NEW YORK CITY DEPARTMENT OF CORRECTION
Joseph Ponte, Commissioner

Ava B. Rice, Assistant Commissioner
Contracts and Procurement
Agency Chief Contracting Officer
75-20 Astoria Boulevard, Suite 160
East Elmhurst, NY 11370
Office: 718 546-0690

April 26, 2017

ADDENDUM #2 to PIN 072201723CPD
Air Conditioning System Replacement at AMKC,
Modular Building Number #1

Dear Prospective Bidder:

Pursuant to 3-02(i)(2) of the Procurement Policy Board (PPB) Rules, the Department of Correction (Department) is issuing Addendum #2 to the solicitation for the services referenced above.

REVISED BID SHEET

Kindly use the attached revised Bid Sheet and disregard the one received with your bid documents.

This is a gentle reminder that the Bid date is scheduled for Thursday, April 27, 2017 at 11:00AM.

Note: The Agency will not longer accept questions regarding this solicitation in order to allow sufficient time for bidders to prepare their bid price.

PROPOSED COST RANGE

The estimated value of this project is in the range between *$5.4Million and $5.8Million.*

DESCRIPTION OF CHANGES:

1) The Addendum includes revisions to the contract documents as generally outlined herein. For detailed revisions please review all the attached documents.
    a. Responses to contractors' questions.
    b. Revision of phasing work,

c. Commissioning scope of work including hiring of the Commissioning Agent by the contractor,

d. Conversion of chilled water system to chilled glycol system.

e. Inclusion of Security Ceiling access doors as Add Alternate No. 1

f. Inclusion Inflatable dampers and Controls as Add Alternate No. 2,

g. Inclusion of temporary 15 & 50 Ton Air Cooled AC/Heating Units with all required connections as Add Alternate No. 3.

h. Revision to the Temporary scope of work including sound barriers, sound and indoor air quality monitoring.

2) Revisions to drawings are shown clouded with triangle number 2. Please note that while substantial revisions have been clouded, not necessarily all revisions are shown clouded. It will be the contractor's responsibility to include all the revisions since the bid set in his bid price whether clouded or otherwise.

3) Specification revisions are shown bold. Please note that while substantial revisions have been indicated in bold, not necessarily all revisions are shown bold. It will be the contractor's responsibility to include all the revisions since the bid set in his bid price whether shown bold or otherwise.

Responses to questions asked by vendor:

Q.1 Drawing E201 calls to provide an allowance of 70 Light Fixtures and Unit Price Bid Sheet B-14 Item C calls for a unit price for 70 light fixtures. Should we include an allowance of 70 in our base bid as well as the separate 70 unit price fixtures?

A.1 Please include replacement of 70 light fixtures as base bid work item as per the updated attached "Bid work sheet" and drawing revision in addendum. In addition, the "bid sheet" must also have a unit price line item. The unit price shall be used for any quantity beyond 70 light fixtures as included in the base bid.

Q.2 We have the following additional question: Simplex Grinnell is the Manufacturer for the Fire Alarm please advise who Building FA vendor is?

A.2 Simplex Grinnell performed a "design build" project to both design and construct fire alarm systems at AMKC-Rikers Island. Therefore, if services in connection with altering and/or reprograming of Simplex fire alarms are required then this contractor shall contact Simplex Grinnell. For DOC projects, please contact Ms. Kay Lee at 917-416-6822.

Q.3 Please advise if there is a roofing warranty and provide the name of manufacturer.

A.3 The roofing currently has no warranty. Contractor to engage qualified roofing contractor to perform work per Division 7 specifications.

Q.4 Summary of work on T002 Item#4 for Architectural indicates to patch and paint all services after completion of all trades work. We assume the intent is to patch and paint only areas effected by our work please confirm or clarify.

A.4 See Drawing T-002. Contractor to paint all walls, floors ceilings, partitions of all portions of Mod 1 building and the Mechanical building upon completion of work.

Q.5 Drawing M201 indicates a new Purge panel yet FA-220 indicates the purge panel is to remain we assume the FA drawings is correct please confirm or clarify.

A.5 The purge panel is new as shown on HVAC drawings, FA drawing revised is attached.

Q.6 Drawing M305 flow diagram indicates a glycol feed unit please provide information on this equipment so we can bid on it please make sure you include electrical requirements for the units.

A.6 Glycol Feed system has been addressed under specification section 232500 (Page C-673). Please note that the specification has been revised under addendum no. 2 to include chilled glycol.

Q.7 Drawing S100 indicates to provide 20 Ton helical piles for the chiller concrete pads please provide more information on your requirements including a detail showing pile diameter, casing, grouting requirements and depth.

A.7 Drawing S100, Detail no. 4 indicates the 20 ton helical pile to be minimum 40 ft dept. The note also requires the contractor to hire a Geo-Technical Engineer to confirm the final depth and size. The addendum will clarify the note.

Q.8 We assume that we can choose from the approved Air Handling Unit Manufactures listed on Page C-756 please confirm.

A.8 Yes.

Q.9 Drawing M604 Pump detail indicates providing a flow meter, please confirm that we can use a triple duty valve with a portable meter in lieu of the flow meter, check valve and plug valve.

A.9 Triple Duty valves are not acceptable. Provided as per contract individual valves and flow meter.

Q.10 Drawing M604 Pump detail does not indicate flex connectors vibration isolation or suction diffusers please confirm the detail is correct or clarify your requirement.

A.10 Detail does show flex connectors. Vibration isolators are required and are governed under specifications section 230598

Q.11 Specification Page C-35 Paragraph 1.04B talks about work that only can be done when the building is totally unoccupied please advise when the building will be unoccupied.

A.11 The building at no time will be unoccupied. All construction will be performed in phases. See phasing plans for construction phases.

Q.12 Drawing M205 keynote 4 calls for "Garde 316 " pipe we assume this to mean 316 Stainless steel, specification 232000 does not include Stainless pipe please clarify and add specifications if stainless pipe is required.

A.12 The note has been revised. Please see addendum drawings.

Q.13 Specification page C-43 and M-604 calls for a Make Up PRV rig please advise if this is required since both the Chilled Water and Hot Water system is Glycol. In addition see previous question asked 4-5-17 regarding no information on Glycol Feed equipment.

