Contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor shall warranty all work for a period of one year from Owner acceptance unless specified otherwise in which case longer equipment warranties may apply.

Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace the following components that fail in materials or workmanship within specified warranty period:

Warranty Period, Commencing on Date of Substantial Completion: One (1) year.

IV. WORKMANSHIP

Perform all work in a practical, neat and workmanlike manner with mechanics skilled in work, and using the best practices of the trade involved.

No work shall be concealed until it has been inspected and approved by the Architect.

Workmanship or materials not meeting with requirements of the specifications and drawings and satisfaction of the Architect shall be rejected and immediately replaced in an acceptable manner, without additional cost to the Owner.

V. SPECIAL WORKMANSHIP FOR ARCHITECTURALLY EXPOSED SYSTEMS

General: In addition to basic project workmanship requirements specified above, a higher degree of care in systems layout and routing shall be exerted in selected areas, as follows.

Architectural Exposures: Note that this project includes locations where systems will be partially or fully exposed to view in finished architectural spaces due either to the intentional omission of ceilings, and/or to the intentional holding back of ceiling edges from walls, for architectural effects. These areas shall receive extra effort and care above and beyond basic project workmanship principles.

Special Workmanship Requirements: In these special areas, comply with the following requirements:

- Run systems tight to overhead structure whenever possible.
- In spaces with gaps between ceiling edges and walls, do not run systems down near ceilings. Locate them as high above as feasible.
- Do not cross under framing members within view of such gaps. Seek alternative routes around or through obstacles.
- Fasten systems sufficiently often to prevent their visually sagging or drooping between support points.
- Route systems parallel to walls, framing members, and other elements defining spatial geometries.
- Change directions orthogonally.
- Do not run diagonally when traversing horizontal or vertical surfaces.

Rejection of Work: Workmanship and/or materials not complying with the above additional requirements in these special areas to the satisfaction of the Architect shall be rejected and shall be immediately replaced in an acceptable manner without additional cost.

VI. SUBMITTALS

Contractor shall submit; shop drawings, product data, samples, record documents (as-builts) and operation and maintenance manuals in accordance with the Contract requirements and particular specification section requirements.

Shop Drawings: Submit shop drawings of all items proposed to be furnished and installed under this Section which shall include but not be limited to:

- Coordination drawings, coordinated with all other trades
- As Built drawings in electronic format as specified by owner with hard copies.
- Piping materials, joints and fittings
- Valves, tags and name plates with schedule and location
- Pipe hangers and supports
- Valves
- Cross connection protection devices
- Pipe sleeves and seals
- Pumps
- Sprinkler heads and accessories
- Access panels
- Miscellaneous fire protection specialties
- Welding certifications: submit reports as required for piping work
- Brazing certifications: submit reports as required for piping work

Manufacturers' recommended installation procedures which, when approved, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

VII. RECORD DRAWINGS

Provide a complete set of as-built drawings reflecting as installed conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of

similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the engineer's comments to produce a clear and concise set of drawings. Drawings shall be submitted in both hard copy and electronic (Auto-cad or Revit version as required by the owner) version. Number of copies of each as requested by the owner.

Indicate the following installed conditions:

- Include all changes and an accurate record, on reproductions of the contract drawings or appropriate shop drawings, of all deviations, between the work shown and work installed.
- Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart.
- Equipment locations (exposed and concealed), dimensioned from prominent building lines.
- Approved substitutions, contract modifications, and actual equipment and materials installed.
- Contract modifications, actual equipment and materials installed.
- Submit for review bound sets of the required drawings, manuals and operating instructions.
- Submit a complete maintenance manual of all equipment installed under this contract.

VIII. SYSTEM DESCRIPTION

Water Supply:

Document and verify new underground fire protection water supply is sufficient to supply the new sprinkler system in accordance with NFPA 13, 14 and local codes (provide hydraulic calculations and water flow test, less than 1 year old).

Contractor shall document (in schematic way) in which renovated area is supplied including pipe sizes, overall length of piping, etc. as necessary to perform hydraulic calculations.

Existing fire protection water supply including fire pump and roof fire storage tank shall remain.

NYC Temporary Sprinkler Loop:

Fire protection work includes but not limited to removal of: existing sprinkler piping, heads, etc and installation of new sprinkler piping, fittings, hangers, heads, etc. As necessary to provide temporary sprinkler loop protection in accordance with NYC buildings bulletin 2017-009.

NY State Temporary Standpipe:

Temporary standpipe systems shall be provided in accordance with the NY State Building and Fire Code. Existing fire standpipes shall be maintained as required by the NY State Building Code Section 3311.

Existing Fire Protection Systems:

Contractor shall carefully visit the site and confirm the extent and areas the existing preaction sprinkler systems serve. Renovated area to then be protected by a wet pipe sprinkler system. Contractor shall confirm any/all other sprinklered areas out of the scope of work remain active.

Existing sprinkler system to remain completely active during demolition phase. Contractor to limit time sprinkler system is down and notify proper authorities each and every time. Fire watch shall be provided as required by AHJ, owner, owner's insurance company, etc. Existing preaction sprinklers, piping etc. in renovated areas to then be removed and properly disposed of as necessary to accommodate architectural renovations. The removal of existing deluge valve, pull stations, smoke detection, wiring, etc. supplying renovated area shall be removed.

Contractor to provide for additional shut-down and/or drainage of existing sprinkler system as required to accommodate owner's phasing/ step schedule.

Fire Sprinkler Systems:

Work starts at areas indicated, including but not limited to: Installation of a new sprinkler control assembly (control valve, tamper switch and flow switch) supplying fire sprinklers throughout the renovated area. Install concealed pendent sprinklers (with custom color coverplates) within areas with finished ceilings and install exposed uprights, pendents, etc. within unfinished areas.

Exposed areas shall have custom piping and color, coordinate routing with architect (and receive approval) prior to installation. Provide additional sprinklers (more than code) in order to ensure symmetry, etc. Piping shall be routed in order to minimize exposed piping and shall be approved and coordinated with architect prior to installation. Wing "E" Gallery shall have custom color piping and sprinkler heads.

Fire Standpipe Systems:

Existing standpipe system shall remain. Existing 2 ½" fire standpipe valve and hose rack assembly located in (between Wing "E" and Wing "F") shall be removed and properly disposed of.

Contractor to install new 2 ½" fire department valve, cap and chain, within cabinet at this location. Install 1 ½" fire hose rack assembly (rack, 1 ¾" hose, adjustable nozzle, etc.) as required by AHJ.

Other

All sprinkler pipe passing through or crossing building seismic and/or expansion joints, shall contain a flexible expansion loop, designed for seismic movement.

IX. COMMISSIONING

This project will include commissioning of fire protection systems by an approved Commissioning Authority (CA) and in accordance with NFPA 3. All sub-contractors shall provide necessary support for demonstration of start-up and operation including all required system adjustments. Personnel shall be available as indicated in the CA schedule.

X. DESIGN CRITERIA

State and Local Code, Owner's Insurance Company FM Global and NFPA Standards. Systems to be hydraulically calculated based upon the following information with area adjustments for dry and attic systems as required by NFPA 13 & 14. Minimum Density for Automatic-Sprinkler Piping Design shall be coordinated with and meet FM Global.

FM GLOBAL CRITERIA
Sprinkler design density, spacing, materials etc. Shall be in accordance with FM global's data sheets including 3-26.

Hazard class 1 (HC-1):
Seminar rooms, offices, studios, and common areas: minimum density of 0.10 gpm/sq.ft. Over the most remote 1500 sq.ft. Plus 250 gpm for hose demand. Maximum coverage per sprinkler head is 196 sq.ft.

Hazard class 2 (HC-2):
Utility and equipment rooms, etc. Minimum density of 0.2 gpm/sq.ft over the most remote 2500 sq.ft. Plus 250 gpm for hose demand. Maximum coverage per sprinkler head is 130 sq.ft. Sprinklers shall have a "k" factor of 8.0.

Hazard class 3 (HC-3):
Loading docks, plastics, etc. Minimum density of 0.30 gpm/sq.ft. Over the most remote 2500 sq.ft. Plus 500 gpm for hose demand. Maximum coverage per sprinkler head is 130 sq.ft. Sprinklers shall have a "k" factor of 11.2.

XI. FIRE STANDPIPE

Hydraulically designed in accordance with NFPA 14, NYC and FDNY requirements.

XII. PIPING MATERIALS

Fire Protection piping below ground: Piping shall be equal to U.S. Pipe and Foundry ductile iron class 52 (ANSI) A21.51 (AWWA C151) with push on rubber gasketed joints and rodding as required. Fittings shall be ductile iron class 250 (ANSI) A21.10 and A21.11 mechanical joint type. Contractor shall use a combination of mechanical joint retainer glands, thrust blocks, tie-rods and pipe clamps, at each fitting. The type of pipe, soil conditions and available space shall determine the proper anchoring method. All ductile iron pipe and fittings shall be cement lined on interior in accordance with ANSI A 21.4 and AWWA C104 and coated on exterior, along with rods and clamps, with coal tar enamel.

Wet Sprinkler Piping:

- 2-1/2" and larger: Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M and grooved fittings. Pipe ends may be factory or field formed to match joining method.
- 2" and smaller: Schedule 40 black steel pipe ASTM A 53/A 53M, Type E, Grade B and ASTM A 865, threaded fittings.

Dry Sprinkler Piping:

- 2-1/2" and larger: Schedule 40 ASTM A 53/A 53M, Type E, Grade B steel pipe and grooved fittings.
- 2" and smaller: Schedule 40 ASTM A 53/A 53M, Type E, Grade B steel pipe and threaded fittings.

Drain Sprinkler Piping:

- Schedule 40 ASTM A 53/A 53M, ASTM A795, Type E, Grade B galvanized pipe and galvanized fittings.

Mechanical Couplings for Joining Carbon Steel Pipe:

Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Victaulic.

All grooved components shall conform to local code approval and/or as listed by UL/ULC, FM, or NFPA.

Grooved end product manufacturer to be ISO-9001 certified.

Rigid Type:

- "Installation Ready" rigid joints shall be Victaulic FireLock® EZ Style 009H and Style 107H which are designed for direct "stab" installation onto grooved pipe without prior disassembly of the coupling. Housings shall be cast with offsetting, angle-pattern bolt pads.
- Standard rigid joints shall be Victaulic Style 005 (FireLock® 005) or 07 (Zero-Flex®). Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.
- Rigid couplings shall require visual pad-to-pad verification of complete installation. Tongue and recess type couplings which require the use of a torque wrench to achieve the exact required gap between housings are not permitted.

Flexible Type: Use in seismic areas where required by NFPA 13.

- "Installation Ready" flexible joints shall be Victaulic Style 177 QuickVic™, in sizes 2" through 6", which shall be designed for direct "stab" installation onto grooved pipe without prior disassembly of the coupling.
- Standard flexible couplings shall be Victaulic Style 004, 75, or 77.

Mechanical Coupling Gaskets: Pressure-responsive, synthetic rubber listed for use with the housings.

Fire Protection Service	Temperature Range	Gasket Recommendation
Dry Systems	Ambient	Grade EPDM, Type A
Freezer Applications	-30°F to 0°F (-34°C to -17°C)	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741 or 744. For mating to ANSI Class 300 flanges use Victaulic Style 743.

Victaulic Grooved End Fittings: Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12 (FireLock), forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Zinc electroplated fittings and couplings conform to ASTM B633.

Installation- ready fittings/grooved fittings shall not be utilized within exposed/architecturally sensitive areas without approval from architect.

XIII. SPRINKLER HEADS

Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.

Sprinkler Heads:

UL listed/FM approved automatic type; upright, concealed pendent, pendent, or sidewall to meet conditions, and of proper temperature rating. Deflector to be marked to indicate position.

Die-cast brass frame, teflon encapsulated Belleville spring seal and frangible glass bulb. Body cast with hex shaped wrench boss. (Sprinklers shall not contain O-rings.) Quick or standard response type.

Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

Sprinkler head finishes to be confirmed with architect. Provide custom colors as required.

Pressure Ratings:

Pressure Rating for Residential Sprinklers: 175 psig maximum.

Pressure Rating for Automatic Sprinklers: 175 psig minimum.

Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

Guards and Escutcheons: UL 199, Guards and escutcheons shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer. Provide as required for heads subject to mechanical injury.

Multiple-Use Flexible Drop System: In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic Aquaflex stainless steel sprinkler fitting system may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided (corrugated) type 304 stainless steel flexible tube, a zinc-plated steel flexible tube 1" NPT Male threaded nipple for connection to branchline piping, and a zinc-plated steel reducer with 1/2" or 3/4" NPT Female thread for connection to the sprinkler head. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate bracket (The bracket shall allow for sprinkler installation before or after the bracket is secured to the sprinkler grid). The braided drop system is FM Approved for sprinkler services to 200 psi (1380 kPa) and can be installed without the use of tools.

Contractor shall confirm use of flex head type system does not cause excessive pressure losses which exceed the available water supply, otherwise utilize hard pipe method at no additional cost.

Spare Sprinkler Equipment:

Spare heads: not less than 12, total number based on one spare head of each type and rating per each 100 similar heads, or part thereof, installed.

Spare head cabinet: baked enameled steel cabinet, hinged cover, of adequate size to contain heads and wrench.

Head wrench: provide at least one, with suitable openings.

XIV. VALVES

Division (Zone) Valves: spaced to isolate specific areas within buildings and hose supplies.

Ball Valves:

UL/FM Global approved, 350 psi, grooved or threaded ends, bronze body (ASTM B-584 Alloy 844), standard port, chrome-plated brass ball, stainless steel stem, TFE seats, brass gearbox, with pre-wired supervisory switches. Victaulic Series 728 FireLock.

Butterfly Valves:

UL/FM Global approved, 300 psi, grooved ends, polyphenylene sulfide (PPS) coated ductile iron body (ASTM A-536, Grade 65-45-12). Ductile iron disc, synthetic rubber encapsulated suited for the intended service, with integrally cast stem. Complete with weatherproof actuator and pre-wired supervisory switches. Victaulic Series 705 FireLock.

Gate Valves: UL/FM Global approved.

2-1/2” through 12” Sizes OS&Y Gate Valves: 250 psi, grooved ends. Ductile iron body conforming to ASTM A-536, cast iron yoke and handwheel conforming to ASTM A-

126-B; EPDM coated ASTM A-126-B cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem seals and body gasket. Victaulic Series 771.

Wall Type Indicator Post: ASTM A-126-B cast iron wall type indicator post, with ASTM B-62 bronze operating stem and carbon steel operating rod. Victaulic Series 773.

Adjustable Indicator Post Vertical Type: ASTM A-126-B cast iron adjustable indicator post vertical type with ASTM A-126-B cast iron extension sleeve, ASTM B-62 bronze operating stem and carbon steel extension rod. Victaulic Series 774.

Check Valves: UL/FM Global approved.

2" through 3"Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, non-slam tilting disc, stainless steel disc and spring, brass shaft, 365 psi. Victaulic Series 717H.

4” through 12” Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, elastomer encapsulated ductile iron disc suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 250 psi. Victaulic Series 717. Designed to accept a riser check kit. Victaulic Series 717R.

XV. EQUIPMENT

Commercial zone control riser module with cast body, shut off valve, test and drain valve combination, flow switch and pressure gauge similar to Victaulic Series 747M Firelock.

Recessed mounted custom cabinet sized for (1) sprinkler control assembly.

2 ½” Fire Department Valve: 2 ½" Cast Brass angle Valve, Rough brass angle body, polished trim and red cast iron wheel handle, 300 PSI, WWP. POTTER-ROEMER 4065 or approved equal.

Recessed mounted custom cabinet sized for (1) 2 ½" valve.

Air vents on wet pipe systems shall be similar to Potters automatic air vent, PAV. Provide all piping, fittings etc. as required to route to an approved drain location. Include Ball valve supervisory switch model RBVS. UL listed, FM Approved.

XVI. ELECTRONIC DEVICES

Valve supervisory devices: UL/FM approved tamperproof signaling initiating switch arranged to detect that controlled valve is in other than fully open position Electrical rating: 120VAC. Listed and labeled as defined in NFPA 70.

Waterflow switch, 24 volt with 2 sets of contacts and pneumatic retard to prevent false alarms. Similar to potter model VSR-F.

Pressure switch: Electrically supervised water-flow switch with retard feature.

Components: Single-pole, double-throw switch with normally closed contacts.

Design Operation: Rising pressure signals water flow. Similar to Potter model PS Series.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Mechanical Narrative

TABLE OF CONTENTS

I. GENERAL

Comply with all current Federal, State, Town and local codes, standards and ordinances including:

2022 New York City Building Code
2022 New York City Mechanical Code
NFPA

The contractor will be responsible to give all necessary notices, obtain all permits and pay all taxes and fees necessary to obtain approvals and complete the work herein. Obtain all required certificates of inspection and deliver same to Owner.

The Mechanical systems will be designed to comply with all current State and Local Codes including associated supplements.

The work includes all labor, materials, equipment and services necessary to complete the work as shown on the drawings, specified herein, and that is required to provide complete and functional systems.

II. COORDINATION

Coordinate the work, with work of other trades and field conditions. Carefully check space requirements and utilities to ensure all equipment can be installed in the spaces allotted thereto and coordinate all necessary utility service requirements. Coordinate, protect and schedule work with work of other trades in accordance with the required construction sequence. Install all work in accordance with equipment manufacturer's installation instructions.

III. WARRANTY

The Contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the work

will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor shall warranty all work for a period of one year from Owner acceptance unless specified otherwise in which case longer equipment warranties may apply.

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of equipment that fail in materials or workmanship within specified warranty period:

Warranty Period, Commencing on Date of Substantial Completion:

- Air Handling Units & Components: 5 years.
- All equipment minimum 18 months

IV. RECORD DRAWINGS

Provide a complete set of as-built drawings reflecting as installed conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the engineer's comments to produce a clear and concise set of drawings. Drawings shall be submitted in both hard copy and electronic (Auto-cad or Revit version as required by the owner) version. Number of copies of each as requested by the owner.

Indicate the following installed conditions:

- All changes and an accurate record, on reproductions of the contract drawings or appropriate shop drawings, of all deviations, between the work shown and work installed.
- Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart.
- Equipment locations (exposed and concealed), dimensioned from prominent building lines.
- Approved substitutions, contract modifications, and actual equipment and materials installed.
- Contract modifications, actual equipment and materials installed.

Submit for review bound sets of the required drawings, manuals and operating instructions.

Submit a complete maintenance manual of all equipment installed under this contract.

V. DESIGN CONDITIONS

Outdoor Design Conditions:

Winter design dry bulb	0°F
Summer design dry bulb	94°F
Coincident wet bulb	80°F

Indoor Design Conditions:

Space Temperature Design Conditions				
Space Type	Summer		Winter	
	DB °F	RH %	DB °F	RH %
Gallery Space	70±3	50±10	70±3	50±10

NC – indicates no control over conditions will be provided.

VI. HVAC System Description

Note: The mechanical narrative is written under the assumption that the Comprehensive Energy Upgrade project will be completed prior to the startup of the Arts of Africa scope in this narrative.

Demolition:

Remove ductwork off unit AHU-3M located in and serving the third floor. Existing ductwork to be cut and capped at the third-floor mezzanine slab. AHU-3Ms airflow to be rebalanced to 4,600 CFM to only serve the third-floor mezzanine art storage. Existing Relief fan RF-AHU-3M shall be rebalanced to 3,900 CFM.

New Proposed Work:

Provide new air handling unit (AHU-31-F) located on the 3rd floor in a new MER directly below the AHU-3M MER. The new AHU-31-F will tie into the existing hot water and chilled water piping serving AHU-3M. The unit will serve the Arts of Africa main Wing F Gallery on the 3rd floor and the southern hyphen gallery connected to the main gallery. The supply ductwork serving the gallery will be located in the East wall and a common architectural return will be located in the South wall.

The Arts of Africa main Wing E Gallery on the 3rd floor will be served by a riser from AHU-22 and 23 that is currently capped at the 2nd floor. A VAV with electric reheat (VAV-3E-1) located on the 3rd floor mezzanine will control airflow to the gallery. In the basement a fan coil unit (FCU-BF-1) will be provided inline in the ductwork off of the AHU-22 and 23 supply air main in the basement. The fan coil unit will add control to the Arts of Africa zone for high humidity conditions in the space as the AHU-22 and 23 units are only controlled by conditions within their existing zone, the Great Hall on the 1st and 2nd floors. A duct mounted adiabatic humidifier (H-BF-1) will also be provided in the basement ductwork to provide humidity control to this zone.

VII. Air Handling Units

Provide factory-assembled and tested air conditioning unit consisting of hot water heating, chilled water cooling, fans, temperature controls, filters and dampers.

Provide two inch MERV 8 prefilters and four inch MERV 13 final filters.

Provide forward-curved, centrifugal, belt-driven fans with adjustable sheaves. Provide unit completely factory wired with necessary controls and with connections for power wiring. Provide programmable thermostat.

Unit casing shall be 2" double wall with 2" of insulation and a perforated interior panel.

SYSTEM	AREA SERVED	SYSTEM TYPE	COOLING CAPACITY (TONS)	AIRFLOW (CFM)	COMPONENTS
AHU-31-F	3rd Floor Gallery F	Variable Volume	21	6,000	1, 2, 3, 4, 5, 6, 7, 8, 9

Air Handling Unit Components:

1. MERV 11 Pre Filter
2. Carbon Cartidge Final Filter
3. Minimum Outside Air Dampers.
4. Hot Water Preheat Coil.
5. Chilled Water Cooling Coil.
6. Supply Fans.
7. Variable Speed Drive Unit(s).
8. Reheat Coil
9. Adiabatic Humidifier

VIII. ELECTRIC COMPONENTS

Electric motors shall comply with NEMA standards premium efficiency type IEEE standard 112, test method B.

Enclosure type shall be open drip proof for indoor use, guarded drip proof where indoors and exposed to contact by personnel or weather protected type totally enclosed fan cooled for outdoor use.

Fractional horsepower motors shall be capacitor start, induction run or split phase type, 1/3hp and less and shall be 120 volt, single phase, 60 Hz, AC service factor 1.35. Motors 1/2 HP and larger shall be 208 or 480 volt, three phase 60 Hz, AC and service factor 1.15.

Motor Controllers: Comply with NEC, NFPA 70 and UL. FVNR for motors 1/3hp and less, 120 volt, 1-phase, 60hz, AC with pilot light, toggle switch, thermal overload and lockout type disconnect switch.

FVNR magnetic across-the-line combination type with fused disconnect switch for motors 1/2hp and greater, 208 or 480 volt, 3-phase, 60hz, AC with hand-off-auto switch, 120 volt control transformer and control circuit, pilot light, two sets of auxiliary contacts, 3-phase ambient temperature compensated thermal overload relays with manual reset push button.

Enclosures shall be NEMA type 1A for indoor applications, NEMA type 3x Stainless or 4x for outdoor applications and NEMA type 4x for locations subject to water spray or high humidity.

Motor Efficiency: All motors shall be premium efficiency and shall comply with local utility company requirements.

IX. DUCTWORK

Submit sheet metal shop standards for review. Construct of galvanized steel ASTM A 527 with G90 coating, in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible dated 2005. Seal all joints with approved sealer.

Ductwork shall be sized not to exceed 800 FPM in mains and 500 FPM max velocity in branch runs to outlets. The use of flex duct shall be limited to 4'-0" and used for alignment purposes only. Flex ductwork shall not be used to create a change of direction or elbows.

Install volume dampers upstream of all supply air outlets and inlets, volume dampers shall have locking quadrants and two end bearings. Provide cable operated dampers where damper is located above an inaccessible ceiling.

Acoustic duct liner shall be installed on interior of ducts a minimum of 15 feet on inlet and discharge side of air handling equipment, fans, 10 feet downstream of all terminal boxes and where indicated on plans.

Air chambers and plenums shall be double wall 20 gauge galvanized steel with 4" thick 6 lb. density fiberglass insulation board.

X. INSULATION

Insulation shall be provided on all ductwork and piping. Duct wrap insulation shall be provided with a vapor barrier and thickness in compliance with 2020 New York City Energy Conservation Code. All piping valves and fittings shall be insulated with pre-formed fibrous glass fittings and per the requirements set forth in 2020 New York City Energy Conservation Code including all state amendments and supplements, or ASHRAE 90.1-2019. All pipe insulation shall be provided with a vapor barrier.

All exposed ductwork on the roof shall be provided with 2” mineral fiber insulation with a 3/4 lb. density. Ductwork shall be wrapped weather and water tight.

XI. PIPING

Comply with ASME standard 31.9 "Building Services Piping" ANSI standard B31.1 Standard for "Power Piping" and B16.5 for welding.

Pipe and tubing materials, fittings and joints:

- Copper tubing: ASTM B-88, Type L with wrought copper fittings ANSI B16.22, solder joints ASTM B32 95-5 tin-antimony. Copper shall be used for pipe sizes 2” and below.
- Steel piping: ASTM A-120 or ASTM A-53 grade B, schedule 40, seamless, black steel pipe with cast iron threaded fittings ANSI B16.4 class 125 or 250, malleable iron threaded fittings ANSI B16.3 class 150 or 300, steel welding fittings ASTM A234, flanged fittings ANSI B16.5, or flanged fittings. Steel pipe shall be used for piping 2 ½” and above.

Comply with MSS-90 requirements for support of piping and International Building Code for seismic requirements.

Pipe hanger spacing and support loading shall be in accordance with Table 305.4 of the New York City Mechanical Code. Where concentrated loads of valves, fittings and components occur space hangers closer as necessary based on the weight to be supported and the maximum recommended loads for the hanger support system.

Pipe hangers shall be of the clevis type, unless piping fluid is above 215°F where axial movement occurs use roller type hangers.

Hydro statically test piping in accordance with ANSI B31.9 requirements at 1-1/2 times system working pressure.

XII. EXECUTION

Examination:

- Inspect site conditions before starting preparatory work and verify that actual conditions are known and acceptable before starting work. Inspect areas where equipment will be installed and verify adequate space is available for access, service, and removal of equipment. Coordinate with the Work of other Sections and Divisions.

Sheet Metal Work:

- All sheet metal work shall be done in a neat and workmanlike manner with ductwork following building lines and in straight lines with smooth transitions and offsets as required to suit actual installation. Sheet metal work, which does not conform to Drawings and/or Specifications or is poorly done shall be repaired and/or replaced as directed by the Architect at no cost to the project.
- All pre-fabricated duct sections shall be cleaned prior to storage on the site and be provided with protective covering on all openings to maintain the interior of the ductwork clean and free of dust and other materials prior to installation. Field-assembled duct sections shall be cleaned during assembly and similarly protected until installation.

Piping Systems Installation:

- Install piping straight, plumb and form right angles on parallel lines with building walls. Locate groups of pipes parallel to each other. Provide sufficient spacing for insulation and valve access.
- Hangers shall be sized to accommodate insulation.
- Pipe shall be free from scale and dirt. Protect open ended pipe ends to prevent debris from entering. All piping shall be reamed free of burrs.
- Joining and bending of copper tubings shall be in accordance with the Copper Development Association Copper Tube Handbook.
- Piping shall be worked into place without springing or forcing.
- Water systems piping shall be pitched in direction of flow. Drain valves shall be located at all system low points. Provide manual air vents at all system high points.
- Locate valves for easy access and operation. Valve stems shall be above horizontal.
- Provide complete dielectric isolation between ferrous and non-ferrous metals.
- Piping connections to coils and equipment shall be made with offsets provided with unions of flanges arranged so that equipment can be serviced or removed without dismantling.

- Provide for expansion and contraction in all piping systems to prevent undue strains on piping or equipment. Provide double off-sets at risers to take up expansion.
- Run piping concealed above ceilings and within furred spaces. Piping in mechanical rooms shall be exposed.
- Support vertical piping at every floor independently of connected horizontal piping. Pipe hangers shall be placed within 12 inches of each horizontal elbow.

Insulation Application Requirements:

- Install insulation, mastics, adhesives, coatings, covers, and weather-protection in accordance with manufacturer's recommendations.
- Remove dirt, scale, oil, rust, and other foreign matter from surfaces to be insulated. All surfaces shall be clean and dry prior to installation of insulation.
- Insulation shall not be applied to piping systems and related equipment until the completion of pressure testing.
- Insulation shall not be applied to duct systems and related equipment until ductwork has been sealed in accordance with specifications.
- Piping and ductwork insulation shall be continuous and full thickness through all penetrations of non-fire-rated construction and through all hangers.
- Equipment nameplates, labels, and access doors shall be exposed with insulation edges finished.
- Valves shall be insulated to top of bonnets.
- Anchors, hangers, and other projections shall be insulated and vapor-sealed to prevent condensation. All openings and punctures shall be sealed with vapor barrier compound.
- Flexible blanket insulation shall be installed with ends tightly butted. Install so that insulation is not excessively compressed at duct corners. Seams shall be stapled 6 inches on-center with outwardly clinching staples. Seal with pressure-sensitive vapor barrier tape. Where rectangular ducts are 24 inches in width or greater, duct wrap insulation shall be secured to bottom of duct with mechanical fasteners such as pins and speed clip washers, spaced on 12-inch centers and not over 3 inches from edges of insulation joints.
- Duct insulation liner shall be adhered to sheet metal with 90 percent coverage of adhesive and all exposed leading edges and transverse joints coated with adhesive and be provided with metal nosing. Duct liner shall be additionally secured with mechanical fasteners. Fasteners shall be impact driven or weld secured with mechanical fasteners. Fastener spacing shall be in accordance with manufacturer instructions. Refer to SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

Protection and Clean-up:

- The Contractor shall be responsible for maintenance and protection of all materials and equipment furnished by him during the construction period from loss, damage or deterioration until final acceptance by the Owner. All materials and equipment on the job site shall be stored and protected from the weather. All piping and equipment openings shall be temporarily closed during construction to prevent obstruction and damage.
- All equipment with damaged finished surfaces shall be cleaned and repainted with the same paints as were factory applied.
- Keep the job site free from the accumulation of waste materials and rubbish daily. At the completion of the work, remove all rubbish, construction equipment and surplus materials from the site and leave the premises in a clean condition.

Test, Adjust and Balance:

- Test, adjust and balance all air and water systems/equipment in accordance with AABC or NEBB requirements.
- Tab agency to be certified by AABC or NEBB.
- Submit typed report of final measurements and equipment operational performance data.

Plumbing Narrative

TABLE OF CONTENTS

I. GENERAL

Comply with all current Federal, State, and local codes, standards and ordinances including:

NEW YORK CITY

- 2022 New York City Building Code
- 2022 New York City Plumbing Code
- 2022 New York City Fuel Gas Code
- 2020 New York City Energy Code
- NYCDDC Design Build Requirements - Volumes 4 (Section D20)

The contractor will be responsible to give all necessary notices, obtain all permits and pay all taxes and fees necessary to obtain approvals and complete the work herein. Obtain all required certificates of inspection and deliver same to Owner.

The work includes all labor, materials, equipment and services necessary to complete the work as shown on the drawings and specified herein.

Provisions for the physically handicapped as required by the State of New York Building Code will be included.

Potable water supply will be protected against backflow, back-siphonage, cross connection and other unsanitary conditions.

II. LEAD-FREE STATEMENT

Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The contractor shall be responsible for providing products that are Lead-Free products and meet the requirements of Safe Drinking Water Act Section 1417 (e) (Section 9 of NSF/ANSI Standard 61) and authorities having jurisdiction.

III. COORDINATION

Coordinate the work, with work of other trades and field conditions. Carefully check space requirements and utilities to insure all equipment can be installed in the spaces allotted thereto and coordinate all necessary utility service requirements. Coordinate, protect and schedule work with work of other trades in accordance with the required construction sequence. Install all work in accordance with equipment manufacturer's installation instructions.

IV. ENERGY CONSERVATION

Energy conservation requirements as set forth in the State of New York Building Code will be included. Additional energy conserving methods will be considered to further affect higher energy savings.

V. WARRANTY

The Contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted, that the Work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the project requirements. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor shall warranty all work for a period of one year from Owner acceptance unless specified otherwise in which case longer equipment warranties may apply.

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

Warranty Period, Commencing on Date of Substantial Completion: One (1) year.

VI. WORKMANSHIP

Perform all work in a practical, neat and workmanlike manner with mechanics skilled in work, and using the best practices of the trade involved.

No work shall be concealed until it has been inspected and approved by the Architect.

Workmanship or materials not meeting with requirements of the specifications and drawings and satisfaction of the Architect shall be rejected and immediately replaced in an acceptable manner, without additional cost to the Owner.

VII. SPECIAL WORKMANSHIP FOR ARCHITECTURALLY EXPOSED SYSTEMS

General: In addition to basic project workmanship requirements specified above, a higher degree of care in systems layout and routing shall be exerted in selected areas, as follows.

Architectural Exposures: Note that this project includes locations where systems will be partially or fully exposed to view in finished architectural spaces due either to the intentional omission of ceilings, and/or to the intentional holding back of ceiling edges from walls, for architectural effects. These areas shall receive extra effort and care above and beyond basic project workmanship principles.

Special Workmanship Requirements: In these special areas, comply with the following requirements:

- Run systems tight to overhead structure whenever possible.
- In spaces with gaps between ceiling edges and walls, do not run systems down near ceilings. Locate them as high above as feasible.
- Do not cross under framing members within view of such gaps. Seek alternative routes around or through obstacles.
- Fasten systems sufficiently often to prevent their visually sagging or drooping between support points.
- Route systems parallel to walls, framing members, and other elements defining spatial geometries.
- Change directions orthogonally.
- Do not run diagonally when traversing horizontal or vertical surfaces.

Rejection of Work: Workmanship and/or materials not complying with the above additional requirements in these special areas to the satisfaction of the Architect shall be rejected and shall be immediately replaced in an acceptable manner without additional cost.

VIII. SUBMITTALS

Contractor shall submit; shop drawings, product data, samples, record documents (as-builts) and operation and maintenance manuals in accordance with the Contract requirements and particular specification section requirements.

Shop Drawings: Submit shop drawings of all items proposed to be furnished and installed under this Section which shall include but not be limited to:

- Coordination drawings, coordinated with all other trades
- As Built drawings in electronic Revit format as specified by owner with hard copies.
- Piping materials, joints and fittings
- Valves, tags and name plates with schedule and location
- Pipe hangers and supports

- Insulation
- Valves
- Cross connection protection devices
- Pipe sleeves and seals
- Drains
- Cleanouts
- Plumbing fixtures
- Water heating equipment
- Water detection equipment
- Hose bibbs and wall hydrants
- Access panels
- Trap primers
- Miscellaneous plumbing specialties
- Welding certifications: submit reports as required for piping work
- Brazing certifications: submit reports as required for piping work

Manufacturers' recommended installation procedures which, when approved, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

IX. RECORD DRAWINGS

Provide a complete set of as-built drawings reflecting as installed conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the engineer's comments to produce a clear and concise set of drawings. Drawings shall be submitted in both hard copy and electronic (Auto-cad or Revit version as required by the owner) version. Number of copies of each as requested by the owner.

Indicate the following installed conditions:

- Include all changes and an accurate record, on reproductions of the contract drawings or appropriate shop drawings, of all deviations, between the work shown and work installed.
- Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart.
- Equipment locations (exposed and concealed), dimensioned from prominent building lines.
- Approved substitutions, contract modifications, and actual equipment and materials installed.
- Contract modifications, actual equipment and materials installed.
- Submit for review bound sets of the required drawings, manuals and operating instructions.
- Submit a complete maintenance manual of all equipment installed under this contract.

X. SUSTAINABLE DESIGN FEATURES

The following indicates proposed sustainable design features:

- Water conserving fixtures.
- Electronic Controlled Fixtures for water use reduction.

XI. SYSTEM DESCRIPTION

Domestic hot and cold water: Install hot and cold-water distribution to plumbing fixtures and other points of connection or service throughout as required by the program. New distribution will be connected to existing distribution at locations indicated on plans. Provide cold water make-up feed to HVAC equipment in Mechanical Rm 3X09. Provide hot and cold water for plumbing fixtures in Green Rm 3CC13 & Studio 3CC12.

Domestic hot water shall be generated by electric tank type water heater (s). The domestic hot water distribution will be a single temperature zone. 120-degree F serving the sink and 105-degree F serving toilet room fixtures. 105-degree F water distribution will be controlled with a thermostatic mixing valve assembly.

Sanitary: Install sanitary, waste and vent piping serving plumbing fixtures and floor drains. Install gravity building drains with connections to the existing sanitary system.

XII. COMMISSIONING

This project will include commissioning of plumbing systems by and approved Commissioning Authority (CA). All sub-contractors shall provide necessary support for demonstration of start-up and operation including all required system adjustments. Personnel shall be available as indicated in the CA schedule.

XIII. DOMESTIC WATER

Scope: Install hot and cold-water distribution to plumbing fixtures and other points of connection or service throughout as required by the program. New piping shall be connected to existing distribution at locations indicated on plans. Provide cold water make-up feed to HVAC equipment in Mechanical Rm 3X09. Provide hot and cold water for plumbing fixtures in Green Rm 3CC13 & Studio 3CC12.

Design Criteria: Pipe sizing in accordance with the International Plumbing Code based upon friction loss charts with a maximum of 6 feet per second velocity.

Source: The existing building domestic water distribution system.

Piping Materials

Domestic hot, cold and hot water recirculation piping above ground (2” and smaller):

Hard drawn seamless Type L copper tubing ASTM B88

Wrought copper solder fittings A.N.S.I. B16.22 and "Bridgit" or other no lead content solder joints ASTM B32-83, alloy Grades SN96 or SB5. Solder flux lead content-zero percent.

Copper Pressure-Seal-Joint Fittings:

Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, and the performance requirements of IAPMO PS117, and ICC LC1002. Press fittings ½-inch thru 2-inch for use with ASTM B88 copper tube type L. Press fittings shall have an EPDM sealing element and Smart Connect (SC), leak detention feature for un-pressed fittings. Press fittings with EPDM sealing element shall conform to NSF 61-G when installed in a potable water system. Installation shall conform to manufacturer's instructions and specifications. Manufacturers: Viega

Domestic hot, cold and hot water recirculation piping above ground (2" and larger):

Hard drawn seamless Type L copper tubing ASTM B88

Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 152 wrought copper fittings with copper tubing sized grooved ends designed to accept Victaulic couplings (flaring of tube and fitting ends to IPS dimensions is not permitted).

Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections cast with offsetting, angle-pattern bolt pads to provide system rigidity upon visual metal-to-metal bolt pad contact with no torque requirement, coated with copper-colored enamel, Grade EHP EPDM-synthetic rubber gasket UL classified in accordance with ANSI/NSF61 for hot (180F) and cold (86F) water, and bolts and nuts. Designs that permit spaces or gaps at bolt pads or require a torque per written manufacturer's installation instructions not permitted. Victaulic Style 607.

Valves:

General: Approved manufacturers; Nibco, Apollo, Stockham, Milwaukee.

Domestic water systems up to 2-1/2"size: 2-piece, full port, bronze threaded, extended stem, 400 psi WOG.

Check valves for domestic water systems up to 2-1/2" size: class 125 all bronze, silent type, threaded.

Balancing valve (domestic hot water circulation): all bronze, threaded end, calibrated stem, balancing ports, Armstrong CBVT series.

Reduced pressure backflow preventers (RPD) - sizes 3/4" through 2": UL listed, AWWA, USC, and SBCCI/IAPMO approved bronze body reduced pressure zone air gap equipped with stainless steel relief and check valves, oversized copper funnel for pressure relief discharge piped to drain, bronze test cocks, integral body unions, bronze strainer and inlet and outlet ball valves. Manufacturer: Watts 909 series.

Hose end drain valve NIBCO Fig. No. T-113-HC, all bronze gate (Watts #B-6000-cc, all bronze ball valve) with 3/4" hose thread outlet, threaded cap, rubber gasket and safety chain.

XIV. DOMESTIC WATER HEATING

Tank Type Electric:

Provide a quantity point-of-use electric water heater(s) as manufactured by HUBBELL Electric Heater Co. The entire unit is to be complete with all operating controls and require only plumbing and electrical service connections. The tank shall be all welded steel commercial construction designed for 150psi working pressure. The tank is to be lined with seamless Hydrastone Cement to a minimum thickness of 1/2" on 100% of all interior tank surfaces and does not require any type of anodic protection. The tank shall be designed and fabricated with non-ferrous copper-silicon threaded tappings and non-ferrous inlet and outlet piping for maximum corrosion resistance. Steel tank tappings will not be acceptable. The entire tank is to be insulated with a minimum of 2" thick polyurethane foam insulation that exceeds the latest ASHRAE standard for stand-by heat loss. The complete heater shall be supplied with a high impact colorized composite protective jacket which cannot rust or corrode and does not require painting. The unit shall bear the UL listing mark certifying the entire water heater.

The cold-water inlet shall be 3/4" Female NPT (Optional Specification: 1 1/2" Male NPT) and include a non-corrosive strata-flow diffuser which prevents incoming cold water from mixing too rapidly with hot water in the tank. A 3/4" hose connection drain is supplied. The hot water outlet shall be 3/4" Male NPT (Optional Specification: 1-1/2" Male NPT) and shall include a factory installed built-in heat trap to prevent water from radiating through the piping during stand-by periods. A separate 3/4" Female NPT tapping is to be provided for relief valve installation. An ASME rated automatic reseating combination temperature and pressure safety relief valve set at 150psi and 210°F shall be factory supplied. The heating elements shall be high quality copper sheath electric immersion type.

The water heater manufacturer shall warranty all electrical components against defects in workmanship and material for a period of one (1) year from date of start-up, and the pressure vessel for a full ten (10) years Non Pro-Rated from date of start-up, provided that the unit is started within three (3) months of date of shipment and installed and operated within the scope of the tank design and operating capability.

Water Heating Specialties:

Thermostatic mixing valve: Threaded inlets and outlet, thermostatic controller with swivel action check stops, removable cartridge with strainer (provide 1 extra cartridge), stainless steel piston and liquid fill thermal motor, volume control/shut-off valve, bi-metal dial thermometer, (3" face, 20 degrees F. to 240 degrees F.) brass pipe, fittings and unions. Rough chrome body finish.

Manufacturer: Symmons series.

Thermometer (TH): adjustable angle type, mercury or liquid actuated, constructed with non-corrosive internal mechanism and recalibrator adjustment; assembled in minimum 3-1/2-inch diameter gasket sealed, glass faced stainless steel case; equipped with stainless steel bracket assembly, separable socket, 30 to 240 degrees F water temperature range. Manufacturer: Trerice L80030.

Pressure and temperature relief valve - P&T: ASME rated, bronze body, non-corrosive trim, automatic reseating, extension thermostat, test lever, threaded inlet and outlet; 75 to 150 psi

adjustable pressure range, set at 125 psi, 210 degrees F. water.

Expansion tanks: ASME certified 125 psi, diaphragm type tank for potable water usage.

XV. SANITARY DRAINAGE

Scope: Drainage of plumbing fixtures, sinks, drinking fountains, and floor drains piped to sanitary building drain. Venting of fixtures and drains to atmosphere.

Design Criteria: International Plumbing Code and State of New York Plumbing Code.

Disposal: Connect to the existing building sanitary sewer system by gravity.

Insulation: above ground horizontal and vertical runs covered with fibrous glass and fire-retardant vapor barrier jacket. Include sound attenuation insulation and wrap.

Piping Materials:

Sanitary, waste and vent piping above ground within building: Hubless cast iron pipe with no hub fittings and "Husky" Series 4000 clamps. Sizes 1-1/2”-4” shall have minimum of (4) sealing bands, Sizes 5”-10” piping shall have minimum of (6) sealing bands.

XVI. INSULATION

Insulation:

Pipe Insulation: piping within building insulated with 1” minimum thickness fibrous glass insulation and pre-formed fibrous glass fittings with fire retardant vapor barrier jacket. Include sound attenuation insulation and wrap.

All insulating materials shall comply with the following ratings:

Flame spread	-25
Smoke Developed	-50
Fuel Contributed	-50

Fiberglass Piping Insulation (interior)

Molded fibrous glass with 3.5 pounds minimum density, Maximum K = .3 at 200°F, mean and rated to 450°F. The insulation should be sectional pipe jacketed with an embossed vapor barrier laminate.

Service: Refer to Drawing Schedule

Manufacturers:

1. Owens-Corning, Type 25 ASJ
2. Knauf - Pipe Insulation with ASJ
3. CertainTeed - Type 500 Snap-On with ASJ
4. Manville - Micro-Lok 650 with AP jacket

Foamglass Piping Insulation (exterior and below grade piping systems)

8.5 PCF average density, max. K = .38 at 75°F mean, and operating temperature -320°F to 300°F, rigid glass cells.

Service:	Thickness:
Outdoor Piping	2”
Water Make-up	2”

Manufacturers:

1. Pittsburgh-Corning, Type Foamglas
2. Trymer L Include Aluminum jacketing on all exterior insulation.

Service: Outdoor Piping on Type C and Type D Insulation

Manufacturer:

1. Childers Products Co. - Lock-on or slip-on type.

Fiberglass insulation for valves, fittings, flanges (vapor seal insulation).

Molded factory-formed fibrous glass with 3.5 PCF minimum density, max. K = .3 at 200°F, mean, rated to 450°. All joints to be sealed with vapor barrier adhesive and wrapped with glass mesh tape. Each fitting to be finished with two coats of Benjamin Foster 30-36 vapor seal.

Service:	Thickness:
Domestic Water:	Same as piping

Manufacturers:

1. Fibrous Glass Products, Inc.
2. Insulcoustic Corp.
3. Hamfab

Protective Shielding Pipe Covers: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements. Truebro LavGuard 2 or approved equal.

Insulate and heat trace all exterior above grade piping. Coordinate electrical requirements with electrical contractor. Provide electrical work as required for operation.

XVII. DRAINS

Floor drain mechanical rooms: heavy duty floor drains with, cast iron body, bottom outlet, 9" diameter cast iron top, trap primer connection, seepage pan and combination membrane flashing clamp.

Floor drain toilet rooms: cast iron body, bottom outlet, 6” square nickel bronze top, trap primer connection, seepage pan and combination membrane flashing clamp.

XVIII. PIPING SUPPORT

Scope: support of piping from building structure including seismic restraint. Provide necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from concrete construction, do not weaken concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted both in the vertical and horizontal direction, as required. Hangers in contact with copper or brass pipe shall be dielectric, compatible with copper and brass alloy or provided with felt sleeve.

Design Criteria: Manufacturers Standardization Society (MSS) Standard Practice SP-69, SMACNA, State of New York Building Code.

XIX. SLEEVES, ESCUTCHEONS, FIRESTOPPING

Scope: sleeves and fire stopping for piping passing through walls and partitions. Escutcheons for piping exposed to view.

Design Criteria: size sleeves for continuous pipe insulation.

XX. PIPE MARKERS, LABELS, VALVE TAGS AND WARNING SIGNS

Scope: vinyl plastic pipe markers and flow arrows, brass valve tags, valve charts and diagrams.

Metal Labels for Equipment - Brass, 0.032-inch minimum thickness, but not less than 2-1/2 by 3/4 inch, Minimum letter size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

Warning Signs and Labels - Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware. Size not less than 2-1/2 by 3/4 inch. Minimum letter size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include caution and warning information, plus emergency notification instructions.

Pipe Labels - Preprinted, color-coded, with lettering indicating service, and showing flow direction. Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

Stencils: Prepared letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

Valve Tags - Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers. Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes

for attachment hardware.

Warning Tags - Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing; 3 by 5-1/4 inches minimum. Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."; Yellow background with black lettering.

Design Criteria: ANSI A13.1.

XXI. CLEANOUTS

Scope:

Accessible cleanouts to permit "snaking" of drainage piping, and other buried non-pressure piping. Cleanout plates for buried piping.

Design Criteria:

Cleanouts at base of vertical stacks and leaders, at ends of horizontal runs, at each change in direction greater than 45°F., approximately 50 feet apart on piping runs.

Provide and install all cleanouts with 24" x 24" flashing material.

Cleanouts shall be installed at the base of all stacks, at all changes of directions greater than 45 degrees and in runs to provide means of cleaning lines at maximum 50' intervals.

Cleanouts shall be at least the same size as the pipe served up to 6” size. Cleanouts for piping over 6” in size shall be 6” minimum size.

Floor plates: cast iron body, appropriate brass cover plate.

Wall plates: stainless steel.

XXII. PLUMBING FIXTURES

Fixtures: As indicated by the Architect, new, complete with trimmings and fittings, including faucets, carriers, supplies, stops, traps, tailpieces, waste plugs, casings, hangers, plates, brackets, anchors, supports, hardware and fastening devices.

Water Closet: Vitreous china, wall hung, elongated siphon jet, flush valve, open front seat, angle supply and stop, floor mounted support. American Standard or approved equal.

Water Closet Flush valve: 1.28 Gallons per Flush. Exposed sensor operated, Sloan Optima or approved equal.

Lavatory: Vitreous china, wall, floor mounted support, supply and waste fittings, provided with sink shroud. Kohler or approved equal.

Lavatory Faucet: Single hole, deck mounted, electronic sensor Sloan Optima or approved equal.

Sinks: Counter mounted drop-in style stainless steel basin, self-rimming type, with supply and waste fittings and P trap. Similar to Elkay or approved equal.

Sink Faucet: Single hole, deck mounted, electronic sensor Sloan Optima or approved equal.

Color Selection shall be by architect.

Handicap fixtures will be provided and set in accordance with the applicable codes.

Stainless steel: type 302, 304, 316, or 317, as noted, sound deadened.

Trimmings and fittings: construct of forged, cast, rolled or extruded brass or bronze with monel and other suitable non-corrosive parts: designed with easily renewable parts that are subject to wear or deterioration. No die castings and stampings other than brass or stainless steel. Plumbing trim shall consist of:

Supply stops: angle stop with integral check valve, Full-Turn Wheel Handle. chrome plated brass, EPDM washer. McGuire Manufacturing ICV Defender Series or engineer approved equal.

Waste tailpiece: P-Trap shall be chrome plated cast brass body with cleanout, with 17-gauge seamless tubular wall bend, cast brass slip nuts. Reducing washers shall be used with reducing cast brass nut. With bell brass flange. Trap shall be certified by CSA or other recognized testing authority. Trap shall bear manufacturer and testing marks. Trap shall be McGuire Manufacturing "Classic" Professional Line or engineer approved equal.

Escutcheons: one-piece chrome plated cast brass or stainless steel.

XXIII. ASSE 1070 THERMOSTATIC MIXING VALVE (SINKS AND LAVATORIES)

Provided each sink and lavatory with an ASSE 1070 Compliant thermostatic mixing valve. The sink tempering valve shall be IAPMO lab certified per ASSE 1070 at 0.25 GPM and CSA standards and shall have a solid brass body with corrosion resistant internal components. It shall include integral checks with screens to prevent backflow and to filter debris from entering the valve. Temperature adjustment shall be made using an allen wrench and a locknut on the bonnet to prevent unauthorized or accidental temperature adjustment. Valve shall provide 4.0 GPM with 3/8" compression connection and 4.5 GPM capacity with the 1/2" NPT connection at 45 psi differential. Temperature range shall be 85°F-115° F.

XXIV. DISINFECTION OF POTABLE WATER SYSTEM

Potable water systems shall be disinfected in accordance with State and Local codes but by not less than one of the following methods before it is placed in operation.

The system, or part thereof, shall be filled with a solution containing 50 parts per million of available chlorine and allowed to stand 24 hours before flushing and returning to service.

The system, or part thereof, shall be filled with a solution containing 200 parts per million of available chlorine and allowed to stand 3 hours before flushing and returning to service.

Repeat procedure where bacteriological testing and examination shows presence of contamination. Perform and submit bacteriological testing and examination reports.

XXV. TESTING

General: Perform tests in accordance with building code requirements in the presence of the authorities having jurisdiction. Do not close in, conceal, or cover up any plumbing work until it has been tested, inspected, and approved.

Flush piping, prior to testing, to remove foreign materials which may have entered during course of installation. Clean filters and strainers after flushing.

Technology & Security Narrative

TABLE OF CONTENTS

I. GENERAL

This narrative describes the Technology scope of work and specifications; refer to floor plans for additional information.

Comply with all current Federal, State, City and local codes, standards and ordinances, the International Building Code, the New York City Building Code including supplements, NFPA, utility company standards, insurance carrier requirements, and local authorities.

The Technology systems will be designed to comply with all state and local codes including the following codes adopted by the authority having jurisdiction:

2022 New York City Building Code
2025 New York City Electric Code
2016 NFPA 72 National Fire Alarm and Signaling Code
2010 ADA Standards for Accessible Design
OSHA, NFPA, utility company standards and all other codes and standards referenced by the above documents.

Additionally, the following standards and documents will be referenced:

1. ANSI/TIA-568.1-E - Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
3. ANSI/TIA-606-C - Administration Standard for Telecommunications Infrastructure
4. ANSI/TIA-607-D - Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises
5. BICSI Telecommunications Distribution Methods Manual – 15th Edition

II. COORDINATION

Coordinate the work, with work of other trades and field conditions. Carefully check space requirements and utilities to ensure all equipment can be installed in the spaces allotted thereto and coordinate all necessary utility service requirements. Coordinate, protect and schedule work with work of other trades in accordance with the required construction sequence. Install all work in accordance with equipment manufacturer's installation instructions.

III. WARRANTY

The Contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted, that the Work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the project requirements. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor shall warranty all work for a period of one (1) year from Owner acceptance unless specified otherwise in which case longer equipment warranties may apply. A 20-year manufacturer's warranty for IT cabling will be specified.

IV. SUBMITTALS

Contractor shall submit: shop drawings, product data, samples, record documents (as-builts) and operation and maintenance manuals in accordance with the Contract requirements and particular specification section requirements.

V. RECORD DRAWINGS

Provide a complete set of as-built drawings reflecting "as-installed" conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the Engineer's comments to produce a clear and concise set of drawings. Drawings shall be submitted in both hard copy and electronic format (AutoCad, Revit, and/or Adobe PDF version as required by the Owner). Number of copies of each as requested by the Owner.

VI. TECHNOLOGY SYSTEMS

One (1) existing IT cabinets are located within the project area; (1) cabinet on the third floor serves the 3rd floor space. The existing cabinet existing cabinet on the third floor will be replaced with a new cabinet. New rack-mount optical fiber enclosures, modular patch panels, pathways and cabling to support the new cabinet will be provided. Active equipment (network switches, servers, etc.) will be furnished and installed by the Owner.

(2) 4" conduits exist in stacked IT cabinets containing single mode fiber and copper backbone cabling. Backbone cabling between Telecommunications Rooms consists of single mode optical fiber and 25-pair copper cables. Backbone cabling shall remain.

Firestopped conduits will be provided between the TR (MEP 3MY09 adjacent to Stair F) wall and pull boxes in the gallery where conduit will be used to route Category 6A cables to each outlet.

All IT cabinets and equipment will be grounded to building steel and the nearest electrical panel with a minimum 3/0 copper grounding electrode conductor.

A standards-compliant structured cabling system, designed by a Registered Communications Distribution Designer (RCDD), will be provided. The structured cabling system will consist of Category 6A UTP cable, wall mounted outlet boxes, cover plates, and 8-pin RJ45 jacks. All cables will be properly labeled and terminated in the equipment racks on modular RJ45 patch panels with 110-style IDCs on the rear of the panel. Wireless Access Point (WAP) cabling will consist of two (2) Category 6A UTP cables to each WAP location.

Pathways for horizontal cabling will primarily utilize conduit. Conduit will be installed for all cable runs. The horizontal cabling will be installed in conduit from each outlet backbox to the TR. The outlet backbox at each work area will consist of a double-gang box with 1" conduit.

Each data outlet in the gallery will receive a duplex drop (2 data cables). Additional voice and/or data drops will be provided in other locations as required. Drops for wall-mount telephones will be provided in designated areas as required. Data cables for people counters will be provided at all gallery entrances.

Wireless Access Points (WAPs) will be located throughout the gallery space to provide adequate coverage to all occupied areas of the gallery. Category 6A cable installed at each WAP location will be terminated on a dual-port faceplate.

Wireless Access Point hardware, antennas and enclosures will be furnished and installed by the Owner.

Networking and telephone system equipment requirements will be coordinated with the Owner's IT Department. Specification of these systems will be by the Owner, but adequate rack mounting space, cooling, power, and grounding will be provided.

Cabling to support Audio Visual equipment including LCD screens, projectors, AV Control Panels, and AV Equipment cabinets will be provided in the gallery and other locations as required. AV outlets will be installed approximately every 10 ft on the ceiling and perimeter of galleries. AV cabling to include (3) Category 6A jacks and (2) OS2 Optical Fiber cabling terminated on LC connectors per location.

VII. SECURITY SYSTEMS

Furnish and install all conduit, backboxes and pathways to support security system installation by the owner's security vendor.

Existing security panels located adjacent to the IT cabinets serve the security devices in the galleries.

Video surveillance cameras will be installed in locations designated by the owner, including cameras at entrances to the galleries and other locations as required. All cameras will be IP-based, with Category 6A cable installed from the camera to the serving IT cabinet. PoE Switches to power the cameras will be Owner-provided.

Intrusion Detection devices will be provided including door contacts on doors, motion sensors, glass break sensors, and keypads located at designated entry locations.

Card readers will be provided at designated locations including Electrical rooms, Telecommunications rooms, Mechanical rooms, and other locations as requested.

MEMO
Project: Brooklyn Museum Arts of Africa, Brooklyn New York
Date: October 17, 2025
By: L'Observatoire International
Re: Lighting Design & Lighting Controls Narrative

Given the sophisticated nature of the project, networked lighting controls are recommended by L'Observatoire to adjust light levels for conservation purposes and to reinforce the exhibition narrative within the African Galleries.

Below please find a lighting controls narrative to accompany the 100% Design Development submission on 10/17/2025.

I) Gallery lighting layers

The following typologies of lighting systems have been proposed within the Arts of Africa galleries

1. Ceiling recessed line voltage track (type TR01) with
    - **a. PR01 LED accent track lights for artwork / objects.**
        - i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
        - ii. On-board switch to turn on/off fixture individually while still powered by track.
    - **b. WW01 LED wallwash track lights for wall hung art.**
        - i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
        - ii. On-board switch to turn on/off fixture individually while still powered by track.
    - **c. PR01-FR LED framing projector lights illuminating gallery signage and or text panels.**
        - i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
        - ii. On-board switch to turn on/off fixture individually while still powered by track.

2. Ceiling recessed line voltage track (type TR02) in suspended ceiling panel (also hosting sprinkler pipe)
    - **a. PR02 LED accent track lights for artwork / objects.**
        - i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
        - ii. On-board switch to turn on/off fixture individually while still powered by track.
    - b. **WW02 LED wallwash track lights for wall hung art**
        - i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
        - ii. On-board switch to turn on/off fixture individually while still powered by track.

c. **PR02-FR LED framing projector** lights illuminating gallery signage and or text panels
    i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
    ii. On-board switch to turn on/off fixture individually while still powered by track.

3. Ceiling recessed monopoint mounts (type TR03) with
    a. **PR03 Monopoint mount LED accent track lights** at center of suspended panel allowing for illumination of walls perpendicular to track lengths. Integrated within suspended ceiling panel.
        i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.

4. Linear LED uplighting integrated into the aforementioned suspended ceiling
    a. **ST01 line voltage linear LED** lighting integrated at back of suspended ceiling uplighting the ceiling and providing a base layer of ambient lighting.
        i. Wireless networked lighting control system to dim all ST01 fixtures together.

5. Ceiling recessed architectural slot with line voltage track on either side of slot (type TR04) with
    a. **PR04 LED accent track** lights for artwork / objects
        i. Wireless networked lighting control system to dim fixtures individually (to be confirmed by Manufacturer) and in groups. Track to be wired as line voltage for on/off control.
        ii. On-board switch to turn on/off fixture individually while still powered by track.

6. Ceiling recessed monopoint mounts (type TR05) allowing for mounting of
    a. **PR05 LED accent track lights** for artwork / objects. Dimmable via
        i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.
    b. **PR05-FR LED framing projector lights** illuminating signage and text panels.
        i. Wireless networked lighting control system to dim fixtures individually and in groups. Track to be wired as line voltage for on/off control.

7. Integral vitrine lighting (low voltage lighting) for objects,
    a. Fixture types pending case design development.
        i. Wireless networked lighting control system to dim fixtures per fixture type in groups. Vitrines to be hardwired or plugged into floor recessed outlets- to be confirmed by Architect/Ownership.

II) Lighting control intent

1. Lighting control system shall facilitate tuning/balancing of lighting layers in the galleries and adjacent spaces (i.e. setting the appropriate light levels for conservation purposes and fine tuning the composition / hierarchy of light within individual spaces).
2. Lighting control system shall allow automatic transition of lighting scenes from morning to midday to early evening using astronomic timeclock. These scene transitions shall be smooth and seamless over 30-minute transition time. These scene transitions are pre-programmed at time of system commissioning, and shall operate automatically on a daily basis.
3. Lighting control system shall also provide a dedicated lighting scene in select galleries for special events. This special event scene is manually triggered by authorized museum staff.
4. Suggested lighting scenes are as follows. These scenes (except Event) occur automatically and can also be manually triggered with laptop/tablet/smartphone with access to wireless software application.

    a. Daytime / cleaning
    b. Mid-day
    c. Early evening
    d. After hours / security rounds
    e. Event (requires manual trigger)

5. With the anticipated wireless lighting control system, as noted above, each track mounted can be programmed as individually controlled as well as in groups. Linear fixtures and potential vitrine lighting fixtures will be controllable as groups (based on zoning/circuiting).

III) Equipment locations

1. A wireless networked lighting control system as described above does not require a centralized controls device, but a controls hub can be added to allow for remote access to the controls system via web browser. Ownership to confirm if remote access will be desired.
2. Physical lighting keypads can be installed (speaking wirelessly to the lighting fixtures) to control the lighting in each room. LOI recommend each gallery space to have a separate wall station. Ownership to confirm.
3. A dedicated PC laptop, tablet or smartphone to be used to control the lighting system via the Manufacturer's software application. The person controlling the system must be within the gallery space to modify the lighting output of the individual fixtures or fixture groupings.
4. Client to confirm required integration to BMS or other systems in the building.

III) Lighting control equipment and commissioning/programming services required

1. Control zone assignments by fixture / fixture type / location (via plan/RCP) and lighting control schedule (with exact quantity of dimming zones, load type assignments, wattage per zone) shall be submitted at 100%DD following Client review/approval of the Lighting Controls Narrative.
2. Provision for emergency lighting transfer switch shall be included. **Final emergency lighting system requirements and components to be determined by Electrical Engineer.**
3. L'Observatoire shall assist the selected Lighting Controls Manufacturer to provide documentation including one-line diagrams and Bill of Material to finalize the lighting control specification.
4. All pricing for lighting controls shall include the following field services from Controls Manufacturer:
    a. Standard pre-wire and post-installation startup / commissioning services for the lighting control system
    b. Minimum of 2 additional site visits (8 hours each visit) for programming of the lighting scenes based on direction from L'Observatoire and the Brooklyn Museum senior management. If required by the Brooklyn Museum, these site visits shall occur after-hours (i.e. after museum closes to public).

c. Training session for the Brooklyn Museum facilities staff, with direct demonstration within the African Galleries. Training session shall include how to make temporary and permanent modifications to lighting control system presets should displays / exhibitions evolve over time. Date of training session to be confirmed directly with the Brooklyn Museum management.

IV) Lighting Loads

1. Project lighting systems and controls will be designed to meet or to be better than code requirements as dictated in NYCECC 2020. Wattage allowance for gallery type spaces is 0.61W/sf for general lighting and an additional 0.75W/sf for highlighting of art.

PROJECT MANUAL

BROOKLYN MUSEUM ARTS OF AFRICA

200 EASTERN PARKWAY
BROOKLYN, NEW YORK

PROJECT NUMBER: 163A

Issued For
Design Development
10-17-2025

Prepared By
Peterson Rich Office
37a 9th Street #3
Brooklyn, NY 11215
(212) 390-1504

SECTION 00 01 03 - PROJECT DIRECTORY

PROJECT TEAM

Architect of Record:
Peterson Rich Office
37a 9th Street #3
Brooklyn, NY 11215
Phone: (212) 390-1504

Architect:
Beyer Blinder Belle
120 Broadway, 20th Floor
New York, NY 10271
Phone: 212-777-7800

Structural Engineering:
T.Y.Lin International Engineering and Architecture
32 Old Slip
New York, NY 10005

MEP Engineering:
Kohler Rohnan
171 Madison Avenue
New York, NY 10016

Envelope Consultant:
WJE Engineers and Architects, PC
1350 Broadway, Suite 910
New York, NY 10018

Lighting Design Consultant:
L'Observatoire International
120 Walker Street, Suite 7E
New York, NY 10013

Audiovisual & Acoustics Consultant:
LSTN Consultants
76 Beaver Street, Floor 2
New York, NY 10005

END OF PROJECT DIRECTORY

SECTION 00 01 07 - SEALS PAGE

ARCHITECTURAL

I hereby certify this plan, specification, or report was prepared by myself or under my direct supervision and I am a duly Registered Architect under the laws of Location.

_____

Date _____ Registration No. _____

STRUCTURAL

I hereby certify this plan, specification, or report was prepared by myself or under my direct supervision and I am a duly Registered Engineer under the laws of Location.

_____

Date _____ Registration No. _____

MECHANICAL

I hereby certify this plan, specification, or report was prepared by myself or under my direct supervision and I am a duly Registered Engineer under the laws of Location.

_____

Date _____ Registration No. _____

ELECTRICAL

I hereby certify this plan, specification, or report was prepared by myself or under my direct supervision and I am a duly Registered Engineer under the laws of Location.

_____

Date _____ Registration No. _____

SECTION 00 01 10 - TABLE OF CONTENTS

Written Contract Documents and Specification Sections identified below are grouped and identified as "Bid Packages" and are numbered and dated as such. The intent of these groups of Documents is to convey sufficient information to allow a designated portion of the Work to be bid upon and constructed. All previously issued Contract Documents and Specifications apply to each successive "Bid Package" and, if not printed and bound herewith, are available from the Construction Manager.

Changes made to prior issues (additions, deletions, and changes) are highlighted in **bold** and ~~strikethrough~~ text within each section, and the Issue date is changed herein to reflect the most current issue. The Contractor is responsible for evaluating all Documents issued, both current and previous issues, and dividing and assigning work to the various trades and subcontractors.

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION

PROCUREMENT AND CONTRACTING REQUIREMENTS

In the absence of forms provided by the Architect or Construction Manager, the following forms shall be used to administer the project.

AIA forms and pre-printed documents listed below are not included in this Project Manual and are hereby made a part of the Contract Documents. AIA forms and pre-printed documents may be obtained from distributors listed at https://www.aiacontracts.org/purchase.

CSI forms and pre-printed documents listed below are not included in this Project Manual and are hereby made a part of the Contract Documents. CSI forms and pre-printed documents may be obtained from www.csiresources.org.

00 65 19.16 ..... AIA Form G706A Affidavit of Release of Liens
00 65 19.19 ..... AIA Form G707 Consent of Surety to Final Payment
00 65 19.29 AIA Form G707 Consent of Surety to Final Reduction in or Partial Release of Retainage

ADDITIONAL PROCUREMENT AND CONTRACTING REQUIREMENTS

Additional Subcontract Procurement and Contracting Documents prepared by the Contractor are bound separately and are not enumerated herein.

SPECIFICATIONS GROUP

DIVISION 13 -- SPECIAL CONSTRUCTION (NOT USED)

DIVISION 14 -- CONVEYING EQUIPMENT (NOT USED)

DIVISION 20 -- RESERVED (NOT USED)

DIVISION 21 -- FIRE SUPPRESSION

DIVISION 22 -- PLUMBING

DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

SECTION 00 31 00 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.1 EXISTING CONDITIONS

A. Certain information relating to existing conditions and structures is available to Contractor, but are not part of the Contract Documents, as follows:

B. Hazardous Materials Survey:
   1. Information is available for inspection at Owner's offices during normal business hours.
   2. Contractor is urged to examine survey data.
   3. Contractor should visit the site and become acquainted with existing conditions.
   4. Interpretation: This survey is provided only for information and convenience. Owner and Architect disclaim responsibility for accuracy, true location and extent of existing conditions that have been documented by others. Owner and Architect further disclaim responsibility for interpretation of the survey data by the Contractor.

1.2 OTHER INFORMATION

A. Lighting Cut Sheets:
   1. A copy is included in Appendix A.
   2. Interpretation: This information is provided only for information and convenience.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 00 31 00

SECTION 00 40 00 - PROCUREMENT FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.1 PROCEDURES

A. Use of forms included in this Section is required.
   1. Use of Contractor's alternative forms is acceptable subject to approval of Architect, and provided that content of alternative forms is substantially equivalent to forms provided in this Section.

B. Complete applicable information on form. Indicate date transmitted and date of required response, as applicable. Attach supporting documentation and additional descriptive information as necessary to fully describe the request.

C. Use a single form for each separate request. Closely related items may be included in a single request only if acceptance of one item requires acceptance of all items in the request.

1.2 FORMS

A. Substitution Request Form (During Procurement): 00 43 25 - Substitution Request Form - During Procurement.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 00 40 00

SUBSTITUTION REQUEST

(During the Bidding/Negotiating Stage)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

Form Version: January 2013
CSI Form 1.5C

SECTION 00 60 00 - PROJECT FORMS

PART 1 GENERAL

1.1 SUMMARY

A. Procedures for use of administrative forms.

B. Administrative forms.

1.2 PROCEDURES

A. Use of forms in this Section is required.
   1. Use of Contractor's alternative forms is acceptable subject to approval of Architect, and provided that content of alternative forms is substantially equivalent to forms provided in this Section.

B. Complete applicable information on form. Indicate date transmitted and date of required response, as applicable. Attach supporting documentation and additional descriptive information as necessary to fully describe the request.

C. Use a single form for each separate request. Closely related items may be included in a single request only if acceptance of one item requires acceptance of all items in the request.

D. Comply with the requirements of Section 01 60 00 for requests for substitution after execution of the Contract.

1.3 ARCHITECT'S ACTION

A. When requests are made within the time allowed for Architect's review, Architect will make reasonable effort to respond in a timely manner, but no claim for delay by Contractor will be allowed.

B. Substitution Requests: Architect's review is for general conformance with the Contract Documents only and does not relieve Contractor from full compliance with the Contract Documents and Contractor's representations specified in Section 01 60 00.

1.4 FORMS

A. Request for Information: Number consecutively; include Architect's project number; clearly specify the document reference by specification Section number, article, paragraph, Drawing number, and detail numbers as applicable. Architect will complete the lower portion of the form as the written response.
   1. RFI Form: 00 63 13 - RFI Form.

B. Substitution Request: Number consecutively; complete all required information on the form; indicate applicable cost savings and time affect, if any. Architect will complete the lower portion of the form as the written response, and will attach further written response as necessary to explain the decision, if required. Forms submitted without all required information as indicated on the form may be returned for completion before review by Architect.

1. Substitution Request Form (During Construction): 00 63 25 - Substitution Request Form - During Construction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 00 60 00

REQUEST FOR INFORMATION FORM

PROJECT:		RFI NUMBER:	
FROM:		DATE:	
RE:		CONTRACT FOR:	

SECTION NUMBER:		TITLE:	
PAGE:		ARTICLE/PARAGRAPH:	
DRAWING NUMBER:		DETAIL REFERENCE:	

Contractor's Request:

☐ Attachments

SIGNED BY: _____ DATE: _____

Architect's Response:

☐ Attachments

RESPONSE FROM:		REC'D:	
TO:		RETURNED:	
SIGNED BY:		DATE:	

END OF FORM

Knowledge for Creating and Sustaining the Built Environment

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Phone: _____

Address: _____

Trade Name: _____ Model No.: _____

Installer: _____ Phone: _____

Address: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product:

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

Form Version: June 2004
CSI Form 13.1A

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ Other:

Form Version: June 2004
CSI Form 13.1A

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name: Brooklyn Museum Brooklyn Museum Arts of Africa.

B. Architect's Name: Peterson Rich Office.

C. The Project consists of the alteration of a portion of an arts exhibit space as more completely described in the Contract Documents.

1.2 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a stipulated price as described in the contract for construction.

B. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

1.3 DIVISION 01 SPECIFICATIONS

A. Division 01 General Requirements expand on the broad provisions of the Conditions of the Contract, and govern the execution of the work of all Sections of the specifications. Division 01 General Requirements specify administrative and procedural requirements relating to execution of the Work, and temporary facilities for use during the construction period.

B. If Construction Manager provides additional Division 01 sections and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.

1.4 PROJECT WARRANTY

A. Refer to General Conditions for warranty provisions applicable to this Contract.
   1. Project warranty period is governed by the codes and statues within the State in which the Project is located, and other provisions of the Contract.

B. Guarantee of Materials and Workmanship:

1. Guarantee in writing to Owner that all work performed and all materials and equipment furnished under this Contract are new and in accordance with the Contract Documents, are free from defects in equipment, materials or design furnished, or workmanship performed by Contractor or any of his subcontractors or suppliers at any tier. Such guarantee shall continue for a period not less than one (1) year from the date of Substantial Completion of the Work, or as otherwise required by the codes and statutes within the State in which the Project is located or other provisions of the Contract.
2. Under this guarantee, Contractor agrees to remedy at his own expense any inferior or defective equipment, materials, workmanship, or design that should develop during the guarantee period, or in restoring any other work damaged in fulfilling the terms of the guarantee.
3. Do not perform any work that shall void any manufacturer guarantee or warranty.

C. Manufacturer's Guarantee and Warranty:
1. As identified in other Sections of the specifications, provide written manufacturer's guarantees and warranties for specific materials, products, and equipment furnished and installed under this Contract.
2. Guarantees and Warranties Period: Valid for the period of time stated in each applicable specification Section from the date of Substantial Completion of the Work, but not less than twelve (12) months.

D. Extended Warranties:
1. As identified in other Sections of the specifications, provide written manufacturer's guarantees and warranties for specific materials, products, and equipment furnished and installed under this Contract.
2. Guarantees and Warranties Period: Valid for the stated extended period beyond twelve (12) months from the date of Substantial Completion of the Work.

E. Exclusions:
1. Warranty requirements contained in the specifications take precedence. These exclusions are superseded by warranty coverage requirements of the specifications.
2. Notify Architect of design conditions which cannot be fully warranted. Submit notice in writing prior to purchase of the affected product or system.
3. Failure to provide such notice will not be grounds for waiver of warranty requirements contained in the specifications.
4. Upon receipt of such notice, Architect will consider modifications necessary to assure that final construction is warrantable to the full extent of Contract requirements.

1.5 WORK BY OWNER

A. Owner will award a contract for supply and installation of _____ which will commence on _____.

B. Certain elements, materials, and tasks for the project have been identified as being "Not in Contract" (N.I.C.), "By Others," or "By Owner." Such materials and labor will be provided by others in a manner and schedule which is not intended to impede the progress of the Work under this contract.

1. Coordinate construction schedule with Owner, and give adequate notice as to when other work should be undertaken. Review with Owner's the time required for various work requiring coordination. Include work under other contracts in Contractor's project schedule.

C. Owner will supply and install the following:
   1. _____.

D. Owner will supply the following for installation by Contractor:
   1. _____.

1.6 OWNER OCCUPANCY

A. Owner intends to occupy portions of the existing building during the entire construction period.
   1. Construction Operations: Minimize interference with normal functioning of building and occupants.
   2. Limit noise. Radios are not permitted. If construction activities will produce noise which is detrimental to the operation of the facility, schedule these activities during non-occupied hours.
   3. Protect entrances, exits, walkways, and other areas in the vicinity of the construction subject to use by the public from falling objects, or appropriately barricade according to governing regulations.

B. Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.7 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas approved by Owner.

B. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.
   4. Use of site and premises by the public.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Existing building spaces and site may not be used for storage, except as permitted by Owner.

E. Utility Outages and Shutdown:
   1. Except as specifically indicated in the Contract Documents, do not permit interruption of mechanical and electrical services, shut down of building systems, services, and utilities without prior approval of Owner.
   2. Limit disruption of utility services to hours the building is unoccupied.
   3. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   4. Prevent accidental disruption of utility services to other facilities.

F. Working Hours:
   1. Owner Occupied Hours: Owner personnel are scheduled to occupy the building during the following hours on weekdays, Monday through Friday, except for established Owner Holidays:
      a. Working Hours: Museum operations and security are staffed 24/7. Museum staff work mostly Monday through Friday from 9:00 AM to 5:00 PM.
      b. Public Hours: Museum is closed to the public on Monday and Tuesdays, which allows the Contractor to schedule work that might otherwise need to be performed during off hours.
         1) www.brooklynmuseum.org/visit/hours_admission/museum_hours/
   2. Owner Unoccupied Hours: Owner personnel are not scheduled to occupy the building during times not indicated as Owner Occupied Hours.
   3. Contractor's General Working Hours: The Contractor working hours shall be generally established to occur during Owner Occupied Hours.
   4. Contractor's Required Working Hours: The following work shall be performed during Owner Unoccupied Hours:
   5. Work accomplished during Owner Unoccupied Hours shall be performed at no additional cost to the Owner. Contractor shall submit a proposed schedule and gain the Architect's approval at least 48 hours before proceeding with any work during Owner Unoccupied Hours.

G. Special Restrictions:
   1. Contractor personnel are prohibited from existing building interiors except as required to execute specific work indicated on Drawings.
   2. Contractor is prohibited from utilizing the building’s computers, phones and internet access.
   3. Contractor and associated personnel and subcontractors are not permitted to use existing and new toilet facilities and service sinks in the building for personal use, for cleaning tools, or for disposing of construction waste materials.
   4. No construction waste materials may be disposed of in Owner's dumpsters or other Owner containers.
   5. Control smoke, dust, dirt, odors and other objectionable effects, and limit to the immediate area of construction. Contractor is responsible for cleaning other areas affected by noncompliance with this requirement, including contents of affected areas.
   6. Clean work areas of debris, and "broom clean" no less frequently than at the end of each work day. Remove all debris from exterior site areas which could be wind blown. See Section 01 70 00 for additional requirements.

1.8 DELEGATED DESIGN WORK

A. Design of products and systems, or components of products and systems, specified to be provided by Contractor are identified in individual specification Sections.

B. Contractor's Responsibilities:
   1. Comply with specified design requirements for each applicable product or system.
   2. Coordinate design and space requirements with other affected work and Architect.
   3. Review applicable submittals and coordinate selections with Architect.
   4. Receive and unload products and systems at the site; inspect for completeness and for damage.
   5. Handle, store, install, and finish products and systems.
   6. Repair or replace damaged, defective, or missing items.
   7. Arrange for manufacturer's warranties, inspections, and service.
   8. Comply with applicable provisions of Division 01 - General Requirements, specifically including administrative requirements, coordination, quality, regulatory, and product requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 10 00

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Modification procedures.

D. Correlation of Contractor submittals based on Contract modifications.

E. Procedures for preparation and submittal of application for final payment.

1.2 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Project record documents.

1.3 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Form: AIA G702 and G703.

C. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

D. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
   1. Forms filled out by hand will not be accepted.

E. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

I. Submit one electronic and three hard-copies of each Application for Payment.

J. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 30 00.
   2. Construction progress schedule, revised and current as specified in Section 01 32 16.
   3. Current construction photographs specified in Section 01 30 00.
   4. Conditional release of liens from each Subcontractor and vendor for the current month's payment application, and unconditional release of liens from each Subcontractor and vendor for the previous month's payment application.
   5. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
   6. Affidavits attesting to off-site stored products.

K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.5 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive modification documents and who will be responsible for informing others in Contractor's employ or subcontractors of modifications to the Contract Documents.

B. Project Modification Forms: Forms for use primarily by Contractor are identified in Table of Contents. Use of Contractor's typical forms will be considered, subject to approval of Architect.

C. Establish and maintain a construction cost log, including the status of all pending and executed Change Orders (accepted, declined, pending, etc.), status of requests for information, supplemental instructions, other modification documents, and the status of allowances, including Owner's contingency allowance.

D. Supplemental Instructions: For minor modifications not involving an adjustment to the Contract Sum or Contract Time; Architect will issue instructions directly to Contractor.
   1. Architect's issuance of supplemental instructions may constitute a modification of the Contract Documents involving an adjustment to the Contract Sum or Contract Time. If Architect's supplemental instructions require such a modification of the Contract Documents, prepare a request for change order or other modification according to applicable modification procedures specified in this Section.

E. Construction Change Directive: For other required modifications, Architect will issue a document signed by Architect and Owner instructing Contractor to proceed with the modification, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

F. Proposal Request: For modifications for which advance pricing is desired, Architect will issue a document which includes a detailed description of a proposed modification with supplementary or revised drawings and specifications. Contractor shall prepare and submit a fixed price quotation within 10 days, estimating any changes to Contract Sum and Contract Time for executing the modification. Contractor's quotation shall stipulate any overtime work required and the period of time during which the requested price will be considered valid.

G. Contractor may propose a change by submitting a request for change order or modification to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.
   1. Document any requested substitutions in accordance with Section 01 60 00.

H. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

I. Substantiation of Costs: Provide full information required for evaluation.

1. Provide the following data:
    a. Quantities of products, labor, and equipment.
    b. Taxes, insurance, and bonds.
    c. Overhead and profit.
    d. Justification for any change in Contract Time.
    e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
    a. Origin and date of claim.
    b. Dates and times work was performed, and by whom.
    c. Time records and wage rates paid.
    d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

J. Execution of Change Orders: Contractor will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

K. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

L. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

M. Promptly enter changes in Project Record Documents.

1.6 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 70 00.
2. Receipt of unconditional release of liens from Contractor and each Subcontractor and vendor for the previous month's payment application.
3. Receipt of final Certificate of Occupancy from jurisdictional authority.
4. Acceptance of Work by Owner and Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 20 00

SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Alternates.

B. Documentation of changes to Contract Sum and Contract Time.

1.2 GENERAL ALTERNATE REQUIREMENTS

A. The description of each Alternate is recognized to be incomplete and abbreviated, but requires that each change must be complete for the scope or work affected. Refer to applicable specification Sections and applicable Drawings for the specific requirements of work.

B. Base Bid: Include work associated with described deductive alternates and exclude described additive alternates. Failure to submit proposals for all alternates may result in rejection of bid.

1.3 DESCRIPTION OF ALTERNATE REQUIREMENTS

A. Alternates are defined as alternative products, materials, equipment, systems, methods, units of work, or major elements of construction which may, at Owner's option, be selected for the work in place of corresponding requirements of the Contract Documents. Selection may occur prior to the Contract date, or may be deferred for possible selection at a subsequent date.

B. Include as part of each Alternate, miscellaneous devices, appurtenances, differences in utility or power requirements, and similar items incidental to or required for complete and functioning installation, whether or not specifically mentioned as part of the alternate description.

C. Immediately following award of the Contract, prepare and distribute to each entity involved, notification of the status of each Alternate. Indicate whether alternates have been accepted, rejected, or deferred for consideration at a later date. Indicate a complete description of negotiated modifications to described scope of Alternates, if any.

1.4 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.5 SCHEDULE OF ALTERNATES

A. Alternate No. 01: Sliding Doors.
   1. Base Bid: No new doors at portal entrances to exhibit space.
   2. Alternate: Provide new doors and hardware in accordance with Section 08 14 16 and 08 71 00 at portal entrances to exhibit space.

B. Alternate No. 02: BAC Stairs.
   1. Base Bid: No work.
   2. Alternate: Remove existing railing and provide new stairs with stone tread and riser finish as detailed at locations indicated in drawings.

C. Alternate No. 03: Wing E Flooring.
   1. Base Bid: Patch and repair existing terrazzo floor.
   2. Alternate: Shotblast existing floor and pour polymer modified cementitious terrazzo (Lixio).

D. Alternate No. 04: Hyphen Flooring
   1. Base Bid: Shotblast existing floor and pour polymer modified cementitious terrazzo (Lixio).
   2. Alternate: Patch and repair existing terrazzo floor.

E. Alternate No. 05: Wing F Flooring.
   1. Base Bid: Pour polymer modified cementitious terrazzo (Lixio) directly on top of existing epoxy floor.
   2. Alternate A: Demolish existing epoxy flooring to reveal terracotta surface below, pour polymer modified cementitious terrazzo (Lixio).
   3. Alternate B: Shotblast existing epoxy floor and pour ultra-thin concrete topping (Get Real Surfaces) on top.

F. Alternate No. 06: Wing E Envelope.
   1. Base Bid: New wall assembly with insulation and vapor barriers at the east and north walls of Wing E.
   2. Alternate A: Repoint limestone on the exterior facade immediately adjacent to the Wing E Gallery. No new interior wall assembly at north and east walls.
   3. Alternate B: Install monitors/sensors from the interior side to measure humidity and water infiltration.

G. Alternate No. 07: Metal Screens at Wing E Windows.
   1. Base Bid: No Work.
   2. Alternate: Remove existing metal screens at exterior of Wing E windows.

H. Alternate No. 08: Wing E Ceiling Plane Support Strategy.
   1. Base bid: Unistrut beam clamp attached to existing beam.
   2. Alternate: Embed threaded rod in grouted cell of existing terracotta flat arch.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.2 RELATED REQUIREMENTS

A. Section 00 43 25 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).

B. Section 00 63 25 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).

C. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

D. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling, and substitution limitations.

1.3 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
      c. Other limitations specified in Section 01 60 00.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. A Substitution Request for specified installer constitutes a representation that the submitter:
   1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
   3. Architect will notify Contractor in writing of decision to accept or reject request.

D. Substitution Request Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

E. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
   1. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

B. Substitution Request Form (before award of contract):

1. Submit substitution requests by completing the form in Section 00 43 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Substitution Request Form (after award of contract):
   1. Submit substitution requests by completing the form in Section 00 63 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Architect will consider requests for substitution only within 60 days after date of commencement of Work, unless otherwise determined by Architect to be acceptable under extenuating circumstances.
   1. Substitutions will also be considered when a Product, through no fault of Contractor, becomes unavailable or unsuitable due to regulatory change.

C. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
      b. Other construction by Owner.
      c. Other unanticipated project considerations.

E. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.5 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Include completed and approved Substitution Request Forms as part of the Project record.

END OF SECTION 01 25 00

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Project closeout meeting.

F. Contractor's daily reports.

G. Progress and documentation photographs.

H. Use of Architect's digital Drawing files.

I. Submittals for review, information, and project closeout.

J. Number of copies of submittals.

K. Requests for Information (RFI) procedures.

L. Submittal procedures.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: General product requirements.

B. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.3 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:

1. Requests for Information (RFI).
2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.
12. Other specified submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Other invited participants.

C. Minimum Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.
   6. Designation of personnel representing the parties to Contract, including Contractor, Owner, and Architect.
   7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.2 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Special consultants.
   5. Contractor's superintendent.
   6. Major subcontractors.
   7. Other invited participants.

C. Minimum Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Owner.
   5. Survey and building layout.
   6. Security and housekeeping procedures.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   10. Procedures for maintaining record documents.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute electronically within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.3 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at weekly intervals, unless otherwise agreed upon and approved by Owner.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Special consultants.
   5. Contractor's superintendent.
   6. Major subcontractors.

D. Minimum Agenda:
   1. Review minutes of previous meetings.
   2. Review and discussion of Weekly Progress Report.
   3. Review of work progress.
   4. Field observations, problems, and decisions.
   5. Identification of problems that impede, or will impede, planned progress.
   6. Review of submittals schedule and status of submittals.
   7. Review of RFIs log and status of responses.
   8. Modification (Change Order) status.
   9. Review of off-site fabrication and delivery schedules.
   10. Maintenance of progress schedule.
   11. Corrective measures to regain projected schedules.
   12. Planned progress during succeeding work period.
   13. Coordination of projected progress.
   14. Maintenance of quality and work standards.
   15. Effect of proposed changes on progress schedule and coordination.
   16. Other business relating to work.

E. Record minutes and distribute electronically within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.4 PREINSTALLATION MEETINGS - SEE SECTION 01 70 00

3.5 PROJECT CLOSEOUT MEETING

A. Schedule and administer a Project closeout meeting minimum 3 months before scheduled Date of Substantial Completion, at location mutually agreed upon by Owner, Contractor, and Architect.

B. Attendance Required: Owner, Contractor, job superintendent, and Architect.

C. Minimum Agenda:
   1. Review specified closeout process, tasks required of respective participants, task scheduling, and deadline dates for each critical path task in the closeout process.
   2. Review closeout submittals required and submittal procedures for each.
   3. Review maintenance materials requirements and Owner's requirements for delivery and storage.
   4. Review final inspection requirements of AHJ and coordination of same.
   5. Review status of record documentation, and discuss process for completing and distributing record documentation to Owner and Architect.

D. Record minutes and distribute electronically within two days after meeting to participants and those affected by decisions made.

3.6 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. List of subcontractors at Project site.
   4. List of separate contractors at Project site.
   5. Approximate count of personnel at Project site.
      a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
   6. Major equipment at Project site.
   7. Material deliveries.
   8. Safety, environmental, or industrial relations incidents.
   9. Meetings and significant decisions.
   10. Unusual events (submit a separate special report).
   11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
   12. Meter readings and similar recordings.
   13. Emergency procedures.
   14. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
   15. Change Orders received and implemented.
   16. Testing and/or inspections performed.
   17. List of verbal instruction given by Owner and/or Architect.
   18. Signature of Contractor's authorized representative.

3.7 PROGRESS PHOTOGRAPHS AND DOCUMENTATION

A. Document existing conditions in the work area prior to start of demolition. Take initial photographs in quantity and at locations required to fully document existing conditions which may become concealed as the result of new Work.

B. Submit initial photographs to Owner and Architect, and discuss existing conditions that are a concern of Contractor in relation to proposed new Work.

C. Take additional photographs as Work progresses, at same locations and from same viewing angles as initial photographs.

D. Establish system for storing photographs electronically throughout the progress of construction; provide access to photographs to Owner and Architect via web interface.

E. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

F. Submit new photographs at least once a month, within 3 days after being taken.

G. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

H. Photography Type: Digital; electronic files.

I. Provide photographs of construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

J. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Final completion, minimum of ten (10) photos.

K. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. File Naming: Include project identification, date and time of view, and view identification.
   2. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.8 DIGITAL DRAWING FILES

A. Architect's Digital Files: Upon request by Contractor, a digital copy of Project Building Information Model (BIM) or CADD Drawing files will be provided as a courtesy for Contractor's limited use. Such information is not considered to be a part of the Contract Documents.
   1. Use of this information is at Contractor's sole risk.
   2. Report to Architect discrepancies, if any, between published Contract Documents and information provided according to General Conditions and other administrative requirements of the Contract.
   3. Prior to receiving digital files, execute data licensing agreement; Architect's standard form.
   4. The following files will be furnished free of charge, if requested:
      a. Building floor plans.
      b. Reflected ceiling plans.
   5. Architect is not responsible for updating or maintaining currency of digital drawing files after initially provided to Contractor.
   6. Additional digital files will be provided, upon request, at a cost of $200.00 for each file; cost will be deducted from the Contract Sum, and Architect will recover corresponding cost from Owner.
   7. Submittals prepared using any of these files as the primary submittal content without the inclusion of substantial additional content generated by Contractor according to specified requirements for applicable submittals will not be accepted or reviewed by Architect.

3.9 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using an electronic version of the form included in Section 00 63 13.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
      a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date; "ASAP", "As Soon as Possible", or "Immediately" not acceptable as reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's Suggested Resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.
   5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 3 calendar days. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.10 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Provide initial schedule at first progress meeting, and provide updated and current schedule at each progress meeting.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Include in schedule anticipated dates for each submittal to Architect, required dates of return of reviewed submittal to Contractor, and any required lead times associated with applicable submittals.
      a. Schedule submittals to expedite the Project, and coordinate submission of related items.
      b. For each submittal for review, allow minimum 15 calendar days for review, excluding delivery time from and back to Contractor.
      c. Arrange information to include specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
      b. If Contractor fails to submit a submittal schedule, Contractor will not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

B. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
   1. Submit complete package of specified submittals for each product or system, generally associated with an individual specification Section. Partial submittals will not be reviewed, and no delay claim will be considered as the result of a partial submittal being returned for proper resubmittal.
   2. Submit interior finishes samples and product data as a single package, including but not limited to finishes items specified in Divisions 09, 10, 12, and 14.
   3. Submit exterior finishes samples and product data as a single package, including but not limited to finishes items specified in Divisions 03, 04, 07, 08, and 09.
   4. Submit all structural steel framing shop drawings, product data, schedules, and other specified submittal information in a single package as specified in Division 05.

5. Submit all door, frame, and hardware product data, schedules, and other specified submittal information in a single package as specified in Division 08.

3.11 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Design data.
   3. Shop drawings.
   4. Samples for selection.
   5. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.12 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Sustainability design submittals and reports.
   2. Certificates.
   3. Test data, test reports, and evaluation reports.
   4. Inspection reports.
   5. Qualification statements.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Sample Warranties.
   9. Approvals of authorities having jurisdiction.
   10. Quality control submittals, including field test reports and inspections.
   11. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual Sections, submit them at project closeout in conformance to requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Demonstration and Training Videos.
   6. Other types specified.

D. Submit for Owner's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents - Submittals for Review and Information: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Submittals for Review: Submit electronically.

C. Submittals for Information: Submit electronically.

D. Samples: Submit the number specified in individual specification Sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.15 SUBMITTAL PROCEDURES - GENERAL

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Transmit using approved form.
      a. Use Contractor's form, subject to prior approval by Architect.
   4. Sequentially identify each item. For revised submittals use original number and a sequential combination numberical and alphabetical suffix.
   5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals not bearing Contractor's review stamp, indicating both review and approval, will not be reviewed and be returned for required review.

b. Submittals from sources other than Contractor will not be acknowledged, reviewed, or returned.

7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Send submittals in electronic format via email to Architect.
8. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 15 calendar days excluding delivery time to and from the Contractor.
   b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 calendar days.
   c. For the purpose of establishing the start of the mandated review period, submittals received after 12:00 noon will be considered as having been received on the following regular working day.
9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
14. Submittals not reviewed by Contractor will be rejected, and will not be reviewed by Architect. Claims for delay as the result of submittals not reviewed by Contractor will not be allowed.
15. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. Do not submit (Material) Safety Data Sheets for materials or products.
   5. Manufacturer's Catalog Submittals: If manufacturer's published catalog information is used as part of a submittal, include only those pages from catalog that are specifically applicable to the proposed products for this Project.
      a. Clearly identify in the submittal those specific products and components for which review and action is requested.
      b. Submittals received that do not clearly identify specific applicable products, or that include more pages than those specifically applicable to the subject submittal, will be returned as "not reviewed" and the time for submittal review will not commence until a properly scoped submittal is received by Architect.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.

2. Do not reproduce the Contract Documents to create shop drawings, unless otherwise permitted.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package to Architect's office, unless otherwise specified.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.16 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action. See below for actions to be taken.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "No Exception Taken", "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Approved as Corrected", "Approved as Noted, Resubmit for Record", or language with same legal meaning.
1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2) Non-responsive resubmittals may be rejected.
2. Not Authorizing fabrication, delivery, and installation:
a. "Revise and Resubmit".
1) Resubmit revised item, with review notations acknowledged and incorporated.
2) Non-responsive resubmittals may be rejected.
b. "Rejected".
1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.
      b. "Rejected" - Submit item complying with requirements of Contract Documents.

F. Architect's Actions:
   1. Architect will review each submittal, mark it with appropriate "action," and return it to Contractor within specified time allowance; except when it must be held for coordination, and Contractor is so advised.
   2. Where submittals include materials, products, systems, or manufacturers not specified, approved by Addendum prior to execution of the Contract, or approved in writing in conjunction with the proposed products list submittal specified in Section 01 60 00, Architect reserves the right to exceed the specified time allowance to allow sufficient time to determine the acceptability of such items, and no claim for delay by Contractor will be allowed.
   3. Where submittals include a material, product, system, or manufacturer substitution which has not been previously accepted or approved in writing, Architect reserves the right to reject such submittal and require a compliant submittal, or may direct that other action be taken by Contractor to achieve compliance with Contract Documents, and no claim for delay by Contractor will be allowed.
   4. Architect's review is for general conformance only and does not relieve Contractor from full compliance with the Contract Documents.

3.17 SUBMITTAL PROCEDURES - ELECTRONIC

A. Project Submittals: All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. It is Contractor's responsibility to submit documents in PDF format.
   3. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the contract sum.

C. Submittal Service: Use one of the following:

1. Architect's approved internet-based service.
2. Substitutions: Permitted, subject to approval of Architect.

D. Distribute electronic copies of each fully reviewed submittal to all Subcontractors involved with or having coordination responsibility for the submittal. Instruct parties to promptly report any inability to comply with requirements.

END OF SECTION 01 30 00

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.2 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 days.

C. Within 10 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 5 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit under transmittal letter form specified in Section 01 30 00 - Administrative Requirements.

1.3 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with two years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

B. Contractor's Administrative Personnel: Two years minimum experience in using and monitoring CPM schedules on comparable projects.

1.4 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.2 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Include conferences and meetings in schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

G. Coordinate content with schedule of values specified in Section 01 20 00 - Price and Payment Procedures.

H. Provide legend for symbols and abbreviations used.

3.3 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.4 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.5 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

3.6 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 32 16

SECTION 01 35 53 - SECURITY PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Security measures including formal security program, entry control, personnel identification, and miscellaneous restrictions.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: use of premises and occupancy.

1.3 SECURITY PROGRAM

A. Protect Work and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.4 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

C. Maintain log of workers and visitors, make available to Owner on request.

1.5 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number , expiration date and employer.

C. Require return of badges at expiration of their employment on the Work.

1.6 RESTRICTIONS

A. Do not allow cameras on site or photographs taken except by written approval of Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 35 53

SECTION 01 35 91 - PERIOD TREATMENT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction procedures appropriate for working with historic sites and structures.

B. Special procedures required for items and features of historical significance and value requiring special treatment.

1.2 RELATED REQUIREMENTS

A. Section 05 03 00 - Conservation Treatment for Period Metals.

1.3 DEFINITIONS

A. Consolidate: Strengthen loose or deteriorated materials in situ.

B. Dismantle: Disassemble and detach items by hand from existing construction to the limits indicated, using small hand tools and small one-hand power tools, to protect nearby historic surfaces, and legally dispose of dismantled items off-site, unless indicated to be salvaged or reinstalled.

C. Existing to Remain: Existing items that are not to be removed or dismantled. Protect materials as indicated.

D. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance subject to preservation, rehabilitation, restoration, and reconstruction procedures defined in NPS (THP). Designation “HF” and words such as “historic,” “historic fabric,” “historic materials,” “historic building materials,” 'historic character,' or words of similar meaning indicate that the material or feature is considered to have aspects that require period treatment procedures.

E. Historic Preservation Conservator: Person or firm retained by Owner to provide guidance on compliance with NPS (THP) requirements.

F. In-Kind: Matching existing in physical and visual aspects including, but not limited to, material, form, color, texture, and workmanship.

G. Matching: Blending with adjacent construction and showing no apparent difference in material type, form, detail, color, texture, finish, or other visible and readily discernible characteristics, as determined and approved by Architect.

H. Preserve: Apply measures to sustain existing form, integrity, and materials of a historic property; may include preliminary measures to protect and stabilize the property.

I. Protect: Take precautions to keep historic materials of the building from damage or injury.

J. Reconstruct: Remove existing item, refurbish existing or replicate damaged or missing components as indicated or directed, and reinstall in original position.

K. Refinish: Remove existing finishes from base material and apply new finish to match original or as otherwise indicated.

L. Remove: Detach or dismantle items from existing construction and dispose of them off-site, unless items are indicated to be salvaged or reinstalled.

M. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall in original location or in other location where indicated.

N. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label, and deliver salvaged items to Owner in ready-for-reuse condition.

O. Repair: Correct damage and defects, retaining existing materials, features, and finishes and employing as few new materials as possible. Includes patching, piecing-in, splicing, consolidating, or reinforcing or upgrading materials with appropriate and approved materials and methods.

P. Replace: Remove, duplicate, and reinstall entire item with new material. Use original item as the pattern unless noted otherwise.

Q. Replicate or Reproduce: Fabricate a new item in exact detail, materials, and finish as the original, unless otherwise indicated; referred to as replicas or reproductions.

R. Restore: Return to original condition; return to the condition extant during the period of interpretation.

S. Retain: Existing to remain; keep existing items that are not to be removed or dismantled.

T. Reversible: New construction work, treatment, or processes that can be removed or undone in the future without damaging historic materials.

U. Stabilize: Provide reinforcement of unsafe or deteriorated items and maintain the present, essential form; reestablish weather-resistant enclosure.

V. Strip: Remove existing finish down to base material, unless otherwise indicated.

W. NPS (THP) - The Secretary of The Interior’s Standards For the Treatment of Historic Properties with Guidelines For Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

B. Sequencing: Ensure that facility services and utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Quality Control Submittals:
   1. Practices and Treatments: Use NPS (THP) recommendations as a general guide for proposed practices and treatments, modified as necessary to suit project requirements and conditions.
   2. Phase Programs: Submit program, in writing, for each phase of period treatment procedures, indicating:
      a. Protection of surrounding materials.
      b. Materials, methods, and equipment to be used.

C. Restoration specialist's qualification statement.

D. Project supervisor's qualification statement.

E. Testing agency's qualification statement.

F. Existing Conditions Documentation: Prior to commencement of period treatment activities, document with digital photography, digital videography, digital photogrammetry, or similar means the existing exterior walls, interior walls, windows, interior finishes, trim, and decorative elements indicated as subject to period treatment.
   1. Submit separate documentation for each designated period treatment work area indicated on drawings.
   2. Document historic items and features. Submit to-scale drawings of items indicated to be replicated. Provide configurations, details, and materials composition, as applicable.

G. Project Record Documents:
   1. Record of conditions encountered before, during, and after completion of work.
   2. Types and locations of identification and labels of new or replacement materials and features.

1.6 QUALITY ASSURANCE

A. Owner has employed a historic preservation conservator to advise the project team.

B. Restoration Specialist Qualifications: Company specializing in restoration work, with at least three years of documented experience in comparable projects, and employing personnel skilled in the procedures and operations required by project scope of work.

C. Project Supervisor: Master craftsperson with at least three years of documented experience in leading work similar in size and scope to this project.

D. Craftspersons: Perform specific cleaning, repairing, and refinishing tasks; have demonstrated applicable successful experience in past historical preservation and restoration projects.

E. Testing Agency Qualifications: Independent testing laboratory with specific expertise in historic materials technology to examine materials prior to use and continuously inspect the work for compliance with requirements of construction documents; approved by Architect.

F. Documents at Project Site: Maintain at the project site a copy of each referenced document for execution requirements.

1.7 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Arrange for one or more demonstration mock-ups, size as directed by Architect, using each type of proposed cleaning, repairing, and refinishing materials and methods.
   1. Refer to related technical period treatment sections for additional mock-up requirements.
   2. Perform demonstrations in presence of Architect and historical preservation specialist (conservator).
   3. Proceed with mock-up work only after initial approval of proposed materials and methods by Architect.
      a. Maintain the mock-up in its approved condition until final acceptance of the completed work.

C. Locate where directed.

D. Mock-ups may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:
   1. Use and reuse materials original to the existing structure wherever practical. Store removed materials under cover, inside, and protect from damage.
   2. Label specific pieces or items to be removed. Label consistently and inconspicuously indicating original location, and document original position.
   3. Protect materials during storage and construction from rain, snow, or groundwater and from soiling with earth or other materials.
      a. Store cementitious materials off ground, under cover, and in a dry location. Protect liquid components from freezing.

b. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

4. Store restoration and cleaning chemicals off-site or in metal cabinets on-site. Do not leave cans open or out of the cabinet overnight. Do not store in unlabeled containers.

1.9 FIELD CONDITIONS

A. Environmental Requirements:

1. Wet or Humid Weather:
   a. Do not remove exterior elements of structures when raining or rain is forecasted.
   b. Do not apply primer, paint, putty, or epoxy when the relative humidity is above 80 percent and in accordance with manufacturer's recommendations.
   c. Do not repair exterior features in rain or fog.
2. Hot Weather: Work in the shade when the temperature is above 75 degrees F. Shield features or areas from excessive heat with protective netting or tarpaulins.
3. Cold Weather: Do not perform exterior wet work when the air temperature is below 40 degrees F.

B. Exterior Cleaning Procedures: Perform cleaning and rinsing of the exterior elements only during daylight hours.

C. Protection of Existing Elements: In accordance with manufacturer's recommendations for use of proposed products and procedures and compatibility with adjacent historic building materials, components, and vegetation.

PART 2 - PRODUCTS

2.1 PROTECTION PRODUCTS

A. Adhesive Walk-Off, Tacky Mats: Mats with multiple layers of disposable, adhesive-coated sheets.

2.2 CLEANING MATERIALS

A. General: Do not use incompatible materials that may contribute to damage of the element being cleaned.

B. Use products specifically intended by the manufacturer for cleaning historic materials or elements.

2.3 REPAIR MATERIALS

A. General: Do not use incompatible materials contributing to damage of repaired elements.

B. Matching: Unless otherwise required, use new materials that match historic materials in type, design, dimension, texture, detailing, and external appearance.

2.4 REFINISHING MATERIALS

A. General: Do not use incompatible materials that may contribute to damage of the element being refinished.

B. Matching: Unless otherwise required, use new materials that match historic materials in type, design, texture, detailing, and external appearance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Dismantling: Follow the reverse order of original construction to the extent practicable.

3.2 PERIOD TREATMENT SPECIAL PROCEDURES

A. Period Treatment Work: Intended to halt deterioration and stabilize the condition of building elements. Repair is necessary where preservation is not sufficient to ensure mid- to long-term survival. Select repair means and methods based on minimal disturbance of existing materials, systems, and assemblies.

B. Review proposed procedures for each type of element with Architect.

C. Salvage as much existing material of each element as practicable; repair, consolidate, and restore rather than renew.

D. Repair rather than replace architectural features wherever possible. Repair or replace missing features with accurate duplications.

E. Use reversible processes wherever possible.

F. Use methods that do not significantly change the aesthetic effect of existing elements.

G. Document condition of items being worked on before, during, and after work is completed.

H. Protect existing materials and substrates from damage.

I. Protect existing elements and features removed, cleaned, and reused from material damage.
   1. Label salvaged items and features and store at project site, in designated location; protect from damage.

J. Exterior Work Procedures: Protect parts of the facility not included in this work from damage.
   1. Protect adjacent property from damage from this work.

2. Do not attach scaffolding, ladders, and working platforms to building unless approved in writing by the Architect.
3. Seal exterior openings to prevent entry of dust, debris, and water into the building.
4. Protect landscape work adjacent to or within period treatment work areas:
    a. Set scaffolding and ladder legs away from plants. Submit pruning requests to Architect.
    b. Provide plank barriers to protect tree trunks. Bind spreading shrubs.
    c. Use covering methods and materials that allow plants to breathe. Remove covering at the end of each workday. Do not cover plant material with a waterproof membrane for more than 8 hours at one time.

K. Interior Work Procedures: Protect parts of the facility not being cleaned or repaired from effects of this work.
1. Provide enclosures to protect against spread of dust, debris, and water at or beyond the work area.
2. Mask or cover adjacent surfaces and permanent equipment. Secure coverings; do not use adhesive type tape or nails. Do not use impervious sheeting.

END OF SECTION 01 35 91

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

L. Basis of design specifications.

M. Delegated design requirements.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 42 16 - Definitions.

C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

D. Individual Specification Sections: Special inspections and tests required, and standards for special inspections and tests.

1.3 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
      b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.4 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions to support construction equipment.

1.5 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.
   1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
   1. Delegated engineering design services specified in individual Sections.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
   2. Include required product data and shop drawings.
   3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
   4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
   5. Provide additional copies of design data for Architect's design consultants, including but not limited to structural engineer, mechanical engineer, plumbing engineer, and electrical engineer; transmit to each design consultant's address concurrently, if requested by Architect.

D. Test Reports: After each test or inspection, testing agency will promptly submit electronic copies of report to Architect and to Contractor.
   1. Transmit one copy of each report to Owner, if requested.
   2. Provide additional copies of each test/inspection report for Architect's design consultants, including but not limited to structural engineer, mechanical engineer, plumbing engineer, electrical engineer, and specialty consultant; transmit to each design consultant's address concurrently, if requested by Architect.
   3. Include in content of reports:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications Section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.

j. Compliance with Contract Documents.

k. When requested by Architect, provide interpretation of results.

4. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.8 REFERENCES AND STANDARDS - SEE SECTION 01 42 19

1.9 QUALITY CONTROL - GENERAL

A. Maintain quality control over subcontractors, suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality according to the requirements of the Contract Documents.

B. Special Testing and Inspection: It is recognized that specified special testing and inspection program is intended to assist Contractor, Owner, Architect, and jurisdictional authorities in nominal determination of probable compliance with specified requirements for certain elements of the Work. This program is not intended to limit Contractor's standard quality control program.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

1.11 BASIS OF DESIGN SPECIFICATIONS

A. Individual specification Sections may include a Basis of Design Manufacturer or Product, which forms the basis of the specifications, Drawing details, and other requirements of the Contract Documents. Unless the specifications have identified that no substitutions will be permitted, the specified Basis of Design Manufacturer or Product is not intended to exclude other manufacturers, products, or systems which comply with the requirements of the Contract Documents, subject to the provisions and requirements specified in individual specification Sections.
   1. See Section 01 60 00 - Product Requirements for product selection options.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.
   1. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

C. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

D. Have work performed by persons qualified to produce required and specified quality.

E. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

A. Mock-ups, General: Full-size installation of physical assemblies consisting of multiple systems and products constructed on-site, or at designated off-site location, in advance of final work to allow the Architect an opportunity to view and approve qualities of materials and execution and establish the standard by which the Work will be judged. Mockups are not Samples.

B. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

C. Field Sample Panels: Assemble a composite panel separate from building for review.
   1. Construct composite panel using each system's required components specified in individual Sections of the specifications, or as indicated on Drawings. Provide adequate supporting structure for mockup materials as necessary.
   2. Refer to individual Sections for size requirements.
   3. Once field sample panel has been accepted by Architect, maintain in accepted condition for remaining duration of Contract Time. Remove field sample panel and clear area immediately prior to Substantial Completion.

D. Integrated Mock-ups: Construct integrated mock-ups as indicated on Drawings. Coordinate installation of materials and products as required in individual Specification Sections.
   1. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work.

E. Notify Architect seven (7) working days in advance of dates and times when mock-ups will be completed and ready for review and evaluation.

F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

G. Assemble and erect specified items with specified backing materials, attachment and anchorage devices, weather barriers, flashings, sealants, applied coatings, surface treatments, and finishes.

H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

I. Accepted mock-ups shall be a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Architect and is specified in product specification Sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
   1. Comply with construction waste management requirements specified in Section 01 74 19.

3.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

A. See individual specification Sections and structural Drawings for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Re-testing: Performed by same agency if required because of non-conformance to specified requirements, on instructions from Architect.
      a. Paid for by Contractor if required because of non-conformance with specified requirements.

3.5 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment,test, adjust and balance of equipment, and inspection of installed materials as applicable, and to initiate instructions when necessary.
   1. Manufacturer's field representative will be required to submit daily reports as specified in this Section, when daily observations and inspections are specified in individual Sections.

B. Submit qualifications of observer to Architect minimum 30 days in advance of required observations.
   1. Observer subject to approval of Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment, with Owner's consent.

END OF SECTION 01 40 00

SECTION 01 41 00 - REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

A. Obtain and pay for required permits, fees, licenses, and inspections as stipulated in the Agreement.

B. Arrange for required regulatory inspections and approvals.

C. Comply with applicable codes and regulations as stipulated in the Agreement.
   1. Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities.
   2. Contractor is required to promptly report to Architect any nonconformity discovered by or made known to Contractor as a Request for Information.

1.2 SUMMARY OF APPLICABLE CODES

A. See Drawings for additional information.

1.3 RELATED REQUIREMENTS

1.4 QUALITY ASSURANCE

A. Become familiar with applicable requirements of codes and regulations.

B. Verify that substituted materials and equipment used in the Work meet or exceed requirements of applicable codes and regulations.

C. Comply with execution requirements of authority having jurisdiction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 41 00

SECTION 01 42 16 - DEFINITIONS

PART 1 GENERAL

1.1 SUMMARY

A. This Section supplements the definitions contained in the General Conditions and other Contract Documents.

B. Other definitions are included in individual specification Sections.

C. Limitations: Definitions and explanations are not necessarily complete or exclusive, but are generally applicable to the Work to the extent such definitions or explanations are not stated more explicitly in other provisions of the Contract Documents.

1.2 SPECIFICATION EXPLANATIONS

A. General: Explanations are provided to assist in understanding format, language, implied requirements and conventions of specification content. None of these explanations will be interpreted to modify the substance of content requirements.

B. Division 01 General Requirements: Expand on the broad provisions of the Conditions of the Contract, and govern the execution of the work of all Sections of the specifications. Division 01 General Requirements specify administrative and procedural requirements relating to execution of the Work, and temporary facilities for use during the construction period.

C. Sections and Divisions: The basic unit of specification text is the "Section," each of which is named and numbered. These are organized into related families called "Divisions," which generally conform to the most current edition of "MasterFormat" as published by CSI. Any Section title is not intended to limit meaning or content of Section, nor to be fully descriptive of requirements specified therein, nor to be an integral part of the text.

D. Imperative Language: Used generally in the Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe the responsibilities which must be fulfilled either indirectly by Contractor, or when so noted by others.

1.3 SPECIFICATION CONTENT CONVENTIONS

A. Overlapping Requirements: Where compliance with two or more industry standards or sets of requirements is specified, and overlapping of those requirements also establishes different or conflicting minimums or levels of quality, the more stringent requirement will be enforced (which is generally the more costly level).

B. Refer apparently equal but different requirements and uncertainties as to which level of quality is required to Architect for interpretation or decision before proceeding.

C. Specification Minimum: In every instance, the specified requirement is the minimum to be performed or fulfilled. In complying with minimum requirements, the indicated numeric values are either minimums or maximums as noted or as appropriate for the context of the requirement. Refer instances of uncertainty to Architect for decision.

D. Abbreviations: The language of the Specifications and elsewhere in the Contract Documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual work abbreviations of a self-explanatory nature have been included in the text.

E. Trade associations and general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular wherever applicable and wherever the full context of the requirements so indicate.

F. Specialists: In certain instances the Specification text may require that specific work be assigned to certain specialists or expert entities for the performance of those units of the Work. These are specified as requirements on which the Contractor has no choice or option.

1.4 DEFINITIONS

A. Approve/Approved: Where used in conjunction with Architect's or Architect's consultant response to submittals, requests, applications, inquiries, reports, and claims by Contractor, the meaning of the term "approve" or "approved" will be held to the limitations of Architect's responsibilities and duties as specified in Section 01 30 00 and stipulated in the General Conditions of the Contract. In no case will approval by Architect be interpreted as an assurance to Contractor that the requirements of the Contract Documents have been fulfilled.

B. By Others: Work performed by entities outside the Contract; interchangeable with "NIC" or "Not in Contract."

C. Contract Documents: Those documents defined in the Owner-Contractor Agreement (Contract) as applicable to the construction of the Project by Contractor.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

D. Contractor's Option: Where materials, products, systems or methods are specified to be at Contractor's option, the choice of which material, method, product, or system will be used is solely Contractor's. There will be no change in Contract Sum or Time because of such choice.

E. Demolish (Demo): Dismantle a defined component of existing construction, remove it from the Site, and dispose of it either as specified or in lawful manner.

F. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect", "requested by Architect", etc. However, no such implied meaning will be interpreted to extend Architect's responsibility into Contractor's area of construction supervision.

G. Dispose: Remove from the Project Site in lawful manner.

H. Drawings: Capitalized term referring to the drawings prepared by Architect and its design consultants, and by any Owner consultants as applicable; bound and published as a sub-set of the Contract Documents as defined in Owner-Contractor Agreement (Contract). Non-capitalized term "drawings" used in the Contract Documents generally refers to other drawings not part of the Contract Documents, unless the context explicitly indicates otherwise.

I. Equipment: Defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including connections (wiring, piping, etc.).

J. Furnish: To supply, deliver, unload, and inspect for damage (by Contractor).

K. General Requirements: Provisions or requirements of Division 01 specification Sections. General Requirements apply to the entire Work of the Contract and, where so indicated, to other elements of work which are included in the Project. See specification explanations in this Section.

L. Indicated: Cross reference to details, notes or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar means of recording requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader accomplish the cross reference, and no limitation is intended except as specifically noted.

M. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use (by Contractor).

N. Installer: The entity (person or firm) engaged by Contractor or his Subcontractor or Sub-subcontractor for the performance of a particular unit of work at the project site, including installations, erection, application and similar required operations.

O. Material(s): Defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.

P. Not in Contract (NIC): Work performed by entities outside the Contract; interchangeable with "By Others."

Q. Product(s): Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

R. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the Specifications.

S. Provide: To furnish and install.

T. Reinstall: Install a removed component of existing construction into new construction as indicated.

U. Remove: Dismantle a defined component of existing construction in a manner which protects and preserves the component for future use/installation; definition includes lawful disposal, unless otherwise specifically indicated to be reinstalled, salvaged, or other described action.

V. Salvage: Remove in a manner preserving the existing condition and integrity of the component, set aside, store and protect for future reinstallation.

W. Supply: Same as Furnish.

X. Testing Agency/Laboratory: An independent entity engaged to perform specific inspections or tests of the Work, either at the project site or elsewhere; and to report and (if required) interpret the results of those inspections or tests.

Y. Work (the Work): Capitalized term referring to the entire scope of work of the Project as defined in the Contract Documents. Non-capitalized term "work" used in the Contract Documents generally refers to work by specific trades or other entities as components or phases of the Work, unless the context explicitly indicates otherwise.

1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 42 16

SECTION 01 42 19 - REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.2 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with the most current date of issue for each reference standard as of the date the Contract Documents are submitted for building permit, except where a different reference standard issue date is established by applicable code.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 42 19

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

C. Temporary barriers and enclosures.

D. Waste removal facilities and services.

E. Project identification sign.

1.2 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power, consisting of connection to existing facilities.
   2. Water supply and sanitary, consisting of connection to existing facilities.

1.3 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Windows-based personal computer or lap-top computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Telephone Land Lines: One line, minimum; one handset per line.
   3. Internet Connections: Minimum of one; Cable modem or faster.
   4. Email: Account/address reserved for project use.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is permitted at locations assigned by Owner.

C. Maintain daily in clean and sanitary condition.

D. At end of construction, return facilities to same or better condition as originally found.

1.5 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.6 INTERIOR ENCLOSURES

A. Provide temporary partitions as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.7 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

F. Do not allow vehicle parking on existing pavement, unless authorized by Owner in writing.

1.8 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site weekly.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.9 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner.

B. No other signs are allowed without Owner permission except those required by law.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Identification of Owner-supplied products.

B. Section 01 25 00 - Substitution Procedures: Substitutions made after Contract award.

C. Section 01 40 00 - Quality Requirements: Product quality monitoring.

D. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 15 days after date of Notice to Proceed.
2. For products specified only by reference standards, list applicable reference standards.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Indoor Emissions and VOC Content Restrictions: Submit evidence of compliance with specified requirements.
   1. Comply with requirements in Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

PART 2 PRODUCTS

2.1 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 01 40 00 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Containing lead, cadmium, or asbestos.

D. Where all other criteria are met, give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste. See Section 01 74 19
   4. Are made of recycled materials.
   5. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
   6. Are Cradle-to-Cradle Certified.
   7. Have a published Environmental Product Declaration (EPD).
   8. Have a published Health Product Declaration (HPD).

2.2 PRODUCT SELECTIONS

A. General:
   1. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements for comparable products to obtain approval for use of an unnamed product.

2. Submit additional documentation, when requested by Architect, to establish equivalency of proposed products. Evaluation of "comparable products" and "or equal" products are by the Architect, whose determination is final.

B. Definitions:
1. Basis-of-Design (BOD) Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "Basis of Design," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers.
2. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

C. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable products when the following conditions are satisfied. If the following conditions are not satisfied, Architect may either require a Substitution Request or return the comparable product request without action, except to record noncompliance with these requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product provides specified warranty.
3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
4. Samples, if requested.
5. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Product Selection Options:
1. Products Specified by Reference Standards or by Description Only:
   a. Use any product meeting those standards or description.
2. Products Specified by Naming One or More Manufacturers without a Provision for Substitutions (closed spec):
   a. Use a product of one of the listed manufacturers and meeting specifications.
   b. No comparable products or substitutions will be allowed (closed spec).
3. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions:

a. Use a product of one of the listed manufacturers and meeting specifications.
b. Submit a comparable product for consideration of an unnamed product.
c. Submit a request for substitution for an unnamed product that does not meet specifications or is not determined to be comparable.

4. Products Specified by Naming a Basis of Design with or without Other Named Manufacturers without a Provision for Substitutions (closed spec):
   a. Use the Basis of Design product.
   b. Use a product of one of the listed manufacturers, if applicable, and meeting specifications.
   c. No comparable products or substitutions will be allowed (closed spec).
5. Products Specified by Naming a Basis of Design with a Provision for Substitutions:
   a. Use the Basis of Design product.
   b. Use a product of one of the listed manufacturers, if applicable, and meeting specifications.
   c. Submit a comparable product for consideration of an unnamed product.
   d. Submit a request for substitution for an unnamed product that does not meet specifications or is not determined to be comparable.

2.3 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification Sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures, for procedural requirements for proposed substitutions.

B. Architect may consider requests for substitutions when one or more of the following conditions exist, as determined by Architect. If one or more of the following conditions are determined not to exist, Architect may not consider request further, and may take no action except to record the request and its non-compliance. Consideration may be given if substitution request:
   1. Offers Owner substantial advantage in cost, time, energy conservation, or other consideration, after deducting additional responsibilities Owner must assume as the result.
   2. Does not require extensive modification of Contract Documents.
   3. Is consistent with intent of Contract Documents, and will produce intended work results.
   4. Is fully documented and properly submitted.
   5. Will not adversely affect Contractor's construction schedule.

6. Resolves specified Product being unable to receive required approval by Authority Having Jurisdiction (AHJ), and substitution has received such approval prior to submission.
7. Resolves incompatibility of specified Product with other related Products, and substitution is compatible with related Products.
8. Resolves non-coordination of specified Product with other related Products, and substitution is coordinated with related Products.
9. Provides specified warranty when specified Product cannot be provided with specified warranty.
10. Is proposed for a Product that, through no fault of Contractor, becomes unavailable or unsuitable due to regulatory change.
11. Will be considered if a Product cannot be provided within the Contract Time; Architect will not consider substitution if Product cannot be provided as the result of Contractor's failure to schedule and coordinate the Work as required by Contract Documents.
12. Has been coordinated with and among all affected Subcontractors and other portions of the Work, and is acceptable to all affected Subcontractors.

3.2 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
1. Designate submittals and delivery date for each product in progress schedule.
2. Review Owner reviewed shop drawings, product data, and samples.
3. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
4. Handle, store, install and finish products.
5. Provide installation inspections required by jurisdictional authorities.
6. Repair or replace items damaged after receipt.

3.3 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

SECTION 01 61 16 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for VOC-Content-Restricted products.

B. Requirement for installer certification that they did not use any non-compliant products.

C. Section 01 30 00 - Administrative Requirements: Submittal procedures.

D. Section 01 61 17 - Accessory Material VOC Content Certification Form: Form for reporting emissions and VOC content.

1.2 DEFINITIONS

A. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Other products when specifically stated in the specifications.

B. Interior of Building: Anywhere inside the exterior weather barrier or air barrier.

C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

D. GreenSeal GS-36 - Standard for Adhesives for Commercial Use.

E. SCAQMD 1113 - Architectural Coatings.

F. SCAQMD 1168 - Adhesive and Sealant Applications.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.5 QUALITY ASSURANCE

A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Aerosol Adhesives: GreenSeal GS-36.
   3. Joint Sealants: SCAQMD 1168 Rule.
   4. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 01 61 16

SECTION 01 61 17 - ACCESSORY MATERIAL VOC CONTENT CERTIFICATION FORM

*** ATTACH THIS FORM TO EVERY SUBMITTAL ***

1.1 USE OF THIS FORM:

A. Because installers are allowed and directed to choose accessory materials suitable for the applicable installation, there is a possibility that such accessory materials might contain VOC content in excess of that permitted, especially where such materials have not been explicitly specified.

B. Contractor is required to obtain and submit this form from each installer of work on this project.

C. For each product category listed, circle the correct words in brackets: either [HAS] or [HAS NOT].

D. If any of these accessory materials has been used, attach to this form product data and MSDS sheet for each such product.

1.2 VOC CONTENT RESTRICTIONS ARE SPECIFIED IN SECTION 01 61 16.

1.3 PRODUCT CERTIFICATION

A. I certify that the installation work of my firm on this project:
   1. [HAS] [HAS NOT] required the use of any ADHESIVES.
   2. [HAS] [HAS NOT] required the use of any JOINT SEALANTS.
   3. [HAS] [HAS NOT] required the use of any PAINTS OR COATINGS.

B. Product data and MSDS sheets are attached.

1.4 CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)

A. Firm Name: _____

B. Print Name: _____

C. Signature: _____

D. Title: _____ (officer of company)

E. Date: _____

END OF SECTION 01 61 17

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures.

B. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

C. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

D. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

E. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

F. Section 07 84 00 - Firestopping.

1.3 DEFINITIONS

A. Verify, Field Verify, or Drawing Abbreviation: Use on Drawings or in specifications is intended to alert Contractor that indicated measurement or description of work may not be fully determined without comparing verified dimension in larger context or other dependent measurements due to specific product, actual versus nominal dimensions, or measurements of existing conditions.
   1. Notify Architect of discrepancies between dimensions shown and field layout or measurements.

1.4 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in Request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor, if applicable.
      g. Written permission of affected separate Contractor, if applicable.
      h. Date and time work will be executed.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.6 QUALIFICATIONS

A. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.7 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.8 COORDINATION

A. Coordinate scheduling, submittals, and work of the various Sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification Sections, convene a pre-installation meeting at the site prior to commencing work of the Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect at least 7 calendar days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review sequencing and coordination with related work.
   3. Discuss field observations, problems, and decisions.
   4. Identify problems that impede, or will impede, planned progress.
   5. Discuss corrective measures.
   6. Review quality standards and mock-ups.
   7. Review field testing requirements.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Promptly notify Architect of any discrepancies discovered.

B. Utilize recognized engineering survey practices.

C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Grid or axis for structures.
   2. Controlling lines and levels required for Work.

D. Periodically verify layouts by same means.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

A. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
   4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

B. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

C. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

D. Clean existing systems and equipment.

E. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

F. Do not begin new construction in alterations areas before demolition is complete.

G. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.

3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials, resulting in clean and neat edges, using masonry saw or core drill. Cutting rigid materials using chisels, impact or pneumatic tools is not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from wall cavities, pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.9 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification Sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

I. Failure to protect installed and existing work may result in withholding of payments to Contractor as determined by Architect. Damage resulting from failure to protect installed and existing work must be fully repaired or replaced as applicable to the satisfaction of Architect at no additional cost to Owner.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.

B. Use cleaning materials that are nonhazardous.

C. Clean glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, and vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Notify Architect in writing when work is considered ready for Architect's Substantial Completion inspection.
   1. Prerequisite for Substantial Completion: In addition to definition of Substantial Completion in the General Conditions or Agreement, Substantial Completion is not considered achieved until Certificate of Occupancy is issued by primary jurisdictional authority, allowing Owner to fully occupy or utilize building and associated facilities for intended use in all respects.
   2. Submittals Prior to Substantial Completion: Submit Closeout Documents a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion.
      a. Closeout Documents: As specified in Section 01 78 00 - Closeout Submittals.
   3. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

a. Advise Owner of pending insurance changeover requirements.
b. Complete startup and testing of systems and equipment.
c. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 - Demonstration and Training.
d. Advise Owner of changeover in heat and other utilities.
e. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
f. Complete final cleaning requirements, including touchup painting.

C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

F. Accompany Owner and Architect on Contractor's preliminary final inspection.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification Sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of Owner.

END OF SECTION 01 70 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

A. Owner desires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean Dimensional Wood: May be used as blocking or furring.
   5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

E. Optional Recycling, Salvage, and Reuse: The following are encouraged to be diverted from landfills to achieve the Owner's sustainability goals:
   1. Concrete.
   2. CMU.
   3. Glass.
   4. Gypsum drywall
   5. Paint.
   6. Plastics.
   7. Foam insulation.
   8. Carpet.

F. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.
   5. Incineration, either on- or off-site.

G. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.3 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

1. This definition also includes trash and waste generated by construction workers and Contractor's personnel while engaged in the work and on lunch and other breaks, including but not limited to items such as lunch bags, food wrappers, drinking cups, and similar trash and waste.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.

2. Preconstruction meeting.
3. Regular job-site meetings.
4. Job safety meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable, if required by recycling company.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
   5. Locate enclosures out of the way of construction traffic.
   6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
   8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01 74 19

SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.3 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product Section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

E. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products, if any.

F. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

H. Additional information as specified in individual product specification sections.

I. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.3 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

D. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

E. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

F. Include test and balancing reports.

3.4 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into electronic files for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification Sections.
   1. Where systems involve more than one specification Section, provide separate electronic bookmarked tab for each system.

B. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

E. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

F. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Electronic scans warranties and bonds.
   4. Design Data: To allow for addition of design data furnished by Architect or others, provide a bookmarked divider page labeled "Design Data" and allow for insertion of additional electronic data, if applicable.

3.5 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

1. Warranties must clearly state that warranty commences on Date of Substantial Completion, and the actual Date of Substantial Completion according to the Contract must be clearly stated on the warranty form.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION 01 78 00

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Demonstration of products and systems where indicated in specific specification Sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Finishes, including flooring, wall finishes, ceiling finishes.
   2. Fixtures and fittings.
   3. Items specified in individual product Sections.

1.2 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Individual Specification Sections: Additional requirements for demonstration and training.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.

e. Objectives of training and suggested methods of ensuring adequate training.
f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
g. Media to be used, such as slides, hand-outs, etc.
h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: DVD Disc or accepted alternative media.
2. Label each disc and container with session identification and date.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this Section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.

8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

D. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.3 DEFINITIONS

A. Demolition (Demo): Dismantle, raze, destroy or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
   1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
   2. Demolition firm qualifications.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.7 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of five years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 DEMOLITION

A. Remove portions of existing buildings as indicated on Drawings.

B. Remove other items as specifically indicated on Drawings.

C. Remove items specifically indicated for salvage, relocation, and recycling.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.

4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until existing elements to be salvaged or relocated have been removed.

D. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

E. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

F. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

3.3 EXISTING UTILITIES

A. Protect existing utilities to remain from damage.

B. Do not disrupt public utilities without permit from authority having jurisdiction.

C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

G. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from areas that remain occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction.
   2. Provide sound retardant partitions of construction and in locations indicated on drawings.

C. Maintain building security; take care to prevent unauthorized entry.

D. Remove existing work as indicated and required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
   2. Remove items indicated on drawings.
   3. Core Drilling: Core drill slabs as required to install new items as detailed on Drawings. If required based on existing slab conditions, employ methods of detecting existing tensioned and un-tensioned reinforcing, and other embedded items, so as not to damage existing facilities and equipment.
   4. Powder-Actuated Fasteners and Post-installed Anchors: Verify existing slab conditions employing methods of detection specified for core drilling; locate fasteners and anchors to avoid structural damage to existing slabs and existing tensioned reinforcing.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.

4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

3.5 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 41 19

SECTION 03 30 00 - CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Structural slabs on metal deck.
2. Furnishing and installing all required anchors and inserts.
3. Placing in the forms all inserts, anchors, anchor bolts, bearing plates and the like furnished by other trades for casting into the concrete and cleaning of same after stripping of forms.
4. Protection of all inserts, anchors, hangers, sleeves and supports furnished and set by others for the attachment of other work to the concrete, or required to permit the passage of other work through the concrete.
5. Supply, fabricate and place all required reinforcing bars, mesh and other reinforcement for concrete where shown, called for, and/or required complete with proper supporting devices.
6. Erection and removal of all formwork required to properly complete the work.
7. Finishing of all concrete work as hereinafter specified.
8. Curing and protection of all concrete work.
9. Site concrete consisting of curbs, walls, pads, boxes and the like as shown on the drawings.
10. Floor sealers and dust-proofing of all areas exposed and/or covered with carpet.
11. Cutting, patching, grouting, repairing and pointing up as required.
12. Grouting of all beam bearing plates and column base plates.
13. Equipment pads as required.
14. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
15. Waste Management

B. Related Requirements:

1. Division 01 Section “Construction Waste Management and Disposal”
2. Division 01 Section “Sustainable Design Requirements”
3. Division 04 Section “Unit Masonry”
4. Division 05 Section “Structural Steel”
5. Division 05 Section “Metal Deck”
6. Division 05 Section “Metal Fabrications”
7. Division 06 Section “Rough Carpentry”
8. Division 07 Section “Joint Sealants”

1.3 SUBMITTALS

A. Product Data: Submit data for proprietary materials and items, including the following:

1. Reinforcement
2. Supports for reinforcement
3. Forming accessories
4. Admixtures
5. Patching compounds
6. Joint systems
7. Curing compounds
8. Dry-shake finish materials
9. Mechanical splice couplers.
10. Others items as requested by Architect.

B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welded splices, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcement required for openings through concrete structures. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.

1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
2. Obtain and coordinate information for sleeves, openings, and conduits in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of all openings, sleeves, and conduits and incorporate this information on the reinforcing drawings.
3. Only those splices indicated on the approved shop drawings will be permitted.

C. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

D. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.

1. Location of contraction joints is subject to approval of the Architect.

E. The use of the Architect’s or Engineer of Record's electronic drawing files as a base for the reinforcement, formwork, and joint layout shop drawings will be permitted at the request of the detailer/designer upon completion and return of the waiver form. The use of the Architect’s or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The detailer/designer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to detailer/designer and their use will be at the detailer/designer’s sole risk and without liability to the design team. The detailer/designer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing

sections and details. The detailer/designer shall also remove all reference to work not included in the concrete contract.

F. Scaling of the Architect's or Engineer of Record's drawings is not permitted. This applies to hard paper, electronic, and all other versions.

G. Samples: Submit samples of materials as requested by Architect, including names, sources and descriptions.

H. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material certificates. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

I. Certification that pozzolanic materials conforms to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.

J. Certified recycled steel content. Provide cut sheets clearly indicating whether the rebar used meets the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.

K. Recycled Aggregate: Provide laboratory reports indicating that aggregate conforms to ASTM C33 for structural concrete or ASTM D1241-00 for sub-base material. Provide cut sheets clearly indicating the source, total weight and volume of the recycled aggregate. If aggregate provided is a mix of virgin and recycled aggregates obtain a written affidavit from the manufacturer stating the recycled content percentage

L. VOC content for curing compounds, sealants and release agents: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each curing compound, sealant, hardener and release agent used highlighting VOC contents. VOC content must be less than or equal to limits stated under "PRODUCTS".

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

D. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. New York City Building Code, Latest Edition

2. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary.”
3. ACI 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight and mass concrete.”
4. ACI 211.2, “Standard Practice for Selecting Proportions for Structural Lightweight Concrete.”
5. ACI 214R, “Evaluation of Strength Test Results of Concrete.”
6. ACI 232.2R, “Use of Fly Ash in Concrete.”
7. ACI 233R, “Guide to Use of Slag Cement in Concrete and Mortar.”
8. ACI 234, “Guide for the Use of Silica Fume in Concrete.”
9. ACI 301 “Specifications for Structural Concrete.”
10. ACI 302.1R “Guide for Concrete Floor and Slab Construction.”
11. ACI 304R, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”
12. ACI 308.1 “Standard Specification for Curing Concrete.”
13. ACI 309R, “Guide for Consolidation of Concrete.”
14. ACI 311.4R, “Guide for Concrete Inspections.”
15. ACI 315, “Details and Detailing of Concrete Reinforcement.”
16. ACI 318 “Building Code Requirements for Structural Concrete and Commentary.”
17. ACI 347 “Guide to Formwork of Concrete.”
18. Concrete Reinforcing Steel Institute, (CRSI) “Manual of Standard Practice.”
19. CRSI-WCRSI, “Placing Reinforcing Bars.”
20. AWS D1.4, “Structural Welding Code Reinforcing Steel.”
21. The ACI Field Reference Manual, SP-15 shall be kept at the job site, and the practices set forth therein shall be strictly adhered to.
22. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
23. AASHTO T 318, “Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.”

E. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

F. Preconstruction Meeting:

1. At least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The Contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.
2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

    a. Contractor's superintendent
    b. Concrete subcontractor
    c. Ready-mix concrete producer
    d. Admixture manufacturer(s)
    e. Concrete pumping equipment manufacturer.

3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by the contractor to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner or owner's representative, Architect, and Engineer of Record.

4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing can produce the concrete quality required by these specifications.
5. The Engineer of Record will be present at the conference. The Contractor shall notify the Engineer of Record at least 10 days prior to the scheduled date of the conference.

1.5 PROJECT CONDITIONS

A. The Contractor, before commencing work, shall examine all adjoining work on which this work is in any way dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Architect or Engineer of Record any condition which prevents this contractor from performing first class work.

B. Protect adjacent finish materials against spatter during concrete placement.

C. Provide all barricades and safeguards at all pits, holes, shaft and stairway openings, etc., to prevent injury to workmen and others within and about the premises. Also provide all safeguards as required by the Building Code, OSHA, or any other departments having jurisdiction. Take full responsibility for all safety precautions and methods.

D. Procedure of Work: The contractor shall keep themself constantly informed as to the progress of the work in the field, materials and workers ready to start work immediately when conditions of preceding work are available or ready, wholly or in part, so as not to delay the progress of building work or to interfere with the progress of work of other contractors, and in any event the contractor shall, within 24 hours after notice from the Owner, proceed with such work as directed to maintain the uninterrupted progress of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed. All reinforcing bars shall be Grade 60 unless otherwise noted. Provide Grade 75, Grade 80, or Grade 100 reinforcing bars where indicated on the contract documents.

B. Weldable Reinforcing Bars: ASTM A 706/A 706M, Grade 60.

C. Mechanical Splice Couplers: ACI 318/ACI 318M, same material of reinforcing bar being spliced. Provide mechanical couplers as an alternate to standard tension lap splices where indicated on the contract documents and in areas of rebar congestion. A mechanical splice coupler shall develop in tension or compression, as required, at least 1.25 times the yield strength of the bar being spliced.

D. Steel Wire and Welded Wire Reinforcement: ASTM A 1064. Galvanized at exterior locations, conditions permanently exposed to weather and/or water, and where noted on drawings (plan and/or sections).

E. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI specifications.

For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2), at a spacing not to exceed 4'-0" on center in either direction.

2.2 CONCRETE MATERIALS

A. Cement: Portland cement (ASTM C 150, Types I, II, or I/II) or Portland limestone cement (ASTM C 595). Total percentage of Portland Cement is NOT to exceed 75% of the cementitious content of each mix, except mixes assigned to exposure class F3. Use one brand of cement throughout project, unless otherwise acceptable to Architect. Provide supplementary cementitious materials in mixes per sections below.

a. Fly Ash: Cast-in-place concrete shall incorporate fly ash as a replacement for at least 25% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record. Where concrete is assigned to exposure class F3, limit the replacement of Portland cement with fly ash (by weight) to 25% max.

b. Ground Granulated Blast Furnace Slag (GGBF): Cast-in-place concrete shall incorporate GGBF as a replacement for at least 40% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record. Where concrete is assigned to exposure class F3, limit the replacement of Portland cement with GGBF slag (by weight) to 50% max.

c. Post-Consumer Recycled Ground Glass Pozzolan (GGP): Cast-in-place concrete shall incorporate GGP as a replacement for at least 25% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record.

d. Pozzolans and Slags: These must be completely accounted for in the design mix. Mix design must meet minimum design requirements set in the contract documents. Additional admixtures may be required to meet early strength requirements and alternative cementitious material goals. If a "blended cement" is used which already contains a certain percentage of Pozzolans or Slags this content may offset or entirely satisfy the minimum percentage required.

1) Coal Fly Ash: ASTM C 618 (Class C or Class F): ASTM C 618 (Note: Class F fly Ash will require higher amounts or air entraining ad-mixtures than class C).
2) Blast Furnace Slag: ASTM C989
3) Ground Glass Pozzolan: ASTM C1866
4) Silica Fume: ASTM C 1240
5) Rice Hull (or “husk”) Ash: ASTM C 618 Blended hydraulic cement, as defined by ASTM C 595 or ASTM C 1157

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
2. Normal weight Fine Aggregate: washed, inert, natural or manufactured or combination thereof, sand conforming ASTM C33 gradation.
3. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33, sizes 57 for foundations and 67 for slabs and structure.

    a. Recycled crushed concrete aggregate in concrete mixes is only to be used with approval of Engineer of Record. Recycled aggregate shall be used only as a substitute for coarse aggregate and must also be washed and well-graded, conforming to ASTM C33.
    b. For sub-base, slabs on grade and non-structural applications and Recycled Aggregate Materials are NOT required to meet the ASTM C 33 standard. In addition to concrete rubble, glass, porcelain, and tire chips can be used as filler material. Any inert material conforming to ASTM D1241 is acceptable for the applications described in this paragraph.

C. Lightweight Aggregates: Well-graded crushed expanded shale produced by rotary kiln method. Solite or equal, conforming to ASTM C330.

D. Water: Free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94. ASTM C94 for gray water use in the production of ready mixed concrete per approval by the Engineer of Record.

E. Air Entraining Admixture: ASTM C 260.

1. Liquid air entrainment: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	“Air Mix”	Euclid Chemical Co.
b.	“AEA-92”	Euclid Chemical Co.
c.	“Darex AEA”	GCP Applied Technologies
d.	“MasterAir AE200”	Master Builders Solutions

F. Water-Reducing Admixture: ASTM C 494.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	“MasterPolyheed 997”	Master Builders Solutions
b.	“Eucon MR”	Euclid Chemical Co.
c.	“WRDA 64”	GCP Applied Technologies

G. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Eucon 37, 1037 or Plastol 5000"	Euclid Chemical Co.
b.	"Rheobuild 1000"	Master Builders Solutions
c.	"MasterGlenium Series"	Master Builders Solutions

d. "Daracem-100" — GCP Applied Technologies

H. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non- corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Accelerating admixtures are not to be used as antifreeze agents. Accelerating admixtures are permitted only upon review by Engineer of Record.

1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

a. "Accelguard NCA, 80, 90, or G3" — Euclid Chemical Co.
b. "Daraset 400 or 422" — GCP Applied Technologies
c. "MasterSet FP 20" — Master Builders Solutions

I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05 percent chloride ions.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Eucon Retarder 75 or 100" — Euclid Chemical Co.
b. "MasterSet R 100" — Master Builders Solutions
c. "Plastiment" — Sika Chemical Co.
d. "Daratard" — GCP Applied Technologies.

J. Microsilica Admixture shall be dry densified or slurry formed. Microsilica shall come from the same source throughout the project. If a single source cannot be maintained, laboratory testing of each new source shall be required before acceptance by the Engineer of Record at no cost to the owner.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Emsac F 100" — Elkem Chemical, Inc.
b. "Eucon MSA" — Euclid Chemical Co.
c. "Force 10,000 D" — GCP Applied Technologies

K. Prohibited Admixtures: Calcium chloride, thyocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

L. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer of Record.

M. Macro-Fibers: Engineered macro-synthetic fibers.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. “Tuf-Strand SF” — Euclid Chemical Co.

b. “Fibermesh 650” Sika Chemical Co.
c. “Strux 90/40” GCP Applied Technologies
d. “Forta-Ferro” Forta

N. Micro-Fibers: Engineered micro-synthetic fibers.

1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

a. "Fiberstrand 100 or F": Euclid Chemical Co.
b. "Fibermesh 150": Sika Chemical Co
c. “Ultra-Net” Forta

O. Natural Fiber Reinforced Concrete: Natural fiber reinforced concrete is permitted only upon review by Engineer of Record. Refer to ACI 544.1R, chapter 5

P. Corrosion Inhibitor: 30% calcium nitrite (where called for in the specifications or on the drawings). Subject to compliance with requirements, provide the following at 3 gal/cy:

1. “Eucon CIA Euclid Chemical Co.
2. “DCI” GCP Applied Technologies
3. “MasterLife CI 30” Master Builders Solutions

Q. Contractor will be required to provide information demonstrating successful use in prior placement involving all admixtures.

2.3 GROUT

A. Non-Shrink, Non-Metallic Grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "NS Grout" Euclid Chemical Co.
b. "Five Star Grout" Five Star
c. "SikaGrout-713" Sika Chemical Co.

B. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 18" x 36" base plate.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Hi-Flow Grout" Euclid Chemical Co.

b. "SikaGrout-928" Sika Chemical Co.
c. “Five Star Fluid Grout 100” Five Star

2.4 RELATED MATERIALS

A. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 1241, Size 10, with 100 percent passing a 3/8 inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

B. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Waterproof paper
b. Polyethylene film
c. Polyethylene-coated burlap

E. Curing Compounds: The compound shall conform to ASTM C 309. Limit VOC content to 130 g/L. Use water-based curing compound. For surfaces receiving both a curing compound and additional flooring, verify that the curing compound and additional flooring are compatible.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. “SealTight 1100” W.R. Meadows
b. “Kurez W VOX” Euclid Chemical Co.

F. Curing & Sealing Compounds: Only specify for slabs that will remain exposed, i.e. will not receive additional flooring. The compound shall conform to ASTM C1315. Limit VOC content to 130 g/L. Use water-based curing compound.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. “Super Diamond Clear VOX” Euclid Chemical Co.
b. “VOCOMP-25” W.R. Meadows

G. Curing, Sealing, & Hardening Compounds: For use on concrete surfaces that will remain exposed. Slabs that will receive additional flooring do not require sealing or hardening. Sealers and hardeners must not yellow under ultraviolet light after 500 hours of test in accordance with and have a maximum moisture loss of 0.039 grams per sq. cm. when applied at a coverage rate of 250 sq. ft. per gallon. Limit VOC content to 130 g/L. Use water- or vegetable-based product.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

    a. “Kure-N-Harden” BASF

H. Evaporation Retardant:

1. Products Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

    a. "Eucobar" Euclid Chemical Co.
    b. "MasterKure ER 50" Master Builders Solutions

I. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F 710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. Insure coatings and adhesives are “benignly compatible” -- in other words, do not combine substances whose constituents are reactive. Reactivity releases VOCs and /or other toxic fumes.

J. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

    a. "Eucolastic 1NS" Euclid Chemical Co.
    b. Maximum allowable depth of this product is ½”.

K. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.

1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

    a. "EucoFloor SL 160" Euclid Chemical Co.
    b. "Ardex" Ardex Co.
    c. "MasterTop 110 SL" Sika Chemical Co.

L. Bonding Admixture: The compound shall be a latex, non-rewettable type.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

    a. "Flex-Con" Euclid Chemical Co.
    b. "SBR Latex" Euclid Chemical Co.

M. High Strength Polymer Repair Mortar: For form and pouring or large horizontal repairs, provide the flowable on-part, high strength repair mortar.

1. Products: subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

    a. "Eucocrete or EucoRepair SCC" Euclid Chemical Co.

b. "Euco Speed MP" (Cold Weather) — Euclid Chemical Co.
c. “Emaco R” — Master Builders Solutions

N. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

a. “Daraweld C” — GCP Applied Technologies
b. “Acrylic Bonding Agent J40” — Dayton Superior
c. Eucoweld 2.0 — Euclid Chemical Co.

O. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Type IV for bonding hardened concrete to hardened concrete, and Type V for bonding freshly mixed concrete to hardened concrete.

P. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

Q. Water: Potable.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Preparation of Design Mixes

1. All mix designs shall be proportioned in accordance with Section 26.4.3.1(b) of ACI 318 and prepared by a licensed testing laboratory approved by the owner, but paid for by the contractor. Submit mix designs on each class of concrete for review.
2. If previously used mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1.10f'c+700 psi when concrete strengths greater than 5000 psi are used.
4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.

B. Submit each proposed mix to the Architect and Structural Engineer for review at least 5 days prior to the pre-concrete conference. Do not begin concrete production until Architect and Engineer of Record has reviewed and approved mixes.

1. Submit Test reports for any pozzolans or slags indicating compliance with ASTM C 618, ASTM C 989, or ASTM C1866 respectively.
2. Provide cut sheets clearly indicating the percentages of pozzolans or slags used in the mix design as replacement for Portland cement. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the percentage.
3. Test reports for recycled aggregate indicating compliance with ASTM C 33. Provide cut sheets clearly indicating the percentage of aggregates used that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.

4. Provide cut sheets clearly indicating the percentage of sub-base and filler aggregate materials that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.

C. Design mixes to provide concrete with strength as indicated on drawings and schedules.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect and Engineer of Record. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect and Engineer of Record before using in work.

E. Admixtures:

1. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in all concrete as required for placement and workability.
2. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50°F (10°C).
3. Use high-range water-reducing admixture in pumped concrete, architectural concrete, parking structure slabs, fiber concrete, concrete required to be watertight, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Exposure category for exterior concrete is F1. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2 percent within following limits:

    a. Concrete structures and slabs exposed to freezing and thawing or deicer chemicals.
        1) 1-1/2” maximum aggregate: 4.5 percent (exposure class F1, moderate exposure); 5.5 percent (exposure class F2 and F3, severe exposure)
        2) 1” maximum aggregate: 4.5 percent (exposure class F1, moderate exposure); 6 percent (exposure class F2 and F3, severe exposure)
        3) ¾” maximum aggregate: 5 percent (exposure class F1, moderate exposure); 6 percent (exposure class F2 and F3, severe exposure)
        4) ½” maximum aggregate: 5.5 percent (exposure class F1, moderate exposure); 7 percent (exposure class F2 and F3, severe exposure)
        5) 3/8” maximum aggregate: 6 percent (exposure class F1, moderate exposure); 7.5 percent (exposure class F2 and F3, severe exposure)

    b. Other Concrete: (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.
    c. Interior concrete to receive hard troweling shall not be air entrained unless specifically approved by the Engineer.

5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Concrete for architecturally exposed structural elements or architecturally exposed surfaces: W/C 0.40.

2. All other concrete: no maximum W/C ratio.
3. Refer to the concrete mix design table in the structural drawings for other W/C ratio requirements based on exposure class, element type, etc.
4. Refer to the requirements for concrete by exposure class in ACI 318 for balance of info related to maximum W/C ratios, minimum f'c values, and additional requirements.

G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramp slabs and sloping surfaces: Not more than 3".
2. Reinforced foundation systems, including mud slabs below hydrostatic slabs: Not less than 1" and not more than 3".
3. Concrete containing HRWR admixture (superplasticizer): Not more than 9" unless otherwise approved by the architect.
4. Other Concrete: Not less than 1" or more than 4".

H. Chloride Ion Level: Chloride ion content shall be tested by the laboratory making the trial mixes. The total chloride ion content of the mix including all constituents shall not exceed the limitations set forth in Table 19.3.2.1 of ACI 318.

2.6 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85^{o}F (30^{o}C) and 90^{o}F (32^{o}C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90^{o}F (32^{o}C), reduce maximum mixing and delivery time to 60 minutes.

D. No water shall be added after mixing to concrete containing HRWR (Superplasticizer). If loss of slump occurs, the concrete treated with HRWR may be redosed as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer of Record and the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 INSPECTION

A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CONCRETE

A. Concrete shall develop the minimum compressive strengths shown on drawings at 28 days when sampled and tested in accordance with ASTM C 31 and C 39 with the maximum slump in accordance with the approved mix design.

B. Concrete shall be in accordance with the requirements and specifications of "Building Code Requirements for Structural Concrete" as modified by the building code noted above.

C. Fly Ash Concrete & Slag Concrete: Concrete mixes containing high volumes of fly ash or Slag have slower set times and may take up to 56 days to reach full strength. The Engineer of Record, agency responsible for concrete mix design, the architect and the concrete subcontractor must coordinate to ensure that the form stripping schedule is consistent with the ability of the structure to support itself and all imposed construction loads.

3.4 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than values indicated in the contract documents.
2. Stagger splices in accordance with ACI 318/ACI 318M
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

F. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

G. Micro-Fibers: All concrete where indicated on the drawings shall contain the specified micro-fibers. Length shall be per the manufacturer's specification. The dosage rate shall be 1.0 – 1.6 lbs per cubic yard per the manufacturer's specification. Submit proposed dosage rate to Engineer of Record for review prior to concrete placement.

H. Macro-Fibers: All concrete where indicated on the drawings shall contain the specified macro-fibers. Length shall be per the manufacturer's specification. The dosage rate shall be 3.0 – 5.0 lbs per cubic yard per the manufacturer's specification. Submit proposed dosage rate to Engineer of Record for review prior to concrete placement.

3.5 JOINTS

A. Construction Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
4. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
5. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

6. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
7. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

3.6 INSTALLATION TOLERANCES

A. Comply with ACI 117/ACI 117M.

3.7 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and

secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.8 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. If form-release compound is required, coat contact surfaces of forms with a form-coating compound *before* reinforcement is placed.

C. Thin form-coating compounds only with thinning agent of type, and amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in- place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.9 CONCRETE PLACEMENT

A. Ready-mix concrete shall comply with the requirements of ASTM C 94 and ACI 304. All plant and transporting equipment shall comply with the concrete plant standards and truck mixer and agitator standards of the National Ready Mix Concrete Association.

B. Placement of structural concrete with a least dimension greater than or equal to 4 feet shall be considered “mass concrete” per ACI definition. Contractor shall adhere to mass concrete procedures and recommendations of ACI 301 and ACI 211.

C. Notify Architect and Owner’s Inspector at least 36 hours (1 1/2 regular working days) before each pour so that forms and reinforcing may be examined. Do not place concrete until inspection has been made or waived.

D. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

E. General: Comply with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete,” and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Use internal vibrators penetrating both the top and preceding layers.

G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

H. Use and type of vibrators shall conform to ACI 309 “Recommended Practice for Consolidation of Concrete.” Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

I. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
2. Per ACI 318, beams, girders, or slabs supported by columns or walls shall not be cast or erected until concrete in the vertical support members is no longer plastic.

J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

K. Slabs: Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedge, bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. See also "MONOLITHIC SLAB FINISHES" below.

L. Maintain reinforcing in proper position during concrete placement operations.

3.10 FINISH OF FORMED SURFACES

A. Concrete mixes containing pozzolans or slags do not set at the same rate or with the same bleed water characteristic as plain Portland cement. Therefore attention must be directed to the proper procedures. Refer to ACI 232.2R and ACI 301.

B. Rough Form Finish: For formed concrete surface not exposed-to- view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

C. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed. Follow all requirements in ACI 301, Chapter 10

for smooth form finish. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction.

3.11 FLOOR FLATNESS/LEVELNESS TOLERANCES

A. FF defines the maximum floor curvature allowed over 24 in. Computed on the basis of successive 12 in. (300 mm) elevation differentials, FF is commonly referred to as the "Flatness F-Number".

B. FL defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.05 m) distance commonly referred to as the "Levelness F-Number".

C. All floors shall be measured within 72 hours of being poured and in accordance with ASTM E 1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound Units).

D. All slabs shall achieve the specified overall tolerance. The minimum local tolerance (1/2 bay or as designated by the architect) shall be 2/3 of the specified tolerances.

E. All elevated slabs shall achieve the specified FL tolerance before the removal of the forms.

F. All slabs on metal deck shall achieve the specified FF.

3.12 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to slabs at crawl spaces, unless otherwise noted. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Surface shall achieve an FF 20 - FL 17 tolerance.

B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system, unless otherwise noted. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a surface leveled to an FF 25/ FL 20 tolerance (FL17 for elevated slabs). Grind smooth surface defects, which would telegraph through applied floor covering system.

C. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, and slab surfaces which are to be covered with membrane or elastic waterproofing, or sand-bed terrazzo, and as otherwise indicated, apply single trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction

D. Sealers, Hardeners and Liquid Densifiers: Apply a coat of the specified compound to all EXPOSED interior concrete floors where indicated on the drawings. This surface must be

continuously moist cured by a method satisfactory to the Architect. Apply and mechanically scrub compound into the floor in strict accordance with the manufacturer's printed instructions.

3.13 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 308 shall be followed using wind breaks and sun shades when recommended.
4. Care must be taken to store water based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.

B. Curing Methods: Perform curing of concrete by moisture curing, moisture-retaining cover curing, curing and sealing compound, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods.

   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:

   a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and sealing compound to exposed interior slabs not receiving additional flooring. A clear curing and sealing compound shall be used on exterior slabs, sidewalks and curbs not receiving a penetrating sealer.
4. Use the specified curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply compound in accordance with manufacturer’s direction.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of the specified curing compound or a continuous moist curing method approved by the architect.

E. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. In addition, insure coatings and adhesives are “benignly compatible” -- in other words, do not combine substances whose constituents are reactive.

F. Sealer and Dustproofer: Apply a second coat of the specified curing and sealing compound to exposed interior slabs not subjected to vehicular traffic, noted on the drawings. These slabs must have received an initial coat of the curing and sealing compound.

3.14 SHORES AND SUPPORTS

A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.

B. Extend shoring from ground to roof for structures 4 stories or less, unless otherwise permitted.

C. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

D. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in- place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated using specified free-flowing non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

E. Where high fluidity and/or increased placing time is required use the specified high flow grout. This grout shall be used for all base plates larger than 10 square feet.

F. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screeds, tamp, and finish concrete surfaces as scheduled.

G. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.16 CONCRETE SURFACE REPAIRS

A. Prior to all repairs, an as-built condition sketch and method of repair must be submitted to the Architect and Engineer of Record for review and approval.

B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

C. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding grout containing the specified bonding admixture. Place patching mortar after while bonding grout is still tacky.

D. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

E. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or pre-cast cement cone plugs secured in place with bonding agent.

F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

G. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for tureens of slope, in addition to smoothness, using a template having required slope.

H. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

I. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, except at hydrostatic slabs.

J. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. The specified underlayment compound or repair toping may be used when acceptable to Architect.

K. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

L. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

M. Structural Repair: All structural repairs shall be made with prior approval of the Engineer of Record as to method and procedure, using the specified polymer repair mortar and/or specified epoxy adhesive. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used. In addition, all cracks shall be filled with the specified crack sealer or other method as approved by the Engineer of Record. All garage slabs shall be repaired prior to the slab being treated with the specified penetrating anti-spalling sealer.

N. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material. Underlayment application shall achieve the tolerances specified in "MONOLITHIC SLAB FINISHES" above.

O. Specified Polymer Horizontal Repair Mortar: All exposed floors shall be leveled, where required, with the specified self-leveling repair topping.

P. Repair Methods not specified above may be used, subject to acceptance of Architect.

3.17 WORK IN CONNECTION WITH OTHER TRADES AND CONTRACTS

A. Sleeves, pockets, openings, etc., shall be set in the concrete walls and arches as required for the mechanical trades as shown on approved shop drawings; these shall be encased or built into the concrete work and shall be properly placed and secured in position in the forms before concrete is placed.

B. Provide all chases, pipe slots, etc., required for the mechanical trades (see mechanical drawings), constructed as shown on the approved shop drawings.

C. Leave temporary access panels where required to install mechanical equipment as required by trade affected. Panels shall be formed with construction joints as specified. Details for such panels shall be submitted to Architect for approval.

D. Coordinate all penetrations, cutting, and patching with waterproofing contractor.

3.18 CUTTING AND PATCHING

A. Contractor for concrete work shall be responsible for all cutting, removing and patching work where concrete surfaces are not installed within the limits shown on the drawings or specified herein. All such work shall meet with the approval of the Architect or Engineer of Record.

B. Where cutting and patching is required to accommodate the work of other subcontractors, such cutting shall be done at the expense of said subcontractors but shall be performed by the contractor for concrete work.

C. The location and extent of cutting in completed concrete work and the patching thereof shall meet with the approval of the Architect or Engineer of Record.

3.19 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of discharge for each truck; additional tests when concrete consistency seems to have changed.
3. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
4. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
5. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 25 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimens tested at 7 days, three specimens tested at 28 days, and one specimens retained in reserve for later testing if required.

    a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
    c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

6. Water Cementitious Ratio Test: Check water content of concrete in accordance with AASHTO T 318 “Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying”. Frequency of this test shall be the same as that of compressive strength tests, noted above.
7. Test results will be reported in writing to Architect, Engineer of Record, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project

identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

a. Non Compliance: All test reports indicating non-compliance shall be faxed immediately to all parties on the test report distribution list and the hard copies submitted on different colored paper.
b. Nondestructive Testing: Windsor probes, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

8. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.20 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.

B. Collect cut off steel and discarded reinforcement steel and place in area for recycling.

C. Place materials defined as hazardous or toxic waste in designated containers.

D. Use trigger operated spray nozzles for water hoses and closed loop system to reduce water consumption.

E. Reusable forms should be cleaned immediately after removal and non-reusable forms recycled to the maximum extent economically feasible.

F. Incorporate crushed concrete or masonry materials in sub-base to the maximum extent feasible in accordance with sub-base specifications.

G. Before concrete pours, designate location or uses for excess concrete. Options include:

1. Additional paving
2. Post footing anchorage
3. Landscaping -- site concrete features
4. Flowable fill

H. To avoid contamination of the local landscape, before concrete pours, designate a location for cleaning out concrete trucks where run-off can be contained, reused or incorporated. Options include:

1. Company owned site for that purpose
2. On-site area to be paved later in project

END OF SECTION

SECTION 03 54 00 - CAST UNDERLAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cementitious underlayment.

1.2 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, mixing instructions, environmental limitations, storage and handling requirements, and installation instructions.

C. Certificate: Certify that products and systems meet or exceed specified regulatory requirements.

D. Manufacturer's Instructions.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for combustibility or flame spread requirements.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.

1.7 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cementitious Underlayment:
1. Underlayment: Schonox US with Schonox FP trowelable primer.
2. Patching Compound: Schonox PL.
3. Featheredge Smoothing and Finishing Compound: Schonox SL.

B. Other Acceptable Manufacturers - Cementitious Underlayment:
1. ARDEX Engineered Cements: www.ardexamericas.com.
2. Dayton Superior Corporation : www.daytonsuperior.com.
3. Dependable Chemical Co., Inc.: www.floorprep.com.
4. Koster American Corporation: www.kosterusa.com.
5. LATICRETE International, Inc.: www.laticretesupercap.com/#sle.
6. The QUIKRETE Companies: www.quikrete.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
1. Compressive Strength: Minimum 4000 pounds per square inch after 28 days, tested per ASTM C109/C109M.

2. Flexural Strength: Minimum 1000 psi after 28 days, tested according to ASTM C348.
3. Density: 120 lb/cu ft, nominal.
4. Final Set Time: 1-1/2 to 2 hours, maximum.
5. Thickness: Capable of thicknesses from 1/8-inch to maximum 3 inch.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

B. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

C. Subfloor Filler and Primer: Manufacturer's recommended type.

D. Patching Compound: Manufacturer' recommended cementitious repair mortar.

E. Smoothing and Finishing Compound: Capable of featheredge installation thickness and having a minimum compressive strength of 3500 psi.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to consistency without over-watering.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Tiled Surfaces: Remove loose and damaged tile. Remaining tile should be sound and well-bonded.

B. Remove substrate surface irregularities and projections. Fill voids and deck joints with filler. Finish smooth.

C. Vacuum clean surfaces.

D. Prime and fill substrate in accordance with manufacturer's instructions. Allow to dry.

E. Close floor openings.

F. Use ramping and patching compound around drains.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.
   1. Pump, move, and screed while the material is still highly flowable.
   2. Be careful not to create cold joints.
   3. Wear spiked shoes while working in the wet material to avoid leaving marks.

3.4 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 03 54 00

SECTION 05 03 00 - CONSERVATION TREATMENT FOR PERIOD METALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repair of damaged metal elements.

1.2 RELATED REQUIREMENTS

A. Section 01 35 91 - Period Treatment Procedures: For general historic preservation project requirements.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
   1. Require attendance of parties directly affecting work of this section.
   2. Review installation conditions, procedures, and coordination with related work.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Restoration Schedule: Detailed description of areas to be restored including assessment of problem areas proposed procedures. Include the following:
   1. Description of existing metal element failures contributing to deterioration of other portions of the project that require repair prior to refinishing of surfaces.
   2. Photographic documentation of areas to be restored, prior to restoration work.

C. Product data.

D. Shop Drawings: Indicate details of connections and anchors for metal elements. Detail bracing and temporary or permanent support as needed.

E. Manufacturer's Instructions: For cleaning materials, indicate special procedures and conditions requiring special attention.

F. Conservation treatment quality control plan.

G. Restorer's qualification statement.

1.5 QUALITY ASSURANCE

A. Conservation Treatment Quality Control Plan: Prior to commencing work of this section, receive written approval of plan of proposed metal restoration and cleaning work. Include the following:
   1. Description of methods of dust containment.
   2. Description of methods of protecting surrounding construction and landscape features.
   3. Description of sequencing, work procedures, materials, and tools proposed for each type of conservation treatment.
      a. Effects of weather variations on treatment sequencing, construction schedule, and protection of completed work.
   4. Description of methods for deconstruction of individual metal items and tools and methods for cleaning for reuse.
   5. Description of methods and approach to removal of corrosion from iron and steel.
   6. Description of methods and approach for assuring repair materials match and are compatible with historic materials.
   7. Description of methods and approach to periodic and final cleaning of metal surfaces.

B. Restorer Qualifications: Company specializing in period metal restoration with minimum five years of documented experience.

1.6 MOCK-UPS

A. Restore one section of steel windows to indicate safe and effective means and methods of cleaning metalwork, including trim, accessories, and flashings.

B. Locate mock-up areas where directed.

C. Approved restoration mock-up areas, including results of procedures employed, may remain and become the quality standard for work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver cleaning, restoration, and new materials and products neatly stacked and tied on pallets or in other appropriate packaging for transportation. Store clear of ground with adequate waterproof covering.

1.8 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature above 40 degrees F prior to, during, and 48 hours after completion of metal work.

B. Maintain materials and surrounding air temperature below 90 degrees F prior to, during, and 48 hours after completion of metal work.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

A. Cleaning Agent: Detergent and Solvent cleaner type.

B. Soap: Mild soap with approximately 8.0 pH.

C. Corrosion Inhibitor/Cleaner for Copper Alloys: Solution of 1.41 ounces benzotriazole per one gallon of warm water.

D. Oil: Solution of 5 ounces of lemongrass essential oil mixed with one gallon of mineral oil.

E. Abrasive: Silicon carbide abrasive pads, standard commercially available pumice stone, or stainless steel wool.
   1. Do not use plain steel wool on bronze or other copper alloy materials.

F. Oxidizing Agent: Aluminum chloride or liquid sulfur.

G. Cloth: Clean cotton waste.

2.2 PAINT REMOVERS

A. Water-Based: Formulated without methylene chloride or methanol, to remove multiple coats of oil-based, water-based, acrylic-based, epoxy-based, urethane-based, elastomeric, and lead-based paints.
   1. Formulation: Thixotropic paste or gel.
   2. Acidic Type: 2.1 pH.
   3. Surface Neutralization After Use: Not required.

B. Solvent Based: Formulated without chlorinated solvents, acids, and caustics; to remove multiple coats of oil-based, water-based, acrylic-based, epoxy-based, urethane-based, elastomeric, and lead-based paints, and lacquers and enamels.

C. Methylene Chloride Based: To remove multiple coats of oil-based, water-based, acrylic-based, epoxy-based, urethane-based, elastomeric, and lead-based paints.

2.3 RUST REMOVERS

A. Removal Agent: Proprietary formulation, nonacidic gel.

B. Removal Agent: Proprietary formulation water-based acidic gel.

2.4 ACCESSORY MATERIALS

A. Fasteners, General: Same basic metal and alloy as metal items being joined, unless indicated otherwise. Do not use incompatible metals that promote galvanic action.
   1. Nonferrous Metals Fastened to Carbon Steel or Iron Supports: Use Type 304 stainless steel fasteners.

B. Galvanic Separator for Dissimilar Metal Contact: Primer or with sealant or tape recommended by manufacturer for the purpose.

C. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15 mil dry film thickness per coat.

2.5 FINISHING MATERIALS

A. See Section 09 91 23 for interior painting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces to be cleaned and restored are ready for work of this section.

B. Consult paint analysis report of existing finishes to determine appropriate materials and methods for new, matching finishes.

3.2 PREPARATION

A. Protect surrounding elements from damage from restoration procedures.

B. Remove and store removable items located in areas to be restored including, but not limited to, fixtures, fittings, finish hardware, and accessories; reinstall upon completion of restoration work.

C. Separate areas to be protected from restoration areas to prevent damage.

D. Mask or cover adjacent surfaces and permanent equipment. Secure coverings without tapes that leave residue, or nails. Do not use impervious sheeting which produces condensation.
   1. Use materials that will withstand cleaning and restoration procedures.

E. Separate adjacent occupied areas with dust proof and weatherproof partitions.

F. When using liquid cleaning methods, install drainage devices to prevent runoff over adjacent surfaces, unless those surfaces are impervious to damage from runoff.

G. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.3 REPAIR

A. General: Perform repairs in properly equipped fabrication facility or in situ, in accordance with Conservation Treatment Quality Control Plan and mock-up.
   1. Match repair method to condition of the element and applicability to the element's metal composition.
   2. Exercise care during dismantling of brittle elements, especially during cold weather.
   3. Complete the repair procedures by preparing surfaces for application of specified finishes.

3.4 REMOVAL OF EXISTING COATINGS

A. Remove existing coatings. Observe remover manufacturer's instructions. Leave metal in a clean, chemical-free, pH neutral condition free of residue.

B. Removal of Coatings: Use techniques least likely to damage cast iron elements. Test effectiveness of proposed techniques on a small area prior to determining appropriateness of their use.

C. Finishing: Prepare elements for finishing in accorance with coating system manufacturer's written requirements.

3.5 FINAL CLEANING

A. Remove stains resulting from the work of this section without delay.

B. Clean surrounding surfaces.

END OF SECTION 05 03 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts, bearing plates and loose lintels with complete instructions and templates to facilitate installation.
2. Furnish and erect all struts, columns, bearing plates, beams, steel trusses, girders, bracing, hangers and all related connections (bolted and welded).
3. Openings (unreinforced and reinforced) in structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Lintels and angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

B. Related Requirements:

1. Division 01 Section “Construction Waste Management and Disposal”
2. Division 01 Section “Sustainable Design Requirements”
3. Division 03 Section “Cast in Place Concrete”
4. Division 04 Section “Unit Masonry”
5. Division 05 Section “Metal Deck.”
6. Division 05 Section “Metal Fabrications.”
7. Division 06 Section “Rough Carpentry.”
8. Division 07 Section “Waterproofing.”
9. Division 07 Section “Joint Sealants.”
10. Division 07 Section “Expansion Joint Cover Assemblies.”
11. Division 31 Section “Dewatering.”

C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.
2. Grout under base and bearing plates.
3. Installation of loose lintels furnished under this section.
4. Miscellaneous metal work
5. Light gage metal roof trusses.

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts, bearing plates and loose lintels with complete instructions and templates to facilitate installation.
2. Furnish and erect all struts, columns, bearing plates, beams, steel trusses, girders, bracing, hangers and all related connections (bolted and welded).
3. Openings (unreinforced and reinforced) in structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Lintels and angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

B. Related Requirements:

1. Division 01 Section “Construction Waste Management and Disposal”
2. Division 01 Section “Sustainable Design Requirements”
3. Division 03 Section “Cast in Place Concrete”
4. Division 04 Section “Unit Masonry”
5. Division 05 Section “Metal Deck.”
6. Division 05 Section “Metal Fabrications.”
7. Division 06 Section “Rough Carpentry.”
8. Division 07 Section “Waterproofing.”
9. Division 07 Section “Joint Sealants.”
10. Division 07 Section “Expansion Joint Cover Assemblies.”
11. Division 31 Section “Dewatering.”

C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.
2. Grout under base and bearing plates.
3. Installation of loose lintels furnished under this section.
4. Miscellaneous metal work
5. Light gage metal roof trusses.

6. Stair framing and hangers.
7. Field painting of structural steel, except as specified herein.
8. Fireproofing systems.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of all connections required by the drawings to be completed by structural steel fabricator (including comprehensive engineering analysis by a qualified professional engineer) to withstand loads indicated and comply with other information and restrictions indicated, unless noted otherwise.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use design method indicated on structural drawings.
3. Moment Connections: Fully restrained unless otherwise noted on drawings.

B. Lateral Force Resisting System: Type used is indicated on structural drawings.

1.5 SUBMITTALS

A. Product Data: Submit data for each type of product indicated in the contract documents.

B. Shop Drawings: Submit shop drawings in accordance with the specifications as follows:

1. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
2. Do not fabricate or deliver work to the site before drawings reviewed by the Architect and Engineer of Record have been returned.

3. Before preparing steel shop drawings, submit proposed submittal schedule for review by Architect and Engineer of Record.
4. Before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connections. Appropriate marks for designating all types and sizes of joint details shall be included. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk
5. Submit calculations for design of connections on job standards and all other connections such as moment and brace frames. Calculations shall be signed and sealed by a Professional Engineer licensed in the state in which the project is located.
6. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review.
7. Prepare shop drawings in conformance with the applicable procedures shown in "*Detailing for Steel Construction*," latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is to take place. During the preparation of shop drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents.
8. Indicate clearly the size and grade of steel for each component. Identify rolled shapes, tubes and plates by using the standard designations used in "Steel Construction Manual" Latest Edition, by AISC.
9. Indicate welds and nondestructive tests by using the symbols conforming to AWS A2.4 "Symbols for Welding and Nondestructive Testing." Where necessary for clarity, indicate welding procedure designations or other data in the tail of the welding symbol.
10. Show explicitly the type of connection used in each location, including the grade, size, and number of bolts; the type, number, position, designation and orientation of each washer; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where applicable and necessary.
11. Show all camber dimensions in the shop drawings. Where specific camber is not shown in the drawings, note on each affected shop drawing that such members are to be fabricated with the natural camber up.
12. Show holes required for securing work specified in other sections to structural steelwork, as well as all holes required for passage through structural steelwork of work of other trades. Provide field work drawings for all such holes not shown in shop or erection drawings. Addition of, or change in size or location of openings will not be permitted without prior approval.
13. Use bolted connections wherever possible; avoid field welding unless otherwise noted on drawings.
14. Make details in such a way as to avoid having steel, connections, bracing, bolts, etc., interfere with architectural details or in any way reduce the areas of shafts, openings, clearances, etc.
15. Detail and schedule cleaning and painting data and requirements, including specific indication of "no-paint" areas.
16. The use of the Architect’s or Engineer of Record's electronic drawing files as a base for the erection shop drawings will be permitted at the request of the structural steel detailer upon completion and return of the waiver form. The use of the Architect’s or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The structural steel detailer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design

team makes no representation regarding the accuracy or completeness of the electronic files given to the structural steel detailer and their use will be at the structural steel detailer's sole risk and without liability to the design team. The structural steel detailer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The structural steel detailer shall also remove all reference to work not included in the steel contract.

17. Scaling of the Architect's or Engineer of Record's drawings is not permitted. This applies to hard paper, electronic, and all other versions.
18. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
19. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to any agreed shop drawing review schedule.
20. Prepare anchor bolt and base plate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with concrete construction sequence.
21. Submit, in writing, any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the architect to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
22. Prior to resubmission of shop drawings with additions or corrections, circle or bubble and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
23. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.

C. Submit certified copies of each survey conducted by a surveyor licensed by the state in which the construction is to take place and employed by the structural steel subcontractor. Survey shall show elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.

D. Reports:

1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use.
2. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
3. Submit producer's literature or Material Test Reports (MTR's) which indicate original EAF

steelmaking production for all structural steel framing products listed on the Structural Drawings.

4. Submit one of the following as evidence of sustainable fabrication:

    a. Evidence of the following sustainable steel fabrication activities:
        1) A sustainability policy including a commitment to tracking energy consumption and waste output and a sustainability goal
        2) The completion of steel sustainability education in the areas of construction material sustainability and sustainable steel fabrication

    b. Evidence of status as an AISC Sustainability Partner in the partner program as indicated at aisc.org/partnerprogram

5. Submit anchor bolt checking certification as required.
6. Submit qualification certificates of all welders who will perform work on the project.
7. Submit survey of erected steelwork as required.

E. Submit verification of bio-degradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

F. Environmental Product Declarations (EPD):

1. Provide a product-specific third-party verified Type III Environmental Product Declaration (EPD) conforming to ISO 14025 with a Global Warming Potential (GWP) no greater than the following limits for the following structural steel framing products listed on the Structural Drawings:

    a. Hot-rolled sections: 1.25 kgCO2e/kg of steel
    b. Plate: 1.84 kgCO2e/kg of steel
    c. Hollow structural sections (HSS): 2.14 kgCO2e/kg of steel

2. EPDs including information for more than one producer's or manufacturer's facility are acceptable as long as each location's global warming potential (GWP) information is reported separately.
3. If multiple EPDs are submitted for the same structural steel products, provide a means to map EPDs to the corresponding products.
4. EPDs must be current and developed in accordance with the current or prior version of the North American Product Category Rule (PCR) for Steel Construction Products.
5. Hot-rolled sections, steel plate, and hollow structural sections (HSS) are subject to this informational submittal only if they are the primary member within a fabricated steel assembly. "Piece parts," such as connection and stiffening material, are not subject to this informational submittal.
6. Steel products that are recovered from an existing site and reused in the project are exempt from this requirement.

1.6 QUALITY ASSURANCE

A. Except as modified by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. New York City Building Code, Latest Edition

2. AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
3. AISC "Code of Standard Practice for Steel Buildings and Bridges" latest edition.
4. AISC “Seismic Provisions for Structural Steel Buildings”, latest edition.
5. Industrial Fasteners Institute "Handbook of Bolt and Bolted Joints" latest edition.
6. RCSC "Specifications for Structural Joints Using High-Strength Bolts."
7. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
8. AWS D1.1, "Structural Welding Code."
9. AWS A5.18 & A5.28, Structural Welding Code for GMAW
10. SSPC "Painting Manual, Volume 2, Systems and Specifications.", Latest edition.

B. Qualifications for welding work shall be as follows:

1. Qualify welding procedures and welding operators in accordance with the AWS "Standard Qualification Procedure."

    a. Include amended requirements of the building code as noted above.

2. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of structural steel subcontractor.

    a. Include licensing requirements as per the building code noted above and local jurisdiction.

1.7 TESTING AND INSPECTION

A. Special Inspection as required by the applicable Building Code of all structural steelwork in the shop and field will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the Owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
4. Information as to time and place of all rolling and shipment of material to shops.
5. Representative sample pieces as requested by the testing agency.
6. Full and ample means and assistance for testing all material.
7. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.

B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.

C. The following minimum criteria shall be adhered to in testing of welds and bolts:

1. All welds and bolts shall be examined by visual means.
2. 25% of all welds, selected randomly, shall be measured.
3. Bolted joints shall be verified per the RCSC “Specification for Structural Joints Using High-

Strength Bolts," Section 9, based on installation method.

4. All welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
5. 10% of all manual fillet welds shall be tested by the magnetic particle method.
6. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
7. 100% of groove welds shall be tested by the ultrasonic method.

D. Shop inspection will include examination of steel for straightness and alignment, fissures, mill scale, and other defects and deformities, as described in ASTM A6, examination of fabricated pieces for conforming to approved shop drawings, testing of bolts and welds, and inspection of shop painting. All shop welds shall be visually inspected and spot tested using Ultrasonic Method ASTM E 114 and AWS, Chapter 6, Part C. All inspected welds shall be identified by the inspector.

E. Field inspection will include examination of erected steel for welding, proper fitting and tensioning of bolts, alignment, trueness and plumbness, touching-up of shop coat, level of billets and base plates.

F. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:

1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the Engineer of Record.
3. The testing agency shall be prepared to utilize the following approved methods of testing:

    a. Liquid penetrant inspection: ASTM E 165.
    b. Magnetic particle: ASTM E 1444.
    c. Radiographic inspection: ASTM E 94 and E 1032.
    d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.

G. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the Engineer of Record. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Engineer of Record.

H. Apparatus and procedures for measuring required tension in pretensioned and slip-critical high strength bolted connections shall be furnished and maintained by the steel contractor, in accordance with the RCSC "Specification for Structural Joints Using High-Strength Bolts," and shall be approved by the inspection agency. The inspection agency shall observe the pre-installation verification testing required and shall ensure by routine observation that the bolted installations conform to the approved pretensioning method being used. The steel contractor shall provide a laborer and scaffolding as required for the testing of connections by the inspection agency, and shall, at his own expense, furnish such facilities and provide such assistance as may be required for proper inspection.

I. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.

J. Inspection of Shop Painting:

1. Visually evaluate surface preparation by comparison with pictorial standards in accordance with SSPC-Vis 1.
2. Measure dry film thickness of each coat with a magnetic film thickness gauge in accordance with SSPC-PA 2.
3. Visually inspect dried film for runs, sags, dry spray, overspray and missed areas.
4. Repair defective or damaged areas in accordance with painting requirements specified. Architecturally exposed structural steel shall be free of runs and holidays. Make repairs to shop or field coat as directed.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. Minimize the disturbances to site and soil conditions.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration, discoloration or staining.

D. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.9 PROJECT CONDITIONS

A. The structural steel contractor shall coordinate the structural steel work with the work of other Contracts. Verify all dimensions and details of this Contract and those of other Contracts that affect the work before proceeding. Any discrepancies shall be immediately reported to the architect.

B. Be fully responsible for the accurate installation of the work. Any discrepancy which arises from his failure to execute the work in conformity to the drawings and specifications shall be properly remedied at the contractor's own expense and in a manner acceptable to the architect.

C. Locate dimensionally on setting plans all anchor bolts, inserts, bearing and base plates, etc., and prepare and deliver all required templates and fully dimensioned setting plans in time for the proper execution of the work. Anchor bolts shall be set by another subcontractor. The structural steel contractor shall check all such settings for correctness after they have been cast in place, and before proceeding with erection work.

D. Report to the architect and certify compliance with the above checking requirements in writing and indicate any inaccuracies found in the location of anchor bolts or inserts, and corrections which must be made to their installation. Any inaccuracies not included in the report and found during or after steel erection shall be the responsibility of the structural steel contractor and the cost of corrective measures shall be borne by the structural steel contractor.

E. Use base lines, bench marks, or other standards for survey work that have been provided or

verified by others. If permanent building bench marks have been established, these will be used for field checking.

F. Coordinate with all other trades to ensure that work of this section does not cause undue conflict. Ensure that location of erection devices such as cranes, derricks, booms or hoists, does not cause over-stresses to steel frame to work previously placed by other trades or to existing structures. When required, retain the services of a licensed professional engineer to ascertain that erection devices do not create unsafe conditions or cause overstresses.

G. Ensure full co-ordination with other related trades and professions.

1.10 SUBSTITUTION

A. Architect reserves the right to require substitute shapes of other sizes than those indicated on the drawings when it is apparent that the shapes specified cannot be furnished within the time required for the progress of construction. Make said substitutions without additional cost to the owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel shapes, including structural steel wide flange and structural tee rolled shapes, channels, angles, plates, pipe, and hollow structural sections: As noted on structural drawings.

B. High Strength Bolts: As noted on Structural Drawings.

C. Anchor Rods: As noted on structural drawings

D. Filler metal for welding electrodes. As noted on structural drawings.

E. VERIFY PAINT REQUIREMENTS WITH THE ARCHITECT. CONFIRM REQUIRED PRODUCTS, VOC LIMITS, MPI NUMBERS, ETC. VERIFY IF THIS SPECIFICATION SHOULD REFERENCE AN ARCHITECTURAL SPEC FOR PAINT (E.G. 099000). MODIFY SECTION E ACCORDINGLY.

F. Structural steel primer paint: rust inhibitive primer conforms to the following criteria

1. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
2. Demonstrate a minimum opacity as determined by ASTM D 2805
3. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
4. “Slip Critical” compatible rating where applicable
5. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in Master Painters Institute (MPI) *Green Performance Standard*, GPS-1-08.
6. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 340 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
7. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same

environmental criteria for the same product category.

a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 76, 79 & 101)
b. Interior exposed steel: Use water based paint (MPI # 107)
c. Special Applications, highly corrosive environments: Use zinc rich paints (MPI #'s 20 & 200)

G. Structural steel field paint for exposed members: rust inhibitive primer conforms to the following criteria

1. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
2. Demonstrate a minimum opacity as determined by ASTM D 2805
3. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
4. "Slip Critical" compatible rating where applicable.
5. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in the Master Painters Institute *Green Performance Standard*, GPS-1-08.
6. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 400 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
7. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.

a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 23, 79)
b. Interior exposed steel: Use water based paint (MPI # 107)
c.

PART 3 - EXECUTION

3.1 FABRICATION

A. All shop connections shall be high strength bolted unless specifically shown otherwise. Fabricate work in shop in as large assemblies as practicable. Use welded connections ONLY where shown on drawings. If a bolted connection is not possible, obtain written approval from the Engineer of Record for the welded connection.

B. Camber: As indicated on drawings.

C. Mill column ends and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates when required by the AISC Specifications. It is not necessary to plane bottom surfaces of plates on grout beds.

D. Drill or punch holes at right angles to the surface of the metal, not more than 1/16" larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 7/8". Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.

E. Provide holes in members to permit connection of the work of other trades. Use suitable templates for proper location of these holes. Steel requiring adjustment or accurate alignment shall be provided with slotted holes or full bearing shims as shown.

F. Provide holes, slots and openings required by other trades together with necessary reinforcing required. Use suitable templates for proper location of these openings. All such openings shall be shown on the shop drawings. No change in size or location will be permitted without prior approval.

G. Manual flame cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is within 1/8" of the required line.

3.2 SHOP CONNECTIONS

A. Provide connections as shown on the drawing exactly as detailed. Where connections are not detailed, the minimum connections shall comply with appropriate tables headed, "Framed Beam Connections" shown in the AISC "Manual of Steel Construction" unless otherwise noted on the drawings. Use high strength bolts unless otherwise shown.

B. Do not use welded connections unless shown on details. Field welding is not allowed without written instruction from the Engineer of Record.

C. Proportion and detail all connections on shop drawings to resist forces shown on design drawings.

D. Bolting

1. Bolts shall be of a length that will extend not less than 1/4" beyond the nuts. Enter bolts into holes without damaging the thread.
2. Joint Type: As noted on the Structural Drawings.
3. Make high-strength bolted joints without the use of erection bolts. Bolt heads and nuts shall rest squarely against the metal. Where structural members have sloping surface, bolted connections shall be provided with beveled washers to afford square seating or framing for bolt heads or nuts.
4. All joints are to be compacted to the snug-tight condition in accordance with Section 8 of the RCSC “Specification for Structural Joints Using High-Strength Bolts.” Protect bolt heads and threads from damage during installation.
5. Pretensioned and slip-crtical joints are to be installed by one of the methods prescribed in Section 8.2 of the RCSC “Specification for Structural Joints Using High-Strength Bolts,” unless written approval is obtained from the Engineer of Record.
6. Bolts that have been completely tightened shall be marked for identification.

E. Welding

1. The following environmentally preferable welding processes shall be used as described for the related application without exception:

    a. Submerged Arc Welding (SAW): Plate girders, fillet and butt joints in pipes, cylinders, columns and beams, and welds where ‘downhand’ or horizontal positions are possible.
    b. Gas Metal Arc Welding (GMAW) shall be used where SAW is not applicable (such as for angled connections and anything irregular or short).

c. Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified

2. Do not begin structural welding until joint elements are inspected for surface preparation, fit-up, and cleanliness of surface to be welded and are then bolted or tacked in intimate contact and adjusted to dimensions shown on drawings, or both, with allowance for any weld shrinkage that is expected. No members are to be spliced without prior approval by the Engineer of Record.

a. Containment surface preparation debris must meet SSPC-Guide 6 guidelines.

3. Pre-heat and interpass temperature shall be in accordance with Table 4.2 (including footnotes) of the AWS Code for Welding in Building Construction. The temperature shall be measured from the side opposite to that which the pre-heat is applied, where possible.
4. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design drawings. Welds made without the aid of a back-up bar shall have their roots chipped, ground or roughened out to sound metal from the second side, before welding is done from the second side.
5. All welds shall be sound throughout. There shall be no crack in any weld or weld pass. Weld may be considered sound if it contains only slight porosity or fusion defects which are well dispersed.
6. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

3.3 SHOP PAINTING AND CLEANING

A. Finishing, coating, plating

1. Shop painting and factory finishing shall be preferred to field painting whenever possible. Where applicable, finishes and surface preparations based on a physical process such as abrasive blasting, grinding, buffing and polishing are preferred to coatings and solvent based cleaning. Where coatings are necessary powder-coated fabrication is preferred to painting and plating. Avoid plated metals especially those using cadmium and chromium as plate material or cyanide or copper/formaldehyde based electroless copper as the plating solution.

B. Remove all rust, scale, grease and other detrimental foreign matter in accordance with SSPC-SP 3, Power Tool Cleaning, unless conditions/opportunities listed below apply.

1. Use surface preparation classification recommended by paint manufacturer, SSPC or Master Painters Institute (MPI) for paint product used.

a. SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations, must be followed for all applicable surface preparation techniques.

C. Immediately after surface preparation, apply structural steel primer paint where specified, in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces. Use type of primer paint as specified in "Materials" article above. Apply two coats to surfaces that will be inaccessible after erection

D. Paint all structural steel in accordance with the foregoing specification, except as follows:

1. Steel which is to receive spray-on fireproofing.
2. Within 2" of field welds or welds made after paint is applied.
3. Faying surfaces in bolted connections shall be prepared per Section 3.2 of the RCSC “Specification for Structural Joints Using High-Strength Bolts.”
4. Machined surfaces and threaded parts required for adjustment of the structure. Protect these with suitable rust inhibiting coating which may be removed after final installation of the work so that proper finished coatings may be applied.

3.4 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

3.5 SOURCE QUALITY CONTROL

A. Refer to testing and inspection requirements specified above.

3.6 EXAMINATION

A. Verify field measurements prior to start of erection. Check the alignment and elevation of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify architect of any errors. Obtain Architect's approval of methods proposed for correcting errors prior to proceeding with corrections and erection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.8 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

C. Column billets and bearing plates shall be supported and aligned on steel wedges, shims, or leveling nuts. After the supported members have been plumbed and properly positioned by

instrument and anchor nuts tightened, the entire bearing area under the plate shall be packed solidly with grout specified in another Section. Wedges and shims shall be set back a minimum of 3/4" from the edges of plates and shall be left in place. Leveling plates are not permitted.

D. Plumbing, Leveling and Bracing

1. Structural steel shall be erected true and level, and temporary bracing shall be introduced wherever necessary to provide for all loads to which the structure may be subjected, including equipment and the operation thereof. Such bracing shall be left in place as long as may be required for safety. No welding shall be done or bolts drawn up tight until structural steel has been properly aligned. Obtain approval for guy locations to assure lack of interference with operations of other trades.

E. Drifting

1. Light drifting necessary to draw holes together will be permitted, but drifting of unfair holes will not be permitted. Twist drills shall be used to enlarge holes as necessary to the next larger size; use next larger size bolts as required. Reaming that weakens the members, or make it impossible to fill the holes properly or to adjust accurately after reaming, will not be allowed.

3.9 FIELD CONNECTIONS

A. In addition to the requirements for shop connections comply with the following:

1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
2. Joint Type: As noted on structural drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

3.10 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Cleaning and touchup painting are specified in Division 9."

C. After erection, all damaged areas in shop coat, exposed surfaces of bolt heads, nuts and washers, and all field welds and unpainted areas adjacent to field welds and high strength bolts shall be painted with a "touch-up" application of same paint used in the shop coat and then painted with same paint used for shop coat tinted another color. Retouch in field, any scraped, abraded, and unpainted surfaces. Painting shall be as specified for shop coats.

D. Structural steel which is to support mechanical equipment and will be left exposed to the weather

in the finished project shall be field painted with one coat of anti-corrosive paint as described in Part 2 for Paint Materials.

3.11 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.

B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.

C. Collect all metal cut-offs and scraps and recycle as above.

D. Fold up metal banding, flatten and place in designated area.

E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.

F. Designated un-used paint for:

1. Immediate re-use
2. Long term maintenance needs
3. Recycling by an appropriate facility.
4. Donation

G. Place empty containers of solvent-based paints in areas designated for hazardous materials.

H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal

I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Floor deck
2. Headed shear studs
3. All necessary deck supports and reinforcing other than principal framing members including diagonals at columns, angles, plates, etc.
4. Flashing, cell closures, closure plates and sheet metal work required to contain concrete.
5. Ceiling hanger tabs at new decking composite with concrete where new suspended ceilings are required.
6. Waste Management.

B. Related Requirements:

1. Concrete and reinforcement over decking
2. Structural steel
3. Shoring of metal deck where unsupported span exceeds the allowable
4. Ceiling systems
5. Mechanical and electrical where supported from deck
6. Fireproofing systems
7. Sheet metal work
8. Waste Management/Recycling Strategies

1.3 PERFORMANCE REQUIREMENTS

A. Metal deck unit sizes and gauges are indicated on the drawings. Gauges indicated on the drawings are a minimum. Thickness of deck may be required to be increased by deck manufacturer for loadings indicated on drawings.

B. Unit shall span over three or more supports except where steel layout does not permit.

C. Maximum allowable deflection under live load plus super imposed dead load shall not exceed (1/360) of the span or (1/4) inch whichever is less.

D. Deck shall be sized as unshored. Shoring of deck is not permitted unless specifically shown in areas on the drawings.

E. Units included in a fire rated assembly must be classified in appropriate UL design.

1.4 SUBMITTALS

A. Product Data: Product data, including manufacturer's specifications, load tables, section properties and installation instructions for each type of decking and accessories.

B. Shop Drawings: Shop drawings for all installations showing gauges, deck layout, type of deck, any shoring required, where located, welding details necessary for fabrication to fit in place, and all accessories. Do not use reproductions of the Design Drawings. In addition, include the following:

1. Ceiling tab, fillers, closures and similar items.
2. Show placement of headed shear studs connectors with respect to the flutes of the metal deck. Variation from the specified deck configuration may result in a decrease of the capacity of the studs, requiring more studs.

C. Product Certificates: Certification of specification compliance for each item specified.

D. Reports

1. Submit certification of recycled steel content. Certification shall indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
2. Submit producer's literature or Material Test Reports (MTR's) which indicate original EAF steelmaking production for all steel deck products listed on the Structural Drawings.
3. Submit verification of finishing process:

    a. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all shop and field paints used highlighting VOC limits and chemical and mineral component limits.
    b. For heavy metals in used plating processes: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each plating material and related compounds highlighting chemical component limits.
    c. Certification of recycled zinc content for galvanized products: Provide cut sheets clearly indicating whether the galvanized products used meet the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.

4. Submit verification of biodegradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

A. Except as modified by governing codes and by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. New York City Building Code, Latest Edition
2. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members".

3. American Welding Society (AWS), D1.1 "Structural Welding Code" and D1.3 "Structural Welding Code-Sheet Steel".
4. Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks, and Roof Decks".
5. American National Standards Institute (ANSI)/Steel Deck Institute (SDI) “Quality Control and Quality Assurance for Installation of Steel Deck”.
6. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.

B. Fabricator Qualifications: The work under this section shall be performed by a fabricator and erector submitting conclusive evidence of having satisfactorily completed work of similar scope and of having the necessary skill, equipment, facilities and capacities to fabricate and perform the erection in accordance with the construction schedules and in full compliance with all requirements of the Contract Documents.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. However, efforts should be made to minimize the disturbance to site and soil conditions for example, by not requiring excessive areas to be put aside for on-site storage.

B. Store materials to permit easy access for inspection and identification. Keep all materials in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect all materials from corrosion and deterioration, discoloration or staining. Make efforts to minimize any wastage and ensure that as much waste as possible is recycled.

C. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.7 PROJECT CONDITIONS

A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

B. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel decking units, the steel decking contractor shall bring the matter to the attention of the contractor for corrective action. The steel decking units are not to be placed until the necessary corrections are made.

C. Installation of the deck and shear studs will be inspected by the Architect and/or Owner’s agent.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 MANUFACTURERS

A. Supply manufactured deck units in accordance with the applicable requirements of the Steel Deck Institute's "Design Manual for Floor Decks and Roof Decks".

B. Deck shall be manufactured by one of the following (or other equivalent as approved by the architect and engineer of record):

1. United Steel Deck (manufactured by Canam)
2. New Millennium
3. Vulcraft

2.3 DECK MATERIALS

A. Non-composite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if minimum gauge indicated is not adequate to support total loads as shown on the drawings.

2.4 ACCESSORIES

A. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

C. Anchor clips, vent clips, welding washers, flashing, saddle plates, sump pans, other accessories shall be those types, sizes, and configurations recommended by the decking manufacturer, and shall be of the same material and finish as the deck units. All accessories shall conform to ASTM A653/A63M.

D. Cell closure flexible strips, and fillers shall be of material in compliance with applicable building code governing class of construction.

E. Provide metal closure strips at edges of all slabs and openings that serve as pour stops for concrete. Gauge shall be sufficient to span or cantilever from steel beams.

F. Headed studs for shear connectors shall be per drawings manufactured from cold drawn wire and conforming to ASTM A 108, Grades 1010 thru 1020.

1. Subject to compliance with requirements, studs shall be manufactured by one of the following:

a. Nelson
b. KSM

2.5 FABRICATION

A. Fabricate deck units in accordance with the AISI's "Specification for the Design of Cold-Formed

Steel Structural Members" and accepted shop drawings. Fabricate deck units to the sizes and configurations indicated and cut to lengths which will span not fewer than three supporting members; use only full length units at overhang where indicated in a manner that laps fit tightly. Locate openings for penetrations where indicated and provide support framing and edge reinforcement for all openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSPECTION

A. Inspection of the metal deck and shear stud installation will be performed by an inspection agency retained by the owner at no expense to the contractor. The inspection agency shall work under the direction of the owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.

3.3 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section. Erection shall closely follow the erection of structural steel.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members as per load schedule provided on contract documents.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work, per drawings and manufacturer’s specifications.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Headed shear studs shall be installed by welding through metal deck onto beam below. Automatic welding machinery of approved design, amperage, duration of current, etc., shall be used. Studs shall be tested by testing laboratory in accordance with AWS Procedures for Bend Test; replace all studs which do not pass test.

H. All welding shall be performed by competent experienced welding mechanics. Welding mechanics must have AWS D1.3 certification for welding sheet metal less than 1/8 inch thick. All welds shall be given a protective coat of paint as specified in painting article of section 051200.

I. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.

3.4 FLOOR DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members per the drawings.Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports per the drawings.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing per manufacturer’s specification but not less than 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2” minimum or butted at Contractor's option.

C. All unframed deck openings in composite deck with concrete larger than 6" shall be reinforced per the drawings.

D. At composite deck with concrete, metal hanger tabs shall be installed at all panel sidelaps 24 inches on-center, longitudinally 24 inches on-center to create a grid nominally 24 inches by 24 inches. Tabs shall be 18 gauge minimum, capable of supporting the specified ceiling, tabs shall be a minimum of 18 gauge capable of supporting ceiling and all other suspended loads or 200 pounds, whichever is greater.

E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

F. Sealing cellular deck openings, butt joints, and junctions with trench headers with tape is not included in this Section. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

G. The steel decking units shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams.

H. Deck shall, where possible, span 3 or more supports.

I. The side laps of adjacent units shall be fastened by approved method (to be shown on shop drawings) between supports at intervals as noted on the drawings.

J. All welding shall be performed by competent experienced welding mechanics. Welding mechanics must have AWS D1.3 certification for welding sheet metal less than 1/8 inch thick. All welds, shall be given a protective coat of paint as specified in painting article of Section 051200.

K. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.

L. Headed shear studs shall be installed by welding through metal deck onto beam below. Automatic welding machinery of approved design, amperage, duration of current, etc., shall be used.

Studs shall be tested by testing laboratory in accordance with AWS Procedures for Bend Test; replace all studs which do not pass test.

M. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.5 FIELD QUALITY CONTROL

A. Special Inspection as required by the applicable Building Code of all metal decking will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Order sheets, material bills, shipping bills and mill test reports.
4. Representative sample pieces as requested by the testing agency.
5. Full and ample means and assistance for testing all material.
6. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.

B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.

C. The following minimum criteria shall be adhered to in testing of welds:

1. All welds shall be examined by visual means.
2. 25% of all welds, selected randomly, shall be measured.
3. In addition, all welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
4. 10% of all manual fillet welds shall be tested by the magnetic particle method.
5. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
6. 100% of groove welds shall be tested by the ultrasonic method.

D. Field inspection will include examination of decking for welding and touching-up of shop coat.

E. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:

1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the architect.
3. The testing agency shall be prepared to utilize the following approved methods of testing:

    a. Liquid penetrant inspection: ASTM E 165.
    b. Magnetic particle: ASTM A 709.
    c. Radiographic inspection: ASTM E 94 and E 1032.
    d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.

F. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect

has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the architect. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Architect.

G. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.

H. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

I. Remove and replace work that does not comply with specified requirements.

J. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 CLEANING UP

A. Remove all equipment, unused materials and debris from the site immediately upon the completion of this work.

3.7 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.

B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.

C. Collect all metal cut-offs and scraps and recycle as above.

D. Fold up metal banding, flatten and place in designated area.

E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.

F. Designated un-used paint for:

1. Immediate re-use
2. Long term maintenance needs
3. Recycling by an appropriate facility.
4. Donation

G. Place empty containers of solvent-based paints in areas designated for hazardous materials.

H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal

I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel items, including:
   1. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for stone and other applications where framing and supports are not specified in other Sections.
   3. Slotted channel framing (Unistrut).

1.2 RELATED REQUIREMENTS

A. Section 09 75 00 - Stone Facing.

B. Section 09 91 23 - Interior Painting: Paint finish.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel.

K. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

L. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.

M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate installation of anchorages and steel weld plates with existing conditions as required to support work specified in other Sections. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
      a. Include the following, as applicable:
         1) Design criteria.
         2) Engineering analysis depicting stresses and deflections.
         3) Member sizes and gauges.
         4) Details of connections.
         5) Support reactions.
         6) Bracing requirements.
   3. Provide Shop Drawings for the following:
      a. Stone anchorage support steel.

C. Designer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design indicated fabrication items under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
   1. W-Shapes: 60 percent.
   2. Channels, Angles: 60 percent.
   3. Plate and Bar: 25 percent.
   4. Cold-Formed Hollow Structural Sections: 25 percent.
   5. Steel Pipe: 25 percent.
   6. All Other Steel Materials: 25 percent.

B. Steel Channel, Angle, and Plate Sections: ASTM A36/A36M.

C. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

D. Plates: ASTM A283/A283M.

E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

F. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

G. Slotted Channel Fittings: ASTM A1011/A1011M.

H. Fasteners: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening stainless steel.
   2. Dissimilar Metals: Type 304 stainless-steel fasteners.

3. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.

I. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

J. Bolts and Nuts (Weathering Conditions): Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

K. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

L. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

M. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

N. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

O. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

P. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

1. Basis of Design Product: Subject to the requirements provide Sherwin-Williams Alkyd Universal Metal Primer, Kem Kromik B-50 Series or a comparable approved product of one of the following:
    a. AkzoNobel; International Paints/Devoe Coatings.
    b. Benjamin Moore & Co.
    c. PPG Architectural Finishes, Inc.

Q. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type II - Organic, complying with VOC limitations of authorities having jurisdiction.

1. Basis of Design Product: ZRC Galvilite Galvanizing Repair Compound cold galvanizing compound of 95% metallic zinc or a comparable product of an approved manufacturer.

R. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

S. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.2 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Form exposed work with accurate angles and surfaces and straight edges.

D. Continuously seal joined members by continuous welds.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
   1. Comply with NOMMA voluntary guidelines for joint finishes; Finish #2 - completely sanded joint, some undercutting and pinholes acceptable.

F. Provide for thermal expansion/contraction of exterior metal railings and similar linear fabrications exceeding 30 feet in running length; and not closer than 24 inches from corners and intersections.

G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

H. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

I. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

J. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.3 FABRICATED ITEMS

A. Provide and install items shown on Drawings with anchorage and attachments necessary for installation. The following is a list of principal items only. Refer to Drawing details for items not specifically scheduled.

B. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; hot-dipped galvanized per ASTM A653, Grade G90 finish.

2.4 FINISHES - STEEL

A. Unless otherwise recommended by finish coating manufacturer, prepare surfaces to be shop primed in accordance with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for exterior items and items indicated to receive zinc-rich primer. For other items, prepare to SSPC-SP 3, "Power Tool Cleaning."

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime paint all steel items, unless otherwise specified.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and miscellaneous framing and supports on exterior of building.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

D. Prime Painting: One coat.
   1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
   2. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

2.5 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on Drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 50 00

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

1.2 RELATED REQUIREMENTS

A. Section 06 40 00 - Architectural Woodwork: Shop fabricated custom cabinet work.

B. Section 09 91 23 - Interior Painting: Painting and coating of finish carpentry items.

1.3 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

B. AWI (QCP) - Quality Certification Program.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

E. PS 1 - Structural Plywood.

F. PS 20 - American Softwood Lumber Standard.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data for each type of product and finish.
2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
2. Provide the information required by AWI/AWMAC/WI (AWS).
3. Include certification program label.

D. Samples: Submit two samples of each type of veneer and finish material, 4 x 4 inch in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of each type of wood trim 12 inch long.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience.
1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Store finish carpentry items in installation areas. If finsh carpentry items must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

D. Stack lumber and provide for adequate air circulation within and around stacks and under temporary coverings.

E. Protect from moisture damage.

F. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.8 FIELD CONDITIONS

A. Comply with specified standard and as additionally specified.

B. Do not deliver finish carpentry items until environmental conditions meet specified requirements for installation areas.

C. Do not deliver or install finish carpentry items until building is enclosed and weatherproof, wet work in installation areas is complete and nominally dry, and building's environmental control systems are operating and will maintain temperature and relative humidity at designed occupancy levels throughout the remainder of the construction period.

D. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless otherwise specified for each carpentry item.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:

1. Moldings, Bases, Casings, and Miscellaneous Hardwood Trim: Prepare for field finish as indicated in Drawings.

2.2 LUMBER AND TRIM MATERIALS

A. Lumber for Opaque Finish (Painted) Interior Trim: Maximum moisture content of 12 percent according to ASTM D4442, S4S, of quality suitable for opaque finishes.

1. Eastern white pine, Finish or 1 Common; NELMA or NLGA.
2. Yellow poplar, FAS; NHLA.
3. White woods, 1 Common; WWPA.

2.3 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B, glue type as recommended for application.

2.4 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.

C. Concealed Joint Fasteners: Threaded steel.

2.5 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Lumber for Shimming: Softwood lumber of pine or fir species.

C. Primer: For factory-primed units, manufacturer's recommended primer.

D. Wood Filler: Solvent base, tinted to match surface finish color.

2.6 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.7 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed finish edges with material of same finish and pattern.

C. Shop prepare and identify panel components for book match grain matching during site erection.

D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.

C. See Section 06 10 00 - Rough Carpentry for installation of wood blocking.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components with finish nails at maximum 8 inch on center.

E. Install finish carpentry items with minimum number of joints practical, using full length pieces from maximum lengths of lumber available. Do not use individual pieces less than 24 inches long, except where necessary.
   1. Stagger joints in adjacent and related standing and running trim.
   2. Cope at returns and miter at corners to produce tight-fitting joints with full surface contact throughout the length of joints.
   3. Use scarf joints at end-to-end joints.
   4. Plane back surfaces of casings as required to provide uniform thickness and flush finished surfaces across joints.
   5. Match color and grain across joints.

F. Install trim after finishing of substrate surfaces is complete.

G. Pre-drill pilot holes in hardwood carpentry items before fastening to prevent splitting. Securely fasten to prevent warping or movement.

3.3 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 91 23.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.5 PROTECTION

A. Protect installed finish carpentry items from damage due to subsequent construction operations.

END OF SECTION 06 20 00

SECTION 06 40 00 - ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated architectural woodwork units.

B. Hardware.

C. Factory finishing.

D. Preparation for installing utilities.

1.2 RELATED REQUIREMENTS

A. Section 12 36 00 - Countertops.

1.3 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

C. AWI (QCP) - Quality Certification Program.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

E. NEMA LD 3 - High-Pressure Decorative Laminates.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Field verify critical dimensions and clearances prior to fabrication of woodwork items; assure that field conditions are as required to comply with indicated design requirements.
2. By accurate field measurements before being enclosed, verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork; record measurements on shop drawings.
3. Where field measurements cannot be made without delaying work, establish required dimensions and maintain those dimensions for fabrication of woodwork.
4. Coordinate construction to ensure that actual dimensions correspond to established required dimensions.

5. Coordinate cabinet spacing and clearances to ensure that doors and drawers do not conflict with each other.
6. Coordinate cabinet opening and spacing requirements with approved appliances and plumbing fixtures.

B. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
2. Provide the information required by AWI/AWMAC/WI (AWS).
3. Shop drawings are required to be generated as separate digital drawings specific to this Project, not utilizing Architect's digital drawing files in any manner.
4. Show all adjacent construction including abutting walls, columns and similar elements affecting woodwork installation.
5. Include certification program label.

C. Product Data: Provide data for hardware accessories.
1. Include loading criteria for hinges

D. Samples: Submit actual samples of architectural woodwork construction, minimum 12 inches square, illustrating each proposed cabinet and woodwork substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, locksets, and all other hardware, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
6. Replace, repair, or rework all work for which certification is refused.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver woodwork items to installation areas only after clean, well ventilated, and temperature-controlled installation areas are available. Do not deliver woodwork items to installation areas until painting and similar operations are complete in those areas.

B. Protect units from moisture and impact damage during transit, delivery, and storage; use protective covers during delivery, storage, and handling operations.

1.8 FIELD CONDITIONS

A. During and after installation of woodwork, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Single Source Responsibility: Provide and install this work from single fabricator.

2.2 CABINETS

A. Quality Standard: Grades as indicated, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:
1. Aesthetic Grade: Premium Grade.
2. Performance Grade: Duty Level 2 - Commercial.
3. Exposed Surfaces: HPVA HP-1 Grade A, species TBD, cut TBD, book-matched.

4. Semi-Exposed Surfaces: HPVA HP-1 Grade B, species TBD, cut TBD, book-matched.
5. Concealed Surfaces: Manufacturer's option.

C. Plastic Laminate Faced Cabinets:
1. Aesthetic Grade: Custom Grade.
2. Performance Grade: Duty Level 2 - Commercial.
3. Exposed Surfaces: High-pressure decorative laminate, type as indicated.
4. Semi-Exposed Surfaces: High-pressure decorative laminate, type as indicated.
5. Concealed Surfaces: Manufacturer's option.

D. Cabinets:
1. Casework Construction Type: Type A - Frameless.
2. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
3. Layout for Cabinet and Door Fronts: Flush panel.
4. Adjustable Shelf Loading: 40 psf.
a. Deflection: L/144.

2.3 WOOD-BASED COMPONENTS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Wood fabricated from old growth timber is not permitted.

2.4 PANEL CORE MATERIALS

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

2.5 HARDWOOD PLYWOOD PANELS

A. Hardwood Plywood: Plywood manufactured for nonstructural decorative applications; consisting of faces and backs applied to a variety of core types; comply with HPVA HP-1.
1. Woodwork Quality Standard: Panels complying with specified woodwork quality standard.

2.6 THERMALLY FUSED LAMINATE PANELS

A. Thermally Fused Laminate (TFL): Melamine- or polyester-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
   1. Test in accordance with NEMA LD 3 Section 3.

2.7 LAMINATE MATERIALS

A. Acceptable Manufacturers:
   1. As indicated in Drawings.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

C. Provide specific types as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as indicated, finish as indicated.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
   3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.
   4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
   5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as indicated, finish as indicated.
   6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.8 COUNTERTOPS

A. Countertops: See Section 12 36 00.

2.9 ACCESSORIES

A. Adhesive: Type recommended by AWI/AWMAC to suit application.

B. Edge Banding: Cap exposed edges with material of same finish and pattern.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.10 HARDWARE

A. Hardware: BHMA A156.9, types as indicated for quality grade specified, unless otherwise specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: As indicated in Drawings.

D. Cabinet Locks: Keyed cabinet-grade lock, two keys per lock, finish to match pull finish.
   1. Keying: Coordinate with Owner's standard keying system.

E. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Finish: Selected from manufacturer's standard line.
   6. Features: Provide self-closing/stay-closed/soft-close type.
   7. Acceptable Manufacturers:
      a. Accuride International, Inc.: www.accuride.com.
      b. Blum, Inc: www.blum.com/#sle.
      c. Grass America Inc: www.grassusa.com/#sle.
      d. Hettich America, LP: www.hettich.com/sle.
      e. Knape & Vogt Manufacturing Company: www.knapeandvogt.com/#sle.
      f. Sugatsune America, Inc: www.sugatsune.com/#sle.
      g. Substitutions: See Section 01 60 00 - Product Requirements.

F. Hinges: European style concealed, self-closing type, steel with satin finish.
   1. Provide self-closing/stay-closed/soft-close type.
   2. At 90 degree inside corner conditions, provide restriction clips to limit the opening of cabinet doors to no more than 86 degrees to prevent damage to adjacent surfaces.
   3. Acceptable Manufacturers:
      a. Blum, Inc: www.blum.com/#sle.
      b. Grass America Inc: www.grassusa.com/#sle.
      c. Hardware Resources: www.hardwareresources.com/#sle.
      d. Hettich America, LP: www.hettich.com/sle.
      e. Sugatsune America, Inc: www.sugatsune.com/#sle.
      f. Titus Cabinet Hardware: www.titusplus.com/us/en/#sle.
      g. Substitutions: See Section 01 60 00 - Product Requirements.

G. Cabinet Door Restraints: Stainless steel cable type with screw attachment from cabinet frame to cabinet door to reduce the swing of cabinet doors.
   1. Required Locations: As an alternative to restriction clips, install door restraints.
   2. Manufacturers:
      a. Halfele; Door Restraint Kit: www.hafele.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.11 FABRICATION

A. Assembly: Shop assemble woodwork for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.

D. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide balance matched panels at each elevation.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.12 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

C. Verify critical clearances and dimensions prior to installation of woodwork items.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure cabinets and woodwork in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe woodwork abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets and woodwork to floor using appropriate angles and anchorages.

G. Secure full height cabinets, shelving units, and similar casework items exceeding 60 inches in height to floor using appropriate angles and anchorages.

H. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean woodwork, casework, counters, shelves, hardware, fittings, and fixtures.

3.5 PROTECTION

A. Protect installed architectural woodwork from damage due to subsequent construction operations.

END OF SECTION 06 40 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items.

B. Sealants for joints within sheet metal fabrications.

1.2 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this Section.
   1. Require attendance of parties directly concerned with the work of this Section, including those who are required to coordinate with the work, and those who are required to protect the work upon completion.
   2. Review preparation and installation procedures and coordinating and scheduling required with related work.

B. Sequencing: Do not proceed with installation of flashing and sheet metal work until substrate construction, cants, blocking, reglets, and other construction are ready to receive the work of this Section.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
   1. Include identification of material, thickness, weight, and finish for each item and location in Project.
   2. Include details of edge conditions and joints.
   3. Include details of connections to adjoining work.
   4. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

D. Samples: Submit two samples 6 x 6 inch in size illustrating each metal finish color.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

C. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion. Defective work includes failure of watertightness or seals.

B. Provide 10 year manufacturer warranty for metal finishes.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet Metal Standards: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.2 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum gage as scheduled, shop pre-coated with PVDF coating.
   1. Exposed Coating: PVDF (Polyvinylidene Fluoride) Superior Performance Organic Finish, AAMA 621; multiple coat, thermally cured fluoropolymer finish system.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

B. Anodized Aluminum: ASTM B209 (ASTM B209M); minimum gage as scheduled; anodized finish of color as selected.
   1. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.
   2. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils thick.

C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M), minimum gage as scheduled; shop pre-coated with with PVDF coating.
   1. Exposed Coating: PVDF (Polyvinylidene Fluoride) Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

D. Stainless Steel: ASTM A240, Type 304 alloy, soft temper, fully annealed, minimum gage and finish as scheduled.
   1. Finish: 2D (dull, cold rolled).

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Hem exposed edges on underside 1/2 inch; miter and seam corners.

C. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

2.4 SHEET METAL FABRICATIONS

A. As detailed.

2.5 ACCESSORIES

A. Fasteners: Stainless steel, concealed unless noted otherwise.

B. Concealed Sealants: Non-curing butyl sealant.

C. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

2.6 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior performance organic finish with minimum 70 percent PVDF fluoropolymer resin by weight, multiple coat, thermally cured finish system.
   1. Acceptable Products:
      a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
      b. Sherwin-Williams Company; SHER-NAR 5000: oem.sherwin-williams.com/#sle.
      c. Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.
      d. Arkema; Kynar 500: www.americas.kynar.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION - GENERAL

A. Comply with SMACNA Architectural Sheet Metal Manual.

B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
   4. Torch cutting of sheet metal flashing and trim is not permitted.
   5. Do not use graphite pencils to mark metal surfaces.

C. Conceal fasteners and expansion provisions where possible in exposed work.

3.3 INSTALLATION - PRE-FINISHED SHEET METAL

A. Take special care in the handling and installation to avoid damage to finish.

B. Remove protective film from each unit after installation, but not before adjacent construction is complete.

C. Touch up minor damage or defects to match factory finish. Replace units which are excessively damaged as determined by Architect.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 81 00 - APPLIED FIRE PROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applied fire protection of interior structural steel not exposed to damage or moisture.

B. Applied fire protection of structural steel exposed to damage or moisture.

C. Preparation of applied fire protection for application of exposed overcoat finish specified elsewhere.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

C. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.

D. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.

E. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.

F. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this Section.
   1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.
   2. Discuss application procedures and limitations, and sequencing in relation to other work.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics, performance criteria, and limitations of use.

C. Delegated Design: Design applied fire proofing thickness required by the Contract Documents to withstand fire ratings indicated and in accordance with requirements of the Building Code, and as follows:
   1. Provide manufacturers standard UL listing where site conditions match standard assembly listings.

D. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.
   1. Provide letter verifying that the UL Designs selected for the project are not load restricted.
   2. Provide letter approving latex paint topcoat and application over fireproofing where indicated.

E. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
   1. Bond strength.
   2. Bond impact.
   3. Compressive strength.
   4. Fire tests using substrate materials similar those on project.

F. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

G. Field Quality Control Submittals: Submit field test report.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience

C. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing as follows:
   1. Provide test specimens and assemblies representative of proposed materials and construction.

2. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
    a. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
    b. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
    c. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
    d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
    e. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.6 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

D. Do not allow roof traffic during installation of roof fireproofing and drying period.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.
    1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
    2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
    1. Carboline Company: www.carboline.com.
    2. GCP Applied Technologies: www.gcpat.com/fireproofing/#sle.

3. Isolatek International Corp.: www.isolatek.com/#sle.
4. Southwest Fireproofing Products Company: www.sfrm.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

2.2 APPLIED FIRE PROTECTION ASSEMBLIES

A. UL listings with a Load Restriction are not allowed.

B. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

C. Thickness and Density: ASTM E605, thickness and density as required by UL test to attain the fire endurance rating shown or as required by governing authorities for the application shown. Thickness shown is the minimum thickness required solely to determine clearances and, in case of conflict, the fire endurance rating prevails. For structural members of sizes not included in the UL beam and column designs, calculate the required fireproofing thickness in accordance with the equation listed in the UL “Fire Resistance Directory” for adjustment of applied protection material thickness.

D. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 MATERIALS

A. Sprayed Fire-Resistive Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
1. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736 when set and dry.
2. Dry Density: 15 lb/cu ft, minimum, when tested in accordance with ASTM E605.
3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605.
4. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf.
5. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760.
6. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937.
7. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859 after 24 hours.
8. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
9. Effect of Deflection: No cracking, spalling, or delamination, when tested in accordance with ASTM E759.
10. Fungal Resistance: No growth after 28 days when tested according to ASTM G21.

11. Acceptable Products:
    a. GCP Applied Technologies; Monokote MK-6: www.gcpat.com.
    b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP.
    c. Isolatek International Inc.; Cafco 300: www.isolatek.com.

2.4 ACCESSORIES

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Primer and Bonding Agent: Type recommended by fireproofing manufacturer.

C. Overcoat: As recommended by manufacturer of applied fire protection material.

D. Metal Lath: Expanded metal lath; minimum weight of 1.7 psf, galvanized finish.
    1. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

G. Water: Clean, potable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.2 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.3 APPLICATION

A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Apply primer adhesive in accordance with manufacturer's instructions.

D. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

E. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.

F. Apply overcoat at the rate recommended by fireproofing manufacturer.

G. Finished Condition: No cracks, voids, spalls, delamination, or any exposure of substrate will be permitted upon complete drying or curing. Surface irregularities (texture and shape only) are acceptable.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

B. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
   1. Submit field test reports promptly to Contractor and Architect.

C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

D. Repair or replace applied fireproofing at locations where test results indicate fireproofing does not meet specified requirements.

E. Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent work.

3.5 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION 07 81 00

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping systems, materials, and accessories.

B. Firestopping at electrical junction boxes in fire-rated walls.

C. Firestopping of all membrane penetrations, through penetrations and joint applications within fire rated assemblies, whether indicated on Drawings or not, and other openings indicated.

D. Contractor's responsibility for determining required scope of firestopping system work, and for determining applicable tested/listed systems for the entire project, and for securing jurisdictional authority approval of firestopping systems.

1.2 DEFINITIONS

A. Firestopping: A material or combination of materials used to retain the continuity and integrity of fire- and smoke-rated construction by maintaining an effective barrier against the spread of flame, and to impede the passage of smoke, gases, and moisture through penetrations, blank openings, construction joints, and perimeter fire/smoke containment in or adjacent to fire-and smoke-rated wall, floor, ceiling, and other rated construction assemblies.

B. Assembly: Particular arrangement of materials specific to type of construction described or detailed in referenced UL or other approved design.

C. Fire-Resistance-Rated Barriers: Fire-resistance-rated fire walls, fire barriers, fire partitions, smoke barrier walls, rated floor/ceiling assemblies, and structural floors.

D. Through Penetration: Opening or foreign material passing through or into a fire-resistance-rated assembly or structural floor such that full thickness of rated materials is interrupted.

E. Membrane Penetration: An opening made through one side of a fire-resistance-rated assembly without passing completely through the assembly.

F. Fire-Resistant Joint System: Gaps between adjacent sections of fire-resistance-rated walls, exterior walls, top of wall and ceiling, structural floors or roof decks, and adjacent sections of structural floors. Where fire-resistance-rated walls meet non-rated wall or floor conditions, reference "Continuity Joint" conditions.

G. 3rd Party Tested Systems: Specific products and applications, classified and numbered by UL or other 3rd party approved testing agency in accordance with specific barrier base designs and through penetration applications.

H. Sleeve: Metal fabrication or pipe section extending through thickness of barrier used to permanently guard penetration in accordancew with tested systems.

I. VOC: Volatile organic compound(s).

1.3 REFERENCE STANDARDS

A. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

B. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

D. ASTM E1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

E. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

F. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.

G. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

H. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus.

I. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

L. ASTM E3038 - Standard Practice for Assessing and Qualifying Candidates as Inspectors of Firestop Systems and Fire-Resistive Joint Systems

M. IFC - International Firestop Council Recommended Guidelines for Evaluating Firestop Systems Engineering Judgements; current edition.

N. ITS (DIR) - Directory of Listed Products.

O. FCIA - Firestop Contractors International Association Manual of Practice; current edition.

P. FM 4991 - Approval Standard of Firestop Contractors.

Q. FM (AG) - FM Approval Guide.

R. SCAQMD 1168 - Adhesive and Sealant Applications.

S. UL 1479 - Standard for Fire Tests of Penetration Firestops.

T. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

U. UL (DIR) - Online Certifications Directory.

V. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

W. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Stage and coordinate installation of firestopping systems with affected trades and adjacent work in accordance with manufacturer's instructions.

B. Preinstallation Meeting: Convene one week before starting work of this Section. Notify Owner, who may request attendance by an independent consultant.
   1. Require attendance of parties directly concerned with the work of this Section, including those who are required to coordinate with the work, and those who are required to protect the work upon completion. Include the manufacturer's technical representative.
   2. Review installation procedures and coordination required with related work, and conditions which could affect successful performance of the work.

C. Sequencing: Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.
   1. Do not cover or conceal firestopping installations until Owner's inspection agency and jurisdictional authority have inspected each installation.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
   1. Use Firestopping Systems Schedule Form attached to the end of this Section, or other form approved by Architect.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Certificate from authority having jurisdiction indicating approval of materials used.

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this Section and:
   1. Trained by firestop system manufacturer.
   2. Meeting any of the three options below:
      a. Approved by UL in accordance with "UL Solutions Qualified Firestop Contractor Program."
      b. Approved by Factory Mutual Research Corporation under FM 4991
      c. Meeting all three of the following criteria:
         1) Verification of minimum five years documented experience installing work of this type.
         2) Verification of at least five satisfactorily completed projects of comparable size and type.
         3) Acceptable to the local authorities having jurisdiction (AHJ).

D. Obtain firestop systems for each type and condition of penetration from a single manufacturer; intermixing of system components for each type and condition of penetration by different manufacturers is not permitted.

E. Listed and tested assemblies and systems must be utilized, if they exist, before alternative systems requiring Engineering Judgement (EJ)/UL Technical Evaluation (UL TE) or Equivalent Fire Resistance Rated Assembly (EFRRA) will be considered. Comply with IFC and FCIA for EJ and EFRRA design and submittal requirements.

1.7 REGULATORY REQUIREMENTS

A. Comply with execution requirements of authority having jurisdiction including, if applicable, the requirement that all firestopping work be performed by a single qualified firm or subcontractor.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Deliver materials in original unopened containers identified with manufacturer's brand designation and applicable UL label.

B. Do not use damaged or expired materials.

1.9 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions. Maintain uniform temperature of minimum 40 degrees F prior to, during, and after installation of materials

B. Provide ventilation in areas where solvent-cured materials are being installed.

1.10 WARRANTY

A. Include agreement to repair or replace joint sealers which fail in joint adhesion, extrusion resistance, migration resistance, general durability, or apparent deterioration beyond manufacturer's printed limitations for stipulated warranty period from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design - Floor, Wall, and Joint Systems:
   1. Specified Technologies Inc.: www.stifirestop.com/#sle.

B. Other Acceptable Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. A/D Fire Protection Systems Inc.: www.adfire.com.
   3. GCP Applied Technologies: www.gcpat.com.
   4. Hilti, Inc: www.us.hilti.com/#sle.
   5. Nelson FireStop Products: www.nelsonfirestop.com.
   6. RectorSeal, a CSW Industrials Company: www.rectorseal.com/firestop-solutions/#sle.
   7. Pecora Corporation: www.pecora.com.
   8. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   9. USG: www.usg.com.
   10. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 MATERIALS - GENERAL

A. Firestopping Materials: Any materials meeting requirements specified.
   1. Comply with ASTM E814, UL 1479, and UL 2079 as applicable to achieve indicated fire ratings.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to Drawings for required systems and ratings.

2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. General: Use firestopping systems which are acceptable for those applications for which they are specifically designed. Use of other UL listed systems is Contractor's Option, subject to compliance with specified performance, regulatory, and quality assurance requirements.
   1. Where there is no specific tested and classified firestop system for an indicated condition, obtain from the firestopping system manufacturer an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) according to IFC and FCIA.

B. Scope: Install firestopping at all locations requiring protected openings where piping, conduit, cables, sleeves, ductwork and similar items penetrate fire-resistive, fire-rated, and smoke assemblies, including but not limited to:
   1. Penetrations through wall, floor, and roof assemblies, including empty openings and openings containing penetrations.
   2. Membrane penetrations where items penetrate one side of the barrier assembly.
   3. Joints between rated assemblies to allow independent movement.
   4. Perimeter barriers between exterior wall assemblies and floor and roof assemblies.
   5. Joints, through-penetrations, and membrane penetrations in smoke-rated assemblies.

C. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

D. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

E. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

F. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

G. Fire Rated Joint Systems: Integrity and indicated fire-resistance ratings as determined by UL 2079, ASTM E1399, or ASTM E1996 as applicable.

H. Fire Rated Construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces and types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

I. Smoke Barrier Construction: Maintain fire-resistance-rated wall and floor barrier and structural floor resistance in conformance with UL 1479 F & L ratings at all penetrations, connections with other surfaces and types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

J. Other General Characteristics:
   1. Surface Burning: ASTM E84 and UL 723; flame spread less than 25, smoke developed less than 450.
   2. Air Leakage of Perimeter Firestopping Barriers and Penetrations: UL 2079; L-rating less than 2.0 cfm/sf or 5.0 cfm/lf as applicable to the type and location of joint.
   3. Durability and Longevity: Permanent.
   4. Side Effects During Installation: Non-toxic.
   5. Side Effects Under Fire Exposure: Non-toxic.
   6. Long Term Side Effects: None.

2.4 MATERIALS

A. Putty Compound: 100 percent solids intumescent or vinyl-type formulation, free of asbestos, silicones, solvents, halogens, PCB's, and inorganic fibers; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84; paintable, not sensitive to freezing after set.

B. Sealant Compound: One-part intumescent, endothermic, ablative, or elastomeric acrylic water-based calking material required by applicable UL Design; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84.

C. Spray-Applied Compound: Water-based, flexible coating which drys to form a flexible seal; tested in accordance with ASTM E1399, complying with wind sway and thermal category, 500 cycles at minimum 10 cycles/minute.

D. Foam Compound: Two-part, liquid-silicone elastomer formulated to foam in place when mixed; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84.

E. Plastic Pipe Device: Intumescent strip material, factory or site fabricated in flexible metal collar with adjustable, screw-tightened stainless steel clamp; UL classified for use with PVC, CPVC, CCPVC, CCABS, PVDF, PP, PB, PEX, and FRPP plastic pipe.

F. Composite Sheet: Composite, intumescent sheet, designed for firestopping large openings in conjunction with other firestopping components, capable of being cut to size in the field and fabricated to fit required penetration openings.

G. Blanket Material: Refractory ceramic fiber blanket encapsulated with aluminum foil scrim complying with NFPA 96; widths and thicknesses required by applicable UL Design; specifically designed as a flexible, fireproof enclosure for kitchen exhaust ducts and fire-rated air ductwork.

H. Fire-Safing Insulation: ASTM C612, Type I; high-melt mineral fibers and resinous binders formed into blankets, density not less than 4.0 lbs/cu ft, tested for 3-hour fire containment for required depths and dimensions.

I. Firestopping Putty Pads: Non-hardening intumescent, putty pad formed to 7.25 x 7.25 x 3/16 inch or 9 x 9 x 3/16 inch self-adhering pads, 2-hour fire rating listed by UL.

J. EP Powershield Electrical Box Insert Pad: Intumescent, non-curing insert pad for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24 inches.

2.5 ACCESSORIES

A. Provide necessary accessory materials specified in UL Design to achieve complete firestop system at each penetration. Include collars, sleeves, attachment devices, intumescent materials, and other items required.

B. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design, and as recommended by firestopping manufacturer for specific substrate surfaces.

C. Dam Material: Mineral fiberboard, mineral fiber matting, sheet metal, alumina silicate fire board, or other permanent material required as part of the firestopping system, or removable if not specifically required as part of the firestopping system.

D. Retainers: Impale type clips to support mineral fiber safing blankets.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this Section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing or damming materials required to arrest liquid material leakage.

3.3 INSTALLATION - GENERAL

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency or in accordance with ASTM E2174 or ASTM E2393 where applicable.

C. Apply firestopping materials in sufficient thicknesses to achieve scheduled fire ratings, to uniform density and texture.

D. Install firestop materials within annular spaces at openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping.

E. Remove dam material after firestopping material has cured only if dam material is not required as part of the firestopping system; otherwise dam material to remain permanently in place.

F. Do not cover installed firestopping until inspected by authorities having jurisdiction.

G. Install labeling required by code.

3.4 INSTALLATION - FIRE SAFING INSULATION

A. Install safing insulation to completely fill spaces between floor slab edges and spandrel construction as detailed.

B. Install safing insulation to completely fill voids between floor and roof deck flutes and top of wall construction where wall ratings are indicated.

C. Install and support safing insulation permanently in position with gaged metal to comply with tested fire assembly and applicable building code requirements.

3.5 INSTALLATION - FIRESTOPPING PADS

A. Install firestopping putty pads on back side of electrical junction boxes or EP Powershield Electrical Box (Insert Pads) in fire-rated walls where boxes are located in same stud space on opposite sides of same wall, and elsewhere required by jurisdictional authority and local fire department.

3.6 THROUGH-PENETRATION FIRESTOPPING IDENTIFICATION

A. Labeling: Identify firestopping systems with pre-printed metal or plastic labels in accordance with FM 4991. Attach label permanently to surfaces immediately adjacent to and within 6 inches of edge of firestop installation so that label will be visible to anyone seeking to remove penetrating items or firestop system.
   1. Metal Labels: Use mechanical fasteners.
   2. Plastic Labels: Use self-adhering type with adhesive capable of permanently bonding label to substrate and, in combination with label material, will result in partial destruction of label if removal is attempted.

B. Include following information on each label:
   1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Installing contractor's name, address, and phone number.
   3. Firestop system designation, including applicable testing and inspection agency.
   4. Date of installation.
   5. Firestop system manufacturer's name.
   6. Installer's name.