A.13 Specification page C-43 makes no mention of PRV. As both Chilled water and hot water systems use glycol and not make up water, cold water make up connection detail in drawing M-604 and M-607 has been omitted in addendum no. 2. Glycol Feed system has been addressed under specification section 232500 (Page C-673). Please note that the specification has been revised to include chilled glycol. See attached.

Q.14 Drawing M-205 keynote 3 calls for Heat Trace on the Chilled Water Piping exposed to weather yet the Hot Piping running adjacent does not call for heat trace please advise. Additionally please advise if the piping running in the crawl space is considered exposed to the weather please note both the Chilled Water and Hot Water system are Glycol systems.

A.14 Note has been revised to include hot water piping. All piping in the crawl spaces shall also be heat traced.

Q.15 M605 Hot Water Coil Detail calls for a Balancing Valve yet the Chilled Water Coil detail on M606 does not call for a balancing type valve please advise.

A.15 On chilled detail it is called as Throttling Valve. This has been clarified as Balancing and Flow Measuring valve in Addendum No. 2

Q.16 You have a specification on thermometer and gauges but the details on the drawing primarily call for thermometer wells and gauge Valves only please confirm or clarify requirements.

A.16 Thermometers and gages are required where thermometer wells and gage ports are shown on drawings. Addendum drawings clarify this.

REVISED SECTIONS IN SCOPE OF WORK

- Spec section 08 38 50 – Security Access Doors
- Spec section 23 08 00 – Commissioning of HVAC
- Spec section 23 09 98 – Sequences of Operation
- Spec section 23 25 00 – Chemical Water Treatment
- Spec section 23 31 00 – Sheetmetal Work and Accessories

NEW SECTIONS TO BE INCORPORATED IN SCOPE OF WORK

- Spec section 23 09 30 – Controls Schedules
- Spec section 26 51 00 – LED Interior Building Lighting

REVISED DRAWING CHANGES:

The below description only provides a general overview of the revisions to the specific drawings. It will be the contractor's responsibility to review each and every document for actual scope of work.

- Revised T002.00 – Included Scope of Add Alternate Work, Revised Summary of Work to include additional required work and for clarification. Revised Page numbers and drawing title.
- Revised M001.00 – Revised Abbreviations List and Symbol List.
- Revised M002.00 – Added Commissioning Note and Item #6 Water Systems Note.
- Revised M004.00 – Added IEQ Notes.
- Revised DM101.00 – Added removal of additional existing dampers. Revised Tag Note #7 and Note #7.
- Revised DM102.00 - Added removal of additional existing dampers. Revised Tag Note #7 and Note #7.

- Revised DM103.00 – Added removal of LPR in crawl space, removal of fence, Tag Note #17, 18. Revised Note #16 relating to the removal of existing fan. Added additional General Note for clarification.

- Revised PM102.00 – Revised Equipment Tag Name. Included Chemical Feed Tank. Revised temporary unit system. Added Tag Note #13, 14 and 15 for Part Plan #2. Added General Note relating to construction noise control. Add Tag Note #8 for Part Plan #3. Add removal of existing hot water heater pumps. Revised notes in drawing for clarification.

- Revised M201.00 – Add access door and inflatable as Add alternate No. 1 & 2. Revised tag note and notes for clarification.

- Revised M202.00 – Add access door and inflatable as Add alternate No. 1 & 2. Revised tag note and notes for clarification.

- Revised M203.00 – Add Chemical Feed Tank, Master units and Air Pumps for inflatable damper system, PDCs, and EHU-1. Added General Note for noise and air monitoring. Revised notes for clarification.

- Revised M204.00 – Added Note #2 regarding to construction noise and air quality monitoring.

- Revised M205.00 – Added Chemical Feed Tank, installation of 4” LPR piping in crawl space, re-fencing, EHU-1, heating tracing, additional expansion loop, support for emergency chilled water glycol backup connection. Added General Note for noise and air monitoring. Revised notes for clarification.

- Revised M302.00 – Revised Chilled Water to Chilled Water Glycol.

- Revised M303.00 – Revised Chilled Water to Chilled Water Glycol. Added Control Table.

- Revised M304.00 – Revised Chilled Water to Chilled Water Glycol.

- Revised M306.00 – Revised Control Point Schedule.

- Revised M401.00 – Revised Chilled Water to Chilled Water Glycol. Added Glycol feed tank in flow diagram.

- Revised M502.00 – Revised heating coil schedule, pump schedule, modular air cooled chiller schedule, expansion tank schedule and heat exchanger schedule.

- Revised M602.00 – Revised Security Metal Pan Ceiling access door detail.

- Revised M604.00 – Revised Return Duct Detail to included inflatable damper system components. Removed cold water make-up connection detail.

- Revised M605.00 – Revised throttling valve to balancing/ flow measuring valve for hot water heating coil connection detail.

- Revised M606.00 – Revised throttling valve to balancing/ flow measuring valve for chilled water heating coil connection detail.

- Revised M607.00 – Added Inflatable Damper Control System Schematic Detail and Chemical Feed System Detail. Removed cold water make-up connection detail.

- Revised E001.00 – Add symbol for PDC.

- Revised E002.00 – Revised Drawing List, Light Fixture Schedule

- Revised DE101.00 – Added electrical work related to temporary unit. Revised Key Note #3.

- Revised DE104.00 – Added location of existing MDB and disconnect switch for temporary units. Revised note for clarification of temporary units and phasing electrical work. Added Key Notes #10, 11 and 12. Removed Note #4.

- Revised E201.00 – Added smoke purge panel, PDC, existing panel RP-L1. Revised Key Note #2 regarding replacement of lighting fixtures. Added Key Note #5 and 6.

- Revised E202.00 – Added PDC. Revised key note #2 regarding replacement of lighting fixtures. Added Tag Note #7.

- Revised E203.00 – Added heat tracing, inflatable damper system, PDC, existing pump, RP-L3A. Revised key notes #11, 14, and 15 and added key notes #16 to 22.

- Revised E401.00 – Revised Single Line Riser Diagram to included temporary units, RP-L3A. Added key notes #6 and 7 and L on Feeder Schedule.

- Revised E502.00 – Revised MDB Panel Schedule.

- Revised FA001.00 – Revised symbol list and drawing list.