C. Wall and Partition Identification: Refer to Section 07 05 53 - Fire and Smoke Assembly Identification.

3.7 FIELD QUALITY CONTROL

A. Independent Testing and Inspection Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

https://systems.stifirestop.com/

UL Alphanumeric Schedule

Type of Penetrant Floor Penetration Systems	Concrete Floors - Minimum thickness Less than or equal to 5"						Concrete Floors - Minimum thickness More than 5"						Framed Floors					
	Caulk	Device	F	T	L	W	Caulk	Device	F	T	L	W	Caulk	Device	F	T	L	W
No Penetrating Item	CAJ-0014		3	2			CAJ-0014		3	2								
Blank Opening	CAJ-0126		2	2	X	X	CAJ-0126		2	2	X	X						
		CAJ-0113	4					CAJ-0113	4									
		CAJ-0116	2					CAJ-0116	2									
0000-0999		CAJ-0061	3	2	X			CAJ-0061	3	2	X							
Metallic Pipe, Conduit or	CAJ-1080	CAJ-1353	3		X		CBJ-1058		2		X	X	FC-1010		2	2	X	
Tubing	CAJ-1354		2		X		CBJ-1065		2	2	X	X	FC-1013		1	1	X	
	CAJ-1240		2		X	X	CBJ-1066		2	2	X	X	FC-1014		2	1	X	
		CAJ-1533	2				FB-1014		2		X	X	FC-1053		1	1		
1000-1999		FA-1118	2	2	X	X	FB-1030	*FB-1021*	2		*X*		FC-1074	FC-1075	2	1	X	
Non-Metallic Pipe,	CAJ-2292		2	2			CBJ-2046		2		X		FC-2032		1	1	X	
Conduit or Tubing		CAJ-2104	2		X	X		FB-2014	3	3	X	X	FC-2158		2	2	X	
		CAJ-2297	3	3	X	X		CAJ-2297	3	3	X	X	FC-2014	FC-2322	1	1		
		CAJ-2772	2	2	X	X		CAJ-2772	2	2	X	X	FC-2320		1	1		
		FA-2192	3	3	X	X		FA-2192	3	3	X	X	FC-2321		2	2	X	
2000-2999		FA-2210	2	1	X	X		FA-2210	2	1	X	X		FC-2348	2	1	X	
Electrical Cables	CAJ-3154		4	2			CBJ-3034		4				FC-3010		1	1		
	CAJ-3042		3		X		CAJ-3042		3		X		FC-3057		2			
		FA-3055	3		X	X		FA-3055	3		X	X	FC-3041		2	2	X	
		FA-3015	4		X			FA-3015	4		X		FC-3042		1	1	X	
		FA-3037	3	2	X			FA-3037	3	2	X		FC-3045		2	2	X	
		FA-3054	4		X			FA-3054	4		X			FC-3046	1	1	X	
3000-3999		FA-3064	2	2	X			FA-3064	2	2	X			FC-3103	1			
Cable Trays with		CAJ-4088	2					CAJ-4088	2									
Electrical Cables		CAJ-4089	2		X			CAJ-4089	2		X							
4000-4999																		
Insulated Pipes	CAJ-5087		2	1	X		CAJ-5087		2	1	X		FC-5014		1	1	X	
	CAJ-5437		2	2			**CAJ-5437**		2	2			FC-5029		1	1		
	CAJ-5103		2	2	X	X	CAJ-5103		2	2	X	X	FC-5043		2	1	X	
		FA-5041	3	1	X	X		FA-5041	3	1	X	X						
5000-5999		FA-5045	3		X	X		FA-5045	3		X	X						
Miscellaneous Electrical	CAJ-6008		3		X		CAJ-6008		3		X							
Penetrants - Elec Buss		CAJ-6019	3					CAJ-6019	3									
6000-6999		CAJ-6038	2					CAJ-6038	2									
Miscellaneous Mechanical	CAJ-7023	CAJ-7027	3		X	X	CAJ-7023	CAJ-7027	3		X	X	FC-7002	FC-7034	1			
Penetrants - "Metal Duct	CAJ-7160		2	2			CAJ-7160		2	2			FC-7014		1	1	X	
and Insulated Metal Duct"	CAJ-7143		2		X		CAJ-7143		2		X		FC-7023	FC-7045	1		X	
7000-7999		CAJ-7106	2					CAJ-7106	2				FC-7060		1	1	X	
Groupings of Penetrations	CAJ-8113		2	2			CAJ-8113		2	2			FC-8001		2	2	X	
"Multiple Penetrations"	CAJ-8188		2		X	X	CAJ-8188		2		X	X	FC-8021	FC-8010	1	1		
		CAJ-8081	3		X			CAJ-8081	3		X		FC-8029	FC-8045	1		X	
8000-8999		CAJ-8093	3	2	X			CAJ-8093	3	2	X		FC-8036	FC-8043	1	1		
Fuel Line Protection	**FP3 / FP4**		**2**	**2**			**Gypsum Wall - Electrical Panel Protection**		**WL-7307**						**2**	**2**		

LEGEND

F - Rating
T - Rating
L - Rating
W - Rating

UL System Alignment

Left - Caulk
Right - Device
Middle - Shaft Wall
Bold - Membrane
E-Wrap

https://systems.stifirestop.com/

UL Alphanumeric Schedule

Type of Penetrant Wall Penetration Systems	Concrete or Masonry Walls - Minimum Thickness less than or equal to 8"						Concrete or Masonry Walls - Minimum Thickness more than 8"						Gypsum Framed Walls					
	Caulk	Device	F	T	L	W	Caulk	Device	F	T	L	W	Caulk Shaft	Device	F	T	L	W
No Penetrating Item	CAJ-0014		3	2			CAJ-0014		3	2			WL-0016		2	2	X	
Blank Opening	CAJ-0126		2	2	X	X	CAJ-0126		2	2	X	X		WL-0010	4	2	X	
		CAJ-0113	4					CAJ-0113	4					WL-0020	4			
		CAJ-0061	3	2	X			CAJ-0061	3	2	X			WL-0032	2		X	
Metallic Pipe, Conduit or	CAJ-1080		3		X		CBJ-1058		2		X	X	WL-1173	WL-1384	4			
Tubing	CAJ-1353		3		X		CBJ-1065		2	2	X	X	WL-1222	WL-1226	2	1		
	CAJ-1354		2		X		CBJ-1066		2	2	X	X		WL-1251	2			
	CAJ-1240		2		X	X							WL-1049		2		X	
		CAJ-1533	2										**WL-1527**	WL-1463	2	2	X	
Non-Metallic Pipe,	CAJ-2292		2	2			CBJ-2046		2		X		WL-2241	**WL-2635**	2	1	X	
Conduit or Tubing		CAJ-2104	2		X	X		CAJ-2297	3	3	X	X	WL-2631	WL-2243	2	2	X	
		CAJ-2297	3	3	X	X		CAJ-2772	2	2	X	X	WL-2237	WL-2288	2	2		
		CAJ-2772	2	2	X	X								WL-2257	2	2		
	WJ-2289		2	2	X								WL-2674	WL-2493	2	2	X	
		WJ-2216	2	1	X								**WL-2636**	**WL-2637**	2	2	X	
Electrical Cables	CAJ-3154		4	2			CBJ-3034		4				WL-3171	**WL-3172**	2			
	CAJ-3042		3		X		CAJ-3042		3		X		WL-3210	WL-3169	2			
	WJ-3063		2	1			CAJ-3154		4	2			WL-3134	WL-3435	2		X	
	WJ-3158	WJ-3158	2	2	X		WJ-3158	WJ-3158	2	2	X		WL-3306	WL-3356	2	2	X	
		WJ-4097	2		X			WJ-4097	2		X			WL-3271	2			
		WJ-3140	2		X			WJ-3140	2		X			WL-3390	4	2	X	
		WJ-3045	2				WJ-3045	WJ-3068	2				WL-3379	WL-3378	2	2	X	
		WJ-3068	2					WK-3001	4	1				WL-3459	2	1	X	
Electrical Box													CLIV		2	2		
Cable Trays with		CAJ-4088	2					CAJ-4088	2				WL-4008	WL-4029	2			
Electrical Cables		CAJ-4089	2		X			CAJ-4089	2		X		WL-4063	WL-4102	2		X	
		WJ-4097	2		X			WJ-4097	2		X		WL-4078	WL-4043	2	2		
													WL-4077		4			
Insulated Pipes	CAJ-5087		2	1	X		CAJ-5087		2	1	X		WL-5121		2	1		
	CAJ-5437		2	2			**CAJ-5437**		2	2			WL-5014		2	1	X	
	CAJ-5103		2	2	X	X	CAJ-5103		2	2	X	X		WL-5262	2	1		
Miscellaneous Electrical	CAJ-6008		3		X		CAJ-6008		3		X		WL-6001		2		X	
Penetrants - Elec Buss		CAJ-6019	3					CAJ-6019	3					WL-6020	2			
		CAJ-6038	2					CAJ-6038	2					WL-6006	2	2		
Miscellaneous Mechanical	WJ-7089		2				WJ-7089		2				WL-7025	WL-7164	2		X	
Penetrants - "Metal Duct	CAJ-7023	CAJ-7027	3		X	X	CAJ-7023	CAJ-7027	3		X	X	WL-7149	WL-7026	2		X	
and Insulated Metal Duct"	CAJ-7160		2	2			CAJ-7160		2	2			WL-7145		2	2	X	
	CAJ-7143		2		X		CAJ-7143		2		X			WL-7238	2			
		WJ-7092	2		X			WJ-7092	2		X			WL-7066	2			
Groupings of Penetrations	CAJ-8188		2		X	X	CAJ-8188		2		X	X	WL-8003		2		X	
"Multiple Penetrations"		CAJ-8081	3		X			CAJ-8081	3		X		WL-8026		2	2		
		CAJ-8093	3	2	X			CAJ-8093	3	2	X		WL-8073		2			

LEGEND

F - Rating
T - Rating
L - Rating
W - Rating

UL System Alignment

Left - Caulk
Right - Device
Middle - Shaft Wall
Bold - Membrane E-Wrap

https://systems.stifirestop.com/

UL Alphanumeric Schedule

Type of joint Fire Rated Joint Systems	Joint Width Less Than or Equal to 2" 0000-0999							Joint Width Greater Than 2", Less Than or Equal to 6" 1000-1999						
	Caulk	Spray	Device	F	T	L	M	Caulk	Spray	F	T	L	M
Continuity Joint	CJD-0001			1			II / III						
	CJD-0002			1			II / III						
	CJD-0003			1	1		II / III						
Concrete Floor-to-Floor		FFD-0028		4	4	X	II		FFD-1007	2	2	X	II
		FFD-0015		4	4	X	II		FFD-1025	3	3	X	II
	FFD-0001			3	3	X	II	FFD-1008		3	3	X	II
	FFD-0016			4	4	X	II	FFD-1001		3	3	3X	II
Edge of Concrete Floor		FWD-0023		4	4	X	II	FWD-1001		3	3	X	II
Slab-to-Wall	FWD-0010			4	4	X	II		FWD-1035	3	3	X	II
			FWS-0019	2	2	X		FWD-1007		3	3	X	II
			FWD-0097	1	1	X	II						
Concrete or Block Wall to	HWD-0156			4	4	X	II	HWD-1006		3	3	X	II
Flat Concrete Slab Floor	HWD-0157			4	4	X	II	HWD-1094		2	2	X	II
(Top of Wall)	HWD-0041			3	3	X	II		HWD-1034	3	3	X	II
		HWD-0885		2	2	X	II		HWD-1089	2	2		II
Concrete or Block Wall to	HWD-0245			2	2	X	II		HWD-1076	2	2	X	II
Concrete Over Fluted Metal	HWD-0039			2	2	X	II		HWD-1089	2	2		II
Deck (Top of Wall)		HWD-0140		2	2	X	II						
		HWD-0086		4	4	X	II						
Gypsum Wall to Flat Concrete	HWD-0034			2	2	X	II		HWD-1075	2	2	X	II
Slab Floor (Top of Wall)		HWD-0044		4	4	X	II						
			HWD00689	2	2	X	II / III						
			HWD-0618	2	2	X	II / III						
			HWD-0846	2	2	X	II / III						
Gypsum Shaft Wall to Flat	**HWD-0485**		**HWD-0548**	2	2	X	II						
Concrete Slab (Top of Wall)			**HWD-0699**	2	2	X	II / III						
Gypsum Wall to Concrete	HWD-0034			2	2	X	II	HWD-1073		2	2	X	II
Over Fluted Metal Deck	HWD-0103			2	2	X	II	HWD-1074		2	2	X	II
(Top of Wall)	HWD-0210			2	2	X	II						
		HWD-0043		4	4	X	II						
		HWD-0099		2	2	X	II						
		HWD-0252		2	2	X	II						
			HWD-0617	2	2	X	II						
			HWD-0749	2	2	X	II						
	HWD-0241			2	2	X	II						
Gypsum Shaft Wall to	**HWD_0644**			2	2	X	II						
Concrete Over Fluted Deck		**HWD-0645**		2	2	X	II						
(Top of Wall)			**HWD-0548**	2	2	X	II						
			HWD-0642	2	2	X	II						
Concrete Wall to Wall	WWD-0018			4	4	X	II	WWD-1002		3	3	X	II
	WWD-0103	WWD-0103		2	2	X	II	WWD-1007		4	4	X	II
			WWS-0063	2	2	X		WWD-1090	WWD-1090	2	2	X	II
								WWD-1091	WWD-1091	2	2	X	II
									WWD-1037	3	3	X	II
Gypsum Wall-to-Concrete Wall	WWS-0052			4	4	X		WWD-1090	WWD-1090	2	2	X	II
			WWS-0063	2	2	X							
			WWS-0064	2	2	X							
Bottom of Wall	BWS-0003			2	2	X							
	BWS-0028			2	2	X							
	BWS-0017			4	4								
	BWS-0020			2	2	x							
			BWS-0029	2	2	x							

LEGEND
F - Rating
L - Rating
M - Movement

UL System Alignment
Left - Caulk
Middle - Spray
Right - Device
Bold - Shaft Wall

Movement:
Class I Thermal
Class II Wind-Sway
Class III Seismic

* Top-of-Wall Joint May Include Spray-On Monokote Fireproofing
** Contact STI For Current UL System or Engineering Judgment
Note: Per UL System, Verify Class II, or Class III Movement Classification

FIRESTOPPING SYSTEMS SCHEDULE

Project: _____ Architect: _____

Number: _____ Date: _____

Contractor: _____ Contract for: _____

Subcontractor: _____ Contract for: _____

The following items require the attention of the Contractor for completion or correction. Submit separate form for each Subcontractor responsible for installing firestopping. Add additional rows as required. Failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the

Design Number (A)	Mfg's I.D. and Manufacturer (B)	Penetrating Item Description: Material, Size, Insulated, Combustible (C)	Annular Space / Opening (D)	Construction (E)	Fire Resistance Rating (F)	F-rating (G1)	T-rating (G2)	L-rating CFM/SF (G3)	W-rating (G4)
Through Penetrations - Horizontal Assemblies									
Through Penetrations - Wall and Partition Assemblies									
Membrane Penetrations - Wall and Partition Assemblies									

Design Number (A)	Mfg's I.D. and Manufacturer (B)	Joint Width Min. / Max. (D)	Adjacent Construction (both sides of joint) (E)	Fire Resistance Rating (F)	F-rating (G1)	T-rating (G2)	L-rating CFM/SF (G3)	W-rating (G4)
Fire-Resistant Joint Systems								

Firestopping Product Manufacturer(s):	

Provide information for proposed firestopping as follows:

(A) Indicate design number or other system designator assigned by FM (AG), ITS (DIR), UL (DIR), UL (FRD), or other testing laboratory acceptable to authorities having jurisdiction.

(B) Indicate manufacturer's system designator, if any. Include reference numbers and drawing numbers, if any.

(C) Identify the various types of penetrating items (i.e. pipe, vent, conduit, cable tray, etc.) and, for piping, indicate if dry (normally empty) or wet (normally filled) type. Include a material description (i.e. metal, plastic, EMT, etc.) and size (length by width or diameter). State whether the penetrating item is externally insulated or not. State whether the penetrating item is combustible or non-combustible.

(D) Indicate size limitations for annular space and/or opening and width limitations for joints.

(E) Identify the various types of construction being penetrated. Horizontal Assemblies include fire-resistance-rated floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies. Wall and Partition Assemblies include fire walls, fire-barrier walls, shaft enclosure walls, fire partitions, smoke-barrier walls, and smoke partitions.

1. Worded description of construction may be omitted if Architect's wall type designator is used (i.e. Wall 3A instead of metal stud & gypsum board).
2. For joints, indicate the types of construction at each side of joint beginning each joint with the following abbreviations:
   a. FF for Floor to Floor joints
   b. FW for Floor to Wall joints
   c. HW for Head of Wall joints
   d. WW for Wall to Wall joints
   e. CW for the Perimeter Fire Barrier System at the intersection of a fire-resistance-rated floor assembly and an exterior curtain wall assembly

(F) Identify the fire resistance rating of the assembly in minutes if less than one hour or hours if one hour or longer as indicated on the Drawings.

(G) System Ratings: Indicate the F-Rating, T-Rating, L-Rating, and W-Rating when installed and tested in accordance with standards specified.

END OF FORM 07 84 00.13

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C834 - Standard Specification for Latex Sealants.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants.

E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

H. SCAQMD 1168 - Adhesive and Sealant Applications.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. Backing material recommended by sealant manufacturer.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints:
      a. Do not seal interior joints indicated on drawings as not sealed.
      b. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
      c. Seal open joints except open joints indicated on drawings as not to be sealed, including, but not limited to, the following:
         1) Joints between plumbing fixtures and adjacent construction.
         2) Joints between door frames and window frames and adjacent construction.
   2. Do Not Seal:
      a. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
      b. Joints where sealant installation is specified in other sections.

B. Type P - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
   1. Type S - Joints in contact with stone panels.

2. Type L - Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.
3. Type Sm - Joints between plumbing fixtures and adjoining walls, floors, and counters: Mildew-resistant silicone sealant.
4. Type Sm - Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant.
5. Type Esr - Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
6. Type Psl - Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.

C. Definitions:
1. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.2 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors for Concealed Locations: Manufacturer's standard.

C. Colors for Locations Exposed to View: As selected by Architect from Manufacturer's Full Range.

D. Custom Color-Matched Colors: Where indicated.

2.3 NONSAG JOINT SEALANTS

A. Type S - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Materials: Non-staining to light-colored natural stone, masonry, and marble when tested in accordance with ASTM C1248.
3. Color: Custom to match adjacent stone

B. Type Sm - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Products:
a. Momentive Performance Materials, Inc/GE Silicones; SCS1700 Sanitary Sealant: www.siliconeforbuilding.com.
b. Pecora Corporation; 860: www.pecora.com.
c. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.
d. Dow Corning Corporation; 786-M.
e. Tremco Incorporated; Tremsil 200.

C. Type P - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Products:
      a. Pecora Corporation; Dynatrol I-XL: www.pecora.com.
      b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
      c. Tremco Incorporated; Dymonic FC.

D. Type L - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
   3. Products:
      a. Momentive Performance Materials, Inc/GE
         Silicones; RCS20 Acoustical Latex Sealant: www.siliconeforbuilding.com.
      b. Pecora Corporation; AC-20+: www.pecora.com.
      c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
      d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
      e. BASF Building Systems; Sonolac.

2.4 SELF-LEVELING JOINT SEALANTS

A. Type Psl - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 40 to 180 degrees F.
   4. Products:
      a. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
      b. W. R. Meadows, Inc; POURTHANE SL: www.wrmeadows.com/#sle.
      c. Tremco Incorporated; Vulkem 45SSL.
      d. Pecora Corporation; NR-201.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Type Esr - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multicomponent, 100 percent solids by weight.

2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
3. Color: To be selected by Architect from manufacturer's standard colors.
4. Joint Width, Minimum: 1/8 inch.
5. Joint Width, Maximum: 1/4 inch.
6. Products:
   a. Adhesives Technology Corporation; CRACKBOND JF-90 HD: www.atcepoxy.com/#sle.
   b. Euclid Chemical Company; EUCO 700: www.euclidchemical.com/#sle.
   c. Mapei; Mapeiflex Joint Sealant EP 90/50: www.mapei.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Sealant Backing Rod, Closed-Cell Type: For joints subject to pedestrian or vehicular traffic.
   1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
   2. Size: 25 to 50 percent larger in diameter than joint width.

C. Sealant Backing Rod, Open-Cell Type: For interior applications not subject to pedestrian or vehicular traffic.

D. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

E. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

F. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

G. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 09 91 23 - Interior Painting: Field painting.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

I. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities.

K. ITS (DIR) - Directory of Listed Products.

L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.

N. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames.

O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

S. UL (DIR) - Online Certifications Directory.

T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate with wall construction for anchor placement.
2. Coordinate installation of hardware.
3. Coordinate installation of electrical connections to electrical hardware items.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Door Schedule: Provide schedule coordinated with numbering on drawings and hardware schedule. Indicate door types and openings receiving electrified hardware.

D. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8 - SDI-100, and as supplemented in this Section.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

C. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified/#sle.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

E. Maintain at project site copies of reference standards relating to installation of products specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Inspect hollow metal products upon delivery for damage. Minor damage may be repaired provided refinishing is equal in all respects to new work and is acceptable to Architect; otherwise replace damaged items with new products as specified.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
3. Deansteel Manufacturing Company, Inc: www.deansteel.com/#sle.
4. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
6. Steelcraft, an Allegion brand: www.allegion.com/#sle.
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Edge Profile: Manufacturers standard for application indicated.
4. Typical Door Face Sheets: Flush, unless otherwise indicated on Drawings.
5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
    a. Prepare doors and frames for hardware in accordance with templates provided under Section 08 71 00 - Door Hardware.
6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) for exterior doors. Coating not required for typical interior door applications. Provide at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.
4. Door Finish: Factory primed and field finished.

B. Interior Doors, Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
    a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
    b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    c. Attach fire rating label to each fire rated unit.
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches, nominal.
5. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum, for doors up to 42 inches wide.
2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum, for doors greater than 42 inches wide.
3. Frame Metal Thickness: 14 gage, 0.067 inch, minimum, for doors with continuous hinges, regardless of width.
4. Frame Finish: Factory primed and field finished.

C. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
3. Frame Finish: Factory primed and field finished.

D. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.6 ACCESSORIES

A. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

B. Silencers: Resilient rubber or vinyl, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. For frame installation, use concealed anchors where possible. Where exposed frame anchors are required, countersink fasteners, fill, and sand smooth.

D. Install door hardware as specified in Section 08 71 00.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Touch up damaged factory finishes.

3.3 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 08 11 13

SECTION 08 12 14 - TRIMLESS DOOR FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Trimless interior door frames and accessories.

1.2 RELATED REQUIREMENTS

A. Section 08 14 16 - Flush Wood Doors: Non-hollow metal door for hollow metal frames.

B. Section 08 71 00 - Door Hardware: Hardware.

C. Section 09 91 23 - Interior Painting: Field painting.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Schedule: Provide schedule coordinated with numbering on drawings and hardware schedule. Indicate door types and openings receiving electrified hardware.

D. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Basis of Design: Specifications are based on products by specified basis of design manufacturer. Products manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, color, aesthetics, weight, and performance are minor, and do not detract substantially from the indicated design intent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. Studco Building Systems; EzyJamb In-Swing Door (ISD) Jamb System: www.studcosystems.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 TRIMLESS INTERIOR DOOR FRAMES

A. In-Swing Door Frames: EZYJamb Inswing - ISD complying with the following.
   1. Material: 18 gauge galvanneal steel, one-piece with perforated flanges.
   2. Depth: Suitable for 2-1/4 inch thick doors, and applicable partition thickness.
   3. Fire Rating: As indicated in Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and the following:
   1. Install frames plumb and square.
   2. Use door as a template when available to ensure proper alignment and clearances.
   3. Install frames securely using fasteners suitable for substrate.
   4. Leave frames ready for taping and application of drywall compound.
   5. Repair frames damaged during installation.
   6. Replace frames which cannot be successfully repaired.

B. Install accessory products in accordance with manufacturer's instructions and the following:
   1. Install products plumb and square.
   2. Install products in proper relationship to adjacent construction.
   3. Repair products damaged during installation.
   4. Replace products which cannot be successfully repaired.

3.3 CLEANING

A. Clean frames as recommended by manufacturer. Protect from damage until acceptance.

END OF SECTION 08 12 14

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

1.3 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. ITS (DIR) - Directory of Listed Products.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

E. UL (DIR) - Online Certifications Directory.

F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

G. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with door opening construction, door frame and door hardware installation.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Door Schedule: Provide schedule coordinated with numbering on drawings and hardware schedule. Indicate door types and openings receiving electrified hardware.

D. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS).
   2. Include certification program label.

E. Verification Samples: Submit two samples of door veneer, 6 by 6 inch in size illustrating each finish and sheen.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Specimen warranty.

H. Warranty, executed in Owner's name.

1.6 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

D. Woodwork Quality Assurance Program:
   1. Comply with AWI (QCP) woodwork association quality assurance service/program in accordance with requirements for work specified in this section; www.awiqcp.org/#sle.
   2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by quality assurance program.
   4. Provide designated labels on installed products as required by quality assurance program.
   5. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

E. Obtain all doors of each type specified from a single manufacturer to assure uniformity of appearance and construction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
   1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Wood Veneer Faced Doors:
   1. AJW: www.ajw.com.
   2. Haley Brothers: www.haleybros.com/#sle.
   3. Forte Opening Solutions: www.forteopenings.com/#sle.
   4. Masonite: www.masonite.com.
   5. Oregon Door: www.oregondoor.com/sle.
   6. Oshkosh Door Company: www.oshkoshdoor.com.
   7. VT Industries, Inc: www.vtindustries.com/#sle.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 DOORS

A. Doors:
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location, unless otherwise noted.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.3 DOOR AND PANEL CORES

A. General Requirement: Provide door cores fully bonded to stiles and rails.

B. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
   1. Particleboard Core Grade: LD-1 or Grade LD-2.
   2. At contractor's option, provide doors with structural composite lumber core (SCLC) instead of particleboard cores with mid-rail blocking for doors indicated to receive exit devices.

C. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.4 DOOR FACINGS

A. Veneer Facing for Opaque Finish: MDF or closed-grained hardwood veneer, in compliance with indicated quality standard.

B. Facing Adhesive: Type II - water resistant.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
      a. Provide solid blocking for other throughbolted hardware.
   2. Provide minimum 6 inch high solid wood top rail and minimum 16 inch high solid wood bottom rail, all doors; fire-resistant treated at fire-rated doors.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

E. Provide edge clearances in accordance with the quality standard specified.

2.6 ACCESSORIES

A. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80, ITS (DIR), and UL (DIR) requirements.

B. Adjust width of non-rated doors by cutting equally on both jamb edges.
   1. Trim maximum of 3/4 inch off bottom edges.
   2. Trim fire-rated doors in strict compliance with fire rating limitations.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.3 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

C. Maximum Undercut at Fire-Rated Doors: 3/4 inch clearance to non-combustible finish floor surface.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

C. Restore finish on all edges of shop finished doors before installation, if fitting or machining is required on site.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule on the Drawings.

END OF SECTION 08 14 16

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Field paint finish.

1.3 REFERENCE STANDARDS

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate installation with work of other trades, and obtain information on door sizes and exact locations from other trades.
   2. Coordinate placement of rough-in openings with Architect in tiled walls and gypsum board ceilings.
   3. Coordinate placement of access doors and panels with locations of toilet partitions and urinal screens so that doors or panels are not placed in conflict with partition or screen locations.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Product Schedule: Include types, locations, sizes, latching or locking provisions & other data pertinent to installation.

D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

E. Project Record Documents: Record actual locations of each access unit.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

C. Basis of Design: Specifications are based on access door types and model numbers by the specified basis of design manufacturer. Access door types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in dimensions and profile are minor, and do not detract substantially from the indicated design intent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. Bauco; XL: www.accesspanelsolutions.com.

B. Other Acceptable Manufacturers:
   1. Acudor Products Inc.: www.acudor.com.
   2. J. L. Industries: www.jlindustries.com.
   3. Karp Associates, Inc.: www.karpinc.com.
   4. Larsen's Manufacturing Co.: www.larsensmfg.com.
   5. Milcor by Commercial Products Group of Hart & Cooley, Inc.: www.milcorinc.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

C. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Panel Material: Aluminum.
   2. Style: Recessed door panel for infill with wall/ceiling finish and drywall bead frame.
   3. Frames: 16 gauge, 0.0598 inch, minimum thickness.
   4. Aluminum Finish: Natural brushed.
   5. Size: Fabricate access door frame assemblies to sizes indicated on drawings or, if not indicated, to smallest size which allows free access to concealed work requiring access. Obtain Architect’s approval for rectangular sizes.
      a. Where access to controls, etc. requiring one handed operation within arm's reach is required, provide 8 by 8 inches.
      b. Where access to controls, etc. requiring two-handed operation or rotation within arm's reach is required, provide 12 by 12 inches.
      c. Where upper body access is required (such as above ceilings or beyond arm’s length) provide 18 by 18 inches.

d. Where full body access is required (such as entering a shaft) provide 24 by 24 inches.

6. Hardware:
   a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
   b. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
      1) Coordinate keying with Owner's standard keying system.
   c. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
   d. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Review access panel locations during wall framing rough-in to confirm location is coordinated with interior wall finishes.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

D. Adjust hardware and panels for proper operation.

E. Remove and replace panels that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 00

SECTION 08 51 69 - METAL STORM WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior steel storm windows.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Show dimensions, layout, profiles and product components; details of anchoring and fastening; sealants and weatherstripping; and recorded field measurements.

D. Finish Samples: Submit color samples, for approval by Architect, that represent the allowable range of finish established from production material specified.

E. Component Samples: Submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components.

F. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

G. Executed warranty documents specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store inside, if possible, in a clean, well-drained area free of dust and corrosive fumes.
   2. Stack vertically or on edge so that water cannot accumulate on or within materials. Use non-staining wood or plastic shims between components to provide water drainage and air circulation.

3. Cover materials with tarpaulins or plastic hung on frames to provide air circulation.
4. Keep water away from stored assemblies.

1.5 WARRANTY

A. Manufacturer's Warranty: Submit warranty against defects in materials and workmanship for period of 5 years from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. Portella; Artisan Series Windows: www.portella.com.

B. Other Acceptable Manufacturers:
   1. Hope's Windows, Inc.: www.hopeswindows.com.
   2. Arcadia, Inc: www.arcadiainc.com
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 STORM WINDOWS

A. General: Low profile storm windows that fit existing windows without gaps of more than 1/8 inch in each unit.
   1. Verify actual measurements of openings by field measurement before fabrication; show recorded measurements on shop drawings.
   2. Allow for out-of-square and irregular conditions.
   3. Verify frame and sill conditions of each opening before fabrication; provide appropriate fabrication details to suit existing conditions.

B. Metal Windows: Steel-framed units, fixed.
   1. Configuration: As shown in Drawings.
   2. Finish: Match existing window finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 08 51 69

SECTION 09 03 20 - HISTORIC TREATMENT FOR PLASTER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repair and replacement of interior gypsum plaster.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this Section.
   1. Require attendance of parties directly affecting work of this Section. At a minimum, require attendance by Contractor, Architect, Plaster Repair Subcontractor, and Owner's Representative.
   2. Verify historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review materials, material application, colors, patterns, and sequencing.
   4. Review fire-protection plan.
   5. Review plasterwork historic treatment program.

1.3 SEQUENCING AND SCHEDULING

A. Perform historic treatment of plaster in the following sequence, which includes work specified in this and other Sections:
   1. Dismantle existing surface-mounted objects and hardware that overlie plaster surfaces except items indicated to remain in place. Tag items with location identification and protect.
   2. Verify that temporary protections have been installed.
   3. Examine condition of plaster surfaces.
   4. Clean plaster surface and remove paint and other finishes to the extent required.
   5. Repair and replace existing plaster and supports to the degree required for a uniform, tightly adhered surface on which to paint or apply other finishes.
   6. Cure repaired surfaces and allow them to dry for proper finishing.
   7. Paint and apply other finishes.
   8. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Include recommendations for product application and use.

C. Qualification Data: For qualified historic treatment specialist.

1.5 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic plastering specialist with expertise in matching and performing the types of historic plasterwork repairs required with at least 10 years of documented experience and at least 10 projects of similar scope. Experience only in installing and repairing new plasterwork, veneer plaster, or gypsum board is insufficient experience for historic treatment work.

1.6 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 40 00.

B. Mock-ups: Prepare mock-ups of historic treatment processes for each type of plaster repair and reconstruction work to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
   1. Locate where directed.
   2. Number and Size: Two wall surfaces of at least 50 sq. ft. or approximately 48 inches in least dimension to represent surfaces and conditions for application of each type of plaster repair and reconstruction under same conditions as the completed Work. Include at least the following:
      a. Repair 3 linear ft. of hairline plaster cracks.
      b. Repair 3 linear ft. of large plaster cracks.
      c. Restoration or reconstruction of each type of moulding, minimum 3 linear feet in length.
      d. Patch 4-sq. ft. area of damaged or missing plaster.
      e. Reattach 4-sq. ft. of delaminated plaster.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Mock-up may remain as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Store materials on elevated platforms, under cover, and in a dry location with ambient temperatures continuously maintained at not less than 45 deg F.

C. Store hydrated lime and factory-prepared lime putty in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.

D. Store materials not in use in tightly covered containers.

E. Store lime putty covered with water in sealed containers.

F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.8 FIELD CONDITIONS

A. Comply with plaster-material manufacturers' written instructions. For gypsum plaster, also comply with ASTM C 842 requirements.

B. Temperatures: Maintain temperatures in work areas at not less than 55 deg F or greater than 80 deg F for at least seven days before application of plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.

C. Conditioning: Acclimatize cast-plaster fabrications to ambient temperature and humidity of spaces in which they are installed. Remove packaging and move units into installation spaces not less than 48 hours before installing them.

D. Field Measurements: Where cast-plaster fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

E. Avoid conditions that result in plaster drying out too quickly.

F. Distribute heat evenly; prevent concentrated or uneven heat on plaster.

G. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.

H. Ventilate work areas in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

PART 2 PRODUCTS

2.1 GYPSUM PLASTER MATERIALS

A. Gypsum Materials:
   1. Lightweight Gypsum Ready-Mixed Plaster: ASTM C 28/C 28M, with mill-mixed perlite aggregate.
   2. Gypsum Neat Plaster: ASTM C 28/C 28M for use with job-mixed aggregates.
   3. Gypsum Wood-Fibered Plaster: ASTM C 28/C 28M.

4. High-Strength Gypsum Neat Plaster: ASTM C 28/C 28M; with a minimum, average, dry compressive strength of 2800 psi per ASTM C 472 for a mix of 100 lb of plaster and 2 cu. ft. of sand.
5. Gypsum Gaging Plaster. ASTM C 28/C 28M.
6. High-Strength Gypsum Gaging Plaster: ASTM C 28/C 28M; with a minimum, average, dry compressive strength of 5000 psi per ASTM C 472 for a neat mix.
7. Gypsum Ready-Mixed Finish Plaster: ASTM C 28/C 28M; manufacturer's standard, mill-mixed, gaged, interior finish.
8. Gypsum Keene's Cement: ASTM C 61/C 61M.
9. Hydrated Lime: ASTM C 206, Type S or Type N.
10. Aggregates:
    a. Aggregate for Base-Coat Plasters: ASTM C 35.
    b. Aggregate for Float Finishes: ASTM C 35; graded per ASTM C 842.
11. Fiber: 1/2 to 1 inch (13 to 25 mm) in length; matching existing type of fiber; free of grease, waxes, and oils; and beaten well to separate fibers before blending into unfibered plaster material.
12. Bonding Compound: ASTM C 631.
    a. Basis of Design:
        1) Larsen Products; Plaster-Weld.

2.2 LATH

A. Wood Lath: 1/4 inch by 1-1/4 inch sound, straight-grained, wood strips

B. Metal Lath:
1. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coated.

2.3 TRIM ACCESSORIES

A. General: According to ASTM C 841 for gypsum plaster; coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
1. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
2. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
3. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
4. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
5. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

6. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fasteners for Attaching Lath to Substrates:

C. For Gypsum Plaster: ASTM C 841.
   1. For Wood Lath: ASTM C 841 requirements for wood-floor-runner or wood-furring fasteners unless otherwise indicated on Drawings.

D. Wire Ties: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

E. Other Products: Select materials and methods of use based on the following, subject to approval of a mock-up:
   1. Previous effectiveness in performing the work involved.
   2. Little possibility of damaging exposed surfaces.
   3. Consistency of each application.
   4. Uniformity of the resulting overall appearance.
   5. Do not use products or tools that could do the following:
      a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
      b. Leave an unintended residue on surfaces.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT OF PLASTER, GENERAL

A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from building interior at 5 feet away from surface and from building exterior at 20 feet away from surface.

B. General: In treating historic plaster, disturb it as minimally as possible and as follows unless otherwise indicated:
   1. Dismantle loose, damaged, or deteriorated plaster, lath, and support systems that cannot be repaired.
   2. Verify extent of plaster deterioration against that indicated on Drawings. Consult Architect on types and extent of required work.
   3. Verify that substrate surface conditions are suitable for repairs.
   4. Provide lath, furring, and support systems for plaster included in the work of this Section.

5. Replace lost details in new, wet-applied and cast plaster that replicate existing or indicated plaster configurations.
6. Leave repaired plasterwork in proper condition for painting or applying other finishes as indicated.
7. Install temporary protective measures to protect historic surfaces that shall be treated later.

C. Illumination: Perform plastering work with adequate, uniform illumination that does not distort the flatness or curvature of surfaces.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate and environmental conditions, installation tolerances, and other conditions affecting performance of the Work.
1. If existing substrates cannot be prepared to an acceptable condition for plastering work, notify Architect in writing.
2. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.

B. Masonry Substrates: Verify that mortar joints are struck flush. Notify Architect of undocumented masonry substrate without flush joints. Proceed with plastering as directed by Architect.

C. Begin historic plastering work only after unsatisfactory conditions have been corrected.

3.3 PREPARATION FOR PLASTERING

A. Substrates: Prepare according to plaster manufacturer's written instructions and as follows:
1. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with plaster.
2. Remove ridges and protrusions greater than 1/8 inch and fill depressions greater than 1/4 inch with patching material. Allow to set and dry.

3.4 PLASTER REMOVAL AND REPLACEMENT, GENERAL

A. Dismantle plaster that is damaged or deteriorated to the limits indicated. Carefully dismantle areas along straight edges that lie over supports, without damaging surrounding plasterwork.

B. Maintain lath and supporting members in an undamaged condition so far as practicable. Dismantle damaged lath and supports that cannot be repaired or resecured and replace with new work of same type.

C. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.

D. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.

E. Clean substrate surfaces to remove grease, waxes, oils, waterborne staining, debris, and other foreign matter and deposits that could impair bond with repair material.

F. Wet subsrates before plaster application. Keep substrate damp to the touch but without visible water droplets.

G. Wet remaining plaster abutting the replacement plaster before installing new plasterwork.

H. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

I. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

3.5 FLAT GYPSUM-PLASTER REMOVAL AND REPLACEMENT

A. General: Dismantle deteriorated plaster to existing sound plaster. Use replacement plaster mixes of gypsum, lime, and aggregate; and application according to ASTM C 842 unless otherwise indicated.
   1. Inspect for lath deterioration. If any, replace lath.
   2. Sand bonding surfaces of repair area, and clean the surface with a nonmetallic bristle brush.
   3. Apply bonding compound to all crack surfaces in strict accordance with manufacturer’s written instructions, then install new plaster to original profiles.

B. Bonding Compound: Apply on substrate plaster bases.

C. General: Provide three-coat plaster (scratch, brown, and finish coats) having a total thickness not less than 5/8 inch. At fire rated conditions thickness as required to achieve rating.
   1. Scratch Coats: Apply with sufficient material and pressure to form full bond with solid base materials. Scratch the surface to form a bond for the brown coat.
   2. Brown Coats: Do not apply brown coat until after the scratch coat has hardened, and not less than 24 hours after application of the scratch coat. All joints in brown coat plaster shall be lap joints. After drying, all shrinkage cracks shall be cut out and filled with scratch coat plaster.
   3. Mix scratch and brown coats shall be mixed in the proportions of 100 lbs. gypsum neat plaster to 2-1/2 cu. ft. of sand. Scratch and brown coats of fibered gypsum plaster shall be mixed in the proportions of 100 lbs. fibered gypsum plaster to one cu. ft. of sand.

4. Finish Coats: Gypsum gauging plaster finish. Apply bonding compound to existing base coat and then apply finish coat over base coat of gypsum plaster. The finish shall be allowed to draw a few minutes and then shall be well-troweled with water to a smooth finish, free from blemishes. The thickness of finish coat shall be from 1/16” to 1/8” and total thickness of gypsum plaster shall be as indicated but no less than 5/8”. Finish to match existing and control sample.
5. Gypsum Plaster Finish Coat on Existing Base Coats: Apply bonding agent to existing base coat following manufacturer’s directions and then apply finish coat as specified above.

3.6 REMOVING AND INSTALLING LATH AND ACCESSORIES

A. General: Dismantle existing plaster as necessary to expose deteriorated or rusted lath, wire ties, and support system, back to firm substrates and supports. Repair in kind with new materials, well secured to existing lath in good condition and to building structure.
   1. Cutting: Cut lath so it can be taken out completely from one support to the next. Cut to avoid cracking surrounding plaster.
   2. Cut out existing base-coat plaster beyond the edges of the new lath to permit new plaster to extend onto the old lath. Then step subsequent plaster coats to permit new plaster to extend over the old material.
   3. Fasten new lath to support system and to good existing lath. Wire tie at least every 6 inches.

B. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.

C. Wood Lath: Install wood lath in same orientation and spacing as remaining wood lath and with lath ends supported by furring or framing. Stagger ends of adjacent laths over different supports, not aligned, and secure with fasteners at each end and spaced a maximum of 24 inches o.c. into supports.

D. Metal Lath: Install according to ASTM C 841 for gypsum plaster.

3.7 PATCH-TYPE REPAIR

A. General: Patch voids, fractured surfaces, and crushed areas in otherwise sound plaster that are larger than cracks.
   1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
   2. Inspect for deterioration of supporting plaster and lath, and repair or replace deteriorated material as required for a sound substrate.
   3. Rake perimeter of hole to sound plaster, and slightly undercut existing plaster to enable replacement plaster to tuck behind existing plaster.
   4. Replace missing lath in kind. Bridge gaps in wood lath with expanded-metal lath, overlapping wood by 6 inches and fastening them together.

5. Clean hole to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the plaster, enlarge the hole to remove these deposits.
6. Apply bonding compound on plaster surfaces in strict accordance with manufacturer's written instructions, then install patch material to original profiles.
7. Maintain adjacent plasterwork in an undamaged condition so far as practicable.

B. Gypsum-Plaster Mix: Type as determined based on approved mock-up to match existing plaster.

C. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster. For molded plaster shapes, tool surface to restore the sharp edges and the shape of the molded shape to original contours.

D. Hairline cracking within the plaster or plaster separation at edge of a patch is unacceptable. Completely dismantle such work and reinstall or repair.

3.8 HAIRLINE CRACK REPAIR

A. General: Repair cracks 1/32 inch in width or narrower in otherwise sound plaster.

B. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
1. Maintain adjacent plasterwork in an undamaged condition so far as practicable.

C. Existing Topcoat: Open crack in existing topcoat to at least 1/8 inch in width and check for broken fiber reinforcement in base coats.

D. Existing Base Coats: Do not open crack wider in existing base coats unless inspection or other indication shows that the fiber reinforcement has broken. Where inspections indicate failure of fiber reinforcement, proceed as for a large crack repair, but only for length of crack with broken fiber reinforcement.

E. Clean out crack to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the topcoat plaster, widen the crack and sand surface of the exposed basecoat to remove these deposits.

F. Apply bonding compound to all crack surfaces in strict accordance with manufacturer’s written instructions.

G. Force repair material demonstrated in mock-up, filling crack to original plaster profile.

H. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster. For molded plaster shapes, tool surface to restore the sharp edges and the shape of the molded shape to original contours.

3.9 LARGE CRACK REPAIR

A. General: Repair cracks over 1/32 inch in width in otherwise sound plaster.
   1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
   2. Maintain adjacent plasterwork in an undamaged condition so far as practicable.

B. Open crack to at least 1/8 inch in width and full depth with V-groove tool, and check for bond separation or lath deterioration.

C. Abrade side surfaces of crack and remove inner crack debris by gouging (keying) the inside area of the crack.

D. Clean out crack to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the plaster, widen the crack to remove these deposits.

E. Apply bonding compound to all crack surfaces in strict accordance with manufacturer’s written instructions.

F. Install repair material demonstrated in mock-up to fill crack to original plaster profile.

G. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster. For molded plaster shapes, tool surface to restore the sharp edges and the shape of the molded shape to original contours.

H. Offset Cracks: If the crack is offset in surface plane by more than 1/8 inch, dismantle the plaster on each side of the crack, a minimum width of 6 inches and down to the lath or other substrate. Then, repair as specified for flat-plaster removal and replacement.

3.10 REATTACHMENT OF DELAMINATED PLASTER

A. General: Reattach plaster that has detached from its lath.
   1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
   2. Maintain adjacent plasterwork in an undamaged condition so far as practicable.

B. Verify extent of detachment of plaster that has not yet fallen by tapping on plaster surface and evaluating the hollow or solid resonance.

C. Protect floors from spillage and debris in the vicinity of work. Use materials resistant to the passage of fluids used in work.

D. Drill 1/4-inch injection ports (holes) through the plaster spaced 3 to 6 inches apart over surface of detached plaster. Dislodge loose plaster particles, and vacuum debris from holes.

E. Prewet injection ports, gaps at edges of lost plaster, back of plaster, and wooden lath with prewet solution.

F. Inject adhesive into ports, enough to fill gaps between detached plaster and lath, and inject into gaps at edges of lost plaster.

G. Clean off excess and smeared adhesive while wet.

H. Apply temporary battens over surface of treated plaster to prevent further separation during repair work. Secure battens in place against plaster with screws through the battens and plaster and into the wood lath or braces supported from floor below.

I. Maintain temporary battens in place for a week or more, allowing adhesive to coalesce and dry.

J. Remove battens, patch holes and missing plaster, and repair cracks.

3.11 CAST-PLASTER REMOVAL AND REPLACEMENT

A. General: Dismantle and replace cast-plaster that is damaged or deteriorated at locations indicated on Drawings. Carefully dismantle whole cast units from joint to joint, without damaging surrounding plasterwork and without damaging cast unit if unit is to be salvaged for mold production and replication or for reinstallation.
   1. Coordinate removal and installation of cast plaster with other plaster repair and installation work.
   2. Label and photograph all units to be salvaged.
   3. Inspect for deterioration of supporting plaster and lath, and repair or replace deteriorated material as required for a sound substrate.
   4. Maintain lath and supporting members in an undamaged condition so far as practicable. Dismantle damaged lath and supports that cannot be repaired or resecured and replace with new work of same type.
   5. Sand repair bonding surfaces and clean the surface with a nonmetallic bristle brush.

3.12 WETTING SUBSTRATE: WET TO DAMP CONDITION, BUT WITHOUT VISIBLE WATER DROPLETS.

A. Replacement Material: Replace cast plaster fabrications with cast gypsum-plaster fabrications.

B. Adhering Cast Plaster: Wet the substrate in replacement area and affix cast plaster using finish-coat plaster for smooth-troweled finish as adhesive. Support units until adhesive can fully support weight of plaster. Remove excess adhesive.

C. Install cast-plaster fabrications level, plumb, true, and aligned with adjacent materials and ready to receive required finishes. Use concealed shims secured with wet plaster where required for alignment.
   1. Install replacement, cast-plaster units into bonding and coursing pattern of existing units. Maintain articulated joint widths, if any, between units to match existing joints.

2. Finish nonarticulated joints with joint-treatment materials so that they are flush or otherwise concealed inconspicuously.
3. 3.Where cast-plaster units are joined to form composite fabrications, join units inconspicuously and as recommended in writing by manufacturer.
4. 4.Repair hollows, voids, scratches, and other surface imperfections on units.

D. Hairline cracking within the plaster or plaster separation at edge of a replacement is unacceptable. Completely dismantle such work and reinstall or repair as a crack repair as directed by Architect.

3.13 INSTALLATION TOLERANCES

A. Completed plaster installation shall not deviate from a true plane by more than 1/8 inch as measured by a 5-foot straightedge placed at any location on a surface, except where existing plaster is retained as a substrate for new plasterwork.

3.14 CLEANING AND PROTECTION

A. Protect work of other trades against damage. Promptly remove plaster from surfaces not indicated to be repaired or plastered. Do not scratch or damage finished surfaces.

B. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

C. Correct damage to other historic surfaces and to new work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Remove temporary protection and enclosure of other work.

END OF SECTION 09 03 20

SECTION 09 03 60 - HISTORIC TREATMENT FOR PERIOD FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repairing damaged and missing stone mosaic and terrazzo flooring.

B. Cleaning existing finishes.

C. Resurfacing Portland cement terrazzo finishes.

D. Sealing.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct at project site minimum one week prior to commencing work of this Section.
   1. Attendance Required: Architect, Owner, Contractor, installer, and other parties directly affecting or affected by work of this Section.
   2. Review methods and procedures related to work of this Section including, but not limited to, the following:
      a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      b. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
      c. Discuss and agree upon quality control procedures.
      d. Review coordination required with other Sections.

1.3 SUBMITTALS

A. Product Data: Descriptive data and application instructions for cleaner and sealer.

B. Samples: For each type and color of flooring required for verification.
   1. Sample Size: Prepare samples of the same thickness and from the same material to be used for the Work.
      a. 12 inches square for flooring materials.
      b. 12 inches in length for linear materials.
   2. Quantity: Minimum of three samples of each type and color required showing the full range of color, texture, and pattern variations expected.
   3. Include in samples, minimum 6 inch long samples of each exposed divider strips required.

C. Analysis of existing terrazzo composition and aggregate mix with proposed materials demonstrating that new materials matches existing.

D. List of materials for use in constructing mockups.

E. Qualification statements for installer.

F. Maintenance data.

1.4 QUALITY ASSURANCE

1. Reference Standards: Perform Work per standards specified and as follows unless modified by requirements in the Contract Documents.
   a. National Terrazzo & Mosaic Association (NTMA):
      1) NTMA Bulletin 54 - Treatment of Cracks.
      2) NTMA Bulletin 55 - Suggested Procedure for Patching Old Terrazzo.
      3) NTMA Bulletin 56 - Restoration of Terrazzo Finish.
2. Installer Qualifications: Minimum 5 years experience under current organizational structure.
   a. Company: A firm or individual who is a contractor member of NTMA specializing in installing and repairing terrazzo comparable in material, design, and extent to that indicated for this Project, and whose work has a record of successful in-service performance.

1.5 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 40 00.

B. Mock-up: Construct at least one mock-up area for each flooring type for evaluation of cleaning, repair, patching and infill, and sealing procedures and aesthetics.
   1. Mock-Up Size: 9 feet square.
   2. Locate where directed in an inconspicuous location.
   3. Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

C. Label aggregate bags with name and size of chip.

1.7 FIELD CONDITIONS

A. Do not perform work at ambient temperatures below 50 degrees F or above 90 degrees F.

B. Maintain this temperature range for 24 hours prior to, during, and for 72 hours after completion of work.

C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during installation.

D. Close spaces to traffic during installation and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 PRODUCTS

2.1 PERFORMANCE

A. NTMA Standards: Comply with NTMA's Terrazzo Specifications Guide Details, and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.2 STONE

A. Stone Materials: Match existing.

B. Mortar and Grout: Match existing.
   1. See Section 09 30 00.

2.3 PORTLAND CEMENT TERRAZZO

A. Portland Cement Terrazzo System: Match existing.
   1. Underbed: Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo system indicated for component proportions and mixing.
   2. Topping: Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo system indicated for matrix and aggregate proportions and mixing.
      a. Terrazzo Topping Thickness: Match existing.
      b. Custom Mix Color and Pattern: Match existing.
   3. Precast Terrazzo Units: Fabricate to sizes and profiles to match adjacent units.
      a. Applications: Wall base.
      b. Setting Material: Epoxy adhesive, ANSI A118.3.

2.4 MATERIALS

A. Portland Cement: ASTM C 150, Type I, color as required to match existing.

B. Sand: ASTM C 33, sharp, coarse, screened, clean, and free of deleterious matter, color to match existing.

C. Aggregate: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
   1. Type and Size: Match existing.
      a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131 and ASTM C 535.
      b. 24-Hour Absorption Rate: Less than 0.75 percent.
      c. Dust Content: Less than 1.0 percent by weight.

D. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.

E. Water: Potable, clean, and free of organic matter.

F. Divider, Control, and Expansion Joint Strips: Match existing for material, type and size.
   1. Strip Adhesive: Recommended by manufacturer for this use.

2.5 ACCESSORIES

A. Bonding Agent: Neat portland cement, or epoxy or acrylic bonding agents formulated for use with topping indicated.

B. Underbed Reinforcement: Galvanized welded-wire reinforcement, wire 2 by 2 inches by 0.062 inch in diameter, complying with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

C. Isolation Membrane: Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils thick; or unperforated asphalt felt, ASTM D 226, Type I (No. 15).

D. Curing Materials: Heavy Kraft paper or polyethylene sheeting.

E. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect flooring color or physical properties; is recommended by sealer manufacturer for each application; and complies with NTMA's "Terrazzo Specifications and Design Guide".
   1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
   2. Acid-Base Properties: With pH factor between 7 and 10.
   3. Sheen: Match existing adjacent flooring.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Examine substrates and conditions, with Installer present, for conditions affecting performance of work.
   2. Verify conditions and surfaces are ready to receive work of this Section.
   3. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection of In-Place Conditions: Protect surrounding areas and surfaces from damage or disfiguration.

B. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
   1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 REMOVING DAMAGED AND DETERIORATED FLOORING

A. Remove damaged and deteriorated flooring without damage to adjacent flooring

B. Cut out and replace areas that evidence objectionable cracks or lack of bond with substrate or underbed, including areas that emit a "hollow" sound when tapped. Cut out areas in full panels defined by strips, walls, or natural boundaries and replace to match adjacent flooring, or repair surfaces according to NTMA's written recommendations, as approved by Architect.

C. Clean substrate; remove loose and foreign matter which might impair bond.
   1. Roughen concrete substrates before installing flooring system according to NTMA's written recommendations.

3.4 STONE REPAIR

A. Repair stone flooring in accordance with approved mock-up procedures and materials.

B. Apply penetrating sealer per manufacturer's written instructions to match adjacent flooring.

3.5 TERRAZZO REPAIR

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Repair objectionable cracks (excluding fine hairline cracks) in accordance with NTMA Bulletin 54.

C. Extend and patch missing and damaged terrazzo floor finishes in accordance with NTMA Bulletin 55.

D. Refinish terrazzo floor in accordance with NTMA Bulletin 56.
   1. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

3.6 CLEANING

A. Remove grinding dust from installation and adjacent areas.

B. Wash surfaces with cleaner immediately after final cleaning of flooring according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

3.7 SEALING

A. Seal surfaces according to NTMA's written recommendations.

B. Apply sealer according to sealer manufacturer's written instructions.

3.8 PROTECTION

A. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that flooring is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 03 60

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Tile and terrazzo flooring.
   2. Resinous flooring.
   3. Other adhesively applied flooring.

B. Preparation of new and existing concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Adhesive bond testing.

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

1.2 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).

B. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

C. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

D. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete.

E. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.

F. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

I. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Certificate: Manufacturer's certification of compatibility with types of flooring and adhesive applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   4. Manufacturer's installation instructions.
   5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

D. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Product data for recommended remedial coating.
   7. Submit report to Architect.
   8. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

F. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

G. Copy of RFCI (RWP).

1.5 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.

F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.7 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

1.8 WARRANTY

A. Provide manufacturer's warranty covering flooring delamination failures for 10 years minimum.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.1 MATERIALS

A. Self-Leveling Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product
   1. Compressive Strength: Minimum 5000 pounds per square inch after 28 days, tested per ASTM C109/C109M.
   2. Flexural Strength: Minimum 1000 psi after 28 days, tested according to ASTM C348.
   3. Thickness: Capable of thicknesses from 1/2 inch minimum to maximum [10] inch.

B. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
   4. Acceptable Manufacturers:
      a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.
      b. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
      c. LATICRETE International, Inc; SKIM LITE: www.laticrete.com/#sle.
      d. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.

e. Schonox HPS North America; Schonox SL Moisture Resistant Floor Patch and Skim Coat.
f. Custom Building Products.
g. Henry Company.
h. Sika; Level SkimCoat.
i. Mapei.
j. Substitutions: See Section 01 60 00 - Product Requirements.

C. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

D. Remedial Floor Coating, Two-Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
2. Use product recommended by flooring manufacturer. In the absence of a recommendation from flooring manufacturer, use testing agency recommendation. In the absence of testing agnency recommendation, use one of the following systems.
3. Acceptable Products:
a. Allied Construction Technologies, Inc; AC Tech 2170 FC: www.actechperforms.com/#sle.
b. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
c. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
d. Floor Seal Technology, Inc; MES 100: www.floorseal.com/#sle.
e. ISE Logik Industries; MVEC 710 with MVBP 600.
f. LATICRETE International, Inc; LATICRETE VAPOR BAN E: www.laticrete.com/#sle.
g. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer: www.sikafloorusa.com/#sle.
h. USG Corporation; Durock CoverPrep: www.usg.com/#sle.
i. UZIN UTZ NORTH AMERICA, INC; UZIN PE 460 with UZIN PE 280: https://us.uzin.com/#sle.
j. Substitutions: See Section 01 60 00 - Product Requirements.

E. Remedial Colloidal Silica Floor Treatment: Clear, penetrating floor treatment intended by its manufacturer to vapor-proof concrete slabs by closing capillary system of concrete, and eliminating route of moisture vapor emission while preserving mechanical key for adhesive bonding.
1. Acceptable Products:
a. Spray-Lock Concrete Protection; SCP 327: www.concreteprotection.com.
b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Water Vapor Emission Controlling Curing Compound: Single-component curing compound for preventative water vapor emission control for newly placed concrete.
   1. Coordinate with curing requirements specified in 03 30 00 - Cast-in-Place Concrete.
   2. Comply with ASTM C309 and ASTM C1315, Type I Class A or C.
   3. Acceptable Products:
      a. Creteseal Concrete Waterproofing Products, Inc.; Creteseal 2000: www.creteseal.com.
      b. Floor Seal Technology, Inc.; VaporSeal 309 System: www.floorseal.com.
      c. SINAK Corporation; VC5: www.sinak.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering.
   2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
      a. Remove existing coatings and curing agents from surface according to recommendations of remedial coating manufacturer.
      b. Prepare surface according to recommendations of remedial coating manufacturer and according to ASTM D4259.
   3. Preliminary cleaning.
   4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   7. Specified remediation, if required.
   8. Patching, smoothing, and leveling, as required.
   9. Other preparation specified.
   10. Adhesive bond and compatibility test.
   11. Protection.

B. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.

2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.3 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.4 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.5 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.
   1. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

E. Report: Report the information required by the test method.

3.6 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
   2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
   3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.7 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.8 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.9 APPLICATION

A. Comply with requirements and recommendations of manufacturer.

B. Curing compounds and membrane forming products are usually considered unacceptable by flooring and adhesive manufacturers. If such materials are used, either obtain the approval of the flooring and adhesive manufacturers prior to use.

3.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION 09 05 61

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.2 RELATED REQUIREMENTS

A. Section 09 29 00 - Gypsum Board: Execution requirements for anchors for attaching work of this section.

1.3 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A413/A413M - Standard Specification for Carbon Steel Chain.

F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

G. ASTM A645/A645M - Standard Specification for Pressure Vessel Plates, 5 % and 51 2 % Nickel Alloy Steels, Specially Heat Treated.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

I. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

J. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

K. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

O. ASTM E413 - Classification for Rating Sound Insulation.

P. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Evaluation Reports: Submit evaluation reports for framing, tracks, anchors, and fasteners from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

B. Manufacturer Qualifications: Comply with one of the following:
1. Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.
2. Member of Supreme Steel Framing System Association (SSFSA): www.ssfsa.com/#sle.

C. Code-Compliance Certification of Studs and Tracks: Provide framing members certified in accordance with the product-certification program of the the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202 "Code of Standard Practice."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.
   3. Jaimes Industries: www.jaimesind.com/#sle.
   4. Marino: www.marinoware.com/#sle.
   5. MBA Building Supplies, Inc.: www.mbastuds.com.
   6. MRI Steel Framing LLC: www.mristeelframing.com.
   7. State Building Products, Inc.: http://www.statebp.com.
   8. Steel Construction Systems: www.steelconsystems.com/#sle.
   9. The Steel Network, Inc: www.SteelNetwork.com/#sle.
   10. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design metal framing to comply with performance requirements, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
   1. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members" and ASTM A645/A645M, Section 10.

B. Performance Requirements:
   1. Interior Suspended Gypsum Board Ceilings, Soffits, and Bulkheads: Design and install to provide deflection of not more than L/360 of distance between supports.
   2. Interior Metal Stud/Gypsum Board Assemblies: Design and install to withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/240 of partition height.
   3. Interior Metal Stud/Gypsum Board Assemblies at Locations with Ceramic Tile or Other Hard Surface Finishes: Design and install to withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/360 of partition height.
   4. Where documents indicate a stud size, size shall be considered minimum. Increase gage to meet minimum performance requirements.
   5. Accommodate building structure deflections in connections to structure.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM A413/A413M by an independent testing agency.

2.3 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and tested according to ASTM E 119 and as scheduled in Drawings.

B. Non-Loadbearing Framing System Components: ASTM C645, galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated.
   1. Protective Coating: ASTM A653/A653M, G40, (Z120); or coating with equivalent corrosion resistance, hot-dip galvanized unless otherwise indicated.
      a. Galvannealed products are unacceptable.
   2. Studs: C shaped with flat or formed webs.
      a. Minimum Base-Steel Thickness: 0.033 inch (20-gage drywall) unless otherwise indicated.
      b. Minimum Base-Steel Thickness at Wall Tile: 0.033 inch.
      c. Minimum Base-Steel Thickness at Opening Jambs: 0.033 inch.
   3. Runners: U-shaped, sized to match studs.
      a. Minimum Base-Steel Thickness: Same as studs.
   4. Equivalent Gauge Studs and Runners:
      a. High strength, roll-formed and embossed with surface deformations to stiffen the framing members so they are structurally comparable to conventional ASTM C645 steel studs and tracks.
      b. Minimum Base Steel Thickness: 0.0181 inch (20 EQ).
      c. Prohibited Locations: High-strength (EQ) studs may not be used at the following locations:
         1) Walls at vestibules or other areas expected to be exposed to wind loads greater than 5 psf.
         2) Walls to receive cement backer board, wall tile or other inflexible finishes.
         3) Walls to receive abuse resistant or impact resistant gypsum board.
         4) Walls used to support countertop construction, casework, audio/visual equipment, or other similar elements.
         5) Walls greater than 15 feet in height.
   5. Ceiling Carrying Channels: C shaped (Main Runners).
      a. Minimum Base-Steel Thickness: 0.053 inch.
      b. Minimum Depth: 1-1/2 inches.
      c. Minimum flange width: 1/2 inch.
   6. Ceiling Furring Channels (Furring Members):
      a. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
      b. Steel Studs and Runners: 0.0296-inch minimum base-steel thickness.
      c. Equivalent Gauge Studs and Runners: 0.0181 inch (20 EQ) minimum base-steel thickness.
      d. Hat-Shaped, Rigid Furring Channels: 0.0296-inch minimum base-steel thickness, 7/8-inch deep.
   7. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

a. Minimum Base-Steel Thickness: 0.0296 inch.

8. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

C. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

D. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung, non-rated system unless otherwise rnoted, composed of main beams and cross-furring members that interlock.

1. Where fire-rated grid system may be required by authorities having jurisdiction provide hanger wire suspension 8-inches off fire breaks in accordance with system manufacturer’s written guidelines.

E. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

F. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

G. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

H. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50.
3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

I. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

1. Products:
   a. ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com/#sle.
   b. Fire Trak Corp.; Fire Trak System.
   c. Metal-Lite, Inc; The System.
   d. Slip Trak Systems; SLP-TRK.
   e. Steel Network, Inc. (The); VertiTrack Series.
   f. Substitutions: See Section 01 60 00 - Product Requirements.

J. Preformed Top Track Firestop Seal:

1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
2. Products:
   a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.

b. Specified Technologies Inc; SpeedFlex TTG Track Top Gasket: www.stfirestop.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

K. Non-Loadbearing Framing Accessories:

1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
   a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
   b. Products:
      1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
      2) Substitutions: See Section 01 60 00 - Product Requirements.
3. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
4. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.
5. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.
   a. Products:
      1) ClarkDietrich; Danback: www.clarkdietrich.com/#sle.
      2) Substitutions: See Section 01 60 00 - Product Requirements.
6. Sheet Metal Backing: 0.0538 inch thick, galvanized.
7. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
8. Fasteners: ASTM C1002 self-piercing self-tapping screws.
9. Anchorage Devices: Powder actuated.
10. Touch-Up Primer for Corrosion Protected Surfaces: SSPC-Paint 20 Type I - Inorganic.

L. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.

1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Tape Thickness: 1/4 inch.
3. Products:
   a. Armacell LLC; ArmaComfort MTD: www.armacell.us/#sle.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

M. Acoustic Insulation and Sealant: As specified in Section 09 29 00 - Gypsum Board.

2.4 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

C. Examine areas and substrates for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION OF STUD FRAMING

A. Install non-structural members in accordance with ASTM C754.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install bracing at terminations in assemblies.
   1. For interior non-load bearing walls indicated to terminate above suspended ceilings provide 20-gauge stud diagonal bracing of walls at door openings, corner wall intersections and at maximum 10’-0” intervals to structural supports or substrates above. Otherwise extend framing full height to structural supports or substrates above suspended ceilings.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

E. Extend partition framing to structure where indicated and to ceiling in other locations.

F. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

G. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

H. Align and secure top and bottom runners at 24 inches on center unless otherwise indicated.

I. At partitions indicated with an acoustic rating:
   1. Install acoustic insulation, sealants, and accessories as described in 09 29 00 - Gypsum Board.
   2. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   3. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

J. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   1. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

K. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

L. Install studs vertically at spacing indicated on drawings unless otherwise required to meet performance requirements.

M. Install studs so flanges within framing system point in same direction.

N. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

O. Align stud web openings horizontally.

P. Secure studs to tracks using crimping method. Do not weld.

Q. Stud splicing is not permissible.

R. Fabricate corners using a minimum of three studs.

S. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
   1. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

T. Brace stud framing system rigid.

U. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.

V. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

W. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

X. Use backing/blocking for reinforcement of the following:
1. Framed openings.
2. Wall mounted cabinets.
3. Plumbing fixtures.
4. Toilet accessories.
5. Wall mounted door hardware.
6. Wall mounted televisions or other equipment.

3.4 CEILING AND SOFFIT FRAMING

A. Contractor's Option: At the Contractor's option suspended ceiling systems may be either suspended steel framing system or grid suspension system.

B. Comply with requirements of ASTM C754.

C. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

D. Install furring independent of walls, columns, and above-ceiling work.

E. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated.
1. Hanger spacing not to exceed 48 inches on center.

F. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

G. Space main carrying channels at maximum 48 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

H. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

I. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

J. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

K. Laterally brace suspension system.

L. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

M. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

N. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 09 22 16 - Non-Structural Metal Framing.

1.3 REFERENCE STANDARDS

A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

F. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

I. ASTM C1193 - Standard Guide for Use of Joint Sealants.

J. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

L. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

O. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

P. ASTM E413 - Classification for Rating Sound Insulation.

Q. GA-216 - Application and Finishing of Gypsum Panel Products.

R. GA-226 - Application of Gypsum Board to Form Curved Surfaces.

S. UL (FRD) - Fire Resistance Directory.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on gypsum board, accessories, joint finishing system, and acoustic insulation and sealants.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

C. Protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with requirements of ASTM C840 or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. American Gypsum Company: www.americangypsum.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Georgia-Pacific Gypsum: www.gpgypsum.com.
4. National Gypsum Company: www.nationalgypsum.com.
5. USG Corporation: www.usg.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
1. Acoustic Attenuation: STC as indicated in Drawings calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
1. Air Pressure Within Shaft: Sustained loads of 10 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35, minimum, unless otherwise indicated, calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Fire Rated Assemblies: Provide completed assemblies tested according to ASTM E 119 and as scheduled in Drawings.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.3 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board unless otherwise required below.
      a. Glass mat faced gypsum panels are required for all pre-rock applications and gypsum installation prior to building being enclosed.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
      b. Mold resistant board is required in areas subject to wetting, steam, or high humidity.
   4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   5. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch, unless otherwise noted.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   6. Paper-Faced Products:
      a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
      b. American Gypsum Company; FireBloc Type C Gypsum Wallboard: www.americangypsum.com/#sle.
      c. CertainTeed Corporation; Type C Drywall: www.certainteed.com/#sle.
      d. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
      e. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
      f. Georgia-Pacific Gypsum; ToughRock Fireguard C: www.gpgypsum.com/#sle.
      g. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
      h. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield C 5/8" Gypsum Board: www.goldbondbuilding.com/#sle.
      i. USG Corporation; Sheetrock Brand EcoSmart Panels Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.
      j. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
      k. Substitutions: See Section 01 60 00 - Product Requirements.

7. Mold-Resistant, Paper-Faced Products:
    a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
    b. American Gypsum Company; M-Bloc Type C: www.americangypsum.com/#sle.
    c. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.
    d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
    e. National Gypsum Company; Gold Bond XP Gypsum Board.
    f. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
    g. USG Corporation; Sheetrock Brand EcoSmart Panels Mold Tough Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.
    h. USG Corporation; Sheetrock Brand Mold Tough Firecode SCX Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
    i. Substitutions: See Section 01 60 00 - Product Requirements.

B. Tile Backing Board:
1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    a. Thickness: 1/2 inch.
    b. Products:
        1) Custom Building Products; Wonderboard Lite: www.custombuildingproducts.com.
        2) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.
        3) USG Corporation; DUROCK: www.usg.com/#sle..
        4) Substitutions: See Section 01 60 00 - Product Requirements.

C. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Paper-Faced Products:
    a. American Gypsum Company; M-Bloc Shaft Liner: www.americangypsum.com/#sle.
    b. CertainTeed Corporation; M2Tech Type X Shaftliner: www.certainteed.com/#sle.
    c. Georgia-Pacific Gypsum; ToughRock Shaftliner: www.gpgypsum.com/#sle.
    d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Shaftliner XP: www.goldbondbuilding.com/#sle.
    e. USG Corporation; Sheetrock Brand Gypsum Liner Panels 1 in. (25.4 mm) SLX: www.usg.com/#sle.

f. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panels 1 in. (25.4 mm) SLX: www.usg.com/#sle.

g. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 GYPSUM BOARD ACCESSORIES

A. Sound Attenuation Insulation: ASTM C665; mineral fiber or glass fiber batt, friction fit type, unfaced.

1. Thickness: As indicated on Drawings, minimum 2 inches.
2. Fire-Rated Assemblies: Use insulation type required by indicated tested assembly.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.

1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Tape Thickness: 1/4 inch.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

1. Products:
   a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.
   b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
   c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
   d. Pecora Corporation; AC-20 FTR.
   e. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
   f. Grabber Construction Products; Acoustical Sealant GSC.
   g. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
   h. USG Corporation; SHEETROCK Acoustical Sealant.
   i. Substitutions: See Section 01 60 00 - Product Requirements.
2. Color of exposed acoustical joint sealants: Match adjacent surface.

D. Acoustical Outlet Box Pads:

1. Minimum thickness - 1/8 inch.
2. Adhesion - adheres readily to metal or plastic.
3. Service temperature - 30 degrees to 200 degrees F.
4. Shall contain no asbestos.
5. Minimum shelf life - 1 year.
6. Non Fire-Rated Products:
   a. Lowry's Outlet Box Pads as manufactured by Harry A. Lowry & Associates, Inc., Sun Valley, CA.
   b. Sound Pad #68 as manufactured by L.H. Dottie Co., City of Commerce, CA.
7. Fire-Rated Products:

a. Flamesafe FSP 1077 Putty Pads as manufactured by W.R. Grace & Co., Hartfield, PA.
b. Putty Pads as manufactured by Specified Technologies Inc., Somerville, NJ.
c. Hilti CP617 Putty Pads as manufactured by Hilti, Tulsa, OK.
d. 3M Fire Barrier Moldable Putty Pads type MPP-X to fit box size as manufactured by 3M, St. Paul, MN.
e. Metacaulk ® Putty Pads as manufactured by RectorSeal, Houston, TX.

E. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, rigid plastic, or composite, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, LC-bead, and Casing Bead at exposed panel edges.
3. Acceptable Products:
a. Same manufacturer as framing materials.
b. ClarkDietrich (Finishing Accessories) www.clarkdietrich.com
c. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
d. Stockton Products: www.stocktonproducts.com/#sle.
e. Trim-tex, Inc: www.trim-tex.com/#sle.
f. Substitutions: See Section 01 60 00 - Product Requirements.

F. Reveal Base: Mud-in type.
1. Material: Extruded aluminum alloy 6063-T5 temper.
2. Height: 4 inches.
3. Finish: Powder coated.
4. Color: As selected by Architect.
5. Basis of Design:
a. Fry Reglet Corporation; Reveal Base.

G. Intumescent Strap for Reveal Base: Provide UL-listed, galvanized steel intumescent strap at reveal base details in fire rated walls.
1. UL Listing: BW-S-0036.
2. Basis of Design:
a. Marino Ware; RBR Strap.

H. Decorative Metal Trim:
1. Material: Extruded aluminum alloy 6063-T5 temper.
2. Finish: Factory primed for field painting.
3. Type: As indicated on drawings.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Conspec Systems, Inc.
b. Fry Reglet Corporation.
c. Gordon, Inc.

d. Pittcon Industries.

I. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, creased paper tape for joints and cornersfor interior gypsum board.
   2. Tape for Tile Backing Panels: As recommended by panel manufacturer.
   3. Joint Compound: Drying type, vinyl-based, ready-mixed.

J. Finishing Compound: Surface coat and primer, takes the place of skim coating.

K. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

L. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

M. Screws for Fastening of Gypsum Panel Products to Wood Framing or Blocking: Type W screws, corrosion resistant. Nails not permitted.

N. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

O. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

P. Adhesive for Attachment to Metal:
   1. Products:
      a. Franklin International, Inc; Titebond Drywall Construction Adhesive: www.titebond.com/#sle.
      b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. General: Limit installation of outlet boxes and other penetrations to one penetration per stud bay. Seal all penetrations and gaps with acoustic sealant, outlet box pads, or other acoustic shielding materials as approved by Architect in accordance with manufacturer's written instructions and tested assembly instructions.

B. Preparation for acoustic sealant:
1. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
2. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

D. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

E. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

F. Acoustic Sealant: Install as follows:
1. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
2. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
3. Place one bead continuously on substrate before installation of perimeter framing members.
4. Place continuous bead at perimeter of each layer of gypsum board.

5. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

G. Acoustical Outlet Box Pads: Install as follows within acoustic partitions:
1. Remove any water, excess dust, dirt and oil from the surfaces.
2. Comply with manufacturer's written instructions and UL requirements.
3. Ensure the entire surface is covered. Seal around conduit where it connects to outlet box using manufacturer's recommended materials.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

C. Form control and expansion joints with space between edges of adjoining gypsum panels.

D. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

E. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

F. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

G. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

H. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

I. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.

J. Installation on Metal Framing: Use screws for attachment of gypsum board.

K. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around and through assemblies, including sealing partitions above acoustical ceilings.

L. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trims and Reveals: Install at locations shown on drawings and in accordance with manufacturer's instructions.
   1. Install intumescent strap in accordance with UL listing at rated walls.

3.6 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Gallery walls and ceilings to receive paint finish. See material schedule and elevations.
   2. Level 4: Back of House and Green Room walls and ceilings. See material schedule and elevations.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   6. Level 0: Temporary partitions.
   7. Level 0: Surfaces indicated to be finished in later stage of project.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.7 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.8 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

B. Repair damage from construction operations.

END OF SECTION 09 29 00

SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Accessories, setting, and grouting materials.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 05 61 - Common Work Results For Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

C. Section 09 29 00 - Gypsum Board: Tile backer board.

1.3 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

B. ASTM C627 - Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

D. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation.

1.4 DEFINITIONS

A. DCOF: Dynamic Coefficient of Friction.

B. Module Size: Actual tile size, with minor facial dimension as measured by ASTM C499, plus joint width indicated.

C. Facial Dimension: Actual tile size, with minor facial dimension as measured by ASTM C499.

D. Large Format Tile: Any tile unit that maintains an edge of 15 inches or greater in any dimension.

E. Slip-Resistant: Installed flooring surface which has a wet coeffecient of friction of 0.42, minimum, as measured according to ANSI 323.3 (BOT-3000E DCOF AcuTest).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate location of tiling movement joints on concrete floor substrates with locations of concrete floor expansion and control joints; align substrate joints and tiling system joints where required by specified reference standards.

B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this Section; require attendance by all affected installers.
   1. Review installation procedures and coordination requirements.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Verification Samples:
   1. Full-sized units of each type and composition of tile and for each color and finish specified. For ceramic mosaic tile in color blend patterns, provide one full sheet of each specified color blend.
   2. Full-sized units of each type of trim and accessory for each color and finish specified.
   3. Grout color samples for each type and color specified.

D. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation; www.tile-assn.com/#sle

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 5 percent of each size, color, and surface finish combination.

1.7 QUALITY ASSURANCE

A. Maintain one copy of ANSI A108/A118/A136, TCNA (HB), and TCNA (HB-GP) on-site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.
      a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).

D. Provide materials obtained from only one manufacturer for each type and color of tile, and for each type of mortar, grout, adhesive, and sealant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 FIELD CONDITIONS

A. Comply with referenced standards and manufacturer's recommendations for protection and maintenance of environmental conditions during and after installation.

B. Do not install solvent-based products in an unventilated environment.

C. Maintain ambient and substrate temperature of 50 degrees F during installation, and for at least seven days after installation. Maintain higher temperatures for proprietary mortars and grouts when recommended by manufacturer.

D. Vent temporary heaters to the exterior to prevent damage to tile work due to carbon dioxide accumulation.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace materials that fail within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products as scheduled.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 TILING MATERIALS

A. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.3 TRIM AND ACCESSORIES

A. Metal Trim: Type and finish as scheduled, style and dimensions to suit application, for setting using tile mortar or adhesive. Provide trim height to match tile and setting bed thickness.
   1. Acceptable Manufacturers:
      a. Genesis APS International: www.genesis-aps.com/#sle.
      b. Schluter-Systems: www.schluter.com/#sle.
      c. Ceramic Tool Company, Inc.
      d. Futura Industries.
      e. National Metal Shapes, Inc. Aluminum L-S Profiles.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

B. Accessible Thresholds and Transitions: Provide transitions between tile surfaces and adjoining finished floor surfaces. Fabricate thresholds to heights indicated, but not more than 1/2 inch above adjoining floor surfaces, with transition edges beveled on a slope not exceeding 1:2.

2.4 SETTING MATERIALS

A. Modified Dry Set Cement Mortar Bond Coat: ANSI A118.4 and ANSI A118.11.
   1. Applications: Use this type of bond coat where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements; X 3+: www.ardexamericas.com/#sle.
      b. Custom Building Products; MegaLite Crack Prevention Mortar, ProLite Tile & Stone Mortar, or Complete Contact Fortified Mortar: www.custombuildingproducts.com/#sle.
      c. H.B. Fuller Construction Products, Inc; TEC Ultimate Large Tile Mortar or Utimate 6 Plus Mortar: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; 4-XLT: www.laticrete.com/#sle.
      e. Mapei Corporation; Ultralite or Ultracontact: www.mapei.com/#sle.

f. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 GROUTS

A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Acceptable Products:
      a. ARDEX Engineered Cements; ARDEX FL (Sanded) or FGC (Unsanded): www.ardexamericas.com/#sle.
      b. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
      c. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc.; LATICRETE PermaColor: www.laticrete.com.
      e. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/16 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 40 mils, maximum.
      c. Products:
         1) ARDEX; S1-K.
         2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
         3) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
         4) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
         5) Mapei Corporation; Mapelastic CI: www.mapei.com/#sle.
         6) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
         7) Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-leveling Underlayment: Flowable, pre-formulated, water-mixed latex-Portland cement-based material; self-leveling to provide flat, level surface on tiling substrates, and meeting the requirements of ASTM C627.

1. Applications: On concrete substrates.
2. Acceptable Manufacturers:
   a. ARDEX; TL1000.
   b. Custom Building Products; "LevelQuick RS" Self Leveling Underlayment: www.custombuildingproducts.com.
   c. LATICRETE International, Inc.; 86 Latilevel Thin Pour: www.laticrete.com.
   d. Mapei Corporation; Ultraplan M20 Plus: www.mapei.com.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Backing Board: Specified in Section 09 29 00 - Gypsum Board.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
   1. Large Format Tile Installations Greater than 500 Square Feet: When specified tile is 24 by 24 inches or larger, or when planks exceed 30 inches in the long dimension, install 1/4 inch application of self-leveling underlayment under the entire installation.
   2. At all other tile installations, Tile contractor shall be responsible for floor prep up to 25% of the total area to be tiled at an average of 1/8 inch thickness, using pourable or trowelable materials supplied by the setting system manufacturer.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Under Thinset Tile: F(F) of 35; F(L) of 25.

C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

D. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

E. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

F. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.3 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Blending: For tile exhibiting color or pattern variations within the ranges of accepted submittals, verify that tile has been blended so that tile units taken from one package show same range in colors or patterns as those taken from other packages.

C. Floor System Coverage: Where specified for individual setting methods, install floor tile units with 95 percent mortar coverage, minimum, by complying with applicable special requirements for back buttering of tile units in referenced ANSI A108 specifications.

D. Wall System Coverage: Where specified for individual setting methods, install wall tile units with 95 percent mortar coverage, minimum, by complying with applicable special requirements for back buttering of tile units in referenced ANSI A108 specifications.

E. Install crack isolation membrane to comply with ANSI A118.10 and membrane manufacturer's written instructions for full floor coverage.

F. Movement Joints: Comply with TCNA (HB) Method EJ171F requirements for locations, spacing, and installation of applicable movement joints, whether or not specifically indicated or detailed on Drawings, and as follows:
   1. Field Joint Spacing - Interior: Maximum 24 feet on center in each direction; reduce spacing to maximum 10 feet on center in areas exposed to direct sunlight or moisture.
   2. Field Joint Spacing - Exterior and Above-Ground Concrete Slabs: Maximum 12 feet on center in each direction.
   3. Joint Width: Match adjacent grouted joint widths, unless TCNA EJ171 requires a specific joint width based on joint location or joint service conditions.
   4. Apply sealant joint to junction of tile and dissimilar materials and junction of dissimilar planes, including but not limited to floor to wall joints, corners, and metal trim and non-ceramic accessory items.
   5. Keep movement joints free of setting adhesive and grout.
   6. Where metal trims are not specified, form internal angles and corners square, not grouted, with sealant joint.
   7. Where metal trims are not specified, form external angles and corners square, not grouted, with sealant joint.

8. Apply specified sealant to joints.

G. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

H. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
1. Where floor and wall tile are of same dimensional module, align floor and wall joints.

I. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

J. Sound tile after setting. Replace hollow sounding units.

K. Keep control and expansion joints free of mortar, grout, and adhesive.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints, except where movement joints are indicated or specified.

N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

O. Allow completed tiling assemblies to cure full 72 hours before allowing heavy foot or equipment traffic on final installations.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113.
1. Provide 95 percent coverage of setting mortar over tile back surfaces, minimum.
2. Use full coverage crack isolation membrane under all tile unless other underlayment is indicated.

3.5 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244 .
1. Provide 95 percent coverage of setting mortar over tile back surfaces, minimum.

3.6 TOLERANCES

A. Comply with applicable requirements of ANSI A108.2, unless otherwise specified in this Section.

B. Flatness - Finished Tiling Surfaces:
1. Ceramic Tile: 1/4 inch in 10 feet.

C. Lippage - Adjacent Tile Units:

1. Wall Tile and Mosaic Tile: 1/32 inch; joint width 1/16 inch to 1/8 inch; 1 x 1 inch to 6 x 6 inch tile size.
2. Pressed Floor Tile and Porcelain Tile: 1/32 inch; joint width 1/16 inch to less than 1/4 inch; all tile sizes.

3.7 CLEANING

A. Clean tile and grout surfaces.

B. Remove grout efflorescence as required with product approved by tile and grout manufacturer.

C. Use cleaning materials and procedures as permitted by the tile and grout manufacturer's written instructions. Protect metal surfaces, iron, and vitreous fixtures from effects of acid cleaning. Flush surfaces with clean water before and after acid cleaning.

D. Leave finished installation clean and free of cracked, chipped, broken, un-bonded, or otherwise defective tile work.

3.8 PROTECTION

A. Do not permit traffic over finished floor surface for minimum 7 days after installation.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

END OF SECTION 09 30 00

SECTION 09 66 23 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.

B. Divider strips.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between terrazzo work and adjacent construction and fixtures.

B. Section 09 05 61 - Common Work Results For Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

A. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

B. NTMA (GRAD) - Aggregate Gradation Standards.

C. NTMA (EPOXY) - Epoxy Terrazzo Specifications.

1.4 DEFINITIONS

A. DCOF: Dynamic Coefficient of Friction.

B. Slip-Resistant: Installed flooring surface which has a wet coeffecient of friction of 0.42, minimum, as measured according to ANSI B101.3 (DCOF Slip Resistance Test).

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for divider strips, control joint strips, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components.

D. Samples: Submit two samples, 6 inch by 6 inch in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Manufacturer's Certificate: Provide letter of certification from manufacturer stating that installer is a certified applicator and is familiar with manufacturer's required procedures for application of specified flooring system.

G. Slip-Resistance: Certify that specified floor finish system, when installed, comply with specified requirements for slip-resistance.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. Minimum five years of documented experience.
   2. Associate member firm of the National Terrazzo and Mosaic Association, Inc.

C. Installer Qualifications: Company specializing in performing the type of work specified in this Section.
   1. Minimum five years of documented experience.
   2. Approved by matrix manufacturer.
   3. Contractor member of the National Terrazzo and Mosaic Association, Inc.

1.7 MOCK-UP

A. Integrated Mock-up: Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 3 by 3 feet.
   1. Locate where directed.
   2. Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F.

C. Keep products away from fire or open flame.

1.9 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

C. Provide ambient lighting level of 50 ft candles, measured at floor surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Key Resin Company: www.keyresin.com/#sle.
2. Sherwin-Williams Company; General Polymers Brand: www.generalpolymers.com.
3. Sika Corporation: www.sikafloorusa.com/#sle.
4. Terrazzco, a brand of Concord Terrazzo Company, Inc: www.terrazzco.com/sle.
5. Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Slip-Resistance: Installed flooring must be slip resistant in paths of egress, and other locations as required by applicable code.

B. Floors:
1. Thickness: 3/8 inch, nominal.
2. Color(s): As indicated on drawings.

C. Wall Base:
1. Thickness: Same as floors.
2. Style: Coved.
3. Color(s): Same as adjacent floor.
4. Aggregate Type and Size: Same as floors.

2.3 MATERIALS

A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
1. Mix Proportions: As required to achieve appearance specified.

B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.

C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.

D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.4 ACCESSORIES

A. Divider Strips: 1/8 inch thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.

B. Control Joint Strips: 1/8 inch nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch wide neoprene filler strip between vertical strips, with anchoring features.

C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.

D. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.

E. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.

F. Crack Isolation Membrane: Manufacturer's recommended product for construction joints, contraction joints (saw cuts), isolation joints, and cracks, complying with NTMA technical bulletin T24.

G. Primer: Manufacturer's recommended type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive terrazzo.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).

1. Test in accordance with Section 09 05 61.

2. Obtain instructions if test results are not within limits recommended by terrazzo flooring manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Clean substrate of foreign matter.

B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.

C. Prepare concrete surfaces according to ICRI 310.2R.

D. Apply crack isolation membrane in accordance with NTMA technical bulletin T24. Assume minimum 15% coverage.

E. Apply primer in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Saw cut substrate to install divider and control joint strips.
1. All concrete joints shall be honored through the flooring system. Refer to manufacturer's technical literature for treatment of joints.

B. Install control joint strips straight and flat to locations indicated.

C. Install divider strips according to pattern approved on shop drawings.

D. Install base divider and control joint strips to match floor pattern.

E. Install terminating cap strip at top of base; attach securely to wall substrate.

F. Place terrazzo mix over substrate to thickness indicated.

3.4 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Produce terrazzo finish surface to match approved mock-up, with 70 percent chip exposed.

C. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.

D. Apply grout to fill voids exposed from grinding.

E. Remove grout coat by grinding, using a fine grit abrasive.

F. Hand grind vertical and curved surfaces similarly.

3.5 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet.

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.6 CLEANING

A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.

B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.

C. Polish surfaces in accordance with manufacturer's instructions.

3.7 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION 09 66 23

SECTION 09 75 00 - STONE FACING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thin stone facing at interior walls.

B. Stone trim units.

1.2 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM C1242 - Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems.

C. ASTM C1528/C1528M - Standard Guide for Selection of Dimension Stone.

D. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII.

E. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section; require attendance by affected installers.
   1. Coordinate items that attach to or penetrate the affected walls.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for stone units, anchor accessories.

C. Shop Drawings: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
   1. Submit plans, elevations, and sections:
      a. Indicate courses for patterns, cutout locations and sizes, and joint widths; and details for corners, door headers, door sills, and jambs.
      b. Indicate locations and details of anchors, including location of supporting construction.
      c. Indicate direction of grain pattern.

D. Samples: Submit two stone samples of each stone type, indicating color range, texture, and markings.

E. Stone fabricator's qualification statement.

F. Installer's qualification statement.

G. Designer's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design stone anchorage components under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Stone Fabricator Qualifications: Company specializing in fabricating cut stone with minimum ten years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type required by this section, with minimum five years of documented experience.

D. Perform work in accordance with NSI (DSDM).

1.6 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct stone wall mock-up, 4 feet long by 4 feet high; include stone anchor accessories, corner condition, and typical control joint.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect stone from discoloration during storage on site.

B. Provide ventilation to prevent condensation from forming on stone.

C. Store stone off the ground and under cover. Store stone panels vertically on edge, resting weight on panel edge.

D. Protect materials during handling and installation to prevent damage or contamination.

E. Store dry materials off ground and under shelter from water.

F. Store liquid materials off ground and covered.

G. Protect liquid materials from freezing.

1.8 FIELD CONDITIONS

A. Maintain ambient air between 50 to 90 degrees F prior to, during, and for 48 hours after completion of work.

PART 2 PRODUCTS

2.1 STONE

A. Stone, General: See recommendations in ASTM C1528/C1528M.

B. Type and Finish: As scheduled.

2.2 STONE ANCHORS AND ATTACHMENTS

A. Provide anchors and attachments of type and size required to support stonework.

B. Comply with NSI (DSDM).

2.3 STONE FABRICATION

A. Thin Stone Veneer:
   1. Comply with requirements of ASTM C1242 for anchorage.
   2. Nominal Thickness: 3/4 inch to 2 inches.
   3. Backs: Sawn.

2.4 ACCESSORIES

A. Anchors in Direct Contact with Stone: ASTM A666 Type 304, stainless steel, of sizes and configurations required for support of stone and applicable superimposed loads.

B. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Verify that items built-in under other sections are properly located and sized.

3.2 THIN STONE VENEER

A. Preparation:
   1. Establish lines, levels, and courses. Protect from disturbance.
   2. Clean concrete surfaces of foreign matter using approved acid solutions, solvents, or detergents, and then rinse surfaces thoroughly with clean water.
   3. Roughen smooth concrete surfaces and apply bonding compound complying with manufacturer's written installation instructions.

B. Setting and Anchoring:
   1. Set stone in accordance with NSI (DSDM) and shop drawings.
   2. Clean exposed stone surfaces in accordance with NSI (DSDM).
   3. Provide joint widths of 1/8 inch.

C. Sealant Preparation:
   1. Remove dust, oil, grease, water, and surface dirt from joints.
   2. Apply sealant to joints indicated on drawings.

3.3 CONTROL AND EXPANSION JOINTS

A. Form joints as detailed on drawings.

B. Apply sealant in accordance with manufacturer's recommendations.

3.4 TOLERANCES

A. Install stone masonry within the site tolerances found in TMS 402/602.

3.5 CLEANING

A. Clean soiled surfaces with cleaning solution.

B. Use nonmetallic tools in cleaning operations.

END OF SECTION 09 75 00

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
   10. Glass.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 09 91 13 - Exterior Painting.

1.3 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

F. SCAQMD 1113 - Architectural Coatings.

G. SSPC-SP 1 - Solvent Cleaning.

H. SSPC-SP 2 - Hand Tool Cleaning.

I. SSPC-SP 6 - Commercial Blast Cleaning.

J. SSPC-SP 13 - Surface Preparation of Concrete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
   3. Allow 30 days for approval process, after receipt of complete samples by Architect.
   4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals, wood cabinets, and wood doors, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
   2. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Pittsburgh Paints: www.ppgpaints.com/#sle.
2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
3. Benjamin Moore: www.benjaminmoore.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. SCAQMD 1113 Rule.
c. Architectural coatings VOC limits of the State in which the Project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. LATEX PAINTS
1. Interior Latex Enamel.
a. Products:
1) PPG Paints Speedhide Zero Interior Latex, 6-4110XI Series, Flat. (MPI #53)
2) PPG Paints Speedhide Zero Interior Latex, 6-4310XI Series, Eggshell. (MPI #44)
3) PPG Paints Speedhide Zero Interior Latex, 6-4410XI Series, Satin. (MPI #52)
4) PPG Paints Speedhide Zero Interior Latex, 6-4510XI Series, Semi-Gloss. (MPI #54)
5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat. (MPI #53)
6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss. (MPI #43)
7) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #44)
8) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)
9) Benjamin Moore Ultra Spec 500 Flat N536. (MPI #53)
10) Benjamin Moore Ultra Spec 500 Low Sheen N537. (MPI #44)
11) Benjamin Moore Ultra Spec 500 Eggshell N538. (MPI #52)

12) Benjamin Moore Ultra Spec 500 Semi-Gloss N539. (MPI #43)

B. WATERBASED EPOXY PAINTS
1. Waterbased Epoxy.
a. Products:
1) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-310 Series, Eggshell. (MPI #151)
2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss. (MPI #153)
3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #151)
4) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #153)
5) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, V342, Eggshell. (MPI #151)
6) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, V341, Semi-Gloss. (MPI #153)

C. ACRYLIC PAINTS
1. Acrylic Enamel for Metal Surfaces (Non-Railing):
a. Products:
1) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel, 90-1210 Series, Semi-Gloss. (MPI #153)
2) Sherwin-Williams Pro Industrial DTM Acrylic, B66 Series, Semi-Gloss (MPI #153)
3) Benjamin Moore Super Spec HP DTM Acrylic, Semi-Gloss. (MPI #153)
2. Acrylic Enamel for Wood Surfaces:
a. Products:
1) PPG Paints Speedhide Zero Interior Zero VOC Latex, 6-4510XI, Semi-Gloss. (MPI #147)
2) Sherwin-Williams Pro Industrial Acrylic, B66 Series, Semi-Gloss. (MPI #147)
3) Benjamin Moore Ultra Spec 500, 539 Series, Semi-Gloss. (MPI #147)

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Interior Drywall Primer Sealer.
a. Products:
1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI.
2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 Series.
3) Benjamin Moore Ultra Spec 500 Primer 534.
2. Interior Rust-Inhibitive Water Based Primer.
a. Products:

1) Pittsburgh Paints Pitt-Tech Plus Interior/Exterior EP DTM Waterborne Acrylic Primer/Finish, 90-1908. (MPI #107)
2) Sherwin-Williams Pro-Cryl Universal Waterbased Primer.
3) Benjamin Moore Ultra Spec HP Acrylic Metal Primer, HP04.

3. Interior Water Based Primer for Galvanized Metal.
   a. Products:
      1) Pittsburgh Paints Pitt-Tech Plus EP DTM Industrial Primer, 90-1912. (MPI #134)
      2) Sherwin-Williams Pro-Cryl Universal Waterbased Primer.
      3) Benjamin Moore Ultra Spec HP Acrylic Metal Primer, HP04.
4. Latex Primer for Interior Wood.
   a. Products:
      1) Pittsburgh Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #39)
      2) Sherwin Williams Premium Wall & Wood Primer B28W8111.
      3) Benjamin Moore Fresh Start Multi-Purpose Primer, N023.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

K. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Mechanical Work: Painting of mechanical work includes the following:
   1. Interior Occupied Areas: Unless otherwise indicated, paint the following when exposed to view in finished construction:
      a. Structural supports for mechanical equipment.
      b. Mechanical equipment (except pre-finished equipment).
      c. Piping, pipe hangers, and supports.
      d. Ductwork.
      e. Insulation on pipe and ductwork.
      f. Accessory items.
      g. Fire suppression system piping.

J. Electrical Work: Painting of electrical work includes the following:
   1. Interior Occupied Areas: Unless otherwise indicated, paint the following when items exposed to view in finished construction:
      a. Structural supports for electrical equipment.
      b. Electrical equipment (except pre-finished equipment).
      c. Conduit and fittings, panels and boxes, and wiremold.
      d. Panelboards, including telephone equipment.
      e. Accessory items.

K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE - PAINT SYSTEMS

A. Naming Convention:
   1. Substrate - Interior or Exterior - Opaque or Transparent - #Coats/Topcoat Type.

B. Paint M-I-OP-3AE - Steel Substrates, Acrylic Enamel (Semi-gloss):
   1. Prime Coat: Rust-Inhibitive Water Based Primer, 3.0 mils DFT.
   2. Intermediate Coat: Acrylic Enamel, 1.4 mils DFT.
   3. Topcoats: Acrylic Enamel, 1.4 mils DFT.

C. Paint G-I-OP-3L - Gypsum Board Substrates, Latex Enamel (Ceilings - Flat; Walls - Eggshell, Unless Otherwise Noted):
   1. Prime Coat: Interior Latex Primer Sealer, 1.4 mils DFT.
   2. Intermediate Coat: Latex Enamel, 1.6 mils DFT.
   3. Topcoats: Latex Enamel, 1.6 mils DFT.

D. Paint G-I-OP-3WE - Gypsum Board Substrates, Waterbased Epoxy (Walls Where Indicated - Eggshell):
   1. Prime Coat: Interior Latex Primer Sealer, 1.4 mils DFT.
   2. Intermediate Coat: Waterbased Epoxy, 1.6 mils DFT.
   3. Topcoats: Waterbased Epoxy, 1.6 mils DFT.

END OF SECTION 09 91 23

SECTION 09 94 13 - DECORATIVE LIME PAINT FINISHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Decorative lime paint finishes.

1.2 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials and sealer.

C. Selection Samples: Submit four color samples 4 by 4 inch in size illustrating range of colors available in Architect's designated range.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.4 MOCK-UP

A. Provide mock-up of finishing system, 3 feet long by 3 feet illustrating color, texture, and quality of work .

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Store at a minimum of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

C. Handling: Maintain a clean, dry storage area to prevent contamination or damage to materials.

1.6 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide factory-mixed coatings unless otherwise indicated.

B. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

2.2 MANUFACTURERS

A. Basis of Design:
   1. JH Wall Paints: www.jhwallpaints.com.

B. Other Acceptable Manufacturers:
   1. Color Atelier Paint: www.coloratelierpaint.com
   2. Portola Paints & Glazes: www.portolapaints.com
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 MATERIALS

A. Prime bare drywall before application of Lime Wash System.
   1. Primer: product recommended by manufacturer for base coat.

B. Lime Wash System:
   1. Lime Wash Paint:
      a. Color: As selected from manufacturer's standard range.
   2. Sealer: Product recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

3.2 PREPARATION

A. Complete the painting of all adjacent surfaces pior to application as lime wash coating should not be tapped off.

B. Clean surfaces of loose foreign matter.

C. Remove dirt, loose mortar, scales, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate. Rinse well. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly setting with water.

D. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water.

E. Protect adjacent surfaces and materials not receiving coating; mask if necessary to provide adequate protection. Repair damage.

3.3 MIXING

A. Mix materials dry to uniform color and consistency before adding water.

B. Mix and proportion lime paint in accordance with manufacturer's instructions.

3.4 PRIMING

A. Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

B. For bare drywall, apply primer in accordance with coating manufacturer's instructions.

C. Slightly sand the surface of residue.

D. Apply undercoat to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.5 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Apply coatings evenly and allow to soak into substrate. Allow to dry 12 hours, minimum, before recoating.

C. Apply minimum 2 coats using methods required to match Architect's approved Field Sample Panel.

3.6 SEALER APPLICATION

A. Apply sealer evenly and per manufacturer's recommended coverage rates.

3.7 CLEANING

A. Clean surfaces immediately of spills, splatter and excess material.

3.8 PROTECTION

A. Protect finished work from damage.

END OF SECTION 09 94 13

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

1.2 RELATED REQUIREMENTS

A. Section 09 22 16: Placement of reinforcement for backing plate reinforcement.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

F. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.

G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

H. ASTM C1036 - Standard Specification for Flat Glass.

I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

B. Coordinate locations of accessories with other work to avoid interference, and to assure proper operation and servicing of accessory units.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Provide accessories by the same manufacturer for each type of accessory unit. For units exposed in the same areas, provide matching finishes.

B. Comply with ASTM F446 for grab bars and accessories, anchorage, test methods, and performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in a manner to protect accessory and its finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. ASI - American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bobrick Washroom Equipment, Inc: www.bobrick.com.
   3. Bradley Corporation: www.bradleycorp.com/#sle.

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Zinc Alloy: Die cast, ASTM B86.

G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 COMMERCIAL TOILET ACCESSORIES

A. Products complying with Owner standards.

2.5 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
   3. Construction: 1/8 inch flexible PVC.
      a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      b. Comply with ICC A117.1.
   4. Color: White.
   5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

E. See Section 09 22 16 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 28 00

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire hose and hydrant cabinets.

C. Accessories.

1.2 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide.

B. NFPA 10 - Standard for Portable Fire Extinguishers.

C. UL (DIR) - Online Certifications Directory.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for each item.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design - Hose Cabinet:

1. Potter-Roemer; Model 1312: www.potterroemer.com.

B. Fire Extinguishers:
1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
2. Ansul, a Tyco Business: www.ansul.com/#sle.
3. Fire-End & Croker Corporation: www.croker.com/#sle.
4. Kidde, a unit of United Technologies Corp.: www.kidde.com.
5. Larsen's Manufacturing Co.: www.larsensmfg.com.
6. Oval Brand Fire Products: www.ovalfireproducts.com/#sle.
7. Potter-Roemer: www.potterroemer.com/#sle.
8. Pyro-Chem, a Tyco Business: www.pyrochem.com.
9. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Stored Pressure Operated: Deep Drawn.
2. Class: A:B:C type.
3. Size: 5 pound 10 pound.
4. Finish: Baked polyester powder coat red color.
5. Temperature Range: -65 degrees F to 120 degrees F.

2.3 FIRE HOSE AND HYDRANT CABINETS

A. Cabinet Construction: Nonfire rated, trimless.
1. Formed galvanized steel sheet; 0.064-inch thick base metal.
2. Configuration: Wall mounted.
3. Application: Contains fire hose and fire hydrant.

B. Door: Glazed with clear tempered safety glass.

C. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

D. Fabrication: Weld, fill, and grind components smooth.

E. Finish: Red baked enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Mount extinguishers as scheduled.

D. Position signage at locations required by Authorities Having Jurisdiction.

3.3 SCHEDULES

A. Dry Chemical Type: Class ABC.
   1. Mounting: Wall bracket mounting.

END OF SECTION 10 44 00

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen appliances.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate clearance requirements and utility service rough-in locations with casework in which appliances are to be installed.

PART 2 PRODUCTS

2.1 APPLIANCES

A. Provided by Owner and installed by Contractor, as indicated in Drawings.

2.2 ACCESSORIES

A. Provide appliances with light bulbs, power cords, and other standard accessories supplied by the manufacturer or required for complete and functional installation of each appliance unit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.3 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.4 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION 11 30 13

SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. AWI (QCP) - Quality Certification Program.

C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material.

D. NEMA LD 3 - High-Pressure Decorative Laminates.

E. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII.

F. PS 1 - Structural Plywood.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizing and configuration of countertops with associated casework and adjacent construction.
   2. Coordinate sizing and locations of cutouts for plumbing fixtures with base cabinet configurations for proper alignments as indicated on Drawings.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other Sections.

1. Indicate plans, sections, dimensions, seam locations, component sizes, edge details, fabrication details, attachment provisions, sizes of furring, blocking, and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in countertops.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with not less than three years of documented experience.

C. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify dimensions of construction to receive countertops by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Solid Surface Material Manufacturer Warranty: Provide manufacturer’s standard warranty for solid surface material for period of 10 years against material defects.

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness: 1-1/4 inch, minimum.
   2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
      a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Finish on Exposed Surfaces: Polished.
      d. Color and Pattern: As scheduled on Drawings.
   3. Other Components Thickness: 3/4 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
   6. Skirts: As indicated on Drawings.
   7. Fabricate in accordance with manufacturer's standard requirements.

2.2 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.3 ACCESSORIES

A. Countertop and Workstation Brackets:
   1. Material: Steel or aluminum.
   2. Load Capacity Per Bracket: 450 pounds minimum.
   3. Finish: Manufacturer's standard, factory-applied powder coat.
   4. Color: Selected by Architect from manufacturer's standard range.
   5. Products: See drawings for types and locations.
      a. A&M Hardware, Inc ; Concealed Brackets: http://www.aandmhardware.com.
      b. Rangine Corporation; Rakks EH-Inside Wall Mount - Counter Support Brackets; www.rakks.com.
      c. The Float Frame; Under The Counter Series Cantilever Bracket: www.thefloat-frame.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Americans with Disabilities Act (ADA)-Compliant Vanity and Countertop Brackets: ADA Compliant bracket with option to install surface-mounted skirt.
   1. Material: Steel or aluminum.
   2. Load Capacity Per Bracket: 450 pounds minimum.
   3. Finish: Manufacturer's standard, factory-applied powder coat.
   4. Color: Selected by Architect from manufacturer's standard range.
   5. Products:
      a. A&M Hardware, Inc ; ADA Vanity Brackets: http://www.aandmhardware.com/#sle.
      b. Rangine Corporation; Rakks ADA Vanity Brackets; www.rakks.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to walls with contact surfaces set in waterproof adhesive.
   2. Height: 4 inches, unless otherwise indicated.

C. Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
   1. Arrange seams symmetrically or in orderly locations, minimum 12 inches from edges of sink and similar cutouts.

D. Cutouts and Holes:
   1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   2. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
   3. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
   4. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on Drawings, finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that blocking/backing has been installed prior to installation of countertop brackets and prefabricated vanities.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

E. Verify actual site dimensions and location of adjacent materials prior to commencing work.

F. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0"

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach wood countertops and wood substrates using screws with minimum penetration into substrate board of 5/8 inch.

C. Attach countertops using compatible adhesive.

D. Stone and Quartz:
   1. Do not cut stone or quartz and resin composite countertops in field unless otherwise indicated. If countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.

E. Set countertops to comply with requirements indicated. Shim and adjust, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure countertops in place.

F. Bond joints with countertop manufacturer's recommended adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

G. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

H. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 36 00

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 GENERAL

A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein, and/or as required by job conditions.

B. Drawings are diagrammatic and indicate a general arrangement of work. General design concepts indicated must be followed or bettered. The bid shall include offsets, additional piping, valves and plumbing equipment and components as required to meet construction conditions for proper operation. Do not scale drawings. Consult Architectural and Structural drawings for space conditions and additional fixtures. Develop and submit coordination drawings as outlined in Division 21 sections.

C. The drawings and specifications are divided into sections to meet the needs of the architect, the engineers, and the design consultants. They are not prepared as instructions to the contractor for how to buy out or subcontract the work. The contractor is responsible for all the work described in the contract documents, regardless of where it is shown. For example, electrical work is shown on fp-series drawings as well as on m-series drawings and e-series drawings. Miscellaneous metals and structural elements are shown on a-series drawings as well as on s-series drawings. Structural supports are required by the fp drawings. To avoid omitting any component of the project, refer to all the contract documents in their entirety.

D. Contractor to provide for additional shut-down and/or drainage of existing sprinkler system as required to accommodate owner’s phasing/ step schedule.

E. The work under this Section shall include all incidentals, labor, material, equipment, appliances, services, hoisting, scaffolding, supports, tools, consumable items, fees, licenses, and administrative tasks required to complete and make operable the plumbing work as intended.

F. The Contractor shall furnish and install all equipment as necessary to provide a complete installation including coordination, system check out and start up on each item and system.

G. This Contractor shall inform himself from the general construction specifications and plans, of the exact dimension of finished work and of the height of finished ceilings in all rooms where equipment or pipes are to be placed and arrange his work in accordance with the schedule of interior finishes, as indicated on the architectural drawings.

H. Manufacturer's qualifications: firms regularly engaged in the manufacturer of fixtures, appliances, pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

I. Material qualifications: shall conform to all local, state, and national/federal codes and regulations which may apply and nothing in these specifications shall be interpreted as an infringement of such codes or regulations.

J. Welding: qualify welding procedures, welders, and operators in accordance with ASME B31.1, or ASME B31.9, as applicable. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

K. Brazing: certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

L. The Contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor shall warranty all work for a period of one year from Owner acceptance unless specified otherwise in which case longer equipment warranties may apply.

   Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components that fail in materials or workmanship within specified warranty period:

   Warranty Period, Commencing on Date of Substantial Completion: One (1) year.

   Comply with all current Federal, State, City and local codes, standards and ordinances, including referenced standards within the Building and Fire Codes.

M. The contractor shall retain a professional engineer licensed in the state the project is being
constructed in. NICET certification acceptable in accordance with State requirements. Submit stamped and signed drawings and calculations for fire protection work within the project scope of work.

N. When a conflict between the drawings, notes and/or specifications occur, the more stringent, and/or larger quantity and/or more expensive shall apply. The requirements listed within notes or specifications shall be required, provided and installed whether specifically indicated on the drawings or not.

The entire fire protection system(s) (wet, dry, preaction, standpipe, as applicable) shall be considered a delegated design and the fire protection contractor shall be responsible for:

permits, producing all shop drawings, calculations, submittals and installation of such equipment to ensure a complete and operational, code compliant system(s). The contractor is responsible for coordinating routing of fire protection systems with other trades including but not limited to, architectural, structural, mechanical, electrical, etc.

1.2 GUARANTEES AND SERVICES

A. All workmanship, installation materials and equipment shall be maintained and serviced for the guarantee period at no additional cost to the Owner.

B. Leave entire system installed under this Contract in perfect working order, and, without additional charge, replace any work or material which develops defects within the guarantee period, including all other work damaged as a result of such defects.

C. Manufacturers' Warranties

1. The manufacturer shall warrant that the equipment which he has furnished is free from defects in material and workmanship. Obligations under this warranty shall be as follows:

   a. The equipment manufacturer or supplier shall provide and pay for all labor, parts, accessories, materials, freight and other services to repair or replace any equipment or part thereof which, in the course of installation, start-up and testing is found to be defective.
   b. For a period of **twelve months** from the date of acceptance by the Owner, the manufacturer shall replace any defective equipment or part thereof; freight costs for return of defective parts, labor for parts replacement, are the responsibility of the installing contractor.
   c. The manufacturer shall provide an additional warranty on all equipment as indicated in their respective specification section.
   d. Performance - where equipment is specified by size, guarantee that it will have the capacity specified in the system in which it is installed.

2. The final acceptance of the equipment will be made after the manufacturer has adjusted his equipment, balanced the various systems, demonstrated that it fulfills the requirements of the drawings and specifications, and has furnished all the required certificates of inspection and acceptance.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Fire-suppression equipment and piping demolition.
7. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Concrete bases.
10. Supports and anchorages.

1.5 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.6 SUBMITTALS

A. Procedure: Prepare and make the submissions listed below and in Division 1.

B. Shop Drawings: Submit shop drawings of all items proposed to be furnished and installed under this Division.

C. Manufacturer's Drawings.

1. Equipment listed in each section, include material specifications, operating characteristics and finishes.

D. Installation Drawings.

1. Coordinated scale drawings of equipment including interconnecting piping and equipment.
2. Coordinate space requirements for equipment and services.
3. Include connections, anchorages and fastenings.
4. Make allowance for clearances for access to and maintenance of equipment.

E. Wiring and Control Diagrams.

1. Electric wiring diagrams and automatic control diagrams and sequences of operation. The wiring diagrams must be complete and coordinated with the equipment actually installed.

F. Provide composite shop drawings showing work of all related construction, when required to ensure full coordination and proper fitting of the work, and when directed by the Architect.

G. Provide drawings showing dimensions and locations of concrete work required.

H. Samples.

1. Color samples for prefinished items.

I. Reports / Contractor shall preform:

1. Manufacturer's certified pressure tests on vessels.
2. Manufacturer's certified performance tests on operating equipment.
3. Field pipe testing reports and certificates of approval including:

    a. Main drain test
    b. Hydrostatic Tests, in accordance with NFPA 13, (200 psi and shall maintain that pressure without loss for 2 hours). Including existing systems prior to any work commencing, document test and any leaks.
    c. Inspector’s / flow test
    d. Backflow full flow test
    e. FDC piping has been tested
    f. Air pressure leakage test (For dry/preaction systems) 40 psi for 24 hours <1 ½ psi of leakage, in accordance with NFPA
    g. Dry pipe trip test (when applicable).
    h. High/low air pressure test (when applicable).
    i. Tamper switches have been tested
    j. Underground piping test (when applicable), in accordance with NFPA 13.

4. Welder's certificates and field test report.
5. Field operating test results for operating equipment.
6. Performance report on balancing of systems.
7. Performance report and calculations for vibration isolation equipment.
8. Manufacturer's certified reports on motorized equipment alignment and installation.

J. Statement of Compliance

1. Contractor shall submit a letter attesting the fire protection systems have been installed in accordance with the approved plans, manufacturer's equipment requirements and NFPA, any deviations must be clearly indicated.

K. If submissions of catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or other variations, those features proposed shall be clearly identified.

1. If any variations from the catalog description are proposed or required, such variations must be clearly noted on the cut.
2. Shop drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and other information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work.
3. Shop drawings shall be numbered consecutively, and drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that units may be checked individually and as an assembly.
4. Keep on the site, in good order, a complete up-to-date set of approved shop drawings. All shop drawings shall be available for inspection by the Architect.
5. On product data submittals, clearly indicate model numbers, dimensions, weights, electrical requirements, accessories and performance data. Submittals not properly prepared will be rejected without further review.
6. The review of shop drawings will be general, and shall not be construed as permitting any departure from the contract requirements other than those specifically brought to the Architect's attention and so approved.

    a. If the shop drawings show any variations from contract requirements because of standard shop practices or other reasons, such variations shall be clearly identified on the drawings in order that, if acceptable, suitable action may be taken for proper adjustment in other work affected thereby.
    b. Failure to identify such variations will not relieve the Contractor of responsibility for executing the work in accordance with the Contract even though such shop drawings have been reviewed and the work installed.
    c. Review shall not relieve the Contractor of responsibility for any error in details, dimensions, etc., that may exist on shop drawings nor for the furnishing of materials or work required by the Contract and not indicated on the shop drawings.
    d. Review shall not be construed as acceptable departure from details or instructions previously furnished by the Architect.
    e. Review with a requirement for resubmission is a review contingent upon satisfactory resubmission within 30 days. Failure to comply shall result in a revocation of the contingent review.

L. Shop Drawing Schedule

1. The Contractor shall submit, within 30 days of the award of his contract, a schedule of all proposed shop drawing submissions.

2. The schedule shall include the following information.

    a. Item to be submitted
    b. Date of submission
    c. Latest date for review
    d. Manufacturers of the specified item.

3. Items not specifically listed as "approved equal" should be listed for consideration at this time.
4. Shop drawings require a minimum of 10 business days from the date they have been received by the Consulting Engineer’s office to adequately review the submittal. If there is any submittal which requires to be expedited sooner than the 10 business days, the Engineer shall be informed in writing at the beginning of construction with a list of those submittals.

M. Submittals will be reviewed for conformance with the contract drawings and specifications. The engineer's review stamp will be affixed to submittals. One of the following actions will be taken:

1. Reviewed:

    a. No comments, corrections, or marks have been made to the submittal. Re-review by the engineer is not required. The submittal is in general conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the work shall be in accordance with the requirements of the Contract Documents. Final acceptance of the work shall be contingent upon such compliance.

2. Furnish As Corrected

    a. Comments, corrections, or marks made. Re-review is not required. Submission is in general conformance with the design concept subject to notations on the returned Submittal. Construction, fabrication, and/or manufacturer can proceed subject to the provisions that the work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Submittal and in accordance with the Contract Documents. Final acceptance of the work shall be contingent on such compliance.

3. Revise and Resubmit

    a. Significant issues/discrepancies/incomplete information was provided in the Submittal. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

4. Rejected

    a. Submittal does not meet Contract document intent. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

N. A submittal review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from Compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. The contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of his or her work with that of all other trades; and for performing all work in a safe and satisfactory manner.

1.7 COORDINATION DRAWINGS

A. Develop and submit coordination drawings as outlined.

B. Sheet metal, plumbing and fire protection shop drawings that have been coordinated with architectural and structural drawings shall be submitted to engineer for review. Drawings must be returned from engineer either "reviewed" or "furnish as corrected" prior to being used as basis for coordination drawings.

C. After sheet metal and piping drawings have been revised per engineers comments, reproducible copies shall be sent to the others trades in the following sequence for the inclusion of their work:

1. Mechanical sheet metal
2. Plumbing contractor
3. Electrical work
4. Mechanical piping
5. Sprinkler piping

D. After all trades have included their work on the coordination drawing and noted conflicts, all trades shall meet to resolve conflicts and agree to acceptable solutions. Each trade shall sign coordination drawings. Items not shown on coordination drawing is responsibility of omitting contractor and contractor is subject to additional costs incurred by other trades.

E. The architect and engineer are not part of the coordination drawing process. The engineer will provide assistance for noted conflicts only. Coordination drawings are not to be considered piping or duct shop drawings. The contractor is required to submit individual piping and ductwork shop drawings for review by the engineer. Piping and ductwork shop drawings shall follow the design intent of the contract documents.

F. Submit final signed coordination drawing to engineer for review. Engineer will review coordination drawings for general arrangement and for noted conflicts only. Specific installation requirements will be reviewed only in individual trade shop drawings.

G. Any work fabricated or installed prior to sign off by all trades which is deemed to be in conflict with coordination drawings shall be removed and re-installed in conformance with coordination drawings.

H. Each contractor (mentioned above) is responsible for the coordination of his sub-contractors.

I. The overall coordination of the coordination process is the responsibility of the contractor. The engineer is not responsible for the coordination process. The engineer will respond to questions that arise from the coordination process. Drawings submitted will be reviewed for clearly identified conflicts only. Solutions to conflicts will not bear additional cost.

1.8 RECORD DRAWINGS

A. Provide a complete set of as-built drawings reflecting as installed conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the engineer’s comments to produce a clear and concise set of drawings. Drawings shall be submitted in both hard copy and electronic (Auto-cad or Revit version as required by the owner) version. Number of copies of each as requested by the owner.

B. Provide "as-built drawings" indicating in a neat and accurate manner a complete record of all revisions of the original design of the work. Indicate the following installed conditions:

C. Include all changes and an accurate record, on reproductions of the contract drawings or appropriate shop drawings, of all deviations, between the work shown and work installed.

D. Mains and branches of piping systems, with valves and control devices located and numbered, Valve location diagrams, complete with valve tag chart.

E. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

F. Approved substitutions, contract modifications, and actual equipment and materials installed.

G. Contract modifications, actual equipment and materials installed.

H. Submit for review bound sets of the required drawings, manuals and operating instructions.

I. Submit a complete maintenance manual of all equipment installed under this contract.

1.9 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. All fire protection equipment / materials shall be sheltered from the weather, covered, and kept off the ground to prevent rust and debris from entering. Materials shall be kept in a safe / secure location from other equipment and/or construction processes to prevent damage or theft.

C. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.11 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.12 CLEANING

A. Contractor shall maintain areas control free of waste materials, debris, and rubbish. Maintain in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces before closing the space / finishing work in that area.

C. Contractor shall periodically clean interior areas before end of each working day and continue cleaning on an as-needed basis.

D. Contractor shall ensure that dust and other particulates from their work does not travel into areas not being renovated.

E. Contractor shall remove waste materials, debris, and rubbish from site daily and dispose of legally off-site. No scrap/debris shall remain inside the building or anywhere on site upon final acceptance of the project.

F. Final cleaning: at completion of work, remove all remaining waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave project clean and ready for occupancy.

1.13 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire equipment including: fire pumps, riser check valve assemblies, dry pipe valve assemblies, preaction valve assemblies, fire standpipe valves, pressure regulating valves, flow switches, tamper switches, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Obtain all general conformances in accordance with Division 1 - General Requirements.

C. Submit to the Architect for review a list of manufacturers of equipment proposed for the work. Intent to use exact make specified does not relieve the Contractor of responsibility for submitting the required list.

D. Where any specific materials, process or method of construction, or manufactured article is specified by name or by reference to catalog number of a manufacturer, or other standards, the intent is not to take precedence over the basic duty and performance specified, noted on drawings, or as required for intended results. In all cases, verify the duty specified with the specific characteristics of the equipment offered for review.

E. Equipment of one type, shall be products of one manufacturer, a manufacturers actual cut sheet and not from a distributer.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.8 Pipe Painting:

1. Paint all interior piping with two coats of enamel epoxy type paint. Prep, clean and prime pipe surfaces, in accordance with paint manufacturers specifications / recommendations prior to installation and final color application.

2. Contractor shall ensure paint and primer are compatible with one another and material being painted.

3. Paint color shall match existing wall color, coordinate with the Owner's requirements prior to installation.

4. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

5. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

6. Piping and fittings exposed to corrosive and/or high humidity areas (i.e. greater then 50% rh) shall be galvanized schedule 40 steel with epoxy coating similar to ameron. Sprinkler heads within these areas shall also be corrosive / moisture resistant (i.e. teflon coated). Pipe hangers and components within these areas shall be hot dipped galvanized steel with epoxy coating. Similar to Ameron.

7. All piping shall be in accordance with FDNY and NYC Building code requirements.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Contractor shall contact owner and as directed; owner's insurance carrier and local AHJ etc. to any/all fire protection shut downs, and limit time system is down. Provide

temporary sprinkler and/or standpipe protection as required by Owner's Insurance carrier, Local AHJ and/or code.

C. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

D. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
   g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   h. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.
   i. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
   j. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
   k. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

   a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
   g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
   h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge and set screw or spring clips.

i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
j. Retain subparagraph above or first subparagraph below.
k. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
l. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Provide listed fire stopping material (coordinated with wall, ceiling etc rating) for all penetrations.

O. Permanent sleeves are not required for holes formed by removable PE sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 21 05 00

SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sleeves shall be in accordance with NFPA 13

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron-Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends. Applications in new, poured concrete shall be furnished with an integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends. Applications in new, poured concrete shall be furnished with an integral waterstop unless otherwise indicated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Industries, LLC.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Products: Subject to compliance with requirements, provide the following:

1. HOLDRITE.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, use NT.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 STAIR FLOOR / LANDING PENETRATIONS (when rating not required)

A. Hole for piping shall be cut to limit annular clear space between hole and piping (i.e. ¼").

B. Seal annular space between piping and hole; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants." Color shall be coordinated with architect prior to installation.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in concrete floors, concrete roof slabs, and concrete/masonry walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Pipe Penetrations Through Fire Rated Assemblies:

1. The Contractor shall coordinate with the firestopping system manufacturer to determine if a pipe sleeve is required to comply with the manufacturer’s installation instructions and the listed firestop system’s testing standards.

2. All penetrations shall maintain the fire-resistance rating of the wall or assembly.

3. Sleeves, where required, shall be properly sized, aligned, and installed to accommodate the pipe type (metallic or non-metallic), account for thermal expansion or movement, and ensure compatibility with the approved firestop system.

4. Installation shall follow the firestop system’s listed design and manufacturer’s guidelines.

5. Cut sleeves to length for mounting flush with both surfaces.

6. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

7. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping." Fire Seal shall be UL listed, approved and tested fire and/or smoke sealing material installed in all fire and/or smoke rated floor and partitions in accordance with NFPA, local code and manufacturers recommendations. Fire Barrier Sealant shall be compatible with the piping it is installed with and in strict accordance with manufacturers recommendations.

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Cast-Iron-Pipe Sleeves or Galvanized-Steel-Pipe Sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-Iron-Pipe Sleeves or Galvanized-Steel-Pipe Sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Galvanized-Steel-Pipe Sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Galvanized-Steel-Pipe Sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Galvanized-Steel-Pipe Sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-Steel-Pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized-Steel-Pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-Steel-Pipe sleeves.

5. Interior Masonry and Concrete Walls:

a. Piping Smaller Than NPS 6: Galvanized-Steel-Pipe sleeves.
b. Piping (DN 150) and Larger: Galvanized-steel-sheet sleeves.

6. Pipe Penetrations Through Fire Rated Assemblies:

a. The Contractor shall coordinate with the firestopping system manufacturer to determine if a pipe sleeve is required to comply with the manufacturer's installation instructions and the listed firestop system's testing standards.
b. All penetrations shall maintain the fire-resistance rating of the wall or assembly.
c. Sleeves, where required, shall be properly sized, aligned, and installed to accommodate the pipe type (metallic or non-metallic), account for thermal expansion or movement, and ensure compatibility with the approved firestop system.
d. Installation shall follow the firestop system's listed design and manufacturer's guidelines.

END OF SECTION 21 05 17

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

   a. One-piece type escutcheon, finish shall be determined by architect.
   b. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   c. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
   d. Insulated Piping: One-piece, stamped-steel type.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
   f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
   h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   i. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
   j. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   k. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
   l. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

2. Escutcheons for Existing Piping:

   a. Two-piece type escutcheon, finish shall be determined by architect.
   b. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   c. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

g. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
h. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
j. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Iron butterfly valves with indicators.
2. Check valves.
3. Iron OS&Y gate valves.
4. Indicator posts.
5. Trim and drain valves.

1.3 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valves shall be UL/FM listed, FM listing is mandatory for FM Global projects

B. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

C. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

D. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

E. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

F. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

G. NFPA Compliance: Comply with NFPA 24 for valves.

H. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

I. Valve Sizes: Same as upstream piping unless otherwise indicated.

J. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

K. 6” and larger sectional and riser control valves shall have a minimum ¾” valved by-pass.

2.2 IRON BUTTERFLY VALVES WITH INDICATORS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Anvil International.
2. Kennedy Valve Company; a division of McWane, Inc.
3. NIBCO INC.
4. Tyco Fire & Building Products LP.
5. Victaulic Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, and EPDM or SBR coated.

7. Actuator: Worm gear or traveling nut.
8. Supervisory / Tamper Switch: Internal or external, wired to main fire alarm panel, provide wiring.
9. Body Design: Grooved-end connections.

2.3 CHECK VALVES

A. Products: Subject to compliance with requirements, provide one of the following:

1. Anvil International.
2. Kennedy Valve Company; a division of McWane, Inc.
3. Mueller Co.
4. NIBCO INC.
5. Reliable Automatic Sprinkler Co., Inc. (The).
6. Tyco Fire & Building Products LP.
7. Victaulic Company.
8. Viking Corporation.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.4 IRON OS&Y GATE VALVES

A. Products: Subject to compliance with requirements, provide one of the following:

1. Clow Valve Company; a subsidiary of McWane, Inc.
2. Hammond Valve.
3. Kennedy Valve Company; a division of McWane, Inc.
4. Mueller Co.
5. NIBCO INC.
6. Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.

4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.5 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

   a. Conbraco Industries, Inc.
   b. Fire-End & Croker Corporation.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Potter Roemer LLC.
   f. Tyco Fire & Building Products LP.
   g. Victaulic Company.
   h. Watts; a Watts Water Technologies company.

2. Description:

   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port size: Full.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Handlever.
   i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.

B. Angle Valves:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fire Protection Products, Inc.
   b. NIBCO INC.
   c. United Brass Works, Inc.

2. Description:

   a. Pressure Rating: 175 psig.
   b. Body Material: Brass or bronze.
   c. Ends: Threaded.
   d. Stem: Bronze.

e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Products: Subject to compliance with requirements, provide one of the following:

a. NIBCO INC.
b. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
2. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above the pipe center.

E. Install valves in position to allow full stem movement.

F. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

G. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

H. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 21 05 23

SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE PROTECTION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210548 "Vibration and Seismic Controls for Fire Protection Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Piping etc. shall be independently supported/hung from building structure.

C. Structural Performance: Hangers and supports for fire protection piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

D. Seismic restraint: Provide seismic restraint of all fire protection equipment and systems in accordance with NFPA Standards, State Building Code Requirements, ASHRAE, and State of California OSHPD. Submit shop drawings designed, signed and sealed by a licensed Professional Engineer registered in the State of the project (which shall be considered the Engineer of record for the seismic design of components within this section) indicating all necessary component cuts, plan locations and calculations for a complete system. The Professional Engineer of record for the seismic design shall at the completion of the seismic installation visit the site, review and document the installation noting any deficiencies, corrective measures, and at completion state that the installation is installed in conformance with his/her design. Refer to other division 21 requirements.

E. Provide necessary additional structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from concrete construction, do not weaken concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected. All such hangers shall be finally adjusted both in the vertical and horizontal direction, as required. Hangers in contact with copper or brass pipe shall be copper plated steel and provided with felt sleeve.

F. No hangers are to be placed off of the deck. All hangers, clamps etc. shall be attached to structural members. Contractor shall provide and install additional structural supports as required.

G. Standard environments:

1. All hangers shall be zinc coated. Rods shall be zinc coated, with zinc hardware.

H. Exterior, corrosive and/or high humidity (i.e. greater than 50% rh) environments:

1. All hangers shall be hot-dipped galvanized type. Rods shall be stainless steel, with stainless steel hardware.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, pipe hanger and support systems shall be one of the following or engineer-approved equal.

1. Anvil International
2. ERICO, Inc.
3. PHD
4. Hubbard Enterprises

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Un-insulated pipes 2 inch and smaller:

    a. Adjustable steel swivel loop (band) hanger.
    b. Adjustable steel clevis hanger.
    c. Adjustable steel swivel J-hanger.
    d. Steel insulated split ring hanger.
    e. Malleable iron swivel split ring hanger.
    f. Malleable iron split ring hanger.

4. Hangers for un-insulated pipe sizes 2-1/2 inch and larger:

    a. Adjustable steel clevis hanger.
    b. Adjustable steel swivel loop (band) hanger.
    c. Two rod roller hanger.
    d. Adjustable one rod roller hanger.

5. Hanger Rods: Continuous-thread rod, hot dipped galvanized with stainless steel hardware.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, hot dipped galvanized with stainless steel nuts, and washer made
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Epoxy.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. Empire Industries, Inc.
   c. ERICO International Corporation.
   d. Haydon Corporation; H-Strut Division.
   e. NIBCO INC.
   f. PHD Manufacturing, Inc.
   g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, hot dipped galvanized with stainless steel nuts, and washer made.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Epoxy.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Drop in anchors, powder driven anchors are not permitted.

B. All hangers, clamps etc. shall be attached to structural members. Metal deck with poured concrete may be considered structure when approved by structural engineer and the required concrete depth is coordinated with anchor manufacturer. Contractor shall otherwise provide and install additional structural supports as required.

C. Hangers are only to be placed off of the metal deck (expandable sleeve anchors, Sammy X-Press type) in accordance with manufacturer’s specifications, NFPA 13

requirements (both load and spacing) and coordinated with structural engineer. When roof metal decking incorporates concrete slab, wedge type anchors are to be utilized.

D. Seismic approved anchors shall be required in: seismic zones, cracked concrete and as required by structural engineer

E. All anchors shall be stainless steel/corrosion resistance.

1. Manufacturers:

a. Powers Fasteners. Model Power-Stud
b. B-Line Systems, Inc.; a division of Cooper Industries Model AWA
c. Hilti, Inc.Model KB
d. ITW Ramset/Red Head. Model Trubolt
e. MKT Fastening, LLC. Model Sup-R-Stud
f. Dewalt

F. Zinc plated carbon steel threaded fasteners acceptable for wood attachment

1. Manufacturers:

a. Powers Fasteners. Model Vertigo
b. Sammy Screw; Model GST 10

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel galvanized pipe hangers and supports metal trapeze pipe hangers and metal framing systems and stainless steel hardware for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
16. Top Beam Clamps

    a. Carbon steel clamp body with hardened steel cup point set screw and locknut and galvanized retaining "J" strap (regardless of seismic zone). Body shall be tapped through to permit extended adjustment of threaded rod.
    b. Galvanized, hot dipped finish.
    c. Approved equal to TOLCO Fig. 65, 66, and 69.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 21 05 29

SECTION 21 05 48 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Pipe-riser resilient supports.
5. Resilient pipe guides.
6. Elastomeric hangers.
7. Snubbers.
8. Restraint channel bracings.
9. Seismic-restraint accessories.
10. Mechanical anchor bolts.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Refer to structural drawings for wind speed and seismic design criteria.

B. Importance Factor:

1. The component importance factor, I*p*, shall be taken as 1.5 if any of the following conditions apply:

   a. The component is required to function for life-safety purposes after an earthquake, including fire protection sprinkler systems and egress stairways.
   b. The component conveys, supports, or otherwise contains toxic, highly toxic, or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.
   c. The component is in or attached to a Risk Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
   d. The component conveys, supports, or otherwise contains hazardous substances and is attached to a structure or portion thereof classified by the authority having jurisdiction as a hazardous occupancy.

2. IDENTIFY ANY SYSTEMS REQUIRING AN IMPORTANCE FACTOR OF 1.5 HERE.

3. All other components shall be assigned a component importance factor, I*p*, equal to 1.0.

C. Seismic-Restraint Loading:

1. Seismic Design Category (SDC): B

2. In Seismic Design Categories A & B: FP systems are exempt from requirements for seismic bracing, except piping crossing seismic joints.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ace Mountings Co., Inc.
b. Isolation Technology, Inc.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.; Mason Super WM.
e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

a. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ace Mountings Co., Inc.
b. Isolation Technology, Inc.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.;.

e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts: .

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ace Mountings Co., Inc.
b. Isolation Technology, Inc.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.
e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene or other elastomeric material.

2.5 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

2.6 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.7 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Ace Mountings Co., Inc.
   b. Isolation Technology, Inc.
   c. Kinetics Noise Control, Inc.
   d. Mason Industries, Inc.
   e. Vibration Eliminator Co., Inc.
   f. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.8 SNUBBERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.;.
3. Vibration Mountings & Controls, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.9 RESTRAINT CHANNEL BRACINGS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; an Atkore International company.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.10 SEISMIC-RESTRAINT ACCESSORIES

A. Products: Subject to compliance with requirements, provide one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.11 MECHANICAL ANCHOR BOLTS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.; Mason SAS.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of equipment supports and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on fire-suppression equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127 and NFPA.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach

equipment. Comply with requirements in Section 211200 "Fire-Suppression Standpipes," Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

END OF SECTION 21 05 48

SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brimar Industries, Inc.
   b. Craftmark Pipe Markers.
   c. Marking Services, Inc.
   d. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 5 by 3 inch.
7. Minimum Letter Size: 1 inch for name of units if viewing distance is less than 24 inches, 2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws; adhesive for locations were screws or rivets would void warranty of equipment.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

D. All control, drain, and test connection valves shall be provided with permanently marked weatherproof metal or rigid plastic identification signs in accordance with NFPA 13. Signs shall indicate portion of system controlled by each valve

E. Contractor shall provide a laminated valve tag schedule indicating: type of valve, location and tag # for all control valves (including pressure reducing type). Laminated valve tag schedule shall be located in fire sprinkler / fire pump room. Indicate area valve serves, make, model, valve size and normal operating position.

F. Contractor shall provide a laminated valve tag schedule indicating: location of all low point drains on any/all dry or preaction systems.

G. Contractor shall place As-built drawings (hard copy and USB), valve schedule etc. within surface mounted Plans Box Labeled “Fire Protection Drawings” Similar to DSB ACE-12 drawing storage box, 37”x5 ½” x 4 ¼” “.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 5 by 3 inch.

G. Minimum Letter Size: 1 inch for name of units if viewing distance is less than 24 inches, 2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws; adhesive for locations were screws or rivets would void warranty of equipment.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

K. Plastic labels shall be plenum rated when located in plenums.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Machine printed, color-coded, with lettering indicating service, pipe size, and showing flow direction. Marker/hand written labels are not acceptable.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Plastic labels shall be plenum rated when located in plenums.

F. Pipe-Label Colors:

1. In accordance with ANSI A13.1 and local fire code requirements

2.4 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries, Inc.
2. Carlton Industries, LP.
3. Champion America.
4. Craftmark Pipe Markers.
5. LEM Products Inc.
6. Marking Sevices Inc.
7. Seton Identification Products.

B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass beaded chain with S-hook or jack chain with S-hook.

C. Valve Tag Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, valve number and service.

1. Example: SPK
Isolation
001

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.
2. Valve-tag schedule shall be framed behind glass and located in each mechanical room

2.5 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 inches high by 7 inches long.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Red background with white lettering.

C. Plastic labels shall be plenum rated when located in plenums.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
8. At all changes of direction.
9. And at all locations required to conform to ASME/ANSI A13.1 - 2007

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule: Coordinate with facility standards. If no facility standards exist or are not desired, conform to ASME/ANSI A13.1 - 2007.

D. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

3.5 VALVE-TAG INSTALLATION

A. Install tags on all valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 2 inches, round.
b. Wet-Pipe Sprinkler System: 2 inches, round.

2. Valve-Tag Color:

a. All services: Natural.

3. Letter Color:

a. All services: Black.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

B. Markings shall be provided in locations required by and meeting the color requirements of the “Safety Code Color for Marking Physical Hazards”, ANSI Z53.1, latest revision.

END OF SECTION 21 05 53

SECTION 21 12 00 - FIRE SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection specialty valves.
3. Hose connections.
4. Alarm devices.
5. Control panels.
6. Pressure gages.

1.3 DEFINITIONS

A. High-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

B. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire-suppression standpipes.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For standpipe systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fire-suppression standpipes, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.

B. Qualification Data: For Installer and professional engineer.

C. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Standpipe Service: Do not interrupt fire-suppression standpipe service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression standpipe service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of fire-suppression standpipe service.
2. Do not proceed with interruption of fire-suppression standpipe service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

2.2 PERFORMANCE REQUIREMENTS

A. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.

B. High-Pressure, Fire-Suppression Standpipe System Component: Listed for 300-psig working pressure.

C. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Available fire-hydrant flow test records indicate the following conditions:

a. Refer to flow test information on drawings.

D. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.

1. Minimum residual pressure at each hose-connection outlet is as follows:

a. NPS 2-1/2 Hose Connections: 65 psig.

E. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.3 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials and for joining methods for specific services, service locations, and pipe sizes.

2.4 BLACK STEEL PIPE AND ASSOCIATED FITTINGS

A. Refer to Specification Section 211313 - WET-PIPE SPRINKLER SYSTEMS

B. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.

C. Schedule 10: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 2 ½" and larger ; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Uncoated, Steel Couplings: ASTM A 865/A 865M, threaded.

E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME B16.1, Class 125.

H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

I. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

J. Grooved-Joint, Steel-Pipe Appurtenances:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Anvil International.
b. Shurjoint Piping Products.
c. Smith-Cooper International.
d. Tyco Fire & Building Products LP.
e. Victaulic Company.

2. Pressure Rating: 300 psig minimum.

3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.5 GALVANIZED-STEEL PIPE AND ASSOCIATED FITTINGS

A. Refer to Specification Section 211313 - WET-PIPE SPRINKLER SYSTEMS

B. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.

C. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

D. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

F. Flanges: ASME B16.1, Class 125, cast iron.

G. Appurtenances for Grooved-End, Galvanized-Steel Pipe:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Anvil International.
   b. Shurjoint Piping Products.
   c. Smith-Cooper International.
   d. Tyco Fire & Building Products LP.
   e. Victaulic Company.

2. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
3. Fittings for Grooved-End, Galvanized-Steel Pipe:

   a. AWWA C606 for steel-pipe dimensions.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.

e. Minimum Pressure Rating:

1) NPS 8 and Smaller: 600 psig.
2) NPS 10 and NPS 12: 400 psig.

2.6 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.1 PIPE HANGERS, SUPPORTS, AND SEISMIC RESTRAINT

A. Refer to Specification Section 211313 - WET-PIPE SPRINKLER SYSTEMS

2.2 SPECIALTY VALVES

A. General Requirements:

1. Refer to Specification Section 211313 - WET-PIPE SPRINKLER SYSTEMS
2. Standard: UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
3. Pressure Rating:

a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
b. High-Pressure Piping Specialty Valves: 300 psig.

4. Body Material: Cast or ductile iron.
5. Size: Same as connected piping.
6. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Kidde Fire Fighting; A UTC Business Unit.

b. Reliable Automatic Sprinkler Co., Inc. (The).
c. Tyco Fire & Building Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.3 2 ½" FIRE DEPARTMENT VALVE

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Guardian Fire Equipment, Inc.
   d. Potter Roemer LLC.
   e. Tyco Fire & Building Products LP.

2. Valve:

   a. 2 1/2" Cast Brass angle Valve, Rough brass angle body, polished trim and red cast iron wheel handle, 300 PSI, WWP. - Approved equal to POTTER-ROEMER 4065
   b. 2 ½" x 1 ½" satin brass reducer - Approved equal to POTTER-ROEMER 2810
   c. 1 1/2" Cast brass cap - Approved equal to POTTER-ROEMER 4715

3. Cabinet:

   a. Fire rated valve cabinet capable of housing 2 ½" fire department valve, 2 ½" x 1 ½" reducer, cap and chain.
   b. 20 ga. Tubular steel, continuous hinge powder coated.
   c. Provide labeling as required by AHJ.
   d. Approved equal to POTTER-ROEMER FRC1810-10.

2.4 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Refer to Specification Section 211313 - WET-PIPE SPRINKLER SYSTEMS

C. Electrically Operated Alarm Bell:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Notifier.

c. Potter Electric Signal Company, LLC.

D. Water-Flow Indicators:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Potter Electric Signal Company, LLC.
b. System Sensor.
c. Viking Corporation.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Valve Supervisory Switches:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Kennedy Valve Company; a division of McWane, Inc.
b. Potter Electric Signal Company, LLC.
c. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

F. Indicator-Post Supervisory Switches:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Potter Electric Signal Company, LLC.
b. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.5 PRESSURE GAGES

A. Refer to Specification Section 211313 - WET-PIPE SPRINKLER SYSTEMS

B. Products: Subject to compliance with requirements, provide one of the following:

1. AMETEK, Inc.
2. Ashcroft Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

C. Standard: UL 393.

D. Dial Size: 3-1/2- to 4-1/2-inch diameter.

E. Pressure Gage Range: Zero to 300 psig.

F. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

G. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install drain valves on standpipes. Extend drain piping to outside of building.

F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.

G. Install alarm devices in piping systems.

H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.

I. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

J. Fill wet-type standpipe system piping with water.

K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

L. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

I. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.

3.6 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device.

D. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."

3.7 HOSE-STATION INSTALLATION

A. Install freestanding hose stations for access and minimum passage restriction.

B. Install NPS 1-1/2 hose-station valves with flow-restricting device unless otherwise indicated.

C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device unless otherwise indicated.

D. Install freestanding hose stations with support or bracket attached to standpipe.

E. Install wall-mounted, rack hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.

6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Refer to schedule on drawings.

END OF SECTION 21 12 00

SECTION 21 12 13 - FIRE-SUPPRESSION HOSES AND NOZZLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide only as required by AHJ.

B. Section Includes:

1. NPS 1-1/2 rack-type hose stations.
2. NPS 1-1/2 by NPS 2-1/2 rack-type hose stations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each product type to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 NPS 1-1/2 RACK-TYPE HOSE STATIONS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Elkhart Brass Mfg. Co., Inc.
2. Fire-End & Croker Corporation.

3. Potter Roemer LLC.
4. Viking Corporation.

B. Hose Rack:

1. Standard: UL 47.
2. Material: Steel with red-enamel finish.
3. Type: Hose-rack assembly. Include hose valve, hose rack, water-retention device, hose pins, and hose.
4. Operation: Semiautomatic.
5. Sized to hold fire hose.

C. Hose Valve:

1. Standard: UL 668, NPS 1-1/2, for connecting fire hose.
2. Type: Adjustable.
3. Hose Valve and Trim Finish: Polished chrome-plated.
4. Pressure Rating: 300 psig minimum.
5. Pattern: Angle.
6. Material: Brass or bronze.
7. Pressure-Control Device: UL 1468 integral or for field installation if indicated.
8. Size: NPS 1-1/2.
9. Inlet: Female pipe threads.
10. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.

D. Hose:

1. Standards: NFPA 1961 and UL 219 lined fire hose with swivel inlet, coupling, gaskets, and nozzle.
2. Size: NPS 1-1/2.
3. Length: 100 feet.
4. Jacket: Combination of natural and synthetic threads.
5. Lining: Rubber, plastic, or combination of rubber and plastic compounds.
6. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
7. Nozzle: UL 401.

    a. Material: Rough chrome-plated brass.
    b. Type: Plain, for nonadjustable water stream.

2.2 NPS 1-1/2 BY NPS 2-1/2 RACK-TYPE HOSE STATIONS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Elkhart Brass Mfg. Co., Inc.
2. Fire-End & Croker Corporation.
3. Potter Roemer LLC.
4. Viking Corporation.

B. Hose Rack:

1. Standard: UL 47.
2. Material: Steel with red-enamel finish.
3. Type: Hose-rack assembly. Include hose valve, reducer adapter, hose rack, water-retention device, hose pins, and hose.
4. Operation: Semiautomatic.
5. Sized to hold fire hose.

C. Hose Valve:

1. Standard: UL 668, NPS 2-1/2, for connecting fire hose.
2. Type: Adjustable.
3. Hose Valve and Trim Finish: Rough brass or bronze.
4. Pressure Rating: 300 psig minimum.
5. Pattern: Angle.
6. Material: Brass or bronze.
7. Pressure-Control Device: UL 1468, integral or for field installation if indicated.
8. Size: NPS 2-1/2.
9. Inlet: Female pipe threads.
10. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
11. Reducer Adapter: NPS 2-1/2 by NPS 1-1/2.

D. Hose:

1. Standards: NFPA 1961 and UL 219, lined fire hose with swivel inlet, coupling, gaskets, and nozzle.
2. Size: NPS 1-1/2.
3. Length: 100 feet.
4. Jacket: Combination of natural and synthetic threads.
5. Lining: Rubber, plastic, or combination of rubber and plastic compounds.
6. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
7. Nozzle: UL 401 spray nozzle unless plain nozzle is indicated.

    a. Material: Rough chrome-plated brass.
    b. Type: Plain, for nonadjustable water stream.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire hoses, reels, racks, and monitors.

B. Examine roughing-in for standpipe systems to verify actual locations of piping connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HOSE-STATION INSTALLATION

A. Install freestanding hose stations for access and minimum passage restriction.

B. Install NPS 1-1/2 hose-station valves with flow-restricting device unless otherwise indicated.

C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device unless otherwise indicated.

D. Install freestanding hose stations with support or bracket attached to standpipe.

E. Install wall-mounted, rack hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."

END OF SECTION 21 12 13

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 SHOP DRAWINGS:

1. HYDRAULIC SUMMARY DATA SHALL BE INCLUDED ON SHOP DRAWINGS.

2. Contractor shall document (in schematic way) in which area is supplied including pipe sizes, overall length of piping, etc. as necessary to perform hydraulic calculations.
3. Calculations shall include a 10 psi "Cushion" between required flow/pressure and available flow/pressure.
4. Hydraulic reference points shall be clearly indicated on drawings. Do not use "pipe numbers", provide consecutively numbered reference points at all areas indicated on hydraulic calculations including at connection to street main.
5. Hydraulic calculations shall include a minimum of 1500 sq.ft. for all remote areas. Grid calculations shall include "Peaking" process (per NFPA requirements) to ensure calculation of most remote area.
6. For areas having unsprinklered combustible concealed spaces (as described in NFPA 13,) the minimum area of sprinkler protection shall be 3,000 sq.ft.
7. Increase hydraulic remote area for all dry and double interlocked preaction systems.
8. Increase hydraulic remote area by 30% for sprinklers used on sloped ceilings with a pitch exceeding one in six (16.7%).
9. Use of: line spacing off wall in excess of 7’-6”, remote area reductions, etc. (as noted in NFPA 13) are not permitted.
10. Contractor shall submit hydraulic calculations for all sprinkler and standpipe systems, including all hazard areas; (i.e. wet, dry, preaction, light, ordinary, extra, etc.) to Insurance carrier, engineer, architect and Fire Marshal.
11. Residential areas shall be calculated in accordance with NFPA 13
12. Exposure sprinkler demand shall be calculated in accordance with NFPA 13, and added to the required wet system demand.
13. Include plans, elevations, sections, and attachment details.
14. Include diagrams for power, signal, and control wiring.
15. Provide dimensional installation piping layout/s coordinated with all trades. Include all sprinkler piping, drains, pipe sizes, hanger styles and locations, valves, alarm equipment, and all other items for a complete shop drawing. Submittal shop drawings shall be clear and legible. All sprinkler information must standout on the shop drawings (ie: bold piping, etc. or lighter background).
16. Include a complete riser diagram indicating new and existing fire protection equipment, hydraulic reference points and elevations at each floor.
17. Provide a full height building cross section noting elevations, types of construction, and locations of ceilings, walls/partitions, and piping.
18. Include a site plan indicating flow test location, north arrow, underground supply piping, building location and adjacent streets.
19. Contractor to indicate number of sprinkler heads and types per floor.
20. Contractor to dimension distance from: sprinkler head to sprinkler head, sprinkler head to wall, etc.
21. Determine deviations from specifications and drawings and indicate on shop drawings.
22. Provide definition/description of sprinkler identification for all sprinklers.
23. Submit all fire protection drawings and calculations to the local AHJ - "Authority having jurisdiction" (ie: Fire Marshal), owners insurance company, architect and engineer. Secure approval prior to installation.
24. The contractor shall retain a professional engineer licensed in the state the project is being constructed in. NICET certification acceptable in accordance

with State requirements. Submit stamped and signed drawings and calculations for fire protection work within the project scope of work.

25. Shop drawings and hydraulic calculations shall be submitted to architect and engineer. Submitted drawings and calculations shall be stamped by a professional engineer licensed in the State of NY. Secure approval prior to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.

D. All components must be approved by Factory Mutual and comply with FM data sheets. Plans must be reviewed and approved by FM Global prior to installation.

E. All components must be UL and/or FM approved. FM approval is mandatory for this project.

F. NYC Temporary sprinkler loop: Fire protection work includes but not limited to removal of: existing sprinkler piping, heads, etc and installation of new sprinkler piping, fittings, hangers, heads, etc. As necessary to provide temporary sprinkler loop protection in accordance with NYC buildings bulletin 2017-009

2.2 STEEL PIPE AND FITTINGS

A. Schedule 10, black steel Pipe: ASTM A 135, Type E, Grade A (2 ½” – 8” NPS), UL/FM listed.

B. Schedule 40, black steel Pipe: ASTM A 53, Type E, Grade A (1”-2” NPS), UL/FM listed.

C. Schedule 40, Galvanized-Steel Pipe (drain, exterior piping, etc.): ASTM A 795, / A53 Type E, Grade A/B, hot dipped galvanized NPS 8" and smaller. UL/FM listed.

1. Products: Sprinkler piping subject to compliance with requirements, provide one of the following:

   a. Wheatland tube.
   b. Bullmoose Tube.
   c. State Pipe & Supply, Inc.
   d. Youngstown Tube.

2. Provide brass type elbows on exterior drains exiting the building, coordinate with architect.

D. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, ERW steel pipe with threaded ends.

E. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.

F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or EPDM rubber gasket.

   a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
   b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Threaded fittings:
1. Malleable Iron or Ductile Iron. Cast Iron not acceptable.

L. Grooved-Joint, Steel-Pipe Appurtenances:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Anvil International.
   b. Smith-Cooper International.

c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Pressure Rating: 300-psig minimum.
3. Galvanized Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Victaulic Firelock installation-ready fittings for 1 1/4”-2 ½”piping

M. Installation- ready fittings/grooved fittings shall not be utilized within exposed/architecturally sensitive areas without approval from architect.

N. Utilize number of flexible type couplings as required for piping to follow curvature of ceiling/catenary structural members. Coordinate with manufacturer specifications, Similar to Grinnell figure 705 Flexible Coupling.

O. Utilize flexhead fire pipe to provide for normally anticipated roof deflection. Coordinate with manufacturers requirements. Contractor to incorporate friction loss into hydraulic calculations. Similar to Anvil / Victaulic brand, UL/FM listed.

P. Install flexible connections in piping where they cross seismic joints or building expansion joints. Flexible connection shall be similar to Metraflex Metrafire Loop and coordinated with requirements of NFPA 13, 9.3.2.3 regardless of building’s seismic zone.

2.3 PIPE PAINTING

A. Paint all exposed interior piping with two coats of enamel epoxy type paint. Prep, clean and prime pipe surfaces, in accordance with paint manufacturers specifications / recommendations prior to installation and final color application.

B. Contractor shall ensure paint and primer are compatible with one another and material being painted.

C. Paint color shall match existing wall color, coordinate with the Owner’s requirements prior to installation.

D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

F. Piping and fittings exposed to corrosive and/or high humidity areas; exterior, attics, basements (i.e. greater than 50% rh) shall be galvanized schedule 40 steel (nitrogen systems shall be schedule 40 steel) with epoxy coating similar to ameron. Sprinkler heads within these areas shall also be corrosive / moisture resistant (i.e. teflon coated). Pipe hangers and components within these areas shall be hot dipped galvanized steel with epoxy coating similar to ameron.

G. Paint and primer shall meet LEED requirements for V4.1 Credit including : 75% (by vol or SA) of adhesive/sealants and/or paints/coating. Any mastics/adhesives, sealants, coatings, or insulation specified for use on the interior of the building will need to meet the VOC-content requirements AND the emissions requirements (for wet-applied products).

H. Coordinate with all FDNY and NYC Building requirements.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 300-psig.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company; FireLock® Alarm Check Valve Series 751.
   d. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application
7. Provide listed relief valve (not less than ½”) to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater. Relief valve shall be routed to main drain

G. Automatic (Ball Drip) Drain Valves:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).

b. Tyco Fire & Building Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

H. Air Venting Valves:

shall be located near a high point in the system to allow air to be removed from that portion of the system. Provide one air vent for each sprinkler control assembly.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Potter

2. UL / FM Approved
3. Furnish and install a ball valve prior to the “Y” type strainer to isolate the automatic air release valve and strainer from the system for replacement of the automatic air vent or WAGS or strainer maintenance.
4. Ball valve shall be supervised.
5. Output 1/2'" NPT
6. Provide strainer connected to air vent
7. Mount in a vertical, accessible location with 8” of clearance above the sprinkler main.
8. The output of the air vent valve shall be piped to a secondary automatic shut off valve, (WAGS). All components shall be brass.
9. The WAGS shall be factory installed in a water retention pan. In the event the primary automatic air vent fails to close and water begins to discharge, the water will flow through the WAGS and into the water retention pan. When the water level in the retention pan reaches a pre-determined level, a water soluble element in the WAGS shall dissolve and release a powerful spring loaded piston to provide a positive water shutoff. Operation of the WAGS shall activate a switch capable of being monitored by a fire alarm panel or remote indicator.
10. Provide drain pan with piping routed to sanitary. Contractor shall indicate vent location and piping path from the vent to the termination point
11. Similar to Potter Automatic air release PAAR-B

I. Universal Manifold assembly:

Out of the box unit, contains: control valve with tamper switch, flow switch, pressure gauge, pressure relief valve, test and drain assembly (with check valve as required by NFPA).

UL/FM listed

Provide custom sized cabinet, rated to wall assembly, coordinate color and door type with Architect.

Similar to:

Victaulic UM universal manifold assembly

Reliable Model FCA Floor Control Assembly

Globe, UMC Universal Manifold Check Assembly

J. All drain / test valves shall have permanent signage indicating areas served and exact location where the drains are routed to (i.e. exterior and/or mop sink etc.) in order that personnel may monitor these locations during testing and/or draining of the system.

2.5 SPRINKLER CONTROL VALVE CABINETS

A. Sized for:

1. One sprinkler control assembly.

B. Construction:

1. No. 18 USSG sheet metal box.
2. No. 16 USSG door frame with No. 20 USSG hollow metal construction door panel marked "SPRINKLER ZONE VALVE" or “SPRINKLER ZONE VALVE & FIRE DEPARTMENT VALVE” with continuous wire hinge and satin chrome plated lever latch.
3. Prime coated inside and out.
4. Cabinet rating shall be similar to wall rating

C. Solid panel door.

D. Type and size: (as noted on plans), coordinate with architect prior to installation

E. Similar to: POTTER-ROEMER, Series 1302, custom 10” deep, fire rated.

F. All sprinkler control valves shall have permanent signage indicating areas served and exact location where the drains are routed to (i.e. exterior and/or mop sink etc.) in order that personnel may monitor these locations during testing and/or draining of the system.

G. Architect to determine finish: stainless steel.

2.6 ACCESS DOORS

A. All cabinet locations shall be coordinated with Architect prior to installation

B. For rated surfaces:

1. 16 gauge steel frame, 20 gauge steel welded pan type door, 1" wide 16 gage steel door flange with continuous hinge.

2. Door shall be filled with fire rated insulation and have automatic closer, be self latching and contain interior latch release.
3. Latches shall be bolt type, operated by a ring turn.
4. Finish shall be prime coat of rust inhibitive electrostatic powder baked grey enamel.
5. Approved equal to KARP model KEP-150FR. Or approved equal.

C. For non-rated surfaces:

1. 16 gauge steel frame, 14 gauge steel door, frame flange shall be one-piece construction, 3/4" wide.Hinge shall be concealed, continuous piano type.
2. Lock shall be flush, screwdriver operated with stainless cam and studs.
3. Masonry applications shall include masonry anchor straps.
4. Base application shall be prime coat of rust inhibitive electrostatic powder baked grey enamel. Custom color finish to be determined by Architect.
5. Approved equal to KARP model DSC-214M. Or approved equal.

2.7 VALVE CABINETS (as applicable).

A. Sized for control valve to elevator sprinklers

B. Size: 18" h x 18" w x 8" d.

C. Construction:20 gauge sheetmetal box, 20 gauge tubular steel door with 20 gauge door frame and a continuous steel hinge (brass pin). Steel corner seams welded and ground smooth. All components powder-coated with an electrostatically-applied, thermally-fused, recoatable white polyester finish. With a locking door lever latch.

D. Cabinet rating shall be similar to wall rating

E. Labeling: "ELEVATOR SPRINKLER VALVE"

F. Similar to:

1. Fire rated cabinet: POTTER-ROEMER Model FRC-1810.
2. Non-rated cabinet: POTTER-ROEMER Model 1810

2.8 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Anvil International.
b. Shurjoint Piping Products.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.

4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.
9. Utilize solid back type mechanical fittings.

B. Flow Detection and Test Assemblies:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. AGF Manufacturing Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company; TestMaster™ II Alarm Test Module Style 720.
   d. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Drain termination:

1. All drain piping and fittings shall be galvanized.
2. Provide necessary piping as required to route to the exterior of building
3. Drains shall not cause damage to landscaping, the building and/or discharge onto sidewalks.
4. Provide splash blocks
5. Utilize MIFAB Series solid hinged downspout cover, custom color. Architect to determine.

F. Flexible Sprinkler Hose Fittings:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fivalco Inc.
   b. FlexHead Industries, Inc.
   c. Gateway Tubing, Inc.
   d. Victaulic Company; VicFlex™ Braided Sprinkler Fitting Assembly.

2. Standard: UL 1474. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.
5. Contractor shall confirm use of flex head type system does not cause excessive pressure losses which exceed the available water supply, otherwise utilize hard pipe method at no additional cost

2.9 SPRINKLERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Reliable Automatic Sprinkler Co., Inc. (The).
2. Tyco Fire & Building Products LP.
3. Victaulic Company; Victaulic Sprinkler Heads.
4. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
4. Temperature ratings must be in accordance with NFPA 13, owner's insurance carrier and AHJ's requirements. Contractor must coordinate with maximum ceiling temperatures (as outlined in NFPA 13). Provide intermediate and high temperature heads as required / applicable (i.e. skylights, attics, mechanical rooms, etc.).

G. Sprinkler Finishes: Refer to schedule on drawings.

H. Special Coatings: corrosion-resistant paint.

I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

J. Sprinkler Guards:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.
4. Provide on all exposed sprinklers subject to mechanical damage and/or <7'-6"AFF.

K. Water Shields: Provide listed water shields on all sprinklers below open grading.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Notifier.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum- diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application
7. Coordinate operating voltage with Division 26.

C. Water-Flow Indicators:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ADT Security Services, Inc.
   b. Potter Electric Signal Company, LLC.
   c. System Sensor.
   d. Viking Corporation.
   e. Watts; a Watts Water Technologies company.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Potter Electric Signal Company, LLC.
   b. System Sensor.
   c. Tyco Fire & Building Products LP.
   d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Kennedy Valve Company; a division of McWane, Inc.
   c. Potter Electric Signal Company, LLC.
   d. System Sensor.Standard: UL 346.

2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. All tamper switches shall be wired to buildings fire alarm panel (when a building's fire alarm system exists). Provide all wiring, conduit, etc. as required.

2.11 PRESSURE GAGES

A. Products: Subject to compliance with requirements, provide one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Where conflicts occur between drawings and specifications, or within either document, the Contractor shall ask for and obtain a written clarification from the Engineer prior to submitting his bid. Otherwise, the items or arrangements of superior quality, greater quantity or higher cost shall prevail and be included in the contract price.

B. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

C. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. All lower level sca's shall have a valved threaded capped outlet for draining system and a valved outlet with drain routed to exterior for testing system.

J. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

K. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

L. Install alarm devices in piping systems.

M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.5 SPRINKLER INSTALLATION

A. Sprinkler head finishes shall be coordinated and approved by Architect prior to installation

B. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

C. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

D. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid (when applicable)

E. All piping and sprinklers shall be of the concealed type in areas where ceilings exist. Exposed piping and sprinklers shall be installed in areas without ceilings. All fire protection work shall be coordinated with other trades including the buildings architectural features (lights, diffusers, etc.).

F. Do not run exposed piping in front of windows and skylights. Keep all piping as high as possible. Coordinate all piping with other trades. Concealed piping should be elevated +/- 6" above the ceiling. Coordinate all piping with lights and diffusers. The ceiling construction consists of a rated assembly and therefore all sprinkler piping shall meet the requirements of NFPA, to ensure continuous rating

G. Clearance from electrical equipment

1. In accordance with NFPA 70 and only allowed above the dedicated space or working space.
2. Piping (except for piping directly supplying sprinklers for such rooms):

    a. Prohibited, except as noted, in:

        1) Electric Rooms and Closets.
        2) Telephone Equipment Rooms and Closets.
        3) Elevator Machine Rooms.
        4) Data Rooms, IDF/MDF Closets (attempt not to route piping directly above any/all data racks).

    b. Limit couplings / fittings within these rooms
    c. Prohibited, except as noted, over or within 5 feet of:

        1) Transformers.
        2) Substations.
        3) Switchboards.
        4) Motor control centers.
        5) Standby power plant.
        6) Bus ducts.

    d. When over or within 5 feet unavoidable, provide custom painted drip pans under piping over electrical equipment.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and as specified in Section 210553.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.10 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Refer to schedule on drawings.

3.11 SPRINKLER SCHEDULE

A. Refer to schedule on drawings

END OF SECTION 21 13 13

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL

A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein, and/or as required by job conditions.

B. Drawings are diagrammatic and indicate a general arrangement of work. General design concepts indicated must be followed or bettered. The bid shall include offsets, additional piping, valves and plumbing equipment and components as required to meet construction conditions for proper operation. Do not scale drawings. Consult Architectural and Structural drawings for space conditions and additional fixtures. Develop and submit coordination drawings as outlined in Division 22 sections.

C. The work under this Section shall include all incidentals, labor, material, equipment, appliances, services, hoisting, scaffolding, supports, tools, consumable items, fees, licenses, and administrative tasks required to complete and make operable the plumbing work as intended.

D. The Contractor shall furnish and install all equipment as necessary to provide a complete installation including coordination, system check out and start up on each item and system.

E. This Contractor shall inform himself from the general construction specifications and plans, of the exact dimension of finished work and of the height of finished ceilings in all rooms where equipment or pipes are to be placed and arrange his work in accordance with the schedule of interior finishes, as indicated on the architectural drawings.

F. Manufacturer's qualifications: firms regularly engaged in the manufacturer of fixtures, appliances, pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

G. Material qualifications: shall conform to all local, state, and national/federal codes and regulations which may apply and nothing in these specifications shall be interpreted as an infringement of such codes or regulations.

H. Welding: qualify welding procedures, welders, and operators in accordance with ASME B31.1, or ASME B31.9, as applicable. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

I. Brazing: certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.2 LEAD-FREE STATEMENT

A. Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The contractor shall be responsible for providing products that are Lead-Free products and meet the requirements of Safe Drinking Water Act Section 1417 (e) (Section 9 of NSF/ANSI Standard 61) and authorities having jurisdiction.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.5 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 INTENT

A. It is the intention of the specifications and drawings to provide for finished work, tested and ready for operation.

B. Items and services not shown on drawings, but mentioned in specifications, or vice versa, or items and services necessary to render the work complete and ready for operation, even if not specified, shall be provided without additional cost.

C. Where conflicts occur between drawings and specifications, or within either document, the Contractor shall ask for and obtain a written clarification from the Architect prior to submitting his bid. Otherwise, the items or arrangements of superior quality, greater quantity or higher cost shall prevail and be included in the contract price.

1.8 WORK INCLUDED

A. The work under this Division shall include all labor, material, equipment plant, services and administrative tasks required to complete and make operable the mechanical work shown on the Drawings, required for proper operation and/or specified herein, including but not limited to, the following:

1. Preparation and submission of shop drawings, diagrams and illustrations.
2. Procuring all necessary permits and approvals, and paying all required fees and charges in connection with the work of this Division.
3. Protection, testing, cleaning, adjustment and guarantee of the work of this Division to safely, properly and continuously operate.

4. As-built drawings, operating and maintenance instructions and manuals.
5. Identification labels, tags, charts and diagrams.
6. Maintain existing services to plumbing, etc. (temporary services during construction).
7. Coordination.
8. Project record documents.
9. Cutting and patching.
10. Cooperation with and full participation in the commissioning process.

1.9 WORK NOT INCLUDED

A. Finish patching of all construction cut under this Division.

B. Waterproofing of roof penetrations for the work of this Division.

C. Concrete and masonry work except as specified.

D. Painting, except as noted.

E. Removal, patching, or otherwise handling of hazardous materials.

1.10 GENERAL CONFORMANCE

A. Obtain all general conformances in accordance with Division 1 - General Requirements.

B. Submit to the Architect for review a list of manufacturers of equipment proposed for the work. Intent to use exact make specified does not relieve the Contractor of responsibility for submitting the required list.

C. Where any specific materials, process or method of construction, or manufactured article is specified by name or by reference to catalog number of a manufacturer, or other standards, the intent is not to take precedence over the basic duty and performance specified, noted on drawings, or as required for intended results. In all cases, verify the duty specified with the specific characteristics of the equipment offered for review.

D. Equipment of one type, shall be products of one manufacturer.

E. Private Label products, equipment and appurtenances shall not be permitted on this project.

1.11 PERMITS AND CERTIFICATES

A. Prior to proceeding with any installation, prepare and submit to the proper authorities, for their review, all required working drawings. Provide all necessary notices, obtain all permits and pay all local, state and federal taxes, fees and other costs in connection

with the work.

B. The contractor shall be responsible for performing all controlled inspections required by applicable Administrative building Code.

1.12 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work required. Do not scale the Drawings. Consult the architectural drawings and details, and the drawings of other trades, for exact location of equipment.

B. Drawings shall be used in layout of work. Check reference drawings to verify spaces in which the work will be installed. Maintain maximum headroom and space conditions. Where headroom or space conditions appear inadequate, Architect shall be notified before proceeding with installation.

C. If directed by the Architect, make minor modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

D. The drawings are schematic and diagrammatic.

1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but not necessarily have dimensional significance, neither do they necessarily delineate all related and subsidiary parts and equipment.
2. The work shall be installed complete and ready for operation in conformity with the intent expressed on the drawings and in the specifications.
3. Coordinate the work with the requirements of the architectural and structural drawings for dimensions, locations and clearances.
4. Locations of items exposed to view shall be taken from the architectural drawings or located as directed.

1.13 EQUIPMENT DEVIATIONS

A. It is the intent of these specifications that wherever a manufacturer of a product or a catalog number is specified, and terms "or equal" or "or approved equal" are used, the substituted item must conform in all essential respects to the specified item including operating efficiency, noise generated, and method of operation. Consideration will not be given claims that the substituted item meets performance requirements with lesser construction. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

B. When such approved deviation requires a different quantity and or arrangement of equipment from that specified or indicated on the drawings, provide required equipment, wiring, piping, connections, valves, and structural supports, and any other additional equipment required by the deviation, at no additional cost to the Owner.

C. When an item of equipment is proposed, other than that detailed or specified on the drawings, which requires any additional equipment or redesign of the structure,

partitions, foundations, piping, wiring or any other part of the mechanical, electrical, plumbing or architectural design, such costs shall be incurred by the Contractor without cost to the Owner.

D. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no cost to the Owner. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.14 EQUIPMENT AND SYSTEMS CRITERIA

A. The criteria of design and performance to produce the required operation is based on equipment shown or scheduled.

1. The equipment must conform to the structural design provisions for loads applied to the structure, to the dimensions established by drawings for mechanical spaces and other clearances, and for inlet and outlet locations and proper relationship to associated equipment and piping.

B. The descriptions cover basic equipment and operation but not all the details of design and construction.

1. The use of singular in descriptions does not limit the quantities of items to be furnished to provide the operation specified. Furnish all equipment required to produce specified performance under installed conditions.
2. Factory wiring, interconnections, piping and connections shall conform to these specifications for the field work.
3. Provide all trim, enclosures and accessories required to make a complete installation.

1.15 SUBMITTALS

A. Procedure: Prepare and make the submissions listed below and in Division 1.

B. Shop Drawings: Submit shop drawings of all items proposed to be furnished and installed under this Division.

C. Manufacturer's Drawings.

1. Equipment listed in each section, include material specifications, operating characteristics and finishes.

D. Installation Drawings.

1. Coordinated scale drawings of equipment including interconnecting piping and equipment.
2. Coordinate space requirements for equipment and services.

3. Include connections, anchorages and fastenings.
4. Make allowance for clearances for access to and maintenance of equipment.

E. Wiring and Control Diagrams.

1. Electric wiring diagrams and automatic control diagrams and sequences of operation. The wiring diagrams must be complete and coordinated with the equipment actually installed.

F. Provide composite shop drawings showing work of all related construction, when required to ensure full coordination and proper fitting of the work, and when directed by the Architect.

G. Provide drawings showing dimensions and locations of concrete work required.

H. Samples.

1. Color samples for prefinished items.

I. Reports:

1. Manufacturer's certified pressure tests on vessels.
2. Manufacturer's certified performance tests on operating equipment.
3. Field pipe testing reports and certificates of approval.
4. Welder's certificates and field test report.
5. Field operating test results for operating equipment.
6. Performance report on balancing of systems.
7. Performance report and calculations for vibration isolation equipment.
8. Manufacturer's certified reports on motorized equipment alignment and installation.

J. If submissions of catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or variations, those features proposed shall be clearly identified.

1. If any variations from the catalog description are proposed or required, such variations must be clearly noted on the cut.
2. Shop drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work.
3. Shop drawings shall be numbered consecutively, and drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that units may be checked individually and as an assembly.
4. Keep on the site, in good order, a complete up-to-date set of approved shop drawings. All shop drawings shall be available for inspection by the Architect.
5. On product data submittals, clearly indicate model numbers, dimensions, weights, electrical requirements, accessories and performance data. Submittals not properly prepared will be rejected without further review.

6. The review of shop drawings will be general, and shall not be construed as permitting any departure from the contract requirements other than those specifically brought to the Architect's attention and so approved.

    a. If the shop drawings show any variations from contract requirements because of standard shop practices or reasons, such variations shall be clearly identified on the drawings in order that, if acceptable, suitable action may be taken for proper adjustment in other work affected thereby.
    b. Failure to identify such variations will not relieve the Contractor of responsibility for executing the work in accordance with the Contract even though such shop drawings have been reviewed and the work installed.
    c. Review shall not relieve the Contractor of responsibility for any error in details, dimensions, etc., that may exist on shop drawings nor for the furnishing of materials or work required by the Contract and not indicated on the shop drawings.
    d. Review shall not be construed as acceptable departure from details or instructions previously furnished by the Architect.
    e. Review with a requirement for resubmission is a review contingent upon satisfactory resubmission within 30 days. Failure to comply shall result in a revocation of the contingent review.

K. Shop Drawing Schedule

1. The Contractor shall submit, within 30 days of the award of his contract, a schedule of all proposed shop drawing submissions.

2. The schedule shall include the following information.

    a. Item to be submitted
    b. Date of submission
    c. Latest date for review
    d. Manufacturers of the specified item.

3. Items not specifically listed as "approved equal" should be listed for consideration at this time.

4. Shop drawings require a minimum of 10 business days from the date they have been received by the Consulting Engineer’s office to adequately review the submittal. If there is any submittal which requires to be expedited sooner than the 10 business days, the Engineer shall be informed in writing at the beginning of construction with a list of those submittals.

L. Submittals will be reviewed for conformance with the contract drawings and specifications. The engineer's review stamp will be affixed to submittals. One of the following actions will be taken:

1. Reviewed:

    a. No comments, corrections, or marks have been made to the submittal. Re-review by the engineer is not required. The submittal is in general

conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the work shall be in accordance with the requirements of the Contract Documents. Final acceptance of the work shall be contingent upon such compliance.

2. Furnish As Corrected

   a. Comments, corrections, or marks made. Re-review is not required. Submission is in general conformance with the design concept subject to notations on the returned Submittal. Construction, fabrication, and/or manufacturer can proceed subject to the provisions that the work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Submittal and in accordance with the Contract Documents. Final acceptance of the work shall be contingent on such compliance.

3. Revise and Resubmit

   a. Significant issues/discrepancies/incomplete information was provided in the Submittal. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

4. Rejected

   a. Submittal does not meet Contract document intent. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

M. A submittal review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from Compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. The contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of his or her work with that of all other trades; and for performing all work in a safe and satisfactory manner.

1.16 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.17 COORDINATION WITH OTHER TRADES

A. Closely schedule the work so that work will be installed at the proper time without delaying the completion of the entire project.

B. Where the work will be installed in close proximity to the work of other trades, or where there is evidence that the work will interfere with the work of other trades, arrange space conditions to make a satisfactory adjustment. If work is installed before coordinating with other trades, make necessary changes to the work to correct the condition without additional cost to the owner.

C. Prepare complete set of drawings showing all necessary slab openings and structural supports that require structural framing. Drawings shall clearly indicate sizes and location relative to established column lines. Drawings shall be completed in sufficient time to allow for structural steel fabrication so as not to delay project schedule.

D. Shop drawing submissions shall demonstrate a knowledge of the work of other trades, and shall show the locations of the work of other trades which affects the work of this contract.

1.18 COORDINATION DRAWINGS

A. Develop and submit coordination drawings as outlined.

B. Sheet metal, plumbing and fire protection shop drawings that have been coordinated with architectural and structural drawings shall be submitted to engineer for review. Drawings must be returned from engineer either "reviewed" or "furnish as corrected" prior to being used as basis for coordination drawings.

C. After sheet metal and piping drawings have been revised per engineers comments, reproducible copies shall be sent to the others trades in the following sequence for the inclusion of their work:

1. Mechanical sheet metal
2. Plumbing contractor
3. Electrical work
4. Mechanical piping
5. Sprinkler piping

D. After all trades have included their work on the coordination drawing and noted conflicts, all trades shall meet to resolve conflicts and agree to acceptable solutions. Each trade shall sign coordination drawings. Items not shown on coordination drawing is responsibility of omitting contractor and contractor is subject to additional costs incurred by other trades.

E. The architect and engineer are not part of the coordination drawing process. The engineer will provide assistance for noted conflicts only. Coordination drawings are not to be considered piping or duct shop drawings. The contractor is required to submit

individual piping and ductwork shop drawings for review by the engineer. Piping and ductwork shop drawings shall follow the design intent of the contract documents.

F. Submit final signed coordination drawing to engineer for review. Engineer will review coordination drawings for general arrangement and for noted conflicts only. Specific installation requirements will be reviewed only in individual trade shop drawings.

G. Any work fabricated or installed prior to sign off by all trades which is deemed to be in conflict with coordination drawings shall be removed and re-installed in conformance with coordination drawings.

H. Each contractor (mentioned above) is responsible for the coordination of his sub-contractors.

I. The overall coordination of the coordination process is the responsibility of the contractor. The engineer is not responsible for the coordination process. The engineer will respond to questions that arise from the coordination process. Drawings submitted will be reviewed for clearly identified conflicts only. Solutions to conflicts will not bear additional cost.

J. Drawings shall be submitted in both hard copy and electronic (AutoCAD or Revit version as required by the Owner) version or AutoCAD Version 2010 if not specified. Number of copies of each as requested by the Owner.

K. Electronic drawing files shall be generated by the Contractor. If requested, electronic files of the mechanical floor plans, sections and elevations only will be made available. Electronic files will be released only upon receipt of the signed Agreement for Transfer of Electronic File Data, Agreement for Transfer of Building Information Model and all fees indicated therein.

1.19 AS-BUILT/RECORD DRAWINGS

A. Provide a complete set of as-built drawings reflecting as installed conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the engineer’s comments to produce a clear and concise set of drawings.

B. Provide "as-built drawings" indicating in a neat and accurate manner a complete record of all revisions of the original design of the work.

1. Drawings shall be submitted in both hard copy and electronic (AutoCAD and Revit version as required by the Owner) version or AutoCAD Version 2010 if not specified. Number of copies of each as requested by the Owner. PDF’s inserted into an AutoCad file are not acceptable.

2. Indicate the following installed conditions:

    a. Include all changes and an accurate record, on reproductions of the contract drawings or appropriate shop drawings, of all deviations, between the work shown and work installed.
    b. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart.
    c. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
    d. Approved substitutions, contract modifications, and actual equipment and materials installed.
    e. Contract modifications, actual equipment and materials installed.
    f. Submit for review bound sets of the required drawings, manuals and operating instructions.
    g. Submit a complete maintenance manual of all equipment installed under this contract.

1.20 GUARANTEES AND SERVICES

A. All workmanship, installation materials and equipment shall be maintained and serviced for the guarantee period at no additional cost to the Owner.

B. Leave entire system installed under this Contract in perfect working order, and, without additional charge, replace any work or material which develops defects within the guarantee period, including all other work damaged as a result of such defects.

C. Manufacturers' Warranties

1. The manufacturer shall warrant that the equipment which he has furnished is free from defects in material and workmanship. Obligations under this warranty shall be as follows:

    a. The equipment manufacturer or supplier shall provide and pay for all labor, parts, accessories, materials, freight and other services to repair or replace any equipment or part thereof which, in the course of installation, start-up and testing is found to be defective.
    b. For a period of **eighteen months** from the date of acceptance by the Owner, the manufacturer shall replace any defective equipment or part thereof; freight costs for return of defective parts, labor for parts replacement, and replacement of lost refrigerant, are the responsibility of the installing contractor.
    c. The manufacturer shall provide an additional warranty on all equipment as indicated in their respective specification section.
    d. Performance - where equipment is specified by size, guarantee that it will have the capacity specified in the system in which it is installed.

2. The final acceptance of the equipment will be made after the manufacturer has adjusted his equipment, balanced the various systems, demonstrated that it

fulfills the requirements of the drawings and specifications, and has furnished all the required certificates of inspection and acceptance.

1.21 SYSTEM MAINTENANCE

A. Contractor shall provide routine and preventive maintenance during the warranty period.

B. Contractor shall submit to Engineer for review a comprehensive plan covering items to be maintained and service to be performed. Plan shall include checklist for use by maintenance personnel.

C. Owner's representative(s) shall accompany contractors' maintenance personnel, and receive instructions on proper maintenance of equipment.

D. Maintenance performed shall include a complete check out of each piece of equipment at least twice during warranty period. The first shall occur approximately half way through the warranty period (change of season) and the second at the conclusion of the warranty period and prior to commencement of the owner's maintenance. Each system and/or piece of equipment shall be inspected, operated through its complete range of operation, and adjusted as required. This inspection shall be the same as performed at the initial start-up of the item or system. In addition, there shall be monthly maintenance inspections of each piece of equipment.

E. During the monthly inspections, equipment shall be checked for items such as dirty filters, belt wear, lubrication, unusual sounds or unusual operating conditions. Monthly inspections shall also include recording of system operating temperatures and pressures.

F. Contractor shall include all labor and material to perform the maintenance, including replaceable items such as filters and belts.

G. Maintenance on the following items shall be included:

1. Water Heaters
2. Thermostatic Mixing valves
3. Backflow preventers
4. Valves
5. Electronic Flush Valves
6. Electronic Faucets

1.22 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish manufacturers operating and maintenance instructions, parts lists and sources of supply for replacements in accordance with Division 1 - General Requirements.

B. Provide the following:

1. Complete sets of final and correct shop drawings, maintenance and replacement parts manuals, and operating instructions, for equipment supplied.
2. Bind each set within a common binder. Index and organize with a table of contents, to permit quick and convenient reference.
3. Three days of instruction in operation and maintenance of equipment to Owner's maintenance force. Design a 2-week period, convenient to Owner, during which qualified personnel, including manufacturers' technicians and engineers will be available for Owner's instruction.

C. Master Operating Manual (submit in quadruplicate)

1. Complete sets of final and correct shop drawings, maintenance and replacement parts manuals, and operating instructions, for equipment supplied.
2. Manufacturer's mechanical and electrical equipment parts lists of all components of the systems listed on the equipment schedules, control diagrams and wiring diagrams of controllers.

    a. List shall give system number, unit number, manufacturer's model number, and manufacturer's drawing numbers.

3. Step by step operating instructions for each system including preparation for starting, summer operation, winter operation, shutdown and draining.
4. Maintenance instructions for each type of equipment.
5. List of nearest local suppliers for all equipment.
6. Manufacturer's literature describing each piece of equipment listed on the equipment schedules, control diagrams and wiring diagrams of controllers and a copy of the air balance report.

7. As-installed control diagrams by the control manufacturer.
8. Description of sequence operation by the control manufacturer.
9. Recommended trouble shooting procedures in the event of foreseeable mechanical system failure.
10. Chart of the tag numbers, location and function of each valve.
11. Copies of the following test reports:

    a. Water Balance.
    b. System Performance.
    c. Required Pressure Tests.
    d. Water Flow Tests.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Equipment to Be Removed: Disconnect and cap services and remove equipment.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.7 COORDINATION AND LAYOUT

A. Study Drawings and Specifications to insure completeness of work required.

1. Include supplementary items normal to manufacturers' requirements or standard accepted trade practices as necessary to complete work, though not specifically indicated or specified.

B. Verify measurements and conditions in field before starting work.

C. Examine materials to which work is to be applied and notify the Architect, in writing, of any conditions existing, which are detrimental to proper and expeditious installation of work.

1. Starting of work shall be construed as acceptance of conditions.

D. Confer with other trades, install work to avoid interference with other trades, and possible necessary adjustments to conform to structural conditions and work of other trades.

E. Coordinate and set inserts and locate openings in floors and walls in new construction.

1. Locate pipes to avoid interference with other work shown on the drawings and as directed by the Architect.
2. Keep all concealed pipes within the enclosing construction provided.
3. Arrange exposed work neatly in parallel runs and parallel with walls or structure, with uniformly spaced hangers and supports, and within the spaces assigned for each kind of work.

F. Make coordinated layouts showing concrete work required for housekeeping pads, equipment bases and inertia masses, which are cast in place, including the location of anchors and dowels.

1. Coordinate the scheduling and placing of the concrete to suit the mechanical work schedules.
2. Concrete housekeeping pads are to cover the full area of each piece of equipment.
3. Concrete bases are to be of dimension and heights to suit the equipment.

4. The forming and placing of concrete will be provided under this specification section.

3.8 MAINTENANCE OF EQUIPMENT AND SYSTEM PRIOR TO FINAL ACCEPTANCE

A. Maintain all equipment and systems installed until final acceptance by the Architect and the Owner, and take such measures as necessary to insure adequate protection of all equipment and materials during delivery, storage, installation and shut-down conditions.

1. This responsibility shall include all provisions required to meet the conditions incidental to the delays pending final test of systems and equipment.

B. After installation of systems has been completed, operate the system to determine the capability of the equipment and controls to conform to the requirements of the drawings and specifications prior to performance testing.

3.9 EQUIPMENT INSTALLATION

A. Locate and set equipment anchor bolts, dowels and aligning devices for all equipment requiring them. Refer to concrete work coordination.

1. Level the equipment and grout solid between the equipment and the surface below. Grout to be premixed Embeco or Five Star Grout mixed in accordance with manufacturer's specifications.

B. The field assembly, installation and alignment of equipment is to be done under field supervision provided by the manufacturer or with inspections, adjustments and reviewed by the manufacturer.

C. Equipment startup.

1. Each manufacturer of equipment shall provide qualified personnel to inspect, review and to supervise the operating tests of the equipment.

D. Equipment and system test operation.

1. Notify the Architect in advance of beginning the equipment and system test operation.
2. Each piece of equipment shall be operated in its system as long as required to provide proper functioning.
3. Perform an operating test of each complete system for twenty-four hours continuous operation as a minimum, or as long as required to provide coordination and proper functioning of all related systems and controls.
4. The operating criteria for each test shall be determined in advance with the Architect's acceptance whenever seasonal conditions will not produce a full design load on any equipment or system.
5. Certify to the Owner that all equipment is functioning properly.

6. Should the apparatus fail to meet the contract requirements, adjust, repair or replace all defective or inoperative parts and again conduct the complete performance tests.

3.10 CLEANING AND ADJUSTING

A. Blow out, clean and flush each system of piping, and equipment as required to thoroughly clean the systems.

1. Clean all materials and equipment, and leave in condition ready to operate and receive succeeding finishes where required.
2. Adjust and align all equipment interconnected with couplings or belts.
3. Adjust valves of all types and operating equipment of all types to provide proper operation.
4. Clean all strainers.

B. Lubricate equipment as recommended by the manufacturer, during temporary construction use, and provide complete lubrication just prior to acceptance.

C. Permanent equipment operated during construction shall not be abused or be used in service different from its design application.

D. Equipment furnished with factory finishes shall be retouched and repainted as required to present a new appearance.

E. Provide and maintain protection for all of the work whether completed or in progress.

1. Provide coverings and enclosures as required.

F. New and existing operating equipment and systems shall be clean and dust free inside and out.

1. Concealed and unoccupied areas such as plenums, pipe and duct spaces and Equipment Rooms shall be free of rubbish and swept clean at time of acceptance.

3.11 TESTING AND BALANCING

A. Tests shall be performed in accordance with Division 1 - General Requirements, and the following.

B. Provide the services of an independent water balancing and testing firm which specializes in balancing and testing of plumbing systems, and which is acceptable to the Owner.

1. All instruments used shall be accurately calibrated and maintained in good working order. If requested, the balancing shall be conducted in the presence of the Architect/Owner.

C. Balancing shall not begin until the system has been completed and is in full working order.

1. After completion of the balancing and testing submit copies of the results to the Architect.

D. Perform tests and make necessary adjustments to obtain the flow and distribution of water required to produce the operating criteria called for by the contract documents, in accordance with the latest standards of the National Environmental Balancing Bureau and the Associated Air Balance Council.

1. Mark final position of balancing valves.

E. Upon completion of the installation, test and balance all equipment and systems under field operating conditions to demonstrate its compliance with specification requirements.

1. Submit three copies of the test report to the Architect. Refer to specification sections for details of report requirements.

F. Should any part of the system fail to meet the contract requirements, adjust, repair or replace all defective or inoperative parts again conduct the complete performance tests.

G. The Architect and Owner shall be notified, in writing, at least 48 hours prior to scheduled test dates.

3.12 CONNECTIONS TO EQUIPMENT

A. Provide mechanical connections to equipment and fixtures requiring such connections which are supplied by Owner or under other divisions.

B. Provide unions, nipples, adapters, valves, flexible connections, and other trim required for final connections for each such fixture or item of equipment, as required for complete and perfect operation.

3.13 WORKMANSHIP

A. Perform all work in a practical, neat and workmanlike manner with mechanics skilled in work, and using the best practices of the trade involved.

B. No work shall be concealed until it has been inspected and approved by the Architect.

C. Workmanship or materials not meeting with requirements of the specifications and drawings and satisfaction of the Architect shall be rejected and immediately replaced in an acceptable manner, without additional cost to the Owner.

3.14 LUBRICATION

A. All equipment furnished, installed or connected under this division, shall be inspected for proper lubrication when connected and before operation of the equipment is begun.

B. The Contractor for the work of this division will be held responsible for any damage to equipment that is operated without having been properly lubricated.

3.15 REMOVALS AND RELOCATIONS

A. All components of abandoned systems and abandoned portions of systems shall be removed, and, unless specifically noted to be relocated and reused, become the Owner's property. Contractor shall dispose of removed materials as directed by the Owner.

B. Where portions of systems noted for removal remain in use, permanently seal the point of disconnection so as not to interfere with the system operation.

C. Where interferences between the existing system components and new work require relocation of the existing components to clear that interference, they may be reused, except where specifically noted to the contrary, providing that their condition is noted by the Owner's representative and they are approved by him as equivalent to new.

D. Where existing system components are required to be replaced, all new components shall be provided.

E. System components include all accessories, cables, controls, conduits, hangers, bases and supports and outlets.

F. The work specified under this contract specifically excludes the removal or patching of "hazardous materials." This includes but is not limited to asbestos, PCBs or any other material having been designated by the Environmental Protection Agency as a hazardous material. If this contractor finds anything, which is suspected of being a hazardous material, it should be immediately brought to the Owner's attention.

3.16 USE OF PREMISES AND CLEANING

A. Remove and dispose of all waste materials and rubbish due to all construction operations under the contract, except as otherwise noted, and keep the building free from rubbish and dirt caused by his and/or his subcontractors' employees.

   1. During the entire progress of the work, rubbish removal shall be made frequently so as to prevent any potential safety or health hazard.

B. Upon completion of the work, remove all protection, paint, putty, and other stains from all fixtures and glass and leave the premises thoroughly broom cleaned.

3.17 CUTTING, ALTERING AND PATCHING

A. Provide all cutting, chasing, drilling, altering and rough patching required for the work of this division.

1. Including the restoring of existing work cut for or damaged by installation of new work, and where present work is removed.
2. All materials and workmanship required in connection with cutting, altering and rough patching shall match the existing work in every respect.

B. Do all shoring, bracing, cutting, patching, piecing out, filling in, repairing and refinishing of all present work as made necessary by the alteration and the installation of new work.

C. All holes and openings occurring in the existing floors after equipment, partitions, floors, steel work, conduits and pipes are removed or installed shall be closed up with materials similar to the adjacent work.

D. The size and location of items requiring an opening, chase or other provisions to receive it shall be given by the trade requiring same in ample time to avoid undue cutting of any new work to be installed. These provisions shall not relieve the Contractor from keeping informed as to the required opening, chases, etc., nor from responsibility for the correctness thereof, nor for cutting and repairing after the new work is in place.

E. Include all cutting, repairing and patching in connection with the work that may be required to make the several parts come together properly and fit it to receive or be received by the work of other trades, as shown on the drawings and/or specified, or reasonably implied by the drawings and specifications.

F. All repairing, patching, piecing-out, filling-in, restoring and refinishing shall be neatly done by mechanics skilled in their trade to leave same in condition satisfactory to the Owner.

G. Materials and their methods of application for patching shall comply with applicable requirements of the specifications.

1. Materials and workmanship not covered by the specifications and items of work exposed to view adjoining existing work to remain shall conform to similar materials and workmanship existing in or adjacent to the spaces to be altered.

H. Cutting, repairing and patching shall include all items shown on the drawings, specified in the specifications or required by the installation of new work or the removal of existing work.

I. Remove partitions, walls, suspended ceilings, etc., as necessary to perform the required alterations or new construction work.

1. Avoid damage to construction and finishes that are to remain.

J. Protect and be responsible for the existing building, facilities and improvements.

1. Any disturbance or damage to the work, the existing building, and improvements, or any impairments of facilities resulting from the construction operations, shall be promptly rectified, with the disturbed, damaged, or impaired work, restored, repaired or replaced at no extra cost.

K. All alterations which are not indicated on the drawings nor specified herein but necessary to make good existing work disturbed by reason of the work shall be restored to a condition satisfactory to the Owner.

L. All holes in masonry floors and walls are to be core drilled.

M. Disturbed concrete and /or cement floor areas shall be patched with approved type latex mortar.

1. When cement mortar is used for patching, the surfaces shall be depressed a minimum depth of 1".

N. Reinstall all weather protection work in waterproof manner.

O. Openings in roofs.

1. Openings in roofs shall be kept properly plugged and caulked at all times, except when being worked on, to preclude the possibility of flooding due to storms or other causes. After completion of work, openings shall be permanently sealed.

P. Temporary openings.

1. All temporary openings cut in walls, floors or ceilings for pipe or ductwork shall be closed off with transite or an equally non-combustible material except when mechanics are actually working at the particular opening.

3.18 SPECIAL WORKSMANSHIP REQUIREMENTS FOR ARCHITECTURALLY EXPOSED SYSTEMS

A. General: In addition to basic project workmanship requirements specified above, a higher degree of care in systems layout and routing shall be exerted in selected areas, as follows:

1. Architectural Exposures: Note that this project includes locations where systems will be partially or fully exposed to view in finished architectural spaces due either to the intentional omission of ceilings, and/or to the intentional holding back of ceiling edges from walls, for architectural effects. These areas shall receive extra effort and care above and beyond basic project workmanship principles.

B. Special Workmanship Requirements: In these special areas, comply with the following requirements:

1. Run systems tight to overhead structure whenever possible.
2. In spaces with gaps between ceiling edges and walls, do not run systems down near ceilings. Locate them as high above as feasible.
3. Do not cross under framing members within view of such gaps. Seek alternative routes around or through obstacles.
4. Fasten systems sufficiently often to prevent their visually sagging or drooping between support points.
5. Route systems parallel to walls, framing members, and other elements defining spatial geometries.
6. Change directions orthogonally.
7. Do not run diagonally when traversing horizontal or vertical surfaces.

C. Rejection of Work: Workmanship and/or materials not complying with the above additional requirements in these special areas to the satisfaction of the Architect shall be rejected and shall be immediately replaced in an acceptable manner without additional cost.

3.19 SHUTDOWN OF EXISTING BUILDING SYSTEMS

A. Do not interrupt existing services or systems in the building unless absolutely necessary. Such interruptions and interferences must be made as brief as possible and only after coordination with the Owner. The Owner requires a minimum of seven (7) days notice. Obtain prior permission, in writing.

B. Where the work makes temporary interruptions unavoidable, they shall be made during off hours. "Off hours" shall be dictated by the Owner.

3.1 Arrange to work continuously, including overtime, if required, to assure that systems will shut down only during the time actually required to make the necessary connections to existing work.

3.2 DEMONSTRATION AND TRAINING

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain all new equipment. Refer to Division 1 Section "Demonstration and Training."

C. The contractor and subcontractors shall be responsible for coordinating, scheduling and completing operations and maintenance training for the Owners designated personnel on all systems and equipment.

D. All training materials (agenda, hand-outs, etc.) shall be submitted to the Owner for review and approval at least two weeks in advance of scheduled training.

E. Equipment training shall be provided by a factory authorized technical representatives, experienced in training, operation and maintenance procedures for installed systems, subsystems and equipment.

F. All qualifications and certifications of the individual performing the training shall be submitted to the Owner for review and approval at least two weeks in advance of scheduled training.

G. Each Subcontractor responsible for training will submit a written training plan to the Owner for review and approval at least two weeks in advance of scheduled training. The plan will include field orientation during installation, classroom instruction and field training after the completion of installation.

H. For all major automated electrically controlled systems and equipment, the contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others in addition to formal training on workstation operation, graphics, etc.

I. Provisions shall be included to provide formal classroom training to representatives of the Owner's personnel for select systems and equipment above and beyond typical preventative maintenance training (e.g. manufacturer provided training school, etc.). Coordinate requirements with the owner.

J. Provisions shall be included to provide professional videotaping of classroom training. For systems not being commissioned, the CM will carry the responsibility of hiring the Cx Videographer. The duration and intensity of the videotaping is to be specified at the discretion of the Owner.

K. Training Requirements Outline:

1. General familiarization and operating procedures for each of the building's system installations.
2. Routine maintenance procedures for equipment.
3. Specific operating and maintenance procedures for:

    a. Plumbing systems

4. Maintenance Procedures: Include manufacturer's written recommendations and the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Schedule for routine cleaning and maintenance.
    e. Repair instructions.

5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
6. Quantity of training: The maintenance personnel shall be trained on the various building systems in sessions of not less than 40 hours of training time. The

training shall be of a sufficient extent to allow the trained staff, to train their peers and to demonstrate the training sessions were effective. Training time shall be provided based on the systems identified as follows:

a. Plumbing systems 4 hrs

7. Video Documentation: The contractor(s) shall provide for the services of a qualified videographer to digitally record the training sessions.

END OF SECTION 22 05 00

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.
3. Silicone sealants.

B. Related Requirements:

1. Division 07 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends. Applications in new, poured concrete shall be furnished with an integral waterstop collar unless otherwise indicated.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot dipped galvanized, with plain ends Applications in new, poured concrete shall be furnished with an integral waterstop collar unless otherwise indicated.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in concrete floors, concrete roof slabs, and concrete/masonary walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized steel pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized steel pipe sleeves.

2. Interior Masonry and Concrete Walls:

    a. Piping Smaller Than NPS 6: Galvanized steel pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

3. Pipe Penetrations Through Fire Rated Assemblies:

    a. The Contractor shall coordinate with the firestopping system manufacturer to determine if a pipe sleeve is required to comply with the manufacturer's installation instructions and the listed firestop system's testing standards.
    b. All penetrations shall maintain the fire-resistance rating of the wall or assembly.

END OF SECTION 22 05 17

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The).

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    b. Chrome-Plated Piping: One-piece steel or split-casting brass with polished, chrome-plated finish.
    c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

    a. Chrome-Plated Piping: Split-casting, stamped steel with concealed hinge with polished, chrome-plated finish.

b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 22 05 18

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Check valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer.

C. FKM: Fluoroelastomer.

D. NBR: Nitrile butadiene rubber (also known as Buna-N).

E. PTFE: Polytetrafluoroethylene.

F. RPTFE: Reinforced polytetrafluoroethylene.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include material descriptions and dimensions of individual components.
b. Include operating characteristics and furnished accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooved ends, press ends, solder ends, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic-water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.18 for cast-copper solder-joint connections.
3. ASME B16.22 for wrought-copper solder-joint connections.
4. ASME B16.51 for press joint connections.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Valve Actuator Type:

1. Gear Actuator: For quarter-turn ball valves NPS 4 and larger.
2. Hand Lever: For quarter-turn ball valves smaller than NPS 4.

I. Valves in Insulated Piping:

1. Provide 2-inch extended neck stems. Milwaukee Insulator/MS Handle (TIH) or approved equal.
2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Provide memory stops that are fully adjustable after insulation is applied.

2.3 BALL VALVES, LEAD FREE

A. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. WATTS.

2. Standards: MSS SP-110 and MSS SP-145.
3. CWP Rating: 600 psig.
4. Body Design: Two piece.
5. Body Material: Forged brass.
6. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Full.

B. Ball Valves, Lead Free, Press Ends - Brass, Two Piece with Full Port and Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Viega
   b. Apollo
   c. Milwaukee
   d. Nibco

2. Description:

    a. Body: Two Piece Zero Lead Bronze Body
    b. Ball: Full Port 316 Stainless Steel
    c. Stem: Blowout – Proof 316 Stainless Steel
    d. Sealing Element: EPDM
    e. Smart Connect (SC) – Leak detection feature on un-pressed valves.
    f. 600 WOG
    g. Listings: UP Code NSF 61 Annex G CSA on ½" - 1"
    h. Metal Handle
    i. Conforms to MSS SP-110
    j. Parameters: 200 PSI Maximum Working Pressure / 0° - 250° F Operating Temperature.

2.4 CHECK VALVES, LEAD FREE

A. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. WATTS.

2. Standard: MSS SP-80, Type 3.
3. CWP Rating: 200 psig.
4. Body Design: Horizontal flow.
5. Body Material: ASTM B62, bronze.
6. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
7. Disc: Bronze.

B. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. WATTS.

2. Standard: MSS SP-80, Type 3.
3. CWP Rating: 300 psig.
4. Body Design: Horizontal flow.
5. Body Material: ASTM B62, bronze.

6. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
7. Disc: Bronze.

C. Check Valves, Lead Free, Swing Type, Press Ends - Bronze:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Viega
   b. Apollo
   c. Milwaukee
   d. Nibco

2. Standards: MSS SP-80 and MSS SP-139.
3. CWP Rating: Minimum 200 psig.
4. Body Design: Horizontal flow.
5. Body Material: ASTM B584, bronze.
6. Ends: Press.
7. Press-End Connections Rating: Minimum 200 psig.
8. Disc: Brass or bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Examine press fittings to verify they have been properly pressed.

F. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and actuator or manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

H. Install check valves for proper direction of flow and as follows:

1. Check Valves, Swing Type: In horizontal position with hinge pin level.

I. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

J. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's written recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 VALVE SCHEDULE

A. Refer to Schedule on Drawings

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Fastener systems.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, metal pipe hanger and support systems shall be one of the following or engineer-approved equal.

1. Anvil International
2. Empire Industries
3. ERICO, Inc.
4. PHD
5. Hubbard Enterprises

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: ,or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.1 INSULATED PIPE SUPPORT SYSTEMS

A. Thermal hanger shields shall be used on all horizontal insulated pipe systems at each point of support. Manufactured units shall comply with MSS SP-58 standards and be tested per MSS SP-89 guidelines. Each assembly shall closely fit the various pipe diameters and match the outside diameter of the adjoining pipe insulation.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Buckaroos, Inc.; CoolDry™ Insulated Saddles, Heavy Duty CoolDry™ Insulated Saddles, and CoolDry™ Insulated Sliding Saddles, or comparable product by one of the following:

1. Buckaroos, Inc.
2. Carpenter & Paterson, Inc.
3. Clement Support Services.

C. Insulation Material for Cold or Hot Piping, from Minus 40 to Plus 275 Deg F: Naturally hydrophobic rigid phenolic foam. Comply with ASTM C 1126, Type III.

1. Flame-spread index of 25 or less and smoke-developed index of 50 or less as tested by ASTM E 84.
2. Thermal Properties, NPS 10 and Smaller: 3.75-lb/cu. ft. nominal density, and thermal conductivity (k-value) not to exceed 0.17 Btu x in./h x sq. ft. x deg F at 75 deg F according to ASTM C 518.
3. Thermal Properties, NPS 12 to NPS 30: 5.0-lb/cu. ft. nominal density, and thermal conductivity (k-value) not to exceed 0.2 Btu x in./h x sq. ft. x deg F at 75 deg F according to ASTM C 518.

D. Vapor Barrier**:** ASTM C 1136, Type IX, three-ply composite membrane consisting of a 0.5-mil white polyester film, 1.0-milaluminum foil, and one 0.5-milclear polyester film.

1. Flame-sp read index of 25 or less and smoke-developed index of 50 or less as tested by ASTM E 84.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, zero-permeance abuse-resistant vapor barrier jacket with 1-1/2-inch-wide longitudinal pressure-sensitive acrylic tape closure system.

E. Insulation Protection Shields: Galvanized metal, G90 coating designation, complying with ASTM A 653/A 653M, 180-degree saddle, centered and adhered to bottom a minimum of 1-1/2 inches for jacketed insulation extending from each side to allow for proper circumferential closure at butt joints with 3-inch-wide zero-permeance tape.

F. Heavy Duty Insulation Protection Shields: Galvanized metal, 12-gage, G90 (Z275) coating designation, complying with ASTM A 653/A 653M, 180-degree saddle, centered and adhered to bottom a minimum of 1-1/2 inches jacketed insulation extending from each side to allow for proper circumferential closure at butt joints with 3-inch-wide zero-permeance tape. Structural steel plate welded to bottom of galvanized shield for sizes NPS 6 and larger.

G. Sliding Protection Shield: Galvanized metal, G90 coating designation, complying with ASTM A 653/A 653M, ribbed, with PTFE layer on top. Ribbed shield is 4 inchesshorter and centered below primary protection shield. Allows for 2 inches of lateral movement to account for linear expansion or contraction.

H. Saddle Label: Manufacturer's saddle label with logo sticker to be visible for verification of proper installation.

I. Thermal hanger shields shall be used on all horizontal insulated pipe systems at each point of support. Manufactured units shall comply with MSS SP-58 standards and be tested per MSS SP-89 guidelines. Each assembly shall closely fit the various pipe diameters and match the outside diameter of the adjoining pipe insulation.

2.2 FASTENER SYSTEMS

A. Mechanical-Wedge Anchors: Wedge-type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Powers Fasteners; Model Power-Stud
b. B-Line Systems, Inc.; a division of Cooper Industries; Model AWA
c. Hilti, Inc.; Model KB
d. ITW Ramset/Red Head; Model Trubolt
e. MKT Fastening, LLC; Model Sup-R-Stud

B. Mechanical Anchor: Steel threaded fastening system for suspending threaded rod vertically overhead; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Powers Fasteners; Model Vertigo; Wood Vertical Hanger and Wood Side Hanger
b. B-Line Systems, Inc.; a division of Cooper Industries; Model ARS, ARSW
c. Simpson Strong-Tie; Model RWV, RWH

2.3 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. All hanger rod and channel ends; exposed and less than or equal to 12ft above finished floor; shall be provided with plastic caps and plastic channel safety end caps. Color shall be same throughout the project.

C. Thermal Hanger-Shield Installation: Install in all pipe hangers and shields for insulated piping.

D. Fastener System Installation:

1. Powder-actuated fasteners are not acceptable.
2. When possible, install concrete inserts before placing concrete.
3. Install mechanical-wedge type anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
4. Pin/nail anchors, spikes, expansion shields, expansion anchors, drop-in anchors, wedge bolts, self tapping screw anchors, and friction clamps are not acceptable.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal hanger-shield inserts shall be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

5. Insert Material: Length at a minimum of 2” longer; in each direction; than protective shield length.

M. All pipe hangers shall be sized to accommodate the pipe, pipe insulation thickness and protective shields and saddles. Insulation shall be continuous through all hangers and penetrations.

1. Insulation may not be continuous through the hanger when riser clamps and pipe clamps are utilized for vertical support. Insulation shall be continuous around the pipe clamp and continue 3” on the method of support; threaded rod, pipe stand.
2. Insulation shall be continuous through the hanger when pipe clamps are utilized for horizontal suspension. Full circumference protective shield shall be utilized.

3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

C. Provide plastic caps on the ends of all threaded rod exposed and less than or equal to 12ft above finished floor. Color shall be same throughout the project.

3.3 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Division 09

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.4 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated and insulated stationary pipes NPS 1/2 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For floor mounting of insulated , stationary pipes NPS 3/8 to NPS 3.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Wedge type mechanical expansion anchor: For upper attachment to suspend hangers from concrete.
2. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
3. Top-Beam Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Retaining strap/clip required.
4. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
5. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
6. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
7. C-Clamps (MSS Type 23): For structural shapes. Only acceptable for support of pipes less than or equal to NPS 2. Retaining strap/clip required.
8. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

9. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
10. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
11. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
12. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
13. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

14. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
15. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
16. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Use mechanical-wedge type anchors in concrete after concrete is placed and completely cured instead of building attachments where required in concrete construction.

1. Powder-actuated fasteners are not acceptable.
2. When possible, install concrete inserts before placing concrete.
3. Install mechanical-wedge type anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
4. Pin/nail anchors, spikes, expansion shields, expansion anchors, dropin anchors, wedge bolts, self tapping screw anchors, and friction clamps are not acceptable.

END OF SECTION 22 05 29

SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Spring hangers.
5. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

1. Seismic Design Category (SDC): B
2. In Seismic Design Categories A & B: Plumbing systems are exempt from requirements for seismic bracing, except for piping crossing seismic joints.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.

4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of sprint isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 22 05 48

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Warning tape.
4. Pipe labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Craftmark Pipe Markers.
   d. LEM Products Inc.
   e. Marking Services, Inc.
   f. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 5 by 3 inch.
6. Minimum Letter Size: 1 inch for name of units if viewing distance is less than 24 inches, 2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws; adhesive for locations were screws or rivets would void warranty of equipment.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Marking Services Inc.
5. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 5 by 3 inch.

F. Minimum Letter Size: 1 inch for name of units if viewing distance is less than 24 inches, 2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws; adhesive for locations were screws or rivets would void warranty of equipment.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

J. Plastic labels shall be plenum rated when located in plenums.

2.3 WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. National Marker Company.
5. Seton Identification Products; a Brady Corporation company.

B. Material: Vinyl.

C. Minimum Thickness: 0.005 inch.

D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.

E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.

F. Maximum Temperature: 160 deg F.

G. Minimum Width: 2 inches.

2.4 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Services Inc.
4. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Machine printed, color coded, with lettering indicating service pipe size, and showing flow direction in accordance with ASME A13.1. Marker/hand written labels are not acceptable.

C. Pretensioned Pipe Labels: MS-970 Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners (straps for 6” O.D. of insulation and larger are acceptable) or adhesive. Self-adhesive, sticker type, or pre-coiled polyester with self-sealing lap are not acceptable. Pipe labels and pipe labels adhered to a clear pretensioned sleeve are not acceptable.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

F. Pipe labels located within plenums only:

1. MS-900 Self-adhesive, sticker type.

2. Pipe Label Contents: Include identification of piping service, pipe size, and an arrow indicating flow direction.

G. Pipe-Label Colors:

1. In accordance with ANSI A13.1 and local fire code requirements

2.5 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.

3. Craftmark Pipe Markers.
4. Marking Services Inc.
5. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: aluminum, 0.031-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain with S-hook or jack chain with S-hook.

C. Valve Tag Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, valve number and service.

1. Example: HW
Isolation
001

D. Letter and Background Color: As indicated for specific application under Part 3.

E. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Include valve-tag schedule in operation and maintenance data.
2. Valve-tag schedule shall be framed behind glass and located in each mechanical room

2.6 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Marking Services Inc.
5. Seton Identification Products; a Brady Corporation company.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Letter and Background Color: As indicated for specific application under Part 3.

C. Plastic labels shall be plenum rated when located in plenums.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Sign and Label Colors.

1. White letters on an ANSI Z535.1 safety-green background.

C. Locate equipment labels where accessible and visible. Where equipment is located within finished spaces, equipment labels shall not be located on the face of the equipment; where possible, the label shall be located on the least conspicuous side.

3.4 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.

3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
5. At all changes of direction.
6. And at all locations required to conform to ASME/ANSI A13.1.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule: Coordinate with facility standards. If no facility standards exist or are not desired, conform to ASME/ANSI A13.1 - 2007.

F. All self-adhesive/sticker type labels located in plenums shall be secured with additional flow arrow tape at each end of the label. Flow arrow tape shall be installed a minimum of 1.5 wraps around the entire circumference of the pipe at each end of the label.

3.5 INSTALLATION OF VALVE TAGS

A. Install tags on all valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.

A. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. All services: 1-1/2 inches, round.

2. Valve-Tag Color:

    a. All services: Natural.

3. Letter Color:

    a. All services: Black.

4. Valve-Tag Colors:

    a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

3.6 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Markings shall be provided in locations required by and meeting the color requirements of the “Safety Code Color for Marking Physical Hazards”, ANSI Z53.1, latest revision.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Insulation schedule indicating insulating material and thickness, service, location (interior, exterior), jacket type, and fastening method.

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

F. Products of one type, shall be by one manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to

authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

D. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Rigid Insulation Blocks: High density, rigid fiberglass material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hamfab H Block

2. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less as tested by ASTM E 84.
3. Factory-Applied Jacket: ASJ-SSL. Requirements are specified in "Factory-Applied Jackets" Article.
4. Service temperatures: -120° F. to +1000° F.
5. Density: 18 lb. cu./ft.
6. Moisture absorption: 0.2% by volume, 96 hrs. at 120° F/ 96% RH
7. Corrosion: Does not cause or accelerate corrosion
8. Safety: Non-combustible
9. Shrinkage: None
10. Dimensionally stable
11. Alkalinity: Ph9
12. Thermal Conductivity: K = .30 (stable, non-deteriorating)
13. Compressive strength: nominal 5% deflection at 30PSI, nominal 10% deflection at 80PSI

G. Rigid Insulation for Elbows and Fittings: High density, rigid fiberglass or mineral wool material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hamfab
   b. FGH Insulation
   c. Tru-Fit Roc 1200
   d. Distribution International

2. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less as tested by ASTM E 84.
3. Field-Applied Jacket: PVC. Requirements are specified in "Field-Applied Jackets" Article.

4. Service temperatures: -120° F. to +1000° F.
5. Corrosion: Does not cause or accelerate corrosion
6. Safety: Non-combustible
7. Shrinkage: None
8. Dimensionally stable
9. Water Vapor Sorption: less than 1%

H. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Pittsburgh Corning Corporation; Foamglas One.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

I. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials with self-sealing adhesive lap seam. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

J. Mineral-Fiber, Preformed Pipe Insulation: Insulation shall be formaldehyde-free or GREENGUARD Gold Indoor Air Quality Certified and meet the GREENGUARD Gold standards for low Volatile Organic Compound (VOC) emissions.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000 Pipe Insulation with ECOSE® Technology.
    c. Manson Insulation Inc.; Alley-K.
    d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.

Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
4. Type IV Grade A 1000 Degree Materials: Glass fiber manufactured with a bio based binder. ASTM C 547, Type IV Grade A. Factory applied ASJ + SSL+ Jacketing.
5. Type IV Grade A 1000 Degree Materials: Glass fiber manufactured with a bio based binder ASTM C 547, Type IV Grade A. Factory applied Redi-Klad Jacket: Venture Clad 5-ply weather and abuse resistant with self seal lap. Zeo Perm Jacket.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 739, Dow Silicone.

b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.
e. Proto PVC Liquid Adhesive

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. Marathon Industries, Inc.; 590.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
   c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ + SSL+: All Service Jacket with Advance Closure System self sealing lap. All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no paper exposed; conforming to ASTM C 1136 Type I,II,III,IV and VII;vapor retarder;with a self-sealing adhesive.

2. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
3. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGuire Manufacturing.
b. Plumberex.
c. Truebro; a brand of IPS Corporation.
d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Continuous, unbroken vapor barrier is required on all below ambient service piping and equipment.

K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness. Installed thickness shall meet the specified thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Do not over compress insulation during installation to less than 75% stated thickness. Installed thickness shall meet the specified thickness.

C. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation.. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulation and finish ends with cement.
5. Insulate strainers using preformed fitting insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe

diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Insulate unions using removable thermal blanket insulation covers specified in the above sections.
8. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
9. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
10. Stencil the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

E. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Do not over compress insulation during installation to less than 75% stated thickness. Installed thickness shall meet the specified thickness.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Boxes may also be formed around valves with handle extensions through the box. Boxes shall be waterproof.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Do not over compress insulation during installation to less than 75% stated thickness. Installed thickness shall meet the specified thickness.

B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Do not over compress insulation during installation to less than 75% stated thickness. Installed thickness shall meet the specified thickness.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as

recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

F. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 PIPING INSULATION SCHEDULE

A. Refer to schedule on drawings.

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cerroflow
2. Elkhart Products Corporation.
3. Howell Metal
4. Mueller Copper Tube
5. NIBCO Inc
6. Precision Tube

B. Drawn-Temper Copper Tube: ASTM B88, Type L.

C. Fittings:

1. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
5. Wrought Copper Unions: ASME B16.22.
6. Tee-drill/mechanically formed extruded outlets are not acceptable.

D. Metallic Press Connect Fittings:

1. Viega ProPress Fittings or equivalent: Bronze or copper press-connect fittings shall be certified in accordance with ASTM F3226 Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems, and the performance requirements of IAPMO PS117, and ICC LC1002. Press-connect fittings ½-inch thru 4-inch for use with ASTM B88 copper tube type K, L, or M and ½-inch up to include 1-1/4-inch annealed copper tube. Press-connect fittings shall have an EPDM sealing element and), leak detention feature for identifying un-pressed fittings. Press-connect fittings with EPDM sealing element shall conform to NSF 61-G when installed in a potable water system. Installation shall conform to manufacturer’s instructions and specifications and in accordance with ASTM B1029 Standard Practice for Making Press-Connect Joints with Seamless Copper and Copper Alloy Tube and Press Fittings

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Viega, LLC.
    b. Elkhart Products Corporation.
    c. NIBCO Inc

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B32, lead-free alloys.

B. Flux: ASTM B813, water flushable.

C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Mfg. Co.
    b. Dresser, Inc.
    c. Ford Meter Box Company, Inc. (The).
    d. Jay R. Smith Mfg Co; a division of Morris Group International.
    e. JCM Industries, Inc.
    f. Romac Industries, Inc.
    g. Smith-Blair, a Xylem brand.
    h. Viking Johnson.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jomar Valve.
    b. Matco-Norca.
    c. WATTS.
    d. Wilkins.
    e. Zurn Industries, LLC.
    f. Viega, LLC

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Matco-Norca.
    b. WATTS.
    c. Wilkins.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, LLC.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. GPT; a division of EnPRO Industries.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
   b. Matco-Norca.
   c. Precision Plumbing Products.
   d. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

F. Dielectric Waterway: Fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service. Fittings shall have threaded ends, grooved ends, or a combination. Victaulic Style 647.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Flanges grooved joints and unions may be used for aboveground piping joints unless otherwise indicated.

D. REFER TO SCHEDULE ON DRAWINGS FOR PIPE AND FITTING APPLICATIONS.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Cap all pipe and equipment outlets during construction and keep lines and inside of equipment free of foreign materials.

C. Install domestic water piping level without pitch and plumb.

D. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

E. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Metallic Press-connect fittings:

1. Shall be made in accordance with the manufacturer’s installation instructions and ASTM B1029 Standard Practice for Making Press-Connect Joints with Seamless Copper and Copper Alloy Tube and Press Fittings.
2. Contractor shall be trained on the use and installation of the system by manufacturer’s representative.
3. Fitting shall be visually examined to insure that sealing element is not damaged and it is properly seated into the fitting. The tubing shall be fully inserted into the fitting.
4. The tubing shall be visibly marked at the face of the fitting.
5. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting.
6. The joints shall be pressed using approved tool(s).

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
5. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 FIELD QUALITY CONTROL

A. Cap all pipe and equipment outlets during construction and keep lines and inside of equipment free of foreign materials.

B. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Pressure test to identify un-pressed connections:

a. After metallic press-connect fittings have been installed a “step test” shall follow.
b. Utilizing air or water, the system shall be pressurized to 45 psi.
c. If there is a significant drop in pressure, the system shall be walked to check for un-pressed fittings.
d. Should an un-pressed fitting be located, the pressure should be released from the system and the un-pressed fitting shall be pressed.
e. If no un-pressed fitting is identified the system shall be pressurized to test pressures required by code, not to exceed 600 psi.

3. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

C. Domestic water piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 LEAD-FREE STATEMENT

A. Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The contractor shall be responsible for providing products that are Lead-Free products and meet the requirements of Safe Drinking Water Act Section 1417 (e) (Section 9 of NSF/ANSI Standard 61) and authorities having jurisdiction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Backflow preventers.
2. Strainers.
3. Drain valves.
4. Water-hammer arresters.
5. Air vents.
6. Flexible connectors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

B. Mark "NSF-pw" on plastic piping components.

C. All piping specialties which come into contact with potable water shall meet the requirements of Safe Water Drinking Act (SWDA).

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Conbraco Industries, Inc.
    c. FEBCO; a division of Watts Water Technologies, Inc.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Size: Refer to drawings.
6. Body: Bronze for NPS 2 and smaller; steel with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged or grooved for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight-through flow.

9. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
    d. Wye Strainer with ball valve drain.

B. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; a division of Watts Water Technologies, Inc.
    c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: per manufacturers recommendation.
    b. Strainers NPS 2-1/2 to NPS 4: per manufacturers recommendation.
    c. Strainers NPS 5 and Larger: per manufacturers recommendation.

6. Drain: Pipe plug or Factory-installed, hose-end drain valve.

2.5 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.

2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Precision Plumbing Products, Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Watts Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.

3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventer on water service entrance according to authorities having jurisdiction. Contractor to contact AHJ to confirm current installation requirements prior to installation.

B. Install backflow preventers in each water supply to mechanical equipment systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Do not install bypass piping around backflow preventers.

C. Install Y-pattern strainers for water on supply side of each backflow preventer, water pressure-reducing valve and pump.

D. Install water-hammer arresters in water piping according to PDI-WH 201.

1. Provide water hammer arrestor on hot and cold-water supply piping to lavatories with sensor operated faucets. Typical at all lavatories and lavatory groups.
2. Provide water hammer arrestor on cold-water supply piping to sensor operated drinking fountains with bottle fillers. Typical at all

3. Provide water hammer arrestor on cold-water supply piping to individual or group flush valves.

E. Install air vents at high points of water piping.

3.2 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 22 11 19

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's and Owner's written permission.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10 ft. head of water.

2.1 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings: ASTM A 888 and CISPI 301.

C. Tensile Strength: 21,000 psig minimum.

D. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF International.

E. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

2.2 HUBLESS, CAST-IRON SOIL PIPE COUPLINGS

A. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.- Model "SD4000"
b. Clamp-All Corp.- Model "Hi-Torq 80"
c. MG Piping Products Company – Model "MG Coupling"

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Heavy-Duty, Shielded, Stainless-Steel Couplings: no hub fittings with stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve with integral, center pipe stop OR Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

B. No-hub Cast Iron Soil Pipe Fitting Restraints:

1. Description: CISPI Designation 301-12 large diameter no-hub cast iron fittings, over 4 inch (102 mm) in size, with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials are not permitted.

a. HOLDRITE 117 Series No Hub Fitting Restraints.

2.3 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) A.Y. McDonald Mfg. Co.
2) Capitol Manufacturing Company.
3) Jomar Valve.
4) Matco-Norca.

5) WATTS.
6) Wilkins.
7) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Capitol Manufacturing Company.
2) Matco-Norca.
3) WATTS.
4) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.
4) GPT; a division of EnPRO Industries.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
      2) Elster Perfection; a Honeywell Company.
      3) Matco-Norca.
      4) Precision Plumbing Products.
      5) Victaulic Company.

   b. Description:

      1) Standard: IAPMO PS 66.
      2) Electroplated steel nipple.
      3) Pressure Rating: 300 psig at 225 deg F.
      4) End Connections: Male threaded or grooved.
      5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

O. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Joint Restraints and Sway Bracing:

1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

a. Provide axial restraint for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
c. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42 clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52 spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting[**, valve,**] and coupling.

D. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support of piping and equipment by means of engineered products designed for each application. Comply with manufacturer's design load capacities. Makeshift, field-devised methods such as use of scrap materials, plumber's tape, tie wires and similar methods are not permitted.

F. Install sway bracing and anchorage on drainage piping 4” and larger in accordance with New York City Plumbing Code Chapter 3, Section 308.6, 308.7 and 308.7.1.

G. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories with the use of manufactured products, designed for each specific application. Makeshift, field-devised, methods shall not be employed.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install Cast Iron pipe in compliance with all U S soil pipe and fitting manufacturers' installation instructions and per CISPI Designation 310-11, CISPI Designation 301-09 and the CISPI Cast Iron Soil Pipe Handbook, regarding auxiliary support for ho-hub cast iron pipe and fitting joints over 4 inches (102 mm) in size and for joints subjected to excessive thrust forces, use manufactured assemblies with appropriate thrust pressure ratings, rather than field assembled miscellaneous materials.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.

d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 TESTING

A. Required tests. The licensed master plumber shall make the applicable tests prescribed below to determine compliance with the provisions of the code. The licensed master plumber shall give two days' notice to the commissioner when the plumbing work is ready for tests. The equipment, material, power and labor necessary for the inspection and test shall be furnished by the licensed master plumber and the licensed master plumber shall be responsible for determining that the work will withstand the test pressure prescribed in the following tests. All plumbing system piping shall be tested with either water or, for piping systems other than plastic, by air. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted to final tests. The commissioner shall require the removal of any cleanouts if necessary to ascertain whether the pressure has reached all parts of the system.

1. Exception: The repair, replacement or alteration to existing water waste, vent or storm water piping or the addition of no more than three (3) plumbing fixtures or roof drains to an existing floor of an existing building, shall require only a visual inspection of waste, vent and storm water pipe roughing and finish in addition to a pressure test of water piping at available building water pressure.

B. Test gauges. Gauges used for testing shall be as follows:

1. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.
2. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
3. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.

C. Drainage and vent water test. A water test shall be applied to the drainage system either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10 foot head of water. In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet of the system, shall have been submitted to a test of less than a 10 foot head of water. This pressure shall be held for at least 15 minutes. The system shall then be tight at all points.

D. Drainage and vent air test. An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 5 pounds per square inch (psi). This pressure shall be held for a test period of at least 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period.

E. Drainage and vent final test. The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of this code except that the plumbing shall be subjected to a smoke test where required by the local code official. Where the smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1–inch water column shall be held for a test period of not less than 15 minutes.

F. Gravity sewer test. Gravity sewer tests shall consist of plugging the end of the building sewer at the point of connection with the public sewer, filling the building sewer with water, testing with not less than a 10-foot head of water and maintaining such pressure for 15 minutes.

G. Forced sewer test. Forced sewer tests shall consist of plugging the end of the building sewer at the point of connection with the public sewer and applying a pressure of 5 psi greater than the shut off pump rating, and maintaining such pressure for 15 minutes.

H. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

I. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Refer to Pipe and Fitting Schedule on drawings.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Miscellaneous sanitary drainage piping specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Refer to schedule on drawings.
3. Standard: ASME A112.36.2M for adjustable housing cleanout.
4. Size: Same as connected branch.
5. Type: Adjustable housing.
6. Body or Ferrule: Cast iron.
7. Outlet Connection: Inside calk or Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Heavy Duty.
13. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

    a. Brass.
    b. Countersunk head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access, Cover Plate: Round, deep, chrome-plated bronze cover plate with screw.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch-minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install deep-seal traps on floor drains and other waste outlets, if indicated.

E. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

F. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

G. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Floor drains.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
d. Wade; a subsidiary of McWane Inc.
e. WATTS.
f. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.

3. Pattern: Floor drain.
4. Outlet: Bottom.
5. Trap Pattern: Deep-seal P-trap.
6. Trap Features: Trap-seal primer valve drain connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19.13

SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 LEAD-FREE STATEMENT

A. Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The contractor shall be responsible for providing products that are Lead-Free products and meet the requirements of Safe Drinking Water Act Section 1417 (e) (Section 9 of NSF/ANSI Standard 61) and authorities having jurisdiction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.5 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial, electric, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: Three years.

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC WATER HEATERS

A. Commercial, Storage, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bradford White Corporation.
b. Heat Transfer Products, Inc.
c. Rheem Manufacturing Company.
d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
e. State Industries.

2. Standard: UL 174.
3. Storage-Tank Construction: Steel, vertical arrangement.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
e. Jacket: Steel with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
h. Temperature Control: Adjustable thermostat.
i. Safety Control: High-temperature-limit cutoff device or system.
j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction with legs for off-floor installation.

B. Capacity and Characteristics:

1. Refer to schedule on drawings.

2.2 DOMESTIC WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Furnish and install as shown on plans, pre-charged hydropneumatic steel expansion tank. The tank construction shall be in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature as listed by manufacturer. All internal wetted parts must comply with FDA regulations and approvals. An internal butyl/EPDM diaphragm or butyl bladder will be used to isolate air charge from water.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL Inc.
b. Honeywell International Inc.
c. Pentair Pump Group (The); Myers.
d. Taco, Inc.

B. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

C. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

D. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

E. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

C. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

F. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

G. Fill electric, domestic-water heaters with water.

H. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 22 33 00

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

A. Water Closets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Kohler Co.
    b. Sloan Valve Company.
    c. TOTO USA, INC.

2. Bowl:

    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Type: Siphon jet.
    d. Style: Flushometer valve.
    e. Height: Standard.
    f. Rim Contour: Elongated.
    g. Water Consumption: 1.28 gal. per flush.
    h. Spud Size and Location: NPS 1-1/2; top.

3. Support:

    a. Standard: ASME A112.6.1M.
    b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
    c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Piston Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Hydrotek International, Inc.
    b. Kohler Co.
    c. Sloan Valve Company.
    d. TOTO USA, INC.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 1.28 gal. per flush.
9. Exposed Sensor
10. Hardwired power supply

2.3 TOILET SEATS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bemis Manufacturing Company.
2. Centoco Manufacturing Corporation.
3. Church Seats.
4. Kohler Co.
5. Olsonite Seat Co.
6. TOTO USA, INC.

a. Standard: IAPMO/ANSI Z124.5.
b. Material: Plastic.
c. Type: Commercial (Standard).
d. Shape: Elongated rim, open front.
e. Hinge: Check.
f. Hinge Material: Noncorroding metal.
g. Seat Cover: Not required.
h. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.

2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 LEAD-FREE STATEMENT

A. Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The contractor shall be responsible for providing products that are Lead-Free products and meet the requirements of Safe Drinking Water Act Section 1417 (e) (Section 9 of NSF/ANSI Standard 61) and authorities having jurisdiction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 LAVATORIES

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Kohler Co.

2.2 FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Sloan Valve Company.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.
3. NEOPERL, Inc.

C. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brasscraft
2. Chicago Faucet
3. Mcquire

C. Standard: ASME A112.18.1/CSA B125.1.

D. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

E. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

F. Operation: Loose key.

G. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

H. Provide with ASSE 1070 lavatory tempering valve set for 105°f delivery at all public lavatory faucets. Refer to Section 221119 "Domestic Water Piping Specialties."

2.5 WASTE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mcquire

2. Souix Chief
3. Zurn

B. Standard: ASME A112.18.2/CSA B125.2.

C. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

D. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

G. Provide water hammer arrestor on hot and cold-water supply piping to lavatories with sensor operated faucets. Typical at all lavatories and lavatory groups.

H. Hot water supply piping to lavatories must circulate within 24” of the supply outlet. Typical at all lavatories.

I. Extend hot water circulation system to individual and group lavatories as required to comply with IECC table C404.5.1 distance requirement. Provide balance and check valves to maintain minimum circulation flow.

J. Public lavatory faucets shall meet ASSE 1070 or be provided with an external ASSE 1070 approved thermostatic mixing valve.

K. Adjust proximity sensor activation distance as required.

L. Connect hard wired AC power supply from single-AC or multi-AC adapter to faucet and flush valves with extension cord as required by specification.

M. Coordinate installation of all fixture related mixing valves, trap primers, water heaters, power supply, traps, stops and supplies with under lavatory shroud or countertop prior to installation. Coordinate electrical connections with electrical contractor. Provide diagrammatic mockup of the assembly prior to installation.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 LEAD-FREE STATEMENT

A. Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The contractor shall be responsible for providing products that are Lead-Free products and meet the requirements of Safe Drinking Water Act Section 1417 (e) (Section 9 of NSF/ANSI Standard 61) and authorities having jurisdiction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Handwash sinks.
2. Sink faucets.
3. Laminar-flow, faucet-spout outlets.
4. Supply fittings.
5. Waste fittings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics[**, electrical characteristics,**] and furnished specialties and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 HANDWASH SINKS

A. Utility Sinks: Stainless steel, counter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Tabco.
b. Eagle Group; Foodservice Equipment Division.
c. Elkay Manufacturing Co.
d. Just Manufacturing.
e. Eagle Group; Foodservice Equipment Division.
f. Elkay Manufacturing Co.
g. Just Manufacturing.

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets:

1. Commercial, Solid-Brass Faucets.

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Chicago Faucets.
2) Delta Faucet Company.
3) Elkay Manufacturing Co.

4) Moen Incorporated.
5) Speakman Company.
6) T & S Brass and Bronze Works, Inc.
7) Zurn Plumbing Products Group.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brasscraft
2. Chicago Faucet
3. Mcquire

C. Standard: ASME A112.18.1/CSA B125.1.

D. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

E. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

F. Operation: Loose key.

G. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

H. Provide with ASSE 1070 lavatory tempering valve set for 105°f delivery at all public child use faucets. Refer to Section 221119 "Domestic Water Piping Specialties."

2.4 WASTE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mcquire
2. Souix Chief
3. Zurn

B. Standard: ASME A112.18.2/CSA B125.2.

C. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

D. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.16

SECTION 23 00 00 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Division shall be governed by the Contract Documents. Provide materials, labor, equipment, and services necessary to furnish, deliver and install all work of this Division as shown on the drawings, as specified herein, and/or as required by job conditions.

B. Requirements given herein may be affected by other related requirements of the project specification. Correlation of the contract requirements is the responsibility of the contractor.

C. Perform the work in accordance with the above requirements and the provisions of all applicable codes and laws.

D. Standard Specifications and Abbreviations

1. The following abbreviations used in the Specifications refer to organizations publishing specifications and standards. These shall be construed to mean the latest standard adopted and published at the date of advertisement for bids and such specifications are made part of the Contract Documents to the same extent as if written out in full.

ADC-Air Diffusion Council
AHDGA-American Hot Dip Galvanizing Association
AISC-American Institute of Steel Construction
AMCA-Air Moving and Conditioning Association
ANSI-American National Standards Institute
ARI-American Refrigeration Institute
ASHRAE-American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME-American Society of Mechanical Engineers
ASSE-American Society of Sanitary Engineers
ASTM -American Society for Testing Materials
AWS-American Welding Society
AWWA-American Water Works Association
FIA-Factory Insurance Association
FM-Factory Mutual
FS-Federal Specifications
MCAA-Mechanical Contractors Association of America

MSS-Manufacturers Standardization Society of Valve and Fittings Industry
NBFU-National Board of Fire Underwriters
NBS-National Bureau of Standards
NEC-National Electrical Code
NEMA-National Electrical Manufacturers Association
NFPA-National Fire Protection Association
NSF-National Sanitation Foundation
OSHA-Occupational Safety Health Act
PDI-Plumbing and Drainage Institute
PPI-Plastics Pipe Institute
SMACNA-Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC-Steel Structures Painting Council
STI-Steel Tank Institute
UL-Underwriters Laboratories, Inc.
USDC-United States Department of Commerce
USPHS-United States Public Health Service

2. Conform to ANSI - 31.1.0 and addenda for basic materials and methods of installation for closed piping systems with pressures in excess of 30 PSI, and for pipe welding regardless of system pressures.
3. Conform to ASME Boiler and Pressure Vessel Code Section VIII and FM requirements for construction of unfired pressure vessels.

E. Where the word "provided" is used in this document, it shall be understood to mean, "provided and installed."

1.2 SUMMARY

A. This Section includes the following:

1. Grout.
2. HVAC demolition.
3. Equipment installation requirements common to equipment sections.
4. Painting and finishing.
5. Concrete bases.
6. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Where the word “provided” is used in this document, it shall be understood to mean “provided and installed.”

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.5 INTENT

A. It is the intention of the specifications and drawings to provide for finished work, tested and ready for operation.

B. Items and services not shown on drawings, but mentioned in specifications, or vice versa, or items and services necessary to render the work complete and ready for operation, even if not specified, shall be provided without additional cost.

C. Where conflicts occur between drawings and specifications, or within either document, the Contractor shall ask for and obtain a written clarification from the Architect prior to submitting his bid. Otherwise, the items or arrangements of superior quality, greater quantity or higher cost shall prevail and be included in the contract price.

1.6 WORK INCLUDED

A. The work under this Division shall include all labor, material, equipment plant, services and administrative tasks required to complete and make operable the mechanical work shown on the Drawings, required for proper operation and/or specified herein, including but not limited to, the following:

1. Preparation and submission of shop drawings, diagrams and illustrations.
2. Procuring all necessary permits and approvals, and paying all required fees and charges in connection with the work of this Division.
3. Protection, testing, cleaning, adjustment and guarantee of the work of this Division to safely, properly and continuously operate.
4. As-built drawings, operating and maintenance instructions and manuals.
5. Identification labels, tags, charts and diagrams.
6. Maintain existing services to heating, etc. (temporary services during construction).
7. Coordination.
8. Project record documents.
9. Operation and Maintenance Data.
10. Cutting and patching.
11. Cooperation with and full participation in the commissioning process.

1.7 WORK NOT INCLUDED

A. Finish patching of all construction cut under this Division.

B. Waterproofing of roof penetrations for the work of this Division.

C. Concrete and masonry work except as specified.

D. Painting, except as noted.

E. Removal, patching, or otherwise handling of hazardous materials.

1.8 SITE INVESTIGATION

A. Examine the drawings and specifications of all trades, and the site, and from these investigations be responsible for the nature and location of work, general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads, etc.

1.9 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work required. Do not scale the Drawings. Consult the architectural drawings and details, and the drawings of other trades, for exact location of equipment.

B. Drawings shall be used in layout of work. Check reference drawings to verify spaces in which the work will be installed. Maintain maximum headroom and space conditions. Where headroom or space conditions appear inadequate, Architect shall be notified before proceeding with installation.

C. If directed by the Architect, make minor modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

D. The drawings are schematic and diagrammatic.

1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but not necessarily have dimensional significance, neither do they necessarily delineate all related and subsidiary parts and equipment.
2. The work shall be installed complete and ready for operation in conformity with the intent expressed on the drawings and in the specifications.
3. Coordinate the work with the requirements of the architectural and structural drawings for dimensions, locations and clearances.
4. Locations of items exposed to view shall be taken from the architectural drawings or located as directed.

1.10 COORDINATION WITH OTHER TRADES

A. Closely schedule the work so that work will be installed at the proper time without delaying the completion of the entire project.

B. Where the work will be installed in close proximity to the work of other trades, or where there is evidence that the work will interfere with the work of other trades, arrange space conditions to make a satisfactory adjustment. If work is installed before coordinating with other trades, make necessary changes to the work to correct the condition without additional cost to the owner.

C. Prepare complete set of drawings showing all necessary slab openings and structural supports that require structural framing. Drawings shall clearly indicate sizes and location relative to established column lines. Drawings shall be completed in sufficient time to allow for structural steel fabrication so as not to delay project schedule.

D. Shop drawing submissions shall demonstrate a knowledge of the work of other trades, and shall show the locations of the work of other trades which affects the work of this contract.

1.11 EQUIPMENT DEVIATIONS

A. It is the intent of these specifications that wherever a manufacturer of a product or a catalog number is specified, and terms "or equal" or "or approved equal" are used, the substituted item must conform in all essential respects to the specified item including operating efficiency, noise generated, and method of operation. Consideration will not be given claims that the substituted item meets performance requirements with lesser

construction. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

B. When such approved deviation requires a different quantity and or arrangement of equipment from that specified or indicated on the drawings, provide required equipment, wiring, piping, connections, valves, and structural supports, and any other additional equipment required by the deviation, at no additional cost to the Owner.

C. When an item of equipment is proposed, other than that detailed or specified on the drawings, (this includes equipment by manufacturers indicated in the specifications) which requires any additional equipment or redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, plumbing or architectural design, such costs shall be incurred by the Contractor without cost to the Owner. Redesign, updates, revisions required for any trade as a result of the use of equipment not detailed on the drawings shall be performed and borne by the contractor.

D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no cost to the Owner. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.12 EQUIPMENT AND SYSTEMS CRITERIA

A. The criteria of design and performance to produce the required operation is based on equipment shown or scheduled.

1. The equipment must conform to the structural design provisions for loads applied to the structure, to the dimensions established by drawings for mechanical spaces and other clearances, and for inlet and outlet locations and proper relationship to associated equipment, piping and ducts.

B. The descriptions cover basic equipment and operation but not all the details of design and construction.

1. The use of singular in descriptions does not limit the quantities of items to be furnished to provide the operation specified. Furnish all equipment required to produce specified performance under installed conditions.
2. Factory wiring, interconnections, piping and connections shall conform to these specifications for the field work.
3. Provide all trim, enclosures and accessories required to make a complete installation.

C. Acoustical performance of equipment and systems.

1. Noise levels from operation of motor driven equipment, whether air-borne or structure-borne, and noise levels created by or within air-handling equipment and

air distribution and control media shall not exceed sound pressure levels determined by the noise criterion curves in the ASHRAE Guide as follows:

Location	Noise Criterion
Galleries	NC 35

2. Testing for conformance to the above requirements will be provided by an acoustical consultant retained by the Owner.

    a. Octave band sound pressure levels will be obtained for ambient room conditions with equipment not operating and also with the installed equipment operating per plans and specifications.
    b. For testing purposes, sound pressure levels will be measured 3'-0" above the floor.