- Revised FA101.00 – Added Smoke Purge Panel. Revised key note #1, and added key note #3.

- Revised FA201.00 – Added Smoke Purge Panel on Fire Alarm Riser Diagram. Revised key notes #1 and 5.

- Revised FA202.00 – Revised Smoke Purge Sequence of Operation item #1.

- Revised S100.00 – Revised description to helical pile.
- Revised PM101.00 – Included phasing work for clarification. Add of temporary 15 & 50 Ton Air Cooled AC/Heating Units with all required connections as Add Alternate No. 3.
- Revised M608.00 – Added Post Fire Purge Panel Detail, Fence Framing Detail, Pipe Flexibility Chart Detail & Power Distribution Cabinet Detail.

Please sign below in acknowledgment of this addendum. ***Submit this addendum with your bid.***

Agency Chief Contracting Officer

I acknowledge receipt of this addendum.

Proposer/Company Name (Print)

Authorized Representative (Print Name)

Authorized Representative (Signature) Date

REVISED BID WORK SHEET Addendum #2

Lump Sum Bid for Contract Work:

A. For all labor, material, overhead and profit, applicable taxes, and associated costs for the supply, installation and construction services for the complete requirements as noted in the contract documents (specifications and drawings) including all other appurtenances, materials, testing, filing, approvals and items required by the Contract documents:

B. Lump Sum Bid for following activities related to the Air Conditioning System Replacement work. The following itemization is a general breakdown of the detailed scope of work included in the subsequent paragraphs, attached drawings, specifications, any subsequent addenda and bulletins. The compete scope of work as described above shall be broken down into the following general categories to provide the total lump sum cost for the project:

I. GENERAL CONSTRUCTION WORK

a. Replace security pan ceilings at locations shown on HVAC drawings..... $:_____

b. Replace wall and floor sections to the extent shown on structural drawings……... $:_____

c. Remove and Replace wall louvers in Mechanical Room $:_____

d. Patch and paint all surfaces upon completion of all trades work shown on all trade documents……... $:_____

e. Patch, repair, and paint walls, ceilings, and floors as required for previous removals and as needed after new installations…….……. $:_____

f. Provide fire stopping/smoke seals in penetrations after new conduits and sleeves installation……..... $:_____

g. Remove and replace existing floor beam sections as shown on floor plans along with floor sections…… $:_____

h. Provide temporary supports for all other trade components prior to such removal work…….……. $:_____

i. Partially remove existing concrete pad for Air Handling Units (AHU)...…….……..... $:_____

j. Provide new concrete pad for chiller and AHUs…….….. $:_____

k. Remove existing support structure serving existing AHU in second floor mechanical room……. $:_____

l. Provide new support structure for new AHU 5, 6, & 7… $:_____

General Construction Work Subtotal
(Sum of para. a through para. l above):…..……. $:_____

II. HVAC WORK

a. Remove existing four existing split type air conditioning units with steam heating coils located in the mechanical modular building serving the cells and dayrooms and three piggyback split type air conditioning units with electric heating coils located in the second floor mechanical room that serve the administrative spaces and control rooms...…… $:_____

b. Remove existing return fans and exhaust fans, air intake and relief vents serving the mod. 1 building…….. $:_____

c. Remove all air inlets and outlets serving mod. 1 building.…. $:_____

d. Remove all associated supports and isolators related to the above scope of work to the extent shown on contract documents……. $:_____

e. Remove all associated ductwork, duct accessories, insulation, related to the above scope of work to the extent shown on contract documents…….. $:_____

f. Not Applicable.

g. Clean all existing ductwork shown on contract documents... $:_____

h. Remove all associated controls, accessories, insulation, related to the above scope of work to the extent shown on contract documents..…… $:_____

i. Provide new glycol chilled water plant as shown on contract documents with associated pumps, expansion tanks, air separators, accessories, piping, insulation related to the above scope of work to the extent shown on contract documents…….. $:_____

j. Provide new glycol hot water/steam heat exchangers as shown on contract documents with associated pumps, expansion tanks, air separators, accessories, piping, insulation related to the above scope of work to the extent shown on contract documents…… $:_____

k. Provide new chilled glycol air handling units with steam heating coils located in the mechanical modular building serving the cells and dayrooms…… $:_____

l. Provide new chilled glycol piggyback air handling units with hot glycol heating coils located in the second floor mechanical room that serve the administrative spaces and control rooms……..

$:_____

m. Provide new return fans and exhaust fans, air intake and relief louvers serving the mod. 1 building…….…… $:_____

n. Provide new air inlets and outlets serving mod. 1 building… $:_____

o. Provide all associated supports, **concrete pads**, and isolators related to the above scope of work to the extent shown on contract documents…….. $:_____

p. Provide all associated ductwork, duct accessories, insulation, related to the above scope of work to the extent shown on contract documents……... $:_____

q. Provide all associated steam piping, chilled glycol piping, hot glycol piping, accessories, insulation, related to the above scope of work to the extent shown on contract documents……..…… $:_____

r. Provide all associated controls, accessories, insulation, related to the above scope of work to the extent shown on contract documents……..…. $:_____

s. Provide new glycol hot water reheat coils, piping and controls……. $:_____

t. Provide and perform Testing and Balancing and provide certified report by an independent agency as specified in the specifications. ……..…… $:_____

u Provide commissioning of HVAC System by an independent commissioning agency engaged by this Contractor……. $:_____

Mechanical Work Subtotal
(Sum of para. a through para. u above):…… $:_____

III. ELECTRICAL WORK

a. Disconnect all power to the HVAC system being removed under the contract along with associated wiring and circuit breakers feeding the equipment to the extent shown on contract documents.…...……. $:_____

b. Provide new circuit breakers along with new conduit, wiring and accessories for the new HVAC equipment to the extent shown on contract documents.…….…... $:_____

c. Disconnect and remove existing smoke detectors in the ductwork and replace with new duct detectors and connect to the existing building fire alarm system to the extent shown on contract documents…….…. $:_____

d. Disconnect existing fans, dampers and controls from the smoke purge panel and reconnect new fans, dampers and controls to the existing smoke purge panel to the extent shown on contract documents……..... $:_____

e. Disconnect and remove existing light fixture for use as temporary access to ceiling plenum space...……. $:_____

f. **Provide Seventy (70) security type LED lighting fixture to replace existing lighting fixtures as per contract document requirements……** **$:_____**

Electrical Work Subtotal
Sum of para. a through para. f above…….. $:_____

IV. SUB TOTAL LUMP SUM BID PRICE: (ITEMS I+II+III ABOVE) $_____

UNIT PRICES WORK SHEET (These Items are estimates provided by DOC for Bid Purposes and shall be used at DOC's discretion as determined by DOC)

A. Contractor shall provide unit price of work items by filling in all the blanks indicated below. The unit prices shall be used by the Department of Correction to order **any amount of** additional quantities of the items included in the "unit price bid work sheet" when required beyond the base scope of work. Unit Prices shall include all costs for labor, materials and incidentals necessary to complete the work

V. GENERAL CONSTRUCTION WORK

a. Replacement ceilings to the extent necessary and restore to original conditions after work is performed by other trades contract scope related work presented in full elsewhere in the contract documents.

Quantity **50** SF x $_____ Per SF = $:_____

b. Provide new 2'x2' access doors in ceilings to the extent necessary to provide access to serviceable and access required components of other trades contract scope related work presented in full elsewhere in the contract documents.
Quantity Two (2) Each x $_____Per Access Door = $:_____

c. Patch, repair, and paint walls, ceilings, and floors as required for previous removals and as needed after new installations.
Quantity **50** SF x $_____Per SF = $:_____

d. Provide fire stopping/smoke seals in penetrations after new conduits and sleeves installation.

1. 1.25"RGS Conduit Up to 20 LF x $_____Per LF = $:_____

$:_____

2. 1.0" RGS Conduit Up to **20** LF x $_____Per LF = $:_____

3. 3/4" RGS Conduit Up to **20** LF x $_____Per LF =

General Construction Work Subtotal (a+b+c+d): **$:_____**

VI. HVAC WORK

a. Air outlets as per contract document requirement.
Quantity:

1. 12"x12" Up to **5** Each x $_____Each = $:_____
2. 10"x10" Up to **5** Each x $_____Each = $:_____
3. 8"x8" Up to **5** Each x $_____Each = $:_____

b. Air inlets as per contract document requirement.
Quantity:

1. 24"x10" Up to **2** Each x $_____Each = $:_____
2. 18"x16" Up to **2** Each x $_____Each = $:_____
3. 12"x12" Up to **2** Each x $_____Each = $:_____
4. 36"x12" Up to **2** Each x $_____Each = $:_____

c. Fire/Smoke Dampers as per contract document requirement.
Quantity:

1. 36"x12" Up to **2** Each x $_____Each = $:_____
2. 30"x16" Up to **2** Each x $_____Each = $:_____

d. Security Grilles as per contract document requirement.
Quantity:

1. 36"x12" Up to **2** Each x $_____Each = $:_____
2. 30"x16" Up to **2** Each x $_____Each = $:_____

e. Provide Sheetmetal ductwork per specifications with insulation per specification,
Up to **50** Lbs x $_____ Per Lb = $:_____

f. Chilled Water Piping with Insulation per specifications:
Quantity:

1. 6" Up to **20** LF x $_____Per LF = $:_____
2. 4" Up to **20** LF x $_____Per LF = $:_____

3. 3" Up to **20** LF x $_____Per LF = $:_____

4. 2" Up to **20** LF x $_____Per LF = $:_____

5. 1.5" Up to **20** LF x $_____Per LF = $:_____

6. 1.25" Up to **20** LF x $_____Per LF = $:_____

7. 1" Up to **20** LF x $_____Per LF = $:_____

g. Hot glycol Piping with Insulation per specifications:
Quantity:

1. 2" Up to **20** LF x $_____Per LF = $:_____

2. 1.5" Up to **20** LF x $_____Per LF = $:_____

3. 1.25" Up to **20** LF x $_____Per LF = $:_____

4. 1" Up to **20** LF x $_____Per LF = $:_____

h. Steam Supply Piping with Insulation per specifications:
Quantity:

1. 6" Up to **20** LF x $_____Per LF = $:_____

2. 4" Up to **20** LF x $_____Per LF = $:_____

3. 3" Up to **20** LF x $_____Per LF = $:_____

4. 2" Up to **20** LF x $_____Per LF = $:_____

i. Steam Return Piping with Insulation per specifications:
Quantity:

1. 4" Up to **20** LF x $_____Per LF = $:_____

2. 3" Up to **20** LF x $_____Per LF = $:_____

3. 2" Up to **20** LF x $_____Per LF = $:_____

4. 1.5" Up to **20** LF x $_____Per LF = $:_____

5. 1.25" Up to **20** LF x $_____Per LF = $:_____

6. 1" Up to **20** LF x $_____Per LF = $:_____

j. Gate Valve with Insulation per specifications:
Quantity:
6" Up to **2** Each x $_____Each =

1. 4" Up to **2** EACH x $_____ Each = $:_____

2. 3" Up to **2** EACH x $_____ Each = $:_____

k. Ball Valve with Insulation per specifications:
Quantity:

1. 2.5" Up to **2** EACH x $_____ Each = $:_____
2. 2" Up to **2** EACH x $_____ EACH = $:_____
3. 1.5" Up to **2** EACH x $_____ EACH = $:_____
4. 1.25" Up to **2** EACH x $_____ EACH = $:_____
5. 1" Up to **2** EACH x $_____ EACH = $:_____

l. Globe/Plug Valve with Insulation per specifications:
Quantity:

1. 6" Up to **2** Each x $_____Each = $:_____
2. 4" Up to **2** EACH x $_____ Each = $:_____
3. 3" Up to **2** EACH x $_____ Each = $:_____

m. Control Valve with Insulation per specifications:
Quantity:

1. 6" Up to **2** Each x $_____Each = $:_____
2. 4" Up to **2** EACH x $_____ Each = $:_____
3. 3" Up to **2** EACH x $_____ Each = $:_____
4. 2.5" Up to **2** EACH x $_____ Each = $:_____
5. 2" Up to **2** EACH x $_____ EACH = $:_____
6. 1.5" Up to **2** EACH x $_____ EACH = $:_____
7. 1.25" Up to **2** EACH x $_____ EACH = $:_____
8. 1" Up to **2** EACH x $_____ EACH = $:_____

n. Strainer with Insulation per specifications:
Quantity:

1. 6" Up to **2** Each x $_____Each = $:_____
2. 4" Up to **2** EACH x $_____ Each = $:_____
3. 3" Up to **2** EACH x $_____ Each = $:_____
4. 2.5" Up to **2** EACH x $_____ Each = $:_____
5. 2" Up to **2** EACH x $_____ EACH = $:_____
6. 1.5" Up to **2** EACH x $_____ EACH = $:_____

1.25" Up to **2** EACH x $_____ EACH = $:_____
1" Up to **2** EACH x $_____ EACH = $:_____

o. F&T Trap with Insulation per specifications:
Quantity:

1. 3" Up to **2** EACH x $_____ Each = $:_____
2. 2.5" Up to **2** EACH x $_____ Each = $:_____
3. 2" Up to **2** EACH x $_____ EACH = $:_____
4. 1.5" Up to **2** EACH x $_____ EACH = $:_____
5. 1.25" Up to **2** EACH x $_____ EACH = $:_____
6. 1" Up to **2** EACH x $_____ EACH = $:_____

p. Thermostatic Trap with Insulation per specifications:
Quantity:

1. 1.25" Up to **2** EACH x $_____ EACH = $:_____
2. 1" Up to **2** EACH x $_____ EACH = $:_____
3. .75" Up to **2** EACH x $_____ EACH = $:_____

HVAC Work Subtotal (Sum of para. a through para. p above):……..... $:_____

VII. ELECTRICAL WORK

a. Provide core drills in floors, walls, and ceilings roofs as required for the electrical trade related work as presented in full elsewhere in the contract documents.
Quantity:
1. 1.25"RGS Conduit Up to **20** LF x $____Per LF = $:_____
2. 1.0"RGS Conduit Up to **20** LF x $_____Per LF = $:_____
3. 3/4" RGS Conduit Up to 20 LF x $_____Per LF = $:_____

b. Provide power wiring, conduits, and junction boxes, pull boxes, supports for electrical trade work as presented in full elsewhere in the contract documents.
Quantity (Qty):
1. 1.25"RGS Conduit Up to **20** LF x $_____Per LF = $:_____
2. 1.0" RGS Conduit Up to **20** LF x $_____Per LF = $:_____
3. 0.75" RGS Conduit Up to **20** LF x $_____Per LF = $:_____

THHN Stranded Wires Per Specification:
1. #10 THHN Up to **20** LF x $_____Per LF = $:_____
2. #12 THHN Up to **20** LF x $_____Per LF = $:_____
3. #14 THHN Up to **20** LF x $_____Per LF = $:_____

c. Provide **security type LED** lighting fixture to replace existing lighting fixtures as per contract document requirements:
1. Twenty (**20**) x $_____Per Fixture = $:_____

d. Provide Five (5) Line voltage switch $:_____

Electrical Work Subtotal (a+b+c+d above):……. $:_____

VIII. Sub Total Unit Price Work Bid Price: $:_____
(Items V+VI+VII Above)

IX. ADD ALTERNATE 1

a. **Provide cost for provision of security ceiling access doors for all areas as shown in contract drawings under addendum no. 2……..**

$:_____

X. Total Add Alternate No. 1:

$:_____

XI. ADD ALTERNATE 2

a. **Provide cost for installation of Inflatable dampers, associated components, power and all required controls tie in work ……..……..**

$:_____

XII. Total Add Alternate No. 2:

$:_____

XIII. ADD ALTERNATE 3

a. **Provide temporary 15 Ton air Cooled AC /Heating Unit and all required temporary connections for AHU-5. 6 7 related work for 18 months……..** **$:_____**

b. **Provide temporary 50 Ton Air Cooled AC/Heating Units, and all required temporary connections for AHU-1,2,3,4 related work for 18 months…….** **$:_____**

XIV. Total Add Alternate No. 3 (a+b above): **$:_____**

XV. TOTAL BID AMOUNT: (IV+VIII+X+XII+XIV Above) **$:_____**

TOTAL BID AMOUNT IN WORDS:

_____

NOTES:

(1) For further explanations of the above cost, see the appropriate sections of the Contract document.

(2) The respondent vendor is not to alter the bid format from that required herein. Any such alterations of the bid format will result in a determination of the respondent being "unresponsive". Inclusion of disclaimers which contradict the requirements of this Invitation to Bid will also result in a determination of the respondent being "unresponsive".

(3) The contractor will be required to submit list of labor laws 220 titles assigned to be in this job, proof of payment of labor law 220 rates and benefits within five (5) business days. Failure to provide this information within five (5) days will result in a determination of the respondent being unresponsive.

Name Of Respondent Company: _____.

Name/Title of Officer Responding On Behalf Of Respondent:

_____.
(Printed) Signature Of Above Respondent Officer:

Date:_____.

END OF BID WORKSHEET

REVISED SECTIONS IN THE SCOPE OF WORK

SECTION 083050 – **SECURITY ACCESS DOORS**

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all access doors and frames located in walls and in ceilings, complete with accessories, as indicated on the Drawings and as specified herein.

1.02 REFERENCES

A. References and industry standards listed in this section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. New York City Building Code

1.03 SUBMITTALS

A. Product Data

For each type of door and frame indicated. Include catalogue cuts, construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. Shop Drawings

Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation. Indicate locations of fire rated doors on schedule.

C. Certification and listing by an Approved Agency

In accordance with NYC Dept. of Buildings rules, indicating that the materials and assemblies as regulated by the NYC Building Code is acceptable for the intended use. When test methods are stipulated in the NYC Building Code, the tests utilized shall be stated in the Certification. Prior MEA and BSA approvals are acceptable for materials conforming to current Code requirements.

Fire rated access doors are regulated assemblies.

D. Keys

Furnish 6 keys for all locks

1.04 QUALITY ASSURANCE

A. Fire rated Doors

1. Fire Rated Access Doors for Walls: Complete assemblies meeting NYC Building Code requirements for 1½ hour rating for a 2-hour wall. Each assembly shall be labeled by an agency approved pursuant to rules of the NYC Dept. of Buildings. The label shall meet Building Code requirements and shall be permanently affixed at the factory.