1.13 GENERAL CONFORMANCE

A. Obtain all general conformances in accordance with Division 1 - General Requirements.

B. Submit to the Architect for review a list of manufacturers of equipment proposed for the work. Intent to use exact make specified does not relieve the Contractor of responsibility for submitting the required list.

C. Where any specific materials, process or method of construction, or manufactured article is specified by name or by reference to catalog number of a manufacturer, or other standards, the intent is not to take precedence over the basic duty and performance specified, noted on drawings, or as required for intended results. In all cases, verify the duty specified with the specific characteristics of the equipment offered for review.

D. Equipment and material of one type, shall be products of one manufacturer. Multiple manufacturers for like items are not acceptable.

1.14 SUBMITTALS

A. Manufacturer's Drawings.

1. Equipment listed in each section, include material specifications, operating characteristics and finishes.

B. Installation Drawings.

1. Coordinated scale drawings of equipment including interconnecting piping and ductwork.
2. Coordinate space requirements for equipment and services.
3. Include connections, anchorages and fastenings.

4. Make allowance for clearances for access to and maintenance of equipment.

C. Wiring and Control Diagrams.

1. Electric wiring diagrams and automatic control diagrams and sequences of operation. The wiring diagrams must be complete and coordinated with the equipment actually installed.

D. Provide composite shop drawings showing work of all related construction, when required to ensure full coordination and proper fitting of the work, and when directed by the Architect.

E. Provide drawings showing dimensions and locations of concrete work required for the mechanical work.

F. Samples.

1. Color samples for prefinished items.

G. Reports:

1. Manufacturer's certified pressure tests on vessels.
2. Manufacturer's certified performance tests on operating equipment.
3. Field pipe testing reports and certificates of approval.
4. Welder's certificates and field test report.
5. Field operating test results for operating equipment.
6. Performance report on the balancing of air and water systems.
7. Performance report and calculations for vibration isolation equipment.
8. Manufacturer's certified reports on motorized equipment alignment and installation.

H. If submissions of catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or other variations, those features proposed shall be clearly identified.

1. If any variations from the catalog description are proposed or required, such variations must be clearly noted on the cut.
2. Shop drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and other information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work.
3. Shop drawings shall be numbered consecutively, and drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that units may be checked individually and as an assembly.
4. Keep on the site, in good order, a complete up-to-date set of approved shop drawings. All shop drawings shall be available for inspection by the Architect.

5. On product data submittals, clearly indicate model numbers, dimensions, weights, electrical requirements, accessories and performance data. Submittals not properly prepared will be rejected without further review.
6. The review of shop drawings will be general, and shall not be construed as permitting any departure from the contract requirements other than those specifically brought to the Architect's attention and so approved.

    a. If the shop drawings show any variations from contract requirements because of standard shop practices or other reasons, such variations shall be clearly identified on the drawings in order that, if acceptable, suitable action may be taken for proper adjustment in other work affected thereby.
    b. Failure to identify such variations will not relieve the Contractor of responsibility for executing the work in accordance with the Contract even though such shop drawings have been reviewed and the work installed.
    c. Review shall not relieve the Contractor of responsibility for any error in details, dimensions, etc., that may exist on shop drawings nor for the furnishing of materials or work required by the Contract and not indicated on the shop drawings.
    d. Review shall not be construed as acceptable departure from details or instructions previously furnished by the Architect.
    e. Review with a requirement for resubmission is a review contingent upon satisfactory resubmission within 30 days. Failure to comply shall result in a revocation of the contingent review.

I. Shop Drawing Schedule

1. The Contractor shall submit, within 30 days of the award of his contract, a schedule of all proposed shop drawing submissions.

1. The schedule shall include the following information.
    a. Item to be submitted
    b. Date of submission
    c. Latest date for review
    d. Manufacturers of the specified item.

2. Items not specifically listed as "approved equal" should be listed for consideration at this time.
3. Shop drawings require a minimum of 10 business days from the date they have been received by the Consulting Engineer’s office to adequately review the submittal. If there is any submittal which requires to be expedited sooner than the 10 business days, the Engineer shall be informed in writing at the beginning of construction with a list of those submittals.

J. Submittals will be reviewed for conformance with the contract drawings and specifications. The engineer's review stamp will be affixed to submittals. One of the following actions will be taken:

1. Reviewed:

   a. No comments, corrections, or marks have been made to the submittal. Re-review by the engineer is not required. The submittal is in general conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the work shall be in accordance with the requirements of the Contract Documents. Final acceptance of the work shall be contingent upon such compliance.

2. Furnish As Corrected

   a. Comments, corrections, or marks made. Re-review is not required. Submission is in general conformance with the design concept subject to notations on the returned Submittal. Construction, fabrication, and/or manufacturer can proceed subject to the provisions that the work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Submittal and in accordance with the Contract Documents. Final acceptance of the work shall be contingent on such

   b. compliance.

3. Revise and Resubmit

   a. Significant issues/discrepancies/incomplete information was provided in the Submittal. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

4. Rejected

   a. Submittal does not meet Contract document intent. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

K. A submittal review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from Compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. The contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of his or her work with that of all other trades; and for performing all work in a safe and satisfactory manner.

1.15 GUARANTEES AND SERVICES

A. All workmanship, installation materials and equipment shall be maintained and serviced for the guarantee period at no additional cost to the Owner.

B. Leave entire system installed under this Contract in perfect working order, and, without additional charge, replace any work or material which develops defects within the guarantee period, including all other work damaged as a result of such defects.

C. Non-durable, expendable items such as air filter media are not subject to replacement after the date of acceptance.

D. The guarantee period shall be extended as follows:

1. For heating systems, one year plus the time necessary to include one continuous heating season from November 1st to April 1st.
2. For air-conditioning systems, one year plus the time necessary to include one continuous cooling season from May 1st to October 1st.

E. Manufacturers' Warranties

1. The manufacturer shall warrant that the equipment which he has furnished is free from defects in material and workmanship. Obligations under this warranty shall be as follows:

    a. The equipment manufacturer or supplier shall provide and pay for all labor, parts, accessories, materials, freight and other services to repair or replace any equipment or part thereof which, in the course of installation, start-up and testing is found to be defective.
    b. For a period of eighteen months from the date of acceptance by the Owner, the manufacturer shall replace any defective equipment or part thereof; freight costs for return of defective parts, labor for parts replacement, and replacement of lost refrigerant, are the responsibility of the installing contractor.
    c. The manufacturer shall provide an additional warranty on all equipment as indicated in their respective specification section.
    d. Performance - where equipment is specified by size, guarantee that it will have the capacity specified in the system in which it is installed.

2. The final acceptance of the equipment will be made after the manufacturer has adjusted his equipment, balanced the various systems, demonstrated that it fulfills the requirements of the drawings and specifications, and has furnished all the required certificates of inspection and acceptance.

1.16 SYSTEM MAINTENANCE

A. Contractor shall provide routine and preventive maintenance during the warranty period.

B. Contractor shall submit to Engineer for review a comprehensive plan covering items to be maintained and service to be performed. Plan shall include checklist for use by maintenance personnel.

C. Owner's representative(s) shall accompany contractors' maintenance personnel, and receive instructions on proper maintenance of equipment.

D. Maintenance performed shall include a complete check out of each piece of equipment at least twice during warranty period. The first shall occur approximately half way through the warranty period (change of season) and the second at the conclusion of the warranty period and prior to commencement of the owner's maintenance. Each system and/or piece of equipment shall be inspected, operated through its complete range of operation, and adjusted as required. This inspection shall be the same as performed at the initial start-up of the item or system. In addition, there shall be monthly maintenance inspections of each piece of equipment.

During the monthly inspections, equipment shall be checked for items such as dirty filters, belt wear, lubrication, unusual sounds or unusual operating conditions. Monthly inspections shall also include recording of system operating temperatures and pressures.

E. Contractor shall include all labor and material to perform the maintenance, including replaceable items such as filters and belts.

F. Maintenance on the following items shall be included:

1. Fans
2. Air handling units
3. Filters
4. Temperature controls
5. Valves
6. Actuators

1.17 PERMITS AND CERTIFICATES

A. Prior to proceeding with any installation, prepare and submit to the proper authorities, for their review, all required working drawings. Provide all necessary notices, obtain all permits and pay all local, state and federal taxes, fees and other costs in connection with the work.

B. The contractor shall be responsible for performing all controlled inspections required by applicable Administrative building Code.

1.18 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

D. It is the intent of these specifications that wherever a manufacturer of a product or a catalog number is specified, and terms “or equal” or “or approved equal” are used, the substituted item must conform in all essential respects to the specified item including operating efficiency, noise, physical size, capacity, quality, and material.

1.19 COORDINATION DRAWINGS

A. Sheet metal and plumbing shop drawings that have been coordinated with architectural and structural drawings shall be submitted to Engineer for review. Drawings must be returned from Engineer either "Reviewed" or "Furnish as corrected" prior to being used as basis for coordination drawings. Refer to Section 233113 for sheet metal shop drawing and 232113 for piping shop-drawing requirements.

B. The contractor shall submit for review sheet metal shop standards. Any sheet metal shop drawings submitted prior to the submission of the shop standards shall be returned "not reviewed".

C. After sheet metal and piping drawings have been revised per Engineers comments, reproducible copies shall be sent to the others trades in the following sequence for the inclusion of their work:

1. Plumbing contractor
2. Electrical work
3. Mechanical piping
4. Sprinkler piping

D. Prior to inclusion of sprinkler piping and equipment, contractor shall have submitted sprinkler plans and calculations to engineer for review and to Rating Bureau for review.

E. After all trades have included their work on the coordination drawing and noted conflicts, all trades shall meet to resolve conflicts and agree to acceptable solutions. Each trade shall sign coordination drawings. Items not shown on coordination drawing is responsibility of omitting contractor and contractor is subject to additional costs incurred by other trades.

F. The Architect and Engineer are not part of the coordination drawing process. The Engineer will provide assistance relative to acceptability of installations.

G. Submit final signed coordination drawing to engineer for review. Engineer will review for acceptability of installations.

H. Any work fabricated or installed prior to sign off by all trades shall be removed and re-installed in conformance with coordination drawings.

I. Each contractor (mentioned above) is responsible for the coordination of his sub-contractors.

J. The overall coordination of the coordination process is the responsibility of the general contractor and/or construction manager.

K. The overall coordination of the coordination process is the responsibility of the general contractor and/or construction manager. The Engineer is not responsible for the coordination process. The Engineer will respond to questions that arise from the coordination process. Drawings submitted will be reviewed for clearly identified conflicts only. Solutions to conflicts will not bear additional cost.

L. Drawings shall be submitted in both hard copy and electronic (AutoCAD or Revit version as required by the Owner) version or AutoCAD Version 2018 if not specified. Number of copies of each as requested by the Owner.

M. Electronic drawing files shall be generated by the Contractor.

2.1 AS BUILT DRAWINGS/RECORD DRAWINGS

A. Provide a complete set of as-built drawings reflecting as installed conditions. As-built drawings shall indicate all installed conditions of systems within this discipline. Drawings shall be of similar scale as the construction documents and include details as necessary to clearly reflect the installed condition. Drawings shall be bound in a complete and consecutive set. Supplemental sketches and loose paperwork will not be acceptable and will be returned for revision. The contractor shall comply with the engineer’s comments to produce a clear and concise set of drawings.

B. Provide "As-Built Drawings" indicating in a neat and accurate manner a complete record of all revisions of the original design of the work.

1. Drawings shall be submitted in both hard copy and electronic (AutoCAD and Revit version as required by the Owner) version or AutoCAD Version 2018 if not specified. Number of copies of each as requested by the Owner. PDFs inserted into an AutoCad file are not acceptable.
2. Indicate the following installed conditions:

    a. All changes and an accurate record from the contract drawings or appropriate shop drawings, of all deviations, between the work shown and work installed.
    b. Ductwork mains and branches, size and location; locations of dampers and other control devices; filters, boxes, coils and terminal units requiring periodic maintenance or repair.
    c. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring

maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart.

d. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
e. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
f. Contract modifications, actual equipment and materials installed.
g. Submit for review bound sets of the required drawings, manuals and operating instructions.

3. Electronic drawing files shall be generated by the Contractor.

PART 2 - PRODUCTS

2.2 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish manufacturers operating and maintenance instructions, parts lists and sources of supply for replacements in accordance with Division 1 - General Requirements.

B. Provide the following:

1. Complete sets of final and correct shop drawings, maintenance and replacement parts manuals, and operating instructions, for equipment supplied.
2. Bind each set within a common binder. Index and organize with a table of contents, to permit quick and convenient reference.
3. Three days of instruction in operation and maintenance of equipment to Owner's maintenance force. Design a 2-week period, convenient to Owner, during which qualified personnel, including manufacturers' technicians and engineers will be available for Owner's instruction.

C. Master Operating Manual (submit in quadruplicate and as digital PDF document)

1. Complete sets of final and correct shop drawings, maintenance and replacement parts manuals, and operating instructions, for equipment supplied.

a. Directory Manual – A TOC for all volumes in the Systems Manual shall be provided. Each heading should include a brief description of contents of each section to help when searching the PDF document.
b. Owner’s Project Requirements (OPR)
c. Basis of Design (BOD)
d. Construction Record Documents
e. System and equipment operating data / Maintenance Procedures – O&M materials as submitted and approved. This should not be limited to MEP O&M’s, but should include all applicable O&M materials through the specified divisions.
f. Final ATC as-built documents

g. Warranty Manual – A separate manual inclusive of all project warranties Warranty start dates shall be clearly presented and conform with project requirements Warranty claims procedures shall be clearly presented.

1) Manual shall be compiled in electronic format, shall be unprotected, and shall be searchable. The documents within this manual shall be easy to navigate provided with table of contents, filed individually tabbed & bookmarked.

2. Manufacturer's mechanical and electrical equipment parts lists of all components of the systems listed on the equipment schedules, control diagrams and wiring diagrams of controllers.

a. List shall give system number, unit number, manufacturer's model number, and manufacturer's drawing numbers.

3. Step by step operating instructions for each system including preparation for starting, summer operation, winter operation, shutdown and draining.
4. Maintenance instructions for each type of equipment.
5. List of nearest local suppliers for all equipment.
6. Manufacturer's literature describing each piece of equipment listed on the equipment schedules, control diagrams and wiring diagrams of controllers and a copy of the air balance report.
7. As-installed control diagrams by the control manufacturer.
8. Description of sequence operation by the control manufacturer.
9. Recommended trouble shooting procedures in the event of foreseeable mechanical system failure.
10. Chart of the tag numbers, location and function of each valve.
11. Copies of the following test reports:

a. Air Balance.
b. Water Balance.
c. System Performance.
d. Required Pressure Tests.

PART 3 - EXECUTION

3.0 HVAC DEMOLITION

Delete this Article if no HVAC demolition is required. Edit this Article as required for HVAC demolition. Show items for demolition on Drawings and supplement Drawings with descriptions in this Article.

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.0 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.0 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Inside of all ductwork where visible through registers and grilles: one coat of flat black paint.

3.0 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.0 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.0 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.1 COORDINATION AND LAYOUT

I. Study Drawings and Specifications to insure completeness of work required.

1. Include supplementary items normal to manufacturers' requirements or standard accepted trade practices as necessary to complete work, though not specifically indicated or specified.

J. Verify measurements and conditions in field before starting work.

K. Examine materials to which work is to be applied and notify the Architect, in writing, of any conditions existing, which are detrimental to proper and expeditious installation of work.

1. Starting of work shall be construed as acceptance of conditions.

L. Confer with other trades, install work to avoid interference with other trades, and possible necessary adjustments to conform to structural conditions and work of other trades.

M. Coordinate and set inserts and locate openings in floors and walls in new construction.

1. Locate pipes and ducts to avoid interference with other work shown on the drawings and as directed by the Architect.
2. Keep all concealed pipes and ducts within the enclosing construction provided.
3. Arrange exposed work neatly in parallel runs and parallel with walls or structure, with uniformly spaced hangers and supports, and within the spaces assigned for each kind of work.

N. Make coordinated layouts showing concrete work required for housekeeping pads, equipment bases and inertia masses, which are cast in place, including the location of anchors and dowels.

1. Coordinate the scheduling and placing of the concrete to suit the mechanical work schedules.
2. Concrete housekeeping pads are to cover the full area of each piece of equipment.
3. Concrete bases are to be of dimension and heights to suit the equipment.
4. The forming and placing of concrete will be provided under this specification section.

3.2 MAINTENANCE OF EQUIPMENT AND SYSTEM PRIOR TO FINAL ACCEPTANCE

A. Maintain all equipment and systems installed until final acceptance by the Architect and the Owner, and take such measures as necessary to insure adequate protection of all equipment and materials during delivery, storage, installation and shut-down conditions.

1. This responsibility shall include all provisions required to meet the conditions incidental to the delays pending final test of systems and equipment.

B. After installation of systems has been completed, operate the system to determine the capability of the equipment and controls to conform to the requirements of the drawings and specifications prior to performance testing.

3.3 EQUIPMENT INSTALLATION

A. Locate and set equipment anchor bolts, dowels and aligning devices for all equipment requiring them. Refer to concrete work coordination.

1. Level the equipment and grout solid between the equipment and the surface below. Grout to be premixed Embeco or Five Star Grout mixed in accordance with manufacturer's specifications.

B. The field assembly, installation and alignment of equipment is to be done under field supervision provided by the manufacturer or with inspections, adjustments and reviewed by the manufacturer.

C. Equipment startup.

1. Each manufacturer of equipment shall provide qualified personnel to inspect, review and to supervise the operating tests of the equipment.

D. Equipment and system test operation.

1. Notify the Architect in advance of beginning the equipment and system test operation.
2. Each piece of equipment shall be operated in its system as long as required to provide proper functioning.
3. Perform an operating test of each complete system for twenty-four hours continuous operation as a minimum, or as long as required to provide coordination and proper functioning of all related systems and controls.
4. The operating criteria for each test shall be determined in advance with the Architect's acceptance whenever seasonal conditions will not produce a full design load on any equipment or system.
5. Certify to the Owner that all equipment is functioning properly.
6. Should the apparatus fail to meet the contract requirements, adjust, repair or replace all defective or inoperative parts and again conduct the complete performance tests.

3.4 WORK RELATING TO CONTROLS AND INSTRUMENTS

A. Under Sections 230900 as applicable, provide control wiring for the following:

1. All circuits actuated by a temperature control system component.
2. All circuits which actuate a temperature control component.
3. All control panel wiring to terminal strips and field wiring from terminal strips to field mounted devices.
4. All wiring from the "AUTO" side of hand-off-auto switches on units being controlled by Sections 230900
5. Wiring of electro-mechanical devices required to be located on or in temperature control panels.
6. Wiring of DDC trunk, communication, and sensor cable wiring.
7. Wiring shall comply with material and workmanship standards of Division 26.
8. All 120 volt power wiring to vav boxes, damper actuators, line voltage thermostats, valve actuators, relay's, etc. not powered by 24 volt power is work of this division. Wiring shall comply with material and workmanship standards of Division 26.

B. Under Division 26, perform the following work under supervision of Sections 230900

1. Wiring of all devices and circuits carrying voltages greater than 120 volts.
2. Wiring of line and load power feeds to all disconnects, starters, and electric motors.
3. Wiring of 115 volt power feeds to all temperature control panels.
4. Power wiring to all motors 110 volt to 480 volt.
5. Furnish smoke detectors for mounting in ducts.
6. Specific power feeds shown or specified in Div 26 documents.

3.5 CLEANING AND ADJUSTING

A. Blow out, clean and flush each system of piping, and equipment as required to thoroughly clean the systems.

1. Clean all materials and equipment, and leave in condition ready to operate and receive succeeding finishes where required.
2. Adjust and align all equipment interconnected with couplings or belts.

    a. Adjust valves of all types and operating equipment of all types to provide proper operation.
    b. Remove and clean elements in all steam trap bodies.
    c. Clean all strainers.

B. Lubricate equipment as recommended by the manufacturer, during temporary construction use, and provide complete lubrication just prior to acceptance.

C. Permanent equipment operated during construction shall not be abused or be used in service different from its design application.

1. Temporary disposable filters shall be used during temporary operation.
2. All expendable media, including belts used for temporary operation and similar expendable materials shall be replaced just prior to acceptance.
3. Packing boxes of equipment operated during construction must be replaced just prior to system acceptance, using materials and methods specified by the supplying manufacturer.

D. Equipment furnished with factory finishes shall be retouched and repainted as required to present a new appearance.

E. Provide and maintain protection for all of the work whether completed or in progress.

1. Provide coverings and enclosures as required.

F. New and existing operating equipment and systems shall be clean and dust free inside and out.

1. Concealed and unoccupied areas such as plenums, pipe and duct spaces and Equipment Rooms shall be free of rubbish and swept clean at time of acceptance.

3.6 TESTING AND BALANCING

A. Tests shall be performed in accordance with Division 1 - General Requirements, and the following.

B. Provide the services of an independent air and water balancing and testing firm which specializes in balancing and testing of heating, ventilating and air conditioning systems, and which is acceptable to the Owner.

1. All instruments used shall be accurately calibrated and maintained in good working order. If requested, the balancing shall be conducted in the presence of the Architect/Owner.

C. Balancing shall not begin until the system has been completed and is in full working order.

1. After completion of the balancing and testing submit copies of the results to the Architect.

D. Perform tests and make necessary adjustments to obtain the flow and distribution of air and water required to produce the operating criteria called for by the contract documents, in accordance with the latest standards of the National Environmental Balancing Bureau and the Associated Air Balance Council.

1. Occupied spaces shall be draft free upon completion.

2. Provide any necessary baffles at registers and diffusers.
3. Maintain the specified acoustical performance of the systems.
4. Mark final position of dampers and balancing valves.

E. Upon completion of the installation, test and balance all equipment and systems under field operating conditions to demonstrate its compliance with specification requirements.

1. Submit three copies of the test report to the Architect. Refer to specification sections for details of report requirements.

F. Should any part of the system fail to meet the contract requirements, adjust, repair or replace all defective or inoperative parts again conduct the complete performance tests.

G. The Architect and Owner shall be notified, in writing, at least 48 hours prior to scheduled test dates.

3.7 PAINTING

A. Thoroughly clean all surfaces, requiring prime painting, of rust, loose scale, oil and grease.

1. Dry surfaces before painting.
2. Do not paint controls, nameplates, or labels.

B. Paint all equipment not painted at the factory with one prime coat.

C. Provide field painting as follows:

1. All exposed iron work, including uninsulated ferrous piping and conduit system components, hangers, supports, equipment bases, and apparatus; prime coat, red oxide primer.
2. Un-insulated ductwork and casing exposed to view and exposed galvanized surfaces of conduit and piping and of equipment prime painted at the shop as indicated on the drawings to be painted Prime coat, zinc chromate for galvanized surfaces.
3. Inside of all ductwork/plenums where visible through registers and grilles: One coat of flat black paint specifically designed for metal surfaces. Paint shall be low VOC.
4. Inside of all outdoor air intake plenums where visible through louvers: One coat of flat black paint specifically designed for exterior metal surface. Paint shall be low VOC.

3.8 CONNECTIONS TO EQUIPMENT

A. Provide mechanical connections to equipment and fixtures requiring such connections which are supplied by Owner or under other divisions.

B. Provide unions, nipples, adapters, valves, flexible connections, and other trim required for final connections for each such fixture or item of equipment, as required for complete and perfect operation.

3.9 WORKMANSHIP

A. Perform all work in a practical, neat and workmanlike manner with mechanics skilled in work, and using the best practices of the trade involved.

B. No work shall be concealed until it has been inspected and approved by the Architect.

C. Workmanship or materials not meeting with requirements of the specifications and drawings and satisfaction of the Architect shall be rejected and immediately replaced in an acceptable manner, without additional cost to the Owner.

3.10 LUBRICATION

A. All equipment furnished, installed or connected under this division, shall be inspected for proper lubrication when connected and before operation of the equipment is begun.

B. The Contractor for the work of this division will be held responsible for any damage to equipment that is operated without having been properly lubricated.

3.11 REMOVALS AND RELOCATIONS

A. All components of abandoned systems and abandoned portions of systems shall be removed, and, unless specifically noted to be relocated and reused, become the Owner's property. Contractor shall dispose of removed materials as directed by the Owner.

B. Where portions of systems noted for removal remain in use, permanently seal the point of disconnection so as not to interfere with the system operation.

C. Where interferences between the existing system components and new work require relocation of the existing components to clear that interference, they may be reused, except where specifically noted to the contrary, providing that their condition is noted by the Owner's representative and they are approved by him as equivalent to new.

D. Where existing system components are required to be replaced, all new components shall be provided.

E. System components include all accessories, cables, controls, conduits, hangers, bases and supports and outlets.

F. The work specified under this contract specifically excludes the removal or patching of "hazardous materials." This includes but is not limited to asbestos, PCBs or any other material having been designated by the Environmental Protection Agency as a hazardous material. If this contractor finds anything, which is suspected of being a hazardous material, it should be immediately brought to the Owner's attention.

3.12 USE OF PREMISES AND CLEANING

A. Remove and dispose of all waste materials and rubbish due to all construction operations under the contract, except as otherwise noted, and keep the building free from rubbish and dirt caused by his and/or his subcontractors' employees.

1. During the entire progress of the work, rubbish removal shall be made frequently so as to prevent any potential safety or health hazard.

B. Upon completion of the work, remove all protection, paint, putty, and other stains from all fixtures and glass and leave the premises thoroughly broom cleaned.

3.13 CUTTING, ALTERING AND PATCHING

A. Provide all cutting, chasing, drilling, altering and rough patching required for the work of this division.

1. Including the restoring of existing work cut for or damaged by installation of new work, and where present work is removed.
2. All materials and workmanship required in connection with cutting, altering and rough patching shall match the existing work in every respect.

B. Do all shoring, bracing, cutting, patching, piecing out, filling in, repairing and refinishing of all present work as made necessary by the alteration and the installation of new work.

C. All holes and openings occurring in the existing floors after equipment, partitions, floors, steel work, conduits and pipes are removed or installed shall be closed up with materials similar to the adjacent work.

D. The size and location of items requiring an opening, chase or other provisions to receive it shall be given by the trade requiring same in ample time to avoid undue cutting of any new work to be installed. These provisions shall not relieve the Contractor from keeping informed as to the required opening, chases, etc., nor from responsibility for the correctness thereof, nor for cutting and repairing after the new work is in place.

E. Include all cutting, repairing and patching in connection with the work that may be required to make the several parts come together properly and fit it to receive or be received by the work of other trades, as shown on the drawings and/or specified, or reasonably implied by the drawings and specifications.

F. All repairing, patching, piecing-out, filling-in, restoring and refinishing shall be neatly done by mechanics skilled in their trade to leave same in condition satisfactory to the Owner.

G. Materials and their methods of application for patching shall comply with applicable requirements of the specifications.

1. Materials and workmanship not covered by the specifications and items of work exposed to view adjoining existing work to remain shall conform to similar materials and workmanship existing in or adjacent to the spaces to be altered.

H. Cutting, repairing and patching shall include all items shown on the drawings, specified in the specifications or required by the installation of new work or the removal of existing work.

I. Remove partitions, walls, suspended ceilings, etc., as necessary to perform the required alterations or new construction work.

1. Avoid damage to construction and finishes that are to remain.

J. Protect and be responsible for the existing building, facilities and improvements.

1. Any disturbance or damage to the work, the existing building, and improvements, or any impairments of facilities resulting from the construction operations, shall be promptly rectified, with the disturbed, damaged, or impaired work, restored, repaired or replaced at no extra cost.

K. All alterations which are not indicated on the drawings nor specified herein but necessary to make good existing work disturbed by reason of the work shall be restored to a condition satisfactory to the Owner.

L. All holes in masonry floors and walls are to be core drilled.

M. Disturbed concrete and /or cement floor areas shall be patched with approved type latex mortar.

1. When cement mortar is used for patching, the surfaces shall be depressed a minimum depth of 1".

N. Reinstall all weather protection work in waterproof manner.

O. Openings in roofs.

1. Openings in roofs shall be kept properly plugged and caulked at all times, except when being worked on, to preclude the possibility of flooding due to storms or other causes. After completion of work, openings shall be permanently sealed.

P. Temporary openings.

1. All temporary openings cut in walls, floors or ceilings for pipe or ductwork shall be closed off with transite or an equally non-combustible material except when mechanics are actually working at the particular opening.

3.14 SEPARATIONS AND NON-RATED ASSEMBLIES

A. Pack annular space between duct (insulation), sleeve and pipe (insulation) and / or conduit in fire rated and non-rated construction with fire retardant putty, sealant and / or caulk. Material shall be non-asbestos based and installed in accordance with manufacturers instructions for fire rating required.

B. Penetrations of multiple items and penetrations with annular space greater than 1/2" shall be provided with a backing material in accordance with manufacturer’s instructions and as part of a UL listed assembly.

C. Fire retardant sealer and system shall meet ASTM E-84, ASTM E-814, and UL-1479.

D. All fire stopping shall be provided by one (1) manufacturer. Refer to Division 07 and architectural drawings for all requirements.

E.

MANUFACTURER	MODEL
Dowsil	Firestop 700
STI	SSP100 Fire Putty
Nelson	CLK, FSP
3M	CP-25WB, Fire Putty MP

3.15 SHUTDOWN OF EXISTING BUILDING SYSTEMS

A. Do not interrupt existing services or systems in the building unless absolutely necessary. Such interruptions and interferences must be made as brief as possible and only after coordination with the Owner. The Owner requires a minimum of seven (7) days notice. Obtain prior permission, in writing.

B. Where the work makes temporary interruptions unavoidable, they shall be made during off hours. "Off hours" shall be dictated by the Owner.

C. Arrange to work continuously, including overtime, if required, to assure that systems will shut down only during the time actually required to make the necessary connections to existing work.

3.16 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain all new equipment. Refer to Division 1 Section "Demonstration and Training."

B. The contractor and subcontractors shall be responsible for coordinating, scheduling and completing operations and maintenance training for the Owners designated personnel on all systems and equipment.

C. All training materials (agenda, hand-outs, etc.) shall be submitted to the Owner for review and approval at least two weeks in advance of scheduled training.

D. Equipment training shall be provided by a factory authorized technical representatives, experienced in training, operation and maintenance procedures for installed systems, subsystems and equipment.

E. All qualifications and certifications of the individual performing the training shall be submitted to the Owner for review and approval at least two weeks in advance of scheduled training.

F. Each Subcontractor responsible for training will submit a written training plan to the Owner for review and approval at least two weeks in advance of scheduled training. The plan will include field orientation during installation, classroom instruction and field training after the completion of installation.

G. For all major systems and equipment, the automated temperature controls subcontractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others in addition to formal automated temperature controls training on work station operation, graphics, etc.

H. Provisions shall be included to provide formal classroom training to representatives of the Owner’s personnel for select systems and equipment above and beyond typical preventative maintenance training (e.g. manufacturer provided training school, etc.). Coordinate requirements with the owner.

I. Provisions shall be included to provide professional videotaping of classroom training. For systems not being commissioned, the CM will carry the responsibility of hiring the Cx Videographer. The duration and intensity of the videotaping is to be specified at the discretion of the Owner.

J. Training Requirements Outline:

1. General familiarization and operating procedures for each of the building’s system installations.
2. Routine maintenance procedures for equipment.
3. Specific operating and maintenance procedures for:

    a. Mechanical systems

b. Electrical systems
c. Plumbing systems
d. Fire protection systems
e. Temperature control system

4. Maintenance Procedures: Include manufacturer's written recommendations and the following:

   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Schedule for routine cleaning and maintenance.
   e. Repair instructions.

5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
6. Video Documentation: The contractor(s) shall provide for the services of a qualified videographer to digitally record the training sessions.

END OF SECTION 23 00 00

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.
3. Silicone sealants.

B. Related Requirements:

1. Division 07 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends. Applications in new, poured concrete shall be furnished with an integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in concrete floors, and concrete/masonry walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete/masonry walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply

with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6: Galvanized-Steel-Pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-Steel-Pipe sleeves.

2. Interior Masonry and Concrete Walls:

    a. Piping Smaller Than NPS 6: Galvanized-Steel-Pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

3. Pipe Penetrations Through Fire Rated Assemblies:

    a. The Contractor shall coordinate with the firestopping system manufacturer to determine if a pipe sleeve is required to comply with the manufacturer’s installation instructions and the listed firestop system’s testing standards.
    b. All penetrations shall maintain the fire-resistance rating of the wall or assembly.
    c. Sleeves, where required, shall be properly sized, aligned, and installed to accommodate the pipe type (metallic or non-metallic), account for thermal expansion or movement, and ensure compatibility with the approved firestop system.
    d. Installation shall follow the firestop system’s listed design and manufacturer’s guidelines.

END OF SECTION 23 05 17

SECTION 23 05 19 - METERS AND GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gauges.
3. Thermowells.
4. Gauge attachments.
5. Test plugs.

B. Related Sections:

1. Division 23 Section "Hydronic Piping”.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Schedule for thermometers, gauges indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer, gauge signed by product manufacturer.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: minimum 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.	Trerice, H. O. Co.	B856-SGW-SWV
2.	Palmer Wahl Instrumentation Group.	5A-SPG-CS
3.	Weiss Instruments, Inc.	5VBM

B. Standard: ASME B40.200.

C. Case: Sealed type; stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with scale markings and scales in deg F.

E. Connector Type(s): Swivel union joint, adjustable angle, external adjust reset, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 inch in diameter; stainless steel, for thermowell installation and of length to suit installation.

H. Window: Glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Accuracy: Plus or minus 1 percent of range.

2.2 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, threaded-type metal fitting made for insertion into piping tee fitting and of type, diameter, and length required to hold thermometer.

1. Standard: ASME B40.200.

2. Material for Use with Copper Tubing: Brass.
3. Material for Use with Steel Piping: Stainless Steel.
4. Type: Tapered shank.
5. Bore: Diameter required to match thermometer bulb or stem.
6. Insertion Length: Length required to match thermometer bulb or stem.
7. Lagging Extension: Include on thermowells for insulated piping and tubing.
8. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

2.3 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.	Trerice, H. O. Co.	450B-SGW, 450LFB-SGW
2.	Wika	232.34, 233.34
3.	Weiss	NF4UGY2, LF4UGY2

B. Direct-and Remote Mounting, Dry and Liquid Filled, Dial-Type Pressure Gauges: Indicating-dial type complying with ASME B40.100.

1. Case: Dry and liquid filled, reinforced thermoplastic or reinforced polypropylene, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type.
4. Movement: Stainless steel mechanical, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with scale markings graduated in psi.
6. Pointer: Metal, micrometer adjustable pointer.
7. Window: Safety Glass.
8. Ring: Reinforced thermoplastic or reinforced polypropylene.
9. Accuracy: Grade 2A, plus or minus 0.5 percent of full scale.
10. Range for Fluids under Pressure: Two times operating pressure.
11. Provide 316 stainless steel capillary tubing and assembly for remote mounted gauges.

2.4 GAUGE ATTACHMENTS

A. Match attachment size below with pressure-gauge-connection size.

1. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
2. Siphons: NPS 1/4 or NPS 1/2 pipe threads.
3. Valves: Brass or stainless-steel ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads. Provide valve extensions to allow handle function to not interfere with the full insulation thickness.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

2.6 TEST KIT

A. Furnish one test kit containing one pressure gauge and adaptor, one thermometer, and carrying case. Pressure gauge, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gauge: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
3. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers where indicated on the plans, details and specifications.

B. Provide the following temperature ranges for thermometers:

1. Heating Hot Water: 30 to 400 deg F, with 2-degree scale divisions.
2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

3. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

3.2 PRESSURE GAUGE APPLICATIONS

A. Install pressure gauges where indicated on the plans, details and specifications.

B. Install liquid filled-type pressure gauges at the following locations:

1. Discharge of each pressure-reducing valve

C. Install dry-type pressure gauges at the following locations:

1. Across water coils per details.

D. Provide the following pressure ranges for pressure gauges:

1. Scale: Two times operating pressure.

3.3 INSTALLATIONS

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions for ease of reading.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.

I. Install remote-mounted pressure gauges on panel.

J. Install valve and snubber in piping for each pressure gauge for fluids.

K. Install valve and siphon fittings in piping for each pressure gauge for medium and high temperature hot water.

L. Install siphon, valve and snubber fittings in piping for each pressure gauge for steam.

M. Provide valve extensions to allow handle function to not interfere with the full insulation thickness.

N. Install test plugs in piping tees.

O. Install permanent indicators on walls or brackets in accessible and readable positions.

P. Install connection fittings in accessible locations for attachment to portable indicators.

Q. All meters and gauges shall be installed according to manufacturer’s requirements.

3.4 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance for meters, gauges, machines, and equipment.

3.5 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gauges to proper angle for best visibility.

END OF SECTION 23 05 19

SECTION 23 05 23 - GENERAL-DUTY VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. High performance ball valves.
3. High-performance butterfly valves.
4. Bronze swing check valves.
5. Iron swing check valves with closure control.
6. Iron, center-guided check valves.
7. Bronze globe valves.

B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NRS: Nonrising stem.

D. OS&Y: Outside screw and yoke.

E. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: minimum five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: All high performance valves (ball and butterfly) 2 1/2” and larger.
2. Handlever: For quarter-turn valves NPS 4and smaller.
3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, except high performance ball valves.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Lugged: for all high performance butterfly valves and iron butterfly valves.
2. Flanged: for high performance ball valves
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Milwaukee Valve Company.
b. NIBCO INC.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Apollo, Conbraco Industries

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Soldered or Threaded.
f. Seats: PTFE or TFE.

g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

3. Insulating tee handle/valve stem insulation:

a. Provide insulating tee handle by the valve manufacturer, if an insulating tee handle is not offered by the valve manufacturer, then an extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation shall be provided.
b. Manufacturer specific insulated tee handles include but are not limited to the following:

1)	Milwaukee	Model: Insulator/MS
2)	Nibco	Model: Nib-Seal insulated handle
3)	Apollo	Model: Therma Seal

4. Insulating tee handle/valve stem insulation:

a. Provide insulating tee handle by the valve manufacturer, if an insulating tee handle is not offered by the valve manufacturer, then an extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation shall be provided.
b. Manufacturer specific insulated tee handles include but are not limited to the following:

1)	Milwaukee	Model: Insulator/MS
2)	Nibco	Model: Nib-Seal insulated handle
3)	Apollo	Model: Therma Seal

2.3 HIGH PERFORMANCE BALL VALVES

A. Class 150, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bray Controls; a division of Bray International.
b. Jamesbury
c. Zwick ArmaturenGMBH.
d. Adams.
e. Apollo, Conbraco Industries
f. NIBCO

2. Description:

a. Standard: MSS SP-72.

b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel.
e. Ends: Flanged or threaded.
f. Seats: M-filled PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.
j. Handle: Gear actuator 2 ½" and larger

3. Insulating tee handle/valve stem insulation:

a. Provide insulating tee handle by the valve manufacturer, if an insulating tee handle is not offered by the valve manufacturer, then an extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation shall be provided.
b. Manufacturer specific insulated tee handles include but are not limited to the following:

1)	Milwaukee	Model: Insulator/MS
2)	Nibco	Model: Nib-Seal insulated handle
3)	Apollo	Model: Therma Seal

2.4 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zwick Armaturen GMBH.
b. Adams.
c. Bray Controls; a division of Bray International.
d. Jamesbury
e. Milwaukee Valve Company

2. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 285 psig at 500 deg F.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel.
e. Seat: Reinforced PTFE. MTFE or Xtreme.
f. Stem: Stainless steel; double offset from seat plane and pipe center axis.
g. Disc: Carbon steel.
h. Service: Bidirectional.
i. Handle: Gear actuator

2.5 BRONZE SWING CHECK VALVES

A. All check valves shall be low pressure type.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Milwaukee Valve Company.
b. NIBCO INC.
c. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.6 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO INC.
b. Mueller
c. Kennedy Valve Co.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
   c. NPS 14 to NPS 24, CWP Rating: 150 psig.
   d. Body Design: Clear or full waterway.
   e. Body Material: ASTM A 126, gray iron with bolted bonnet.
   f. Ends: Flanged.
   g. Trim: Bronze.
   h. Gasket: Asbestos free.
   i. Closure Control: Factory-installed, exterior lever and weight.

2.7 IRON, CENTER-GUIDED CHECK VALVES

A. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crispin Valve.
   c. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
   c. NPS 14 to NPS 24, CWP Rating: 250 psig.
   d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
   e. Style: Globe, spring loaded.
   f. Ends: Flanged.
   g. Seat: Stainless Steel.

2.8 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Red-White Valve Corporation.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide and install access doors in ceilings and walls where valves are located behind inaccessible ceilings and walls. Indicate all access doors on shop drawings, coordinate locations with architect.

C. Provide support of piping adjacent to valves such that no force is imposed upon valves.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above center of pipe.

F. Install valves in position to allow full stem movement.

G. Install chain wheels on gear operators for ball, butterfly, and globe valves greater than or equal to 83 inches above floor. Extend chains to 48 inches above finished floor. Provide chain storage bucket for each.

H. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

I. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

J. Install insulating tee handle for all manually operated ball valves.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly valves
2. Butterfly Valve Dead-End Service: Lug type.
3. Throttling Service except Steam: Globe, ball or butterfly valves.

B. Valves installed in wet/damp or exterior locations shall be suitable for the environment. Valve bodies, handles, flanges, wheels shall be factory epoxy coated by the manufacturer. Bolts, washers, and nuts used for flange connections shall be stainless steel.

C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

D. Select valves, with the following end connections:

1. Chilled, and hot water:

a. For Copper Tubing, NPS 2 and Smaller: Threaded ends or soldered ends with union.
b. For Steel Piping: Lug type. Flanged for high performance ball valves

3.5 CHILLED WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves: Two-piece, full port, bronze with stainless steel trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.
3. Bronze Globe Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. High Performance Butterfly Valves: Class 150; Lug type
2. High performance Ball Valves: flanged
3. Ball Valves: Two piece, full port, bronze with stainless steel trim.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, or lever and weight.
5. Iron, Center-Guided Check Valves: Class 150, globe, metal seat.
6. Iron Globe Valves: Class 125.

3.6 HEATING WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves: Two-piece, full port, bronze with stainless steel trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.
3. Bronze Globe Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. High Performance Butterfly Valves: Class 150; Lug type
2. High performance Ball Valves: flanged
3. Ball Valves: Two-piece, full port, bronze with stainless steel trim.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, or lever and weight.

5. Iron, Center-Guided Check Valves: Class 150, globe, metal seat.
6. Iron Globe Valves: Class 125.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.
7. Thermal-hanger shield inserts
8. Insulation clamps

B. Related Sections:

1. Section 232113 “Hydronic Piping”
2. Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design shop and field fabricated trapeze pipe hangers and shop and field fabricated equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for shop and field fabricated components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For shop and field fabricated trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of shop and field fabricated trapeze hangers.
2. Design Calculations: Calculate requirements for designing shop and field fabricated trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, metal pipe hanger and support systems shall be one of the following or engineer-approved equal.

1. Anvil International
2. ERICO, Inc.
3. PHD
4. Hubbard Enterprises

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS-SP-58, factory-fabricated components, for Types indicated in PART 3 EXECUTION.
2. Metallic Coatings:

a. Corrosive/Moist/Exterior environments: Hot dipped galvanized.
b. General Service: Electrogalvanized.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. MSS SP-58 Continuous-thread hanger rod, nuts, and washers:

a. Corrosive/Moist/Exterior environments: Carbon-Steel Hot dipped galvanized.
b. General Service: Carbon-Steel Electrogalvanized.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS-SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes.

B. Metallic Coatings:

1. Corrosive/Moist/Exterior environments: Hot dipped galvanized.
2. General Service: Electrogalvanized.

C. MSS SP-58 Continuous-thread hanger rod, nuts, washers, and U-bolts:

1. Corrosive/Moist/Exterior environments: Carbon-Steel Hot dipped galvanized.
2. General Service: Carbon-Steel Electrogalvanized.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of:

    a. General Service: Carbon-Steel.

7. Metallic Coatings:

    a. Corrosive/Moist/Exterior environments: Hot dipped galvanized.
    b. General Service: Electrogalvanized.

8. All hanger rod and channel ends; exposed and less than or equal to 12 ft above finished floor; shall be provided with plastic caps and plastic channel safety end caps. Color shall be same throughout the project.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Buckaroos, Inc.
2. Zsi-Foster HWP/HWT

B. 3.75 PCF phenolic foam or calcium silicate pipe insulation shall have a maximum K factor of 0.16 Btu-in/hr-ft²°F at a mean temperature of 75°F.

C. For cold applications below 75°F, a zero perm rated (ASTM E96), abuse resistant vapor retarder jacket with an 1 ½" wide acrylic longitudinal self-seal tape shall be installed. Matching zero perm Butt Strips will be provided for a complete sealed

system. Insulation and zero perm jacketing shall extend 1 ½" beyond the Saddle to allow for sealing the butt joints to be sealed with a 3" wide zero perm.

D. ASTM E84 0 FSI, 50 SDI

E. For Trapeze or Clamped Systems: Shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Shield shall cover lower 180 degrees of pipe.

2.6 INSULATION CLAMPS

A. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1.	Zsi-Foster	Cush-A-Therm
2.	Aeroflex	Aerofix

B. Insulation shall be continuous through support.

C. ASTM E84 0 FSI, 50 SDI

D. Water vapor permeability: 0 (ASTM E96)

2.7 FASTENER SYSTEMS

A. Mechanical-Wedge Anchors: Wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a.	Powers Fasteners.	Model Power-Stud
b.	B-Line Systems, Inc.; a division of Cooper Industries	Model AWA
c.	Hilti, Inc.	Model KB
d.	ITW Ramset/Red Head.	Model Trubolt
e.	MKT Fastening, LLC.	Model Sup-R-Stud

B. Mechanical Anchor: Steel threaded fastening system for suspending threaded rod vertically overhead; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a.	Powers Fasteners.	Model Vertigo; Wood Vertical Hanger and Wood Side Hanger

b. B-Line Systems, Inc.; a division of Cooper Industries Model ARS, ARSW
c. Simpson Strong-Tie Model RWV, RWH

2.8 EQUIPMENT SUPPORTS

A. Indoor equipment supports:

1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

B. Metallic Coatings:

1. General Service: Electrogalvanized.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars

B. Metallic Coatings:

1. General Service: Electrogalvanized.

C. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS-SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS-SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. All hanger rod and channel ends; exposed and less than or equal to 12ft above finished floor; shall be provided with plastic caps and plastic channel safety end caps. Color shall be same throughout the project.

E. Thermal-Hanger Shield Installation: Install in all pipe hangers and shields for insulated piping.

F. Fastener System Installation:

1. Powder-actuated fasteners are not acceptable.
2. When possible, install concrete inserts before placing concrete.
3. Install mechanical-wedge type anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
4. Pin/nail anchors, spikes, expansion shields, expansion anchors, dropin anchors, wedge bolts, self-tapping screws, screw anchors, and friction clamps are not acceptable.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Install insulated clamps.
2. Attach clamps and spacers to piping. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
3. Install MSS SP-58, Type 39, protection saddles. Fill interior voids with insulation that matches adjoining insulation.
4. Install MSS SP-58, Type 40, protective shields. Shields shall span an arc of 180 degrees.

    a. Thermal-hanger shield inserts shall be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

5. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

6. Insert Material: Length at a minimum of 2” longer; in each direction; than protective shield length.

P. All pipe hangers shall be sized to accommodate the pipe, pipe insulation thickness and protective shields and saddles. Insulation shall be continuous through all hangers and penetrations.

1. Insulation may not be continuous through the hanger when riser clamps and pipe clamps are utilized for vertical support. Insulation shall be continuous around the pipe clamp and continue 3” on the method of support; threaded rod, pipe stand.
2. Insulation shall be continuous through the hanger when pipe clamps are utilized for horizontal suspension. Full circumference protective shield shall be utilized.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

C. Provide plastic caps on the ends of all threaded rod exposed and less than or equal to 12ft above finished floor. Color shall be same throughout the project.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS-SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel electrogalvanized pipe hangers and supports, electrogalvanized metal trapeze pipe hangers and electrogalvanized metal framing systems and attachments for general service applications.

F. Use carbon-steel hot dipped galvanized pipe hangers and supports, hot dipped galvanized metal trapeze pipe hangers and hot dipped galvanized metal framing systems and attachments for corrosive/moist/exterior service applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated and insulated, stationary pipes NPS 1/2 to NPS 2.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For floor mounting of insulated , stationary pipes below 100°F NPS 3/8 to NPS 3.
6. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
7. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 2-1/2 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
10. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

11. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Wedge type mechanical expansion anchor: For upper attachment to suspend hangers from concrete.
2. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete.
3. Top-Beam (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Retaining strap/clip required.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length indicated in above sections.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS-SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

1. Each pipe shall be provided with a U-bolt to retain the pipe on the hanger.
2. Each insulated pipe shall be provided with a 360 degree insulation shield at each U-bolt.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical-wedge type anchors in concrete after concrete is placed and completely cured instead of building attachments where required in concrete construction.

1. Powder-actuated fasteners are not acceptable.
2. When possible, install concrete inserts before placing concrete.
3. Install mechanical-wedge type anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
4. Pin/nail anchors, spikes, expansion shields, expansion anchors, dropin anchors, wedge bolts, self tapping screws, screw anchors, and friction clamps are not acceptable.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation mounts.
2. Housed spring mounts.
3. Elastomeric hangers.
4. Spring hangers.
5. Restraining braces and cables.
6. Thrust Restraints

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Seismic Design Category (SDC): B
2. In Seismic Design Categories A & B: HVAC systems are exempt from requirements for seismic bracing, except for ductwork and piping crossing seismic joints.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

    a. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    b. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kinetics Noise Control. (KNC)
2. Mason Industries. (MI)
3. Vibration Eliminator Co., Inc. (VE)

B. Pads, Type NP (Neoprene Pad): Arranged in a single layer of ¾” thick ribbed or waffled neoprene for uniform loading over pad area, molded with a nonslip pattern and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.
Type NP isolators shall be one of the following products:
Type Super W…….MI

Type NGD.……..KNC
Type 400N..……VE

C. Spring Isolators Type FSN (Floor Spring and Neoprene): Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
   Type FSN isolators shall be one of the following products with appropriate neoprene pad (if used) selected from Type NP:
   Type SLFH.……MI
   Type FDS B…….KNC
   Type OST……VE
   Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
7. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
8. Base: Factory drilled for bolting to structure.
9. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

D. Elastomeric Hangers Type HN (Hanger Neoprene): Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

E. Type HN isolators shall be one of the following products:
   Type HD.……..…….MI
   Type RH…….……KNC
   Type 3C..……VE

F. Spring Hangers Type HSN (Hanger Spring and Neoprene): Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

Type HSN isolators shall be one of the following products:

Type 30N……..….MI
Type SRH……..……..…..KNC
Type SNRC……..….VE

2.2 FLEXIBLE DUCT CONNECTIONS

A. Refer to specification section 233300 for requirements.

2.3 STAINLESS STEEL FLEXIBLE PIPE CONNECTIONS (FPC-SS) FOR CONNECTION TO ALL EQUIPMENT WITH SPRING ISOLATION (AIR HANDLING UNIT COILS, ETC.)

A. Refer to Flexible Pipe Connections (FPC) Pipe To Pump above for pipe to pump connection requirements.

B. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

Flanged		
3" x 12"	6" x 18"	12" x 24"
4" x 12"	8" x 18"	14" x 30"
5" x 18"	10" x 18"	16" x 32"

Male Nipples		
1/2" x 12"	1-1/4" x 12"	2" x 12"
3/4" x 12"	1-1/2"x 12"	2-1/2" x 18"
1" x 12"		

At equipment, hoses shall be installed on the equipment side of the shut-off valves horizontal and parallel to the equipment shafts wherever possible. Flexible pipe connections shall be one of the following or an approved equal:

Type FFL……..…… M.I.

2.4 THRUST RESTRAINTS

A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as

specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be precompressed at the factory to allow for a maximum of 1/4" movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods. Thrust restraints shall be one of the following products or an approved equal:

Type TRK ..... A.B.
Type HSR ..... K.N.C.
Type WB ..... M.I.
Thrust Restraint ..... V.E.

2.5 GROMMETS

A. Grommets shall be made of neoprene or neoprene impregnated duck that is specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an approved equal:

Type Isogrommets..... MBIS, Inc. (Bedford Heights, OH)
Type WB ..... Barry Controls (Brighton, MA)
Type HG.....Mason Industries Inc. (Hauppauge, NY)

2.6 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the resilient, nonhardening sealants indicated below:

Acoustical sealant ..... D.A.P.
BR-96 or AC-20 (AC-20 FTR - Fire Rated) ..... Pecora
Sonoloc ..... Sanborn
Acoustical Sealant #834 (Acrylic Latex).....Tremco
Acoustical sealant ..... U.S.G.

2.7 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

PART 1 - EXECUTION

1.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

D. General

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the drawings or specified herein.
2. The static deflections of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will not be approved.

E. Major Equipment Isolation

1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on housekeeping pads. See architectural or structural drawings for details.
2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as scheduled on the drawings or specified hereunder.
3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the drawings.
4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment.

5. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.
6. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 2.5" or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

F. Miscellaneous Mechanical Equipment Isolation

1. Miscellaneous pieces of mechanical equipment, such as converters, pressure reducing stations, strainers, storage tanks, condensate receiver tanks, and expansion tanks, which are connected to isolated piping systems, shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for 0.1" static deflection), unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

G. Pipe Isolation

1. All chilled water, condenser water, hot water, drain piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:

    a. Within mechanical rooms;
    b. Within 50' total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.);

2. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.
3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2", Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to 1/2", Type HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type HN achieving at least 1/4" static deflection.
4. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.
5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
6. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the drawings.

H. Duct Isolation

1. All sheet metal ducts and air plenums that are within mechanical rooms or within a distance of 50' total duct length of connected vibration-isolated equipment (whichever is longer) shall be isolated from the building structure by Type HSN or HN isolators. All isolators shall achieve 1" minimum static deflection.
2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3. Flexible duct connections shall be provided as called for above under Major Equipment and wherever shown on the drawings.

1.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

B. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

E. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Use wedge type anchors only.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

1.4 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.
4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad. Anchors shall be located a minimum of 6” from the edge of the pad.
5. Hanger rods for vibration-isolated support shall be connected to major structural members, not the floor slab between major structural members. Provide suitable intermediate support members as necessary.
6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
7. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and unisolated pipes on the same trapeze.
8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
10. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
2. Unless otherwise indicated, there is to be a minimum operating clearance of 1" between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
3. Isolation bases shall be installed in strict accordance with the manufacturer’s instructions.

D. Flexible Duct Connections

1. Prior to installation of the flexible connection, sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section, and the gap between connected parts shall be uniform. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections

1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.
2. Where equipment is spring isolated, install flexible pipe connections at all pipe connections to equipment.

F. Thrust Restraints

1. Thrust restraints shall be attached on each side of the fan parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

1.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

1.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

1.7 HVAC VIBRATION-CONTROL SCHEDULE

A. Refer to schedule on drawings.

END OF SECTION 23 05 48

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 5 by 3 inches.
6. Minimum Letter Size: 1 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws; adhesive for locations were screws or rivets would void warranty of equipment.

B. Label Content: Include equipment's Drawing designation tag or unique equipment number, equipment description, and electrical panel designation serving the equipment. Pump tags shall also indicate gpm, ft of head, and HP for the pump, as indicated on the balance report submittal.

1. Label Format:
EQUIPMENT NUMBER
DESCRIPTION
SERVICE
DATA
ELECTRIC PANEL

2. Examples:

CWP-5	AHU-1
CHILLED WATER PUMP	VAV AIR HANDLING UNIT
CHILLED BEAMS	FIRST FLOOR EAST
210 GPM / 55 FT / 5 HP	15,000 CFM,
EP-7 / CKT 15,16,17	EP-9 / CKT 21,22,23

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

D. Plastic labels shall be plenum rated when located in plenums.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 5 by 3 inch.

F. Minimum Letter Size: 1 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws; adhesive for locations were screws or rivets would void warranty of equipment.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

I. Plastic labels shall be plenum rated when located in plenums.

2.3 PIPE LABELS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Marking Service Inc. MS-478, MS-970 +MS-1000
2. Seton
3. Brimar Industries

B. General Requirements for Manufactured Pipe Labels: Machine printed, color-coded, with lettering indicating service, pipe size, and showing flow direction. Marker/hand written labels are not acceptable. Not to be utilized on bare pipe with fluid temperatures over 125°F.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners (straps for 6” O.D. of insulation and larger are acceptable) or adhesive. Self-adhesive, sticker type, or pre-coiled polyester with self-sealing lap are not acceptable. Pipe labels and pipe labels adhered to a clear pretensioned sleeve are not acceptable.

D. Pipe Label Color Schedule: Coordinate with facility standards. If no facility standards exist or are not desired, conform to ASME/ANSI A13.1 - 2023.

E. Pipe Label Contents: Include identification of piping service, pipe size, and an arrow indicating flow direction.

1. Lettering Size: Conform to ASME/ANSI A13.1 - 2023.

F. Pipe labels located within plenums only: Self-adhesive, sticker type, rated for plenum use.

1. Pipe Label Contents: Include identification of piping service, pipe size, and an arrow indicating flow direction.

G. Pipe labels located outdoors shall be provided with a UV protective coating.

2.4 DUCT LABELS

A. Stencils: Minimum letter height of 2 inches for ducts; and minimum letter height of 1 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Paint: Exterior, acrylic enamel in colors as indicated.

B. Label Contents: Include identification of duct service using same designations as used on Drawings, duct size, and an arrow indicating flow direction.

C. Lettering and arrows color shall meet the facilities standards, if no standard exists, confirm the following color scheme is acceptable prior to commencement of work:

1. Lettering and Arrows:

a. Blue: For outside air supply ducts.
b. Yellow: For supply air ducts.
c. Green: For exhaust, relief, return, and mixed air ducts.
d. Red: For hazardous material exhaust.

2.5 VALVE TAGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Inland Products
2. NAPTAGS
3. Indianapolis Badge & Nameplate Company
4. Carolina Laser, Inc.
5. Metal Marker Manufacturing Company

B. Valve Tags: Stamped or engraved with 1/2-inch letters for piping system abbreviation and valve number and 1/4-inch for all other information. Laser engraved and etched text is not acceptable.

1. Tag Material: Brass, 0.040 inches minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Jack chain with S-hook.

C. Valve Tag Contents: Include identification of piping service using full designations as used on Drawings symbol and abbreviations lists, equipment served, service, and valve number. Do not use abbreviations.

1. Label Format: VALVE NUMBER
   EQUIPMENT SERVED
   SERVICE
   DESCRIPTION

2. Example: HWS-001
   AHU-1 HEATING COIL
   HOT WATER SUPPLY
   ISOLATION VALVE

D. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. As required for label information.

2. Valve-Tag Color:

   a. Natural.

3. Letter Color:

   a. Black.

E. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.
2. Valve-tag schedule shall be framed behind glass and located in each mechanical room.

2.6 AIR CONTROL DEVICE IDENTIFICATION

A. Identifying Ribbons: Nylon

1. Size: Minimum 1-inch-wide by minimum 12 inches long, free hanging length.
2. Fasteners: Hand tied.
3. Color: Orange or Yellow.

B. Nylon ribbons shall be plenum rated when located in air plenums.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 inches high by 7 inches long.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Red background with white lettering.

B. Plastic labels shall be plenum rated when located in plenums.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible. Where equipment is located within finished spaces, equipment labels shall not be located on the face of the equipment; where possible, the label shall be located on the least conspicuous side.

C. All motor driven equipment, HVAC components, and major electrical boxes shall be individually numbered. (Example: For unit heaters, use UH-1, UH-2, etc., even though both units are of the same size and type.) All designations shall be unique, integrated with and distinguished from existing designations.

D. Air handling unit tags shall have a minimum of 1-inch-high lettering.

E. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them. All items of equipment such as fans, pumps, etc., shall be clearly marked using engraved nameplates as hereinafter specified. The item of equipment shall indicate the same number as shown on the Drawings.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units (less than 2’ in length)
3. Where flow pattern is not obvious, mark each pipe at branch.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings.
8. Both side of penetrations through walls, floors, ceilings, and inaccessible enclosures.
9. At all changes of direction.
10. And at all locations required to conform to ASME/ANSI A13.1 - 2023.

B. Pipe Label Color Schedule: Coordinate with facility standards. If no facility standards exist or are not desired, conform to ASME/ANSI A13.1 - 2023.

C. All self-adhesive/sticker type labels located in plenums shall be secured with additional flow arrow tape at each end of the label. Flow arrow tape shall be installed a minimum of 1.5 wraps around the entire circumference of the pipe at each end of the label.

3.4 DUCT LABEL INSTALLATION

A. Stenciled Duct Label: Stenciled labels, showing service, duct size, and flow direction.

B. Locate labels/stencils:

1. Near points where ducts enter into concealed spaces.
2. At maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.
3. At all changes of direction.
4. Both sides of penetrations through walls, floors, ceilings, and inaccessible enclosures.
5. Near major equipment items and other points of origination and termination.

C. Labeling/stenciling of all exposed ductwork shall be coordinated with the architect and engineer prior to the commencement.

3.5 VALVE-TAG INSTALLATION

A. Install tags on all valves and control devices in piping systems, including check valves, valves within factory-fabricated equipment units and shutoff valves. List tagged valves in a valve schedule.

3.6 AIR CONTROL DEVICE IDENTIFICATION INSTALLATION

A. Install identifying ribbons on all control devices in duct systems including but not limited to manual volume/balance dampers, splitter dampers, cable operated dampers, automatic control dampers, and barometric dampers when located above accessible and inaccessible ceilings.

B. Ribbon tied on to control device for the purpose of visibly identifying device locations.

C. Attach ribbons at the time each control device is installed.

D. Ribbon shall hang down a minimum of 12” from control device. Ribbons shall not hang below any ceiling.

END OF SECTION 23 05 53

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

    a. Rigid Insulation Blocks.
    b. Rigid Insulation for Elbows and Fittings
    c. Cellular glass.
    d. Flexible elastomeric.
    e. Mineral fiber.

2. Fire-rated insulation systems.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Field-applied jackets.
7. Tapes.
8. Securements.
9. Corner angles.
10. Insulation at Duct Hangers

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Insulation schedule indicating insulating material and thickness, service, location (interior, exterior), jacket type, and fastening method.

C. Jacketing schedule indicating thickness, service, location (interior, exterior), color.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

G. Products of one type, shall be by one manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program, manufacturer's installation training certification or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer.

D. Follow manufacturer's recommended handling practices.

E. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants; whenever available.

F. Fiber Glass and Mold: Contractor shall take precaution to protect insulation materials from moisture exposure or physical damage. Any fiber glass insulation that becomes wet or damaged shall be replaced at no additional cost.

1. HVAC duct work insulation used in the air stream must be discarded if exposed to liquid water.

1.5 DEFINITIONS

A. Thermal Conductivity (k value): BTU-in. / (hr · ft² · °F)

B. UL Environment / GREENGUARD provides independent, third-party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product-related pollutants. Certification is based upon criteria used by EPA, OSHA and WHO.

C. IAQ: Indoor Air Quality

D. EPA: Environmental Protection Agency

E. WHO: World Health Organization

F. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no paper ex-posed.

G. ASJ: All Service Jacket

H. SSL+: Self-sealing Advanced Closure System

I. SSL: Self-Sealing Lap

J. FSK: Foil-Scrim-Kraft; jacketing

K. PSK: Poly-Scrim-Kraft; jacketing

L. PVC: Polyvinyl Chloride

M. FRP: Fiberglass Reinforced Plastic

N. ECOSE® Technology: a revolutionary new binder system based on rapidly renewable bio-based materials rather than petroleum-based chemicals commonly used in other fiber glass insulation products. ECOSE Technology reduces our binder embodied energy by up to 70% and does not contain phenol, formaldehyde, acrylics or artificial colors.

O. The UL Environment / GREENGUARD Certification Program (formerly known as GREENGUARD Indoor Air Quality Certification) gives assurance that products designed for use in indoor spaces meet strict chemical emissions limits, which contribute to the creation of healthier interiors. Achieving UL Environment / GREENGUARD Certification gives credence to manufacturers' sustainability claims, backing them with empirical scientific data from an unbiased, third-party organization.

P. UL Environment / GREENGUARD GOLD Certification: (Formerly known as GREENGUARD CHILDREN & SCHOOLS Certification) offers stricter certification criteria, considers safety factors to account for sensitive individuals (such as children and the elderly), and ensures that a product is acceptable for use in environments such as schools and healthcare facilities. It is referenced by both The Collaborative for High Performance Schools (CHPS) and the Leadership in Energy and Environmental Design (LEED) Building Rating Systems.

Q. UL Environment / GREENGUARD Formaldehyde Free Verification Requirements: for a product to be verified as formaldehyde free, product samples must have a measured emission factor of less than or equal to 5 µg/m2 h at 24 elapsed hours or 3 µg/m2 h at 336 elapsed hours. An emission factor of 5 µg/m2 h, corresponds to a chamber concentration of 2.5 µg/m3 for a typical building ratio of 0.5 m2/m3.This chamber concentration is comparable to, or below typical outdoor air concentrations. This demonstrates that the formaldehyde exposure from products labeled as formaldehyde free will not contribute to airborne formaldehyde concentrations at greater levels than those found in the natural outdoor environment.

R. Underwriter's Laboratories Environment (UL Environment / GREENGUARD): offers independent green claims validation, product assessment and certification. UL Environment / GREENGUARD provides third-party credibility for sustainable products.

S. UL Environment Claims Validation (ECV): service and label tests a manufacturer's product and validates that the environmental claims they make in their marketing and packaging materials are factual. This Environmental Claims Validation (ECV) service will allow manufacturers to verify that their products contain a quantifiable amount of recycled content and, as such, help limit raw material extraction and reduce landfill waste. It also will enable products to qualify for LEED® points under Pilot Credit 43: MR – Certified Products.

T. EUCEB: exonerated fiber from a health and safety standpoint by the European Certification Board process.

U. Recycled content – post-consumer: materials such as bottled glass collected at curbside or other collection sites after consumer use and used in the manufacturing process to create a new product rather than being placed in a landfill or incinerated.

V. Recycled content – pre-consumer (aka post-industrial): materials used or created from one manufacturing process which are collect-ed as scrap and placed back into another manufacturing process rather than being placed in a landfill or incinerated.

W. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Oc-ta-BDE or Deca-BDE fire retardants: have been linked to adverse health effects after exposure in low concentrations.

X. UL Classified: UL has tested and evaluated samples of the product with respect to certain properties of the product. UL Classifies products to:

Applicable UL requirements

Standards for safety

Standards of other National and International organizations

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Rigid Insulation Blocks: High density, rigid fiberglass material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hamfab H Block

2. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less as tested by ASTM E 84.
3. Factory-Applied Jacket: ASJ-SSL. Requirements are specified in "Factory-Applied Jackets" Article.
4. Service temperatures: -120° F. to +1000° F.
5. Density: 18 lb. cu./ft.
6. Moisture absorption: 0.2% by volume, 96 hrs. at 120° F/ 96% RH
7. Corrosion: Does not cause or accelerate corrosion
8. Safety: Non-combustible
9. Shrinkage: None
10. Dimensionally stable
11. Alkalinity: Ph9
12. Thermal Conductivity: K = .30 (stable, non-deteriorating)
13. Compressive strength: nominal 5% deflection at 30PSI, nominal 10% deflection at 80PSI

G. Rigid Insulation for Elbows and Fittings: High density, rigid fiberglass or mineral wool material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hamfab
   b. FGH Insulation
   c. Tru-Fit Roc 1200
   d. Distribution International

2. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less as tested by ASTM E 84.
3. Field-Applied Jacket: PVC. Requirements are specified in "Field-Applied Jackets" Article.
4. Service temperatures: -120° F. to +1000° F.
5. Corrosion: Does not cause or accelerate corrosion
6. Safety: Non-combustible
7. Shrinkage: None
8. Dimensionally stable
9. Water Vapor Sorption: less than 1%

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Insulation shall be formaldehyde-free or GREENGUARD Gold Indoor Air Quality

Certified and meet the GREENGUARD Gold standards for low Volatile Organic Compound (VOC) emissions. Comply with ASTM C 553, Type I and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite FSK.
    c. Knauf Insulation; Atmosphere Duct Wrap with ECOSE Technology.
    d. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Insulation shall be formaldehyde-free or GREENGUARD Gold Indoor Air Quality Certified and meet the GREENGUARD Gold standards for low Volatile Organic Compound (VOC) emissions. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ for all exposed locations, FSK (attic locations). Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; CertaPro Commercial Board - CB 300.
    b. Johns Manville; 800 Series Spin-Glas - Type 814.
    c. Knauf Insulation; Atmosphere Air Duct Board with ECOSE technology-3.0 pcf.
    d. Owens Corning; Fiberglas 703 Series.

J. Mineral-Fiber, Preformed Pipe Insulation: Insulation shall be formaldehyde-free or GREENGUARD Gold Indoor Air Quality Certified and meet the GREENGUARD Gold standards for low Volatile Organic Compound (VOC) emissions.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000 Pipe Insulation with ECOSE® Technology.
    c. Manson Insulation Inc.; Alley-K.
    d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
4. Type IV Grade A 1000 Degree Materials: Glass fiber manufactured with a bio based binder. ASTM C 547, Type IV Grade A. Factory applied ASJ + SSL+ Jacketing.

5. Type IV Grade A 1000 Degree Materials: Glass fiber manufactured with a bio based binder ASTM C 547, Type IV Grade A. Factory applied Redi-Klad Jacket: Venture Clad 5-ply weather and abuse resistant with self seal lap. Zeo Perm Jacket.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Insulation shall be formaldehyde-free or GREENGUARD Gold Indoor Air Quality Certified and meet the GREENGUARD Gold standards for low Volatile Organic Compound (VOC) emissions. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation with ECOSE® Technolgy.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1 or 2-hour fire rating by a NRTL acceptable to authority having jurisdiction and meet ASTM E 2336.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Morgan Advanced Materials; Pyroscat Ductwrap XL
b. Morgan Advanced Materials; FireMaster FastWrap XL
c. 3M; Fire Barrier Wrap Products.
d. Unifrax; Fyre Wrap

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. Red Devil, Inc.; Celulon Ultra Clear.
d. Proto PVC Liquid Adhesive

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. Marathon Industries, Inc.; 590.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. Marathon Industries, Inc.; 501.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.

3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; Encacel.
   b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
   c. Marathon Industries, Inc.; 570.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-76.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45.
   c. Marathon Industries, Inc.; 405.
   d. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Submit color chart for selection by facility. Color of the pvc jacket shall be different for each system type.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, mechanical joints.

5. Factory-fabricated tank heads and tank side panels.
6. Fitting and pipe jacket shall be 25/50 flame and smoke spread rated.
7. Thickness: 20 mil minimum.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing.
    b. 0.024” thickness.
    c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

    a. Sheet and roll stock ready for shop or field sizing.
    b. Material, finish, and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

7. Comply with UL 181-A.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CH-10.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: ONLY ACCEPTABLE FOR EQUIPMENT, TANKS AND VESSELS. NOT TO BE USED ON DUCTWORK. Baseplate welded to projecting spindle that is capable of

holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1-1/2 inch by 1-1/2 inch, PVC according to ASTM D 1784, Class 16354-C.

B. Manufacturers:

1. Speed Line Corporation
2. Or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Continuous, unbroken vapor barrier is required on all below ambient service piping, ductwork, and equipment.

K. Where vapor barrier is indicated, for joints, seams, and penetrations; insulate hangers, supports, anchors, and other projections with appropriate insulation material finishing it with a vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
6. On any piping that will carry chilled liquid, create a water dam every fourth joint by sealing the butted ends of the pipe covering with the correct mastic.

N. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness. Installed thickness shall meet the specified thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Do not over compress insulation during installation to less than 75% stated thickness. Installed thickness shall meet the specified thickness.

C. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation.
4. Insulate valves using preformed fitting insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulation and finish ends with cement.
5. Insulate strainers using preformed fitting insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Insulate unions using removable thermal blanket insulation covers specified in the above sections.
8. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a

breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

9. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
10. Stencil the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

E. Install removable thermal blanket insulation covers at all hot water:

1. automatic control valves ≥4”
2. unions ≥ 4”
3. butterfly valves

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Do not over compress insulation during installation to less than 75% stated thickness. Installed thickness shall meet the specified thickness.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

F. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and discharge-weld insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 18 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Impale insulation over pins and attach speed washers.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 6 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Install high density, rigid insulation sections (similar to H-Block or rigid polyisocyanurate board insulation) between ductwork and support/hanger (trapeze).
8. Insulate duct stiffeners, hangers, stands, legs, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

G. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and discharge-weld insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Do not over compress insulation during installation.
4. Install capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 12 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 12 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

5. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions. Refer to sections above for vapor stops.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
    c. Do not over compress insulation during installation.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
8. Install high density, rigid insulation sections (similar to H-Block or rigid polyisocyanurate board insulation) between ductwork and support/hanger (trapeze).
9. Install PVC corner angles on all edges of insulated ductwork; 6ft and less above finished floor; within mechanical rooms. Apply tape and mastic on both legs of the angle to fully adhere the ancles to the insulation and cover the angles.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

    1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
    2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
    3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

    1. Draw jacket material smooth.
    2. Install lap or joint strips with same material as jacket.
    3. Secure jacket to insulation with manufacturer's recommended adhesive.
    4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install as follows:

1. Circumferential seams shall be a minimum 1 inch (25 mm) overlap, and longitudinal seams shall be 1.5 to 2 inch (38 to 51 mm) overlap. For horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
2. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
3. PVC pipe end caps shall be provided at all piping ends wherever the pipe insulation terminates, to seal or conceal edges of the pipe insulation.
4. Cone reducers shall be provided where changes of insulation/pipe sizes occur.
5. On below ambient services, an intermediate vapor retarder compatible with PVC is required to completely seal the insulation prior to installing the PVC cover. Care should be taken to ensure that the vapor barrier mastic is applied between the pipe insulation and the fitting cover, and on fitting cover throat overlap seam. All circumferential and longitudinal seams of jackets and fitting covers should be sealed with manufacturers recommended solvent welding adhesive.
6. PVC jacketing colors shall be different for every system. Comply with the Facilities Standards color scheme; if one is not present, provide the following for all back of house and mechanical spaces:

Service (Piping and Equipment)	Jacket Color
Primary Chilled Water	DARK BLUE
Low Temperature Hot Water Heating	ORANGE
Coil Condensate	WHITE

7. PVC jacketing for piping located in front of house, public spaces, may be a single color or may follow the above chart. PVC jacketing color for these spaces shall be coordinated with the architect.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 INSULATION AT DUCTWORK HANGERS

A. For board insulation:

1. Place high density insulation board (Hamfab H-Block or polyisocyanurate) between angle iron or strut support and duct. High density insulation shall extend beyond bearing surface of duct. Duct requiring vapor barrier must not bear directly on support system.
2. Apply vapor jacket and tape. Continue the vapor barrier across high density board between duct support and insulation.

3. For board insulation over flanged duct, maintain minimum 1/2" thickness insulation beyond flange height. May require oversized insulation to be cut and material removed where flange is located. Required on outdoor air ducts and as an alternate insulation system over duct flange: apply insulation board to ductwork butting to the flange, place a 3” wide strip over top of the flange to overlap first layer of board insulation by a minimum of 1". Provide vapor barrier mastic and tape around entire perimeter.

B. For blanket insulation

1. Place high density insulation board (Hamfab H-Block or polyisocyanurate) between angle iron or strut support and duct. High density insulation shall extend beyond bearing surface of duct. Duct requiring vapor barrier must not bear directly on support system.
2. Apply vapor jacket and tape. Continue the vapor barrier across high density board between duct support and insulation.
3. For blanket insulation over flanged duct, maintain the thickness specified beyond flange height. Provide vapor barrier mastic and tape around entire perimeter.
4. For insulated duct with strap hangers, provide vapor seal tape where strap penetrates through the insulation or vapor barrier.

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.10 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 DUCT AND PLENUM INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return, and outdoor air, unless otherwise noted.
2. Indoor, exposed supply, return, and outdoor air, unless otherwise noted.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior and 10 ft upstream of damper.
4. Indoor, exposed exhaust between isolation damper and penetration of building exterior and 10 ft upstream of damper.
5. Flexible duct connectors shall be insulated with blanket type insulation to allow movement.
6. And all systems/requirements indicated on the drawings schedules.

B. Items Not Insulated: unless otherwise noted.

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1
2. Vibration-control devices.
3. Factory-insulated access panels and doors.

3.13 PIPING, VALVES, FITTING, EQUIPMENT INSULATION SCHEDULE, GENERAL

A. Refer to schedule on drawings and specification requirements.

3.14 FIELD-APPLIED JACKET SCHEDULE

A. Refer to schedule on drawings and specification requirements.

B. All interior exposed piping shall be fitted with PVC jacketing.

END OF SECTION 23 07 00

SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC, ELECTRICAL, AND PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 230519 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
2. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.
3. Section 019113 – General Commissioning Requirements.

1.2 SUMMARY

A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

E. This contractor shall include and provide the controls, equipment, meters, devices, gauges, sensors and control wiring for all equipment and sequences indicated and implied in this section, Specification Section 230993 SEQUENCE OF OPERATION, on the plans, schedules, and on the flow and control diagrams.

F. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

G. Section 019113 – General Commissioning Requirements.

1.3 DEFINITIONS

A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level.

C. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.

D. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.

E. Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

G. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.

H. Node: A digitally programmable entity existing on the BMS network.

I. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes; including third party controls and devices, in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.

J. Provide: The term “Provide” and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.

K. PC: Personal Computer from a recognized major manufacturer

L. Furnish: The term “Furnish” and its derivatives when used in this Division shall mean supply at the BMS Contractor’s cost to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.

M. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.

N. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.

O. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.

P. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

Q. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.

R. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.

S. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC	-	Analog to Digital Converter
AI	-	Analog Input
AN	-	Application Node
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
ASHRAE		American Society of Heating, Refrigeration and Air Conditioning Engineers
AWG	-	American Wire Gauge
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	Digital Input
DO	-	Digital Output
EEPROM	-	Electronically Erasable Programmable Read Only Memory
EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers

I/O	-	Input/Output
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not In Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
RTD	-	Resistance Temperature Device
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
TTD	-	Thermistor Temperature Device
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current
WAN	-	Wide Area Network

1.4 BMS DESCRIPTION

A. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

C. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division's specification together with the associated Drawings and the associated interfacing work as referenced in the related documents.

D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces,

wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

E. Provide a complete, neat and workmanlike installation. Use only manufacturer approved employees/contractors who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

F. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades. Notify relevant contractors, owner and design team if the work of other trades is impeding any BMS work.

G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BMS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.

H. Vendor shall provide ALL required hardware, software, equipment, programming, wiring, power, etc. for a fully functional and complete operational system.

I. All controllers, local control units, control units, unitary controllers, shall be provided with uninterruptable power supplies. In the event of the loss of normal power, the controllers shall continue to operate for a user adjustable period of up to 10 minutes to maintain controls.

J. All controls work shall be provided and installed by the BMS contractor, unless specified otherwise. Equipment shall be controlled, monitored and programmed through the BMS with end-devices provided by the BMS Contractor.

K. BMS time shall utilize the astronomical time clock.

1.5 QUALITY ASSURANCE

A. General

1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.
2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
3. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. As evidence and assurance of the contractor’s ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer’s latest standard of design at the time of bid.
6. BMS manufacturer shall be able to show backward compatibility of software and controllers for a minimum of 10 years.

B. Workplace Safety and Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors’ company is in full compliance with the Project safety requirements.
8. The Contractor’s safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor’s employees and subcontractor’s staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:

   a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
   b. Manage the financial aspects of the BMS Contract.
   c. Coordinate as necessary with other trades.
   d. Be responsible for the work and actions of the BMS workforce on site.

2. The Project Manager shall be the same through the course of the project and shall not be changed without notification to and approval by the Owner.

1.6 REFERENCES

A. All work shall conform to the following Codes and Standards, as applicable:

1. National Fire Protection Association (NFPA) Standards.
2. National Electric Code (NEC) and applicable local Electric Code.
3. Underwriters Laboratories (UL) listing and labels.
4. UL 864 UUKL Smoke Control
5. UL 268 Smoke Detectors.
6. UL 916 Energy Management
7. NFPA 70 - National Electrical Code.
8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
9. NFPA 92A and 92B Smoke Purge/Control Equipment.
10. Factory Mutual (FM).
11. American National Standards Institute (ANSI).
12. National Electric Manufacturer’s Association (NEMA).
13. American Society of Mechanical Engineers (ASME).
14. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
15. Air Movement and Control Association (AMCA).
16. Institute of Electrical and Electronic Engineers (IEEE).
17. American Standard Code for Information Interchange (ASCII).
18. Electronics Industries Association (EIA).
19. Occupational Safety and Health Administration (OSHA).
20. American Society for Testing and Materials (ASTM).
21. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
22. Americans Disability Act (ADA)
23. ANSI/EIA 909.1-A-1999 (LonWorks)
24. ANSI/ASHRAE Standard 135-2010 (BACnet)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.7 SUBMITTALS

A. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 60 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
4. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
5. The BMS Contractor shall correct any errors or omissions noted in the first review, these and any further corrections and additions to subsequent submittals shall be bubbled with a revision cloud.
6. At a minimum, submit the following:

    a. BMS network architecture diagrams including all nodes and interconnections.
    b. Systems schematics, sequences and flow diagrams.
    c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
    d. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
    e. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
    f. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Design and Actual Valve CV, Design Pressure and Actual Pressure Drop, and Actuator Type.
    g. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
    h. Details of all BMS interfaces and connections to the work of other trades.
    i. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

B. The BMS shall adhere to the most recent version of the Facilities control system standards.

C. Laminated control drawings including system control schematics, as-built sequences of operation, as-built controller locations and panel termination drawings, shall be provided in panels for major pieces of equipment. Terminal unit drawings shall be located in the central plant equipment panel or mechanical room panel. The drawings shall accurately record the actual controller programming and settings at the time of building turnover and an electronic copy of all as-builts shall be provided to the Instrumentation & Controls department at the completion of the project.

1.8 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals

1. Four (4) printed hard copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project.

2. The entire Operation and Maintenance Manual shall also be uploaded to the BMS server/operator workstation in PDF format, accessible via a graphical link. The Operation and Maintenance Manual link and the printed hard copies shall include the following in an organized, tabulated fashion:

    a. Table of contents.
    b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
    c. Manufacturer’s product data sheets or catalog pages for all products including software.
    d. System Operator’s manuals.
    e. Archive copy of all site-specific databases and sequences.
    f. BMS network diagrams.
    g. Final record of BMS sequence of operations.
    h. Interfaces to all third-party products and work by other trades.

B. All As-Built drawings and documentation shall be uploaded to the BMS server/operator workstation in PDF format. Each equipment graphic shall contain a link to a copy of the as-built documents associated with the system including, at a minimum, the controls flow diagram, controller wiring diagrams, sequence of operation and cut sheets for applicable control devices.

C. Digital copies of the Operation and Maintenance Manual and As-built documents shall be provided in PDF format, on a USB flash drive, and turned over to the Owner at the completion of the project. The USB flash drive shall include all necessary software required to access and view the documents. A logically organized table of contents shall provide dynamic links to view and print all documents. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 WARRANTY

A. Standard Material and Labor Warranty:

1. Provide an eighteen (18) month labor and material warranty on the BMS from substantial completion.
2. If within eighteen (18) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming are readily available. Warranty work shall be done during BMS Contractor's normal business hours.

PART 2 - PRODUCTS

2.1 DDC SYSTEM CONTROLLERS

A. Controller

1. The Controller shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
2. The controllers shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The controller shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The controller shall include a removable base to allow pre-wiring without the controller.
6. The controller shall include troubleshooting LED indicators to identify the following conditions:

    a. Power On
    b. Power Off
    c. Download or Startup in progress, not ready for normal operation
    d. No Faults
    e. Device Fault
    f. Field Bus - Normal Data Transmission
    g. Field Bus - No Data Transmission
    h. Field Bus - No Communication
    i. Sensor-Actuator Bus - Normal Data Transmission

j. Sensor-Actuator Bus - No Data Transmission
k. Sensor-Actuator Bus - No Communication

7. The controller shall accommodate the direct wiring of analog and binary I/O field points.
8. The controller shall support the following types of inputs and outputs:

   a. Universal Inputs - shall be configured to monitor any of the following:

      1) Analog Input, Voltage Mode
      2) Analog Input, Current Mode
      3) Analog Input, Resistive Mode
      4) Binary Input, Dry Contact Maintained Mode
      5) Binary Input, Pulse Counter Mode

   b. Binary Inputs - shall be configured to monitor either of the following:

      1) Dry Contact Maintained Mode
      2) Pulse Counter Mode

   c. Analog Outputs - shall be configured to output either of the following

      1) Analog Output, Voltage Mode
      2) Analog Output, current Mode

   d. Binary Outputs - shall output the following:

      1) 24 VAC Triac

   e. Configurable Outputs - shall be capable of the following:

      1) Analog Output, Voltage Mode
      2) Binary Output Mode

9. The controller shall have the ability to reside on a Controller Bus

   a. The controller Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
   b. The controller Bus shall support communications between the controllers.
   c. The controller Bus shall also support Input/Output Module (IOM) communications with the controllers.
   d. The controller Bus shall support a minimum of 100 IOMs and controller in any combination.
   e. The controller Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.

10. The controller shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

    a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
    b. The SA Bus shall support a minimum of 10 devices per trunk.
    c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the controller and the furthest connected device.

11. The controller shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the Controller Bus or the SA Bus.
12. The Controller shall support, but not be limited to, the following:

    a. Hot water, chilled water/central plant applications
    b. Built-up air handling units for special applications
    c. Terminal units
    d. Special programs as required for systems control

2.2 FIELD DEVICES

A. Input/Output Module

1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the Controller.
2. The IOM shall communicate with the Controller over either the Controller Bus or the SA Bus using BACnet Standard protocol SSPC-135, Clause 9.
3. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
4. The IOM shall have a minimum of 4 points to a maximum of 17 points.
5. The IOM shall support the following types of inputs and outputs:

    a. Universal Inputs - shall be configured to monitor any of the following:

        1) Analog Input, Voltage Mode
        2) Analog Input, Current Mode
        3) Analog Input, Resistive Mode
        4) Binary Input, Dry Contact Maintained Mode
        5) Binary Input, Pulse Counter Mode

    b. Binary Inputs - shall be configured to monitor either of the following:

        1) Dry Contact Maintained Mode
        2) Pulse Counter Mode

    c. Analog Outputs - shall be configured to output either of the following

        1) Analog Output, Voltage Mode
        2) Analog Output, current Mode

d. Binary Outputs - shall output the following:

1) 24 VAC Triac

e. Configurable Outputs - shall be capable of the following:

1) Analog Output, Voltage Mode
2) Binary Output Mode

6. The IOM shall include troubleshooting LED indicators to identify the following conditions:

a. Power On
b. Power Off
c. Download or Startup in progress, not ready for normal operation
d. No Faults
e. Device Fault
f. Normal Data Transmission
g. No Data Transmission
h. No Communication

B. Networked Thermostat

1. The Networked Thermostat

a. shall be capable of controlling any piece of equipment scheduled on the contract documents.
b. shall communicate over the Field Controller Bus using BACnet Standard protocol SSPC-135, Clause 9.
c. shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.
d. shall provide an occupancy override function. Activation of timed override switch on zone thermostats shall only reset zone heating and cooling setpoints to “occupied” values, but shall not affect otherwise scheduled Unoccupied operating mode of air handling unit. This allows the user to override the Unoccupied scheduled setpoints and put the system into an occupied setpoints mode for set duration and reset to normal operation at the end of the period or whenever the override button is held for more than 5 seconds (adjustable). The override duration is individually adjustable for each thermostat through the BMS or the same range can be applied to all thermostats globally.
e. shall provide local temperature adjustment via a knob, slider bar, or tough screen adjustment. The temperature adjustment range shall be individually adjustable for each thermostat, programmed through the BMS or the same range can be applied to all thermostats globally.
f. shall provide the flexibility to support any one of the following inputs:

1) Integral Indoor Air Temperature Sensor
2) Duct Mount Air Temperature Sensor

3) Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.
4) Two configurable binary inputs

g. shall provide the flexibility to support any one of the following outputs:

1) Three Speed Fan Control
2) Two On/Off
3) Two Floating
4) Two Proportional (0 to 10V)

h. shall provide a minimum of six (6) levels of keypad lockout.
i. shall employ nonvolatile electrically erasable programmable read-only memory for all adjustable parameters.
j. shall have backlit LCD digital display.
k. shall not include the manufacturer's name or logo exposed to view.

C. Network Sensors

1. shall have the ability to monitor the following variable as required by the systems sequence of operations:

a. One sensor for Zone Temperature and Zone setpoint
b. One sensor for Zone Humidity

2. shall transmit the zone information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
3. shall include the following items:

a. Plain space mounted sensors with temperature sensing only.
b. Space mounted sensors with humidity sensing only.

4. shall be available with either screw terminals or phone jack.
5. shall be available in either surface mount or wall mount styles.
6. shall not include the manufacturer's name or logo exposed to view.

2.3 SYSTEM TOOLS

A. System Configuration Tool

1. The Configuration Tool shall be a software package enabling a computer platform to be used as a stand-alone engineering configuration tool.
2. The configuration tool shall provide an archive database for the configuration and application data.
3. The configuration tool shall have the same look-and-feel at the User Interface (UI) regardless of whether the configuration is being done online or offline.

4. The configuration tool shall include the following features:

    a. Basic system navigation tree for connected networks
    b. Integration of Metasys N1, LonWorks, and BACnet enabled devices
    c. Customized user navigation trees
    d. Point naming operating parameter setting
    e. Graphic diagram configuration
    f. Alarm and event message routing
    g. Graphical logic connector tool for custom programming
    h. Downloading, uploading, and archiving databases

5. The configuration tool shall have the capability to automatically discover field devices on connected buses and networks. Automatic discovery shall be available for the following field devices:

    a. BACnet Devices
    b. LonWorks devices
    c. N2 Bus devices
    d. Metasys N1 networks

6. The configuration tool shall be capable of programming the Field Equipment Controllers.

    a. The configuration tool shall provide the capability to configure, simulate, and commission the Controllers.
    b. The configuration tool shall allow the controllers to be run in Simulation Mode to verify the applications.
    c. The configuration tool shall contain a library of standard applications to be used for configuration.

7. The configuration tool shall be capable of programming the field devices.

    a. The configuration tool shall provide the capability to configure, simulate, and commission the field devices.
    b. The configuration tool shall allow the field devices to be run in Simulation Mode to verify the applications.
    c. The configuration tool shall contain a library of standard applications to be used for configuration

8. A wireless access point shall allow a wireless enabled portable PC to make a temporary Ethernet connection to the automation network.

    a. The wireless connection shall allow the PC to access configuration tool through the web browser using the User Interface (UI).
    b. The wireless use of configuration tool shall be the same as a wired connection in every respect.
    c. The wireless connection shall use the Bluetooth Wireless Technology.

B. Wireless MS/TP Converter

1. The converter shall provide a temporary wireless connection between the SA or Field Bus and a wireless enabled portable PC.
2. The converter shall support downloading and troubleshooting controllers and field devices from the PC over the wireless connection.
3. The converter shall employ Bluetooth Wireless Technology.
4. The converter shall be powered through a connection to either the Sensor-Actuator (SA) or the Controller Bus.
5. The converter shall operate over a minimum of thirty three (33) feet within a building.
6. The converter shall have LED indicators to provide information regarding the following conditions:

    a. Power - On/Off
    b. Fault - Fault/No Fault
    c. SA Controller Bus - Bus Activity/ No Bus Activity
    d. Blue - Bluetooth Communication Established/ Bluetooth Communication Not Established

7. The SWCVT shall comply with FCC Part 15.247 regulations for low-power unlicensed transmitters.

C. Handheld VAV Balancing Sensor

1. The sensor shall be a light weight portable device of dimensions not more than 3.2 x 3.2 x 1.0 inches.
2. The sensor shall be capable of displaying data and setting balancing parameters for VAV control applications.
3. The sensor shall be powered through a connection to either the Sensor-Actuator (SA) or the Controller Bus.
4. The sensor shall be a menu driven device that shall modify itself automatically depending upon what type of application resides in the controller.
5. The sensor shall contain a dial and two buttons to navigate through the menu and to set balancing parameters.
6. The sensor shall provide an adjustable time-out parameter that will return the controller to normal operation if the balancing operation is aborted or abandoned.
7. The sensor shall include the following

    a. 5 foot retractable cable
    b. Laminated user guide
    c. Nylon caring case

8. The sensor shall be Underwriters Laboratory UL 916 listed and CSA certified C22.2 N. 205, CFR47.

2.4 INPUT DEVICES

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
2. Finished space wall mounted room sensors shall not include the manufactures name or logo exposed to view.

B. Temperature Sensors

1. General Requirements:

a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	**Accuracy**
Water Temperature	± .5°F
Room Temperature	± .5°F
Duct Temperature	± .5°F
All Others	+ .75°F

2. Room Temperature Sensors

a. Room sensors shall be constructed for either surface or wall box mounting.

3. Thermo wells

a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
b. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
c. Thermo wells and sensors shall be mounted in a threadolet or 1/2” NFT saddle and allow easy access to the sensor for repair or replacement.
d. Thermo wells shall be constructed of 316 stainless steel.

4. Outside Air Sensors

    a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
    b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
    c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

5. Duct Mount Sensors

    a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
    b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
    c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

6. Averaging Sensors

    a. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
    b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
    c. Capillary supports at the sides of the duct shall be provided to support the sensing string.

7. Acceptable Manufacturers: Alerton Controls, Setra.

C. Humidity Sensors

1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 deg F unless specified elsewhere.
4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.

6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
7. Acceptable Manufacturers: Veris Industries, and Mamac.

D. Differential Pressure Transmitters

1. General Air and Water Pressure Transmitter Requirements:

   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
   c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
   d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

2. Low Differential Water Pressure Applications (0” - 20” w.c.)

   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:

      1) .01-20” w.c. input differential pressure range.
      2) 4-20 mA output.
      3) Maintain accuracy up to 20 to 1 ratio turndown.
      4) Reference Accuracy: +0.2% of full span.

   c. Acceptable Manufacturers: Setra and Mamac.

3. Medium to High Differential Water Pressure Applications (Over 21” w.c.)

   a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:

      1) Differential pressure range 10” w.c. to 300 PSI.
      2) Reference Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability).

   b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low

connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

c. Acceptable Manufacturers: Setra and Mamac.

4. Building Differential Air Pressure Applications (-1” to +1” w.c.)

   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:

      1) -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
      2) 4-20 mA output.
      3) Maintain accuracy up to 20 to 1 ratio turndown.
      4) Reference Accuracy: +0.2% of full span.

   c. Acceptable Manufacturers: BAPI and Setra.

5. Low Differential Air Pressure Applications (0” to 5” w.c.)

   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:

      1) (0.00 - 1.00” to 5.00”) w.c. input differential pressure ranges. (Select range appropriate for system application.)
      2) 4-20 mA output.
      3) Maintain accuracy up to 20 to 1 ratio turndown.
      4) Reference Accuracy: +0.2% of full span.

   c. Acceptable Manufacturers: BAPI and Setra.

6. Medium Differential Air Pressure Applications (5” to 21” w.c.)

   a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:

      1) Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
      2) Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.

3) Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).

b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

c. Acceptable manufacturers: BAPI and Setra.

E. Flow Monitoring

1. Air Flow Monitoring

a. Fan Inlet Air Flow Measuring Stations

1) At the inlet of each fan and near the exit of the inlet sound trap, airflow traverse probes shall be provided that shall continuously monitor the fan air volumes and system velocity pressure.

2) Each traverse probe shall be of a dual manifolded, cylindrical, type 3003 extruded aluminum configuration, having an anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifold shall have sensors located along the stagnation plane of the approaching airflow. The manifold should not have forward projecting sensors into the air stream. The static pressure manifold shall incorporate dual offset static tops on the opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as + 20° in the approaching air stream.

3) The airflow traverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presences in the air stream. Each airflow-measuring probe shall contain multiple total and static pressure sensors placed at equal distances along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for duct traversing.

4) Airflow measuring stations shall be manufactured by Air Monitor Corp., Tek-Air Systems, Inc., Ebtron, or Dietrich Standard.

b. Single Probe Air Flow Measuring Sensor

1) The single probe airflow-measuring sensor shall be duct mounted with an adjustable sensor insertion length of up to eight inches. The transmitter shall produce a 4-20 mA or 0-10 VDC signal linear to air velocity. The sensor shall be a hot wire anemometer and utilize two temperature sensors and a heater element temperature. The other sensor shall measure the downstream air temperature. The temperature differential shall be directly related to airflow velocity.
2) Acceptable manufacturers: Air Monitor Corp., Tek-Air, Ebtron Model GOLD (basis of design). Provide full 3 year warranty.

c. Duct Air Flow Measuring Stations

1) Each device shall be designed and built to comply with, and provide results in accordance with, accepted practice as defined for system testing in the ASHRAE Handbook of fundamentals, as well as in the Industrial Ventilation Handbook.
2) Airflow measuring stations shall be fabricated of 14-gauge galvanized steel welded casing with 90 Deg. connecting flanges in configuration and size equal to that of the duct into which it is mounted. Each station shall be complete with an air directionalizer and parallel cell profile suppressor (3/4” maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 6000 feet per minute. This air directionalizer and parallel cell honeycomb suppressor shall provide 98% free area, equalize the velocity profile, and eliminate turbulent and rotational flow from the air stream prior to the measuring point.
3) The total pressure measurement side (high side) will be designed and spaced to the Industrial Ventilation Manual 16th Edition, Page 9-5. The self-averaging manifolding will be manufactured of brass and copper components.
4) The static pressure sensing probes (low side) shall be bullet-nosed shaped, per detailed radius, as illustrated in Industrial Ventilation Manual 16th Edition, Page 9-5.
5) The main take-off point from both the total pressure and the static pressure manifolds must be symmetrical.
6) Total and static pressure manifolds shall terminate with external ports for connection to control tubing. An identification label shall be placed on each unit casing, listing model number, size, area, and specified airflow capacity.
7) Installation Considerations

a) The maximum allowable pressure loss through the Flow and Static Pressure elements shall not exceed .065” w.c. at 1000 feet per minute, or .23” w.c. at 2000 feet per minute. Each unit shall measure the airflow rate within an accuracy of plus 2% as determined by U.S. - GSA

certification tests, and shall contain a minimum of one total pressure sensor per 36 square inches of unit measuring area.

b) The units shall have a self-generated sound rating of less than NC40, and the sound level within the duct shall not be amplified nor shall additional sound be generated.

c) Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.

d) Where control dampers are shown as part of the airflow measuring station, opposed blade precision controlled volume dampers integral to the station and complete with actuator, pilot positioner, and linkage shall be provided.

e) Stations shall be installed in strict accordance with the manufacturer's published requirements, and in accordance with ASME Guidelines affecting non-standard approach conditions.

8) Acceptable manufacturers: Air Monitor Corp., Tek-Air, Ebtron Model GTx116-P and GTx116-F (basis of design). Provide full 3 year warranty.

d. Static Pressure Traverse Probe

1) Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple static pressure sensors located along exterior surface of the cylindrical probe.

2) Acceptable manufacturers: Cleveland Controls

e. Shielded Static Air Probe

1) A shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding. A suitable probe for indoor and outdoor locations shall be provided.

2. Water Flow Monitoring (1" and larger: chilled water, hot water, condenser water; 3" and larger: domestic cold water, domestic hot water, make up water)

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) ONICON Incorporate, F-3100 series
2) Siemens
3) SeaMetrics Inc.
4) Niagara Meters.

b. Description: Inline electromagnetic flow meter.
c. Construction: Carbon steel body, PTFE liner, ANSI Class 150 flange and Class 300 flange.
d. Pressure Rating: 580 psig minimum.
e. Temperature Rating: 400 deg F minimum.
f. Display: Remote mounted electronics, visual instantaneous rate of flow, with register to indicate total volume in gallons.
g. BMS input for rate of flow and total volume.
h. Accuracy: minimum 1 percent.

3. Water Flow Monitoring (3/4": chilled water, hot water, condenser water; 3/4"-2 1/2": domestic cold water, domestic hot water, irrigation, backwash, blow down drains, make-up water)

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) ONICON Incorporate, F-4600 series
2) Siemens
3) SeaMetrics Inc.
4) Niagara Meters.

b. Description: direct beam wetted ultrasonic transducers, temperature sensor, mounting hardware and calibration certificate.
c. Construction: Flowmeter shall consist of a drop forged corrosion resistant metal flow body with process connections, integral transducers and a processor / transmitter. All wetted materials shall be NSF 372 compliant.
d. Pressure Rating: 450 psig minimum.
e. Temperature Rating: 200 deg F minimum.
f. Display: Remote mounted electronics, visual instantaneous rate of flow, with register to indicate total volume in gallons.
g. BMS input for rate of flow and total volume.
h. Accuracy: minimum 2 percent.

F. Power Monitoring Devices

1. Current Measurement (Amps)

a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.
b. Current Transformer - A split core current transformer shall be provided to monitor motor amps.

1) Operating frequency - 50 - 400 Hz.
2) Insulation - 0.6 Kv class 10Kv BIL.
3) UL recognized.
4) Five Amp secondary.

5) Select current ration as appropriate for application.
6) Acceptable manufacturers: Veris Industries

2. Current Transducer - A current to voltage or current to mA transducer shall be provided. The current transducer shall include:

a. 6X input over amp rating for AC inrushes of up to 120 amps.
b. Manufactured to UL 1244.
c. Accuracy: +.5%, Ripple +1%.
d. Minimum load resistance 30kOhm.
e. Input 0-20 Amps.
f. Output 4-20 mA.
g. Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
h. Acceptable manufacturers: Veris Industries

G. Smoke Detectors

1. Duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 26.

H. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

3. Current Sensor/Transducer

a. The current sensors shall be loop or self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch,

SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

b. Analog output current sensors providing a signal corresponding to actual amperage draw of the monitored load. Current sensors shall be used for fans, pumps, and other miscellaneous motor loads.

c. Current sensors shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

4. Air Filter Status Switches

a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.

b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.

c. Provide appropriate scale range and differential adjustment for intended service.

d. Acceptable manufacturers: Dwyer, Cleveland Controls

5. Air Flow Switches

a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.

b. Acceptable manufacturers: Dwyer, Cleveland Controls

6. Air Pressure Safety Switches

a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.

b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.

c. Acceptable manufacturers: Dwyer, Cleveland Controls

7. Water Flow Switches

a. Water flow switches shall be equal to the Johnson Controls P74.

2.5 OUTPUT DEVICES

A. Actuators

1. General Requirements

a. Damper and valve actuators shall be electronic as specified in the System Description section.

2. Electronic Damper Actuators

    a. Electronic damper actuators shall be direct shaft mount.
    b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
    c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to the BMS head end and indicate damper position.
    d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
    e. Provide 5-year warranty.
    f. Acceptable manufacturers: Belimo.

3. Electronic Valve Actuators

    a. Electronic valve actuators shall be manufactured by the valve manufacturer.
    b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.
    c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
    d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10

VDC. . The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator shall be wired back to the BMS head end and display valve position.

e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated piece of equipment.

f. Acceptable manufacturers: Belimo

B. Control Dampers

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a.	Ruskin Company	CD50, CD60, CDTI-50
b.	Greenheck Fan Corporation.	VCD-33, ICD-45
c.	Tamco	9000BF

3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Frames:

a. Hat shaped.
b. Galvanized-steel channels, 0.0625 inch thick except outside air dampers shall be 0.125 thick extruded aluminum and required to be thermally broken.
c. Mitered and welded corners.

5. Blades:

a. Airfoil shape, multiple blade with maximum blade width of 8 inches.
b. Parallel- and opposed-blade design.
c. Galvanized steel except outdoor air damper blades shall be aluminum.
d. 16 gauge thickness (steel) or 0.063 inch thickness (aluminum).
e. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
f. Operating Temperature Range: From minus 40 to plus 200 deg F.

6. Bearings:

a. Molded synthetic or stainless steel.
b. All dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.
c. Thrust bearings at each end of every blade.

7. Performance Data:

    a. Temperature Rating: Withstand -72 to 275 degrees F (-58 to 135 degrees C).
    b. Closed Position: Maximum pressure of 13 inches w.g. (3.2 kPa) @ a 12 inch blade length.
    c. Open Position: Maximum air velocity of 6,000 feet per minute (1,829 m/min).
    d. Leakage: Maximum 5.2 cubic feet per minute per square foot (0.6 $m^3/min/m^2$) at 4 inches w.g. (1 kPa) for size 48 x 48 inches (1219 x 1219 mm).
    e. Pressure Drop: Maximum 0.03 inch w.g. (0.01 kPa) at 1,500 feet per minute (457 m/min) across 24 inch x 24 inch (610 x 610 mm) damper.

C. Control Dampers W/ Integral Airflow Monitor

1. Control dampers shall be of low leakage design. Dampers shall be opposed blade type except where parallel blades are required for air mixing.
2. The integral air monitor/damper shall incorporate measuring ports built into the damper blades and shall control the minimum amount of outside air as scheduled on the Drawings. The acceptable range of operation shall be 300 to 2000 feet per minute face velocity. Airflow measurement and reporting shall be within an accuracy of 5%.
3. The integral damper/monitor assembly shall incorporate an air straightener section to ensure proper airflow readings. The air straightener section shall be flanged as required by the application.
4. Frames shall be constructed of 60663T5 extruded aluminum hat channel with hat mounting flanges on both sides of the frame. Each corner shall be reinforced with two die formed internal braces and machine staked for maximum rigidity.
5. Damper blades shall be 6” wide 6063T5 extruded aluminum airfoil type. Blade edge seals shall be Ruskiprene or approved equal. Jamb seals shall be flexible metal compression type.
6. Bearings shall be non-corrosive molded synthetic. Axles shall be square or hexagon to provide positive locking connection to blades and linkage.
7. Damper leakage through a 48” x 48” damper at 1 in. w.g. pressure difference shall not exceed 2.0 cfm per square foot. Damper manufacturer’s data shall include performance data developed from testing in accordance with AMCA Standard 500 in an AMCA approved laboratory showing pressure drop for all sizes of dampers required at all anticipated flow rates.
8. Damper linkage arrangement shall be equal percentage and shall match the damper operator.
9. Each air monitor/damper shall include a 24VAC electric modulating motor and an application specific controller designed for this application furnished by the damper manufacturer. Each integral air monitor/damper shall be calibrated in an AMCA registered laboratory and a certification chart shall accompany the air monitor/damper.
10. Air tubing/piping connections shall terminate in a control panel housing the differential pressure transducer and controller. The controller shall monitor the control blade position using a feedback signal from the damper actuator. With the signal from the pressure transducer and the blade position signal, the

controller shall convert the pressure differential into an accurate CFM value. Based on the difference between the actual CFM reading and the CFM setpoint, the controller will adjust the damper position to maintain the desired outside air quantity.

11. Application: Outside Air
12. Dampers shall be in all respects equivalent to Ruskin Model IAQ50.

D. Control Relays

1. Control Pilot Relays

a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
b. Mounting Bases shall be snap-mount.
c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
d. Contacts shall be rated for 10 amps at 120VAC.
e. Relays shall have an integral indicator light and check button.
f. Acceptable manufacturers: Alerton Controls, Lectro

E. Control Valves: Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system, unless otherwise indicated.

1. Hydronic system globe valves shall have the following characteristics: Used for modulating, bypass, and three way valves:

a. Manufacturers:

1) Belimo

b. NPS 2 and Smaller: Class 150 bronze body, stainless steel trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
c. NPS 2-1/2 and Larger: Class 150 iron body, stainless steel trim, rising stem, plug-type disc, flanged ends, seat and disc.
d. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

1) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
2) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

e. Flow Characteristics: Three-way valves shall have linear characteristics.
f. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 300 psid.
g. Provide 5-year warranty.

2. Hydronic system ball valves shall have the following characteristics: Used for NPS 2 and smaller: two position valves, modulating, bypass, and three-way valves.

    a. Manufacturers:

        1) Belimo

    b. Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
    c. The control valve assembly shall be provided and delivered from a single manufacturer as a complete assembly.
    d. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
    e. Bronze body rated at no less than 300 psi, stainless steel ball and stem.
    f. The manufacturer shall warrant all components for a period of 2 years from the date of substantial completion.
    g. Flow Characteristics: Valves shall have equal percentage characteristics.
    h. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 1 1/2 times the maximum system pressure.

3. Butterfly valves: Used for NPS 2-1/2 and larger: bypass, automatic isolation and three way valves.

    a. Same valve selection as required in Section 230523.
    b. Sizing: 1-psig maximum pressure drop at design flow rate.
    c. Electronic Signal Isolation Transducers
    d. A signal isolation transducer shall be provided whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
    e. The signal isolation transducer shall provide ground plane isolation between systems.
    f. Signals shall provide optical isolation between systems.
    g. External Manual Override Stations
    h. External manual override stations shall provide the following:
    i. An integral HAND/OFF/AUTO switch shall override the controlled device pilot relay.
    j. A status input to the BMS shall indicate whenever the switch is not in the automatic position.
    k. A Status LED shall illuminate whenever the output is ON.
    l. An Override LED shall illuminate whenever the HOA switch is in either the HAND or OFF position.
    m. Contacts shall be rated for a minimum of 1 amp at 24 VAC.
    n. Butterfly valves shall be rated for dead-end service and have a minimum close-off pressure (differential) Pressure Rating of 1 1/2 times the maximum system pressure.

2.6 MISCELLANEOUS DEVICES

A. Local Control Panels

1. All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch and lock.
2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals. All I/O connections shall be wired to a terminal strip within the control panel and not direct to the DDC controller.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

B. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.
9. All control power shall be provided from a standby panel board.

PART 3 - PERFORMANCE/EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate of this section and with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site.

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance.

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
2. Train Test and Balance Contractor to use control system interface tools.
3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

C. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided under Division 26. Interlock smoke detectors to air handlers for shutdown as specified in Sequences of Operation.
2. Smoke dampers and actuators required for duct smoke isolation are provided under division 23. Interlock smoke dampers to air handlers as specified in Sequences of Operation.
3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23.

D. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.

1. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation regardless of where within the contract documents those products are described.
2. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
3. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 BMS SPECIFIC REQUIREMENTS

A. Actuation / Control Type

1. Air Handling Equipment

a. All air handers shall be controlled with a HVAC-DDC Controller
b. All damper and valve actuation shall be electric.

2. Terminal Equipment:

a. Terminal Units (VAV, UH, etc.) shall have electric damper and valve actuation.
b. All Terminal Units shall be controlled with HVAC-DDC Controller.

3.5 INSTALLATION PRACTICES

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation.

D. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.

2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring

    a. All controls wiring (including wiring for meters) shall be plenum rated, shielded cable.
    b. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
    c. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

E. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
3. DDC terminal unit controllers may not use AC power from motor power circuits.
4. All control power shall be provided from a standby panel board.

F. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

G. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
2. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

H. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

I. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

J. HVAC Input Devices - General

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Mount sensors rigidly and adequately for operating environment.
6. Outside Air Sensors

    a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
    b. Sensors shall be installed with a rain proof, perforated cover.

7. Water Differential Pressure Sensors

    a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
    b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
    c. The transmitters shall be installed in an accessible location wherever possible.

8. Medium to High Differential Water Pressure Applications (Over 21" w.c.):

    a. Air bleed units, bypass valves and compression fittings shall be provided.

9. Building Differential Air Pressure Applications (-1” to +1” w.c.):

    a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
    b. The interior tip shall be inconspicuous.

10. Duct Temperature Sensors:

    a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
    b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
    c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
    d. The sensor shall be mounted to suitable supports using factory approved element holders.

11. Combination Space Thermostats, Humidity, Carbon Dioxide:

    a. Install combination devices on concealed junction boxes properly supported by wall framing.
    b. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.
    c. Shall be mounted per ADA requirements, maximum 48” above finished floor.

12. Space Sensors:

    a. Install room sensors on concealed junction boxes properly supported by wall framing.
    b. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.
    c. Shall be mounted 54” (typical) above finished floor to center of sensor. Coordinate exact height with architect prior to installing back box.

13. Carbon Dioxide Sensors:

    a. Install room sensors on concealed junction boxes properly supported by wall framing.
    b. Shall be mounted 36”-72” (54” typical) above finished floor to center of sensor. Coordinate exact height with architect prior to installing back box.

14. Air Differential Pressure Status Switches:

    a. Install with static pressure tips, tubing, fittings, and air filter.

15. Water Differential Pressure Status Switches:

    a. Install with shut off valves for isolation.

16. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

17. Air and Water Flow Meters:

    a. Install flowmeter elements in accessible positions in piping systems.
    b. Install flow meter displays in an accessible location for easy reference and reading, between 4 ft and 6 ft above the floor.
    c. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions and installation book.

K. HVAC Output Devices

1. All output devices shall be installed per the manufacturer’s recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI.
5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

L. All electric actuators, valves and dampers specified on the contract documents or necessary for the control system to function as specified under Division 23 are to be furnished and installed under this section.

M. Automatic control dampers shall be furnished and installed under this division unless they are part of factory-assembled equipment.

N. All conduit, wiring, etc., to accomplish the sequence of operation in this section, shall be provided under this section. All electrical work performed under this section shall comply with the National Electric Code and Underwriters Laboratories where applicable, and shall be installed by licensed journeyman electricians.

O. Furnish to the Division 23 Contractor for installation, wells for any sensors that are to monitor water temperatures. Provide stainless steel separable wells.

P. Furnish to the Division 23 Contractor for installation, any sensors such as flow sensors, or flow meters which are to be installed in water lines.

Q. All virtual system alarm points shall be displayed visually on each associated equipment graphic as text or flashing light indicator that clearly identifies the alarm condition in a red color as to draw attention to the alarming condition. The graphical alarm text or indicator light shall either be hidden when the alarm condition does not exist or it shall change to a color (white or green) indicative of normal conditions.

3.6 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
4. Provide necessary mounting hardware and linkages for actuator installation.

C. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer.

D. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the fan shutoff pressure as a minimum requirement.

E. The total damper area operated by an actuator shall not exceed 80 percent of manufacturer's maximum area rating.

F. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison.

G. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.

H. Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

I. Provide mounting hardware and linkages for connecting actuator to damper.

J. Provide (1) spare actuator of each type being used for control valves and control dampers.

3.7 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 260533 "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 26,

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.8 WARNING LABELS

A. Affix permanent warning labels to equipment that can be automatically started by the control system.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows.

C A U T I O N

This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows.

C A U T I O N

This equipment is fed from more than one power source with separate disconnects.
Disconnect all power sources before servicing.

3.9 PROGRAMMING

A. Point Naming. Name points based the sequence of operations and when applicable conform to the existing standards set up by the clients control systems.

B. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.

1. Application Programming. Provide application programming that adheres to sequences of operation. Program documentation or comment statements shall reflect language used in sequences of operation.
2. System Programming. Provide system programming necessary for system operation.

C. Operator Interface.

1. Standard Graphics. Provide graphics as specified in System Graphics. Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List. Point information on graphics shall dynamically update.
2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in this section.

3.10 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under this section.
2. Verify that control wiring is properly connected and free of shorts and ground

faults. Verify that terminations are tight.

3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
8. Alarms and Interlocks.

    a. Check each alarm with an appropriate signal at a value that will trip the alarm.
    b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
    c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

9. CO detection system components shall be installed, tested and maintained in accordance with the manufacturers' published instructions and NFPA 720.

B. Acceptance Log Sheet

1. Submit the log sheets to the Engineer for review and acceptance.

C. VAV box performance verification and documentation:

1. The BMS Contractor shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.
2. The BMS Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.

D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

3.11 FINAL REVIEW

A. Submit written request to Architect and Construction Manager when DDC system is ready for final review. Written request shall state the following:

1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Review by Architect and Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. A part of DDC system final review shall include a demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration shall include, but not be limited to, the following:

    a. Accuracy and calibration of 10 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
    b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 10 I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
    c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.

d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
f. Trends, summaries, logs and reports set-up for Project.
g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
h. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
i. Software's ability to edit control programs off-line.
j. Data entry to show Project-specific customizing capability including parameter changes.
k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
l. Execution of digital and analog commands in graphic mode.
m. Spreadsheet and curve plot software and its integration with database.
n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
p. System speed of response compared to requirements indicated.
q. For Each Network and Programmable Application Controller:

    1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
    2) Operator Interface: Ability to connect directly to each type of digital controller with a portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
    3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
    4) Electric Power: Ability to disconnect any controller safely from its power source.
    5) Wiring Labels: Match control drawings.
    6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.
    7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.

r. For Each Operator Workstation:

    1) I/O points lists agree with naming conventions.
    2) Graphics are complete.
    3) UPS unit, if applicable, operates.

s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Requirements must be met even if only one manufacturer's equipment is installed.

1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
10) Device and Network Management:

a) Display of network device status.
b) Display of BACnet Object Information.
c) Silencing devices transmitting erroneous data.
d) Time synchronization.
e) Remote device re-initialization.
f) Backup and restore network device programming and master database(s).
g) Configuration management of routers.

3.12 TRAINING

A. The BMS contractor shall provide the following training services:

1. Provide 48 hours of training by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software

layout and naming conventions, schedule modification, and a walk through of the facility to identify panel and device locations.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

3.14 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.

10. Check DDC system as follows:

    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.15 WORK RELATING TO CONTROLS AND INSTRUMENTS

A. Under Sections 230900 as applicable, provide control wiring for the following:

1. All circuits actuated by a temperature control system component.
2. All circuits which actuate a temperature control component.
3. All control panel wiring to terminal strips and field wiring from terminal strips to field mounted devices.
4. All wiring from the "AUTO" side of hand-off-auto switches on units being controlled by Sections 230900.
5. Wiring of electro-mechanical devices required to be located on or in temperature control panels.
6. Wiring of DDC trunk, communication, and sensor cable wiring.
7. Wiring shall comply with material and workmanship standards of Division 26.
8. Wiring of damper and valve actuators, VAV box actuators, relays, transformers, PE switches and all other control apparatus.
9. All 120 volt power wiring to vav boxes, damper actuators, line voltage thermostats, valve actuators, relay’s, etc. not powered by 24 volt power is work of this division. Wiring shall comply with material and workmanship standards of Division 26. Obtain 120 volt from local electrical panels or junction box. Coordinate with Division 26 contractor.
10. Wiring of line voltage fan isolation dampers located within fan curbs regardless of voltage in order to achieve specified sequence of operations.
11. Smoke detectors installed at transfer ducts to close associated dampers.

B. Under Division 26, perform the following work under supervision of Sections 230900:

1. Wiring of all devices and circuits carrying voltages greater than 110 volts unless otherwise noted.
2. Wiring of line and load power feeds to all disconnects, starters, and electric motors.
3. Wiring of 115 volt power feeds to all temperature control panels.
4. Power wiring to all motors 110 volt to 480 volt unless otherwise noted.
5. Furnish smoke detectors for mounting in ducts used for shutting down of air handling equipment. Smoke detectors installed at transfer ducts shall be provided by temperature control contractor.
6. Specific power feeds shown or specified in Div 26 documents.