2. Fire Rated Access Doors for Ceilings: Complete assemblies complying with NYC Building Code requirements for one-hour combustible and one-hour non-combustible floor/ceiling systems. Each assembly shall be labeled by an agency approved pursuant to rules of the NYC Dept. of Buildings. The label shall meet Building Code requirements and shall be permanently affixed at the factory.

1.05 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle access doors and frames as recommended by the Manufacturer, to protect from damage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Karp Associates, Inc., Maspeth, NY 11378

B. Milcor, Inc., Lima, OH 45804

C. **William Brothers**

2.02 **HIGH SECURITY ACCESS DOORS**

A. **Access Doors: William Brothers make model WB HG SEC 1100 Series or Karp DSB 123DC or approved equal High Security Access Door**

1. Door: 10 gauge steel.

2. Frame: 2 inch x 2 inch x 3/16 inch angle.

3. Hinges: Heavy-duty detention butt hinges welded to surround and door. Opens 180 degrees. Minimum of 2 hinges per door. Maximum of 4 hinges per door for larger doors.

4. Anchors: Heavy steel, welded to frame.

5. Lock: Heavy Detention Lock.

6. Finish: Electrostatically-applied, baked grey enamel coat over rust-inhibiting phosphate treated steel.

2.03 FIRE RATED ACCESS DOORS FOR WALLS

A. Frames

Minimum 10 gage steel, with integral exposed flange not less than 1" wide around the perimeter.

1. Anchorage: Predrilled holes in frame for anchoring with fasteners.

B. Flush Type Door Panel

Minimum 10 gage steel double wall construction with insulation, equipped with automatic closer and inside release mechanism.

1. Hinge: Continuous hinge set to open to approximately 175º.

2. Finish: Factory-applied baked enamel primer over phosphate treated steel.

C. Automatic Latches

Direct action Knurled knob or turn ring, or key operated; sufficient number to hold door panel in flush, smooth plane when closed.

1. Heavy Detention Lock.

2.04 KEYING FOR NON-FIRE RATED ACCESS DOORS AND FIRE RATED ACCESS DOORS

A. Key all locks and latches alike. Furnish 6 keys total.

2.05 **(DELETED)**

2.06 FABRICATION AND MANUFACTURE

A. Manufacture access door assemblies as integral units complete with all parts and ready for installation. Fabricate units of continuous welded steel construction unless otherwise indicated or specified. Grind welds smooth and flush with adjacent surfaces. Attachment devices shall be of size and type required to secure access doors to types of supports indicated on the Drawings.

1. Allowable Size Variations: Manufacturer's standard size units that vary slightly from the sizes indicated may be acceptable, subject to the approval of the Owner.

2.07 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the access doors in accordance with the manufacturer's printed installation instructions, except as shown or specified otherwise.

B. Coordinate access door installation with installation of supporting construction.

C. Set units accurately in position and securely attach to support with face panel plumb or level in relation to adjoining finish surface.

3.02 ADJUSTMENT

A. Adjust hardware and doors for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.03 LOCATION

A. Provide non-fire rated access doors in non-fire rated construction and fire rated access doors in fire rated construction.

END OF SECTION 08 30 50

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:		
Catalog cuts, Construction Details, Finishes, Fire Ratings		
Shop Drawings:		
1. Details of construction		
2. Schedule		
Certification and listing by an approved agency for fire-rated doors:		
Keys:		
Furnish 6 keys for all locks		

* * *

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections: None

1.2 COMMISSIONING SERVICES

A. This project will have selected building systems commissioned. The equipment and systems to be commissioned are specified in following sections. The commissioning process, which the Contractor is responsible to execute, is defined in Part 7. The commissioning process will be directed by a Commissioning Authority whose services will be provided by the Contractor. The commissioning will be approved by the Owner's Construction Manager.

B. Abbreviations. The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 17100, Part 1.6.

A/E-	Architect and design engineers	FT-	Functional performance test
CA-	Commissioning Authority	GC-	General or Mechanical or Prime (prime)
CC-	Controls contractor	MC-	Mechanical contractor
OWNER-	Construction Manager (the Owner's Representative)	PC-	Prefunctional checklist
Cx-	Commissioning	PM-	Project manager (the Owner)
Cx Plan-	Commissioning Plan document	Subs-	Subcontractors to General
EC-	Electrical contractor	TAB-	Test and balance contractor

1.3 ADMINISTRATIVE / SUPERVISORY PERSONNEL

A. Commissioning Authority: The Contractor will hire the services of a qualified Commissioning Authority. The responsibilities of the Commissioning Authority are defined in Part 5 through 7 below. The Commissioning Authority will report directly to the Owner's Construction Manager.

1. Commissioning Authority Qualifications: The Commissioning Authority will satisfy the following requirements:

a. Have extensive experience in the operation and troubleshooting of HVAC systems, energy management control systems and lighting controls systems. Extensive field experience is required. A minimum of 5 full years in this type of work is required.

b. Knowledgeable in test and balance of both air and water systems.

c. Direct experience in monitoring and analyzing system operation using energy management control system trending or stand-alone datal ogging equipment.

d. Excellent verbal and written communication skills, highly organized and able to work with both management and trade contractors.

e. A bachelors degree in Mechanical Engineering is highly preferred and P.E. certification is desired, however, other technical training and past commissioning and field experience will be considered.

f. The Commissioning Authority requirements cannot be fulfilled by the combined expertise of a company, but must be part of the skill and experience set of the one individual who will be the designated Commissioning Authority, unless specifically noted above.

g. The Commissioning Authority will be an independent contractor and not an employee of the General or Mechanical or Prime or any other subcontractor on this project, including the A/E.

h. The Commissioning Authority shall have been the prime commissioning agent for commissioning at least 5 facilities of 20,000 sf and similar complexity in system type in the last 5 years.

i. The Commissioning Authority will provide a detailed description of at least three commissioning projects completed recently with their personal involvement, the names and telephone numbers of the Owner's project manager and the General or Mechanical or Prime's site superintendent.

2. The Contractor will submit, the CA's resume and qualifications to the owner for approval. The Owner reserves the right to require the Contractor to submit another party for the position, in the event the first party submitted is considered unqualified for the project. Final approval will reside with the owner.

B. Test and Balance Contractor (TAB) Qualifications. The Contractor will provide the services of a qualified test and balance contractor, approved by the Owner, as specified in Section 15990.

C. Controls Contractor and Lead Technician Qualifications. The Control contractor and the lead technician shall be approved by the Owner as specified in Section 15950.

1.4 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

A. Normal Submittals.

1. **The Commissioning Authority will receive a copy of the normal submittals for equipment to be commissioned.**

2. **The Commissioning Authority will review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.**

B. Data for Commissioning.

1. **The Contractor will receive a written request from the Commissioning Authority requesting specific information needed about each piece of commissioned equipment or system.**

2. **Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.**

3. **The Commissioning Authority may request further documentation necessary for the commissioning process.**

4. **This data request may be made prior to normal submittals.**

5. **Much of this information is contained in the regular O&M manual submittals normally submitted in the project. Typically, this information is required prior to the regular formal O&M manual submittals.**

C. Contractor's responsibility for deviations in submittals from requirements of the Contract Documents is not relieved by the Commissioning Authority's review.

1.5 COMMISSIONING CLOSE-OUT

A. The commissioning of Part 5 through 7 below must be complete, except for functional testing and controls training, prior to Substantial Completion, unless approved in writing by the Owner.

1.6 PREREQUISITES TO FUNCTIONAL COMPLETION

A. All TAB work and the commissioning of Part 5 through 7 below must be complete prior to Functional Completion, unless approved in writing by the Owner's Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:

1. **Completed and signed start-up and prefunctional checklist documentation**
2. **Requested trend log data**
3. **Submission of final approved TAB report**
4. **Completion of all functional testing**
5. **Required training of Owner personnel completed and approved**
6. **Submission of the approved O&M manuals**
7. **All identified deficiencies have been corrected or are approved by the Owner to be excepted from this milestone**

B. The Owner's Project Manager will determine the date of Functional Completion after reviewing the Commissioning Agent's recommendation for Functional Completion.

1.7 OPERATIONS AND MAINTENANCE DATA

A. The commissioning process requires detailed O&M documentation. Division 1 is alerted to the O&M documentation requirements identified in this section, and other referenced sections.

B. The commissioning agent's contribution to the O&M manuals is found in Part 5 through 7 below.

C. The CONTRACTOR shall compile O&M manuals for every piece of equipment and building operating or electrical system with the following format.

1. **Quantity: 8**
2. **Format: 8 ½" x 11" loose leaf binders. Each binder shall be clearly labeled on the spine. Use as many as required. Do not overload binders. There shall be dividers with permanently marked tabs of card stock separating each section and sub section. Tab labels shall not be handwritten.**
3. **There shall be a title page and table of contents in the front of each binder for each binder's contents. In each binder, there shall be a main tab for each specification section. Behind the section number tab there shall be the equipment ID tag sub-tab for each piece of major equipment (or group, if small or numerous). These sub-tabs shall be similar to the specification number tabs but of a different color. Behind each equipment name tab shall be the following sections, in the given order, divided by a double weight colored sheet labeled with the title of the section.**

   a. **Contractor. The first page behind the equipment tab shall contain the name, address and telephone number of the manufacturer and installing**

contractor and the 24-hour number for emergency service for all equipment in this section, identified by equipment.

b. Submittal and Product Data. This section shall include all approved submittal data, cut sheets and appropriate shop drawings. If submittal was not required for approval, descriptive product data shall be included.

c. Operation and Maintenance Instructions. These shall be the written manufacturer's data with the model and features of this installation clearly marked and edited to omit reference to products or data not applicable to this installation. This section shall include data on the following:

1. Installation, startup and break-in instructions

2. All starting, normal shutdown, emergency shutdown, manual operation, seasonal changeover and normal operating procedures and data, including any special limitations.

3. O&M and installation instructions that were shipped with the unit.

4. Preventative maintenance and service procedures and schedules.

5. Troubleshooting procedures.

6. A parts list, edited to omit reference to items which do not apply to this installation.

7. A list of any special tools required to service or maintain the equipment.

8. Performance data, ratings and curves.

9. Warranty, which clearly lists conditions to be maintained to keep warranty in effect and conditions that would affect the validity of the warranty.

10. Any service contracts issued.

d. Supplemental Data. Prepare written text and/or special drawings to provide necessary information, where manufacturer's standard printed data is not available and information is necessary for a proper understanding and operation and maintenance of equipment or systems, or where it is necessary to provide additional information to supplement data included in the manual or project documents.

e. Control Drawings. Include the control drawings for the piece of equipment and its components, including the sequence of operation. This section will be provided by the controls contractor. The drawings will be repeated in the control contractor's O&M submittals.

f. Specifications. This section is comprised of the component or system specification section copied and inserted complete with all addenda.

g. System Description. This section shall include the individual equipment portion of the overall system Design Documentation Narrative, if available. It will contain simplified professionally drawn single line system diagrams on 8 ½ x 11 or 11 x 17 sheets, if the system's control drawing is not adequate.

h. Preventive Maintenance Instructions. This section shall include condensed typewritten excerpts from the manufacturer's written instructions for weekly, monthly, quarterly, annual, etc. maintenance. This summary shall be prepared by the HVAC mechanical contractor with help from the equipment supplier. It shall be prepared for all items listed under condensed operating instructions (below), plus package, window or through the wall AC units and electric unitary heating equipment.

1.8 AUTOMATIC CONTROLS MANUFACTURER AND LEAD INSTALLING TECHNICIAN

A. Manufacturer and Vendor. Within 14 days after notice to proceed, the controls contractor shall submit to the owner a certified statement, signed by an officer of the manufacturer and vendor which includes the following: name and address of company; name, address and telephone number of the local representative; a general sales bulletin covering the full line of products manufactured; a certification that the products proposed for this contract have been in continuous and successful use for at least 1 year, not including beta testing, and general information covering the functions and characteristics of the systems proposed. In addition, provide a list of four projects which the vendor has installed that are similar in size and complexity to this contract, with the name and telephone number of the contracting officer and facility administrator, size of project, location and brief description and date of completion.