3.16 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.17 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – General Commissioning Requirements.

B. Complete installation and startup checks and functional tests according to Section 019113 – General Commissioning Requirements and manufacturers written instructions.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the start up procedure.

D. Verify that equipment is installed and commissioned as per requirements of section 019113 and manufacturers written instructions/requirements.

END OF SECTION 23 09 00

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC, PLUMBING, AND ELECTRICAL CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.
2. Floor plans.
3. Flow and Control Diagrams.

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.

B. DDC: Direct digital control; interchangeable with BMS

C. VAV: Variable air volume.

D. BMS: Building Management System; interchangeable with DDC

E. VFD: Variable Frequency Drive

F. CO_2: Carbon dioxide

G. AQ: Air quality including CO_2, CO, NO_2, VOC’s, and other gases / particulate matter.

H. 24/7: 24 Hours per day / 7 days per week

1.4 GENERAL

A. Controls contactor shall have a meeting with the architect, engineer, and owner prior to programming to discuss capabilities, schedules and sequences.

B. Controls contractor shall allocate programming hours (not less than 40 hours) for programming of the facilities program schedules.

C. Contractor shall provide all required control devices, meters, hardware and software to achieve the specified sequences of operation as outlined in these specifications and as detailed on drawings whether indicated and/or implied. Refer to drawing for general I/O points. All points may not be listed and are indicated for general description.

D. BMS shall monitor and report all control function alarm points.

E. BMS shall monitor and report status of all equipment for use in sequence of operations, trending and verification.

F. BMS shall monitor all modulating valve and damper positions.

G. All setpoints including but not limited to temperature, time, CO, CO2, enthalpy, wet bulb, pressure, etc. shall be adjustable.

H. All safeties shall operate whether the starters or VFD's are in the hand or automatic mode.

I. Thermostats shall provide local temperature adjustment via a knob or slider bar. The temperature adjustment range shall be individually adjustable for each thermostat, programmed through the BMS or the same range can be applied to all thermostats globally.

J. Thermostats shall also provide an occupancy override function. Activation of timed override switch on zone thermostats shall only reset zone heating and cooling setpoints to "occupied" values, but shall not affect otherwise scheduled Unoccupied operating mode of air handling unit. This allows the user to override the Unoccupied scheduled setpoints and put the system into an occupied setpoints mode for set duration and reset to normal operation at the end of the period or whenever the override button is held for more than 5 seconds (adjustable). The override duration is individually adjustable for each thermostat through the BMS or the same range can be applied to all thermostats globally.

K. The temperature controls contractor, equipment manufacturers, and mechanical contractor shall provide all parts, sensors, hardware and accessories for a complete and operational system. If alternate/additional sensors/relays or hardware is required by deviating from the basis of design, the control contractor is to provide all required hardware, installation and communication wiring for these devices.

1.5 DESIGN CONDITIONS

A. Outdoor Design Conditions:

Winter design dry bulb	0˚F
Summer design dry bulb	94˚F
Coincident wet bulb	80˚F

B. Indoor Design Conditions:

Space Design Conditions				
Space Type	Summer		Winter	
	DB °F	RH %	DB °F	RH %
Galleries	70+3	50+10	70+3	50+10

1.6 AIR HANDLING UNITS AND DUCT DISTRIBUTION GENERAL REQUIREMENTS

A. APPLICATION

1. This section applies to all duct systems whether air handling equipment is present or not. For instance, there may be applications of Fire & Smoke dampers at rated walls for exhaust systems that are not associated with any air handlers.

B. GENERAL SAFETIES

1. It is intended that, in general, the Division 23 Contractor will be responsible for all control sequences. Critical safety interlocks which are not directly wired by the Division 26 sub-contractor, such as freezestats, high limit protectors, end switches etc., shall be directly connected, through wire, so as not to depend on any digital control system “Sequence of Operation” to perform their safety function.
2. Following a safety shut-down, a manually initiated restart command shall restart the system as previously described under Normal Operating Mode.
3. The BMS shall monitor all fans status via a current sensor. If anytime the fan is enabled and current is not sensed, an alarm shall be initiated at the BMS central computer and at the local panel.

C. FIRE ALARM INTERFACE

1. The BMS shall monitor all fire/smoke and smoke damper positions via interface with the Fire Alarm Control Panel.
2. Alarm shall be initiated upon any smoke detector activation.

D. FIRE & SMOKE CONTROL

1. Supply or return duct mounted smoke detectors; upon sensing products of combustion, or signal received from central fire alarm system, shall shut down the associated air handling system supply, return and relief fans with the HOA switch in both the ”hand” and “auto” positions. Reset of smoke detector initiation shall be manual. Initiate an alarm upon shut down via duct smoke detector. BMS shall monitor status and receive trouble alarm upon detector activation.
2. Upon building wide shutdown of air handling units from central fire alarm system, after the fire alarm is reset to normal mode, manually re-start up of air handling units to eliminate simultaneous starting.

3. Combination Fire/Smoke Damper control through Fire Alarm Control Panel and BMS:

    a. Combination fire/smoke dampers shall close upon activation of a signal from the central fire alarm panel or smoke detector.
    b. Combination fire/smoke dampers shall close whenever associated HVAC system is shutdown. When HVAC system is energized on, associated combination fire/smoke dampers shall open.
    c. Smoke detectors shall be furnished by Division 26, installed in the ductwork by Division 23, wired the control system by the temperature controls contractor (provide interface panel), and wired to the fire alarm system by Division 26 (provide control modules).
    d. Upon activation of the supply or return duct smoke detector(s) of the associated system, or any area smoke detector, a signal from the fire alarm system shall shut down the system(s) fan(s) and the systems combination fire/smoke dampers via the fire alarm control modules (one to the fan and one to each FSD). Once the fire alarm system is in normal mode, the FAS shall send a signal to the BMS indicating the system is in normal mode. Upon receipt of the FAS's normal mode signal, the BMS shall send a signal to the mechanical interface panel to open the FSD. Upon shutdown of the associated HVAC system, the BMS shall send a signal to the mechanical interface panel to close the FSD.
    e. Combination fire/smoke dampers shall be energized open via 120V power wired by the electrical contractor.
    f. BMS shall monitor damper end switches for all combination fire/smoke dampers, both open and closed. Provide an alarm if damper position is not in the open position while building fire alarm system is in normal safe mode.
    g. The damper shall be proven open via its end switch prior to the fan being energized.

4. Smoke Damper (duct mounted and AHU isolation dampers) control through Fire Alarm Control Panel:

    a. Smoke dampers shall close upon activation of a signal from the central fire alarm panel. When a fan system is shutdown, the BMS shall send a signal to the mechanical interface panel to close all smoke dampers associated with that fan system.
    b. Smoke dampers shall be furnished on units >15,000 cfm.
    c. Smoke detectors shall be furnished by Division 26, installed in the ductwork by Division 23, wired to the control system by the temperature controls contractor (provide interface panel), and wired to the fire alarm system by Division 26 (provide control module).
    d. Upon activation of the supply or return duct smoke detector(s) or any area smoke detector, a signal from the fire alarm system shall shut down the associated system(s) fan(s) and the associated system(s) smoke dampers. Smoke dampers shall be reset after the fire alarm system is reset to normal mode by the central fire alarm system.
    e. Smoke dampers shall be energized open via 120V power wired by the electrical contractor.

f. BMS shall monitor damper end switches for all smoke dampers, both open and closed. Provide an alarm if damper position is not in the open position while building fire alarm system is in normal safe mode.
g. The damper shall be proven open via its end switch prior to the fan being energized.

E. FREEZE PROTECTION

1. Freeze protection sensor element (provide complete coil coverage per manufacturer's recommendations with a minimum of 1.0 ft of sensor for each 1.0 sq. ft. of coil face) located on the leaving side of the heating hot water coil (when coil is in preheat position), on entering side of cooling coil (when heating coil is in reheat position), or on the leaving side of the cooling coil when the preheat coil utilizes glycol. When the temperature across the freeze stat drops below 38˚F, the freeze stat shall trip and be reset automatically twice. On the third trip, the air handling unit fans shall be shut down via BMS signal to the to the starters, with the HOA switch in both the "hand" and "auto" positions. An alarm shall be initiated at the BMS central computer and at the local control panel. Reset shall be manual on the third trip.
2. During unoccupied (Winter/Heating Mode) When the outdoor air temperature falls below 10°F, sensor located downstream of the hot water coil shall modulate the hot water coil control valve to maintain unit casing temperature of 40˚F.
3. If freeze protection pumps are provided: In heating mode the coil freeze protection pumps shall be energized and run continuously when a either the outdoor air temperature falls below 10°F or when temperature sensor located upstream of the subject coil; senses casing temperature less than or equal to 40˚F (adj.). Coil control valve shall be closed.

F. PRESSURE AND TEMPERATURE HIGH / LOW LIMITS

1. Supply and return duct mounted high limit pressure sensors (hard wired into safety circuits) shall shut down both supply when the duct static pressure exceeds 4" w.c. (adjustable) and return fans if discharge or inlet static pressures exceed pressure classification ratings of the ductwork or fans and an alarm generated at the BMS. Reset shall be manual at the BMS.
2. Alarm to the BMS in the event there is a substantial change 0.5" w.c. (adj.) in system pressure for more than 15 seconds (adj.): Alarm indicating a door is ajar or other system issue is present.
3. The BMS shall monitor the discharge air temperature via a temperature sensor located in the supply duct. If the discharge air temperature deviates more than 5˚F above or below the setpoint for a period of 5 minutes while the unit is enabled, an alarm shall be initiated at the BMS central computer and at the local panel.

G. CONTROL OF OUTSIDE AIR

1. Outside air is controlled to satisfy whichever of the following predominates:

a. The outside air volume required to maintain a CO_2 differential as described below.

b. OA intake will be limited to a maximum of the "design OA cfm" which is shown in the Schedule of Air Handling Units. This limit is not applicable to the economizer cycle.
c. The outside air volume required to provide make-up air for the exhaust systems associated with each air handler and maintain a positive building pressure.

H. OPTIMUM START

1. Each air handling unit (and associated hydronic system) start up sequence shall include an optimal start routine. BMS shall trend time frame, based on outdoor and indoor conditions, it takes respective systems to achieve warmup/cooldown temperature setpoints. BMS shall automatically adjust startup schedules to achieve warmup/cooldown setpoints based on trended data.

I. CARBON DIOXIDE CONTROL

1. BMS shall monitor return and room air CO_2 sensor and modulate outside air dampers from units minimum to maximum scheduled. CO_2 control shall be overridden during economizer. BMS shall continually poll space mounted CO_2 sensors and override return air CO_2 sensor to maintain desired levels of outside air within the building.
2. BMS shall monitor mixed air temperature and modulate outdoor air dampers to maintain a minimum of mixed air temperature of 50°F (adjustable). CO2 control shall be overridden during economizer.
3. The outside air dampers shall modulate to maintain room carbon dioxide levels a maximum of 700 PPM (adjustable) above ambient CO2 levels, at all times. An alarm shall be generated if any room CO2 sensor level rises 10% (adjustable) or more than 1300 ppm (adjustable).
4. Ambient CO2 levels to be provided by the outdoor air CO2 sensor located at the exterior for monitoring.
5. In units with multiple CO2 sensors, if BMS fails to read a signal from any of the CO2 sensors or the sensor fails, an alarm shall be generated and remaining sensor(s) shall maintain control of outside air. If only a single sensor resides or failure of remaining multiple sensors, and signal or sensor failure occurs, then the units outside air dampers shall remain at last known position and an alarm shall be generated. Operator may override any failed CO_2 sensor.

J. FILTER DIFFERENTIAL PRESSURE

1. The BMS shall monitor the differential pressure across the filters.
2. Alarms shall be provided as follows:

a. Filter Change Required: Filter differential pressure exceeds a user definable limit (adj.).

K. EVENT INITIATED TRENDING

1. In the event that the temperature or humidity of any zone shall enter alarm condition, the DDC system shall begin a trend of the parameters which affect the ability of the system to maintain conditions.
2. The points trended shall be similar but not limited to:
   Air handling unit discharge temperature.
   Air handling unit discharge humidity.
   Zone supply air temperature.
   Zone temperature and humidity.
   Chilled water supply and return temperature.
   Hot water supply and return temperature.
   Outside air temperature and humidity.
3. The BMS shall plot the variables on a single real time graphic display.
4. The BMS shall monitor these points at 1 minute intervals and periodically download the values into Microsoft Excel.

1.7 VARIABLE AIR VOLUME AIR HANDLING SYSTEMS (AHU-31-F)

A. General

1. Enabled Mode: The unit shall be enabled 24/7 through the BMS. All control functions shall be accomplished and monitored through the BMS. Once enabled the unit shall enter Occupied and Unoccupied modes based on the following criteria:

   a. Predetermined schedule
   b. BMS command to override predetermined schedule
   c. Occupancy sensors to automatically enter occupied mode
   d. CO_2 (AQ) sensor high limit shall automatically enter occupied mode
   e. Zone level manual override via push button or space thermostat operator-initiated change, shall automatically enter system into occupied mode

2. Disabled mode: Entering into and leaving disabled mode shall only be executed via a command from a (human) operator through the BMS.

B. Disabled Mode

1. When the unit is disabled, the supply fans shall be off, associated relief/return fans shall be off and the outside air, relief air, unit supply and return isolation dampers shall be closed. The heating coil, chilled water coil, and humidifier control valves shall be closed. BMS monitoring of the system shall continue, general requirements and general safeties shall continue to be maintained in this mode. General requirements and general safeties are outlined in this Specification Section.

C. Occupied Operating Mode

1. When the unit is enabled the supply fan array shall start. The supply fan array shall ramp up via its lead variable frequency drive to maintain the supply duct static pressure setpoint. A static pressure pickup sensor in the supply duct, referenced to atmosphere, located approximately two thirds down the main supply duct will, through a controller with P-I-D control algorithm, modulate a variable frequency fan speed controller, to maintain the static pressure setting. The setpoint shall be determined during the testing and balancing process (initial setpoint shall be 0.75"W.C. until a final value is determined through testing and balancing). Provide a high limit pressure sensor with two setpoints. One setpoint to alarm above-normal pressures, the second setpoint, set higher, to shut the fan down.
2. For each supply fan array there shall be two (2) VFDs. One shall be lead and the other standby. The BMS shall monitor status and run time. Failure to verify status shall initiate an alarm, shut down lead VFD and automatically start the standby VFD.
3. The BMS shall monitor run time of each VFD and alternate lead/stand by VFD based on the user defined schedule to equalize run times.
4. Each supply fan array has been designed to operate at full airflow and system static pressure with the loss of a single fan in the array. The loss of any fan in the array shall not inhibit the continued use the other fans. Every individual fan shall be monitored via a current sensor. Should a fan fail to energize, an alarm shall be sent to the BMS and the remaining fans shall ramp up to maintain static pressure / air volume set point.
5. The outside air, return and relief dampers also must be integrated with the fan tracking to ensure minimum ventilation air and to maintain proper pressure relationships within the system. The damper controls are discussed in the OA control section.
6. Provide supply, relief and outside air flow monitor stations to modulate supply fan and relief fans via variable speed controller to maintain minimum scheduled outside air volume. As outside air varies across minimum range the relief fan shall be reduced to maintain a CFM value offset and therefore a pressure offset. Fan tracking based on a constant offset in fan speed is not acceptable. Provide a building pressure differential control strategy to control relief fan speed to maintain slight building positive pressure.
7. Five (5) minutes after the supply fan array has met the static pressure requirements of the system, the outside air damper shall open and the relief air damper shall open.
8. The outside damper, the relief air damper, relief fan and the return air damper shall be modulated, each via a separate control signal, to maintain the required outside air quantity.
9. The heating coil and chilled water coil control valves shall modulate to maintain the discharge temperature setpoint of 55°F (adjustable).
10. Where stacked cooling/heating coils have been indicated, the BMS shall modulate control valves in unison to maintain required SA discharge set point temperatures.
11. The BMS shall continuously monitor the position of all terminal box dampers and hot water reheat coil valves in zones associated with the air handling unit. The control system shall use this information to reset the supply air discharge

temperature between a minimum of 55° F and a maximum of 60°F, and to reset the supply plenum static pressure setpoint.

12. When all reheat control valves are at least partially open, the BMS shall reset the supply air temperature upwards. When all terminal box dampers are at least partially closed, the supply air static pressure setpoint shall be reset downwards. If at least one (1) terminal box damper is open fully and is calling for further cooling, the supply air static pressure setpoint shall be reset toward its design value. If the supply air static pressure reaches its design value and a zone is still calling for additional cooling, the supply air temperature shall be reset down toward its design value of 55° F (adjustable).
13. The air handling unit relief fan shall ramp down to exhaust only the differential volume between the outdoor air entering the air handling unit and to maintain a slightly positive pressure offset to the attic.
14. When the space humidity sensor or return air humidity sensor exceeds the humidity setpoint (50% adjustable) by >3% for at least 10 minutes (adjustable), an alarm shall be initiated at the BMS central computer and at the local panel. The discharge temperature setpoint shall be set to 52°F. The terminal box heating coil control valve shall modulate to maintain space temperature set point. If after 15 minutes, the relative humidity has not returned to set point, the discharge temperature shall be dropped by 1°F, this sequence shall continue until the humidity level returns to within the 2% of the setpoint for more than 30 minutes, then the unit shall return to normal operating mode.
15. When any of the space humidity sensors fall below the humidity set point (50% adjustable) the humidifier shall be enabled. The humidifier control valve shall modulate to maintain the space relative humidity set point (50% +/- 2% adjustable). If the space humidity sensor falls below the humidity set point (50% adjustable) by 3% or more for at least 10 minutes (adjustable), an alarm shall be initiated at the BMS central computer and at the local panel. The humidifier automatic isolation valve shall open whenever the fan is enable via hard wired interlock with the fan starter.

D. Unoccupied Operating Mode

1. Outside air and relief air dampers shall be closed. If applicable, the associated relief fan shall be off. If applicable, the return fan shall remain on. The unit shall otherwise continue to run as per the normal mode. The space temperature set point shall continue to be maintained at 70°F (adj.) during a call for cooling and 70° F (adj.) during a call for heating. The space relative humidity set point shall continue to be maintained at (50% +/- 2% adjustable). CO_2 control shall be disabled.

E. VAV Zone Control

1. The unit shall have limited Variable Volume functionality, the VAV box minimum setpoint shall be 60% (adj.) of its scheduled maximum CFM to ensure continuous air processing of the gallery air. 60% represents the airflow value not the VAV box position. For example, if a VAV box's scheduled CFM value is 1000 CFM the minimum position shall provide 600 CFM.
2. Winter: The space sensor shall modulate hot water reheat control valve to maintain space set point of 70°F (adjustable). If the VAV box is at the scheduled

minimum position associated with an airflow of (60%) and the space is still below set point the VAV box shall modulate from minimum to maximum position and the hot water reheat control valve shall continue to modulate to maintain space set point.

3. Summer: The space sensor shall modulate VAV box cfm between the scheduled minimum (60%) and maximum values to maintain space temperature set point. If the VAV box is at minimum position and the space is still below set point the hot water reheat control valve shall modulate to maintain space set point of 70°F (adjustable).
4. At any point in time should the space RH fall below set-point (50% +/- 4% adjustable) the VAV box shall modulate from the scheduled minimum (75%) to maximum position and the hot water reheat control valve shall modulate to maintain space temperature set point.
5. At any point in time should the OA damper be fully open and the associated return air plenum CO2 (AQ) sensor is above CO2 set point (700 PPM (adjustable) above ambient CO2 levels), the VAV box shall modulate from its minimum to maximum position. The hot water reheat control valve shall continue to modulate to maintain space temperature set point.

1.8 CABINET/UNIT HEATERS AND HEATING ONLY FAN COIL UNITS

A. On a call for heat the fan shall start through the BMS based on the wall mounted temperature sensor. The BMS shall open 2 position control valve and cycle the unit fan to maintain the desired space temperature. Provide a strap-on thermostat to stop the fan whenever the hot water supply temperature drops below 120°F.

B. The space temperature shall initiate a BMS alarm below an adjustable setpoint.

1.9 UNIT HEATERS

A. On a call for heat the fan shall start the packaged controls and the unit mounted thermostat. The unit fan and control valve shall cycle to maintain the desired space temperature. Provide a strap-on thermostat to stop the fan whenever the hot water supply temperature drops below 120 degrees F.

B. The a wall mounted temperature sensor space temperature shall initiate a BMS alarm below an adjustable set point.

1.10 VFD STATUS

A. BMS system shall monitor VFD fault alarms and associated motor speeds.

1.11 LEAK DETECTOR MONITORING

A. The BMS shall monitor the water leak detector(s) located in all auxiliary drain pans.

B. Upon water detection, an alarm shall be initiated at the BMS, the associated fan coil unit shall be shut down and the hot water and chilled water control valves shall be closed.

1.12 FAN COILS

A. Fan coil units operation shall be started remotely through the DDC system in accordance with the pre-determined operating schedule.

B. On a call for cooling or heating as sensed by the wall mounted temperature sensor, the BMS shall sequence fan speed, cooling coil and heating coil control valves to maintain the space temperature setpoint.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 09 93

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 01 91 13 – General Commissioning Requirements.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot water heating piping.
2. Chilled water piping.
3. Glycol cooling water piping.
4. Glycol heating water piping.
5. Condensate-drain piping.
6. Air-vent piping.
7. Safety-valve-inlet and -outlet piping.
8. Chemical Treatment
9. Valves
10. Transition Fittings
11. Di-electric Fittings
12. Air Control Devices
13. Air Vents
14. Hydronic Piping Specialties

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

1.4 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot Water Heating Piping: 150 psig at 250 deg F.
2. Chilled Water Piping: 150 psig at 200 deg F.
3. Condenser Water Piping: 150 psig at 200 deg F.

4. Air-Vent Piping: 200 deg F.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Plastic pipe and fittings with solvent cement.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for pressure independent combination automatic flow-control valves.
3. Air control devices.
4. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Electronic drawing files shall be generated by the Contractor.
2. Drawings shall be submitted in both hard copy and electronic (AutoCAD or Revit version as required by the Owner) version or AutoCAD Version 2010 if not specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Field quality-control test reports.

D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

E. Comply with the 2022 NYC Mechanical Code.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Elkhart Products
2. Mueller Streamline
3. Nibco
4. Cambridge-Lee Industries
5. Cerro Flow Products

B. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

C. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

D. DWV Copper Tubing: ASTM B 306, Type DWV.

E. Fittings:

1. Wrought Copper and Copper Alloy Solder Joint Pressure Fittings (ASME B16.22)
2. Tee-drill/mechanically formed extruded outlets are not acceptable.

F. Wrought-Copper Fittings: ASME B16.22.

G. Wrought-Copper Unions: ASME B16.22.

H. Copper or Bronze Pressure-Seal Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Stadler-Viega.

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

2.2 STEEL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wheatland Tube Company
2. NORCA Industrial Company
3. WELDBEND
4. Zekelman Industries
5. U.S. Steel Tubular Products

B. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article and on the drawings schedule.

C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article and on the drawings schedule.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article and on the drawings schedule.

E. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

F. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

H. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 TRANSITION FITTINGS

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.
    e. Matco-Norca, Inc.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.

2. Description:

    a. Standard: ASSE 1079.
    b. Pressure Rating: 125 psig minimum at 180 deg F.
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Matco-Norca, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    e. Wilkins; a Zurn company.

2. Description:

    a. Standard: ASSE 1079.
    b. Factory-fabricated, bolted, companion-flange assembly.
    c. Pressure Rating: 125 psig minimum at 180 deg F.
    d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Description:

    a. Nonconducting materials for field assembly of companion flanges.
    b. Pressure Rating: 150 psig.
    c. Gasket: Neoprene or phenolic.
    d. Bolt Sleeves: Phenolic or polyethylene.
    e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elster Perfection.
    b. Grinnell Mechanical Products.
    c. Matco-Norca, Inc.
    d. Precision Plumbing Products, Inc.
    e. Victaulic Company.

2. Description:

    a. Standard: IAPMO PS 66
    b. Electroplated steel nipple complying with ASTM F 1545.
    c. Pressure Rating: 300 psig at 225 deg F.
    d. End Connections: Male threaded
    e. Lining: Inert and noncorrosive, propylene.
    f. 6” Long

2.6 VALVES

A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 230523 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 230900 Section.

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    c. Flow Design Inc.
    d. Griswold Controls.

2. Body: Bronze, ball type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.

5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    c. Flow Design Inc.
    d. Griswold Controls.

2. Body: Cast-iron or steel body, ball, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Brass, Y-pattern globe, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Tour and Andersson
    b. Macon
    c. Bell and Gossett

2. Body: Brass, globe type.
3. End Connections: Threaded or socket.
4. Pressure Gage Connections: Integral seals for portable differential pressure meter.
5. Handle Style: Hand wheel, with memory stop to retain set position.
6. CWP Rating: Minimum 125 psig.
7. Maximum Operating Temperature: 250 deg F

F. Steel, Y-pattern globe, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Tour and Andersson
    b. Macon
    c. Bell and Gossett

2. Body: steel body, globe pattern
3. End Connections: Flanged.
4. Pressure Gage Connections: Integral seals for portable differential pressure meter.
5. Handle Style: handwheel, with memory stop to retain set position.
6. CWP Rating: Minimum 125 psig.
7. Maximum Operating Temperature: 250 deg F.

G. Diaphragm-Operated, Pressure-Reducing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

H. Diaphragm-Operated Safety Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.

f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

I. Combination Automatic Balance/Flow Measuring Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. IMI Flow Design
b. Griswold Controls.
c. Nexus

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.
10. Balancing/flow measuring valves larger than 8” shall be pressure independent type with a spring loaded diaphragm to maintain a constant flow rate.
11. Valves shall have integral 1/4” NPT body tapings with P/T test valves.
12. The valves shall automatically control flow to plus or minus 5% of the specified value.
13. Valve cartridge shall be of stainless steel construction.
14. Valves manufacturer shall provide a 5 year material, workmanship and performance warranty.
15. Balancing/flow measuring valves larger than 8” sizes have 150 lb. flanged connections.

J. Combination Automatic Balance/Flow Measuring Device shall not be required on devices where pressure independent control valves are installed.

K. Combination Automatic Balance/Flow Measuring Device are required where a pressure independent control valve is installed controlling more than one device.

2.7 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Bell & Gossett Domestic Pump; a division of ITT Industries.
3. Spirotherm
4. Honeywell

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 .
5. Discharge Connection: NPS 1/8 .
6. CWP Rating: 150 psig .
7. Maximum Operating Temperature: 225 deg F .

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig .
7. Maximum Operating Temperature: 240 deg F .

2.8 HYDRONIC PIPING SPECIALTIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Watts/Mueller
b. Red White Valve
c. Nibco

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron bolted cover and bottom drain connection for NPS 2-1/2 and larger; bronze with bottom blowoff outlet NPS 2 and smaller .
2. End Connections: Solder ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 20-mesh stainless-steel.
4. Class 125 psig .

C. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

D. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig .

E. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be the following:

1. Schedule 40 steel pipe; type E, grade B, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be the following:

1. Schedule 40 steel pipe; type E, grade B, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Condensate-Drain Piping: indoor shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered.

F. Condensate-Drain-Piping, outdoor, aboveground, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered.

G. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

H. Air-Vent Piping:
1. Type K, annealed-temper copper tubing with soldered or flared joints.

I. Safety Valve Inlet and Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply and return mains, and at supply and return connections to each piece of equipment.

B. Install automaticbalance/flow measuring device at each branch connection to return main and at each piece of equipment.

C. Install balancing valves in the return pipe of each heating or cooling terminal where multiple units are served by one control valve.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap and chain, at low points in piping system mains, branches and elsewhere as required for system drainage.

M. Pitch horizontal mains up at 1" per 40 ft in direction of flow. Install manual air vents at all high points where air may collect. If vent is not in accessible location, extend air vent piping to nearest code acceptable drain location with vent valve located at nearest accessible location to pipe.

N. Reduce pipe sizes using eccentric or concentric reducer fittings. When eccentric fitting is used, install with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 230523 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated. Unions at final connections to equipment and coils shall be within 12” of the equipment and coil to allow for service and removal. No piping trim, specialties, valves, air vents, test ports, etc. shall be located upstream of the final connection union.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. Flanges at final connections to equipment and coils shall be

within 12” of the equipment and coil to allow for service and removal. No piping trim, specialties, valves, air vents, test ports, etc. shall be located upstream of the final connection union.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Provide hose end, cap, and chain on discharge. Match size of strainer blowoff connection for strainers smaller than NPS 2 .

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Trap each cooling coil and drain pans with trap seal of sufficient depth to prevent conditioned air from moving through piping. Extend drain piping to approved drain location. Construct trap with plugged tee for cleanout purposes. Pitch pipe down at 1/4" per one foot for proper drainage.

Y. Install drains throughout systems to permit complete drainage of entire system.

Z. Do not install piping over electrical panelboards, switchgear, switchboards or motor control centers.

AA. Contractor shall verify existing piping prior to making connections to existing systems. The contractor shall not assume that pipe labels correctly identify supply and return lines

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 8 feet ; minimum rod size, 3/8 inch .
2. NPS 1: Maximum span, 8 feet ; minimum rod size, 3/8 inch .
3. NPS 1-1/4: Maximum span, 8 feet ; minimum rod size, 3/8 inch .
4. NPS 1-1/2: Maximum span, 10 feet ; minimum rod size, 3/8 inch .
5. NPS 2: Maximum span, 10 feet ; minimum rod size, 3/8 inch .
6. NPS 2-1/2: Maximum span, 10 feet ; minimum rod size, 1/2 inch .
7. NPS 3: Maximum span, 10 feet ; minimum rod size, 1/2 inch .

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 6 feet ; minimum rod size, 3/8 inch .
2. NPS 1: Maximum span, 6 feet ; minimum rod size, 3/8 inch .
3. NPS 1-1/4: Maximum span, 6 feet ; minimum rod size, 3/8 inch .
4. NPS 1-1/2: Maximum span, 10 feet ; minimum rod size, 3/8 inch .
5. NPS 2: Maximum span, 10 feet ; minimum rod size, 3/8 inch .
6. NPS 2-1/2: Maximum span, 10 feet ; minimum rod size, 1/2 inch .
7. NPS 3: Maximum span, 10 feet ; minimum rod size, 1/2 inch .

E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

G. All hanger rod and channel ends; exposed and $\leq$ 12’ above finished floor; shall be provided with plastic caps and plastic channel safety end caps. Color shall be same throughout the project; yellow, orange or red.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32. Tee-drill/mechanically formed extruded outlets are not acceptable.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8. Tee-drill/mechanically formed extruded outlets are not acceptable.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. Pipe air vent discharge to floor drain.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting. Pipe air vent discharge to floor drain.

C. Install di-electric fittings where dissimilar metals are joined together.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be line size, reduce at the control valve (if required), increase immediately after the control valve to line size, and reduce immediately at the terminal equipment to the connection size. Line size is defined as the branch piping size indicated on the documents to the equipment.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 230519 Section "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's design pressure but not less than 100 psi. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 2 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.

4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.9 AIR ELIMINATION

A. The Contractor's attention is specifically directed to the problem of proper air elimination. In installing water piping systems and all equipment, the Contractor shall carefully plan the actual installation in such a manner that high points and air pockets be kept to a minimum and that they are properly vented where they are unavoidable. All air elimination devices called for on the drawings and in these specifications shall be provided and properly installed. In addition, this Contractor shall furnish and install all other air elimination devices which may be required due to job conditions. The liability of the Contractor under the guarantee provisions of the contract is intended to cover his responsibility for a proper, continuous and automatic air elimination to assure even and balanced distribution of water to all equipment.

3.10 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 01 91 13 – General Commissioning Requirements.

B. Complete installation and startup checks and functional tests according to Section 01 91 13 – General Commissioning Requirements and manufacturers written instructions.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the start up procedure.

D. Verify that equipment is installed and commissioned as per requirements of section 01 91 13 and manufacturers written instructions/requirements.

END OF SECTION 23 21 13

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 01 91 00 – General Commissioning Requirements.

C. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Sealants and gaskets.
5. Hangers and supports.

D. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Section 230700 “HVAC Insulation”.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

B. Comply with all requirements of the 2022 NYC Mechanical Code, latest adopted version.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Electronic drawing files shall be generated by the Contractor.
2. Drawings shall be submitted in both hard copy and electronic (AutoCAD or Revit version as required by the Owner) version or AutoCAD Version 2010 if not specified.
3. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
4. Factory- and shop-fabricated ducts and fittings, and sheet metal shop standards. Edited to specification and job specific requirements. Sheet metal shop standards shall be submitted for review prior to the submission of sheet metal shop drawings. Any sheet metal shop drawings submitted prior to the submission and review of the sheet metal shop standards shall be returned “not reviewed.”
5. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
6. Shop drawings shall be submitted in 3/8” scale.
7. Elevation of top and bottom of ducts.
8. Dimensions of main duct runs from building grid lines.
9. Fittings and fitting construction edited to specification and job specific requirements.
10. Reinforcement and spacing.
11. Seam and joint construction.
12. Penetrations through fire-rated and other partitions.
13. Equipment installation based on equipment being used on Project.
14. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
15. Hangers and supports, including methods for duct and building attachment and vibration isolation.
16. Schedule indicating ductwork material, service, location (interior, exterior), and sealing method.
17. Submittals with multiple manufacturers listed for a single product will not be reviewed shall be returned “not reviewed.”

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

c. Sprinklers.
d. Access panels.
e. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports, AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. Mockups:

1. Before installing duct systems, build mockups representing static-pressure classes of 2-inch wg and greater. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

a. Five transverse joints.
b. One access doors.
c. Two typical branch connections, each with at least one elbow.
d. Two typical flexible duct or flexible-connector connections for each duct and apparatus.
e. One 90-degree turn with turning vanes.
f. One fire dampers.
g. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 STANDARDS

A. SMACNA "HVAC Duct Construction Standards - Metal and Flexible” Latest Edition.

B. Minimum duct gauge shall be 24 for all rigid round, flat oval, and rectangular ductwork.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Refer to specification sections below and the details on the drawings for more information regarding acceptable elbows, transitions, offsets, branch connections, and other duct construction.

E. Sheet metal shop duct identification labels/tags shall not be installed on the inside surface of ductwork or fittings.

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Round and flat oval ductwork shall be pre-fabricated spiral seam round or spiral flat oval by a listed manufacturer in indicated below.

B. Where round and flat oval ductwork is exposed, ductwork manufacturer shall thoroughly clean exterior surfaces of all products and provide packaging to protect exterior finish of ductwork.

C. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.

D. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

E. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 48 Inches in Diameter: Flanged.

F. Spiral Seams: Spiral lockseam (smooth) according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2" Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." RL-2, 3, 4, 5, and snaplock seam types RL-6A, 6B, 7, 8 are not acceptable. SMACNA form M Metallic duct (semi rigid) is not acceptable.

G. Tees and Laterals: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5,"90 Degree Tees and Laterals," 45 degree lateral taps and tees, (the use of 90 degree taps and fittings are not acceptable) for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Refer to specification sections below and the details on the drawings for more information regarding acceptable elbows, transitions, offsets, branch connections, and other duct construction.

I. Sheet metal shop duct identification labels/tags shall not be installed on the inside surface of ductwork or fittings.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: G60

C. Galvannealed or Mill Phosphatized: Comply with ASTM A 653/A 653M.

1. Finished for surfaces indicated to be field painted: galvannealed or mill phosphatized: A60.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; galvanized.

1. Where galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Tie rod material shall match the duct material. 3/8-inch minimum diameter.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with UL 181 or ASTM C 1071 for erosion/velocity, UL 181 or ASTM C1338 for mold/humidity, NFPA 90A, NFPA 90B, ASTM 1104 < 5%, and with NAIMA AH124, “Fibrous Glass Duct Liner Standard.”

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Owens-Corning Fiberglass Company - Quiet R Rotary Duct Liner
b. CertainTeed – ToughGard T Textile Duct Liner
c. Knauf – Sonic XP Duct Liner with ECOSE Technology

B. Material shall be a Glass fiber coated with a black pigmented fire resistant coating fascia. Material shall be the thickness as called out on the drawings and have a 1.5 lbs/ft3 density minimum. Material shall meet or exceed applicable testing requirements set forth herein and shall meet or exceed the requirements of NFPA 90. When tested according to ASTM E84, product shall have a Flame Spread Rating of no more than 25 and Smoke Developed Rating of no more than 50. Product shall be UL 723 Class 1 product. Material shall be secured to substrate with adhesive and mechanical fasteners.

C. Absorptive material shall be adhered by 100% covering of a fire retardant adhesive. In addition, use non-ferrous mechanical fasteners as welded pins, 12" on center maximum. Apply a brushcoat of adhesive to washers, extending onto material surface a minimum of 2". Fasteners shall comply with SMACNA HVAC Duct Construction Standards Article S2.11

D. Absorptive fiberglass material shall have the following minimum sound absorption coefficients when tested in accordance with ASTM C423 procedures utilizing ASTM 95 mounting:

	Octave Band Center Frequency, Hz.						
	125	250	500	1000	2000	4000	NRC
1" thick	0.15	0.25	0.45	0.68	0.79	0.81	0.55
1.5" thick	0.16	0.36	0.61	0.83	0.90	0.92	0.70
2.0” thick	0.20	0.53	0.79	0.94	0.95	0.97	0.80

Thermal Performance: Type I, Flexible:

1" thick 0.26 Btu x in./h x ft2 x °F at 75 deg F mean temperature, R=4.0
1.5" thick 0.27 Btu x in./h x ft2 x °F at 75 deg F mean temperature, R=6.0
2.0” thick 0.26 Btu x in./h x ft2 x °F at 75 deg F mean temperature, R=8.0

E. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant

coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

F. Adhesives:

1. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CH-10.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Electrogalvanized steel rods, washers and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct." Minimum threaded rod shall be 3/8”.

C. Wire, steel cables and cable clutches are not acceptable for hanging ductwork.

D. Duct Attachments: Sheet metal screws or self-tapping metal screws; compatible with duct materials and of appropriate length.

E. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Electrogalvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

F. All hanger rod and channel ends; exposed and 12’ or less above finished floor; shall be provided with plastic caps and plastic channel safety end caps. Color shall be same throughout the project; yellow, orange or red.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and indicated on the Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated, smoke rated interior partitions and exterior walls, install fire dampers or smoke dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines." using “Advance Level” protection requirements.

3.2 SHOPAPPLICATION OF DUCT LINER

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation" for the construction of metal nosing. Application and location of metal nosing shall be provided as indicated below.

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream and downstream that do not receive metal nosing.
3. Completely seal all cut edges and factory edges not covered by nosing.
4. Butt transverse joints without gaps, provide metal nosing and coat joint with adhesive.
5. Fold and compress liner in corners of rectangular ducts and cut and fit the final corner to ensure butted-edge overlapping.
6. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
7. Apply adhesive coating on longitudinal seams in ducts.
8. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
9. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceded by unlined duct.
    c. Upstream edges of all transverse joints and edges of all upstream transverse joints between butted edges of lining.
    d. Upstream edges of multiple pieces of lining in a single duct/plenum.
    e. Upstream edges at all takeoffs, taps, transitions, and taps.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.3 INSTALLATION OF ALL (NON-EXTERNALLY INSULATED) EXPOSED DUCTWORK/FITTINGS

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. For acoustically lined ductwork, trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Wire, steel cables and cable clutches are not acceptable for hanging ductwork.

G. Spiral seams shall align when round spiral seam ductwork sections are joined.

H. Sheet metal shop duct identification labels/tags shall be removed. Sheet metal shop duct identification labels/tags shall not be installed on the inside surface of ductwork or fittings.

I. Provide flush seam ductwork for all ductwork where un-insulated and exposed in finished spaces or where required to maintain clearances.

J. Non-acoustically lined ductwork shall be internally sealed.

3.4 DUCT SEALING

A. Seal all duct seams and joints to comply with ASHRAE 90.1-2010 6.4.4.2.1 (unless otherwise noted) which is more stringent than SMACNA requirements. All duct types shall be sealed at a minimum seal class per the table below:

DUCT SEAL CLASS

Duct location	Duct Type			
	Supply		Exhaust (Positive and Negative side of fan)	Return
	≤2 in.wc	>2” in.wc		
Outdoors	A	A	A	A
Unconditioned Space	A	A	A	A
Conditioned Space (includes return air plenums)	A	A	A	A

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports." Refer to specification sections and drawings for all acceptable hanging and support methods.

B. Building Attachments: Stud wedge type expansion, female wedge type expansion or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Do not use powder-actuated concrete fasteners for seismic restraints or ductwork hangers.
3. Pin/nail anchors, spikes, expansion shields, expansion anchors, dropin anchors, wedge bolts, self tapping screw anchors, and friction clamps are not acceptable.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 12 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Wire, steel cables and cable clutches are not acceptable for hanging ductwork.

F. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

G. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

H. All hanger rod and channel ends; exposed and $\leq$ 12’ above finished floor; shall be provided with plastic caps and plastic channel safety end caps. Color shall be same throughout the project; yellow, orange or red.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts and plenums that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Pressure Class:

1. Refer to schedule on drawings.

C. Leakage Tests:

1. Test the following systems in accordance with the methods outlined in SMACNA's "HVAC Air Duct Leakage Test Manual." The quantity for each pressure class shall be as indicated below. Submit a test report for each test.

    a. Ducts with a Pressure Class Higher Than 2-Inch wg: Test representative duct sections totaling no less than 90 percent of total installed duct area for each designated pressure class.
    b. Ducts with a Pressure Class of 2-Inch wg and less: Test representative duct sections totaling no less than 90 percent of total installed duct area for each designated pressure class.

2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Test for leaks before applying external insulation.
4. Conduct tests at static pressures equal to the specified pressure class of the duct system. Do not include ductwork from multiple different pressure classes in the same leakage test. Do not pressurize duct systems above the specified pressure class. If pressure classes are not indicated, test system at maximum pressure class of the system installed.
5. Give seven days' advance notice for testing.
6. Submittal shall indicate:

    a. Test section
    b. Test duct surface square feet
    c. Targeted test pressure
    d. Actual test pressure
    e. Leakage class
    f. Allowable leakage
    g. Test leakage
    h. Orifice plate used
    i. Tester and witness names
    j. Pass/fail

7. Submittals that do not include this information will be returned without review.

D. Leakage Class:

1. Supply Ducts:

a. Pressure Class: Positive 1, 2, 3 inch wg.

1) Seal Class: A.
2) SMACNA Leakage Class for Rectangular: 6.
3) SMACNA Leakage Class for Round and Flat Oval: 4.

b. Pressure Class: Positive 4, 6, 10 inch wg.

1) Seal Class: A.
2) SMACNA Leakage Class for Rectangular: 4.
3) SMACNA Leakage Class for Round and Flat Oval: 2.

2. Return Ducts:

a. Pressure Class: Positive or negative 1, 2, 3 inch wg.

1) Seal Class: A.
2) SMACNA Leakage Class for Rectangular: 6.
3) SMACNA Leakage Class for Round and Flat Oval: 4.

b. Pressure Class: Positive or negative 4, 6, 10 inch wg.

1) Seal Class: A.
2) SMACNA Leakage Class for Rectangular: 4.
3) SMACNA Leakage Class for Round and Flat Oval: 2.

E. Duct System Cleanliness Tests:

1. Following duct cleaning indicated in the sections below Under “DUCT CLEANING”:

a. Visually inspect duct system to ensure that no visible contaminants are present.
b. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

1) Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

F. Duct system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal and external surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with G90 galvanized sheet steel except as otherwise indicated on the Duct Material Schedule on the drawings.

B. Static Pressure Classes:

1. Refer to Duct Pressure Class schedule on drawings.

C. Liner:

1. Install acoustical liner as indicated on drawings, as noted, or specified elsewhere.
2. Minimum of 15 ft upstream and downstream of all fans, except those outside air plenums, outside air ducts.
3. Minimum 10 ft downstream of all VAV boxes.
4. In all transfer ducts.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts:

   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

3. Aluminum Ducts: Aluminum.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane

Runners," and Figure 4-4, "Vane Support in Elbows" and the requirements indicated in specification section 233300 Air Duct Accessories. Single wall vanes are not acceptable. RE 2 is only acceptable where space does not permit the use of radius type RE 1 elbows.

c. Elbow types RE 4, 6, 7, 8, 9, and 10 are not acceptable.

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Gored, minimum 5 gores.
d. Adjustable elbows are not acceptable.
e. Elbows for exposed ductwork: elbows shall match the appearance of the ductwork. Gored elbows shall be utilized for connection to spiral seam ductwork; minimum 5 gores elbows. Stamped elbows shall be utilized for longitudinal seam ductwork to 12 inches; minimum 5 gore elbows shall be utilized for elbows greater than 12 inches for longitudinal seam ductwork.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch:

1) Radius entry with clinch lock.
2) Self-adhesive and “high efficiency” duct takeoffs are not acceptable.

b. Rectangular Main to Round Branch:

1) Spin -in bellmouth
2) Self-adhesive and ”high efficiency” duct takeoffs are not acceptable.
3) Rectangular radius entry with clinch lock with transition to round attached.
4) Transitioning rectangular to round tap with and without integral volume dampers and gasket are not acceptable.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing ducts only.

a. 45-degree lateral fitting.

b. 90 degree taps and fittings are not acceptable unless otherwise specified.

G. Offset, Transition and Obstruction Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-7, "Offsets and Transitions and Figure 4-8 “Obstructions”

a. Offsets type 1 is not acceptable.
b. All offsets shall be use radius elbows; mitered elbow offsets are not acceptable.
c. Concentric transitions shall be limited to 40°. Angle may need to be greater based on job conditions. Each instance shall be reviewed.
d. Eccentric transitions shall be limited to 20°. Angle may need to be greater based on job conditions. Each instance shall be reviewed.
e. Obstruction Figure D is not acceptable; Figure B shall be utilized as space allows. If space does not allow radius elbow offsets, each instance shall be reviewed.

3.12 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 01 91 00 – General Commissioning Requirements.

B. Complete installation and startup checks and functional tests according to Section 01 91 00 – General Commissioning Requirements and manufacturers written instructions.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the start up procedure.

D. Verify that equipment is installed and commissioned as per requirements of section 01 91 00 and manufacturers written instructions/requirements.

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Fire dampers.
3. Smoke dampers.
4. Combination fire and smoke dampers.
5. Flange connectors.
6. Turning vanes.
7. Remote damper operators.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Duct accessory hardware.

B. Related Requirements:

1. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers; include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" latest edition for acceptable materials, material thicknesses, and duct construction

methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with New York City Mechanical Code.

2.2 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" latest edition for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: G60
3. Finished for surfaces indicated to be field painted: galvannealed.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Material shall match components, minimum 3/8-inch.

2.3 MANUAL VOLUME DAMPERS

A. Single Blade Dampers. Maximum width of single blade shall be 14”, use opposed blade damper for height exceeding 14”. Pre-manufactured dampers shall be part of an assembly complete with damper, frame, axle and bearings. The damper frame shall be installed internal to the duct and fastened with the appropriate hardware. The installation shall not interfere with the operation of the damper blade(s). Approved products shall be pre-manufactured devices.

B. Multiple Blade Dampers. Opposed blade damper shall be used where duct height exceeds 14”. Approved products shall be pre-manufactured devices.

C. Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Rectangular	Air Balance	AC-111
	Greenheck	MBD-10
	Ruskin	MD25
Round	Air Balance	AC-112
	Greenheck	MBDR50
	Ruskin	MDRS25
Opposed Blade	Air Balance	AC-2
	Greenheck	MBD-15
	Ruskin	MD35OB

2. Linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

   a. Hat shaped.
   b. Galvanized-steel channels, 0.064 inch thick.
   c. Mitered and welded corners.
   d. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

   a. Parallel- or opposed-blade design.
   b. Stiffen damper blades for stability.
   c. Galvanized, roll-formed steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

   a. Dampers in ducts shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Jamb Seals: Cambered aluminum.
9. Tie Bars and Brackets: Aluminum.
10. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

       1) Locking quadrants shall be equivalent to Rossi Megalock, Windgate SURE-LOC HD, Durodyne Dyna-Click with cast metal handle.

    b. Include standoffs for insulated ductwork.

D. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

E. All dampers shall be furnished with an elevated platform/standoff for insulated duct mounting.

F. Provide dampers in all branch ducts and duct splits whether indicated or not on the drawings.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company DIBDX, IBDT, DIBDXGA

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.060-inch thick and of length to suit application. Sleeve thickness shall not be less than the gauge of the connecting duct.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as necessary for proper installation.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165°F rated, fusible links.

K. Grille Access Fire Dampers shall be provided where sidewall grilles are mounted to a fire rated wall.

L. Provide dampers; as required by all local and state codes; in ducts whether indicated or not on the drawings.

2.5 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company. Model SD60

B. General Requirements: Label according to UL 555S by an NRTL.

C. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

E. Leakage: Class I.

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 0.060-inch thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking. Sleeve thickness shall not be less than the gauge of the connecting duct.

H. Damper Motors: Modulating or two-position action as indicated in operational sequences.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.
8. All actuators shall be furnished with normally open (NO) and normally closed (NC) contacts.

J. Grille Access Smoke dampers shall be provided where sidewall grilles are mounted to a smoke rated wall.

K. Accessories:

1. Auxiliary end switches for signaling.
2. Auxiliary position indicator switched for signaling when installed as part of a smoke control/evacuation system.

3. Test and reset switches, damper mounted.

L. Provide dampers; as required by all local and state codes; in ducts whether indicated or not on the drawings.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.	Greenheck Fan Corporation.	FSD3 w/ TOR
2.	Nailor Industries Inc.	
3.	Ruskin Company.	FSD60 w/ TS-150, FSD60FA w/TS-150

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours and 3 hours.

E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

G. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.060-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking. Sleeve thickness shall not be less than the gauge of the connecting duct.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: Modulating or two-position action as indicated in operational sequences.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC" and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.
8. All actuators shall be furnished with normally open (NO) and normally closed (NC) contacts.

O. Grille Access Fire/Smoke dampers shall be provided where sidewall grilles are mounted to a smoke rated wall.

P. Accessories:

1. Auxiliary end switches for signaling.
2. Auxiliary position indicator switched for signaling when installed as part of a smoke control/evacuation system.
3. Test and reset switches, damper mounted.

Q. Provide dampers; as required by all local and state codes; in ducts whether indicated or not on the drawings.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufacturers Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows" unless otherwise noted.

D. Vane Construction: Turning vanes shall be double wall construction of minimum 24 gauge galvanized metal for 4 1/2” radius vanes and minimum 26 gauge galvanized metal for 2” radius vanes. Each vane shall be securely riveted or welded to minimum 22 gauge runner or directly to duct.

E. Turning vanes shall have 2" inside radius spaced 2-1/8" apart through 24" wide duct. Vanes in elbows larger than 24" shall have a 4 1/2" radius and be spaced 3 1/4" apart.

F. Vanes shall be installed in sections to reduce unsupported length for ducts exceeding 60” in height.

2.9 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metropolitan Air model RT-WGA
2. Young Regulator
3. DuroDyne

B. Description: Worm and spur gear driven, rotary actuation cable system designed for remote manual damper adjustment.

C. Cable: Steel.

D. Cable operated dampers (COD) shall be provided where indicated on plans, and/or where required due to damper location above/behind finished construction, where access to damper would require access door in finished construction.

E. Provide cable operated dampers in branch duct serving diffusers in inaccessible ceiling locations whether indicated or not on the drawings.

F. Cable shall terminate within the face of each diffuser/register/grille. Damper shall be adjustable through the face of the diffuser/register/grille with standard Philips head tool. Provide thin-blade screwdriver adjustable cable tip.

G. Furnish all required duct penetration seal plates, gaskets, bearings, retainers, and cable to duct mounting clamps.

H. Cable lengths shall be coordinated to allow damper to be placed at the branch duct take-off immediately off the main. Dampers shall be located as far as possible from the terminal outlet/diffuser.

I. Damper shall be by the manufacturer specified in the Manual Volume Dampers section of this specification. Bowtie and radial blade dampers are not acceptable.

2.10 DUCT AND PLENUM MOUNTED ACCESS DOORS (0.5-2.0 in w.g.)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor
2. KEES Incorporated
3. Ruskin
4. Ventfabrics Incorporated

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct" unless otherwise noted.

1. Door:

a. Double wall, rectangular.
b. Door material shall match the duct/plenum material it is installed in.
c. Door shall be double wall with insulation fill.
d. Insulation thickness shall meet the insulation thickness of the duct/plenum the access door is installed in. Provide 2” thick insulation double wall access door unless otherwise noted.
e. Latches: equivalent to Ventfabrics, Inc. No. 100 for small doors and No. 310 where physical access is possible. Window latch/sash type hardware is specifically prohibited. Use multiple latches (minimum 4) where the

door swing for a hinged door is restricted by the hung ceiling or some other obstruction.

f. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors less than 12 inches: Two hinges and one latch.
b. Access Doors 12 inches up to 20 Inches: Two hinges and two latches.
c. Access Doors 22 inches up to 24 Inches: Three hinges and two latches with outside and inside handles.
d. Access Doors larger than 24 Inches: Three hinges and two latches with outside and inside handles.

4. Access doors shall be rated to maintain the fire/smoke rating of the equipment/duct in which they are installed.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the wrap and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the wrap and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..

2. Tensile Strength: 285 lbf/inch in the wrap and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.12 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.	Flexmaster U.S.A., Inc.	Type 3M
2.	H&C Flex	F296
3.	Buckley	Type 3M
4.	Thermaflex	M-KC

B. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum/metalized/polyester core supported by helically wound, spring-steel wire; formaldehyde-free fibrous-glass insulation; aluminized/metalized polyester jacket and vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 5.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Flame/Smoke Spread: 25/50.
5. R-value=6.0 minimum unless otherwise noted.

C. Flexible Duct Connectors:

1. Clamps: Stainless steel strap in sizes 3 through 18 inches, to suit duct size.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a.	Ventlok	#699
b.	DuroDyne	IP-2, IP4

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install motorized dampers at the discharge of exhaust fans or exhaust ducts as close as possible to the exhaust outlet unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts whether indicated or not. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel. Install damper in acoustically lined ducts in such a manner to avoid damage to liner and to avoid erosion of duct liner.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Provide volume dampers in each branch duct serving all inlets and outlets whether indicated or not.

G. Install volume damper as close to main as possible, maximum 2 duct widths from branch takeoff.

H. Install ribbon tag tied on to air control device for the purpose of visibly identifying control device locations.

I. Install fire, fire /smoke and smoke dampers according to UL listing.

J. Connect ducts to duct silencers rigidly.

K. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible

links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

L. Install access doors with swing against duct static pressure.

M. Access Door Sizes:

1. One-Hand or Inspection Access: 12 by 12 inches.
2. Two-Hand Access: 12 by 12 inches.
3. Head and Hand Access: 20 by 16 inches.
4. Head and Shoulders Access: 24 by 24 inches.
5. Body Access: 24 by 24 inches.
6. Body plus Ladder Access: 24 by 24 inches.

N. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

O. Locate all duct balancing dampers above accessible ceilings, or provide cable operated dampers.

P. Install flexible connectors to connect ducts to equipment.

Q. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

R. Install duct test holes where required for testing and balancing purposes.

3.2 TEST CONNECTIONS

A. On the discharge duct from each air handling unit downstream at least 5'-0" from unit if duct is accessible, or closer to unit if necessary, install a #699 Ventlock instrument test hold device for balancing and testing of system.

3.3 ACCESS DOORS IN WALLS AND CEILINGS

A. Furnish access doors complying with the specified requirements in Access Doors and Panels.

B. At each control and balancing damper in ductwork, at each fire damper and volume box, when located above ceiling or inside the wall not accessible by removal of grille or from the airshafts, furnish an access door for installation by the general contractor. Access doors shall be 18" x 18"(minimum) unless otherwise indicated on plans. In plenum ceilings, provide felt between the door and frame to make an airtight seal.

C. All access panel locations shall be shown on the Coordination Drawings.

D. Access doors shall be rated to maintain the fire/smoke rating of the wall/ceiling/construction in which they are installed.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.
4. Seismic-restraint devices.

B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air terminal units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: minimum 18 months from substantial completion.

PART 2 - PRODUCTS

2.1 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Price.
2. Titus.
3. Metalaire.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
2. Air Outlet: S-slip and drive connections.
3. Access Doors: Provide removable panels for access with latches upstream and downstream of coil and to parts requiring service, adjustment, or maintenance; with airtight gasket.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

E. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

1. SCR Control.
2. Access door interlocked disconnect switch.
3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
4. Nickel chrome 80/20 heating elements.
5. Airflow switch for proof of airflow.
6. Fuses in terminal box for overcurrent protection (for coils more than 48 A).

F. Direct Digital Controls: Single-package unitary controller and actuator specified in Section 230900 "Instrumentation and Control for HVAC."

G. VAV manufacturer to provide airflow transducer, damper, and minimum 40 vA power transformer for controls.

2.2 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Hot dipped galvanized, all-thread rods and nuts.

C. Steel cables and cable clutches are not acceptable for hanging Terminal Air Units.

D. Air Terminal Unit Attachments: Sheet metal screws or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Where practical, install concrete inserts before placing concrete.
2. Do not use powder-actuated fasteners for terminal units or seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

E. Steel cables and cable clutches are not acceptable for hanging Terminal Air Units.

3.3 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553

"Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.

E. Air terminal unit will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Linear slot diffusers.
2. Linear bar grilles.

B. Related Sections:

1. Section 089000 or 089119 for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, unique number identifier, and accessories furnished.
3. Register, grille, and diffuser layout: Submit floor plans with all diffusers, grilles, registers and air terminal devices indicated, and tagged with the unique number identifier indicated in the submitted Diffuser, Register, and Grille Schedule mentioned above. Indicate air patterns for all air terminal devices, baffles, pattern controllers, and vanes.
   This layout shall be used by the air balance contractor in their balance report. Balance report notations and register, grille, and diffuser tags shall be coordinated with these plans.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: minimum 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Price Industries.
b. METALAIRE, Inc.
c. Titus.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material - Shell: Aluminum.
4. Material - Pattern Controller and Tees: Aluminum.
5. Finish - Pattern Controller: Baked enamel, black.
6. Finish - custom color as selected by Architect.
7. Mounting: Concealed and Lay-in.

2.2 REGISTERS AND GRILLES

A. Linear Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.
   b. Architectural Grille
   c. Titus.

2. Material: Aluminum.
3. Finish: custom color as selected by Architect.
4. Frame: 1 inch wide.
5. Mounting: Concealed and Lay-in.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Provide supplemental supports for all registers, grilles, diffusers as required for concealed mounting. Surface screws/attachments are not acceptable.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns on the drawings or as directed in the shop drawings, before starting air balancing.

B. Adjust patterns for all the register, grille and diffuser baffles, pattern controllers, and vanes of adjustable outlets to those indicated on the drawings or in the registers, grilles and diffusers shop drawing for proper distribution without drafts.

END OF SECTION 23 37 13

SECTION 23 73 13 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Constant-air-volume, single-zone air-handling units.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/100 where "L" is the unsupported span length within completed casings.

1.4 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:

    a. Certified fan-performance curves with system operating conditions indicated.
    b. Certified fan-sound power ratings.
    c. Fan construction and accessories.
    d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.
5. Dampers, including housings, linkages, and operators.
6. Filters with performance characteristics.

B. Delegated-Design Submittal: For vibration isolation indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each air-handling unit fan.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Klimak
2. Haakon
3. Ventrol

2.2 GENERAL

A. AHU casings shall be of double wall no-thru metal construction for indoor and outdoor application.

B. General Description: Factory assembled, consisting of fan arrays, coils, drip pans, plenums, filters, mixing box with dampers.

C. The Contractor and the AHU manufacturer shall be responsible for ensuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit components.

D. AHU sections shall be fully assembled (unless they are beyond the shipping container dimensions), by the manufacturer in the factory in accordance with the arrangement

shown on the drawings. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. Factory tested units shall be fully assembled, tested and then split to accommodate shipment and job site rigging. When the units that are not shipped fully assembled, the manufacturer shall tag each section and include airflow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.

E. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly.

F. The manufacturer shall provide a local representative at the job site to supervise the assembly and to assure the units are assembled to meet manufacturer's recommendations and requirements noted on the drawings.

G. Gaskets: All door and panel gaskets shall be high quality which seal airtight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.

2.3 BASE

A. Provide a heavy-duty steel base for supporting all AHU major components. Bases shall be constructed of minimum 4” high made of 10-gauge steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. A base rail of necessary height shall be provided, as required to obtain proper operation heights for cooling coil condensate drain trap as shown on drawings.

B. AHUs shall be self-supporting for installation on concrete house-keeping pads, steel support pedestals, or suspended as shown on drawings.

C. The AHU base frames shall be cleaned, primed with a rust inhibiting primer, and finished with powder coating.

2.4 CABINET

A. General: AHU shall be designed and constructed such that removal of any panel shall not affect the structural integrity of the unit. Unit casing shall meet R-17.

B. Materials: Double wall panels shall be fitted to anodized/powder coated aluminum alloy frames, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. The casing inner and outer liners of the panel shall be coated with oven backed polyester paint finish. Uncoated liners are not acceptable.

C. Outer Liner:

1. Coated (Polyester) Aluminum alloy sheet (for indoor unit) - 20 ga minimum,
2. Coated (Polyester) Aluminum alloy sheet (for outdoor unit) - 18 ga min

Inner Liner:

1. Polyester coated Aluminum alloy sheet (for indoor/outdoor unit) – 18 ga min
2. Inner Liner for Wet Sections: Stainless steel – 20 ga.

Floor Plate: 10 ga Aluminum checkered tread plate at all access sections.

D. Unit sections shall be tightly joined in the field through the use of casing brackets and shall be gasketed to make the casing airtight.

E. Casing panels shall be secured to aluminum alloy frame with stainless steel screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow withdrawal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are not acceptable.

F. Provide sealed sleeves, metal or plastic or grommets for penetrations through casing for coil connections, power and temperature control wiring and pneumatic tubing.

G. Coordinate number and location with electrical and temperature control sub-contractors. Coordinate lights, switches, and duplex outlets and disconnect switch location and mounting. All penetrations and equipment mounting shall be provided in the factory. Neatly seal all openings airtight.

H. Insulation: CFC free polyurethane foam insulation, complying with NFPA 90A flame spread and smoke generation requirements.

1. The walls, roof and floor of the AHU including coil section shall be insulated.
2. Insulation shall be injected foam between the inner and outer skin of casing, shall not absorb moisture and shall be rot resistant.
3. Thickness: minimum 2” for indoor units and 3” for outdoor units.
4. Insulation shall be of 3 lb minimum density

I. Access Panels and hinged doors shall be provided for each access section and shall be of the same materials and finishes as cabinet and complete with latches, handles, and gaskets

1. Doors shall be of minimum 24” wide and shall be the full casing height up to a maximum of 60”.
2. Doors shall be gasketed, hinged, and latched to provide an airtight seal.
3. Doors shall be out-swing for casings under negative pressure and inswing for casings under positive pressure.
4. Each door shall include a minimum 8” diameter double thickness reinforced glass or Plexiglas inspection window in a gasketed frame.
5. Hinges: Manufacturers standard, designed for door size, weight and pressure classifications.

6. Latches: Non-corrosive construction, with operating levers for positive cam action, operable from both inside and outside. Door shall be outswing for draw-through and inswing for blow-through application.
7. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Gasket shall be secured with to eliminate possibility of gasket slipping or coming loose.
8. Fan and filter sections shall have inspection windows and access panels and doors sized and located to allow periodic maintenance and inspections.

J. IAQ Drain Pans: Condensate drain pans shall be designed and manufactured in accordance with ASHRAE 62.1 Section §5.10 in sizes and shapes to collect condensate from cooling coils, including coil piping connections and return bends. Depth of drain pan shall be at least 2” and shall handle all the condensate without overflowing. Drain pan shall be continuous and welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly

1. Drain pan shall me made of not less than 18 gage thick stainless-steel sheets of grade 304.
2. Drain pan shall be sloped to drain and extended in accordance with Section §5.10.4, ASHRAE 62.1.
3. Coils above 4’ in height shall have an intermediate drain pan and drain pipe or drain trough to collect condensate from top coil pack.
4. Cooling coil headers shall be enclosed by cabinet and shall be factory insulated against sweating or shall drain to a drain pan.
5. All pans shall have a double slope to the drain point, located at the lowest point.

K. Electrical and Lighting: Wiring and equipment specifications shall conform to the respective specification division.

1. Provide factory installed vapor-proof LED lights installed in each access section, fan, coil, filter and mixing box sections.
2. A switch shall control the lights in each compartment mounted outside the respective compartment access door.
3. Wiring between switches and lights shall be factory installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for 115 V - 1 phase field connection.
4. Provide a convenience GFCI outlet next to the light switch.

L. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Electrical Specifications.

2.5 FAN SECTION [Centrifugal Fan Arrays]

A. Operating Performance

1. Air Handling unit manufacturers shall account for, and include in, submitted fan selections any static pressure drops associated with unit, and system effect due to fan operating in the Air Handling unit.

    a. Add additional static pressure to fan scheduled total static pressure
    b. If fan motor horsepower is increased, notify Engineer.

2. Fans shall have sharply rising pressure characteristics at operating point and stable in operation. Fan horsepower characteristics shall be self-limiting and non-loading.
3. Fan speed, brake horsepower, and sound power levels indicated are maximum acceptable.
4. Scheduled motor horsepower, airflow rate, and static pressure are minimum acceptable. Motor horsepower shall be capable of handling maximum horsepower of fan at scheduled speed.
5. As a minimum, fans shall have AMCA class indicated on Drawings.

    a. Fan operating limits shall be in accordance with AMCA 99 for AMCA class indicated.
    b. If AMCA class is not indicated, use AMCA 99 as basis for determining AMCA class.
    c. AMCA class selected shall be capable of accommodating a plus 10 percent increase to fan static pressure indicated on Drawings.

6. Motor starting torque shall exceed fan speed-torque requirements.
7. Airflow Profile:

    a. Fan arrangement within fan array shall produce a uniform airflow and velocity profile across Air Handling unit air tunnel when measured 12 inches upstream of fan inlet and 48 inches downstream of fan inlet.

B. Vibration Balance:

1. Each fan/motor assembly shall be factory balanced to AMCA 204, BV-5, Balance Quality Grade G1.0 or better through entire operating speed range from minimum speed to maximum speed. If minimum speed is not indicated on Drawings, assume minimum speed to be 20 percent of design speed.
2. Identify and record each speed and speed range within the fan operating range that could cause potential vibration problems.
3. Submit test reports as an informational submittal for Project record.

C. Operation and Service Requirements

1. Remaining fans in array shall continue to operate with one or multiple failed fans.
2. Each fan/motor assembly of fan array shall be capable of lock-out/tag-out procedure without interrupting operation of other fans in the array.

3. Each fan/motor assembly shall be controlled through a variable-frequency controller, except for fans with electronically commutated (EC) motors having integral motor controls.
4. A single mechanical, electrical, and control device failure shall not result in a fan array available capacity of less than 33 percent of the Air Handling unit total scheduled airflow capacity.
5. Fan wheel/motor assembly shall pass through the Air Handling Unit access door servicing fans. The entire individual fan assembly shall pass through the door to the room where the Air Handling Unit is located.
6. Design and incorporate features to permit safe and rapid maintenance.

D. Airflow Measurement, Local Indication, and Remote Monitoring:

1. All fans in fan array shall be provided with Piezometric ring / Nozzle provision on the fan intake.
2. Include airflow totalization measurement of all operating fans in fan array with output indication in CFM.
3. Airflow measurement instrumentation shall not restrict or deflect air travel through fan and shall not impact fan air and sound performance.
4. Include digital display of individual fan airflow and total fan array airflow on face of fan control panel.
5. Include a (4~20 mA / 0~10 VDC) output signal for remote monitoring of total fan array airflow.

E. Fan Array Local Control:

1. Include fan array control panel with operator interface to control fan array locally through the fan control panel and to switch to control of fan array through a remote-control source.
2. Local control shall include on/off operation and speed adjustment for entire fan array and each individual fan/motor in fan array.

F. Fan Array Remote Control:

1. Include fan control panel with control interface for remote control.
2. Fan array on/off operation shall be remotely controlled through a single hardwired digital output signal.
3. Fan array speed shall be remotely controlled through a single hardwired analog (0~10 VDC) output signal.

G. Fan Inlet Cone:

1. Include a precision-spun or die-formed, matched inlet and wheel cone to ensure streamlined airflow into the wheel and full loading of fan blades.
2. Inlet cone shall be a single piece, constructed of aluminum or powder-coated steel.
3. Fasten inlet cone to fan assembly using bolts, nuts, and washers to provide a positive and secure attachment that can be field removable.

H. Fan Wheel:

1. Construct blades of aluminum or composite, reinforced for AMCA fan class
2. Design blades to provide smooth airflow over all surfaces of blade.

I. Fan Drive:

1. Direct drive fans.

J. Fan Motors, Electronically Commutated (EC):

1. Description: EC, variable-speed, DC, programmable brushless motor
2. Features:

    a. Integral controller/inverter operates wound stator and senses rotor position to electronically commutate the stator
    b. Controller shall control motor speed either through manual adjustment locally at fan array control panel or through a remote (0~10 VDC) control signal
    c. Motor Mounting: Coordinate with driven equipment; suitable for mounting with motor shaft in either horizontal or vertical position.

3. Performance:

    a. Altitude: Suitable for operation at side altitude
    b. Electrical Characteristics: Suitable for operation with field power source.
    c. Energy Efficiency: Complying with governing energy codes
    d. Power Factor: 0.9 or higher at full load
    e. Service Factor: 1.0 or higher at full load
    f. Speed control: Variable

        1) Synchronous speed rotation with no slop losses
        2) Gradual ramp-up to set point upon receiving start signal
        3) Soft speed change ramps
        4) Able to overcome reverse rotation without impact
        5) Control Airflow within 5% of set point regardless of static pressure

    g. Temperature: Suitable for operation in ambient temperature range encountered.
    h. Thermal Protection
    i. Automatically breaks electrical power to motor when temperature exceeds a safe value
    j. Automatically resets and restores power when temperature returns to normal range

4. Bearings: Sealed and permanently lubricated ball bearings
5. Insulation: Class B or Class F
6. Rotor: Permanent magnet with near zero rotor losses that operates independent of motor current.

2.6 2.6 COILS

A. Coil Sections: Design and construct the coil sections to facilitate removal and replacement of coil for maintenance and to assure full airflow through coils.

B. Coil Construction: Rigidly supported across full face, pitched to allow drainage.

1. Fins: 0.01” thick aluminum, mechanically bonded to tubes.
2. Tubes: 0.015” thick seamless copper 5/8” diameter tubes.
3. Coil Casing: 16 ga stainless steel.
4. Headers for Water Coils: Copper with connections for drain valve and air vent and threaded piping connections.
5. Coils handling more than 30% untreated fresh air shall have coils dip coated with electro epoxy coating process. Such dip coated coils can be with galvanized steel frames. Spray coatings and pre-coated fins are not acceptable. Electro coated coils shall be selected with AHRI 410 certified software and de-rated with air side fouling factor of 0.01.

C. Water Coils: Drainable with threaded plugs. Coil type guide rail shall be designed to ensure that all condensate drain including the headers are effectively collected in the drain pan.

D. Direct-Expansion Refrigerant Coils: ASHRAE 15, with the following features:

1. Suction Headers and Distributor Tubes: Seamless copper.
2. Refrigerant Distributors shall be designed for low-pressure drop, down feed with solder connections, and with maximum of 12 circuits for each distributor

E. Coil-Performance Tests: Factory-test cooling coils, except sprayed surface coils for rating according to AHRI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

F. Coils shall be certified to AHRI 410, "Standard for Forced-Circulation Air-Cooling and Air-Heating Coils. Letter in original shall be presented along with the submittal from the coil manufacturer confirming that the coils being supplied for this project are selected in accordance with the AHRI Certified software and they will carry AHRI 410 Label.

2.7 2.7 DAMPERS

A. General: Provide with factory mounted outside and return air dampers in mixing boxes, combination Filter/Mixing Box shall be of aluminum alloy blades assembled in aluminum frames with vinyl bulb edging and edge seals, in opposed blade arrangement with non-slip keyed connecting rods and linkages. Permanently secure damper blades on a single shaft with nylon bearings. Position damper blades across short air opening dimensions.

B. Leakage rate, according to AMCA 500, "Test Methods for Louvers, Dampers and shutters," shall not exceed 2 percent of air quantity.

2.8 2.8 FILTER SECTION

A. Air Filters: Refer to Section "Air Filters."

B. Filters: Comply with NFPA 90A.

C. Filter Housing: Provide powder coated filter holding frames for flat panel filter and bag filters, made of 18 gauge stainless steel sheet with no cut edges. Alternately frames made of Aluminum alloy sheet is acceptable. Provide access doors with fixed air sealing gaskets to be airtight at the static pressure expected in service. Provide test ports / pressure tappings into each filter cabinet or plenum. Test port shall not penetrate to filter frame or media.

D. Pre-filters: 2in thick, synthetic, clean airflow resistance of not more than 0.2inwc at face velocity of 500 FPM filter with 90% arrestance efficiency (MERV 8)

E. Fine Filters: Bag type synthetic media held in galv. steel frames with 90% efficiency (MERV 14 or above).

2.9 TESTING

A. General:

1. AHRI certified AHUs: No individual AHU testing required.
2. Non-AHRI certified AHUs: All units shall be factory assembled and tested.
3. Units specified to be tested shall be factory assembled and tested in accordance with specified Test Procedure to demonstrate compliance with required unit capacities, ensure correct fit of all components and minimize field assembly labor.

B. Factory Test: One AHU chosen by the engineer shall be factory tested for

1. Casing leakage test at the maximum working fan pressure.
2. Air volume, static pressure for AHU and each component, fan speed and power consumption for the maximum of present or future design conditions. Submit fan curves showing test results. Test results shall not be less than 5% of the specified fan performance.
3. One AHU randomly chosen by the engineer shall be tested for the air and cooling performance at the design parameters at an independent laboratory. Test results shall not be less than 5% of the specified air performance and 2% less for the cooling performance.
4. When the AHU is tested at an independent lab, factory air performance test may not be required.

C. Approval:

1. Factory tests shall be witnessed by the Engineer’s and Employer’s representative.

2. Failure of AHU to meet the above test tolerances shall require correction of deficiency in the form of replacing the coil/fan/motor/pulleys and re-testing of the unit.
3. Submit written results of factory tests for approval prior to shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install air-handling units on concrete bases using elastomeric pads. Secure units to anchor bolts installed in concrete bases. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that face-and-bypass dampers provide full face flow.
7. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
8. Comb coil fins for parallel orientation.
9. Verify that proper thermal-overload protection is installed for electric coils.
10. Install new, clean filters.
11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 23 73 13

SECTION 23 82 19 - FAN COIL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fan-coil units and accessories.

1.3 DEFINITIONS

A. BAS: Building automation system.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of fan-coil unit indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension components.
2. Structural members to which fan-coil units will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Manufacturer Seismic Qualification Certification: Submit certification that fan-coil units, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fan Belts: Furnish 2 spare fan belts for each unit installed.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.9 COORDINATION

A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fan coil units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
a. Coil leak.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In the Fan-Coil-Unit Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
3. Basis-of-Design Product: The design for each fan-coil unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 DUCTED FAN-COIL UNITS

A. Basis-of-Design Product: or a comparable product by one of the following:

B. Available Manufacturers:

1. Carrier Corporation.
2. International Environmental Corporation.
3. Trane.

C. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

D. Coil Section Insulation: 1-inch thick foil-faced glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1.

F. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.

G. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.

1. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis.
2. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
3. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.
4. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

H. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Washable Foam: 70 percent arrestance and 3 MERV.
2. Glass Fiber Treated with Adhesive 80 percent arrestance and 5 MERV.
3. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.

I. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

J. Indoor Refrigerant Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and brazed joints at fittings. Comply with ARI 210/240, and leak test to minimum 450 psig for a minimum 300-psig working pressure. Include thermal expansion valve.

K. Steam Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 75 psig.

L. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

M. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

N. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

1. Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections.

B. Install piping as indicated on Shop Drawings.

C. Provide piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect piping to fan-coil-unit.
3. Connect condensate drain to indirect waste.

    a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

D. Coil Piping: In addition to requirements in Section 232113 "Hydronic Piping," connect coils to supply with shutoff valve, strainer, drain, air vent, control valve, and union or flange; and to return with balance/flow measuring device, isolation valve, drain, air vent, and union or flange.

E. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated. Unions at final connections to equipment and coils shall be within 12” of the equipment and coil to allow for service and removal. No

piping trim, specialties, valves, air vents, test ports, etc. shall be located upstream of the final connection union.

F. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 23 82 19

SECTION 23 84 13 - HUMIDIFIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following humidifiers:

1. In-duct pressurized nozzle and evaporative media humidifier/cooler

1.3 DEFINITION

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.

1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which humidifiers will be attached.
2. Size and location of initial access modules for acoustical tile.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For humidifiers to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Supply one replacement electrode cylinder with each self-contained humidifier.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ARI 640, "Commercial and Industrial Humidifiers."

1.9 COORDINATION

A. Coordinate location and installation of humidifiers with manifolds in ducts and air-handling units or occupied space. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

PART 2 - PRODUCTS

2.1 IN-DUCT PRESSUIZED NOZZLE AND EVAPORATIVE MEDIA HUMIDIFIER/ COOLER

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Carel USA, LLC.
2. Herrmidifier.
3. Mee Industries Inc.

D. General:

1. Pre-engineered system, for air handler/duct application, uses pressurized nozzle technology to directly inject fine mist into the airstream with a ceramic evaporative media downstream for additional evaporation and mist elimination.
2. Humidifier wet section maximum installation length of 36” (distance from nozzle grid to ceramic media)
3. Humidifier accepts reverse osmosis water (0.5-15µS).
4. Pressurized nozzles to operate between 43.5 and 101.5 psi (3-7 bar).
5. Evaporative media to be porous ceramic material designed for post evaporation and mist elimination.
6. Electronic controller, which monitors the operation of the system, controls output levels and initiates self-cleaning and flush cycles to ensure hygiene operation.
7. Humidifier powered by 200-240 volts single phase power supply.
8. Hydraulic system to supply water to the pressurized nozzles with 3, 7, 15 or 31 steps of control, depending on humidifier capacity and cross-section.
9. Duct shall contain nozzle grid, connection hoses, and ceramic media. Pumps, valves, controls, and other mechanical components shall be provided in a separate module for installation external to the air stream.
10. Control panel includes BTL Certified BACnet IP and BACet MS/TP, Modbus RTU (RS485 interface), and Modbus TCP (RJ45 Ethernet) as standard. Lonworks available as an option.
11. Control panel includes IoT connection to Condair Cloud via IoT Ethernet. Connection via IoT mobile module as an option.
12. Central rack for mounting the control panel and hydraulic unit shall be provided.

E. Nozzle Grid:

1. Pre-assembled nozzle grid sections with color coded nozzle assemblies for easy connection to staging solenoid valves.
2. 316SS pressurized nozzles with capacities of: 3.3 lb/hr (1.5 l/hr), 5.5 lb/hr (2.5 l/hr), 6.6 lb/hr (3.0 l/hr), 8.8 lb/hr (4.0 l/hr), 9.9 lb/hr (4.5 L/hr), or 11 lb/hr (5.0 l/hr)
3. Nozzles spray angle can be adjusted into (4) positions to prevent condensing on AHU walls.
4. Threaded nozzle connections. All other connections to be push fit quick connections.

F. Evaporative Media:

1. Media: Made of porous ceramic material, absolutely free of fiberglass.
2. Replacement: Individual removable tiles.
3. No tools required for media removal.

G. Droplet Separator:

1. Additional droplet separator required if air velocity exceeds the allowable limit.

    a. DL without additional droplet separator allows velocities operation up to 492 fpm (2.5 m/s).

b. DL with additional droplet separator allows velocities operation up to 787 fpm (4.0 m/s).

H. Management System:

1. Microprocessor control using a proportional or proportional-integral method for interpreting analog signals from a humidity sensor or a demand signal from an external humidity controller.
2. The controller determines which stages should be activated to meet humidification loads.
3. The controller activates self-maintenance cycles. This includes controlled flushing of the water supply lines, and drain cycles to maintain cleanliness of the water loop.
4. Control panel complete with on/off switch and LCD capacitive touch screen for error, maintenance, and operational indication, viewing process and functional data history, and settings manipulation.
5. Remote operating and fault indication.

I. Control panel with backlit Capacitive Touch Screen Display to have the following functionality:

1. Service indicator and LED power on.
2. Intuitive touch screen back-lit graphic display.
3. Display of relative humidity and set point.
4. Display of operating hours.
5. Capacity output.
6. Real-time date and time.
7. Numpad for integer input.
8. Quick access menu.
9. Save / reset settings.
10. Remote fault indication.
11. Error history indication.
12. Error analyzer.
13. Error / warning reset via software
14. Limited capacity adjustment.
15. Inlet flush and line purging.
16. BTL Certified BACnet IP and BACet MS/TP, Modbus RTU (RS485 interface), and Modbus TCP (RJ45 Ethernet) as standard host protocol.
17. Terminal block installed for easy field connections.

J. Humidity Control Methods:

1. Enthalpy Control, Dew Point Control or Humidity sensor or demand signal, from an external controller. BMS control via Modbus or BACnet.
2. Accepts standard modulating control signals
3. Enable On/Off, 24 VAC safety loop for On/Off control (air proving, and/or high limit.

K. Hydraulic Assembly:

1. Packaged Hydraulic Assembly: Shall be installed external to airstream and include all components required for circulation water including; VFD pump, “Hygiene Plus” Silver Ion System, Silver Ion cartridge, spray valves, pressure and conductivity sensors, and drainage system.
2. A maximum of 31 stage control shall be available as an option, 7 stage standard and controlled by up to (5) 24Vdc solenoid valves.
3. VFD controlled pump
4. Optional sterile filter.
5. Water jet pump to allow for draining of the nozzle supply lines.
6. The hydraulic unit shall include a "Hygiene Plus" cartridge to actively dose the supply water with silver ions as a means of bacteria control.
7. Inlet valve, pressure gauge and sensor to ensure correct supply water pressure of 43.5-101.5 psi (3-7 bar).
8. Standard conductivity sensor to monitor supply water conductivity. Control panel to trigger alarm if conductivity increases above allowable limit.

L. Aerosol Breakdown and Hygiene Control:

1. Management System capable of real-time flushing, purging and cleaning cycles via the Management System control panel. In the event of no call for humidity, humidifier shall drain all water from the nozzle supply lines.
2. Humidifier Operation: Aerosol-free operation guaranteed under maximum air velocity of 787 fpm (4.0 m/s).

M. Optional Features/Accessories:

1. Secondary droplet separator.
2. VFD controlled booster pump.
3. 15 or 31 step control.
4. Remote fault indication board.
5. Integrated sterile filter.
6. External 5µm water filter.
7. Leak monitoring.
8. Sensor for water temperature monitoring via integrated controller.
9. External dosing system connection port (type A systems only).
10. Relay external dosing contact for control of an external disinfection pump (pump by others).
11. External valve block with additional auxiliary outlet valve (type A systems only).
12. Silicone free.
13. Compressed air flushing connections.
14. On/Off digital duct high limit humidistat.
15. Air proving switch.
16. 10V Digital Duct Humidistat package.
17. 0 - 10V Digital Wall Humidistat.
18. 2-10V Digital Wall Humidity Sensor.
19. 2-10V Duct Humidity Sensor.
20. Gateway board for BMS connectivity via LonWorks.

N. Model: Condair DL Pressurized Nozzle and Evaporative Media Humidifiers/Coolers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install humidifiers with required clearance for service and maintenance. Maintain path, downstream from humidifiers, clear of obstructions as required by ASHRAE 62.1.

B. Seal humidifier manifold duct or plenum penetrations with flange.

C. Install humidifier manifolds in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

D. Install galvanized-steel drain pan under each manifold mounted in duct.

1. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1.
2. Connect to condensate trap and drainage piping.
3. Extend drain pan upstream and downstream from manifold a minimum distance recommended by manufacturer but not less than required by ASHRAE 62.1.

E. Install manifold supply piping pitched to drain condensate back to humidifier.

F. Equipment Mounting: Install steam generator on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases specified in Section 033000 "Cast-in-Place Concrete."

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct bases to withstand, without damage to equipment, seismic force required by code.
3. Construct concrete bases 4-inch high and extend base not less than 6 inches in all directions beyond the maximum dimensions of steam generator, unless otherwise indicated or unless required for seismic anchor support.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to humidifiers to allow service and maintenance.
2. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.

B. Install electrical devices and piping specialties furnished by manufacturer but not factory mounted.

C. Install piping from safety relief valves to nearest floor drain.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 23 84 13

SECTION 26 01 00 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Division shall be governed by the Contract Documents. Provide materials, labor, equipment, and services necessary to furnish, deliver and install all work of this Division as shown on the drawings, as specified herein, and/or as required by job conditions.

B. This Section 260100 governs general procedures, materials and workmanship as applicable to the electrical work specified in the other Division 26 sections. Refer to Division 1 sections for additional general requirements.

C. Perform the work in accordance with the requirements and provisions of all applicable codes and laws.

D. Equipment, materials, and installation shall conform to applicable standards and requirements of the following organizations and documents:

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CBM	Certified Ballast Manufacturers Association
ETL	ETL Testing Laboratories
FCC	Federal Communications Commission
FM	Factory Mutual
FS	Federal Specifications
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IESNA	Illuminating Engineering Society of North America
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories, Inc.

1.2 INTENT

A. It is the intention of the specifications and drawings to obtain finished work, clean, tested, and ready for operation.

B. Items and services not shown on drawings, but mentioned in specifications, or vice versa, or items and services necessary to render the work complete and ready for operation, even if not specified or indicated on the drawings, shall be provided without additional cost.

C. Where conflicts occur between drawings and specifications, or within either document, the Contractor shall ask for and obtain a written clarification from the Architect prior to submitting his bid. Otherwise, the items or arrangements of superior quality, greater quantity or higher cost shall prevail and be included in the contract price.

1.3 WORK INCLUDED

A. The work under this Division shall include all labor, material, equipment, services and administrative tasks required to complete and make operable the electrical work shown on the drawings and specified herein, and including, but not limited to, the following:

1. Preparation and submission of shop drawings, diagrams and illustrations.
2. Procuring all necessary permits and approvals, and paying all required fees and charges in connection with the work of this Division.
3. Coordinating with, and complying with requirements of, the local electric utility, telephone company, and other franchised utility and service companies as applicable to the scope of this work.
4. Record drawings.
5. Operating and maintenance instructions and manuals.
6. Identification labels, tags, charts and diagrams.
7. Final connections to all electrical equipment and devices.
8. All cutting, drilling, and patching required for the work of this Division.
9. Excavation and backfill for underground electrical work.
10. Concrete housekeeping pads for floor-mounted electrical equipment.
11. Temporary light and power for construction purposes.
12. Testing and adjustment of all systems and equipment furnished, installed, and/or connected under this Division.

1.4 APPROVALS

A. See General Conditions and Division 1 sections, in addition to the following requirements.

B. Submit for approval a list of manufacturers of equipment proposed for the work. Contractor's intent to use exact make specified does not relieve him of responsibility for submitting such a list.

C. Where any specific material, process or method of construction, or manufactured article is specified by name or by reference to catalog number of a manufacturer, or other standards, the intent is not to take precedence over the basic duty and performance specified, noted on drawings, or as required for intended results. In all cases, the

Contractor shall verify the duty specified with the specific characteristics of the equipment offered for approval.

D. If material or equipment is installed before it is approved, the Contractor shall be liable for its removal and replacement with no additional cost.

1.5 SUBMITTALS

A. See Division 26 equipment sections for specific submittals required. Unless otherwise indicated, submittals are required for all electrical devices, equipment, and systems including basic construction materials such as conduit, 600 volt building wire, and standard fittings and boxes.

B. Manufacturers' Data

1. If catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or other variations, those features that the Contractor proposes to furnish shall be clearly identified. If any variations from the catalog description are proposed or required, such variations must be clearly noted on the cut.

C. Shop Drawings

1. Shop drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and other information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work.
2. Shop drawings shall be numbered consecutively, and drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that such units may be checked both individually and as an assembly.
3. Contractor shall keep on the site, in good order, a complete up-to-date set of approved shop drawings. Shop drawings shall be made available for inspection by the Architect.
4. The approval of shop drawings will be for general conformance to drawings and specifications, and shall not be construed as permitting any departure from the contract requirements. If the shop drawings show any variations from contract requirements because of standard shop practices or other reasons, such variations shall be clearly identified on the drawings or specifically noted in the letter of transmittal, in order that, if acceptable, suitable action may be taken for proper adjustment in other work affected thereby. If the Contractor fails to so identify such variations, he will not be relieved of responsibility for executing the work in accordance with the contract, even though such shop drawings have been approved and the work installed. Approval shall not relieve the Contractor of responsibility for any error in details, dimensions, etc. that may exist on shop drawings, nor for the furnishing of materials or work required by the contract and not indicated on the shop drawings. Approval shall not be construed as approved departure from details or instructions previously furnished by the Architect.

5. No work for which shop drawings are required shall be executed until the Architect's approval is obtained.

D. Shop Drawing Schedule

1. The Contractor shall submit, within 30 days of the award of his contract, a schedule of all proposed shop drawing submissions.
2. The schedule shall include the following information.

    a. Item to be submitted
    b. Date of submission
    c. Latest date for review
    d. Manufacturers of the specified item.

3. Items not specifically listed as "approved equal" should be listed for consideration at this time.
4. Shop drawings require a minimum of 10 business days from the date they have been received by the Consulting Engineer’s office to adequately review the submittal. If there is any submittal which requires to be expedited sooner than the 10 business days, the Engineer shall be informed in writing at the beginning of construction with a list of those submittals.

E. Operating and Maintenance Instructions

1. Furnish manufacturer's operating and maintenance instructions, parts lists, and sources of supply for replacements.

F. Submittals will be reviewed for conformance with the contract drawings and specifications. The engineer's review stamp will be affixed to submittals. One of the following actions will be taken:

1. Reviewed:

    a. No comments, corrections, or marks have been made to the submittal. Re-review by the engineer is not required. The submittal is in general conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the work shall be in accordance with the requirements of the Contract Documents. Final acceptance of the work shall be contingent upon such compliance.

2. Furnish As Corrected

    a. Comments, corrections, or marks made. Re-review is not required. Submission is in general conformance with the design concept subject to notations on the returned Submittal. Construction, fabrication, and/or manufacturer can proceed subject to the provisions that the work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Submittal and in accordance with the Contract Documents. Final acceptance of the work shall be contingent on such compliance.

3. Revise and Resubmit

    a. Significant issues/discrepancies/incomplete information was provided in the Submittal. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

4. Rejected

    a. Submittal does not meet Contract document intent. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

G. A submittal review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from Compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. The contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of his or her work with that of all other trades; and for performing all work in a safe and satisfactory manner.

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

E. Upon installation of back boxes for devices but prior to installation of raceway to same the contractor shall notify the Owner, Architect and Engineer at least two weeks prior so that a site visit for review of back box locations may be performed. Contractor shall

promptly be given marked up directions indicating which back boxes are to be relocated. Relocation of back boxes as a result of the site review shall be performed at no additional cost to the Owner.

1.7 RECORD DRAWINGS

A. Provide record drawings in accordance with contract requirements, indicating in a neat and accurate manner a complete record of all revisions to the original design of the work. Include all changes and an accurate record, on reproductions of the contract drawings or appropriate shop drawings, of all deviations between the work shown and the work installed.

B. The contractor shall provide a complete set of as-built drawings. Drawings shall be submitted in both hard copy and electronic (AutoCAD and Revit version as required by the Owner) version or AutoCAD Version 2018 if not specified. Number of copies of each as requested by the Owner. PDFs inserted into an AutoCad file are not acceptable.

C. The as-built drawings shall reflect as installed conditions including all addenda, and miscellaneous revisions. The contractor shall make necessary modifications to the as-built drawings based upon the review submission comments. The final product shall include a copy of all electronic files of all as-built drawings of size and format consistent with the project standards.

1.8 GUARANTEES AND SERVICES

A. All workmanship, installation materials, and equipment shall be guaranteed as specified in the General Conditions and Division 1.

B. Contractor shall leave entire system installed under this Contract in proper working order, and shall replace any work or material which develops defects within the guarantee period, including all other work damaged as a result of such defects, without additional cost.

1.9 PERMITS AND CERTIFICATES

A. Prior to proceeding with any installation, the Contractor shall prepare and submit to the proper authorities for their approval all working drawings required by them, and shall give all necessary notices, obtain all permits, and pay all local, state and federal taxes, fees and other costs in connection with this work.

1.10 EQUIPMENT MANUALS AND OPERATING INSTRUCTIONS

A. Provide the following:

1. Three complete sets of final and correct shop drawings, maintenance and replacement parts manuals, and operating instructions for the equipment supplied. Bind each set within a common binder. Index, number, and organize with a table of contents to permit quick and convenient reference.
2. Three days of instruction in operation and maintenance of equipment to Owner's maintenance force during a 2-week period. Designate a 2-week period, convenient to the Owner, during which qualified personnel, including manufacturers' technicians and engineers, will be available for Owner's instructions.

1.11 SHORT CIRCUIT, OVERCURRENT PROTECTION SELECTIVE COORDINATION, AND ARC FLASH STUDY

A. The contractor shall perform and submit for review and approval (1) a short circuit study, (2) an overcurrent protection selective coordination study, (3) an arc flash study in accordance with IEEE "Red Book" Standard 141 for all service and distribution equipment supplied, including, but not limited to, equipment specified in Section 262416 Panelboards. Study reports shall accompany submittals for above equipment. Submittals for the above items submitted without study reports shall be rejected. If the report is not submitted with the equipment submittals, then the contractor shall replace any overcurrent protection device or equipment as required to meet the short circuit and selective coordination requirements at no additional cost to the Owner.

B. Manufacturer shall document that overcurrent protection devices will perform in accordance with their U.L. listings and ANSI/IEEE Standard 242.

C. The contractor shall be responsible for final field adjustment of ground fault, overload and short circuit settings of adjustable circuit breakers and fused devices in compliance with the short circuit and coordination study recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS, EQUIPMENT AND SYSTEMS

A. Materials and equipment and systems shall be new, bear manufacturer's name and trademark, and comply with applicable standards specified.

B. The UL label shall be borne on each piece of applicable material or equipment.

C. Equipment shall be provided with all required hardware for proper installation, assembly, and operation.

D. The descriptions cover basic equipment and operation but not all the details of design and construction. The use of singular in descriptions does not limit the quantities of items to be furnished to provide the operation specified. Furnish all equipment required to produce specified performance under installed conditions. Provide all trim, enclosures and accessories required to make a complete installation.

E. Follow manufacturers' directions in delivery, storage, protection and installation of equipment and materials. Notify Architect promptly, in writing, of any conflict between requirements of the contract documents and manufacturers' directions, and obtain Architect's written instructions before proceeding with work. Bear all costs to correct deficiencies arising from failure to comply with the manufacturers' directions and instructions.

F. Deliver equipment and materials to the site and store in original containers, suitably sheltered from the elements. Store items subject to moisture damage in dry, heated spaces. Tightly cover and protect equipment against dirt, water, chemical, and mechanical injury, and against theft.

G. Equipment and materials of the same general type shall be of the same manufacturer, make and model throughout the work to provide uniform appearance, operation and maintenance.

H. Where new products or components are indicated to be installed or connected to existing systems or equipment, verify compatibility and performance with the manufacturer of the existing systems or equipment prior to purchase and installation.

I. Where devices and/or equipment are indicated to be relocated, conductors and raceway shall be extended to the new location and reconnected to provide a complete working system. If there are associated devices with the relocated equipment they shall be relocated as well, unless otherwise noted, and connected into the system.

2.2 EQUIPMENT DEVIATIONS

A. Where Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, and which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical or electrical layouts, such redesign and new drawings required thereby, with approval of the Architect, shall be prepared by the Contractor without additional cost.

B. Where such approved deviation requires a different quantity or arrangement of equipment from that specified or indicated on the drawings, the Contractor shall provide any structural supports, controllers, motors, starters, wiring, conduit, and any other additional equipment required by the deviation, at no additional cost.

C. It is the intent of these specifications that wherever a manufacturer of a product or a catalog number is specified, and terms "or equal" or "or approved equal" are used, a substituted item must conform in all essential respects to the specified item. Consideration will not be given to claims that a substituted item meets performance requirements with lesser

construction. Performance as indicated in schedules and in specifications shall be interpreted as minimum acceptable performance.

PART 3 - EXECUTION

3.1 SITE INVESTIGATION

A. Examine drawings, specifications, and site, and be responsible for the nature and location of work and the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, electric power, roads, etc.

3.2 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work required. Do not scale the drawings. Consult the Mechanical and Architectural drawings and details for exact locations of equipment.

B. Drawings shall be used in layout of work. Check reference drawings to verify spaces in which work will be installed, and maintain maximum headroom and space conditions. Where headroom, working clearances or space conditions appear inadequate, Architect shall be notified before proceeding with installation.

C. If directed by the Architect, make minor modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

3.3 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Equipment Mounting: Install floor mounted equipment on concrete base, 4” height with 1” 45-degree chamfer extended 3” from equipment footprint. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

F. Right of Way: Give to piping systems installed at a required slope.

3.4 COORDINATION WITH OTHER TRADES

A. Closely schedule the work so that the work will be installed at the proper time and without delaying the project's completion.

B. Where the work of this Division is to be installed in close proximity to the work of other trades, or where there is evidence that the work will interfere with the work of other trades, assist in working out space conditions to make a satisfactory arrangement. If the work is installed before such coordination with other trades, make necessary changes in the work as directed by the Architect to correct any conflicts or interferences, without additional cost.

3.5 COORDINATION AND LAYOUT

A. Study drawings and specifications to ensure completeness of work required. Include supplementary items normal to manufacturers' requirements or standard accepted trade practices as necessary to complete the work, even if not explicitly shown or specified.

B. Verify measurements and conditions in field before starting work.

C. Examine materials, surfaces, and structures to which work is to be applied and notify the Architect, in writing, of any conditions which are detrimental to proper and expeditious installation of work. Starting of work shall be construed as acceptance of conditions.

D. Confer with other trades to install work to avoid interference with other trades. The necessary adjustments to conform to structural conditions and work of other trades, particularly ductwork and piping layouts, is included under this section. Assist other trades in the preparation of coordinated layout drawings.

3.6 CONNECTIONS TO EQUIPMENT FURNISHED UNDER OTHER DIVISIONS OR BY OWNER

A. Provide electrical connections to equipment and fixtures requiring such connections which are supplied by Owner or under other Divisions.

B. Provide conduit, wire, fittings, accessories, and trim for final connection of each item of equipment as required for complete assembly and specified operation.

C. Verify with approved project submittals that power conductor’s meet both project as well as manufacturer requirements prior to conductor procurement and installation.

D. Verify conductor material and specified size are compatible with equipment to be connected to.

E. Notify architect and design team of identified issues prior to conductor procurement and installation.

F. Proceed with procurement and installation only after unsatisfactory conditions have been corrected.

3.7 WORKMANSHIP

A. Perform work in practical, neat, and workmanlike manner, with electricians skilled in the work they are performing, and using the best generally recognized trade practices.

1. Architectural exposures: Use of exposed conduit shall be limited to the greatest extent possible within the building interior. Where systems must be partially or fully exposed to view in finished architectural spaces extra effort and care above and beyond basic project workmanship principles shall be provided. A shop drawing shall be provided for design team review.

B. No work shall be covered or hidden from view until it has been inspected and approved by the required Building Department personnel and the Architect.

C. Workmanship or materials not meeting with requirements of the specifications or drawings, or the satisfaction of the Architect, shall be rejected and shall be immediately replaced in an acceptable manner without additional cost.

3.8 TESTS

A. Test all wiring, lighting fixtures, switches, controllers, starters, motors, etc., wired under this Division. Leave free from grounds, crosses, shorts, opens, etc., and leave materials and apparatus in proper and satisfactory working condition. Perform additional tests as listed in the other Division 26 specification sections.

B. Furnish necessary meters, instruments, temporary wiring, and skilled labor to perform tests and adjustments. Measuring instruments shall be properly calibrated.

C. Prior to energizing, test insulation resistance of conductors as per the requirements of specification 260519 Conductors and Cables.

D. Prior to energizing, test for continuity and identification of each conductor. Identify both ends of each conductor.

E. Perform additional tests required by Owner, Architect or any other authorities having jurisdiction.

F. Correct or replace any circuit, material or equipment which is found to be defective by these tests. Correct defects, whether due to faulty workmanship or material furnished, in a manner acceptable to Engineer without additional cost.

G. Test for proper operation of emergency lighting equipment under simulated emergency conditions.

H. Test all distribution equipment, motors, and three phase receptacles for proper phase connections and phase rotation. Correct as required.

I. Notify Architect, in writing, at least one week prior to tests, of the proposed testing timetables. Perform tests with the approval of and in the presence of the Architect or his representative.

3.9 IDENTIFICATION

A. Equipment

1. Identify each item and the system or area it serves. Provide an engraved multilayer, multicolor, plastic nameplate in a visible location on each disconnect, switch, control and similar accessory. Provide stencils on all major equipment.
2. All switchboard devices, panels, cabinets, junction boxes, switches, controllers, etc., shall be identified as to systems, voltage, phases, etc., on their exteriors.

B. Wiring

1. Provide fiber tags for feeders and branch circuits in pull boxes, cabinets, and outlets to identify each feeder and circuit.
2. All cables and branch wiring shall be identified showing phasing, system designations, and items served. Identity is required in switchboards, panels, junction boxes, switches, controllers, cabinets, etc.

C. Provide complete, accurate, typewritten panelboard and switchboard directories mounted securely to panelboard doors and switchboard faces.

3.10 TEMPORARY LIGHT AND POWER

A. Contractor shall furnish, install and maintain a temporary light and power system to provide the buildings, field offices, and project site with temporary light to provide safe working conditions throughout, and to supply construction power as required on the job.

B. The system shall be furnished, installed, and operating at the earliest possible date.

C. All work for the system shall be in accordance with NEC Article 305, the requirements of the Utility Company, and as approved by the Owner and authorities having jurisdiction.

D. The work shall include generally, but not be limited to, the following:

1. Make all arrangements with the utility company or the Owner to furnish and install the temporary light and power service.
2. Review and coordinate the electrical needs of all trades on a continuing basis, until permanent power and light is available and the temporary system is removed and no longer needed.
3. Furnish, install, and maintain all required temporary system equipment, devices,

and wiring. Remove when no longer needed, or at the direction of the Owner. Modify, add, or relocate equipment, devices, and wiring as required to suit job conditions.

END OF SECTION 26 01 00

SECTION 26 05 19 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Aluminum building wire rated 600 V or less.
3. Metal-clad cable, Type MC, rated 600 V or less.
4. Mineral-insulated cable, Type MI, rated 600 V or less.
5. Fire-alarm wire and cable.
6. Category 6 twisted pair cable.
7. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
2. Section 271513 “Communications Copper Horizontal Cabling” for additional Category 6 twisted pair cable requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Cerro Wire LLC.
3. General Cable Technologies Corporation.
4. Okonite Company (The).
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type RHH and Type RHW-2: Comply with UL 44.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems; a part of Atkore International.
2. Belden Inc.
3. General Cable Technologies Corporation.
4. Okonite Company (The).
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

H. Armor: Steel, interlocked.

I. Jacket: PVC applied over armor.

2.3 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568.2-D, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products.
2. ABB Installation Products
3. AFC Cable Systems; a part of Atkore International.
4. Hubbell Power Systems, Inc.
5. ILSCO.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. Ideal Electrical.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

C. Exposed Emergency Feeders: Mineral Insulated Cable, Type MI, unless otherwise noted on drawings.

D. Emergency Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Mineral Insulated Cable, Type MI, unless otherwise noted on drawings.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

H. Exposed Lighting Control Wiring, Including in Crawlspaces: Conductors in raceway.

I. Lighting Control Wiring Concealed in Ceilings, Walls, and Partitions: Conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.

    a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
4. Signaling Line Circuits: Power-limited fire-alarm cables must not be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on teminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. For Class A circuits, provide separate conduits or cable for outgoing and return conductors.

3.5 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568.2-D.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated devices.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from fittings.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

C. Open-Cable Installation:

1. Install cabling with horizontal cable guides in spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-E for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.6 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength, fire rating and insulation ratings than unspliced conductors.

1. Use weatherproof connectors and terminals for all connections made at boxes on or in exterior surfaces, floor boxes located on grade, and boxes located outdoors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.7 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.8 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.9 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration. Do not energize any circuits with a reading of less than 50 megohms. Circuits under megger insulation test shall be connected to respective final terminals but with switches and breakers in the "OFF" position.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

D. Category 6 Cable Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1-E.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA-568.2-D. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

E. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

F. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

G. End-to-end cabling will be considered defective if it does not pass tests and inspections.

H. Prepare test and inspection reports.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

1) Grounding arrangements and connections for separately derived systems.

b. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA. NFPA 70 – National Electrical Code

B. NFPA 780 - Standard for the Installation of Lightning Protection Systems

C. UL 96 – UL Standard for Safety for Lightning Protection Systems

D. UL 467 – Grounding & Bonding Equipment

E. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors

F. UL 1059 – Terminal Blocks

G. IEEE / ANSI 142 – Latest edition Recommended Practice for Grounding of Industrial and Commercial Power Systems

H. IEEE 837 – Standards for Qualifying Permanent Connections Used in Substation Grounding

I. ASTM B3 - Solid Conductors

J. ASTM B8 – Assembly of Stranded Conductors

K. ASTM B33 – Tinned Conductors

L. NEMA GR1 – Ground Rods and Ground Rod Couplings

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Blackburn Installation Products.
2. Burndy; Part of Hubbell Electrical Systems.
3. ERICO; a brand of nVent.
4. Harger Lightning & Grounding.
5. ILSCO.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. Siemens Industry, Inc., Energy Management Division.
8. VFC / Lyncole Lightning & Grounding.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Mechanical Connectors: Material – The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of silicon bronze and supplied as part of the connector body and shall be two bolted pressure types.

C. The mechanical connectors shall meet or exceed UL467 and be clearly marked with catalog number, conductor size and manufacturer.

D. Compression Connectors: Provide Irreversible compression connectors that meet or exceed the performance requirements of IEEE837 and UL467 latest revisions. Compression connectors shall be listed and labeled by a nationally recognized testing laboratory acceptable to Authorities having Jurisdiction for applications in which used and specific types, sizes and combination of conductors and other items connected.

E. Compression Connectors: Material – The irreversible compression connectors shall be manufactured of pure wrought copper.

F. The installation of the connectors shall be made with a hydraulic compression tool and die system clearly showing embossed die stamp on each crimp recommended by the manufacturer of the connectors

G. The connectors shall be clearly marked with the manufacturer, catalog number and conductor size.

H. Welded Connectors: Provide exothermic-welding connections for copper to copper and copper to steel, connections to ground rods, ground buses, ground wires and steel beams, kits of types recommended by kit manufacturer for materials being joined and installation conditions.

I. Welded Connectors: Material – Conductors spliced with exothermic welded connections shall be considered as a continuous conductor, as stated in the noted accompanying NEC Article 250.50, 250.64 and IEEE Standard 80 latest editions.

J. Procedures outlined in the manufacturer’s installation instructions shall be followed. Molds shall not be modified during installation in field applications.

K. Welded metals shall be a mixture of copper oxide and aluminum. Only one weld metal mixture shall be required for each grounding connection.

L. Grounding connections shall be tested and certified in accordance with IEEE837, UL487A and UL467.

M. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Furseweld Installation Products
2. Burndy Thermoweld Part of Hubbell Electrical Systems
3. Erico Cadweld A Brand of nVent

N. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

O. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

P. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

Q. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

R. Conduit Hubs: Mechanical type, terminal with threaded hub.

S. Ground Rod Clamps: Exothermic and or irreversible compression type.

T. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

U. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.
2. U-bolt type with malleable-iron clamp and copper ground connector

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel;3/4 inch by 10 feet, non-sectional.

Chemical-Enhanced Grounding Electrodes: Shall not be acceptable.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

G. Equipment Grounding Conductor Application: comply with NFPA 70, as amended by state and local codes, for sizes and quantities of equipment grounding conductors except where specific types, larger sizes or more conductors are indicated.

1. Provide equipment grounding conductors with circuit conductors for all feeders and branch circuits.

H. Bond metallic conduits containing grounding electrode conductor and main bonding conductors to the ground bus service enclosure and/or grounding electrode at both ends of each run utilizing grounding bushings and jumpers. Bonding jumpers shall be sized equal to the grounding electrode conductors.

I. Provide grounding bonds for all metallic conduits of the light and power system which terminate at (or in pits below) distribution equipment for which a ground bus is specified. Accomplish this by equipping the con

J. duits with bushings of the grounding type connected individually to the ground bus.

K. Provide supplementary ground bonding to maintain continuity of the equipment and raceway grounding system as follows:

1. Bonding jumpers shall be applied where wiring devices (receptacles and switches) are not equipped with approved self-grounding features. Include any necessary field modifications for termination of the bonding jumpers to ensure grounding continuity.
2. Bonding jumpers shall be applied to ensure that grounding continuity does not depend solely on the supporting screws fastening metallic enclosures together.

3. Include any necessary field modifications for termination of the bonding jumpers to ensure grounding continuity.

L. Where specifically noted on the drawings, or described hereinbefore in this Section, include insulated equipment and raceway grounding conductors run within the raceways. Where insulated equipment grounding conductors required for feeders have not been included in the quantities of conductors indicated on the drawings, incorporate such conductors in accordance with the electrical code. Adjust conduit sizing of required.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded or irreversible compression type connectors for outdoor locations; if a disconnect-type connection is required, use a mechanical bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, contractor shall provide additional grounding electrodes until resistance value is achieved.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB Super Strut Installation Products.
b. Allied Tube & Conduit: a division of Eaton.
c. Cooper B-Line, Inc.; a division of Atkore
d. ERICO International Corporation. A division of nVent.
e. GS Metals Corp.; a division of Eaton.
f. Unistrut A; a division of Atkore.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.
6. All channel ends; exposed and less than or equal to 12 ft above finished floor; shall be provided with plastic channel safety end caps. Color shall be consistent throughout the project.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101. MC cable shall be supported and secured by products UL listed for the purpose. Cable ties shall not be allowed for supporting MC cable but shall be allowed for bundling. The use of miscellaneous wire to secure or support MC cable for any reason shall not be allowed. MC cable shall be supported by MCS Series cable supports as manufactured by Caddy a Division of Erico, Inc. or equal. MC cable shall be supported parallel to studs with Colorado Jim supports as manufactured by Caddy a Division of Erico, Inc. or equal.

C. Conduit and Cable Support Devices: Hot dipped galvanized steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Shall not be acceptable.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Eaton.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded hot dipped galvanized steel.

    a. All hanger rods; exposed and less than or equal to 12 ft above finished floor; shall be provided with plastic caps. Color shall be consistent throughout the project.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

    1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. Where indicated to provide cables routed in free air in other specifications or drawings, all cables routed in free air, including but not limited to fire alarm cables and lighting control cables, shall be neatly tie wrapped, secured and supported with the appropriate hangers and supports, and shall not rest on ductwork, piping or conduits. Cables shall not be supported from hung ceilings or ceiling support wires.

F. Environment Applications and Finishes

1. Indoor locations: Dry non-corrosive areas channel framing shall be pre-galvanized -electro galvanized steel finished. All hardware shall be pre-galvanized zinc plated steel.
2. Outdoor wet or damp locations: Channel framing shall be hot dipped galvanized or 304 / 316 stainless steel as per drawings. All hardware shall be either hot dipped galvanized or 304 / 316 stainless steel and installed same as channel framing installation.
3. Corrosive locations: In corrosive areas channel framing shall be 316 stainless steel as per drawings all hardware shall be 316 stainless steel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
3. Locations of transition junction boxes from homerun conduit to MC cable as outlined in specification section 260519 – Con
4. ductors and Cables.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB Installation Products
b. AFC Cable Systems; a part of Atkore International.
c. Allied Tube & Conduit; a part of Atkore International.
d. Electri-Flex Company.
e. O-Z/Gedney; a brand of Emerson Industrial Automation.
f. Robroy Industries.
g. Southwire Company.
h. Wheatland Tube Company.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. IMC: Comply with ANSI C80.6 and UL 1242.
6. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

a. Comply with NEMA RN 1.
b. ANSI C80.1
c. UL6
d. Coating Thickness: 0.040 inch, minimum.
e. Interior Urethane Coating 0.20 mils.

7. EMT: Comply with ANSI C80.3 and UL 797.
8. FMC: Comply with UL 1; zinc-coated steel.

9. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360. Select appropriate LFMC for each application environment.

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB Installation Products.
    b. AFC Cable Systems; a part of Atkore International.
    c. Allied Tube & Conduit; a part of Atkore International.
    d. Anamet Electrical, Inc.
    e. Electri-Flex Company.
    f. O-Z/Gedney; a brand of Emerson Industrial Automation.
    g. Robroy Industries.
    h. Southwire Company.
    i. Wheatland Tube Company.

2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:

    a. Material: Steel.
    b. Type: compression.

7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
9. Fittings for PVC Coated Conduit shall be NEMA 4X rated with stainless steel encapsulated screws. Design based on ABB O
10. CAL or approve equal by engineer.

C. Joint Compound for GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB Carlon Installation Products
    b. AFC Cable Systems; a part of Atkore International.
    c. Anamet Electrical, Inc.
    d. Arnco Corporation.
    e. CANTEX INC.
    f. CertainTeed Corporation.
    g. Condux International, Inc.
    h. Electri-Flex Company.
    i. Lamson & Sessions.
    j. RACO; Hubbell.
    k. Topaz Electric; a division of Topaz Lighting Corp.

2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fiberglass:

    a. Comply with NEMA TC 14.
    b. Comply with UL 2515 for aboveground raceways.
    c. Comply with UL 2420 for belowground raceways.

4. ENT: Comply with NEMA TC 13 and UL 1653.
5. RNC: Type EPC-40-PVC or Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
6. LFNC: Comply with UL 1660.
7. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB Carlon Installation Products
    b. AFC Cable Systems; a part of Atkore International.
    c. Arnco Corporation.
    d. CANTEX INC.
    e. CertainTeed Corporation.
    f. Condux International, Inc.
    g. Electri-Flex Company.
    h. Lamson & Sessions.
    i. RACO; Hubbell.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

    a. Fittings for LFNC: Comply with UL 514B.

4. Solvents and Adhesives: As recommended by conduit manufacturer.
5. Nonmetallic Combination Expansion / Deflection Fittings: Shall have a neoprene outer jacket with stainless steel straps and shall be ABB NM-XD Series.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Hoffman; a brand of nVent.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hubbell Incorporated; Wiring Device-Kellems.
    b. MonoSystems, Inc.

c. Panduit Corp.
d. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated.
b. MonoSystems, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Steel City & Carlon Installation Products.
2. Crouse-Hinds, an Eaton business.
3. Hoffman; a brand of nVent.
4. Hubbell Incorporated.
5. Hubbell Incorporated; Wiring Device-Kellems.
6. Milbank Manufacturing Co.
7. Oldcastle Enclosure Solutions.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. RACO; Hubbell.
10. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Epoxy Coated Sheet Metal On-Grade Outlet and Device Box: Comply with NEMA 0S1 and UL514A

E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

F. UL QCIT - Metallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Crouse-Hinds; brand of Eaton, Electrical Sector.
    c. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. Topaz Lighting & Electric.

G. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 METALLIC EXPANSION/DEFLECTION COUPLING

A. Fittings shall be galvanized malleable iron or steel with an internal bonding jumper.

B. Manufacturer:

1. ABB XD & XJG Series Instillation Products.
2. Crouse-Hinds Model XD & XJG a division of Eaton.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: Aluminum.
2. Concealed Conduit, Aboveground: Aluminum.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried, 3” sand encased all around for branch circuits. For conduits being provided for primary cables (5KV or 15KV) the conduit shall be Type EPC-80-PVC concrete encased 3” all around.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
6. Corrosive areas, PVC Coated Rigid Galvanized Steel Conduit.
7. Conduits installed underground, whether below a concrete slab or not, or embedded in a concrete slab shall have GRC elbows and from that elbow before coming out of the floor slab or pad shall remain metal conduit. The type of metal shall be suitable for the space it is installed in as indicated elsewhere in this specification section.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Aluminum.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed elbows. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC (PVC) to metallic conduit before rising out of the slab. The type of metal shall be suitable for the space it is installed in as indicated elsewhere in this specification section. GRC elbows shall be used at all bends.

M. Stub-Outs to Above Recessed Ceilings:

1. Use EMT, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-outs not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

U. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints. Refer to architectural/structural drawings for locations.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Outlet, device, pull, and junction boxes on or in exterior surfaces and boxes located outdoors shall be cast type, not stamped type. This shall also apply to locations under canopies where the boxes may not be exposed directly to rain but are exposed to moisture in the air.

DD. Recessed junction and pull boxes in exterior surfaces shall be stainless steel type with stainless steel cover and hardware.

EE. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

FF. Locate boxes so that cover or plate will not span different building finishes.

GG. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

HH. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

II. Set metal floor boxes level and flush with finished floor surface.

JJ. Where the installation of backboxes occur in fire rated assemblies fire rated putty shall be installed on the exterior of the backbox. Refer to architectural drawings for fire rated assembly locations.

KK. Where the installation of backboxes occur in sound isolating walls the backboxes shall be separated by at least one stud bay to avoid the degradation of the sound isolation.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve-seal systems.
4. Grout.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Steel Wall Sleeves:

1. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

2.2 RECTANGULAR SLEEVES

A. Rectangular, Galvanized-Steel, Sheet Metal Sleeves:

1. General Characteristics:

a. Material: Galvanized sheet steel.
b. Minimum Metal Thickness:

1) For sleeve cross-section rectangle perimeter less than 50 inch and with no side larger than 16 inch, thickness must be 0.052 inch.
2) For sleeve cross-section rectangle perimeter not less than 50 inch or with one or more sides larger than 16 inches, thickness must be 0.138 inch.

2.3 SLEEVE-SEAL SYSTEMS

A. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Garlock, Inc.

C. Options:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Fiber-reinforced plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 GROUT

A. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or floor and wall assemblies.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Install sleeves and seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

F. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

G. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

H. Underground, Exterior-Wall and Floor Penetrations:

1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Install sleeve during construction of floor or wall.
2. Install steel pipe sleeves. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with expanding foam without leaving voids.

D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels. Labels located in plenum spaces shall be plenum rated.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for service, feeder and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 240-V Circuits:

a. Phase A: Black.
b. Phase B: Red.

4. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

5. Color for Neutral: White for 208/120 or 120/240-volt systems and gray for 480/277-volt systems.
6. Color for Equipment Grounds: Green for 208/120-volt systems and Green with a yellow stripe for 480/277-volt systems.
7. Colors for Isolated Grounds: Green with white stripe.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES." for 208-volt systems and 48” for 480-volt systems.

E. Equipment Identification Labels:

1. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Not Permitted.

F. Plastic Labels for Equipment Name Identification

1. Engraved, multilayer, multicolor, plastic labels for engraving, 1/8” thick.
2. Self-adhesive: Not Permitted.
3. Predrilled holes for attachment hardware.
4. Colors: White letters on black background, unless specified otherwise herein or elsewhere in contract documents.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum letter height shall be 1/2”.
7. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2” by 1-1/2”. Where multiple lines are required, add ½” in height per additional line.
8. Fasteners: Stainless-steel rivets or self-tapping screws.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.
d. Seton Identification Products.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Marking Services, Inc.
    c. Panduit Corp.
    d. Seton Identification Products.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Marking Services, Inc.
    c. Panduit Corp.
    d. Seton Identification Products.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Marking Services, Inc.
    c. Panduit Corp.
    d. Seton Identification Products.

2. Minimum Nominal Size:

    a. 1-1/2 by 6 inches for raceway and conductors.
    b. 3-1/2 by 5 inches for equipment.
    c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Panduit Corp.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ideal Industries, Inc.
b. Marking Services, Inc.
c. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Marking Services, Inc.

C. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Ideal Industries, Inc.
    c. Marking Services, Inc.
    d. Seton Identification Products.

2. Tape:

    a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
    b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

    a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

4. Tag:

    a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Overall Thickness: 5 mils.
    d. Foil Core Thickness: 0.35 mil.
    e. Weight: 28 lb/1000 sq. ft..
    f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Marking Services, Inc.
    b. Panduit Corp.
    c. Seton Identification Products.

2. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlton Industries, LP.
    b. Emedco.
    c. Marking Services, Inc.

2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches.

    a. Engraved legend with white letters on a dark gray background.
    b. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    c. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ideal Industries, Inc.
2. Marking Services, Inc.
3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings,

Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side. Factory painted bands are acceptable.

1. Secure tight to surface of conductor, cable, or raceway.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

J. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

K. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

L. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

M. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

N. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate. When mounted on NEMA-4 or 4X cabinets or

other equipment intended to prevent water intrusion, apply sealant/pad to back of label prior to fastening. Sealant shall be suitable for the label and cabinet materials as to not have adverse chemical reaction.

Where manufacturer of equipment will void warranty for installation of fasteners in cabinet, provide stenciled legend on equipment in l

ieu of plastic engraved label.

O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

R. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

U. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

V. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose, UV-stabilized, plenum-rated cable ties as applicable.

W. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

X. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

Y. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

Z. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits: Identify with self-adhesive raceway labels, vinyl tape applied in bands.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 25-foot maximum intervals in straight runs, and at 15-foot maximum intervals in congested areas.

D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

M. Arc Flash Warning Labeling: Self-adhesive labels.

N. Operating Instruction Signs: Baked-enamel warning signs.

O. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

P. Equipment Identification Labels:

1. Indoor Equipment: Baked-enamel signs.
2. Outdoor Equipment: Stenciled legend 4 inches high.
3. Equipment to be labeled: In addition to all requirements in this specification section, equipment below shall be labeled with its name, and the name and circuit number of the source equipment energizing it.

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Emergency system boxes and enclosures.
    e. Emergency system raceways and cables.
    f. Enclosed circuit breakers.
    g. Enclosed controllers.
    h. Variable-speed controllers.
    i. Push-button stations.
    j. Power-transfer equipment.
    k. Contactors.
    l. Remote-controlled switches, dimmer modules, and control devices.
    m. Battery-inverter units.
    n. Monitoring and control equipment.

END OF SECTION 26 05 53

SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. CGI CYME.
2. Power Analytics Corporation.
3. EasyPower, LLC.
4. Operation Technology, Inc.
5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

D. Computer software program shall be capable of printing arc-flash hazard warnings for equipment.

2.3 ARC-FLASH ANALYSIS

A. Conduct arc flash analysis after acceptance by Engineer of short-circuit study and coordination study. Perform arc flash analysis for each operating mode of the system, in accordance with IEEE 1584 and NFPA 70E.

B. Document the protection and calculation procedures and coordination review in testing report. Present analysis results in tabular format showing the following:

1. Bus and protection device name.
2. Bolted and arcing fault values.
3. Protective device trip times.
4. Arc flash boundary, working distance, and incident energy.
5. Required protective flame-resistant (FR) clothing class.

C. Arc-flash hazard warning labels for equipment shall be printed on vinyl, weather and UV-resistant, pressure-sensitive adhesive labels complying with NFPA 70E.

1. Label shall have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard study:

a. Equipment designation.
b. Nominal voltage.
c. Protection boundaries.

1) Arc-flash boundary.
2) Restricted approach boundary.
3) Limited approach boundary.

d. Arc-flash PPE category.
e. Required minimum arc rating of PPE in Cal/cm squared.
f. Available incident energy.
g. Working distance.
h. Engineering report number, revision number, and issue date.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled.

3.2 POWER SYSTEM DATA

A. The contractor shall gather and tabulate the following input data, by performing field surveys and equipment investigation, to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus.
2. Distribution panelboard.
3. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, IEEE 241 and IEEE 242.

1. Transformers:

a. ANSI C57.12.10.
b. ANSI C57.12.22.
c. ANSI C57.12.40.
d. IEEE C57.12.00.
e. IEEE C57.96.

2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
3. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 141, IEEE 241, IEEE 242 recommendations for fault currents and time intervals.

C. The electrical distribution system’s coordination shall be coordinated as required by the NYC Electrical Code.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

    a. Device tag.
    b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
    c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
    d. Fuse-current rating and type.
    e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

    a. Device tag.
    b. Voltage and current ratio for curves.
    c. Three-phase and single-phase damage points for each transformer.
    d. No damage, melting, and clearing curves for fuses.
    e. Cable damage curves.
    f. Transformer inrush points.
    g. Maximum fault-current cutoff point.

F. Completed data sheets for setting of overcurrent protective devices.

END OF SECTION 26 05 73

SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes networked lighting control system comprised of the following components:

1. System Software Interfaces

    a. Smartphone (iOS & Android) Programming Interface for Wireless Devices

2. System Backbone and Integration Equipment

    a. System Bridge
    b. Energy Monitoring
    c. Real Time Clock
    d. UL924 Emergency Lighting Control

3. Wireless Networked Devices

    a. Wireless Networked Wall Switches, Dimmers
    b. Wireless Networked Fixture Control Devices
    c. Wireless Networked Indoor Occupancy/Vacancy with Photosensors
    d. Wireless Networked Outdoor Occupancy and Photosensors
    e. Wireless Networked Indoor Luminaire Embedded Sensors
    f. Wireless Networked Power Packs
    g. Non-Wireless Power Packs
    h. Wireless Networked Luminaires

4. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
5. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 RELATED DOCUMENTS

A. Section 26 27 26 Wiring Devices

B. Section 26 09 23 Lighting Control Devices

C. Section 26 09 43.13 Digital-Network Lighting Controls

D. Section 26 09 43.16 Addressable Fixture Lighting Control

E. Section 26 09 43.19 Wireless Network Lighting Controls

F. Section 26 51 13 Interior Lighting Fixtures

1.3 Submittals

A. Submittal shall be provided including the following items.

1. Bill of Materials necessary to install the networked lighting control system.
2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
3. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms (if applicable).
8. Hardware and Software Operation Manuals.

1.4 Approvals

A. Prior approval from owner’s representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

B. Any alternate product or system that has not received prior approval from the owner’s representative at least 10 days prior to submission of a proposal package shall be rejected.

C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner’s representative.

D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.5 Quality Assurance

A. Product Qualifications

1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V5.0.
3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
5. All components and the manufacturing facility where product is manufactured must be RoHS compliant.

B. Installation and Startup Qualifications

1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements

1. Phone Support: Toll-free technical support shall be available.
2. Remote Support: The bidder shall offer a remote support capability.
3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.

1.6 Project Conditions

A. Only install Domino indoor equipment after the following site conditions are maintained:

1. Ambient Temperature: 10 to 122 degrees F (-12 to 40 degrees C)
2. Relative Humidity: less than 90% non-condensing

B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.

C. Only properly rated equipment and enclosures, installed per the manufacturer’s instructions, may be subjected to dust and moisture following installation.

1.7 Warranty

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.

B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.8 Maintenance & Sustainability

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 - EQUIPMENT

2.1 Manufacturers

Acceptable Manufacturers

A. Domino NLC by Satco Products, Inc.

B. Basis of Design System: Domino Wireless Network Lighting Controls

2.2 System Compliance

A. System components shall comply with UL 916 and UL 924 standards where applicable.

B. System components shall be RoHS compliant.

C. System components shall be UL recognized (low voltage) and/or listed where applicable.

D. Housing materials shall be UL 94-V0 for use in plenum ceiling where applicable.

E. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 System Performance Requirements

A. System Architecture

1. System shall have an architecture that is based upon three main concepts:

a. Bluetooth (BLE) wireless mesh network intelligent lighting control devices,
b. Unlimited standalone (no gateway required) lighting control zones using distributed intelligence,
c. Optional Bluetooth/Wi-Fi connectivity for time based and third-party system integration for global operation (REST API).

2. Intelligent lighting control devices shall have individually addressable BLE wireless mesh network communication capability and consist of one or more basic lighting control components: occupancy/vacancy and daylight harvesting sensor, luminaire/load controller, dimming output, contact closure input, analog 0-10V

input, and manual wall station capable of indicating switching, dimming, and/or scene control.
Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

3. System must be capable of interfacing directly with networked luminaires such that Bluetooth Low Energy (BLE) wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see Control Zone Characteristics sections for each type of wireless network connection).
4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy/vacancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.” Non-Gateway.

    a. Unlimited lighting control zones of a maximum of 100 devices per zone shall be supported.

6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
7. Lighting control zones shall be capable of being networked with a higher- level system backbone to provide time-based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
8. The system may include one or more system controllers that provide time- based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via TCP, REST APIs protocol.
9. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

B. Wireless Networked Control Zone Characteristics

1. No wired connections between networked devices shall be required for the purposes of system communications.
2. Multiple wireless networking protocols shall be supported:

    a. A standards based, distributed mesh topology type of protocol for 2.4 MHz communication, so as to support lighting control applications and IoT applications.

3. A Bluetooth standard protocol for 2.4 GHz communication that supports direct connection to a smartphone and tablet device, so as to support device

configuration, control applications, and IoT without requiring the use of a system backbone.

4. Wireless network shall be self-healing, such that the loss of backbone or local communication between devices does not result in the loss of control of the lights in the space.
5. Wireless network communication shall support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wall station signal.
6. To support the system architecture requirement for distributed intelligence, wireless network communication shall support communication of control signals from sensors and wall stations to networked luminaires and wireless load control devices, without requiring any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge or gateway.
7. All wireless communication between lighting control components shall support UL1376 and IOXT standards including the following five tiers of security measures:

    a. Data Encryption
    b. Firmware Protection
    c. Tamper-Proof Hardware
    d. Authenticated User Access
    e. Mutual Device Authentication

8. Accounting for typical environmental conditions and building construction materials encountered within commercial indoor lighting environments, wireless networked devices shall be capable of communicating to at least 100’ spacing between devices with embedded wireless transceivers under typical site conditions.
9. Wireless networked devices shall have a line-of-sight communication range of at least 300’ under ideal environmental conditions.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard via TCP, REST APIs protocol:

    a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.
    b. The system shall support reading of individual device status information. The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.
    c. The system shall support activation of pre-defined system Global Profiles (see Supported Sequence of Operations for further definition of Global Profile capabilities).

2. The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.

D. Supported Sequence of Operations

1. Control Zones

a. Networked luminaires and intelligent lighting control devices installed in an area (zone) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 100 unique luminaires to support different and reconfigurable sequences of operation within the zone. These shall also be referred to as control zones.

2. Control Groups

a. An unlimited number of groups can be part of a zone (with up to the maximum of 100 luminaires). A networked luminaire installed in an area (zone) can be a member of up to 20 groups. A group can have up to the maximum allowed per zone of 100 and shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information to support different and reconfigurable sequences of operation within the group. These shall also be referred to as control groups.

3. Wall station Capabilities

a. Wall stations shall be provided to support the following capabilities:

1) On/Off and Auto of a local control group.
2) Continuous dimming control of light level of a local control group.
3) Scene control with up to 32 scenes per light and up to 127 per zone.

b. 3-way/multi-way control: multiple wall stations shall be capable of controlling the same local control groups, to support “multi-way” switching and/or dimming control.

4. Occupancy Vacancy Sensing Capabilities

a. Occupancy/vacancy sensors shall be configurable to control an individual luminaire or group.
b. Multiple occupancy/vacancy sensors shall be capable of controlling the same local groups.
c. System shall support the following types of occupancy sensing sequence of operations:

1) Auto On/Off Occupancy Sensing
2) Auto Partial-On Occupancy Sensing
3) Auto Partial-Off Occupancy Sensing
4) Vacancy Sensing (Manual-On/Automatic-Off)

5. Auto On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:

    a. Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Provide complete installation of the Networked Lighting Control Devices in accordance with contract documents and as shown on the Construction Drawings.

B. Sensors

1. Coordinate layout and installation of ceiling-mounted, wall-mounted devices with other construction that penetrates ceilings, walls or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
2. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
3. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted, and fixture-mounted daylight sensors shall not have direct view of luminaries.

C. Systems integration to be coordinated with owner’s representative, Keilton + Autani lighting control system manufacturer and other related equipment manufacturers.

D. Provide equipment at locations and in quantities indicated on drawings.

E. Provide any additional equipment required to provide control intent.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section [01 40 00]

B. Verify that all control devices, components, receptacles, lighting equipment, etc. are powered and energized prior to initiating factory start up and commissioning.

C. Verify LED driver type and functioning / powered luminaires.

3.3 STARTUP

A. Factory Startup – If Factory startup is required/quoted provide both the manufacturer and the electrical engineer minimum ten (10) working days written notice to schedule services.

B. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in final testing.

C. Final programming to be completed by an authorized manufacturer's representative to establish control of the network as required by the specified sequence of operations.

D. Project Record Documents: Provide five (5) copies of the final results including actual locations of components and accessories to the building owner and owner's representatives.

E. If deficiencies are discovered during the Factory Start Up, the Electrical Contractor to provide reimbursement of all expenses necessary for scheduling additional time and subsequent site visitation for required attendees.

F. An unsatisfactory condition revealed by these test results, or unsatisfactory methods of tests and/or testing apparatus and instruments, shall be brought to the attention of the Engineer, Project Manager and Factory Representative. Corrections by the electrical contractor shall be validated by re-tests to the satisfaction of the Engineer, Project Manager, and Factory Representative.

3.4 ACCEPTANCE AND COMMISSIONING

A. Final acceptance, Per California building Efficiency Standards (Title 24, Parts 1 and 6), Per local code requirements shall depend upon the satisfactory test results as performed in accordance with the verification of the sequence of operations and manufacturer's instructions.

B. Test and Inspections:

1. Operate the system and its various components to ensure that it is performing properly and in accordance with the sequence of operations.
2. Run a preliminary test for the purpose of:

    a. Determining whether the equipment is in a suitable condition to conduct the acceptance test.
    b. Checking and adjusting equipment.
    c. Training facility personnel.
    d. Verify that sensors are mapped to appropriate devices.
    e. Verify that lighting scheduling has been applied.
    f. Verify drawings are uploaded and viewable within the energy management system software.
    g. Verify that all system alerts and trigger notifications are configured.

3. Final system acceptance test: Individually test each networked device and demonstrate that they are operating properly in accordance with ASHRAE Functional testing requirements.
4. Supply all equipment necessary for system adjustment and testing.
5. Verify that the electrical data and information displayed is correct and properly tracking in real time.

3.5 COMMISSIONING, TRAINING AND DEMOSTRATION

A. Commission the system such that all connected devices are operational, reporting accurately and correctly in accordance with the sequence of operations.

B. Demonstrate the operational use of the system to the Owner.

C. Upon completion of the system programming, provide four (4) hours training to the owner’s personnel on the operation and maintenance of the system.

D. Attendance: Electrical Contractor, System Integrator, Owner, Owner’s Representative, Designated Design Representative(s) for and Keilton+Autani Manufactured System Representative.

E. Provide five (5) copies of final acceptance testing and test results.

END OF SECTION 26 09 43

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

B. Related Requirements

1. Section 260573 "Overcurrent Protective Device Coordination Study" for arc-flash analysis and arc-flash label requirements.
2. Section 262713 “Electricity Metering” for additional meter requirements.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge protective device.

1.4 SUBMITTALS

A. Equipment shall be submitted with short circuit, overcurrent protection coordination, and arc flash studies as noted in specification 260100 General Electrical Requirements.

B. Product Data: For each type of panelboard, switching and overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

D. Qualification Data: For qualified testing agency.

E. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

H. Delegated Design Submittal: Arc Flash Study

1. An arc flash study shall be performed on all new electrical switchgear, switchboards and panelboards and labels shall be affixed to the front of the equipment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407, NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace parts that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

6. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: As per project requirements.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Square D (by Schneider Electric) or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

1. Eaton.
2. ABB.
3. Siemens.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

E. Mains: As per the contract drawings.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Square D (by Schneider Electric) or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

1. Eaton.
2. ABB.
3. Siemens.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: As per the contract drawings.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Square D (by Schneider Electric) or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

1. Eaton.
2. ABB.
3. Siemens.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 100 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing: Refer to contract drawings for electronic trip circuit breakers; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (5-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).

7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type, comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching LED lighting loads.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75percent of rated voltage.
    f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    i. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    j. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    k. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    l. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 PANELBOARD SUPPRESSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Square D (by Schneider Electric) or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

    1. Current Technology; a subsidiary of Danahar Corporation.
    2. Eaton.
    3. ABB.
    4. Liebert Corporation.

5. Siemens.

C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

a. LED indicator lights for power and protection status.
b. Audible alarm, with silencing switch, to indicate when protection has failed.
c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

2.6 METERING

A. Power metering shall be provided where indicated on the drawings.

B. Meters shall be integrally mounted.

C. Power metering shall be calibrated and tested by factory-authorized service professional. Provide report at project completion certifying metering accuracy and confirming that information captured by meters are accurately being sent to building management system.

D. Power meter shall transmit data to the building automation system. Communication protocol shall match building automation system protocol. Data shall be updated at a minimum of 1 second intervals.

E. Metering values shall include, but shall not be limited to, current, current demand, kilowatt hours, kilowatt demand, power factor, voltage, and frequency.

F. Power metering shall be capable of monitoring the following parameters and initiate alarm commands:

1. Voltage over/under.
2. Current over/under.
3. Phase loss.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407, NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407, NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Mount panelboards such that no overcurrent protection device actuating handle when in highest position is located more than 6’-7” above finished floor.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 26 24 16

SECTION 26 27 13.13 - ELECTRICAL MULTI-CIRCUIT SUBMETERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the supply and installation of a complete multi-circuit submetering system as detailed on the drawings and as described in these specifications.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:

1. Electrical Multi-Circuit Submetering equipment.

B. Shop Drawings for Electrical Multi-Circuit Submetering equipment .

1. Submit system description including an overview of the system provided with detailed description of suggested communications architecture.
2. Bill of material including a complete listing of all hardware, software, configuration, training and start-up services being supplied under this contract.
3. Hardware and software description shall be provided in detail.
4. Dimensioned plans and sections or elevation layouts.
5. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
6. Approved submittal shall be stamped and signed by the contractor prior to start-up.

C. A final closeout submittal shall be provided and include a system operation manual that will include the following information:

1. A system description and as built layout.
2. System field verification and commissioning report.
3. Product data covering each component.

4. Manuals for all the products.
5. Software data files if software is provided.
6. A complete list of device addresses and ID numbers.

1.4 RELATED STANDARDS

A. ANSI C12.1

B. The multi-circuit metering unit shall be UL listed.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Manufacturer Qualifications: The manufacturer of this equipment shall have a minimum of 10 years experience producing similar electrical equipment.

1. Comply with requirements of the latest revisions of applicable industry standards.
2. The multi-circuit meter must be made of steel manufactured of steel and metal containment.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver material in manufacturer’s original unopened protective packaging.

B. Securely store materials in original packaging in a manner to prevent soiling, physical damage, incursion of moisture or corrosion prior to installation.

C. Handle in a manner to prevent damage to finished surfaces.

D. Maintain protective coverings until installation is complete and remove such covers as part of final clean-up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by SATEC, Inc. or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their

standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and

C. Manufacturers

1. E-Mon Energy Meters, by Honeywell.
2. Quadlogic Controls Corp.

2.2 COMPONENTS

A. The multi-circuit meter shall be installed in enclosures mounted externally from the desired panel or switchboard to be metered.

B. The metering operating software shall have a minimum of 4 virtual channel totalization sub-meters, allowing automatic totalization of multiple sub-meters.

C. The multi-circuit meter system is defined to include, but not be limited to, pre-wired current transformers in the manufactures panelboard, central display for monitoring the system, web-based software, software configuration, ancillary equipment, start-up and training services.

D. A kWh total display shall be available at the multi-circuit meter monitor unit for energy consumption and in a mechanical numeric digit format for each individual channel.

E. The multi-circuit meter shall be configured to accept the following: Refer to Contract Documents for quantity of circuits to be metered.

F. The units may be mounted in single NEMA 1 enclosures rating suited for the environment the equipment is installed.

G. The metering units will provide daily load profile data for up to 150 days (15 min-energy) or 30 min profile for up to 300 days.

H. A minimum of 256MB of non-volatile memory is required.

I. A local touchscreen LCD display will view all basic measurement requirements along with on screen vector and phasor monitoring.

J. The metering units shall use metering grade current transformers.

K. Multi-circuit meter shall be rated for up to 6kV impulse, isolated for 2.5kV. Voltage output shall not exceed 8 Volts max. Measurement category shall not exceed CAT III.

L. Front-end equipment such as a modem, network controller or computer shall not be required to be part of the metering system.

M. Remote Web Based software shall be available for monitoring all loads via the internet.

2.3 COMMUNICATION OVERVIEW

A. The multi-circuit meter shall be able to utilize the following standard communications configuration, as a minimum:

1. Optically isolated RS485 port standard: Modbus RTU/ASCII
2. Standard serial TTL RS-232 non-isolated port for graphic display module
3. Standard Ethernet port: Transformer isolated 10/100 Base-T port
4. Power Line Carrier communication will not be accepted.

2.4 EQUIPMENT OVERVIEW

A. Direct Application Voltages: 120 / 240 – Max 480 L-L.

B. Operating Frequency: 60 Hz

C. Voltage Rating: 120/208V

D. Power Factor Range: 0.5 to 1.0 leading or lagging

E. Power Supply Requirements: 3 Phase, 4 Wire Wye (120/208 or 277/480 V) +/- 15%

F. Current Rating: 400A

G. Accuracy: +/- 0.5% of registration @ 1.0pf, 1% to 100% of rated current and +/- 0.75% of registration @ 0.5pf, 1% to 100% of rated current.

H. Operating Temperature Range: -25 degrees to +65 degrees C (-13 degrees to 149 degrees F)

I. Provide revenue class solid or split core current transformers associated within the metering system.

J. Current Transformers (CT) shall be 40 mA on secondary side. Each CT shall include blocking diodes to prevent harmful operation when not connected to multi-circuit meter base. Mili-voltage driven CT will not be acceptable.

K. Each current transformer input channel shall have the ability to adjust the individual transformer correction with phase angle adjustment within minutes to provide precise measurement.

2.5 POTENTIAL TRANSFORMER

A. The potential transformers, if required, may be mounted in a separate enclosure rated for the size and capacity necessary to feed the number of multi-circuit meters shown as per the drawings and rated by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

3.2 ADJUSTING AND CLEANING

A. The multi-circuit meters shall be adjusted so that accurate readings appear and that the readings are within the CT accuracy range.

B. Clean exposed surfaces using manufacturer recommended materials and methods.

3.3 FIELD QUALITY CONTROL

A. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered circuits.
2. Turn off circuits supplied by metered circuit and secure them in off condition.
3. Run test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use test load placement and setting that ensures continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at test load connection. Record test results.
5. Repair or replace deficient or malfunctioning metering equipment, or correct test setup; then retest. Repeat for each multi-circuit meter in installation until proper operation of entire system is verified.

3.4 WARRANTY

A. All equipment shall be free from defects in materials and workmanship under normal use and service for the period of thirty-six (36) months from the date of shipment from factory.

3.5 STARTUP SERVICES

A. Project management shall be provided for the entire project through a single source of contact. The end-user shall also provide a single source of contract with authority over the project to make decisions on timely bases.

1. On-Site start-up and training of the Owner’s personnel is required on the system and shall be included in the project bid.

2. Start-Up shall consist of complete multi-circuit meter configuration and on-site service testing of the multi-circuit meters and communication to the web-based system.
3. Training shall include any documentation and hands-on exercises needed by the owner's personnel at the site during the last day of the startup.
4. Supplier shall have a remote fully functional support facility for support related questions.

B. Calibration and Maintenance Service

1. All multi-circuit meters shall be factory calibrated with precision test equipment and shall remain accurate for the life of the product eliminating the need for in-service calibration or adjustments.

C. Time Of Use

1. All multi-circuit meters are factory configured for "Time of Use" application if or when required.

END OF SECTION 26 27 13.13

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Special configuration receptacles.
3. Receptacles with integral surge suppression units.
4. Wall-box motion sensors.
5. Snap switches and wall-box dimmers.
6. Low voltage wall-box control devices.
7. Combination occupancy/vacancy sensors.
8. Floor service outlets, poke-through assemblies, and multioutlet assemblies.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

F. Contractor shall perform a coordination review with the lighting fixture vendor and the wiring device submittal to ensure that the wiring devices are compatible with the lighting fixtures they are controlling and shall submit a letter with the shop drawing. If letter is not included, then shop drawing shall be automatically rejected.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service Outlet Assemblies: 1 for every 10, but no fewer than 1.
2. Poke-Through, Fire-Rated Closure Plugs: 1 for every 5, but no fewer than 2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. ABB Installation Products.
2. Cooper Wiring Devices; a division of Eaton.
3. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
4. Leviton Mfg. Company Inc. (Leviton).
5. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; Decorator series
b. Hubbell; DR series
c. Leviton; Decora series
d. Pass & Seymour; Decorator series

B. Controlled (Switched) Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; 5362CD for both outlets marked and the 5362CH for one outlet marked.
b. Hubbell; SNAP5362C2 for both outlets marked and SNAP 5362C1 for one outlet marked.
c. Leviton; 5362-S2 for both outlets marked and 5362-S1 for one outlet marked.
d. Pass & Seymour; 5362CD for both outlets marked and 5362CH for one outlet marked.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; TRBR20.
b. Hubbell; BR20__TR.
c. Leviton; 8300-SGG.
d. Pass & Seymour; 63H.

2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

D. Tamper Resistant Controlled (Switched) Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; TR5362CD for both outlets marked and the TR5362CH for one outlet marked.
b. Hubbell; BR20C2 for both outlets marked and the BR20C1 for one outlet marked.
c. Leviton; 5362-2P.
d. Pass & Seymour; TR5362CD.

2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; SGF20.
b. Hubbell GFRST20SNAP
c. Pass & Seymour; 2095.
d. Leviton; GFNT2

C. Weather Resistant, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL WC-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; WRSGF20F.
b. Hubbell; GFWRST20.
c. Leviton; GFWR2
d. Pass & Seymour; WR5362.

2. To be provided where “WP” is indicated next to a receptacle.

2.4 TAMPER RESISTANT GFCI RECEPTACLES (Decora Style)

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; TRSGF20.
b. Hubbell; GFTRST20.
c. Leviton; GFTR2.
d. Pass & Seymour; 1595SWTTR.

2.5 TAMPER RESISTANT AFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex AFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; TRAFCI20
b. Hubbell; AFR20TR
c. Leviton; AFTR1

2.6 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Crouse-Hinds.
b. EGS/Appleton Electric.
c. Killark; a division of Hubbell Inc.

2.7 SPECIAL CONFIGURATION RECEPTACLES

A. Single Convenience Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Refer to drawings for configuration.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Eaton.
b. Hubbell.
c. Leviton.
d. Pass & Seymour.

B. Isolated-Ground, Single Convenience Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Refer to drawings for configuration.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Eaton.
b. Hubbell.
c. Leviton.
d. Pass & Seymour.

2. Description: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.8 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; Decorator series
b. Hubbell; Style line Decorator series
c. Leviton; Decora series
d. Pass & Seymour; Decorator series

C. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; Decorator series
b. Hubbell; Style line Decorator series
c. Leviton; Decora series

d. Pass & Seymour; Decorator series

2.9 EMERGENCY DIMMING BYPASS RELAY

A. MANUFACTURER:

1. Current; NXRCFX-UL924
2. Hubbell; UL924EPC1D-UNV
3. LVS; EPC-2-D
4. Greengate; CEPC-2-D
5. Myers; EPC-2-D

B. DESCRIPTION:

1. Control module that monitors the standby power and normal power circuits local to the area as indicated on the drawings. Module will allow switching and dimming of emergency light fixture with normal power light fixtures.
2. Upon loss of normal power, module will energize emergency light fixtures to 100% output.
3. Module shall be 120/277 volt rated, 20 ampere capacity. Module shall be installed above associated room light switch.
4. All lighting control devices that control both normal and emergency lighting fixtures shall be provided with an associated control module even if not shown on the drawings.
5. Relay shall be UL 924 listed.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof “In-Use” Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.11 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Steel

2. City Installation Products.
3. Hubbell Incorporated; Wiring Device-Kellems.
4. Pass & Seymour/Legrand; Wiring Devices & Accessories.
5. Square D/ Schneider Electric.
6. Wiremold a division of LeGrand.

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. The device shall be listed in accordance to UL 514A.
2. The minimum spacing of 2 feet on center and not more than one unit per each 65 square feet of floor area in each span.
3. UL File Number: E2969.
4. UL Fire Resistance Directory: R9140.

C. Fire Rating Application:

1. 1-Hour Rated Floor:

   a. 2-1/4 inches minimum concrete over steel decking required.
   b. 3 inches minimum concrete for reinforced slab required.
   c. 7-1/2 inches maximum concrete thickness required.

2. 2-Hour Rated Floor:

   a. 3-1/4 inches minimum concrete over steel decking.
   b. 4 inches minimum concrete for reinforced slab.
   c. 7-1/2 inches maximum concrete thickness.

D. Provide a flush power and communications poke through for use in a 4 inch hole.

1. Base: Die-cast zinc, galvanized steel and intumescent fire-stop material.
2. Conduit Hubs: Cast Iron.
3. Cover: Solid Brass with brushed finish.

E. Basis of design for six (6”) inch poke through device shall be as follows.

1. Provide a recessed power and/or communications poke through for use in a 6-inch hole.

2. Product: RPT6 Series Recessed Service, 3-Gang Poke Through as manufactured by ABB Installation Products.

   a. Shall accommodate one duplex receptacle.
   b. Shall accommodate a combination of up to three devices for power, data and/or communications.
   c. Base: Die-cast zinc, Galvanized steel, and intumescent fire-stop material.
   d. Configurable Junction Box: Galvanized steel, 56 cubic inch capacity with 1¼ inch, 1½ inch and 2 inch KO's for power conduit connections.

e. Cover: Solid brass with brushed finish.

F. Manufacturers:

1. ABB Steel City - Model RPT6 Installation Products
2. Hubbell Inc.
3. Wiremold A Division of Legrand.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use press on label, black lettering on white background on face of plate and in easily readable location inside device backbox, and durable wire markers or tags on conductors inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Molded-case circuit breakers (MCCBs).
5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Square D; by Schneider Electric. or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

1. ABB Inc.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.

C. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.

6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. Integrally mounted control power is not available in safety switches.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Square D (by Schneider Electric) or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

1. ABB.
2. Eaton.
3. Siemens.

C. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

D. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to

mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

E. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.

F. MCCBs shall be equipped with a device for locking in the isolated position.

G. Lugs shall be suitable for 167 deg F rated wire.

H. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

I. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 100 A and larger.

J. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

K. Electronic trip circuit breakers with rms sensing: Refer to contract drawings for electronic trip circuit breakers; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

L. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (5-mA trip).

N. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching LED lighting loads.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Electrical Operator: Provide remote control for on, off, and reset operations.
7. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).

C. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

3.3 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Division 26 Section " Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Comply with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the
c. absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
e. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units
f. with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.

g. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

h. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
i. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
j. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Test procedures used.

2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

END OF SECTION 26 28 16

SECTION 26 43 13 – SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Sections include the following:

1. Section 262416 "Panelboards" for factory-installed SPDs.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Qualification Data:

1. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

C. Field quality-control test reports.

D. Sample Warranty: For manufacturer’s special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **10** years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 PANEL SUPPRESSORS

A. Basis-of-Design Product: The system shall be constructed using multiple surge current diversion modules utilizing an array of 6 or more metal oxide varistors (MOVs) computer matched to a variance of +/- 1 volt. Subject to compliance

with requirements, provide ASCO Power Technologies Inc. (APT) or comparable product by one of the following manufacturers in the next paragraph.

B. Manufacturers: Subject to compliance with performance and site condition requirements, one of the manufacturers listed below may be provided in lieu of the Basis of Design manufacturer. Naming these products does not imply that their standard construction or configuration is acceptable or meets the specifications. Alternate equipment proposed must meet the specifications including all architectural, acoustic, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications, and space constraints.

1. Current Technology.
2. LEA International; Protection Technology Group.

C. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Comply with UL 1283.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Neutral to Ground: 700 V for 208Y/120 V.
4. Line to Line: 1200 V for 208Y/120 V.

G. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700V.
3. Neutral to Ground: 700V.
4. Line to Line: 1200V.

H. SCCR: Equal or exceed 100 kA.

I. Inominal Rating: 20 kA.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.4 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Conductors and Cables."

PART 3 – EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. If wire leads exceed 5 ft. in length provide low impedance cable.

C. Use crimped connectors and splices only. Wire nuts are unacceptable.

D. Wiring:

1. Power Wiring: Comply with wiring methods in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 265000 - ARCHITECTURAL LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Division 26 Electrical sections apply to work specified in this section.

C. Refer to lighting specification booklet for light fixture cut sheets.

1.2 SCOPE

A. Furnish labor, materials, tools, equipment and related items required for complete installation of lighting systems as indicated by Contract Documents.

1.3 SUMMARY

A. Extent, location, and details of lighting fixture work are indicated on drawings and in schedules.

B. Types of lighting fixtures in this section include the following:
1. LED (Front of House only)
2. Other lamps as noted on fixture schedule (Front of House only).

C. Fixture: A complete lighting unit, including lamps and parts required to distribute light. Exact construction into ceiling shall not be an extra cost to the project.
1. All materials, accessories, and any other equipment necessary for the complete and proper installation of all lighting fixtures included in this Contract shall be furnished by the Contractor.
2. Fixtures shall be manufactured in strict conformance with the Contract Drawings and Specifications.
3. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary of the work.
4. Minor details, not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fixtures, shall be included, the same as if they were herein specified or indicated on the drawings.
5. The Owner shall not be held responsible for the omission of absence of any detail, construction feature, etc. which may be required in the production of the fixtures.

1.4 SUBMITTALS

Submit shop drawings, samples and prototypes as specifically instructed below.

A. Submittals shall include, but not be limited to:
1. Submit fixture submittals in booklet form with a separate sheet for each fixture, assembled in “luminaire type” alphabetical order, with proposed fixture and accessory catalog numbers clearly indicated on each sheet.
2. Manufacturer’s dimensioned scale drawings (“shop drawings”) showing in complete detail the fabrication of all lighting fixtures including:
    a. Manufacturer’s complete catalog number,
    b. Overall and detail dimensions,

c. Finishes,
d. Metal thickness and/or gauge,
e. Glass thickness and type,
f. Ballasts, transformers, drivers,
g. Lamp sockets drawn to correct scale,
h. Type of lamp shielding,
i. Reflectors and/or trims,
j. Hinges,
k. Gaskets,
l. Provisions for re-lamping,
m. Mechanical and electrical connections,
n. Fasteners, welds, joints, end conditions,
o. Pertinent mounting details,
p. Rotational and locking devices for adjustable fixtures,
q. Provisions for the work of others,
r. All other information to show compliance with the Contract Documents,
s. Shop drawings shall be in a minimum ½ full scale for select fixture types.

3. Test Data: Submit certified test data and reports including photometric data rendered by an independent testing laboratory developed according to methods of the Illuminating Engineering Society of North America as follows:
   a. For direct and semi-direct lights used for general illumination, include:
      1) Candlepower distribution data, presented graphically and numerically, in 5-degree increments (5 degrees, 10 degrees, 15 degrees, etc.) Data developed for up and down quadrants @ normal, parallel and 22 ½ degree, 45 degree, 167 ½ degree to lamps if light output is asymmetric,
      2) Fixture efficiency,
      3) Surface to mounting height ratio,
      4) Coefficients of utilization,
      5) Zonal lumens stated numerically in 10-degree increments (5 degrees, 15 degrees, etc.) as above,
      6) Lamping information at time of photometric test
      7) UL listing and environmental classification.
   b. For area and roadway luminaires, include:
      1) Candlepower distribution data presented graphically and numerically, in 5-degree increments (5 degrees, 10 degrees, 15 degrees, etc.),
      2) Iso-footcandle charts,
      3) Fixture efficiency,
      4) Coefficient of utilization table,
      5) UL listing and environmental classification.
4. Maintenance Data: For Owners' documentation, Contractor to submit maintenance data and parts list for each lighting fixture including fixture accessories. In addition to the product data and shop drawings, Contractor to provide maintenance manual for all fixture types. Maintenance manual to describe procedures for operating, cleaning, and maintaining the fixture including lens and/or reflector cleaning procedure, ballast and fuse data (if applicable), the specified lamp type, and the tool(s) required to properly maintain the fixture.
5. Manufacturer shall not proceed with final production of fixture(s) without approval of all required submittals and samples by the Lighting Designer and Architect.

B. Samples:
1. Samples may be requested by the Lighting Designer or Architect for any or all of the fixtures specified.
2. Submit for review samples called for by the Lighting Designer when and where directed, with the components tagged with the fixture types and name of the project, provided with a cord and plug and specified lamps. Samples will not be returned. Allow ten business days from the date of receipt for thorough examination and comment by the Lighting Designer.
3. All fixture samples require a submission of material finish samples, component review, and a complete operating prototype fixture to be reviewed prior to shipment of any material to the project. All fixture components to be complete, including any plaster/concrete rings and mounting frames.

4. Fixtures under the contract shall be identical with the reviewed sample fixture. No fixture used as a sample will be allowed to be installed on the project.
5. Samples shall be submitted to the Architect and/or Lighting Designer with sufficient time prior to scheduled fixture shipment to job site to allow for any required design revisions.
6. In the event the submissions are disapproved, the fixtures will be returned to the contractor to immediately make a new submission of fixture meeting the contract requirements.
7. All costs associated with fixture samples and the shipment of samples are to be paid by the Contractor.

C. Wiring Diagrams:
1. Submit wiring diagrams for lighting fixtures showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring which are manufacturer-installed and portions which are field installed.
2. For all LED lighting fixtures, manufacturer, at time of shop drawing submittal, shall include full wiring schematic diagram showing the entire LED system including specific fixture type(s), final run lengths and/or quantity of LED units, control gear (drivers/power supplies), wire types and gauges, length of wire whips/tails, and wire splice locations. LED lighting submittal shall also show how LED fixtures connect to lighting control system (if present on the project).

D. Shop drawings and samples requested shall be submitted for review before fabrication. Any material produced prior to the approval of shop drawings and/or samples, and not in conformance with the Contract Documents, shall be disapproved.

E. When required and requested by the Architect and Lighting Designer, samples submitted as per above shall be subjected to photometric, thermal, mechanical, acoustical, electrical or water testing at an independent testing laboratory. Photometric testing methods shall conform to IESNA standards. Thermal, mechanical, electrical and water testing methods shall conform to UL standards pertinent to the specific test required and/or requested.

F. No variation from the general arrangement and details indicated on the drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises, and then only with the written acceptance of the Architect. All variations must be clearly marked as such on the drawings submitted.

G. Provide field mock-ups, as directed by the Architect and Lighting Designer at no additional cost to the Owner, for verification purpose of mounting details, lighting distribution, illumination levels, proper lamping, proper fixture selection, overall aesthetics, and to evaluate and set the standard quality for the final work.
1. Required mock-ups are listed in Table 1. Required prototype installations are listed in Table 2. Required prototype fixtures are listed in Table 3.
2. Contractor shall confer with design team prior to start of mock-up work to verify the goals and visual qualities that individual mock-up is intended to achieve.
3. Where the lighting effect is dependent upon interaction with architectural features (such as frosted glass surface, architectural cove, etc.), the mock-ups shown in Table 1 shall include the architectural details, materials, and dimensions per the Construction Documents.
4. For light fixtures originally specified for ceiling recessed conditions, the mock-up of such fixtures shall be mounted at equivalent height AFF as the Construction Documents.
5. It is the responsibility of the General Contractor to coordinate the work for the lighting mock-ups with the related building trades.
6. Locate mock-ups at the project site as directed by Architect or Owner’s Representative.
7. Provide modifications to mock-ups as required until Architect’s or Owner’s Representative approval has been issued.
8. Protect and maintain approved mock-ups throughout the work of the Construction Contract.
9. Demolish and remove mock-ups from the project site at the completion of the Project. Legally dispose of demolished mock-up materials.

TABLE 1
List of Required Mock-ups

Fixture Type	Description Of Mock-Up Goals
TR01 PR01 WW01	Mock-up review before full implementation: Mock-up review of typical gallery ceiling recessed track and track mounted accent and wallwash fixtures with integral wireless modules. Fixtures to be fully operational to be tested onsite.
TR02 PR02 PR03 ST01	Mock-up review before full implementation: Mock-up review dropped ceiling plane (a smaller section) in gallery 3G12 with recessed track, track mounted accent and wallwash fixtures with integral wireless modules as well as linear uplighting. Fixtures to be fully operational to be tested onsite.

H. Fixture Substitutions: Proposed fixture substitutions and manufacturers not listed on the fixture schedule must be pre-qualified by the Lighting Designer at least 10 working days prior to bid. Substitutions proposed by the Contractor less than 10 working days prior to bid submittal, and/or not including proper documentation as listed in Section 1.4, Heading H, shall not be considered. For all manufacturers/fixture substitutions, the Contactor and Manufacturer shall comply to specifications herein and as outlined below:

1. In the event that the Contractor-proposed fixture substitutions exceed 10% of the specified fixture types, the Contractor shall compensate the Lighting Designer at an hourly rate of $150/hour for review and comment on additional substitutions. For any individual fixture type, a maximum of 2 Contractor-proposed fixture substitutions are permitted.
2. Substitute Manufacturer shall have not less than five years' experience in design and manufacture of lighting fixtures of the type and quality shown. Prequalification submissions must include a list of completed projects indicating length of experience, past shop drawings, and current catalog cut sheets.
3. Contractor shall provide catalog cut sheet(s) for all light fixture substitutions, containing photometric test data as described in Section 1.4, Heading A, Sub-Heading 3. Printed mechanical, electrical and photometric data shall be clearly highlighted to show the differences between the proposed substitutions and the specified light fixtures.
4. Contractor shall submit photometric information as an electronic file in IES standard format. The electronic file shall represent photometric test data measured in accordance with IESNA standard testing procedures.
5. When requested by the Lighting Designer and/or Architect, Contractor shall provide point-by-point lighting calculations of areas affected by proposed substitution.
6. Contractor shall submit a prototype sample of each substitute fixture requested for review by the Architect and Lighting Designer, following the guidelines for samples in Section 1.4, Heading B. Prototype samples shall be sufficiently detailed and operational for evaluation of compliance with the salient features of the specification. Catalog cut sheets and/or preliminary shop drawings shall not be accepted in place of requested prototype samples. Substitution samples delivered by Contractor less than 5 working days prior to bid submittal, and/or not including proper documentation as listed in Section 1.4, Heading H, shall not be considered. Contractor shall be responsible for all costs associated with the procurement and shipment of samples for substitute fixtures.
7. Lighting Designer shall be provided 10 working days following receipt of substitution cut sheet/fixture sample for review and comment on the proposed substitution.
8. Any submittals for cost reduction alternates or value engineering shall include itemized unit prices for the specified manufacturer, the "specified equal" manufacturer when noted, and the Contractor-proposed alternate(s). Contractor shall provide these unit prices at time of submitted the proposed alternate(s).
9. Where proposed substitutions change the function and/or appearance of specified fixture or change spatial or mounting detail requirements as indicated in the Contract Documents, the Contractor shall indicate such changes in the proposal and include associated costs for revised design and construction for the applicable trades.

10. During the construction period, no fixture substitutions shall be considered unless compelling reasons are given, such as an inability to meet the delivery schedule. The inability to meet a delivery schedule shall not be considered an acceptable reason for fixture substation if the delay is caused by the Contractor's failure to order the fixture and accessories in time for installation as outlined in Section 1.7. All requests/proposals for fixture substitutions during the construction period must follow the guidelines outlined in Section 1.4, Heading H.
11. The Architect and/or Lighting Designer shall reserve the right to disqualify any fixture and/or manufacturer substitution that does not meet the specification.

I. Unit Pricing: At time of bid, Contractor shall submit itemized budget showing quantity takeoffs and unit costs for all fixtures and accessories.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 5 years of successful installation experience on projects with lighting fixture work similar to that required for the project.

C. Codes and Standards:
1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 250, 410, and 500 as applicable to installation and construction of building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub/No's LE1 and LE2 pertaining to lighting equipment.
3. IES Compliance: Comply with IES RP-1 pertaining to office lighting practices and RP-15, regarding selection of illuminance values for interior office lighting. Comply with IES RP-8, 19, 20 and PB-15 pertaining to exterior, parking, and roadway lighting practices and fixtures.
4. UL Compliance: Comply with UL standards, including UL 486A and 486B, pertaining to lighting fixtures. Provide lighting fixtures and components which are UL-listed and labeled.

D. Special Listing and Labeling: Provide fixture for damp locations, wet locations, recessed in rated ceilings and walls, hazardous locations, etc. that are UL listed and labeled for their specific use.

E. Materials and Equipment:
1. Materials, equipment, and appurtenances as well as workmanship provided under this Section shall be specified as indicated on drawings. Fixture parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion and thermal and mechanical stresses encountered in the normal application and function of the fixtures.
2. All fixtures shall be manufactured to a consistent level of quality. Size, color and component parts shall be identical for all fixtures of the same fixture type.

1.6 DELIVERY, STORAGE, HANDLING

A. Deliver lighting fixture in factory-fabricated containers of wrappings, which properly protect fixture from damage. Factory-fabricated containers shall clearly indicate fixture type designation on the exterior packaging and the shipping invoice/packing list.

B. Store Lighting fixture in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperature, humidity, laid flat and blocking off the ground.

C. Handle lighting fixture carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.7 SEQUENCE, SCHEDULING AND EQUIPMENT ORDERING

A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways to properly interface installation of lighting fixtures with ceiling requirements.

B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

C. All specified and approved-substitute lighting equipment, accessories, and components shall be ordered with sufficient time given for the manufacture and assembly of said equipment before the scheduled installation – without rush charges, penalties or additional cost to the Owner. In the event of failure by Contractor to order specified or approved-substitute lighting equipment, accessories, and components on time for scheduled installation, Contractor is ultimately responsible for any construction schedule delays and associated fees and/or penalties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The Contactor shall base bid for lighting fixture(s) on the manufacturer catalog numbers listed in the fixture schedule.

B. Alternate manufacturer's identification by means of manufacturer's names in the fixture schedule is to establish basic features and performance standards of the primary manufacturer listed.

C. Qualifications: The Contractor is allowed 60 days after the contract has been awarded to submit independent photometric tests, catalog cut sheets, and samples (when requested) for all alternative fixtures. If these fixtures fail to comply with the specification requirements at that time the Contractor will furnish specified fixtures at no additional cost and with no delay to the project.

2.2 MATERIALS

A. Provide materials as specified with the following characteristics:
   1. Stainless steel:
      a. AISI Type 302 or UNS Type S30200 18-8 grade: `8 percent chromium and 8 percent nickel. Austenite grain structure with excellent corrosion resisters and high strength.
      b. ANSI Type 316 Most resistant to salt spray and industrial fumes for use in these applications.
      c. ANSI Type 430 Most economical Ferritic Chromium Steel, very good corrosion resistance, for use only where specified.
   2. Galvanized Steel: Coated steel with zinc by a method of hot dipping on electroplating.
   3. Aluminum: A pure metal. Aluminum alloys meeting the national standard ANSI H35.1-1982.
   4. Zinc: A pure metal. May be specified as an alloying element in aluminum.
   5. Glass: All glass shall be heat strengthened (tempered) clear float glass should conform to the requirements of Federal Specification DD-G-1403B, transmittance not less than 88 percent or laminated safety glass. For exterior fixtures, use Borosilicate glass, tempered, Corning #7740. For fixtures directly exposed to the elements and aimed above horizontal with radiant energy of 4.16 watts per square inch or greater, use Vycor glass.
   6. Acrylic: 100 percent virgin acrylic polymer, colorless.
   7. Neoprene: All neoprene rubber should be heat resistant to withstand heat generated by lamp operation.
   8. Silicone: A plastic based on silicone which is not an organic compound. Suitable for use in a wider temperature range (-80 to +500 F). Used as an additive to plastic to improve adhesion, increase strength, and improve water resistance.

2.3 FABRICATION

A. Provide thickness of metal required or as specified so that all fixtures are rigid, stable and will resist deflection, twisting, warping or bending under normal installation procedures, loading, re-lamping, etc., or no less than follows:
   1. All steel housings minimum 22 gauge cold rolled steel.
   2. All aluminum extrusion housings minimum 0.125” thick.
   3. All spun, hydro-formed, or sheet aluminum reflectors fabricated from #12 aluminum sheets, minimum 15 gauge, 0.57” or heavier.
   4. All cast aluminum housings minimum of 0.375” thick.
   5. All sheet steel, aluminum or other metal plate minimum of 22 gauge.

B. Provide neoprene or high-temperature silicone gasketing, stops, and barriers where required to prevent light leak or water vapor (penetration).

C. Provide finished product with ground metal edges, tight fitting connections, hinges and closures; clean, neat edges, trims, and frames; continuous welds, ground smooth with no sharp corners and burrs; all exposed screws counter shrunk flush.

D. Provide positive durable means of connection at all joins as required.

E. All cast parts, including die-cast members, shall be of uniform quality, free from blow holes, pores, hard spots, shrinkage defects, cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.

F. Fasteners shall be manufactured of non-magnetic stainless steel, except in indoor applications where galvanized steel is acceptable in non-visible locations. Provide tamperproof screws in all fixtures mounted below 8’ above finished floor.

G. Provide sufficient ventilation for lamps, ballasts, transformers and drivers including vent holes where required. Outdoor fixtures shall have corrosion resistant wire mesh screens in the vent holes. Vent holes for indoor and outdoor fixtures shall be designed to prevent light leaks.

H. All adjustable fixtures shall be provided with reliable locking devices to secure optical focus; these locking features shall secure vertical aiming angle and horizontal rotation of the fixture housing or lamp yokes as well as lamp and lens orientation. Lenses requiring specific orientation (such as asymmetric spread lens) shall be “keyed” and sit inside a “keyed lens holder” to secure lens in the specified position.

I. All springs shall be stainless steel and have permanent temper. Flexibility shall be sufficient to allow fifty percent overtravel without distortion or failure. Springs shall not be attached by spot welding.

2.4 FINISHES

A. Fixture finishes shall be applied in a manner that will assure a durable, wear resistant surface.
   1. Prior to finishing, all surfaces shall be free from foreign materials such as dirt, rust, oil, polishing compounds and mold release agents.
   2. Where necessary, surfaces shall be hot cleaned by accepted chemical means and shall receive corrosion inhibiting (phosphating) treatment assuring positive paint adhesion.
   3. Exposed metal surfaces used in interior areas, except chromium plated parts, shall be given an even coat of high-grade methacrylate lacquer, or transparent epoxy with satin finish.
   4. All castings, extrusions, and spinnings shall be machined, sanded or similarly treated, and given minimum on coat of baked-on clear methacrylate lacquer, unless a painted finish throughout all exposed surfaces.
   5. Exterior metal surfaces such as extruded parts or castings which do not otherwise receive a finishing coating, shall be machined, sanded or similarly treated. All such finished

components shall be given a minimum of one coat of baked-on-clear methacrylate lacquer, satin finish, unless an alternate finish is specified.

6. Aluminum surfaces exposed to the weather shall receive a duronic or polyester powder paint of clear methacrylate lacquer finish as specified for corrosion resistance. When in contact with concrete, aluminum shall be coated with bituminous paint, zinc chromate primer, or separated by a layer of plastic or other gasketing material. Creosote and tar coatings should not be used because of their acid contents.
7. For weatherproof and vapor tight fixtures, painted finishes and accessories shall be weatherproof enamel using proper primers of galvanized and bonderized epoxy in accordance with the manufacturer's requirements. Unless otherwise specified, all painted surfaces shall have an outdoor life expectancy of not less than 20 years.
8. Sheet steel fixture housings, iron and steel parts, which have not received phosphating treatment ("Bonderizing' or similar process) or are to be utilized in exterior applications shall be made corrosion resistant by zinc or cadmium plating, or hot-dip zinc galvanizing after completion of all forming, welding, or drilling operations. Where aluminum parts come in contact with steel (or other metals), the steel shall be zinc plated or cadmium plated. Minimum thickness of above protective coatings shall be:
   a. Hot galvanized zinc coating – 0.0005".
   b. Cadmium plating – 0.00015".
9. Parts operated under temperatures injurious to hot-dipped galvanizing shall be electroplated.
10. Where aluminum parts come in contact with bronze parts, apply to both surfaces a coating of Corogard No. 1706 as manufactured by Minnesota Mining & Manufacturing Company.

B. Completely painted reflectors before application of primer and enamel color coats: Reflectors and reflector bodies having baked-on enamel finish shall be made of steel of the thickness specified and given a suitable primer and white color coats properly applied to meet all applicable requirements and tests.

C. When requested by the Architect and Lighting Designer, the Contractor shall submit a sufficient quantity of flat metal panels having the identical primer and color coats applied in the same manner as proposed for the Contract items, for subjection to any one or all fo the tests listed herein by an approved independent testing laboratory. Provide panels of suitable size with all holes pre-drilled as necessary for a particular test.

2.5 WIRING

A. All wiring shall comply with the following:
1. All wiring devices within light fixture or from the fixture to the splice with the project branch circuit wiring shall be as specified below.
2. Wiring shall be protected with tape or tubing at all points where abrasion may occur.
3. Wiring shall be concealed within the fixture construction except where design or mounting dictated otherwise.
4. Connections of wires to terminals of lamp holders and other accessories shall be made in a neat and workman like manner and electrically and mechanically secure with no protruding or loose strands. The numbers of wires extending to or from the terminals of a lamp holder or other accessory shall not exceed the number which the accessory is designed to accommodate.
5. Joints in wiring within fixtures and connections of the fixture wiring to the wiring of the building shall be specified in Division 16.
6. Wiring channels and wireways shall be free from projections and rough or sharp edges throughout, and all points are edges over which conductors must pass and may be subject to injury or wear shall be rounded, free from burrs, and bushed.
7. Insulated bushings shall be installed at points of entrance and exit of flexible wiring.
8. Junction boxes attached to lighting fixtures shall be manufactured in accordance with the National Electrical Code and approved for the number of conductors indicated on the drawings. Supplementary junction boxes shall be installed where required to comply with Code.

9. When exposed, all junction boxes and conduits are to be painted as per the Architect's and Lighting Designer's direction at no additional cost to the Owner.

2.6 MARKING OF FIXTURES

A. Fixtures designed for voltages other than 110-125 volts shall be marked with operating voltage.

B. Fixtures equipped for operation of rapid start lamps shall be clearly marked "USE RAPID START LAMPS ONLY".

C. Fixtures designed for operation of lamps below the rated enclosure maximum shall be clearly marked "LAMP WATTS NOT TO EXCEED _____" to maintain the design energy load.

D. All labels shall be clear and placed on light fixtures in locations readily visible to service personnel, but invisible from normal viewing angles when lamps are in place. Label examples include (but are not limited to) IBEW, UL, CSA, ETL, CE, etc.

2.7 SOUND TRANSMISSION

A. Sound transmission through the light fixture units, when spaced as indicated on drawings, shall be sufficiently attenuated to maintain speech privacy between adjoining spaces. Contractor to provide insulating battens around the fixtures where sound transmission levels are unacceptable.

2.8 THERMAL PROTECTORS

A. Provide thermal protectors as required by the N.E.C., or as required by local Code, to prevent operation of lighting fixtures in enclosed spaces or adjacent to combustible materials at temperatures at or above 90ºC (194ºF).

B. Fixtures approved for operation in fire-resistant material at temperatures up to 150ºC (302ºF) shall be plainly marked.

C. All incandescent fixtures shall be provided with thermal protectors except where otherwise indicated or were approved for operation without such protectors by the N.E.C. and by the local building authority.

2.9 LAMPS

A. Provide lamps as shown in the fixture schedule or as modified in reviewed shop drawings. Lamps shall be new and delivered to the site in original packing cases.

B. Lamps as specified for the individual luminaries or lighting equipment shall be delivered and installed in fixtures and lighting equipment, leaving these completely lamped and in normal operating condition.

C. All halogen lamps must be burned at full output for 10 minutes at least once per week in order to regenerate the halogen cycle within the lamp, ensuring fully rated lamp life and lumen output.

D. Incandescent lamps shall be rated for 120-volt operation, unless otherwise noted in the fixture schedule.

E. Lamps produced by the following manufacturers are acceptable, unless otherwise specified:
1. General Electric Lighting
2. Osram Sylvania, Inc.
3. Philips Lighting
4. Soraa
5. Others, only when specified.

F. Lamp/LED module – Driver Compatibility: It is the responsibility of the contractor to verify with the Manufacturer the compatibility of every lamp/LED module and driver specified. Where lamps/LED modules fail prematurely due to a driver compatibility issue, the Manufacturer of the fixture type in question and the installing Contractor are responsible to rectify the problem – by replacing all lamp/LED modules or drivers in the problem fixture to reach a fully functioning lamp/LED module – driver combination resulting in the fully rated lamp life and fully rated lumen output for said fixture.

G. Contractor shall provide to the owner, back-stock of all specified lamps equal to 10% of the installed lamp quantity. The contractor has the right to appeal this requirement, but must do so in writing, to the owner, prior to award of the project contract.

2.10 LAMPHOLDERS

A. Lamp sockets shall be rigidly attached to fixture enclosure or husk.

B. Incandescent lampholders shall be made of heavy-duty heat-resistant porcelain.

C. Plastic or metal sheet sockets are not to be used.

D. Provide nickel plated brass or nickel and silver plated contacts in all lampholders for tungsten halogen lamps, and lamps in outdoor fixtures.

E. All lamp sockets shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fixture components. All adjustable sockets shall be preset at the factory for specified lamp.

2.11 LED LAMPS (DIODES), LED FIXTURES, LED POWER SUPPLIES / DRIVERS / CONTROL GEAR

A. All LED fixtures and control gear shall be UL-listed luminaires (or equivalent by ETL / CSA) for appropriate mounting environment (for example when specified for wet location use).

B. LED power supplies shall comply with ANSI Standard C82.SSL1.

C. For installation in New York City, LED fixtures shall also be Local-3 Union approved.

D. All LED control gear to be suitable for 120-volt A/C operation @ 60 Hz as primary input power, without negative impact on fixture and control gear performance and life.

E. All LED fixtures and associated control gear shall be provided by a single manufacturer and sold as a system to ensure compatibility and full warranty for the entire LED system.

F. LED fixture housing shall be designed to act as a heat sink to transfer heat away from the LED diode and circuit board to ensure temperature at LED diode and associated circuit operates within range recommended by LED manufacturer.

G. All hardwired connections to LED fixtures shall be reversed polarity protected and provided with high voltage protection in case connections are reversed or shorted during the installation process.

H. All LEDs used in the LED fixture shall be of proven quality from established and reputable LED diode manufacturers with minimum 5 years' experience in the manufacture of LED diodes.

I. LED fixture supplier shall have minimum 5 years' experience designing, selling and supporting installations of LED systems.

J. Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency within a 3-step MacAdam ellipse per ANSI Standard C78.377 within all

luminaires. All LED luminaires shall be nominal 3000K color temperature with an allowed variance of +/- 175K among all LED luminaires installed on the project unless otherwise specified.

K. All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing or prior to installation at job site. Any units that fail within this 8-hour burn-in period shall be immediately replaced by Contractor.

L. Manufacturer shall provide photometric data based on test results from an independent testing lab including candlepower distribution data in polar graph form and total lumen output per light fixture.

M. Manufacturer shall provide all mounting hardware/parts necessary for completed and proper installation. Manufacturer shall provide installation guide with all fixture shipments.

N. Manufacturer shall provide complete system wiring diagrams per Section 1.4, Heading C.

O. LED fixtures shall have an optic that is UV resistant.

P. LED fixture manufacturer shall power the LED diodes at a drive current recommended by LED diode manufacturer to reach 50,000-hour lamp life. LED diodes shall not be “overdriven” at a higher drive current to increase light output to detriment of rated lamp life.

Q. LED fixture manufacturer shall follow LED diode manufacturer’s recommended heat sinking / heat dissipation instructions to ensure LED junction temperature does not exceed recommended operating range to achieve 50,000-hour lamp life.

R. LED power supplies and control electronics intended for outdoor use shall have reliable starting and operation at temperatures – 20ºF and higher, except as noted otherwise in fixture specification.

2.12 TRANSFORMERS (COLD CATHODE, NEON, LOW VOLTAGE)

A. All transformers shall be sized to accommodate the intended load and operate lamps in a method approved by Underwriter’s Laboratory and acceptable by code and shall not exceed the following:
1. Neon: 9,000 volts, 30 ma.
2. Cold Cathode: 300 ma.

B. Provide self-contained, UL Listed transformers in 16-gauge steel housing with secondary and primary wiring compartments, mount all transformers securely to the fixtures housing (if integral) or to the building structure (if remote) with neoprene pads to isolate vibration and noise.

C. Provide all transformers with secondary overcurrent protection and a primary switch when the wiring compartment cover is removed.

D. All transformers shall be installed in an accessible and ventilated location with a maximum 100ºF, ambient temperature with air circulation on all sides.

E. All winding type transformers will be high power with a maximum crest factor of 1.6.

F. All regulating transformers shall be tested to have an output regulated to +/- percent for input variations of 14 percent to 25 percent, less than 3 percent distortion with a minim load efficiency of 85 percent, and operating temperature of -20ºC to 70ºC.

G. All transformers to be of electronic type unless otherwise noted in the fixture schedule and/or approved shop drawing.

2.13 REFLECTORS

A. Reflectors and reflecting cones or baffles shall be as follows:

1. Absolutely free of any burrs and tooling marks including spinning lines, indentations caused by riveting or other assembly techniques.
2. No rivets, springs, or other hardware visible after installation.
3. First quality polished, buffed and anodized finish, “Alzak” or approved equal. Finish shall be guaranteed against pitting or discoloration for 5 years.
4. Semi-Specular or Specular finish, color as selected by the Architect or as specified in the fixture schedule. Finish shall be guaranteed against pitting or discoloration for 5 years.
5. All reflectors and baffles of modified elliptical contour, with no apparent brightness from above 40º above the nadir, with no lamp image or any part of the lamp visible from above 40º above the nadir.
6. Cone flange formed as an integral part of the cone with identical color finish. Width of the flange covers all ceiling openings without light leaks or visible hardware. Reflectors shall be pulled tightly to the ceiling, ensuring complete contact of the reflector flange with the ceiling surrounding the fixture. Fixture shall be free of light leaks at the ceiling aperture.
7. All removable reflectors ad trims shall be held in a way which prevents accidental dropping when servicing the fixture, ballast, and/or lamp (for example, a safety chain, torsion springs, hinges, etc.). These devices shall not be visible from normal viewing angles in the installed fixture.

B. Other aluminum reflectors shall be as follows:
1. Formed as noted on the Drawings and elsewhere in the Specification.
2. Reflectors free from blemishes, scratches, or indentations which would distort their reflective function.
3. Finished by means of the “Alzak” process or approved equal unless otherwise noted.

C. Samples of colored aluminum finishes (black, brass, bronze, etc.) shall be submitted for approval before fabrication.

D. All reflectors shall be finished according to the minimum requirements outlined below.

	MIN WEIGHT OF COATING		% MINIMUM REFLECTIVITY	
CLASS	(mg/sq.in)	SERVICE	SPECULAR	DIFFUSE
MI	0.5	Normal interior service	83	75
SI	7.5	Medium service industrial, exterior when operated within glass	82	73
SE	10.0	Exterior industrial or commercial service, exposed to atmosphere. Marine service enclosure	78	65

2.14 LENSES

A. All lenses secured by positive means with neoprene or silicone gasketing, washers, or springs as required to hold the lens tight within a frame or attach to a housing. When noted, lenses are to be “keyed” to a fixed position within the fixture assembly.

B. All glass lenses shall be heat treated (tempered) or sealed with a clear acrylic laminate layer to provide a “safety glass” rating. All lenses which require removal for re-lamping or normal maintenance shall be attached to the fixture housing by a minimal length of safety chain to prohibit the lens from falling and striking surrounding surfaces. Glass edges exposed during the re-lamping

process shall be gasketed to prevent chipping or cracking. Glass lenses shall be borosilicate glass and a minimum 0.375" thick, unless otherwise noted.

C. Glass lenses specified as translucent, or "opal" shall be treated as follows.
   1. Sand-blasted.
   2. Acid etched.
   3. White flashed.

D. Acrylic lenses shall be 100 percent virgin acrylic polymer, colorless, as manufactured by Rohm Haas, Acrylite, or Dupont. All lenses shall be a minimum 0.156" thick.

E. The quality of the raw acrylic material must exceed IES, SPI, and NEMA Specifications by at least 100 percent which, as a minimum standard, shall not exceed yellowness factor of 3 after 2,000 hours of exposure to the Fade-o-meter or as tested by an independent test laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified, UV stable, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 15 years.

2.15 LOUVERS / BAFFLES

A. All louvers shall be fabricated of the specified material. Aluminum louvers shall be a minimum gauge of 0.5mm.

B. Louver finishes shall be provided as specified. The finishing process shall be accurately controlled to ensure that no visually detectable variations exist between louver assemblies when lighted. Louver assemblies with lighted visual appearances differing more than the approved range will be rejected. Louvers and side reflectors shall be checked under lighted conditions to insure visual consistency before assembly. Louver and reflector parts with different lighted visual appearance will be rejected. Any reflectors producing iridescence with the specified lamp will be rejected. Finish shall be guaranteed against pitting or discoloration for 5 years.

C. All plastic parabolic louvers shall be destaticized before and after fabrication to insure minimum maintenance.

D. All metal louvers shall by coated with anti-rust material and electrostatically painted.

E. All louvers shall be heat tested to withstand lamp operating temperatures with no deformation of shape, paint blistering or discoloration.

F. Aluminum reflectors, baffles, and louvers shall be fastened and interlocked to form one integral unit which can be removed from the fitting housing for cleaning. It shall be braced to provide sufficient rigidity, such that no sagging, twisting, or racking occurs and that the assembly seats flush and true to the light fixture. Corners shall be diagonally mitered and interlocked to prevent separation.

2.16 FIXTURE TRIMS

A. Recessed LED fixtures shall have finished trim designed for the following types of ceiling systems: Ceiling type – trim type
   1. Recessed LED Fixtures:
      a. Plaster – Overlap trim or spackle-in flush trim ("trimless")
      b. Concrete – Overlap trim.
      c. Tile – Overlap trim or modified "trimless".
      d. Gypsum – Overlap trim or spackle-in flush trim ("trimless").
      e. Lay-in – Modular, tile with flush fit-in.
      f. Wood – Overlap trim or modified "trimless".

B. Provide trim details as shown on Drawings or as specified, which are indicative of appearance and dimensional requirements. Trim finish and dimensions are subject to the approval of the Architect and Lighting Designer.

C. Mitered corners shall be continuously welded and smoothed before shop finish is applied. No lapping of trim metal for all flush mounted ceiling trims for rectangular or square fixtures.

D. Provide a mounting frame or ring with lock for recessed or semi-recessed light fixture to secure the mounting frame to the ceiling and support any reflectors, trims, or lenses. Ring shall be compatible with the ceiling and of sufficient strength to rigidly support the fixture and any stress applied in re-lamping. NOTE: Catalog numbers are included for reference. Provide all accessories and design features described herein regardless of whether such features are included in catalog reference including mounting hardware, louvers, lenses, filters, transformers, etc.

E. Fixture trim shall be compatible with the applicable ceiling type and construction and, unless otherwise specified, shall require no modifications to the ceiling system except for the relocation of ceiling support members in case of conflicts with fixture location. Any visible corners of the trim shall be diagonally mitered. All corners of the trim shall be interlocked to prevent separation. There shall be no exposed fasteners.

F. All removable reflectors and trims shall be held in a way which prevents accidental dropping when servicing, ballasts, and/or lamp (for example, a safety chain, torsion springs, hinges, etc.) These devices shall not be visible from normal viewing angles in the installed fixture.

G. Width of trims covers all ceiling openings without light leaks or visible hardware. Trims shall be pulled tightly to the ceiling, ensuring complete contact of the trim with the ceiling surrounding the fixture. Fixture shall be free of light leaks at the ceiling aperture.

2.17 LIGHTING FIXTURE TYPES AND CATALOG NUMBERS

A. General: Various fixture types are indicated on the lighting fixture schedule. Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling types, modules, suspension systems appropriate to installation.

2.18 SUPPORTS FOR SUSPENDED FIXTURES

A. Provide separate and isolated suspension foal l fixtures required by the Local Building Department and seismic requirements. This may include rod hangers, hook hangers, or single stem hangers.

2.19 CUSTOM LIGHTING FIXTURES

A. Unit pricing shall be provided for all custom light fixtures.

B. Quantity of 2 full-scale prototype fixtures shall be included in the bid package unless otherwise noted in the fixture schedule. The prototype fixtures shall be produced upon the request of the Lighting Designer at a time deemed significant by the Lighting Designer during the development process.

C. Quantity of 2 quarter scale or half scale rapid prototype models shall be included in the bid package unless otherwise noted in the fixture schedule. These scale models shall be produced upon the request of the Lighting Designer at a time deemed significant by the Lighting Designer during the development process.

D. All costs associated with the production and shipping of samples and prototypes for custom fixtures shall be included in the bid package.

E. A minimum of 24 weeks prior to scheduled fixture shipment (to job site) shall be provided for the development, prototyping, and manufacture of custom lighting fixtures. During the fixture development process, allow ten business days from the date of receipt of drawings, material samples, scale or full-size models/prototypes for thorough examination and comments by the Lighting Designer and/or Architect.

2.20 MILLWORK LIGHTING

A. For light fixtures located within millwork, display cases, or other furniture, the fabricator of the millwork / display case / furniture shall be responsible to ensure light fixtures specified by the Lighting Designer receive proper air ventilation to operate within the temperature range recommended by light fixture Manufacturer. All ventilation details shall be submitted for review by the designer of the millwork / display case / furniture. NOTE: the Lighting Designer is responsible for the specification of the light fixture, but the design of the millwork / display case / furniture is typically by the Architect or Interior Designer.

PART 3 - EXECUTION

3.1 LIGHTING CONTROL SYSTEM

A. Examine areas and conditions under which lighting fixtures are to be installed and substrate for supporting lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected in manner acceptable to the installer.

3.2 INSTALLATION OF LIGHTING FIXTURES

A. Contractor to coordinate exact quantities and critical dimensions with field conditions.

B. Contractor to verify and coordinate that appropriate framing, support structures, mounting brackets, and other required structural connections, are provided by the General Contractor or other trades to insure a timely, neat installation of all luminaires.

C. Contractor to coordinate and provide any associated mounting hardware, conduit connections, or associated appurtenances to effectively install the luminaires. Provide each light fixture with complete installation instructions including mounting instructions with all fixture shipments. All light fixtures to be installed in strict conformance with manufacturer’s recommendations and instructions.

D. Contractor is responsible for coordinating the final electrical and installation requirements for all LED fixtures with Architect of Record and Lighting Designer. This includes (but is not limited to) verification of the following:
   1. Final run lengths of LED fixtures.
   2. Final lengths for factory pre-molded wire whips/wire tails.
   3. Final cable types and cable connectors that meet project requirements and local code requirements.
   4. Final quantity and specification for LED drivers, power supplies, control gear, and NEMA approved enclosure boxes.
   5. Final locations for all remote LED control gear.
   6. Final mounting hardware and mounting details for all LED fixtures and control gear.
   7. Final operating voltage.
   8. Ventilation details for LED light fixtures and/or associated power supplies for light fixtures located in millwork, display cases, POS displays, and/or furniture.

E. Install lighting fixtures in accordance with fixture manufacturer’s written instructions, applicable requirements of NEC, NECA’s “standard of Installation”, NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

F. Exact locations of all lighting fixtures including mounting heights and plan dimensions are as per the Architectural Drawings. Any ambiguities or conflicts in this dimensional information to be identified to the Architect prior to installation.

G. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than specified herein, for review by the Architect and Lighting Designer.

H. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface. All fixture (flush or overlap reflectors/trims), when installed, shall be free of light leaks, warps, dents, or other irregularities. No light leaks are permitted at the ceiling line or from any visible part or joint of the fixtures.

I. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

J. Fasten fixtures to structural supports and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one-inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures. Allowable tolerances for individual pendant mounted fixtures shall not exceed ¼ inch and shall not vary more than ½ inch from the AFF mounting height shown on the drawings. Install pendant fixtures hung in continuous rows absolutely level and in line with each other. Hanging devices for pendant fixtures shall comply with code requirements.

K. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified on UL Standards. 486A and 486B and the National Electrical Code.

L. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixtures stud.

M. Fasten electrical lighting fixtures and brackets securely to structural supports, including poles/standards, and ensure that installed fixtures are plum and level.

N. Rigidly align all continuous rows of fixtures for true in-line appearance.

O. Do not install exposed fixtures, reflectors or trims until all plastering, painting, wet work and general cleanup is complete in the area of fixtures. Replace blemished, dented, damaged or unsatisfactory fixtures as directed.

P. Support all fixtures independent of ductwork or piping.

Q. Contractor to follow specified manufacturer instructions for all flush "spackle-in" fixtures. Contractor to budget and allow scheduling for the multi-step installation process that is required for specified "spackle-in" fixtures. All flush fixtures shall be installed so that no portion of the fixture projects beyond the finished plane of the ceiling.

R. All reflectors, louvers and baffles shall be installed with gloves to prohibit transfer of fingerprints to the surface of these components.

3.3 FIELD QUALITY CONTROL

A. Replace defective and burned-out lamps for 3 months following the Date of Substantial Completion.

B. As referenced in Specification Section 26 50 00, Item 2.9G, furnish stock or replacement lamps amounting to 10 for every 100 of each type and rating installed, but not less than one (1) lamp in each case, of each type and size lamp used in each fixture type.

LED Lamps: 10 for every 100 of each type and rating installed. Furnish at least one (1) of each type.

Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one (1) of each type.

Plastic diffusers and lenses: 1 for every 10 of each type and at least one (1) one of each type.

Standard Light fixtures: 2 each of standard interior light fixtures.

Custom Light fixtures: 4 each of any custom light fixtures.

Ballasts: 1 for every 100 of each type and at least one (1) of each.

LED power supplies/drivers: Contractor to consult with owner and provide if required, back stock of all LED power supplies/drivers in a quantity to the Owner's preference. Remote drivers may be supplied individually as back-stock, integral drivers may require the entire fixtures as back stock. The Contractor has the right to appeal this requirement but must do so in writing to the Owner prior to award of the project contract.

Exterior Glass and plastic lenses: 1 for every 10 of each type and at least one (1) of each type.

Exterior Globes and Guards: 1 for every 2 of each type and rating installed. Furnish at least one (1) of each type.

Deliver replacement stock as directed to Owner's storage space.

3.4 AIMING AND ADJUSTMENT

A. All adjustable lighting units shall be aimed, focused, locked, etc., by the Contractor under the supervision of the Architect and Lighting Designer. All aiming and adjusting shall be carried out after the entire installation is complete. All lifts, ladders, scaffolds, etc., required shall be furnished by the Contractor. As aiming and adjusting is completed, locking mechanisms shall be tightened securely. For all adjustable lighting units with lens accessories (honeycomb louvers, spread lens diffusers, color adjustment lenses), application of lens accessories to be determined at the discretion of the Lighting Designer, during final aiming and focusing by the Contractor under the supervision of the Lighting Designer.

B. Where possible, units shall be focused during the normal working day. However, where daylight interferes with visibility of lighting intent, aiming shall be accomplished at night.

C. When requested by Lighting Designer, verify that measured illuminance values comply with isolux plot diagram values as supplied for approved substitute/alternate fixtures.

3.5 CLEAN-UP

A. Clean lighting fixtures of dirt and construction debris upon competition of installation. Clean fingerprints and smudges from lenses, reflectors, louvers, baffles, and trim plates using manufacturer approved materials and methods. Two weeks prior to substantial completion, re-clean all fixtures of dust, fingerprints, and smudges from all visible parts of the fixture. All specular and semi-specular components shall be free of fingerprints.

B. Protect installed fixtures from damage during remainder of construction period.

C. Immediately prior to receipt of Temporary Certificate of Occupancy (TCO), all fixtures shall contain new lamps with less than 200 hours of total burn time.

D. At the time of final acceptance by the owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, all broken parts shall have been replaced, and all lamps shall be operative.

3.6 GROUNDING

A. Provide equipment grounding connections for lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

3.7 DEMONSTRATION

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.

3.8 WARRANTY

A. General Terms
1. The equipment installed under the present contract is covered by warranty starting after substantial completion of the project (owner acceptance).
2. The warranty covers functioning defects in lighting equipment due to manufacturing defects and/or equipment that was improperly installed.
3. The defective equipment will be replaced within 10 days after notification from the architect or from the user of the project.

B. Length of Warranty
1. Provide 1-year warranty for all lamps and 5-year warranty for all ballasts/drivers in lighting fixtures. Replace defective and burned-out lamps for a period of one year and replace defective ballast/drivers for a period of five years following the time of project substantial completion (Owner acceptance).
2. Provide 5-year warranty for LED fixtures including control gear. For all other fixtures, provide a 5-year warranty of failure in materials, workmanship, ballast, etc., in addition to and not limited to, other rights the Owner may have under the contract documents. A full warranty shall apply for the first year, and a pro-rated warranty for the remaining years of the warranty period.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and drivers.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section " Modular Dimming Controls "for architectural dimming systems.
3. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
4. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
5. Division 26 Section "Wiring Devices" for lighting control devices.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. CU: Coefficient of utilization.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including driver housing if provided.

E. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Driver.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
    b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Structural members to which suspension systems for lighting fixtures will be attached.
4. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

5. Perimeter moldings.

D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

1. Accessories: Cords and plugs.

E. Qualification Data: For agencies providing photometric data for lighting fixtures.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

H. Warranties: Special warranties specified in this Section.

I. Contractor shall perform a coordination review with the wiring device vendor and the lighting fixture submittal to ensure that the wiring devices are compatible with the lighting fixtures they are controlling and shall submit a letter with the shop drawing.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. LED fixtures, both interior and exterior, shall be DLC listed. LED fixtures shall have a minimum efficacy of 90 lumens/watt.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

B. Special Warranty for LED fixtures and drivers: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in

materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Seven years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least 1 of each type.
2. Drivers: 1 for every 50 of each type and rating installed. Furnish at least 1 of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers indicated in the fixture schedule. If alternate manufacturers are provided, contractor shall provide floor plans with foot candle levels indicated with submittal so design team can verify foot candle levels match the design intent.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

F. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
    b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
    g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

3. Master/Remote Sign Configurations:

   a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.5 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

A. Refer to the fixture schedule on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.

2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes common work requirements and results for all Communications work performed under Division 27 specifications.

B. Related Requirements:

1. Section 260533 – “Raceways and Boxes for Electrical Systems” for conduit and fittings, raceways, boxes, enclosures, cabinets, and handholes.

1.3 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All work of Section 270526 - Grounding and Bonding for Communications Systems
2. All work of Section 270528 - Pathways for Communications Systems
3. All work of Section 270529 - Hangers and Supports for Communications Systems
4. All work of Section 270537 – Firestopping for Communications Systems
5. All work of Section 270553 - Identification for Communications Systems
6. All work of Section 270800 - Commissioning of Communications
7. All work of Section 271116 - Communications Cabinets, Racks Frames and Enclosures
8. All work of Section 271513 - Communications Copper Horizontal Cabling
9. All work of Section 271523 - Communications Optical Fiber Horizontal Cabling

B. Alternates: Not Applicable

C. Items To Be Installed Only: Not Applicable

D. Items To Be Furnished Only: Not Applicable

E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Not Applicable

1.4 PROJECT DESCRIPTION

A. This project consists of the installation of a complete structured cabling and infrastructure pathway system for The Brooklyn Museum Arts of Africa Galleries.

1.5 SPECIAL CONDITIONS

A. The general conditions for contracts of construction, referred to in the contract documents as the General Conditions, together with the following articles of the Communications Structured Cabling Specifications, which amend, modify and supplement various articles and provisions of the General Conditions, are made part of the Contract and shall apply to all work under the Contract.

B. The Contractor represents that he/she is familiar with, and has expertise in the Work of this nature and scope. The Contractor further agrees that he/she shall provide all Work as may be required to make a complete job of that which may not be fully defined in the Contract documents.

C. These specifications are material, equipment, and performance specifications. Actual installation requirements shall be as indicated on the drawings. Installation details indicated on the drawings shall govern if they differ from the specifications. Contractor is obligated to identify such differences at the time of bid submission.

D. Contractor shall comply with all applicable governmental regulations and with all Federal, State, City, and other applicable codes and ordinances. If the contractor performs any work which is contrary to such regulations, codes, and ordinances, contractor shall make all changes to comply therewith and bear all costs arising there from.

E. It is the intent of this Specification that all items under these Sections be engineered, assembled, installed and maintained by, and under the full responsibility of a single Contractor, whether these processes are actually performed by the Contractor or not. Deviations from this intent are to be fully described in the proposal, with reasons for the same, and the coordination methods required facilitating the least effect of the deviation on the project's implementation.

1.6 WORK INCLUDED

A. The Owner seeks to identify a qualified low voltage communications cabling contractor capable of performing the scope of work as identified in the Contract Documents.

B. It is the intent of these Specifications to create an ANSI/TIA-568.1-E compliant cabling system to support high-speed data applications up to 10 Gbps including IEEE standards based on Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet. System acceptance shall be judged on its ability to perform as such, the successful adherence to the installation instructions of this Specification, and compliance with parts and workmanship warranties.

C. The work covered by this specification includes the installation of a complete cabling system, including all labor necessary to perform and complete such installation, all materials and equipment incorporated or to be incorporated in such installation, and all services, supervision, consumable items, fees, licenses, facilities, tools, and equipment necessary or used to perform and complete such installation.

D. The Work Included is defined by the following and further defined in the drawings and Sections of Division 270000.

1. Provide project management and oversight for the installation of a complete structured cabling system.
2. Prepare and submit component documentation shop drawings, outlet labeling drawings, cable pull/termination schedules, cable test results and as built drawings as described within this Specification and per the General Conditions.
3. Preparation of shop drawings, record or as-built drawings, manufacturer cut sheets, and other documentation described herein.

1.7 REFERENCES

A. Abbreviations and Acronyms

1. A/E: Architect / Engineer (designer)
2. ANSI: American National Standards Institute
3. AHJ: Authority Having Jurisdiction
4. APC: Angled Physical Connector
5. BDF: Building Distribution Frame
6. BICSI: Building Industry Consulting Service International
7. CMP: Communications Plenum cable
8. CMR: Communications Riser cable
9. DAS: Distributed Antenna System
10. EIA: Electronics Industry Alliance
11. ELFEXT: Equal Level far End Cross Talk
12. ER: Equipment Room
13. F/UTP: Foil Screened Unshielded Twisted Pair
14. FOTP: Fiber Optic Test Procedure
15. GHz: Gigahertz
16. IDC: Insulation Displacement Conductor
17. IDF: Intermediate Distribution Frame
18. IT: Information Technology
19. ISP: Inside Plant
20. LC: A type of small form factor optical fiber connector
21. LOMMF: Laser Optimized Multimode Fiber

22. MDF: Main Distribution Frame
23. MHz: Megahertz
24. MMF: Multimode Fiber
25. MPO: Multi-fiber Push On connector
26. MPOE: Minimum Point of Entry
27. MTER Main Telecommunications Equipment Room
28. NEXT: Near End Cross Talk
29. OFNP: Optical Fiber nonconductive plenum cable
30. OFNR: Optical Fiber nonconductive riser cable
31. OSP: Outside Plant
32. OTDR: Optical Time Domain Reflectometer
33. PBB: Primary Bonding Busbar
34. PoE: Power-over-Ethernet
35. PSELFEXT: Power Sum Equal Level far End Cross Talk
36. PSNEXT: Power Sum Near End Cross Talk
37. RCDD: Registered Communications Distribution Designer
38. RMU: Rack Mount Unit
39. RoHS: Restriction of Hazardous Substances
40. SBB: Secondary Bonding Busbar
41. ScTP: Screened Twisted Pair
42. STP: Shielded Twisted Pair
43. SMF: Singlemode Fiber
44. TCIM: Telecommunication Cabling Installation Manual
45. TDMM: Telecommunications Distribution Methods Manual
46. TDR: Time Domain Reflectometer
47. TIA: Telecommunications Industry Association
48. TR: Telecommunications Room
49. TSER: Telecommunications Service Entry Room
50. UL: Underwriters Laboratory
51. UTP: Unshielded Twisted Pair
52. WAP: Wireless Access Point

B. "PROVIDE" or "FURNISH" means to supply, purchase, transport, place, erect, connect, label, test and turn over to Owner, complete and ready for regular operation, all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for a telecommunications cabling system.

C. "SUPPLY" means to purchase, procure, acquire, and deliver complete with related accessories.

D. "INSTALL" means to move from property line, set in place, join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner of equipment and/or components. It means the installation is to be complete and ready for regular operation, except as otherwise noted.

E. "WIRING" or "CABLING" includes furnishing, unless otherwise noted, of all fittings, hangers, supports, sleeves, etc.

F. "CONDUIT" and CABLE TRAY" includes furnishing, unless otherwise noted, of all fittings, hangers, supports, sleeves, etc.

G. “AS DIRECTED" means as instructed by the Project Manager or his representative.

H. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.

I. "EXPOSED" means not installed underground or "CONCEALED" as defined above.

J. “PERMANENT LINK” means the end-to-end test configuration for a link excluding test cords and patch cords, but including the mated connection with the link.

1.8 CODES, REGULATIONS, AND STANDARDS

A. All equipment shall be equal to or exceed the minimum requirements of OSHA, NEMA, IEEE, ASME, ANSI, NEC and Underwriters Laboratories.

B. The installation shall comply fully with all applicable local, county and state laws and ordinances, regulations and codes.

C. Local electrical and building codes in New York may be more stringent than national codes, recommendations or practice. Follow the most restrictive code or recommendations.

D. All products, services and materials provided and performed under the scope of this specification shall conform to the following codes and standards. Refer to the most recent version, update or addenda.

1. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual - latest edition
2. Building Industry Consulting Service International (BICSI) Information Transport Systems Installation Manual (ITSIM) – latest edition
3. ANSI/TIA-568.1-E, Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA-568.2-E Balanced Twisted-Pair Telecommunications Cabling and Components Standard
5. ANSI/TIA-568.3-E, Optical Fiber Cabling Components Standard
6. ANSI/TIA-569-E, Commercial Building Standards for Telecommunications Pathways and Spaces
7. ANSI/TIA-606-D, Administration Standard for Commercial Telecommunications Infrastructure
8. ANSI/TIA-607-E, Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
9. ANSI/TIA-862-B Building Automation Systems Cabling Standard
10. ANSI/TIA-942-B, Telecommunications Infrastructure for Data Centers
11. FCC Part 15
12. FCC Part 68
13. IEEE 802.3ab, 1000Base-T Ethernet Specification
14. IEEE 802.3af Power over Ethernet (PoE) Standard
15. IEEE 802.3at Power over Ethernet+ (Plus) Standard
16. IEEE 802.3an Physical Layer and Management Parameters for 10 Gbps Operation Type 10GBASE-T.

17. IEEE 802.3ba Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbps and 100 Gbps Operation.
18. IEEE 802.11, Wireless Ethernet Specifications, including 802.11a, 802.11b, 802.11g, 802.11n and 802.11ac.
19. IEEE 802.12, 100Base-TX Ethernet
20. NEC Article 770, Optical Fiber Cables
21. NEC Article 800, Communications Circuits
22. NFPA 70, National Electrical Code
23. NFPA 75, Protection of Electronic Computer / Data Processing Equipment
24. NFPA 101, Life Safety Code.
25. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory
26. ASTM E 84, Surface Burning Characteristics of Building Materials.
27. ASTM E 119, Fire Tests of Building Construction and Materials.
28. ASTM E 814, Fire Tests of Penetration Firestop Systems.
29. ANSI/UL263, Fire Tests of Building Construction and Materials.
30. ANSI/UL723, Surface Burning Characteristics of Building Materials.
31. ANSI/UL1479, Fire Tests of Through Penetration Firestops.

1.9 QUALITY ASSURANCE

A. All materials furnished shall be new, unused, clean and free from damage, defects or corrosion.

B. Equipment and materials of the same type shall be a product of the same manufacturer throughout unless specifically exempted in advance. A specific example is all products comprising the Permanent Link (station cable, patch panels, jacks, faceplates, etc…)

C. Component manufacturer shall be ISO 9001:2008 and offer products that are RoHS compliant.

1.10 SUBMITTALS

A. Certificates:

1. Submit management and installation team reference documentation verifying that:

    a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
    b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents.
    c. The Contractor is a certified Berk-Tek/Leviton Technologies contractor/installer.

B. Qualification Statements

1. The contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

C. Procedure: Prepare and make the submissions listed below and in Division 1.

D. Shop Drawings: Submit shop drawings of all items proposed to be furnished and installed under this Division.

E. The use of copied Construction Documents or Bid Documents is unacceptable without prior authorization from Design Consultant or The Architect. Copied documents include but are not limited to; design documents copied to drawings with contractor’s title block, scanned copies of documents inserted into the submittals, direct links to the Consultant BIM model, or CAD files.

F. Submittals and shop drawings that are copied, incomplete, or which contain insufficient information will be returned without review, for resubmittal

G. Manufacturer's Drawings.

1. Equipment listed in each section, include material specifications, operating characteristics and finishes.

H. Installation Drawings.

1. Coordinated scale drawings of equipment.
2. Coordinate space requirements for equipment and services.
3. Include connections, anchorages and fastenings.
4. Make allowance for clearances for access to and maintenance of equipment.

I. Provide composite shop drawings showing work of all related construction, when required to ensure full coordination and proper fitting of the work, and when directed by the Architect.

J. If submissions of catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or variations, those features proposed shall be clearly identified.

1. If any variations from the catalog description are proposed or required, such variations must be clearly noted on the cut.
2. Shop drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work.
3. Shop drawings shall be numbered consecutively, and drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that units may be checked individually and as an assembly.

4. Keep on the site, in good order, a complete up-to-date set of approved shop drawings. All shop drawings shall be available for inspection by the Architect.
5. On product data submittals, clearly indicate model numbers, dimensions, weights, electrical requirements, accessories and performance data. Submittals not properly prepared will be rejected without further review.
6. The review of shop drawings will be general, and shall not be construed as permitting any departure from the contract requirements other than those specifically brought to the Architect's attention and so approved.

    a. If the shop drawings show any variations from contract requirements because of standard shop practices or reasons, such variations shall be clearly identified on the drawings in order that, if acceptable, suitable action may be taken for proper adjustment in other work affected thereby.
    b. Failure to identify such variations will not relieve the Contractor of responsibility for executing the work in accordance with the Contract even though such shop drawings have been reviewed and the work installed.
    c. Review shall not relieve the Contractor of responsibility for any error in details, dimensions, etc., that may exist on shop drawings nor for the furnishing of materials or work required by the Contract and not indicated on the shop drawings.
    d. Review shall not be construed as acceptable departure from details or instructions previously furnished by the Architect.
    e. Review with a requirement for resubmission is a review contingent upon satisfactory resubmission within 30 days. Failure to comply shall result in a revocation of the contingent review.

K. Shop Drawing Schedule

1. The Contractor shall submit, within 30 days of the award of his contract, a schedule of all proposed shop drawing submissions.
2. The schedule shall include the following information.

    a. Item to be submitted
    b. Date of submission
    c. Latest date for review
    d. Manufacturers of the specified item.

3. Items not specifically listed as "approved equal" should be listed for consideration at this time.
4. Shop drawings require a minimum of 10 business days from the date they have been received by the Consulting Engineer’s office to adequately review the submittal. If there is any submittal which requires to be expedited sooner than the 10 business days, the Engineer shall be informed in writing at the beginning of construction with a list of those submittals.

L. Submittals will be reviewed for conformance with the contract drawings and specifications. The engineer's review stamp will be affixed to submittals. One of the following actions will be taken:

1. Reviewed:

a. No comments, corrections, or marks have been made to the submittal. Re-review by the engineer is not required. The submittal is in general conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the work shall be in accordance with the requirements of the Contract Documents. Final acceptance of the work shall be contingent upon such compliance.

2. Furnish As Corrected

a. Comments, corrections, or marks made. Re-review is not required. Submission is in general conformance with the design concept subject to notations on the returned Submittal. Construction, fabrication, and/or manufacturer can proceed subject to the provisions that the work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Submittal and in accordance with the Contract Documents. Final acceptance of the work shall be contingent on such compliance.

3. Revise and Resubmit

a. Significant issues/discrepancies/incomplete information was provided in the Submittal. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

4. Rejected

a. Submittal does not meet Contract document intent. Revise or prepare a new submittal in accordance with the notations and Contract Documents. Resubmit without delay.

M. A submittal review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from Compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. The contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of his or her work with that of all other trades; and for performing all work in a safe and satisfactory manner.

1.11 COORDINATION OF WORK

A. Refer to requirements listed in Division 01.

1.12 PROJECT CLOSEOUT

A. Subsequent to the installation and prior to acceptance of the work, the contractor shall prepare and issue record (as-built) drawings, in Adobe PDF format, that reflect the lengths of cables installed, the actual manner and conditions of installation, including all deletions from, additions to or departures from the contract documents. These documents are to include the information outlet station numbers and cable routing where it varies from the original plan.

B. Provide revised cable termination schedules for all cables installed under the Work. Schedules shall be in printed form and on CD in Microsoft Excel format.

C. Provide two (2) sets of Operation and Maintenance Manuals including wiring diagrams, parts list, shop drawings and manufacturers' information on all equipment and cables provided under this Work. Provide manuals in a high quality, 3 ring binder, completely indexed. Provide manuals within fifteen days of systems acceptance.

1.13 MANUFACTURER'S EXTENDED WARRANTIES

A. All manufacturer extended product warranties shall be afforded to The Owner. A copy of certification by the manufacturer for all products listed in this specification is to be provided.

B. Contractor to provide the Berk-Tek/Leviton Technologies Limited Lifetime warranty for the structured cabling system.

C. Prior to commencement of the work, the successful bidder shall contact an authorized manufacturer’s representative to inform them that this job is being registered under the warranty program.

D. Upon completion of the work, the contractor shall coordinate with the manufacturer the issuance of a full warranty on the entire copper and fiber optic cable plant including the horizontal cabling for both parts and labor. The cabling contractor at his sole expense will correct any deficiencies determined by the manufacturer

PART 2 - PRODUCTS

2.1 REFER TO THE SPECIFIC SECTIONS OF THE SPECIFICATIONS FOR EQUIPMENT REQUIREMENTS

PART 3 - EXECUTION

3.1 STAFFING

A. Craft personnel shall be certified personnel qualified to perform the work and be knowledgeable of the following activities.

1. Color coding of standard American telephone/ data telecommunications cables.
2. Bonding and grounding of shields.
3. Testing conductors for transmission impairments.
4. Testing conductor insulation.
5. Installation and termination of optical fiber cabling.
6. Testing and verification of optical fiber transmission characteristics with a power meter.
7. Telephone and Data Industry Cable Installation Standards and Manufacturer's Instructions will be used for in-process quality control and final acceptance of the work installation.
8. Cable tray and ladder rack installation.

B. Craft personnel will be required to provide and use the proper tools and test equipment in the performance of each activity. The tools must be in good working order, and the test equipment must have current calibration certificates, as applicable. The Owner reserves the right to review the tool and test equipment lists and maintenance procedures of the contractor.

C. Use of Site – Refer to the Division 01 Requirements.

D. Follow manufacturer's instructions for installing, connecting, and adjusting all telecommunications riser and horizontal cabling and associated supporting, termination and splicing equipment, conduits, poke-throughs, and ladder rack. Provide a copy of such instructions at the equipment during any work on the equipment.

E. Keep all items protected before and after installation. Provide protection for exposed cables roughed onto the floor prior to their installation into the furniture systems. Clean up and remove all debris.

F. If products and materials are specified herein for a specific item or system, use those products or materials. If products and materials are not listed, use first-class products and materials, subject to acceptance of shop drawings.

G. Examine and compare the communications cabling drawings and specifications with the drawings and specifications of other trades; report any discrepancies between them to the Construction Manager; and obtain from him written instructions for changes necessary in the work.

H. The locations of structural and architectural features, existing sleeves, floor slots, termination and cross connect fields, panels, racks and other equipment indicated on the drawings are approximate. The contractor shall verify the existence, locations, and

suitability of all such items, and shall present, with bid response, required modifications to contract documents necessary to complete this work.

3.2 SPECIAL CONDITIONS

A. Furnish, install, terminate and test all horizontal (station) and backbone cabling for all floors shown in the attached and associated drawings and as described below.

1. The contractor shall route all copper and fiber cabling, unless otherwise identified, via hung ceilings, cable tray, ladder rack, conduits, raised floors, poke-throughs, and furniture systems unless otherwise noted. Contractor shall install all overhead station cable in such a manner that the selected route does not in any way compromise ceiling integrity. Cables that are routed in open ceiling areas must be neatly tie wrapped and suspended with the appropriate hangers and shall not be allowed to rest on ducts, pipes and conduits. At no time will cable be supported from hung ceilings or ceiling support wires. All overhead cabling must be neatly bundled and secured as close as possible to the overhead slab to avoid conflict with or EMI from flexible electrical conduits, motors, etc.
2. Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
3. Install plenum cable in environmental air spaces, including plenum ceilings.
4. Comply with requirements for cable trays specified in Section 270536 "Cable Trays for Communications Systems."
5. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
6. Core drilling and the installation of aftersets, grommeted access slots, sleeves, conduits, fire-rated poke-throughs, and raceways required to route copper and fiber optic cabling will be furnished and installed by parties as indicated by contract documents. Where pathways furnished by others are not sufficient for the routing of cabling, this condition shall be brought to the attention of the Construction Manager, in writing, by this contractor.
7. As indicated, cabling shall run to workstation and other outlets through cavities in the drywall and openings in sheet metal or wooden studs within the drywall construction. The sheet metal studs will not be gasketed for this purpose, it shall be the contractor's responsibility to exercise extreme care in snaking cable through these areas to avoid damage to the cable jacketing.
8. Information Outlet faceplates for all boxes will be furnished and installed by this contractor.
9. All cabling shall be installed at least: 12” from high voltage lighting and fluorescent fixtures unless within a metal enclosure 72” from transformers and motors.

3.3 INSTALLATION

A. Most optical fiber and copper cables will enter the Telecom Room(s) through sleeves, conduits and overhead cable tray based on the cable routing requirements reflected on drawings

B. Contractor shall take all necessary precautions to assure that the maximum tensile load and minimum bend radius of all cables (fiber and copper) are not exceeded. When terminating UTP cable, the contractor must maintain pair twists up to the termination point and the cable sheath shall not be removed more than 0.5” from the termination point. Velcro tie wraps are to be hand tightened on cables to prevent crimping cable sheath. Plastic tie wraps are not to be used on lateral cables. The contractor is responsible for protecting all connectorized cables from damage by other contractors at the information outlet before and after installation of the outlet faceplates

C. Termination Hardware

1. All horizontal station cabling will be terminated on 8-pin modular patch panels. The fiber optic riser and tie cabling shall be terminated on fiber distribution coupler panels with LC connectors. All copper riser and tie cables shall be terminated on rack- mounted patch panels unless otherwise noted.
2. All termination hardware shall be grounded and bonded according to applicable codes, TIA standards, and Section 270526 “Grounding and Bonding for Communications Systems”.

D. Horizontal (Station) Cabling: All horizontal (station) cables shall be installed as uninterrupted conductor sections between the Telecom Room(s) and station outlets.

1. Installation of outlet jacks shall be coordinated by the contractor with the work of other trades, all working together with the Construction Manager.
2. Standard information outlets shall be housed in a single gang box, flush mount poke through, surface mount raceway, or furniture system raceway as indicated on the drawings. All horizontal cables shall be terminated on 8-pin modular jacks.
3. All installed connectors shall be protected and insulated during and following the installation. Protective caps or dust covers shipped with connectors shall be left in place or replaced by the contractor if found to be dislodged or damaged.

E. Fire Stop - Penetration Sealant: Refer to Section 270537 “ Firestopping for Communications Systems.”

3.4 REPLACEMENT

A. Any fiber strand, connector, block, or module installed by the contractor, which fails to meet the loss budget, or tests below the manufacturer's standards, shall be replaced at no additional cost to the Owner. The replacement cable, connector, or part shall be tested after repairs have been made to verify compliance. Only equipment that meets the installation requirements stated herein shall meet The Owner’s acceptance requirements.

3.5 SOURCE MANUFACTURING AND QUALITY CONTROL

A. Cables that are supplied by the contractor, and test outside of the factory test data by a margin of 10 percent on loss, may, at The Owner’s option, be deemed non-usable and returned to the manufacturer for replacement.

3.6 POST IMPLEMENTATION TESTING

A. Following the physical installation of the cabling, the contractor will conduct pre-checkout tests as described below, "Physical Inspection", prior to the formal acceptance tests with The Owner.

3.7 PHYSICAL INSPECTION

A. Prior to conducting any transmission testing, the following visual inspections will be performed:

1. Verify that all cable has been installed to full compliance with the proposal specifications.
2. Check for physical damage to the optical fiber distribution panels and termination hardware.
3. Check that all cabling is properly jacketed, installation properly labeled at both ends of the cable, innerduct and termination hardware is completed in all Telecom Room(s).
4. Verify that all cable bends are within the manufacturer's specified bend radius.
5. Verify that all cabinets and racks (which require grounding) are properly grounded and comply with the National and Local Electrical Codes for grounding.
6. Verify that the cables are properly approved and structurally supported for termination.
7. Verify that the requirements of all authorities having jurisdiction have been satisfied.

END OF SECTION 27 05 00

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Selection and installation of communications busbars.
2. Selection and installation of communications bonding conductors.
3. Selection of signal reference grids.
4. Installation of grounding and bonding for towers and antennas.

B. Related Requirements:

1. Section 270548 "Vibration and Seismic Controls for Communication Systems” for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
2. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

A. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.

B. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.

C. RBB: Rack bonding busbar, located in equipment cabinets and racks.

D. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.

E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.

F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.

G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.

H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. For communications equipment room signal reference grid.
2. Include plans, elevations, sections, details, and attachments to other work.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Installing wire connector on conductor.
2. Recommended torque values.

1.5 CLOSEOUT SUBMITTALS

A. Record Documentation: Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of TBC connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF COMMUNICATIONS BUSBARS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. PBB:

1. Dimensions: 1/4 inch thick by 4 inch high.
2. Stand-Off Distance: 2 inch.

C. SBB:

1. Dimensions: 1/4 inch thick by 4 inch high.
2. Stand-Off Distance: 2 inch.

3.3 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Communications Busbar Connections:

1. TBC: Not smaller than 3/0 AWG and no smaller than largest TBB.
2. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
3. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
4. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
5. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
6. Bonding Conductors to Structural Steel: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.

C. Cable Tray Connections:

1. Cable Tray Equipment Grounding Conductor: 6 AWG.
2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper not smaller than 10 AWG and not longer than 12 inch. If jumper is wire, it must be terminated with lug having two holes and long barrel for two crimps. If jumper is flexible braid, it must be terminated with one- or two-hole ferrule. Attach with bonding screw or connector provided by cable tray manufacturer.

3.4 INSTALLATION OF BONDING FOR COMMUNICATIONS

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Busbars:

   a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 12 inch above finished floor unless otherwise indicated.
   b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

2. Conductors:

   a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
   b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:

      1) Use crimping tool and die specific to connector.
      2) Pretwist conductor.
      3) Apply antioxidant compound to bolted and compression connections.

   c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
   d. Install without splices.
   e. Support conductors at not more than 36 inch intervals.
   f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.

      1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 260533 "Raceways and Boxes for Electrical Systems," and bond both ends of raceway to SBB.

3. Provide TBC and terminate ends to PBB and intersystem bonding busbar at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.
4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together BBCs where required by TIA-607-E.

5. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
6. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
7. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide top-mounted RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
8. Shielded Cable: Bond shield of shielded cable to SBB in communications rooms and spaces. Comply with TIA-568.1-E and TIA-568.2-E when grounding shielded balanced twisted-pair cables.
9. Primary Protector: Bond to PBB with insulated bonding conductor.
10. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located in same room or space, bond each ground bar of panelboard to SBB.
11. Cable Trays: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
12. Ladder Racks: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
13. Access Floors: Bond metal parts of access floors to SBB.

3.5 IDENTIFICATION

A. Comply with Section 270553 "Identification for Communications Systems."

B. Labels must be preprinted or computer-printed type.

1. Label PBB(s) with "ts-PBB," where "ts" is telecommunications space identifier for location of PBB.
2. Label SBB(s) with "ts-SBB," where "ts" is telecommunications space identifier for location of SBB.
3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.6 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by authorities having jurisdiction.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.

2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.

    a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

        1) If measured resistance from electrical service equipment to ground exceeds 5 Ω, notify Architect and include recommendations to reduce resistance to ground.

    b. Measure resistance between SBBs and PBB. Maximum acceptable value is 100 mΩ.

3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.

    a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1 A.

C. Nonconforming Work:

1. Communications bonding will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports.

3.7 PROTECTION

A. After installation, protect busbars and conductors from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 27 05 26

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type OFR and Type CR communications raceways and fittings.
2. Cable supports and positioning devices.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" specifies firestopping for communications pathways installed by this Section.
2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding conductors and connectors for communications pathways installed by this Section.
3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports for communications pathways installed by this Section.
4. Section 260533 "Raceways and Boxes for Electrical Systems" specifies the following installed by this Section:

    a. Type EMT-A and Type EMT-SS duct raceways and elbows.
    b. Type EMT-S duct raceways and elbows.
    c. Type ENT duct raceways and fittings.
    d. Type HDPE and Type EPEC duct raceways and fittings.
    e. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
    f. Type ERMC-S duct raceways, elbows, couplings, and nipples.
    g. Type FMC-S and Type FMC-A duct raceways.
    h. Type FMT duct raceways.
    i. Type IMC duct raceways.
    j. Type LFMC duct raceways.
    k. Type LFNC duct raceways.
    l. Type PVC duct raceways and fittings.
    m. Type RTRC-AG duct raceways and fittings.
    n. Type RTRC-BG duct raceways and fittings.
    o. Fittings for conduit, tubing, and cable.
    p. Electrically conductive corrosion-resistant compounds for threaded conduit.
    q. Solvent cements.

5. Section 260533 "Raceways and Boxes for Electrical Systems" specifies the following installed by this Section:

    a. Metallic outlet boxes, device boxes, rings, and covers.
    b. Nonmetallic outlet boxes, device boxes, rings, and covers.

c. Junction boxes and pull boxes.
d. Cover plates for device boxes.
e. Hoods for outlet boxes.
f. Surface metal raceways and fittings.
g. Surface nonmetallic raceways.
h. Strut-type channel raceways and fittings.
i. Wireways and auxiliary gutters.

6. Section 260539 "Underfloor Raceways for Electrical Systems" specifies underfloor raceways for communications pathways installed by this Section.
7. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" specifies sleeves and sleeve seals for communications pathways installed by this Section.
8. Section 260553 "Identification for Electrical Systems" specifies labels and warning signs for communications pathways installed by this Section.
9. Section 260533 "Raceways and Boxes for Electrical Systems" specifies the following installed by this Section:

    a. Wall-mounted, surface metal raceway multi-outlet assemblies.
    b. Wall-mounted, surface nonmetallic raceway multi-outlet assemblies.
    c. Floor-mounted, recessed metal raceway multi-outlet assemblies.
    d. Indoor service poles.

10. Section 262726 "Wiring Devices" specifies the following installed by this Section:

    a. Floor-mounted, enclosure multi-outlet assemblies.
    b. Fire-rated, poke-through assemblies.
    c. Above-floor service fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

    a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

        1) If listed manufacturer differs from selling manufacture, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
        2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
        3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions submittals.

PART 2 - PRODUCTS

2.1 CABLE SUPPORTS AND POSITIONING DEVICES

A. Description: This category covers straps, hooks, and similar types of hardware for installation and use in communications cabling systems in accordance with NFPA 70 and manufacturer's installation instructions

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

C. UL DWMU - J-Hook or G-Hook Cable Support:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB Electrification Installations Products.
b. ADI.
c. Cablofil; Legrand North America, LLC.
d. Elite Components Inc.; subsidiary of SIGMA Piping Products (SPP) LLC.
e. Panduit Corp.
f. Southwire Company, LLC.

2. Source Limitations: Obtain products from single manufacturer.
3. Product Listing Criteria: UL CCN DWMU; including UL 2239 or UL 1565.
4. Product Characteristics:

a. Material: Galvanized steel.

D. UL DWMU - Conduit or Cable Support Strap:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB Electrification Installations Products.
b. CADDY; brand of nVent Electrical plc.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Hilti, Inc.
e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. Southwire Company, LLC.

2. Source Limitations: Obtain products from single manufacturer.
3. Product Listing Criteria: UL CCN DWMU; including UL 2239 or UL 1565.
4. Product Characteristics:

    a. Mounting Orientation: Vertical.
    b. Conduit, Cable, or Tubing Bundle Capacity: See Drawing Details.

5. Required Product Options:

    a. Suitable for use in air handling space.

PART 3 - EXECUTION

3.1 SELECTION OF PATHWAYS FOR COMMUNICATIONS SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

B. Type OFR and Type CR Communications Raceways: Comply with Table 800.154(b) of NFPA 70.

C. Minimum Pathway Size:

1. For Copper and Aluminum Cables: Metric designator 21 (trade size 3/4).
2. For Optical-Fiber Cables: Metric designator 25 (trade size 1).

D. Maximum Pathway Length Between Cable Access Points: 75 ft.

E. Indoor Pathways:

1. Exposed and Subject to Physical Damage: EMT. Locations include the following:

    a. Locations less than 2.5 m (8 ft) above finished floor.
    b. Stub-ups to above suspended ceilings.

2. Exposed and Not Subject to Physical Damage: EMT.
3. Concealed above Suspended Ceilings: EMT.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. In Vertical Runs: EMT.

F. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

G. Cable Supports and Positioning Devices:

1. Size hooks to allow minimum of 25 percent future capacity without exceeding design capacity limits.

2. Support hooks directly from building structure. Do not use ceiling grid support rods or wires.
3. Hook spacing must allow no more than 6 inch of slack. Lowest point of cables must be no closer than 6 inch to ceiling tiles, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 ft on center.
5. Provide hook at each change in direction.

H. Boxes and Enclosures:

1. Indoors: UL 50E Type 1, except use Type 4 nonmetallic units in institutional and commercial kitchens and damp or wet locations.

3.2 PROTECTION

A. Protect coatings and finishes of pathways, boxes, and enclosures from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 27 05 28

SECTION 27 05 37 - FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Firestopping of Through Penetrations in Fire Rated Assemblies.
2. Smoke Seals.
3. Construction enclosing compartmentalized areas.

B. Related Requirements:

1. Section 078413 “Penetration Firestopping” for penetration firestopping systems installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 DEFINITIONS

A. Not applicable

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of an ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer (RCDD) to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti
2. Specified Technologies Inc.

2.2 FIRESTOPPING DESCRIPTION

A. General

1. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
2. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
3. Provide an enclosed fire rated cable management device whenever cable bundles penetrate fire rated walls. The cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type.
4. Provide non-curing, re-penetrable, intumescent firestop materials around communications cable trays or ladder racks penetrating through a fire rated wall. The firestop system assembly shall be able accessible and re-installed from one side of the wall. The firestop material shall allow up to 12” of unreinforced annular space.

2.3 PERFORMANCE REQUIREMENTS

A. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

B. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.

3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

C. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

D. Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.4 COMPONENTS

A. Firestop Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal® Series SSS Sealant or approved equivalent.
2. Specified Technologies Inc. (STI) SpecSeal® Series LCI Sealant or approved equivalent.

B. Firestop Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal® Series SSP Putty or approved equivalent.

C. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows or approved equivalent.

D. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway – no approved equivalent.

E. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material for use in blank openings and cable sleeves, the following products are acceptable:

1. Specified Technologies, Inc. (STI) SpecSeal Series FP Firestop Plug or approved equivalent.

F. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing individual cable penetrations up to 0.27 in. (7 mm) diameter, the following products are acceptable:

1. Specified Technologies, Inc. (STI) Ready Firestop Grommet or approved equivalent.

2.5 SOURCE QUALITY CONTROL

A. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

B. Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

B. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer’s installation instructions and technical information.

C. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

D. Provide masking and temporary covering to protect adjacent surfaces.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Process:

1. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
2. Manufacturer’s Instructions: Comply with manufacturer’s instructions for installation of firestopping products.

3.3 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the owner prior to beginning any re-installation work.

3.4 FIELD QUALITY CONTROL

A. Inspections: Owner shall engage qualified independent inspection agency to inspect through-penetration firestop systems.

B. Keep areas of work accessible until inspection by authorities having jurisdiction.

C. Where deficiencies are found, repair firestopping products so they comply with requirements.

3.5 ADJUSTING AND CLEANING

A. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

3.6 SCHEDULES

A.

	Concrete Floor	Concrete Wall	Gypsum Board Wall
Penetrant Type			
Blank Opening	C-AJ-0100, C-AJ-0101	C-AJ-0100, C-AJ-101	
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits/ Raceways	C-AJ-2140, C-AJ-2292	W-J-2018, W-J-2076	W-L-2093, W-L-2241

	Concrete Floor	Concrete Wall	Gypsum Board Wall
Cables	F-A-3021, F-A-3037	W-J-3098, W-J-3130, W-J-3158, W-J-3180	W-L-3218, W-L-3255, W-L-3306, W-L-3377
Cable Trays	C-AJ-4029	W-J-4021, W-J-4022, W-J-4033	W-L-4008, W-L-4029, W-L-4043

3.7 CLOSEOUT ACTIVITIES

A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION 27 05 37

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Labels.
2. Cable ties. (Hook and Loop)
3. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Labels.
2. Cable ties. (Hook and Loop)
3. Miscellaneous identification products.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

C. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation.
2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
3. Racks: Scaled drawings indicating location and proposed designation.
4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-D.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, polyester flexible labels with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. Panduit Corp.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

B. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. HellermannTyton.

b. Ideal Industries, Inc.
c. Panduit Corp.

2. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

2.4 CABLE TIES (HOOK AND LOOP)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. HellermannTyton.
2. Ideal Industries, Inc.
3. Panduit Corp.

B. Plastic cable ties not allowed.

C. General-Purpose Hook and Loop Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and constructed of soft, premium material to use on high performance network cables, protecting against over-tensioning.

1. Minimum Width: 1/2 inch .
2. Tensile Strength at 73 deg F According to ASTM D 638: .
3. Temperature Range: Zero to plus 220 deg F .
4. Color: Black, except where used for color-coding.

D. Plenum-Rated Hook and Loop Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and constructed of soft, premium material to use on high performance network cables, protecting against over-tensioning.

1. Minimum Width: 1/2 inch .
2. Tensile Strength at 73 deg F According to ASTM D 638: 40 lbs.
3. UL 94 Flame Rating: 94V-2.
4. Temperature Range: Zero to plus 122 deg F.
5. Color: Red/Maroon.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Owner-approved labeling scheme is intended to comply with the ANSI/TIA-606-D standard for labeling and administration of a cable plant. It is the responsibility of the contractor to acquire, understand, and utilize the owner's labeling scheme for all components of the voice data communications system.

3.2 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.3 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches from cable end.

I. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

J. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

K. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.4 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:

a. Telecommunications.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.
3. Faceplate number.

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
2. Patch Panels: Label individual rows in each rack, starting at top and working down, with self-adhesive labels.
3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:

a. Room number being served.
b. Colon.
c. Faceplate number.

F. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:

1. Room number.
2. Colon.
3. Faceplate number.

END OF SECTION 27 05 53

SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Copper cable test device
2. Optical fiber cable test device
3. Cable Test Results and testing procedures
4. As-built drawings

B. Related Requirements:

1. Not applicable.

C. Alternates: Not Applicable.

D. Items To Be Installed Only: Not Applicable.

E. Items To Be Furnished Only: Not Applicable.

1.3 SCOPE

A. Testing shall be carried out in accordance with this document. This includes testing the attenuation and polarity of the installed cable plant with an optical loss test set (OLTS) and the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR). The condition of the fiber end faces shall also be verified.

B. Testing shall be performed on each cabling link (connector to connector - 100% testing).

1. Testing shall be performed on each cabling channel (equipment to equipment) that is identified by the owner.

C. Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

D. All tests shall be documented including OLTS dual wavelength attenuation measurements and OTDR traces with event tables as well as OTDR maps.

E. Optionally, documentation shall also include optical length measurements and pictures of the connector end face.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of an ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer (RCDD) to perform the on-site inspection.

B. All testing procedures and field-test instruments shall comply with applicable requirements of:

1. ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources.
2. ANSI/EIA/TIA 455 50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements.
3. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
4. ANSI/TIA/EIA 455 60A, Measurement of Fiber or Cable Length Using an OTDR
5. ANSI/TIA/EIA 455 61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
6. ANSI/TIA/EIA 526 7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant.
7. ANSI/TIA 526 14 B, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedure- Part 4-1: Installed cable plant- Multimode attenuation measurement.
8. TIA-TSB-4979 Practical Considerations for Implementation of Multimode Launch Conditions in the Field.
9. ANSI/TIA-1152, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling.
10. ANSI/TIA-568.0-E, Generic Telecommunications Cabling for Customer Premises.
11. ANSI/TIA-568.1-E, Commercial Building Telecommunications Cabling Standard.
12. ANSI/TIA-568.2-E, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

13. ANSI/TIA-606-D, Administration Standard for Commercial Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.

C. Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

1. Manufacturer of the copper and fiber optic cable and connectors.
2. Manufacturer of the test equipment used for the field certification.
3. Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida; ACP Association of Cabling Professionals™ Cabling Business Institute located in Dallas, Texas)

D. The Owner or the Owner's representative shall be invited to witness and/or review field-testing.

1. The Owner or the Owner's representative shall be notified of the start date of the testing phase five (5) business days before testing commences.
2. The Owner or the Owner's representative will select a random sample of five percent of the installed links. The Owner or the Owner's representative shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than two percent of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat one hundred percent testing at no cost to the Owner.

1.5 SUBMITTALS

A. Manufacturers catalog sheets and specifications for the copper cable test equipment and fiber optic field instruments including optical loss test sets (OLTS; power meter and source), optical time domain reflectometer (OTDR) and video microscope.

B. A schedule (list) of all balanced twisted-pair copper and optical fibers links to be tested.

C. Sample test reports.

1.6 ACCEPTANCE OF TEST RESULTS

A. Unless otherwise specified by the Owner or the Owners representative, each Category 6 cabling link shall be tested for:

1. Wire Map
2. Length
3. Propagation Delay
4. Delay Skew

5. DC Loop Resistance – recorded for information only
6. DC Resistance Unbalance – recorded for information only
7. Insertion Loss
8. NEXT (Near-End Crosstalk)
9. PS NEXT (Power Sum Near-End Crosstalk)
10. ACR-N (Attenuation to Crosstalk Ratio Near-End) – recorded for information only
11. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End) – recorded for information only
12. ACR-F (Attenuation to Crosstalk Ratio Far-End)
13. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
14. Return Loss
15. TCL (Transverse Conversion Loss) – recorded for information only
16. ELTCTL (Equal Level Transverse Conversion Transfer Loss) – recorded for information only

B. Unless otherwise specified by the Owner or the Owners representative, each Category 6A cabling link shall be tested for:

1. Wire Map
2. Length
3. Propagation Delay
4. Delay Skew
5. DC Loop Resistance
6. DC Resistance Unbalance within a pair
7. DC Resistance Unbalance between pairs
8. Insertion Loss
9. NEXT (Near-End Crosstalk)
10. PS NEXT (Power Sum Near-End Crosstalk)
11. ACR-N (Attenuation to Crosstalk Ratio Near-End)
12. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
13. ACR-F (Attenuation to Crosstalk Ratio Far-End)
14. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
15. Return Loss
16. TCL (Transverse Conversion Loss)
17. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
18. PS ANEXT (Power Sum Alien Near-End Crosstalk) – sampled per section 3.2.
19. Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk) – sampled per section 3.2.
20. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End) – sampled per section 3.2.
21. Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End) – sampled per section 3.2.

C. Unless otherwise specified by the Owner or the Owners representative, each cabling link shall be in compliance with the following test limits:

1. Optical loss testing

a. Multimode and Singlemode links

1) The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA-568.0-E.

a) Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)
b) Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
c) Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
d) Maximum allowable connector_loss = 0.75 dB Check your application limits, you may need to reduce the allowable connector loss here
e) Splice_Attn (dB) = number_of_splices * splice_loss (dB)
f) Maximum allowable splice_loss = 0.3 dB Check your application limits, you may need to reduce the allowable connector loss here
g) The values for the Attenuation_Coefficient (dB/km) are listed in the table below: Your cable may perform better than this, check the datasheet from the vendor and insert values here if desired

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

2. OTDR testing

a. Reflective events (connections) shall not exceed:

1) 0.75 dB in optical loss when bi-directionally averaged
2) -35 dB Reflectance for multimode connections
3) -40 dB reflectance for UPC single mode connections
4) -55 dB reflectance for APC single mode connections

b. Non-reflective events (splices) shall not exceed 0.3 dB.

3. Magnified end face inspection

    a. Fiber connections shall be visually inspected to IEC 61300-3-35 Edition 1.0 for end face quality.
    b. Scratched, pitted or dirty connectors shall be diagnosed and corrected.

D. All installed cabling permanent links and channels shall be field-tested and pass the test requirements and analysis as described in Part 3. Any permanent link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected permanent link or channel meets performance requirements. The final and passing result of the tests for all permanent links and channels shall be provided in the test results documentation in accordance with Part 3.

E. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

Note: High Bandwidth applications such as 1000BASE-SX, 10GBASE-SR, and FC1200 impose stringent channel loss limits. Where practical, certification should consider loss length limits that meet maximum channel (transmitter to receiver) loss. 0.75 dB per connector pair loss may not support the intended application.

F. Performance specification for multimode fiber links at 850 nm.

Fiber Type		Bandwidth	1000BASE-SX		10GBASE-SR		FibreChannel 1200-MX-SN-I	
	µm	(MHz• Km)	Length (m)	Loss (dB)	Length (m)	Loss (dB)	Length (m)	Loss (dB)
OM1	62.5	200	275	2.38	33	2.5	33	2.4
OM2	50	500	550	3.56	82	2.3	82	2.2
OM3	50	2000	N/A	N/A	300	2.6	300	2.6
OM4	50	47000	N/A	N/A	400	2.9	N/A	N/A

PART 2 - PRODUCTS

2.1 CABLE TEST DEVICE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fluke
2. Ideal Networks
3. EXFO
4. Greenlee Communications

2.2 BALANCED TWISTED-PAIR CABLE TESTER

A. Must meet or exceed TIA Level IV compliant network cable-testing device certification by an independent laboratory, such as Intertek, for verification of high speed, TIA T568 compliant cables.

B. Copper test equipment must be capable of certifying Category-3, Category-5e, Category 6 and Category 6A UTP/ScTP links or channels independent of termination hardware configuration (RJ45 port or 110-style) for each level of performance.

C. Provide full 2-way Autotest of Category-3, 5e, 6, and 6A twisted pair links.

D. All test equipment shall be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

E. The field-test instrument shall be within a 12 month calibration period.

F. Results Storage

1. Must be capable of storing > 10,000 results for all measurements found in 2.2G below

G. Measurement capabilities

1. Wire Map
2. Length
3. Propagation Delay
4. Delay Skew
5. DC Loop Resistance
6. DC Resistance Unbalance within a pair
7. DC Resistance Unbalance between pairs
8. Insertion Loss
9. NEXT (Near-End Crosstalk)
10. PS NEXT (Power Sum Near-End Crosstalk)
11. ACR-N (Attenuation to Crosstalk Ratio Near-End)

12. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
13. ACR-F (Attenuation to Crosstalk Ratio Far-End)
14. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
15. Return Loss
16. TCL (Transverse Conversion Loss)
17. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
18. Time Domain Reflectometer
19. Time Domain Xtalk Analyzer
20. PS ANEXT (Power Sum Alien Near-End Crosstalk)
21. Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk)
22. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)
23. Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

H. Accessory Products:

1. Interface Adapters

a. TIA Category-3, 5e, 6 and 6A: 100 ohm
b. Category/Class E permanent link adapters for TIA Cat 3, 5e 6, and 6A unshielded and shielded cables.

1) RJ45 plug must meet the requirements for NEXT, FEXT and Return Loss in accordance with ANSI/TIA-568.2-E Annex C
2) Twisted pair Category 5e, 6, 6A, 7 or 7A cords are not permitted as their performance degrades with use and can cause false Return Loss failures

2.3 OPTICAL FIBER CABLE TESTER

A. The field-test instrument shall be within the calibration period recommended by the manufacturer and a copy of the calibration certificate made available.

B. Optical loss test set (OLTS)

1. Multimode optical fiber light source

a. Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm). VCSEL sources are not permitted per ANSI/TIA-526-14-B.
b. Output power of –20 dBm minimum.
c. The launch shall meet the Encircled Flux launch requirements of ANSI/TIA-526-14-B.
d. The test reference cords must demonstrate an insertion loss ≤ 0.15 dB when mated against each other.

2. Single mode optical fiber light source

    a. Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).
    b. Output power of –10 dBm minimum.
    c. The test reference cords must demonstrate an insertion loss ≤ 0.25 dB when mated against each other.

3. Power Meter

    a. Provide 850 nm, 1300 nm, 1310 nm, and 1550 nm wavelength test capability.
    b. Power measurement uncertainty of ± 0.25 dB.
    c. Store reference power measurements.
    d. Save at least 10,000 results to internal memory.
    e. PC interface (USB).

4. Optional length measurement

    a. It is preferable to use an OLTS that is capable of measuring the optical length of the fiber using time-of-flight techniques. In the case of MPO/MTP trunk cables, this is not possible.

C. Optical Time Domain Reflectometer (OTDR)

1. Shall have a bright, color LCD display with backlight.
2. Shall have rechargeable Li-Ion battery for 8 hours of normal operation.
3. Weight with battery and module of not more than 4.5 lb and volume of not more 200 in³.
4. Internal non-volatile memory with capacity for storing at least 2,000 OTDR bi-directionally tested fiber links.
5. USB port to transfer data to a PC or thumb drive/memory stick.
6. Multimode OTDR

    a. Wavelengths of 850 nm (± 10 nm) and 1300 nm (+ 35 nm / - 15 nm).
    b. Event dead zones not to exceed 0.7 m at 850 nm and 1300 nm.
    c. Attenuation dead zones not to exceed 2.5 m at 850 nm and 4.5 m at 1300 nm.
    d. Distance range not less than 9,000 m.
    e. Dynamic range at least 28 dB for 850 nm and 30 dB at 1300 nm.
    f. Allow bi-directional testing without moving the OTDR to the far end.

7. Single mode OTDR

    a. Wavelengths of 1310 nm (± 25 nm) and 1550 nm (± 30 nm).
    b. Event dead zones not to exceed 0.6 m at 1310 nm and 1550 nm.
    c. Attenuation dead zones not to exceed 3.7 m at 1310 nm and 1550 nm.
    d. Distance range not less than 80 km at 1310 nm and 130 km at 1550 nm.
    e. Dynamic range at least 32 dB for 1310 nm and 30 dB at 1550 nm.
    f. Allow bi-directional testing without moving the OTDR to the far end.

D. Fiber Microscope

1. Field of view 420 µm x 320 µm

a. Video camera systems are preferred.
b. Camera probe tips that permit inspection through adapters are required.
c. Test equipment shall be capable of saving and reporting the end face image to IEC 613003-3-35.
d. Fiber Inspector Mini Video Microscope – Fluke Model No. FT500; the DSX-5000Qi is preferred since it allows the images to be saved.

E. Integrated OLTS, OTDR and fiber microscope

1. Test equipment that combines into one instrument an OLTS, an OTDR and a fiber microscope may be used.

F. Accessory Products:

1. Interface Adapters

a. DTX Fiber Module for Multimode cable @ 850 and 1300 nm – Fluke Model No. DTX-EFM2 or DSX-5000Qi/CertiFiber Pro for EF (encircled flux) Compliance.
b. DTX Fiber Module for Single mode cable @ 1310 and 1500 nm – Fluke Model No. DTX-SFM2
c. EF Test reference cords.

2.4 ADMINISTRATION

A. Administration of the documentation shall include test results of each copper and optical fiber Permanent Link and channel.

B. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

C. The test result records saved within the field-test instrument shall be transferred into a Windows® -based database utility that allows for the maintenance, inspection and archiving of these test records.

D. Alien Crosstalk measurements shall be stored to a PC upon completion of the test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

B. Verify telecommunications cabling is installed and supported, terminated, mounted in an appropriate housing or terminated on the applicable component and labeled prior to certification testing and documentation.

C. Verify certification tester universal interface adapters and manufacturer patch cords that enable permanent link verification are in new condition not indicating any twisting or kinking resulting from incorrect storage of the tester interface adapters.

D. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

E. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.

F. Optical fiber patch cords shall be inspected to ensure connector surfaces are clean and free of defects that may affect testing results.

3.2 BALANCED TWISTED PAIR CABLE TESTING

A. Field-test instruments shall have the latest firmware installed.

B. Permanent Link test results, including the individual frequency measurements from the tester, shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

C. Permanent Link testing shall be performed on each cabling segment (connector to connector). Sampling is not acceptable.

D. Alien Crosstalk testing shall be performed using a sampling plan. An acceptance quality level (AQL) of 0,4 %, normal inspection, general inspection level I as defined in ISO 2859-1 for populations of up to 500,000 links shall be used. The following table represents this sampling level.

E.

Total number of links (N)	Sample size (No. of links to test)
3 – 33	3 or 0.1 x N (whichever is greatest)
34 – 3,200	33
3,201 – 35,000	126
35,001 – 150,000	201
150,001 – 500,000	315

F. Disturbed (Victim) links chosen for Alien Crosstalk testing shall be an equal combination of short, medium and long links.

G. Permanent Link adapters made from twisted pair Category 5e, 6, 6A, 7 or 7_A cords are not permitted as their performance degrades with use and can cause false Return Loss failures.

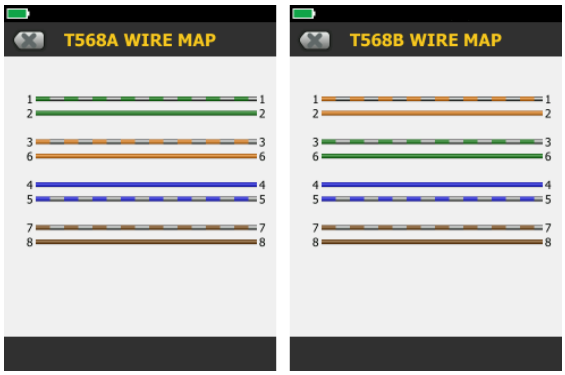
H. The installer shall build a reference link. All components shall be anchored so it is not possible to disturb them. The technician is to conduct a Category 6A Permanent Link test each day to ensure no degradation of the tester or its Permanent Link adapters.

I. Wire Map Measurement

1. The wire map test is intended to verify pin-to-pin termination at each end and check for installation connectivity errors.
2. For each of the eight conductors in the cabling, the wire map indicates:

    a. Continuity to the remote end
    b. Shorts between any two or more conductors
    c. Reversed pairs
    d. Split pairs
    e. Transposed pairs
    f. Distance to open on shield
    g. Any other miss-wiring

3. The correct connectivity of telecommunications outlets/connectors is defined in ANSI/TIA-568.2-E. Two color schemes are permitted. The user shall define which scheme is to be used. The field tester shall document which color scheme was used. Examples are given below:



J. Length Measurement

1. The length of each balanced twisted pair shall be recorded.
2. Since physical length is determined from electrical length, the physical length of the link calculated using the pair with the shortest electrical delay shall be reported and used for making the pass or fail determination.
3. The pass or fail criteria is based on the maximum length allowed for the Permanent Link as specified in ANSI/TIA-568.2-E plus the nominal velocity of propagation (NVP) uncertainty of 10%. For a Permanent Link, the length measurement can be 325 ft. (99 m) before a fail is reported.

K. Propagation Delay measurement

1. Is the time it takes for a signal to reach the end of the link.
2. The measurement shall be made at 10 MHz per ANSI/TIA-1152.
3. The propagation delay of each balanced twisted pair shall be recorded.
4. Is not to exceed 498 ns per ANSI/TIA-568.2-E Section 6.3.18.

L. Delay Skew measurement

1. Is the difference in propagation delay @ 10 MHz between the shortest delay and the delays of the other wire pairs.
2. The delay skew of each balanced twisted pair shall be recorded.
3. Is not to exceed 44 ns per ANSI/TIA-568.2-E Section 6.3.19.

M. DC Loop Resistance

1. Often reported as Resistance, is the DC loop resistance of both conductors in the pair.
2. The DC Resistance shall be reported for all four pairs.
3. Is not to exceed 21 Ω for all four pairs per ANSI/TIA-568.2-E Section 6.3.1.

N. DC Resistance Unbalance within a pair

1. Is the difference in DC resistance of the two wires within the same pair.
2. The DC Resistance Unbalance within a pair shall be reported for all four pairs.
3. Is not to exceed 200 mΩ or 3%, whichever is the greatest per ANSI/TIA-568.2-E Section 6.2.2.

O. DC Resistance Unbalance between pairs

1. Is the difference in DC parallel resistance of the conductors of a pair compared to the DC parallel resistance of another pair, given in the formula below:

$$Resistance\_Unbalance_{Between\_pairs} = \left(\frac{|R_{P1} - R_{P2}|}{R_{P1} + R_{P2}} \right) 100\%$$

Where:

R_{P1} is the DC parallel resistance of the conductors of a pair.

R_{P2} is the DC parallel resistance of the conductors of another pair.

2. The DC Resistance Unbalance shall be reported for the following pairs

   a. 1,2-3,6
   b. 1,2-4,5
   c. 1,2-7,8
   d. 3,6-4,5
   e. 3,6-7,8
   f. 4,5-7,8

3. is not to exceed 200 mΩ or 7.5%, whichever is the greatest.

P. Insertion Loss

1. Is the loss of signal strength over the cabling (in dB).
2. The frequency resolution shall be:

   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
   d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in one direction for all four pairs.
4. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.7.

Q. NEXT (Near-End Crosstalk)

1. Is the difference in amplitude (in dB) between a transmitted signal and the crosstalk received on other wire pairs at the same end of the cabling.

2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for the following pair combinations

    a. 1,2-3,6
    b. 1,2-4,5
    c. 1,2-7,8
    d. 3,6-4,5
    e. 3,6-7,8
    f. 4,5-7,8

4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E 6.3.8.
5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
6. The Time Domain Xtalk data shall be stored for any marginal or failing NEXT results.

R. PS NEXT (Power Sum Near-End Crosstalk)

1. Is the difference (in dB) between the test signal and the crosstalk from the other pairs received at the same end of the cabling.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.
4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.9.
5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
6. The Time Domain Xtalk data shall be stored for any marginal or failing PS NEXT results.

S. ACR-N (Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of NEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz

b. 31.25 – 100 MHz: 250 kHz
c. 100 – 250 MHz: 500 kHz
d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for the following pairs

a. 1,2-3,6
b. 1,2-4,5
c. 1,2-7,8
d. 3,6-4,5
e. 3,6-7,8
f. 4,5-7,8

4. Although not specified in ANSI/TIA-568.2-E, it shall be recorded for all twelve possible combinations.

T. PS ACR-N (Power Sum Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of PS NEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:

a. 1 – 31.25 MHz: 150 kHz
b. 31.25 – 100 MHz: 250 kHz
c. 100 – 250 MHz: 500 kHz
d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.
4. Although not specified in ANSI/TIA-568.2-E, it shall be recorded for all eight possible combinations.

U. ACR-F (Attenuation Crosstalk Ratio Far-End)

1. Is a calculation of FEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:

a. 1 – 31.25 MHz: 150 kHz
b. 31.25 – 100 MHz: 250 kHz
c. 100 – 250 MHz: 500 kHz
d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for the following pairs

a. 1,2-3,6
b. 1,2-4,5
c. 1,2-7,8
d. 3,6-1,2
e. 3,6-4,5

f. 3,6-7,8
g. 4,5-1,2
h. 4,5-3,6
i. 4,5-7,8
j. 7,8-1,2
k. 7,8-3,6
l. 7,8-4,5

4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.11.
5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

V. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)

1. Is a calculation of PS FEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:

a. 1 – 31.25 MHz: 150 kHz
b. 31.25 – 100 MHz: 250 kHz
c. 100 – 250 MHz: 500 kHz
d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.
4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.13.
5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

W. Return Loss

1. Is the difference (in dB) between the power of a transmitted signal and the power of the signals reflected back.
2. The frequency resolution shall be:

a. 1 – 31.25 MHz: 150 kHz
b. 31.25 – 100 MHz: 250 kHz
c. 100 – 250 MHz: 500 kHz
d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.
4. Shall be ignored at all frequencies where the Insertion Loss is less than 3 dB for that pair.

5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.6.

6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
7. The Time Domain Reflectometer data shall be stored for any marginal or failing Return Loss results.

X. TCL (Transverse Conversion Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the near-end on the same wire pair.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.
4. Is not to exceed the Category 6A limits found ANSI/TIA-568.2-E Section 6.2.14.

Y. ELTCTL (Equal Level Transverse Conversion Transfer Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the far end on the same wire pair minus the Insertion Loss of that pair.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.
4. Is not to exceed the Category 6A limits found in ANSI/TIA-568.2-E section 6.2.16.

Z. PS ANEXT (Power Sum Alien Near-End Crosstalk)

1. Takes into account the combined alien crosstalk (statistical) on a receive pair from all external near-end disturbers operating simultaneously.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. The disturbed (victim) link shall have disturber links to the left and right of it and if present, links above and below it.

4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links
5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.21.

AA. Average PS ANEXT (Power Sum Alien Near-End Crosstalk)

1. Is calculated by averaging the individual PSANEXT loss values, in dB, for all four pairs in the disturbed (victim) link.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.22.

BB. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

1. AFEXT loss is the coupling of crosstalk at the far-end from external link pairs into a disturbed (victim) pair of the 4-pair link under test. PS AACR-F is the calculated power sum from all external pairs into the disturbed (victim) pair.
2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. The disturbed (victim) link shall have disturber links to the left and right of it and if present, links above and below it.
4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links
5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.25.

CC. Average PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

1. Is calculated by averaging the individual PS AACR-F values, in dB, for all four pairs in the disturbed (victim) link.

2. The frequency resolution shall be:

    a. 1 – 31.25 MHz: 150 kHz
    b. 31.25 – 100 MHz: 250 kHz
    c. 100 – 250 MHz: 500 kHz
    d. 250 – 500 MHz: 1000 kHz

3. The disturbed (victim) link shall have disturber links to the left and right of it and if present, links above and below it.
4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links
5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-E Section 6.3.26.

3.3 Administration - Copper Cabling

A. Test results documentation

1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
2. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period and shall be passed to the Owner's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.
3. The database for the complete project, including twisted-pair copper cabling and fiber links, if applicable, shall be stored and delivered on CD or DVD prior to Owner acceptance of the building. This CD or DVD shall include the software tools required to view, inspect, and print any selection of the test reports.
4. Circuit IDs reported by the test instrument should match the specified label ID.
5. For Permanent Link testing, the detailed test results documentation data is to be provided in an electronic database for each tested balance twisted-pair and shall contain the following information.

    a. The overall Pass/Fail evaluation of the link-under-test
    b. The date and time the test results were saved in the memory of the tester
    c. The identification of the customer site as specified by the end-user
    d. The name of the test limit selected to execute the stored test results
    e. The name of the personnel performing the test
    f. The version of the test firmware and the version of the test limit database held within the test instrument
    g. The manufacturer, model and serial number of the field-test instrument

h. The adapters used
i. The factory calibration date
j. Wire Map
k. Propagation Delay values, for all four pairs
l. Delay Skew values, for all four pairs
m. DC Resistance values, for all four pairs
n. DC Resistance Unbalance within a pair, values for all four pairs
o. DC Resistance Unbalance between pairs, values for all four pairs
p. Insertion Loss, worst case values for all four pairs
q. NEXT, worst case margin and worst case values, both directions
r. PS NEXT, worst case margin and worst case values, both directions
s. ACR-N, worst case margin and worst case values, both directions
t. PS ACR-N, worst case margin and worst case values, both directions
u. ACR-F, worst case margin and worst case values, both directions
v. PS ACR-F, worst case margin and worst case values, both directions
w. Return Loss, worst case margin and worst case values, both directions
x. TCL, worst case margin and worst case values, both directions
y. ELTCTL, worst case margin and worst case values, both directions.
z. Time Domain Crosstalk data if the link is marginal or fails
aa. Time Domain Reflectometer data if the link is marginal or fails

6. For Alien Crosstalk testing, the detailed test results documentation data is to be provided in AxTalk Analyzer for each tested balance twisted-pair and shall contain the following information

a. The overall Pass/Fail evaluation of the link-under-test
b. The date and time the measurements were made
c. The identification of the customer site as specified by the end-user
d. The name of the test limit selected to execute the stored test results
e. The name of the personnel performing the test
f. The version of the test software
g. PS ANEXT, worst case margin for all four pairs
h. Average PS ANEXT, worst case margin
i. PS AACR-F, worst case margin for all four pairs
j. Average PS AACR-F, worst case margin

B. Record copy and as-built drawings - Copper Cabling

1. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on a CD or DVD. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:

a. Field directed changes to pull schedule.
b. Horizontal cable routing changes.

c. Associated detail drawings.

3.4 OPTICAL FIBER CABLE TESTING

A. Field-test instruments shall have the latest software and firmware installed.

B. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

C. Fiber end faces shall be inspected using a video scope with a field of view not less than 425 µm x 320 µm.

1. It is preferable that the end face images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.

D. Testing shall be performed on each cabling segment (connector to connector).

E. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.

F. Testing of the cabling shall be performed using high-quality test reference cords of the same core size as the cabling under test, terminated with reference grade connectors. Reference grade connectors are defined as having a loss not exceeding 0.1 dB for multimode and 0.2 dB for singlemode. The test reference cords for OLTS testing shall be between 2 m and 5 m in length. The length of the launch and tail fibers for multimode OTDR testing shall be at a least 100 m (328 ft.). For singlemode, the length of the launch and tail fibers will depend on the link under test. As a guide, the following table can be used for determining the length of the launch and tail fibers.

Maximum Length of Link (km)		Typical Pulse Width (ns)	Minimum Launch and Tail Cord Length (m)
1310	1550 nm only		
0 to 35	0 to 50	≤ 1,000	130
35 to 45	50 to 65	3,000	400
45 to 50	65 to 75	10,000	1,000
≥ 50	≥ 75	20,000	2400

G. Optical loss testing

1. Horizontal/Backbone link

a. Multimode links shall be tested in one direction at 850 nm and 1300 nm in accordance with ANSI/TIA-526-14-B, one-cord reference method, with an Encircled Flux compliant launch.
b. Singlemode backbone links shall be tested in one direction at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1 (One-cord reference method).
c. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

H. OTDR Testing

1. Fiber links shall be tested at these wavelengths for anomalies and to ensure uniformity of cable attenuation, connector insertion loss and reflectance.

a. Multimode: 850 nm and 1300 nm.
b. Singlemode: 1310 nm and 1550 nm.

2. Each fiber link and channel shall be tested in both directions.

a. The launch and tail fibers shall remain in place for the measurement in the opposite direction – failing to do so will result in an increase in measurement uncertainty.
b. The use of a loop back fiber at the far end with a tail fiber at the near end on the adjacent fiber is permitted for bi-directional testing, so long as the OTDR is able to split the trace automatically into two traces for the two fibers under test.

3. A launch cable shall be installed between the OTDR and the first link connection.
4. A tail cable shall be installed after the last link connection.

I. Magnified End face Inspection

1. Fibers shall be inspected using a video scope with a minimum field of view 425 µm x 320 µm to IEC 61300-3-35 Edition 1.0. The following test limits shall be used:

a. Multimode connectors; Table 6 of IEC 61300-3-35 Edition 1.0
b. Singlemode field polished connectors; Table 5 of IEC 61300-3-35 Edition 1.0
c. Singlemode factory polished connectors; Table 3 of IEC 61300-3-35 Edition 1.0
d. Angled Physical Contact (APC) connectors; Table 4 of IEC 61300-3-35 Edition 1.0

J. Length Measurement

1. The length of each fiber shall be recorded.
2. It is preferable that the optical length be measured using an OLTS or OTDR.

K. Polarity Testing

1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568.0-E. The polarity of the paired duplex fibers shall be verified using an OLTS.

3.5 ADMINISTRATION – OPTICAL FIBER

A. Test results documentation

1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The following formats do not provide adequate protection of these records and shall not be used.

    a. Portable document format (PDF)
    b. Word (.doc & .docx)
    c. Comma separated values (.csv)
    d. Excel separated values (.xls & .xlsx)
    e. Text (.txt)

2. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period and shall be passed to the Owner's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.
3. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD/DVD prior to Owner acceptance of the building in the original format used by the cabling vendors’ software.
4. Circuit IDs reported by the test instrument should match the specified label ID (see 3.6 of this Section).
5. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information

    a. The identification of the customer site as specified by the end-user.
    b. The name of the test limit selected to execute the stored test results.
    c. The name of the personnel performing the test.
    d. The date and time the test results were saved in the memory of the tester.
    e. The manufacturer, model and serial number of the field-test instrument.
    f. The version of the test software and the version of the test limit database held within the test instrument.
    g. The fiber identification number.

h. The length for each optical fiber.
i. The index of refraction used for length calculation when using length capable OLTS.
j. The backscatter coefficient of the fiber under test when using an OTDR.
k. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
l. Test results to include OTDR link and channel traces, event tables at the appropriate wavelength(s) and a map of the link tested.
m. The length for each optical fiber as calculated by the OTDR.
n. The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements
o. Optional

1) A picture or image of each fiber end-face
2) A pass/fail status of the end-face using IEC 61300-3-35 Edition 1.0

B. Record Copy and As-built drawings – Optical Fiber

1. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on CD/DVD. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. CAD drawings are to incorporate test data imported from the test instruments.
2. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-built shall include all field changes made up to construction completion:

a. Field directed changes to pull schedule.
b. Field directed changes to cross connect and patching schedule.
c. Horizontal cable routing changes.
d. Backbone cable routing or location changes.
e. Associated detail drawings.

3.6 IDENTIFICATION

A. Labeling

1. Labeling shall conform to the requirements specified within ANSI/TIA-606-D or to the requirements specified by the Owner or the Owner’s representative.

3.7 REPAIR

A. Any connections failing to meet referenced standards or more stringent performance requirements stated above, must be removed and replaced with connections that prove, in additional testing, to meet or exceed the performance standards set forth.

3.8 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time and/or end user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the owner prior to beginning the work.

3.9 CLOSEOUT ACTIVITIES

A. Contractor to submit all test results and any test documentation required prior to acceptance by the Owner.

B. Record copy and as-built drawings

C. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on CD-ROM. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. CAD drawings are to incorporate test data imported from the test instruments.

D. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:

1. Field directed changes to pull schedule.
2. Field directed changes to cross connect and patching schedule.
3. Horizontal cable routing changes.
4. Backbone cable routing or location changes.
5. Associated detail drawings.

END OF SECTION 27 08 00

SECTION 27 11 16 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-rated plywood backboard.
2. 19-inch wall-mounted equipment cabinets.
3. Power strips.
4. Grounding.
5. Labeling.

B. Related Requirements:

1. Section 270526 "Grounding and Bonding for Telecommunications Equipment" for PBBs and SBBs.
2. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.
3. Section 271523 "Communications Optical Fiber Horizontal Cabling" for optical-fiber data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. SBB: Secondary Bonding Busbar.

G. PBB: Primary Bonding Busbar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of SBB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. UL listed.

C. RoHS compliant.

D. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.3 19-INCH EQUIPMENT CABINETS

A. Description: Manufacturer-assembled four-post frame enclosed by side and top panels and front and rear doors, designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72 inches between rails.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chatsworth Products, Inc.
2. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
3. Middle Atlantic Products; Legrand North America, LLC.

C. General Cabinet Requirements:

1. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Sheet steel.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Modular Wall Cabinets:

1. Height: As indicated on Drawings.
2. Depth: 24 inches.
3. Load Rating: 300 lb.
4. Number of Rack Units: 26.
5. Threads: 12-24.
6. Lockable front doors.
7. Louvered side panels.
8. Cable access provisions top and bottom.
9. Grounding lug.
10. Roof-mounted, 250-cfm fan.
11. Power strip.
12. All cabinets keyed alike.

E. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Cord connected with 15-foot line cord.
8. Rocker-type on-off switch, illuminated when in on position.
9. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

2.5 LABELING

A. Comply with TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.2 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Chapter 4.

C. Locate SBB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind SBB. Connect SBB with a minimum No. 4 AWG grounding electrode conductor from SBB to suitable electrical building ground. Connect rack SBB to near SBB or the PBB.

3.3 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-D. Comply with requirements in Section 270553 " Identification for Communications Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA-606-D for Class 2 level of administration.

D. Labels shall be machine printed. Type shall be 1/4 inch in height.

END OF SECTION 27 11 16

SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Category 6A twisted pair cable.
2. Twisted pair cable hardware.
3. Cable management system.
4. Identification products.

1.2 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. Jack: Also commonly called an "outlet," it is the fixed, female connector.

H. LAN: Local area network.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568.1-E requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Category 6A twisted pair cable.
2. Twisted pair cable hardware.
3. Cable management system.
4. Identification products.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules:

    a. Electronic copy of labeling schedules that are part of cabling and asset identification system of software.

2. Cabling administration Drawings and printouts.
3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications pathways.

c. Telecommunications system access points.
d. Telecommunications grounding system.
e. Telecommunications conductor drop locations.
f. Typical telecommunications details.
g. Mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

D. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting Blocks: One of each type.
2. Cover Plates: One of each type.
3. Jacks: Ten of each type.
4. Patch-Panel Units: One of each type.
5. Plugs: Ten of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568.1-E, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-E.

C. Grounding: Comply with TIA-607-E.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated:

a. Type CMP complying with UL 1685.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 6A TWISTED PAIR CABLE

A. Category 6A Twisted Pair Cable: Four-pair, balanced twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6A cable at frequencies up to 500 MHz.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Berk-Tek, a Leviton Company; SST Cat 6A UTP Plenum Cable or a comparable product by one of the following:

1. Belden Inc.
2. Hitachi Cable America Inc.

C. Standard: Comply with TIA-568.2-E for Category 6A cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP).

F. Cable Rating: Plenum.

G. Jacket: Blue thermoplastic.

2.4 TWISTED PAIR CABLE HARDWARE

A. Twisted Pair Cable Hardware: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Berk-Tek, a Leviton Company; or a comparable product by one of the following:

1. Belden Inc.

2. Hitachi Cable America Inc.

C. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6A.
2. Comply with TIA-568.2-E, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.

E. Connecting Blocks:
1. 110-style IDC for Category 6A.
2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

3. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

G. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

H. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568.2-E.

I. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568.2-E.

J. Cover Plate:

1. Two Four Six port, vertical single gang cover plates designed to mount to single gang wall boxes.
2. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

K. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA-568.1-E.

C. Factory test twisted pair cables according to TIA-568.2-E.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Comply with Section 270528 "Pathways for Communications Systems."

B. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568.0-E, TIA-568.1-E, and TIA-568.2-E.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.

8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
13. In the communications equipment room, install a 10-foot-long service loop on each end of cable.

14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-E for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-E, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-E and NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-D. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Administration Class: Class 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-D for Class 2 level of administration.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and

destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-D requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1-E.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568.2-E. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

C. Nonconforming Work:

1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

D. Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to support field tests and inspections.

END OF SECTION 27 15 13

SECTION 27 15 23 - COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. 9/125 micrometer, single-mode, indoor-outdoor optical fiber cable (OS2).
2. Optical fiber cable hardware.
3. Cross-connects and patch panels.
4. Grounding.
5. Identification products.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. RCDD: Registered Communications Distribution Designer.

1.3 OPTICAL FIBER HORIZONTAL CABLING DESCRIPTION

A. Optical fiber horizontal cabling system is to provide interconnections between Distributor A, Distributor B, or Distributor C and the equipment outlet, otherwise known as "Cabling Subsystem 1" in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568.1-E requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling is to contain no more than one transition point or consolidation point between the horizontal cross-connect and the equipment outlet.
3. Bridged taps and splices are not to be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

A. Product Data:

1. 9/125 micrometer, single-mode, indoor-outdoor optical fiber cable (OS2).
2. Optical fiber cable hardware.
3. Cross-connects and patch panels.
4. Grounding.
5. Identification products.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules:

a. Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration Drawings and printouts.
4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

a. Telecommunications rooms plans and elevations.
b. Telecommunications pathways.
c. Telecommunications system access points.
d. Telecommunications grounding system.
e. Telecommunications conductor drop locations.
f. Typical telecommunications details.
g. Mechanical, electrical, and plumbing systems.

C. Fiber optic cable testing plan.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting Blocks: One of each type.
2. Jacks: Ten of each type.
3. Patch-Panel Units: One of each type.
4. Plugs: Ten of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation is to be under the direct supervision of Level 2 Installer, who is to be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system is to comply with transmission standards in TIA-568.1-E, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-E.

C. Grounding: Comply with TIA-607-D.

2.2 9/125 MICROMETER, SINGLE-MODE, INDOOR-OUTDOOR OPTICAL FIBER CABLE (OS2)

A. Description: Single mode, 9/125-micrometer, 2 fibers, tight buffered, nonconductive optical fiber cable.

B. Basis-of-Design Product: Subject to compliance with requirements, provide OCC, Optical Cable Corporation; or a comparable product by one of the following:

1. Berk-Tek, a Leviton Company.
2. CommScope, Inc.

C. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.

D. Jacket:

1. Jacket Color: Yellow.
2. Cable cordage jacket, fiber, unit, and group color are to be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

E. Standards:

1. Comply with TIA-492CAAB for detailed specifications.
2. Comply with TIA-568.3-D for performance specifications.
3. Comply with ICEA S-104-696 for mechanical properties.

F. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Nonconductive:

a. Type OFNP, complying with NFPA 262.
b. Type OFNP in listed plenum communications raceway.
c. Type OFNP or Type OFNR in metallic conduit.
d. Type OFNP, complying with NFPA 262; Type OFNP in listed plenum communications raceway; or Type OFN, Type OFNG, Type OFNP, or Type OFNR in metallic conduit.

2.3 OPTICAL FIBER CABLE HARDWARE

A. Basis-of-Design Product: Subject to compliance with requirements, provide OCC, Optical Cable Corporation; or a comparable product by one of the following:

1. Berk-Tek, a Leviton Company.
2. CommScope, Inc.

B. Standards:

1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568.3-D.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Patch Cords: Factory-made, single-fiber cables in 36-inch lengths.

E. Connector Type: Type LC complying with TIA-604-10-B, connectors.

F. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Fusion splice-on connectors.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.

3. Designed to snap-in to a patch panel or faceplate.

H. Faceplate:

1. Two port, vertical single-gang faceplates designed to mount to single-gang wall boxes.
2. -port, vertical double-gang faceplates designed to mount to double-gang wall boxes.
3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

2.4 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.5 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568.3-D.

C. Factory test preterminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568.3-D.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method, Raceways: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method, Concealed: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301 and NECA/BICSI 568.

B. General Requirements for Optical Fiber Cabling Installation:

1. Comply with TIA-568.1-E and TIA-568.3-D.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
3. Terminate all cables; no cable is to contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps are not to be used for heating.
9. In the communications equipment room, provide a 10-foot-long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable is not to be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-E, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-C. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Administration Class: Class 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification are to comply with TIA-606-C for Class 2 level of administration.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, horizontal pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels are to be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-C, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1-E.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

a. Test instruments are to meet or exceed applicable requirements in TIA-568.1-E. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
b. Link End-to-End Attenuation Tests:

1) Attenuation test results for horizontal links are to be less than 2.0 dB. Attenuation test results are to be less than those calculated according to equation in TIA-568.1-E.

C. Data for each measurement are to be documented. Data for submittals are to be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 27 15 23

New York State
Parks, Recreation and
Historic Preservation

KATHY HOCHUL
Governor

ERIK KULLESEID
Commissioner

August 23, 2023

Brigham Keehner
Capital Projects Executive
Brooklyn Museum
200 Eastern Parkway
Brooklyn, NY 11238

Re: HUD
BMA - Brooklyn Museum - African Art Gallery Renovations
200 Eastern Pkwy, Brooklyn, NY 11238
23PR04943
HUD Grant Number B-22-CP-NY-0647

Dear Brigham Keehner:

Thank you for providing a more detailed overview of the project during our on-site meeting and walk-through today. Based on our discussions and the conditions observed, the proposed project appears to meet the Secretary of the Interior's Standards.

This letter evidences that Stipulation 1 of our conditional No Adverse Effect letter dated July 7th, 2023 has been fulfilled.

We look forward to reviewing the design documents, once available. If you have any questions, I am best reached via e-mail.

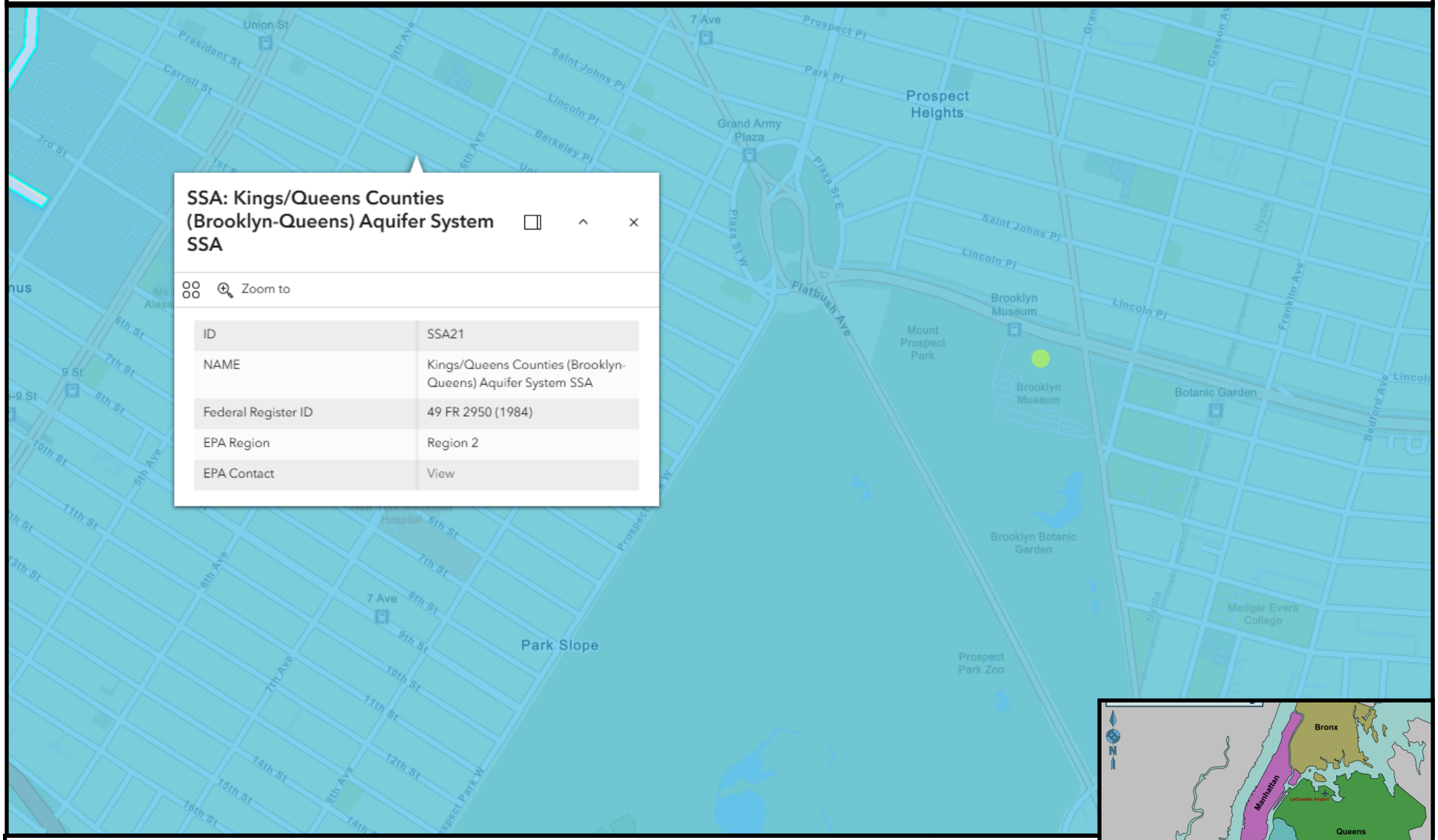
Sincerely,

Olivia Brazee
Historic Site Restoration Coordinator
olivia.brazee@parks.ny.gov

cc: K. Kurtz and K. Lewis-Hue, Brooklyn Museum via e-mail only

Brooklyn Museum - African Art Galleries

Sole Source Aquifers Map



Legend

ArcGIS World Geocoding Service

Sole_Source_Aquifers

N

Data source: Sole Source Aquifers Interactive Map on 01/20/2026

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
REGION II, NEW YORK, NEW YORK

AND

THE ENVIRONMENTAL PROTECTION AGENCY
REGION II, NEW YORK, NEW YORK

PURPOSE and GOAL

This Memorandum of Understanding (MOU) is established to assist the Environmental Protection Agency (EPA), Region II, and the Department of Housing and Urban Development (HUD), Region II, in meeting the Sole Source Aquifer (SSA) project review requirements of Section 1424(e) of the 1974 Safe Drinking Water Act (SDWA) PL 93-523.

The MOU establishes a formal agreement of each agency's responsibilities and the procedures to be followed in evaluating the potential groundwater impact of projects/activities submitted for HUD Federal financial assistance which are located within the project review area of a designated SSA in Region II.

Under Section 1424(e), an aquifer may be designated by EPA as a SSA if it is determined that the aquifer is the sole or principal source of drinking water for an area and, if contaminated, would create a significant hazard to public health. Following designation, no commitment of Federal financial assistance may be entered into for any project/activity within the SSA project review area which the EPA Administrator determines may contaminate the aquifer so as to create a significant hazard to public health.

The overall goal is to ensure that each project/activity receiving Federal financial assistance in a SSA project review area is designed and constructed in a manner that will prevent the introduction of contaminants into the SSA in quantities that may create a significant hazard to public health.

GEOGRAPHIC AREAS AFFECTED

This MOU applies to HUD federal financially assisted projects/activities in the project review area of all current and future designated SSAs in Region II.

Attachment 1, Designated SSAs in Region II, lists the designated SSA areas within the states of New York and New Jersey in EPA, Region II; the date of designation; and the Federal Register Notice citation. Attachment 1 also provides a map of the SSA project review area boundary for each of the designated aquifers. When any other SSAs are designated in Region II, EPA will notify HUD in writing.

DEFINITIONS

Significant Hazard to Public Health:

A level of contaminant which causes or may cause the aquifer to:

(a) Exceed any (1) maximum contaminant level set forth in any promulgated National Primary Drinking Water Standard; (2) state standard where more stringent than the Federal standard; (3) public health advisory level for currently unregulated contaminants; at any point where the water may be used for drinking purposes, or

(b) May otherwise adversely affect the health of persons, or

(c) May require a public water system to install additional treatment to prevent such adverse effect.

Federal Financial Assistance:

Financial benefits provided directly as aid to a project by a department, agency, or instrumentality of the federal government in any form including contracts, grants and loan guarantees. Actions or projects carried out by the federal government itself do not involve federal financial assistance.

Actions performed for the federal government by contractors should be distinguished from contracts entered into specifically for the purpose of providing financial assistance, and will not be considered programs or actions receiving Federal financial assistance.

Federal financial assistance is limited to benefits earmarked for a specific project or action and directly awarded to the project or action. Indirect assistance, e.g., in the form of a loan to a developer by a lending institution which in turn receives federal assistance not specifically related to the project in question is not federal financial assistance under Section 1424(e).

SSA Project Review Area:

The area within which federal financially assisted projects/activities will be reviewed, which includes the designated area and may include all or a portion of the streamflow source area(s). The designated area can include the area above the aquifer, the area which recharges the aquifer (possibly including all or a portion of the streamflow source area) and the area where the population served by the aquifer resides. Streamflow source zone is defined as the upstream headwaters area of losing streams (streams contributing to recharge to Ground Water) that drain into the recharge area. The extent of the SSA project review area is outlined in the Federal Register designation notice for that SSA. Attachment 1 lists the Federal Register Notice citation and provides a map of the SSA project review area.

MOU ATTACHMENTS

Attachment 1: Designated SSAs in Region II

Attachment 2: A. Non-Housing Initial Screen Criteria
B. Housing Initial Screen Criteria

Attachment 3: SSA Preliminary Review Information Requirements

Attachment 4: Hazardous Constituents

ENVIRONMENTAL REVIEW RESPONSIBILITY

Pursuant to Section 1424(e) of the SDWA, EPA is responsible for designating SSAs and reviewing federal financially assisted projects/activities within SSA project review areas.

Pursuant to the National Environmental Policy Act (NEPA) and other provisions of law, HUD is responsible for environmental review and decision making except in those cases delegated by law such as with Community Development Block Grant Program (CPD). Environmental responsibility includes compliance with Section 1424(e) of the SDWA.

EIS EARLY NOTIFICATION/SCOPING

If an Environmental Impact Statement (EIS) is prepared for a project/activity in a SSA project review area, HUD or its grant recipients that assume by law environmental responsibilities and EPA shall coordinate at the earliest possible time so that the draft EIS contains EPA's SSA review determination. This is to ensure that any possible groundwater contamination has been considered.

This early notification will serve to initiate consultations with the developer to determine the scope of study that may be necessary if any formal groundwater quality assessment is required.

REVIEW PROCESS:
COMMUNITY PLANNING AND DEVELOPMENT (CPD) and HOUSING PROGRAM

The general procedures to be followed by HUD, its delegated agencies and EPA in reviewing HUD federal financially assisted activities and determining their potential impact on the SSA are outlined below. The overall goal is to ensure that each project/activity receiving federal financial assistance is designed and constructed in a manner that will prevent the introduction of contaminants into the SSA in quantities that may create a significant hazard to public health. Two levels of potential review are: (1) Initial Screen/Preliminary Review, and (2) Formal Section 1424(e) Review.

I. Excluded Projects/Activities

EPA and HUD mutually agree that the following list of project/activity categories would not create a significant hazard to public health:

-Construction of individual new residential structures containing from one to four units

-Funding of planning grants

-Rehabilitation of residential units

-Funding of all other grants for non-construction projects/activities

-Projects identifed as exempt in 24 CFR 58.34

These categories of projects/activities are therefore excluded from the Initial Screen/Preliminary Review requirements as outlined in Sections II and III below. Potential CPD recipients; states; other delegated agencies and HUD are responsible for making this determination for their respective programs. EPA may request information on these projects/activities and conduct a review if EPA determines it to be necessary.

II. CPD Applications/Final Statements

A. Initial Screen/Preliminary Review

HUD shall notify all potential CPD recipients, including states that are administering HUD programs (Non-Entitlement Small Cities Program, etc.) and other delegated agencies with jurisdiction in SSA project review areas of the SSA review requirements under Section 1424(e) and of their responsibility as outlined in this MOU.

Potential CPD recipients shall conduct an initial screen of CPD projects/activities proposed for HUD federal financial assistance prior to submission of an application or final statement to HUD. Attachment 2.A, Non-Housing Initial Screen Criteria, shall be used for CPD projects/activities that do not involve housing; and Attachment 2.B, Housing Initial Screen Criteria, for CPD projects/activities involving housing only.

EPA shall be notified of any projects/activities which result in a positive response to one of the criteria questions in Attachment 2. Where a project/activity meets one of the criteria in Attachment 2, the information in Attachment 3, SSA Preliminary Review Information Requirements, shall also be completed and forwarded to EPA along with applicable project/final statement information.

Upon receipt of the above, EPA will conduct it's Preliminary Review. If additional information is required, EPA will inform the potential CPD recipient and HUD. The potential CPD recipient shall be responsible for submitting to EPA any additional information requested in a timely manner.

Based on the information provided, EPA will make its determination on whether to complete its review at this stage and provide SSA review clearance, or proceed to a Formal Section 1424(e) Review. The project/activity may be cleared as is, or with modifications.

B. Timeframe for **Preliminary Review** and Notification

Within fifteen calendar days of EPA's receipt of the project's final statement, Attachment 2 and Attachment 3, EPA will notify the potential CPD recipient and HUD of one or more of the following:

-the project/activity has received SSA review clearance
-the project/activity requires modifications to receive SSA review clearance
-additional environmental information is required
-additional time to review the project, is required
-the project/activity raises major environmental concerns requiring interagency consultation
-a Formal Section 1424(e) Review is required

If EPA does not notify HUD within 15 days of receipt of the project, HUD should proceed with its project review.

HUD shall not authorize a release of funds until all outstanding issues with regard to the subject project/activity have been resolved.

C. Formal Section 1424(e) Review

Should a Formal Section 1424(e) Review be required, EPA shall formally notify the potential CPD recipient and HUD of this decision. If additional information is required, the potential CPD recipient shall be responsible for submitting the requested information to EPA in a timely manner. EPA may also schedule a public hearing to gather additional information.

Based on the information provided, EPA shall make a determination to either approve the project/activity, request more information, suggest modifications or disapprove the project/activity.

III. **Housing Program Applications**

A. Initial Screen/Preliminary Review

HUD shall notify all of its field offices of the SSA review requirements under Section 1424(e) and of their responsibilities as outlined in this MOU.

HUD shall conduct an initial screen of housing projects proposed for HUD Federal financial assistance. Attachment 2.B, Housing Initial Screen Criteria, shall be used for this review. EPA shall be notified of any projects which result in a positive response to one of the criteria questions in Attachment 2.B. Where a project meets one of the criteria in Attachment 2.B, the information in Attachment 3, SSA Preliminary Review Information Requirements, shall also be completed and forwarded to EPA along with the applicable project information.

Upon receipt of the above, EPA will conduct its Preliminary Review. If additional information is required, EPA will inform the HUD field office who shall than be responsible for submitting to EPA the requested information in a timely manner.

Based on the information provided, EPA will make its determination on whether to complete its review at this stage and provide SSA review clearance or proceed to a Formal Section 1424(e) Review. The project may be cleared in its existing form, or with modifications.

B. Timeframe for **Preliminary Review** and Notification

Within fifteen calendar days of EPA's receipt of the pertinent environmental information from the housing application, Attachment 2 and Attachment 3, EPA will notify HUD of one or more of the following:

- -the project has received SSA review clearance
- -the project requires modifications to receive SSA review clearance
- -additional environmental information is required
- -additional time to review the project is required
- -the project raises major environmental concerns requiring interagency consultation
- -a Formal Section 1424(e) Detailed Review is required

The project environmental clearance needed for project approval shall not be considered complete (appropriate sign-offs) until outstanding SSA issues with regard to the subject project have been satisfactorily resolved.

If EPA does not notify HUD within 15 days of receipt of the project, HUD should proceed with its project review.

C. Formal Section 1424(e) Review

Should a Formal Section 1424(e) Review be required, EPA shall formally notify HUD of this decision. If additional information is required, HUD shall be responsible for submitting the requested information to EPA in a timely manner. A public hearing may be held to gather additional information.

Based on the information provided, EPA shall make a determination to either approve the project, request more information, suggest modifications or disapprove the project.

D. Local Area Certification For Housing Environmental Review

If the community is wholly or partially within a SSA project review area boundary, the local certified agency shall have the same responsibility as HUD in meeting the SSA review requirements as outlined in Section 1424(e) and this MOU.

GENERAL PROCEDURAL MATTERS

Materials submitted to EPA by HUD or the applicant will be addressed to the attention of:

Chief, Environmental Impacts Branch
U.S. EPA Region II
26 Federal Plaza, Room 500
New York, New York 10278

Chief, Environmental Review Section
USEPA Region 2
290 Broadway, 25th floor
New York, NY 10007

The following representatives will serve as liaisons for HUD and EPA respectively. The liaisons will maintain communication as needed regarding projects/activities affecting the SSAs and this MOU.

HUD: Regional Office Environmental Officer
(212) 264-0793

EPA: Chief, Environmental Impacts Branch
(212) 264-1840

Chief, Environmental Review Section
212-637-3738

This MOU is subject to revision upon agreement by both parties.

U.S. Department of Housing and Urban Development

A. M. Villane, Jr., DDS
Regional Administrator/
Regional Housing Commissioner

Date: AUG 24 1990

U.S. Environmental Protection Agency

Constantine Sidamon-Eristoff
Regional Administrator

Date: 8/10/90

ATTACHMENT 1

DESIGNATED SOLE SOURCE AQUIFERS IN REGION II

Name	State	Citation	Publication Date
Brooklyn/Queens Aquifer System (AS)	NY	49 FR 2950	01/24/84
Buried Valley AS	NJ	45 FR 30537	05/08/80
Cattaraugus Creek AS	NY	52 FR 36100	09/25/87
Clinton Street-Ballpark AS	NY	50 FR 2025	01/14/85
Cortland-Homer-Preble AS	NY	53 FR 22045	06/13/88
Highlands AS	NJ/NY	52 FR 37213	10/05/87
Nassau/Suffolk	NY	43 FR 26611	06/21/78
New Jersey Coastal Plain AS	NJ	53 FR 23791	06/24/88
Northwest New Jersey Fifteen Basin AS	NJ	53 FR 23685	06/23/88
Ridgewood Area	NJ	49 FR 2943	01/24/84
Schenectady/Niskayuna AS	NY	50 FR 2022	01/14/85
Upper Rockaway River Basin AS	NJ	49 FR 2946	01/24/84

ATTACHMENT 2.A

NON-HOUSING PROJECT/ACTIVITY INITIAL SCREEN CRITERIA
(For projects in a designated Sole Source Aquifer area)

The following list of criteria questions are to be used as an initial screen to determine which **non-housing** projects/activities should be forwarded to the Environmental Protection Agency (EPA) for Preliminary Sole Source Aquifer (SSA) Review. (For housing projects/activities see Attachment 2.B) If any of the questions are answered affirmatively, Attachment 3, SSA Preliminary Review Requirements, should also be completed. The application/final statement, this Attachment, Attachment 3, and any other pertinent information should than be forwarded to EPA at the address below.

Any project/activity not meeting the criteria in this Attachment, but suspected of having a potential adverse effect on the Sole Source Aquifer should also be forwarded. Contact EPA if you have any questions.

Chief, Environmental Impacts Branch
USEPA Region II
26 Federal Plaza, Room 500
New York, New York 10278
(212) 264-1840

Chief, Environmental Review Section
USEPA Region 2
290 Broadway, 25th floor
New York, NY 10007
212-637-3738

CRITERIA QUESTIONS

	YES	NO	N/A
1. Is the project/activity located within a currently designated or proposed groundwater sensitive area such as a special Ground Water Protection Area, Critical Supply Area, Wellhead Protection Area etc.? [This information can be obtained from the County or Regional planning board, the local health department, the State health department or the State environmental agency.]	___	___	___
2. Is the project/activity located within a one half mile radius (2640 feet) of a current or proposed public water supply well or wellfield? [This information can be obtained from the local health department, the State health department or the State environmental agency.]	___	___	___

3. Will the project/activity include or directly cause: (check appropriate items)

- construction or expansion of solid waste disposal, recycling or conversion facilities	___	___	___
- construction or expansion or closure of landfills	___	___	___
- construction or expansion of water supply facilities (i.e., treatment plant, pump house, etc.)	___	___	___
- construction or expansion of on-site wastewater treatment plants or sewage trunk lines, greater than 1/4 mile	___	___	___
- construction or expansion of gas or petroleum trunk lines, greater than 1200 feet	___	___	___
- construction or expansion of railroad spurs or similar extensions	___	___	___
- construction or expansion of municipal sewage treatment plants	___	___	___

4. Will the project/activity include storage or handling of any hazardous constituents as listed in Attachment 4, Hazardous Constituents? ___ ___ ___

   If these constituents are used during the construction phase of the project, than an assurance statement must be provided indicating that chemicals will be used in a safe and proper manner, and that they will be promptly removed after construction is completed.

5. Will the project/activity include bulk storage of petroleum in underground or above ground tanks in excess of 1100 gallons? ___ ___ ___

6. Will the project/activity require a federal or state discharge elimination permit or modification of an existing permit? ___ ___ ___

This attachment was completed by:

Name: _____

Title: _____

Address: _____

_____

_____

Telephone number: _____

Date: _____

ATTACHMENT 2.B

HOUSING/PROJECT INITIAL SCREEN CRITERIA
(For projects in a designated Sole Source Aquifer area.)

The following list of criteria questions are to be used as an initial screen to determine which **housing** projects/activities should be forwarded to the Environmental Protection Agency (EPA) for Preliminary Sole Source Aquifer (SSA) Review. (For non-housing projects see Attachment 2.A). If any of the questions are answered affirmatively, Attachment 3, SSA Preliminary Review Requirements, should also be completed. The application/final statement, this Attachment, Attachment 3, and applicable project information than be forwarded to EPA at the address below.

Any project not meeting the criteria in this Attachment, but suspected of having a potential adverse effect on the Sole Source Aquifer should also be forwarded. Contact EPA if you have any questions.

Chief, Environmental Impacts Branch
USEPA, Region II
26 Federal Plaza, Room 500
New York, New York 10278
(212) 264-1840

Chief, Environmental Review Section
USEPA Region 2
290 Broadway, 25th floor
New York, NY 10007
212-637-3738

CRITERIA QUESTIONS:

	YES	NO	N/A
1. Is the project located within a currently designated or proposed ground water sensitive area such as a Special Ground Water Protection Area, Critical Supply Area, Wellhead Protection Area etc.? [This information can be obtained from the County or Regional planning board, the local health department, the State health department or the State environmental agency.]	___	___	___
2. Is the project located within a one half mile radius (2640 feet) of a current or proposed public water supply well or wellfield? [This information can be obtained from the local health department, the State health department or the State environmental agency.]	___	___	___
3. Will the total impervious surfaces be greater than 75 percent?	___	___	___
4. Is the propsed project site greater than 30 acres?	___	___	___
5. Will the proposed density of the project be greater than 150 units per acre ?	___	___	___

6. Will the project include or directly cause: (check appropriate items)
   - construction or expansion of water supply facilities (i.e., treatment plant, pumphouse, etc.) ___ ___ ___
   - construction or expansion of on-site wastewater treatment plants ___ ___ ___
   - construction or expansion of sewage trunk lines greater than 1320 feet in length ___ ___ ___
   - construction or expansion of gas or petroleum trunk lines greater than 1320 feet ___ ___ ___

7. Will the project include storage or handling of any hazardous constituents as listed in Attachment 4, Hazardous Constituents? If these constituents are used during the construction phase of the project, an assurance statement must be provided indicating that chemicals will be used in a safe and proper manner, and they will be promptly removed after construction is completed. ___ ___ ___

8. Will the project include bulk storage of petroleum in underground or above ground tanks in excess of 10,000 gallons or permit verification? ___ ___ ___

9. Will the project require a federal or state pollutant discharge elimination permit or modification of an existing permit? ___ ___ ___

This attachment was completed by:

Name: _____

Title: _____

Address: _____

_____

_____

Telephone number: _____

Date: _____

ATTACHMENT 3

SSA PRELIMINARY REVIEW INFORMATION REQUIREMENTS

Where currently available, the information in this Attachment should be provided to the Environmental Protection Agency (see address below) along with the application/final statement; Attachment 2.A, Non-Housing Initial Screen Criteria or Attachment 2.B, Housing Initial Screen Criteria; and any other information which may be pertinent to a Sole Source Aquifer review. Where applicable, indicate the source of your information.

Chief, Environmental Impacts Branch
USEPA, Region II
26 Federal Plaza, Room 500
New York, New York 10278
(212) 264-1840

Chief, Environmental Review Section
USEPA Region 2
290 Broadway, 25th floor
New York, NY 10007
212-637-3738

	ENCLOSED YES	NO
I. Project/Activity Location		
1. Provide the geographic location and total acreage of the project/activity site. Include a site location map which identifies the site in relation to the surrounding area. [Examples of maps which can be used include: 1:24,000 or 1:25,000 U.S. Geological Survey quadrangle sheet, Hagstroms Street Map.]	___	___
2. If applicable, identify which groundwater sensitive areas (Special Ground Water Protection Area, Critical Supply Area, Wellhead Protection Area etc.) the project/activity is located within or adjacent to. [This information may be obtained from the County or Regional planning board, the local health department, the State health department or the State environmental agency.]	___	___
II. Nature of Project/Activity		
3. Provide a general narrative describing the project/activity including but not limited to: type of facility; type of activities to be conducted; number and type of units; number of residents etc. Provide the general layout of the project/activity site and a site-plan if available.	___	___

III. Public Water Supply

4. Provide a description of plans to provide water supply. ___ ___

5. Provide the location of nearby existing or proposed public water supply wells or wellfields within a one half mile radius (2640 feet) of the project/activity. Provide the name of the supplier(s) of those wells or wellfields. This information should be available from the local health department, State health department or the State environmental agency. If private wells are to be used, then information necessary to obtain a well drilling permit should be provided. ___ ___

V. Wastewater and Sewage Disposal

6. Provide a description of plans to handle wastewater and sewage disposal. If the project/activity is to be served by existing public sanitary sewers provide the name of the sewer district. ___ ___

7. Provide a description of plans to handle storm water runoff. ___ ___

8. Identify the location, design, size of any on-site recharge basins, dry wells, leaching fields, retention ponds etc. ___ ___

VI. Use, Storage, Transport of Hazardous or Toxic Materials **(Applies only to non-housing projects/activities)**

9. Identify any products listed in Attachment 3, Hazardous Constituents, of the Housing and Urban Development-Environmental Protection Agency Memorandum of Understanding which may be used, stored, transported, or released as a result of the construction activity. ___ ___

10. Identify the number and capacity of underground storage tanks at the project/activity site. Identify the products and volume to be stored, and the location on the site. ___ ___

11. Identify the number and capacity of above ground storage tanks at the project/activity site. Identify the products and volume to be stored, and the location on the site. ___ ___

This form was completed by:

Name: _____

Title: _____

Address: _____

_____

_____

Telephone number: _____

Date: _____

ATTACHMENT 4 HAZARDOUS CONSTITUENTS

Source: adapted from 40 CFR Ch.I (7-1-87 Edition)
Part 261, App. VII

Common Name	Chemical abstracts name
Acetonitrile	Same
Acetophenone	Ethanone, 1-phenyl-
2-Acetylaminofluorene	Acetamide, N-9H-fluoren-2yl-
Acetyl Chloride	Same
1-Acetyl-2-thiourea	Acetamide, N-(aminothioxymethyl)-
Acrolein	2-Propenal
Acrylamide	2-Propenamide
Acrylonitrile	2-Propenenitrile
Aflatoxins	Aflatoxin
Aldicarb	Propanal, 2-methyl-2-(methylthio)-, O[(methylamino)carbonyl]oxime
Aldrin	1,4:5,8-Dimethanonapthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-, (1alpha, 4alpha, 4beta, 5alpha, 8alpha, 8beta)-
Allyl alcohol	2-Propen-1-ol
Allyl chloride	1-Propane, 3-chloro-
Aluminum phosphide	Same
4-Aminobiphenyl	(1,1'-Biphenyl)-4-amine
5-(Aminomethyl)-3-isoxazolol	3(2H)-isoxazolone, 5-(aminomethyl)-
4-Aminopyridine	4-Pyridineamine
Amitrole	1H-1,2,4-Triazol-3-amine
Ammonium vandate	Vanadic acid, ammonium salt
Aniline	Benzenamine
Antimony and compounds, NOS	Antimony
Aramite	Sulfurous acid, 2-chlorethyl-, 2-[4-(1,1-dimethylethyl) phenoxy]-1-methylethyl ester
Arsenic and compounds, NOS	Arsenic
Arsenic acid	Arsenic acid AsH3O4
Arsenic pentoxide	Arsenic oxide As2O5
Arsenic trioxide	Arsenic oxide As2O3
Auramine	Benzamine, 4,4'-carbonimidoylbis[N,N-dimethyl-
Azaserine	L-Serine, diazoacetate (ester)
Barium and compounds NOS	Barium
Barium cyanide	Same
Benz[c]acridine	Same
Benz[a]anthracene	Same
Benzal chloride	Benzene, (dichloromethyl)-
Benzene	Same
Benzenearsonic acid	Arsonic acid, phenyl-
Benzidine	[1,1'-Biphenyl]-4,4'-diamine
Benzo[b]fluorathene	Benz[e]acephenanthrylene
Benzo[j]fluorathene	Same
Benzo[a]pyrene	Same

p-Benzoquinone	2,5-Cyclohexadiene-1,4-dione
Benzotrichloride	Benzene, (trichloromethyl)-
Benzyl chloride	Benzene, (chloromethyl)-
Beryllium and compounds NOS	Beryllium
Bis(2-chloromethoxy)ethane	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-
Bis(2-chloroethyl)ether	Ethane, 1,1'-oxybis[2-chloro-
Bis(2-chloroisopropyl)ether	Propane, 2,2'-oxybis[2-chloro-
Bis(chloromethyl)ether	Methane, oxybis[chloro-
Bis(2-ethylhexyl) phthalate	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester.
Bromoacetone	2-Propanone, 1-bromo-
Bromoform	Methane, tribromo-
4-Bromophenyl phenyl ether	Benzene, 1-bromo-4-phenoxy
Brucine	Strychnidin-10-one, 2,3-dimethoxy
Butyl benzyl phthalate	1,2-Benzenedicarbozylic acid, butyl phenylmethyl
Cacodylic acid	arsenic acid, dimethyl-
Cadmium and compounds NOS	Cadmium
Calcium chromate	Chromic acid, calcium salt
Calcium cyanide	Same
Carbon disulfide	Carbon bisulfide
Carbon oxyfluoride	Carbonic difluoride
Carbon tetrachloride	Methane, tetrachloro-
Chloral	Acetaldehyde, trichloro-
Chlorambucil	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino-
Chlordane, alpha and gamma isomers	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
Chlorinated benzenes, NOS	
Chlorinated ethane, NOS	
Chlorinated fluorocarbons NOS	
Chlorinated naphthalene, NOS	
Chlorinated phenol, NOS	
Chlornaphazine	2-Naphthalenamine, N,N-bis(2-chloroethyl)-
Chloroacetaldehyde	Acetaldehyde, chloro-
Chloroalkyl ethers, NOS	
p-Chloroaniline	Benzenamine, 4-chloro-
Chlorobenzene	Benzene, chloro-
Chlorobenzilate	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester
p-Chloro-m-cresol	Phenol, 4-chloro-3-methyl-
1-Chloro-2,3-epoxypropane	Oxirane, (chloromethyl-)
2-Chloroethyl vinyl ether	Ethene, (2-chloroethoxy)-
Chloroform	Methane, trichloro-
Chloromethyl methyl ether	Methane, chloromethoxy-
beta-Chloronaphthalene	Napthalene, 2-chloro-
o-Chlorophenol	Phenol, 2-chloro-
1-(o-Chlorophenyl) thiourea	Thiourea, (2-chlorophenyl)-
Chloroprene	2-Chloro-1,3-butadiene
3-Chloropropionitrile	Propanenitrile, 3-chloro-
Chromium and compounds NOS	Chromium
Chrysene	Same
Citrus red No. 2	2-Napthalenol, 1-[(2,5-dimethoxyphenyl)azo]-
Coal tars	
Copper cyanide	Copper cyanide CuCN

Creosote	Same
Cresols (Cresylic acid)	Phenol, methyl-
Crotonaldehyde	2-Butenal
Cyanides (soluble salts and complexes) NOS	
Cyanogen	Ethanedinitrile
Cyanogen bromide	Same
Cyanogen chloride	Same
Cycasin	beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl..
2-Cyclohexyl-4,6-dinitrophenol	Phenol, 2-cyclohexyl-4,6-dinitro-
Cyclophosphamide	2H-1,3,2-Oxazaphosphorin-2-amine, N,N-bis) 2-chloroethyl)tetrahydro-, 2-oxide
2,4-D, salts and esters	Acetic acid, (2,4-dichlorophenoxy)-, salts and esters..
Daunomycin	5,12-Napthacenedione,(8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy-alpha-L-lyxo-hexoypranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-
DDD	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro-
DDE	Benzene, 1,1'-(dichloroethenylindene)bis[4-chloro-
DDT	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-
Diallate	Carbamothioic acid, bis(1-methylethyl)-S-(2,3-dichloro-2-propenyl) ester
Dibenz[a,h]acridine	Same
Dibenz[a,j]acridine	Same
Dibenz[a,h]anthracene	Same
7H-Dibenzo[c,g]carbazole	Same
Dibenzo[a,e]pyrene	Naptho[1,2,3,4-def]chrysene
Dibenzo[a,h]pyrene	Dibenzo[b,def]chrysene
Dibenzo[a,i]pyrene	Benzo[rst]pentaphene
1,2-Dibromo-3-chloropropane	Propane, 1,2-dibromo-3-chloro-
Dibutylphthalate	1,2-Benzenedicarboxylic acid, dibutyl ester
o-Dichlorobenzene	Benzene, 1,2-dichloro-
m-Dichlorobenzene	Benzene, 1,3-dichloro-
p-Dichlorobenzene	Benzene, 1,4-dichloro-
Dichlorobenzene NOS	Benzene, dichloro-
3,3'-Dichlorobenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-
1,4-Dichloro-2-butene	2-Butene, 1,4-dichloro-
Dichlorodifluoromethane	Methane, dichlorodifluoro-
1,2-Dichloroethylene	Ethene, 1,2-dichloro-, (E)-
Dichloroethylene, NOS	Dichloroethylene
1,1-Dichloroethylene	Ethene, 1,1-dichloro-
2,4-Dichlorophenol	Phenol, 2,4-dichloro-
2,6-Dichlorophenol	Phenol, 2,6-dichloro-
Dichlorophenylarsine	Arsonous dichloride, phenyl-
Dichloropropane, NOS	Propane, dichloro-
Dichloropropanol, NOS	Propanol, dichloro-
Dichloropropene, NOS	1-Propene, dichloro-
1,3-Dichloropropene	1-Propene, 1,3-dichloro-
Dieldrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha, 7beta,7aalpha)-
1,2:3,4-Diepoxybutane	2,2'-Bioxirane

Diethylarsine	Arsine, diethyl-
1,4 Diethyleneoxide	1,4 Dioxane
N,N'-Diethylthydrazine	Hydrazine, 1,2-diethyl-
O,O-Diethyl S-methyldithiophosphate	Phosphorodithioic acid, O,O-diethyl S-methyl ester
Diethyl-p-nitro phenyl phosphate	Phosphoric acid, diethyl-4-nitrophenyl ester
Diethylphthalate	1,2-Benzenedicarboxylic acid, diethyl ester
O,O-Diethyl O-pyrazinyl phosphorothioate	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
Diethylstilbesterol	Phenol, 4,4'-(1,2-diethyl-1,2-ethenediyl)bis,(E)
Dihydrosafrole	1,3 Benzodioxole, 5-propyl-
3,4-Dihydroxy-alpha-(methylamino) methyl benzyl alcohol	(+ -)-1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-
Diisopropylfluorophosphate (DFP)	Phosphorofluoridic acid, bis(1-methylethyl)ester
Dimethoate	Phosphorodithioic acid, O,O-dimethyl S-[2-
3,3'-Dimethoxybenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-
p-Dimethylaminoazobenzene	Benzenamine, N,N-dimethyl-4-(phenylazo)-
7,12-Dimethylbenz[a]anthracene	Benz[a]anthracene, 7,12-dimethyl
3,3'-Dimethylbenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
Dimethylcarbamoyl chloride	Carbamic chloride, dimethyl-
1,1-Dimethylhydrazine	Hydrazine, 1,1-dimethyl-
1,2-Dimethythydrazine	Hydrazine, 1,2-dimethyl-
alpha, alpha-Dimethylphenethylamine	Benzeneethanamine, alpha,alpha-dimethyl-
2,4-Dimethylphenol	Phenol, 2,4-dimethyl-
Dimethylphthalate	1,2-Benzenedicarboxylic acid, dimethyl ester
Dimethyl sulfate	Sulfuric acid, dimethyl ester
Dinitrobenzene, NOS	Benzene, dinitro-
4,6-Dinitro-o- cresol and salts	Phenol, 2-methyl-4,6-dinitro- and salts
2,4-Dinitrophenol	Phenol, 2,4-dinitro-
2,4-Dinitrotoluene	Benzene, 1-methyl-2,4-dinitro-
2,6-Dinitro toluene	Benzene, 2-methyl-1,3-dinitro-
Dinoseb	Phenol, 2-(l-methylpropyl)-4,6-dinitro-
Di-n-octylphthalate	1,2-Benzenedicarboxylic acid, dioctyl ester
Diphenylamine	Benzenamine, N-phenyl-
1,2-Diphenylhydrazine	Hydrazine, 1,2-diphenyl-
Di-n-propylnitrosamine	1-Propanamine, N-nitroso-N-propyl-
Disulfoton	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
Dithiobiuret	Thioimidodicarbonic diamide
Endosulfan	6,9-Methano-2,4,3-benzodioxathiepen, 6,7,8,9,10,10 -hexachloro-1,5,5a,6,9,9a-hexahydro-,3-oxide
Endothal	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
Endrin	2,7:3,6-Dimethanonapth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-,1aalpha, 2beta,2abeta,3alpha,6alpha,6abeta,7beta,7aalpha)-
Ethyl carbamate (urethane)	Carbamic acid, ethyl ester
Ethyl cyanide	Propanenitrile
Ethylenebisdithiocarbamic acid, salt and esters	Carbamodithioic acid, 1,2-ethanediylbis-, salts and esters
Ethylene dibromide	Ethane, 1,2-dibromo-
Ethylene dichloride	Ethane, 1,2-dichloro-
Ethylene glycol monoethyl ether	Ethanol, 2-ethoxy-
Ethyleneimine	Aziridine

Ethylene oxide	Oxirane
Ethylenethiourea	2-Imidazolidinethione
Ethylidene dichloride	Ethane, 1,1-dichloro-
Ethyl methacrylate	2-Propenoic acid, 2-methyl-, ethyl ester
Ethylmethane sulfonate	Methanesulfonic acid, ethyl ester
Famphur	Phosphorothioic acid, 0-[4-[(dimethylamino) sulfonyl] phenyl] O,O-dimethyl ester
Fluoranthene	Same
Fluorine	Same
Fluoroacetamide	Acetamide, 2-fluoro-
Fluoroacetic acid, sodium salt	Acetic acid, fluoro-, sodium salt
Formaldehyde	Same
Glycidylaldehyde	Oxiranecarboxyaldehyde
Halomethane, NOS	
Heptachlor	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
Heptachlor epoxide	2,5-Methano-2H-indeno[1,2b]oxirene,2,3,4,5,6,7,7-heptachloro- 1a,1b,5,5a,6,6a-hexahydro-alpha, beta and gamma isomers)
Hexachlorobenzene	Benzene, hexachloro-
Hexachlorobutadiene	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
Hexachlorocyclopentadiene	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
Hexachlorodibenzo-p-dioxins	
Hexachlorodibenzofurans	
Hexachloroethane	Ethane, hexachloro-
Hexachlorophene	Phenol, 2,2'-methylenebis[3,4,6-trichloro-
Hexachloropropene	1-Propene, hexachloro-
Hexaethyltetraphosphate	Tetraphosphoric acid, hexaethyl ester
Hydrazine	Same
Hydrogen cyanide	Hydrocyanic acid
Hydrogen fluoride	Hydrofluoric acid
Hydrogen sulfide	Same
Indeno[1,2,3cd]pyrene	Same
Iron dextran	Same
Isobutyl alcohol	1-Propanol, 2-methyl-
Isodrin	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydrol-1alpha,4alpha, 4beta,5beta,8beta,8beta-
Isosafrole	1,3-Benzodioxole, 5-(1-propenyl)-
Kepone	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
Lasiocarpine	2-Butenoic acid, 2-methyl-,7-[(2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-ester, [1S-[1alpha(Z),7(2s,3R),7alpha]]-
Lead and compounds NOS	
Lead acetate	Acetic acid, lead(2 +) salt
Lead phosphate	Phosphoric acid, lead (2 +) salt
Lead subacetate	Lead, bis(acetato-O)tetrahydroxytri-
Lindane	Cyclohexane, 1,2,3,4,5,6-Hexachloro-
Maleic anhydride	2,5-Furandione
Maleic hydrazide	3,6-Pyridazinedione, 1,2-dihydro-

Malonoitrile	Propanedinitrile
Melphalan	L-Phenylalanine, 4-[bis(2-chloroethyl)amino]-
Mercury fulminate	Fulminic acid, mercury (2 +) salt
Mercury and compounds NOS	Same
Methacrylonitrile	2-Propanenitrile, 2-methyl-
Methapyrilene	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-
Methomyl	Acetimidic acid, N-[(methylcarbamoyl)oxy]thio-, methyl ester
Methoxychlor	Benzene, 1,1'-(2,2,2-trichloroethylidene)[4-methoxy-
Methyl bromide	Methane, bromo-
Methyl chloride	Methane, chloro-
Methylchlorocarbonate	Carbonchloridic acid, methyl ester
Methyl chloroform	Ethane, 1,1,1-trichloro-
3-Methylcholanthrene	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
4,4'-Methylenebis(2-chloroaniline)	Benzenamine, 4,4'-methylenebis[2-chloro-
Methylene bromide	Methane, dibromo-
Methylene chloride	Methane, dichloro-
Methyl ethyl ketone (MEK)	2-Butanone
Methyl ethyl ketone peroxide	2-Butanone, peroxide
Methyl hydrazine	Hydrazine, methyl-
Methyl iodide	Methane, iodo-
Methyl isocyanate	Methane, isocyanato-
2-Methyllactonitrile	Propanenitrile, 2-hydroxy-2-methyl-
Methyl methacrylate	2-Propenoic acid, 2-methyl-, methyl ester
Methyl methanesulfonate	Methanesulfonic acid, methyl ester
Methyl parathion	Phosphorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester
Methylthiouracil	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
Mitomycin C	Azirino[2',3':3,4]pyrrolo[1,2-a]indole-4,7-dione,6amino-8[[(aminocarbonyl)oxy]methyl]-1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-[1aR-(1aalpha,8beta,8aalpha,8alpha)]-
MNNG	Guanidine, N-methyl-N'-nitro-N-nitroso-
Mustard gas	Ethane, 1,1'-thiobis[2-chloro-
Napthalene	Same
1,4-Naphthloquinone	1,4-Naphthalenedione
alpha-Naphthylamine	1-Naphthalenamine
beta-Naphthylamine	2-Naphthalenamine
alpha-Naphthylthiourea	Thiourea, 1-naphthalenyl-
Nickel and compounds NOS	Same
Nickel carbonyl	Nickel carbonyl, (T-4)-
Nickel cyanide	Same
Nicotine and salts	Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts
Nitric oxide	Nitrogen oxide NO
p-Nitroaniline	Benzenamine, 4-nitro-
Nitrobenzene	Benzene, nitro-
Nitrogen dioxide	Nitrogen oxide NO2
Nitrogen mustard and hydrochloride salt	Ethanamine, 2-chloro, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt
Nitrogen mustard N-oxide and hydrochloride salt	Ethanamine, 2-chloro-N-(2-chloroethyl)-N-methyl, N-oxide, and hydrochloride salt

Nitroglycerin	1,2,3-Propanetriol, trinitrate
p-Nitrophenol	Phenol, 4-nitro-
2-Nitropropane	Propane, 2-nitro-
4-Nitroquinoline-1-oxide	Quinoline, 4-nitro-1-oxide-
Nitrosamine, NOS	
N-Nitrosodi-n-butylamine	1-Butanamine, N-butyl-N-nitroso-
N-Nitrosodiethanolamine	Ethanol, 2,2'-(nitrosoimino)bis-
N-Nitrosodiethylamine	Ethanamine, N-ethyl-N-nitroso-
N-Nitrosodimethylamine	Methamine, N-methyl-N-nitroso-
N-Nitro-N-ethyl urea	Urea, N-ethyl-N-nitroso-
N-Nitrosomethylethylamine	Ethanamine, N-methyl-N-nitroso-
N-Nitroso-N-methylurea	Urea, N-methyl-N-nitroso-
N-Nitroso-N-methylurethane	Carbamic acid, methylnitroso-, ethyl ester
N-Nitrosomethylvinylamine	Vinylamine, N-methyl-N-nitroso-
N-Nitrosomorpholine	Morpholine, N-nitroso-
N-Nitrosonornicotine	Pyridine, 3-(1-nitroso-2-pyrrolidinyl)-,(S)-
N-Nitrosopiperidine	Piperidine, 1-nitroso-
Nitrosopyrrolidine	Pyrrolidine, 1-nitroso-
N-Nitrososarcosine	Glycine, N-methyl-N-nitroso-
5-Nitro-o-toluidine	Benzenamine, 2-methyl-5-nitro-
Octamethylprophosphoramide	Diphosphoramide, octamethyl-
Osmium tetroxide	Osmum oxide (OsO4)
Paraldehyde	1,3,5-Trioxane, 2,4,6-trimethyl-
Parathion	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
Pentachlorobenzene	Benzene, pentachloro-
Pentachlorodibenzo-p-dioxins	
Pentachlorodibenzofurans	
Pentachloroethane	Ethane, pentachloro-
Pentachloronitrobenzene (PCNB)	Benzene, pentachloronitro-
Pentachlorophenol	Phenol, pentachloro-
Phenacetin	Acetamide, N-(4-ethoxyphenyl)-
Phenol	Same
Phenylenediamine	Benzenediamine
Phenylmercury acetate	Mercury, (acetato-O)phenyl-
Phenylthiourea	Thiourea, phenyl-
Phosgene	Carbonic dichloride
Phosphine	Same
Phorate	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
Phthalic acid esters, NOS	
Phthalic anhydride	1,3-isobenzofurandione
2-Picoline	Pyridine, 2-methyl-
Polychlorinated biphenyls NOS	
Potassium cyanide	Same
Potassium silver cyanide	Argentate(1-), bis(cyano-C)-, potassium
Pronamide	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-
1,3-Propane sultone	1,2-Oxathiolane, 2,2-dioxide
n-Propylamine	1-Propanamine
Propargyl alcohol	2-Propyn-l-ol
Propylene dichloride	Propane, 1,2-dichloro-
1,2-Propylenimine	Aziridine, 2-methyl-

Propylthiouracil	4(1H)-Pyrimidinone, 2,3-dihydro-6-propyl-2-thioxo-
Pyridine	Same
Reserpinen	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester
Resorcinol	1,3-Benzenediol
Saccharin and salts	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide and salts
Safrole	1,3-Benzodioxole, 5-(2-propenyl)-
Selenium dioxide	Selenious acid
Selenium and compounds, NOS	Selenium
Selenium sulfide	Same
Selenourea	Same
Silver and compounds NOS	Silver
Silver cyanide	Same
Silvex (2,4,5-TP)	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-
Sodium cyanide	Same
Streptozotocin	D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-
Strontium sulfide	Same
Strychnine and salts	Strychnidin-10-one arid salts
TCDD	Dibenzo[b,e] [1,4]dioxin, 2,3,7,8-tetrachloro-
1,2,4,5-Tetracholorobenzene	Benzene, 1,2,4,5-tetrachloro-
Tetrachlorodibenzo-p-dioxins	
Tetrachlorodibenzofurans	
Tetrachloroethane, NOS	Ethane, tetrachloro-, NOS
1,1,1,2-Tetrachloroethane	Ethane, 1,1,1,2-tetrachloro-
1,1,2,2-Tetrachloroethane	Ethane, 1,1,2,2-tetrachloro-
Tetrachloroethylene	Ethene, tetrachloro-
2,3,4,6-Tetrachlorophenol	Phenol, 2,3,4,6-tetrachloro-
Tetraethyldithiopyrophosphate	Thiodiphosphoric acid, tetraethyl ester
Tetraethyl lead	Plumbane, tetraethyl-
Tetraethylpyrophosphate	Diphosphoric acid, tetraethyl ester
Tetranitromethane	Methane, tetranitro-
Thallium and compounds NOS	Thallium
Thallic oxide	Thallium (III) oxide
Thallium (I) acetate	Acetic acid, thallium (1+) salt
Thallium (I) carbonate	Carbonic acid, dithallium (1+) salt
Thallium (I) chloride	Thallium chloride
Thallium (I) nitrate	Nitric acid, thallium (1+) salt
Thallium selenite	Thallium selenide
Thallium (I) sulfate	Sulfuric acid, thallium salt
Thioacetamide	Ethanethioamide
Thiofanox	2-Butanone, 3,3-dimethyl-1-(methythio)-, O-[(methylamino)carbonyl]oxime
Thiomethanol	Methanethiol
Thiophenol	Benzenethiol
Thiosemicarbazide	Hydrazinecarbothioamide
Thiourea	Same
Thiram	Thioperoxydicarbonic diamide, Tetramethyl-
Toluene	Benzene, methyl-
Toluenediamine	Benzenediamine, ar-methyl-
2,4-Toluenediamine	1,3-Benzenediamine, 4-methyl-

2,6-Toluenediamine	1,3-Benzenediamine, 2-methyl-
3,4-Toluenediamine	1,2-Benzenediamine, 4-methyl-
Toluene diisocyanate	Benzene, 2,4-diisocyanato-1-methyl-
p-Toluidine	Benzenamine, 4-methyl-
o-Toluidine hydrochloride	Benzenamine, 2-methyl-,hydrochloride
Toxaphene	Same
1,2,4-Trichlorobenzene	Benezene, 1,2,4-trichloro
1,1,2-Trichloroethane	Ethane, 1,1,2-trichloro
Trichloroethylene	Ethene, trichloro
Trichloromethanethiol	Methanethiol, trichloro-
Trichloromonofluoromethane	Methane, trichlorofluoro-
2,4,5-Trichlorophenol	Phenol, 2,4,5-trichloro-
2,4,6-Trichlorophenol	Phenol, 2,4,6-trichloro-
2,4,5-T	Acetic acid, (2,4,5-trichlorophenoxy)-
Trichloropropane, NOS	
1,2,3-Trichloropropane	Propane, 1,2,3-trichloro-
O,O,O-Triethylphosphorothioate	Phosphorothioic acid, O,O,O-triethyl ester
sym-Trinitrobenzene	Benzene, 1,3,5-trinitro
Tris (1-aziridinyl)phosphine sulfide	Aziridine, 1,1'1"-phosphinothioylidynetris-
Tris (2,3-dibromopropyl)phosphate	1-Propanol, 2,3-dibromo-, phosphate (3:1)
Trypan blue	2,7-Naphthalendisulfonic acid, 3,3'-[(3,3'-dimethyl [1,1'-biphenyl]- 4,4'-diyl)bis(azo)]bis[5-amino-4-hydroxy-, tetrasodium salt
Uracil mustard	2,4(1H,3H)-Pyrimidinedione, 5-[bis(2-chloroethyl)amino]-
Same as CAS name	Undecamethylenediamine, N,N' -bis(2-chlorobenzyl)-dihydrochloride
Vanadium pentoxide	Vanadium oxide V2 O3
Vinyl chloride	Ethene, chloro-
Warfarin	2 H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-
Zinc cyanide	Same
Zinc phosphide	Zinc phosphide P2 Zn3

NOS (not otherwise specified) signifies those members of the general class not specifically listed by name in this appendix.

ATTACHMENT 2.A

NON-HOUSING PROJECT/ACTIVITY INITIAL SCREEN CRITERIA
(For projects in a designated Sole Source Aquifer area)

The following list of criteria questions are to be used as an initial screen to determine which **non-housing** projects/activities should be forwarded to the Environmental Protection Agency (EPA) for Preliminary Sole Source Aquifer (SSA) Review. (For housing projects/activities see Attachment 2.B) If any of the questions are answered affirmatively, Attachment 3, SSA Preliminary Review Requirements, should also be completed. The application/final statement, this Attachment, Attachment 3, and any other pertinent information should than be forwarded to EPA at the address below.

Any project/activity not meeting the criteria in this Attachment, but suspected of having a potential adverse effect on the Sole Source Aquifer should also be forwarded. Contact EPA if you have any questions.

Chief, Environmental Impacts Branch
USEPA Region II
26 Federal Plaza, Room 500
New York, New York 10278
(212) 264-1840

Chief, Environmental Review Section
USEPA Region 2
290 Broadway, 25th floor
New York, NY 10007
212-637-3738

CRITERIA QUESTIONS

	YES	NO	N/A
1. Is the project/activity located within a currently designated or proposed groundwater sensitive area such as a special Ground Water Protection Area, Critical Supply Area, Wellhead Protection Area etc.? [This information can be obtained from the County or Regional planning board, the local health department, the State health department or the State environmental agency.]	___	X	___
2. Is the project/activity located within a one half mile radius (2640 feet) of a current or proposed public water supply well or wellfield? [This information can be obtained from the local health department, the State health department or the State environmental agency.]	___	X	___

3. Will the project/activity include or directly cause: (check appropriate items)

- construction or expansion of solid waste disposal, recycling or conversion facilities	___	X	___
- construction or expansion or closure of landfills	___	X	___
- construction or expansion of water supply facilities (i.e., treatment plant, pump house, etc.)	___	X	___
- construction or expansion of on-site wastewater treatment plants or sewage trunk lines, greater than 1/4 mile	___	X	___
- construction or expansion of gas or petroleum trunk lines, greater than 1200 feet	___	X	___
- construction or expansion of railroad spurs or similar extensions	___	X	___
- construction or expansion of municipal sewage treatment plants	___	X	___

4. Will the project/activity include storage or handling of any hazardous constituents as listed in Attachment 4, Hazardous Constituents? ___ X ___

If these constituents are used during the construction phase of the project, than an assurance statement must be provided indicating that chemicals will be used in a safe and proper manner, and that they will be promptly removed after construction is completed.

5. Will the project/activity include bulk storage of petroleum in underground or above ground tanks in excess of 1100 gallons? ___ X ___

6. Will the project/activity require a federal or state discharge elimination permit or modification of an existing permit? ___ X ___

This attachment was completed by:

Name: Juliet Jacobs

Title: Environmental Unit Head (Community Development)

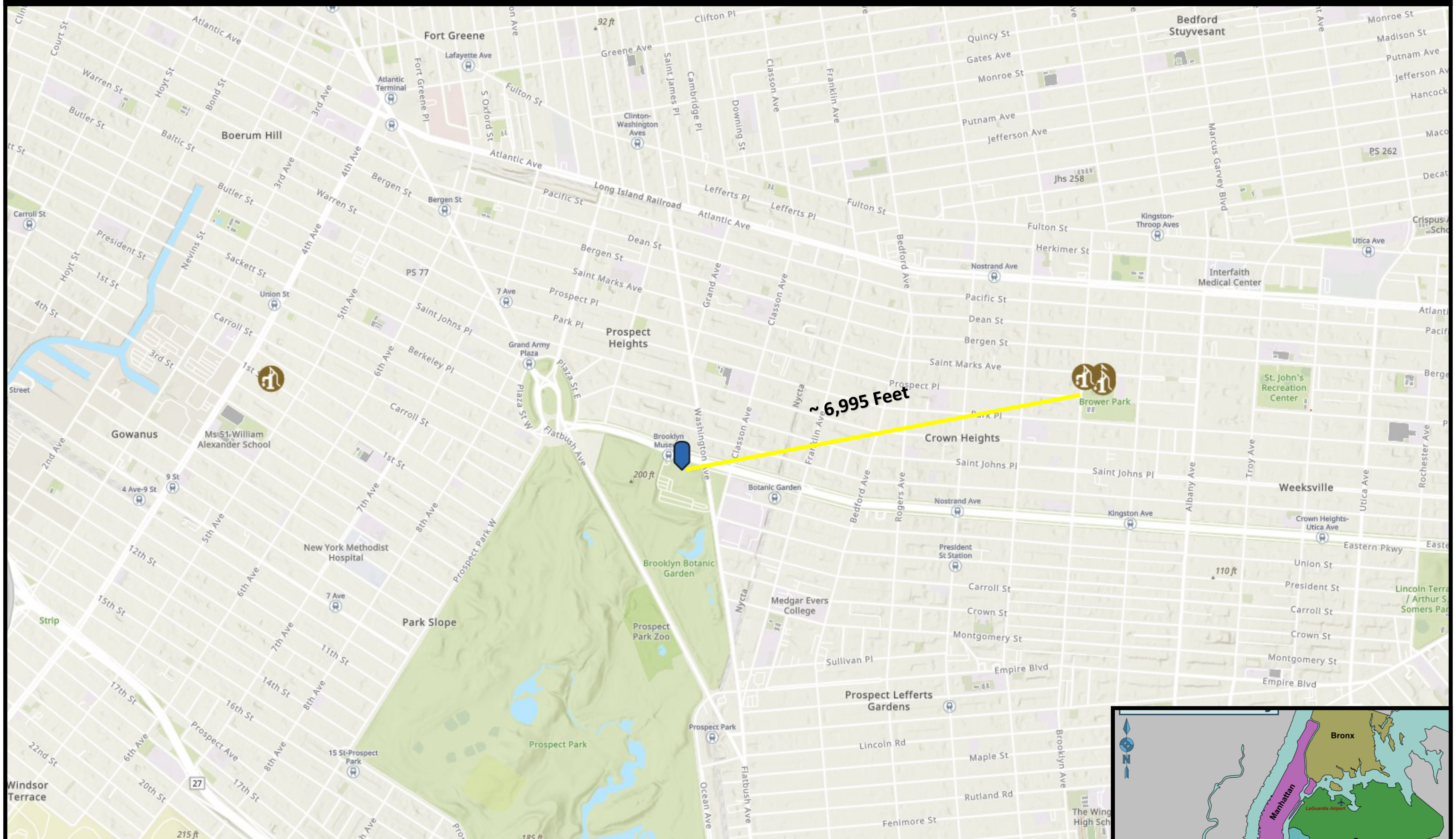
Address: 255 Greenwich Street, 8th Floor

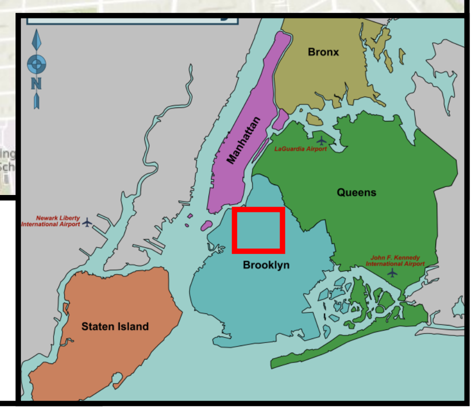
New York, NY 10007

Telephone number: 212-788-1653

Date: 01/20/2026

Brooklyn Museum - African Art Galleries Water Wells Map





Legend

Water Wells

Approximate Distance

Project Site

N

Data source: Water Wells - Overview on 01/20/2026

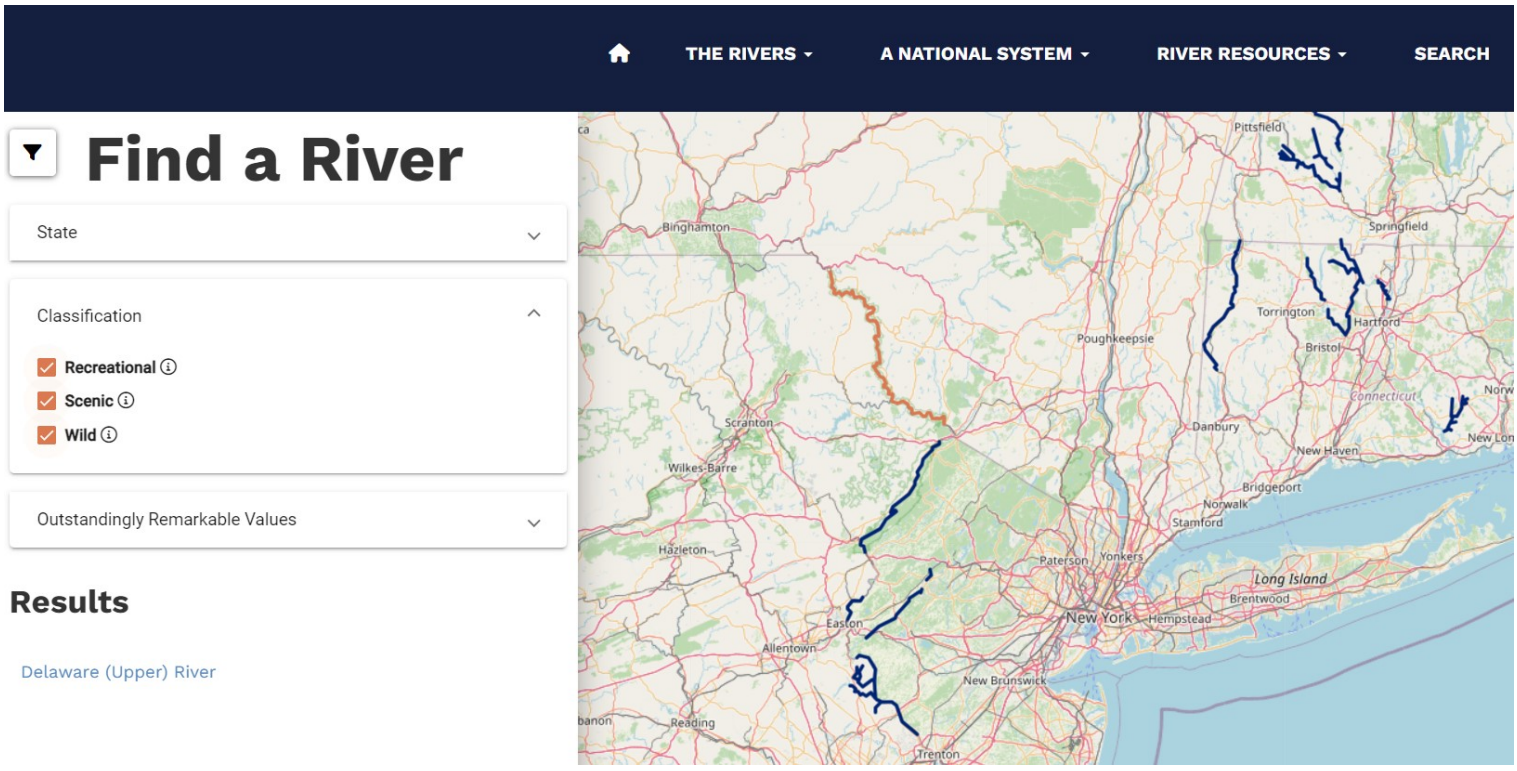
The City of New York
Office of Management and Budget
255 Greenwich Street • New York, New York 10007-2146

NYC Office of Management and Budget
Environmental Review Statement on Wild and Scenic Rivers - 2025

There are no Recreational, Wild, or Scenic Rivers (either designated Rivers or Study Rivers) within or adjacent to the boundaries of the City of New York.

The nearest designated Wild and Scenic River to the New York City Metro Area is the Delaware (Upper) River, which is approximately 60 miles away at its closest point. Its entire length is found outside of the NYC area.

The Proposed Project is located in a densely developed urban area of New York City, within the State of New York, and would not cause disturbance to or impact Wild and Scenic Rivers. Therefore, the proposed project would not violate the Wild and Scenic Rivers Act. No further assessment is required.



Study Rivers

There are two study provisions in the Act — Section 5(a), through which Congress directs the study of select rivers, and Section 5(d)(1), which directs federal agencies to identify potential additions to the National Wild and Scenic Rivers System (National System) through federal agency plans. A brief explanation is provided in the following respective sections below.

Current Active Studies

Currently, there are two rivers or river systems under "authorized" study under Section 5(a) of the Wild & Scenic Rivers Act. This does not include those that might be under assessment as part of normal agency land-planning processes.

- Kissimmee River, Florida (Public Law 117-328, December 29, 2022) – Study not yet initiated by the National Park Service.
- Little Manatee River, Florida (Public Law 117-328, December 29, 2022) – Study not yet initiated by the National Park Service.

Section 2(a)(ii) Studies

Under Section 2(a)(ii) of the Act, a governor (or governors for a river in multiple states) of a state can request that a river be designated, provided certain conditions are met (refer to the **Council White Paper on Section 2(a)(ii)** for specifics). The National Park Service then conducts a study to determine of certain conditions are met. Here are some of the studies conducted under Section 2(a)(ii). Again, if you don't see a study listed, we do not have a copy.

Section 2(a)(ii) Studies

- **Allagash River Study Report**, Maine
- **American River Eligibility Report**, California
- **American River Environmental Impact Statement**, California
- **Big & Little Darby Creeks Study Report & Environmental Assessment**, Ohio
- **Eel River Eligibility Report**, California
- **Eel River Environmental Impact Statement**, California
- **Klamath River Eligibility Report**, California
- **Klamath River Environmental Impact Statement**, California
- **Klamath River Study Report**, Oregon
- **Lumber River Study Report**, North Carolina
- **New River (South Fork) Study Report & Environmental Impact Statement**, North Carolina
- **Smith River Eligibility Report**, California
- **Smith River Environmental Impact Statement**, California
- **Trinity River Eligibility Report**, California
- **Trinity River Environmental Impact Statement**, California
- **Wallowa River Study Report**, Oregon
- **Westfield River Study Report & Environmental Assessment (Initial Study 1993)**, Massachusetts
- **Westfield River Draft Study Report (Expansion 2002)**, Massachusetts

Site Name	Site Number	Address	Type of Facility	Largest Tank Size (Gallons)	Contents	ASD (feet)	Approximate Distance to Site (feet)
133-01 BOOTH MEMORIAL AVE REALTY	2-611072	133-01 BOOTH MEMORIAL AVE	Petroleum Bulk Storage	3000	#2 fuel oil	437.09	450
BP SERVICE STATION #20975	2-337862	49-04 COLLEGE POINT BOULEVARD	Petroleum Bulk Storage	280	#2 fuel oil	162.74	690
THE PARK REGENT CONDOMINIUM	2-194158	41-25 KISSENA BLVD	Petroleum Bulk Storage	30,000	#4 fuel oil	1,140.69	2900
BEST CONCRETE MIX CORP	2-607654	35-10 COLLEGE POINT BOULEVARD	Petroleum Bulk Storage	3000	Diesel	437.09	4500
132-09 MAPLE AVENUE	2-296937	132-09 MAPLE AVENUE	Petroleum Bulk Storage	2000	#2 fuel oil		
132-24 MAPLE AVENUE	2-296953	132-24 MAPLE AVENUE	Petroleum Bulk Storage	2000	#2 fuel oil		
132-25 MAPLE AVENUE VENTURES, LLC	2-358940	132-25 MAPLE AVENUE	Petroleum Bulk Storage	10,000	#2 fuel oil		
132-70 SANDFORD AVENUE	2-287660	132-70 SANFORD AVE	Petroleum Bulk Storage	5000	#6 fuel oil		
134-54 MAPLE AVE. TENANTS CORP.	2-308927	134-54 MAPLE AVENUE	Petroleum Bulk Storage	10,000	#4 fuel oil		
140-60 BEECH AVE LLC	2-282308	140-60 BEECH AVENUE	Petroleum Bulk Storage	275	#2 fuel oil		
140-65 BEECH OWNERS CORP.	2-294497	140-65 BEECH AVE	Petroleum Bulk Storage	6000	#2 fuel oil		
140-70 ASH AVENUE	2-314951	140-70 ASH AVENUE	Petroleum Bulk Storage	5000	#6 fuel oil		
143-43 41ST AVE. TENANTS CORP	2-362069	143-43 41ST AVENUE	Petroleum Bulk Storage	5000	Biofuel oil		
143-45 SANFORD AVE	2-606075	143-45 SANFORD AVE	Petroleum Bulk Storage	4500	#2 fuel oil		
144-03 BARCLAY AVE	2-604809	144-03 BARCLAY AVENUE	Petroleum Bulk Storage	5000	#4 fuel oil		
144-07/11 SANFORD AVE	2-147486	144-07/11 SANFORD AVE	Petroleum Bulk Storage	10,000	#6 fuel oil		
37-33 COLLEGE POINT BLVD	2-274542	37-33 COLLEGE POINT BLVD	Petroleum Bulk Storage	5000	#6 fuel oil		
41-08 PARSONS BLVD. ASSOCIATES, LLC	2-303615	41-08 PARSONS BOULEVARD	Petroleum Bulk Storage	4000	#2 fuel oil		
46-06 MANAGEMENT SERVICES LLC	2-247820	46-06 BOWNE STREET	Petroleum Bulk Storage	2000	#2 fuel oil		
A & K SANFORD REALTY CORP.	2-612848	143-33 SANFORD AVENUE	Petroleum Bulk Storage	3000	#2 fuel oil		
A&S USED AUTO PARTS	2-606187	126-17 34TH AVENUE	Petroleum Bulk Storage	275	Waste oil		
ADAMS LLC	2-202193	142-24 38TH AVE	Petroleum Bulk Storage	10,000	#6 fuel oil		
ALLWALL CONSTRUCTION CORP.	2-610642	147-25 SANFORD AVENUE	Petroleum Bulk Storage	1000	#4 fuel oil		
APARTMENT HOUSE	2-194387	41-69 PARSONS BLVD	Petroleum Bulk Storage	5000	#4 fuel oil		
A-PLUS AUTO REPAIR INC.	2-611050	46-06 KISSENA BOULEVARD	Petroleum Bulk Storage	275	Waste oil		
ASH AVE LLC	2-332623	140-50 ASH AVENUE	Petroleum Bulk Storage	5000	#2 fuel oil		
ASH TERRACE LLC	2-244554	140-37 ASH AVENUE	Petroleum Bulk Storage	15,000	#4 fuel oil		
BAXTER HOUSE CONDOMINIUM	2-281956	137-10 FRANKLIN AVE	Petroleum Bulk Storage	10,000	#6 fuel oil		
BCA AUTO PARTS INC.	2-606134	126-43 37TH AVENUE	Petroleum Bulk Storage	275	Waste oil		
BEECH 140 LLC	2-154555	140-40 BEECH AVENUE	Petroleum Bulk Storage	5000	#4 fuel oil		
BOWNE HOUSE OWNERS CORP.	2-194808	42-40 BOWNE STREET	Petroleum Bulk Storage	3000	#2 fuel oil		

CAMEO OWNERS CORP.	2-607989	143-55 41 AVE	Petroleum Bulk Storage	3000	#2 fuel oil		
CANARRI AUTO REPAIR	2-607875	127-14 WILLETS PT BLVD	Petroleum Bulk Storage	275	Waste oil		
CARLYLE TOWERS COOP B. INC.	2-404691	138-10 FRANKLIN AVENUE	Petroleum Bulk Storage	20,000	#6 fuel oil		
CASEY STENGEL BUS DEPOT	2-190268	123-53 WILLETS POINT BOULEVARD	Petroleum Bulk Storage	1000	Lube oil		
CEDAR GROVE CEMETERY ASSN.	2-032107	135-08 63RD ROAD	Petroleum Bulk Storage	275	Waste oil / Lube oil / Motor oil		
CHERRY LANE OWNERS CORP.	2-321117	42-95 MAIN STREET	Petroleum Bulk Storage	3000	#2 fuel oil		
DNZ AUTO PARTS & AUTO SALES INC	2-605813	127-54 WILLETS POINT BLVD.	Petroleum Bulk Storage	275	Waste oil		
DRAGON AUTO CENTER INC.	2-606173	131-19 SANFORD AVENUE	Petroleum Bulk Storage	275	Waste oil		
DSNY QUEENS DISTRICT 7 GARAGE	2-455466	30-04 121ST STREET	Petroleum Bulk Storage	500	Waste oil		
DUPAR AUTO RIM INC	2-611889	126-25 36TH AVENUE	Petroleum Bulk Storage	250	Waste oil		
E.E.H. REALTY CORPORATION	2-107379	134-14 FRANKLIN AVE	Petroleum Bulk Storage	5000	#4 fuel oil		
EMPIRE EQUIPMENT SALES CO., INC.	2-609965	34-09 126TH STREET	Petroleum Bulk Storage	275	Waste oil		
FLUSHING GOLD COAST APT., LLC	2-202088	140-71 ASH AVE	Petroleum Bulk Storage	3000	#2 fuel oil		
FLUSHING HOSPITAL MEDICAL CENTER	2-233307	4500 PARSONS BOULEVARD	Petroleum Bulk Storage	10,000	Biofuel oil		
FLUSHING TOWING	2-609996	126-28 35TH AVENUE	Petroleum Bulk Storage	250	Waste oil		
FRANCONIA VILLAGE COOP INC	2-237361	43-57 UNION ST	Petroleum Bulk Storage	5000	#2 fuel oil		
FRANCONIA VILLAGE COOPERATIVE	2-237353	44-55 KISSENA BLVD	Petroleum Bulk Storage	11,000	#2 fuel oil		
G.T.R. AUTO PARTS INC	2-609263	126-02 35TH AVENUE	Petroleum Bulk Storage	250	Waste oil		
GAROLFALO HOLDING CORP.	2-318728	143-30 SANFORD AVENUE	Petroleum Bulk Storage	5000	#2 fuel oil		
GLOBAL MONTELLO GROUP #1725	2-156779	137-17 NORTHERN BOULEVARD	Petroleum Bulk Storage	250	Waste oil		
GREAT BEAR AUTO & BODY INC.	2-610088	47-01 KISSENA BOULEVARD	Petroleum Bulk Storage	275	Waste oil		
HK FIRM 2, LLC	2-280275	136-42 MAPLE AVE	Petroleum Bulk Storage	7500	#6 fuel oil		
HOLIDAY HOUSE OWNERS CORP.	2-358827	143-30 ROOSEVELT AVE	Petroleum Bulk Storage	7500	#2 fuel oil		
HOP YICK CO., INC.	2-607294	41-63 FRAME PLACE	Petroleum Bulk Storage	5000	#2 fuel oil		
JJW ENTERPRISES, INC	2-271179	143-15 38TH AVE	Petroleum Bulk Storage	3000	#2 fuel oil		
JJW ENTERPRISES, INC	2-258318	143-21/25 38TH AVENUE	Petroleum Bulk Storage	4000	#2 fuel oil		
JOHN BOWNE HS - QUEENS Q425	2-353108	63-25 MAIN STREET	Petroleum Bulk Storage	2000	#2 and #4 fuel oil		
JOSE MORENO	2-606101	45-35 PARSONS BLVD.	Petroleum Bulk Storage	3000	#2 fuel oil		
KISSENA APARTMENTS	2-204730	42-02 KISSENA BOULEVARD	Petroleum Bulk Storage	3000	#2 fuel oil		
KISSENA DEVELOPMENT, INC.	2-272752	46-16 KISSENA BOULEVARD	Petroleum Bulk Storage	280	Waste oil		
KISSENA GARDENS	2-083062	43-43 KISSENA BLVD	Petroleum Bulk Storage	8000	#6 fuel oil		
LEGEND OF NORTH SHORE AUTO	2-609751	35-11 COLLEGE POINT BOULEVARD	Petroleum Bulk Storage	275	Waste oil		

LIGHTNING AUTO SERVICE INC.	2-609916	34-02 127TH STREET	Petroleum Bulk Storage	275	Waste oil		
LOTTE-HANM II AUTO REPAIR INC.	2-609747	35-01 COLLEGE POINT BOULEVARD	Petroleum Bulk Storage	250	Waste oil		
LOWELL SCHOOL	2-247782	142-45 58TH ROAD	Petroleum Bulk Storage	2000	#2 fuel oil		
M.S. AUTO & TRUCK SERVICES INC.	2-605942	131-25 41ST AVENUE	Petroleum Bulk Storage	275	Waste oil		
MAINTENANCE BUILDING	2-455512	127-45 34TH AVENUE	Petroleum Bulk Storage	5000	#2 fuel oil		
MANCHESTER LLC	2-604934	140-18 ASH AVENUE	Petroleum Bulk Storage	5000	#2 fuel oil		
MAPLE GOLDEN 168 LLC	2-610600	134-37 MAPLE AVENUE	Petroleum Bulk Storage	4000	#6 fuel oil		
MARCY APARTMENTS	2-260282	144-31 41ST AVE	Petroleum Bulk Storage	7500	#2 fuel oil		
MARGARET T. PAN D.B.A PAN REAL ESTATE	2-109487	41-81 FRAME PLACE	Petroleum Bulk Storage	2000	#2 fuel oil		
MONTENEGRO REALTY CORP.	2-293113	140-19 BEECH AVENUE	Petroleum Bulk Storage	4000	#2 fuel oil		
NEW COMPLETE AUTO	2-611776	42-22 HAIGHT STREET	Petroleum Bulk Storage	275	Waste oil		
NEW WIN AUTO REPAIR INC.	2-611111	133-16 35TH AVENUE	Petroleum Bulk Storage	200	Waste oil		
NOR CREST S/S INC.	2-188425	178-02 UNION TURNPIKE	Petroleum Bulk Storage	280	Waste oil / #2 fuel oil		
P.S. /I.S. 499 - QUEENS Q499	2-609698	148-20 REEVES AVENUE	Petroleum Bulk Storage	7500	#2 fuel oil		
PAYSONS APTS. CORP.	2-400106	43-55 KISSENA BOULEVARD	Petroleum Bulk Storage	4,000	#4 fuel oil		
POWER PLUS INC	2-609371	131-29 SANFORD AVENUE	Petroleum Bulk Storage	250	Waste oil		
RMT MANAGEMENT INC.	2-609538	131-63 40TH ROAD	Petroleum Bulk Storage	275	Waste oil / Lube oil		
SANFORD APARTMENT CORP	2-601348	144-44 SANFORD AVE	Petroleum Bulk Storage	5000	#2 fuel oil		
SANFORD BOWNE BULDING	2-332267	143-07 SANFORD AVENUE	Petroleum Bulk Storage	7500	#6 fuel oil		
SANFORD PLAZA APT CORP	2-237272	144-54/64 SANFORD AVENUE	Petroleum Bulk Storage	10,000	#2 fuel oil		
SJS ASSOCIATES LLC	2-083453	140-10 FRANKLIN AVENUE	Petroleum Bulk Storage	5000	#2 fuel oil		
SKYLINE TOWERS #6	2-294225	43-70 KISSENA BLVD	Petroleum Bulk Storage	15,000	#2 fuel oil		
ST MICHAELS R.C. CHURCH	2-404942	136-76 41ST AVENUE	Petroleum Bulk Storage	275	#2 fuel oil		
ST MICHAELS SCHOOL	2-404934	136-58 41ST AVENUE	Petroleum Bulk Storage	3000	#2 fuel oil		
THE INFINITIY 8 ON BOWNE CONDOMINIUM	2-601428	41-60 BOWNE STREET	Petroleum Bulk Storage	5000	#2 fuel oil		
THE INFINITY 8 ON FRANKLIN CONDOMINIUM	2-310735	142-20 FRANKLIN AVE	Petroleum Bulk Storage	5000	#2 fuel oil		
THE LAFAYETTE APARTMENTS, INC	2-611402	138-70 ELDER AVE	Petroleum Bulk Storage	3000	#2 fuel oil		
TOP GEAR AUTO PERFORMANCE INC.	2-609382	41-17 FULLER PLACE	Petroleum Bulk Storage	275	Waste oil		
TRADING USED AUTO PARTS CORP.	2-605829	127-02 35TH AVENUE	Petroleum Bulk Storage	275	Waste oil		
TRANSWORLD AUTO REPAIR	2-610359	112-13,15 ROOSEVELT AVENUE	Petroleum Bulk Storage	250	Waste oil		
U.S. AUTO WRECKING INC	2-605888	126-26 35TH AVE	Petroleum Bulk Storage	250	Waste oil		
W.J. AUTO REPAIR INC	2-609771	127-11 WILLETS POINT BOULEVARD	Petroleum Bulk Storage	200	Waste oil		

WBK 41, LLC	2-196150	143-48 41ST AVE	Petroleum Bulk Storage	3000	#6 fuel oil		
YORKSHIRE GARDENS CONDOMINIUM	2-333514	42-20 KISSENA BOULEVARD	Petroleum Bulk Storage	10,000	#2 fuel oil		