B. Lead Programmer (LP). The majority of the programming for this project will be completed by the lead programmer. The LP will personally review and approve all programming by others. Within 14 days after notice to proceed, the controls contractor shall submit the following regarding the LP: name; address; telephone number; certification of training on this system; list of two projects of similar size and complexity to this contract which were primarily programmed by the LP; and for each project the project name, location, description, cost, name and telephone number of the contracting officer and current facility administrator and date of completion. A replacement to the LP must be approved in writing by the Owner.

C. Lead Installation Technician (LIT). The automatic controls will be installed under the direct and continuous supervision of a lead technician authorized by the manufacturer. Within 14 days after notice to proceed, the controls contractor shall submit the following regarding the LIT: name; address; telephone number; certification of training on this system; list of two projects of similar size and complexity to this contract which were directly supervised by the LIT; and for each project the project name, location, description, cost, name and telephone number of the contracting officer and current facility administrator and date of completion. A replacement to the LIT must be approved in writing by the Owner.

D. Acceptance. A review of the qualifications and action upon the acceptance of the manufacturer and the LIT and LP will be completed by the Owner. If the manufacturer, the proposed product line or the qualifications of the LIT or LP are not in accordance with the Contract Documents or, in the opinion of the Owner, will not result in a satisfactory completed product, alternatives must be submitted for approval.

1.9 TREND LOGGING CAPABILITIES

A. The control system installed shall be capable of, and set up to readily trend data with the following minimum features.

1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC controller's point group.

2. Collection may be by either pre-defined time interval or upon a pre-defined change of value (COV).

3. Each DDC controller panel shall have a dedicated RAM-based buffer for trend data and shall be capable of storing at least 10,000 samples.

4. At least six columns of data can be viewed on the screen at once and can be graphed using a graphing program integral to the control system, with at least four parameters graphed against time on the same graph. The columnar format shall have time down the left column with columns of data to the right (one column for each parameter).

5. The system shall have the ability to graph real-time data of up to four points on the EMS at once, giving each point its own scale.

6. Without any special or difficult conversions, this data shall be able to be designated to be stored as an ASCII delimited file in the same columnar format for use in graphing with normal commercial spreadsheet software.

7. The trend log data is automatically downloaded at appropriate intervals onto the hard drive when space in the field cabinets becomes full, so that no data is lost. This is done without the user having to calculate the size of the trends and download frequency.

8. **Any limitations in the trending as to speed of sampling vs number of sampled points in a given trend, and the effect on actual sampling rate and simultaneousness of the sampling across parameters shall be clearly explained in writing. Programming and trending setup examples of all representative situations shall be provided.**

9. **The trends shall be capable of being set up to start sampling all trended points in a given trend or group of trends at the same exact time.**

10. **Specifications for standard trends shall be able to be set up by the user and be saved by a name and initiated by only recalling the name. The control contractor shall assist the operators in setting up at least six standard trends during training.**

11. **A key for the names and definitions of all point abbreviations (both physical and virtual) shall be provided.**

12. **The system shall have the ability to automatically accumulate and store run-time hours of digital input and output points and to count events (totalization and counting functions).**

13. **Ideal, but not required, shall be the capability to graph with the control system software, one or more points against another, rather than just against time.**

1.10 TEMPORARY PROGRAMMING AND TESTING TERMINAL

A. **If the permanent terminal and display is graphical for viewing values and setpoints, and the update time for the graphical display is considered by the CA to be too slow, the controls contractor shall provide and set up, during the entire functional testing process, a second input and output terminal with a text based format (in addition to the graphics-capable permanent terminal), which will significantly speed up the point readout update time. Both terminals will be simultaneously active.**

1.11 GLOBAL COMMAND CAPABILITY

A. **The system shall be capable of executing from the central control terminal, temporary or permanent global commands, such as a change in space temperature setpoint.**

1.12 COMMISSIONING AND MONITORING POINTS

A. **All control points of the central building automation system, required to automatically control the equipment specified in the Contract Documents and to execute all specified control sequences, shall be installed and be able to be monitored. To simplify TAB and commissioning of the systems and to provide better control during occupancy, all the points shall be provided as monitored points in the control system, even if they are part of equipment integral controls, or are not required in any control sequence or intermediate**

calculation. Some points may be measured values or output signals, while others may be calculated or virtual points.

1.13 TEST PORTS

A. The controls contractor shall provide test ports for handheld instrument readings near all piping system sensors in the primary system (not at the zone level).

1.14 GAGES

A. The controls contractor shall provide gages in the following locations, even if included as a sensor and monitored point in the control system:

1. **Pressure gages on both sides of all pumps greater than 1 hp.**

2. **Mercury thermometers in the return and supply of all primary thermal plant equipment (chillers, cooling towers, boilers, converters, etc.).**

1.15 TESTING, ADJUSTING AND BALANCING CONTRACTOR'S RESPONSIBILITIES

A. TAB will be responsible to carry out the commissioning requirements specified in Section 230593 and other sections referenced in Part 5 thru 7 below.

1.16 ADDITIONAL RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors are as follows (all references apply to commissioned equipment only):

Construction and Acceptance Phases

1. **Include and itemize the cost of commissioning in the contract price.**

2. **In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.**

3. **Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.**

4. **Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.**

5. **Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.**

a. **Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.**

b. **The Commissioning Agent may request further documentation necessary for the commissioning process.**

c. **This data request may be made prior to normal submittals.**

6. **Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.**

7. **Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.**

8. **Provide limited assistance to the CA in preparing the specific functional performance test procedures as specified in Part 5 through 7 below. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.**

9. **Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup. Refer to Part 5 through 7 below for further details on start-up plan preparation.**

10. **During the startup and initial checkout process, execute the mechanical-related portions of the prefunctional checklists for all commissioned equipment.**

11. **Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.**

12. **Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.**

13. **Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.**

14. **Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment in Part 5 through 7 below and 17100. Assist the CA in interpreting the monitoring data, as necessary.**

15. **Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, OWNER and A/E and retest the equipment.**

16. **Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.**

17. **During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).**

18. **Provide training of the Owner's operating staff using expert qualified personnel, as specified.**

19. **Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.**

Warranty Period

20. **Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.**

21. **Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.**

B. Mechanical Contractor. The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. **Provide startup for all HVAC equipment, except for the building automation control system.**

2. **Assist and cooperate with the TAB contractor and CA by:**

   a. **Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.**

   b. **Including cost of sheaves and belts that may be required by TAB.**

   c. **Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.**

   d. **Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.**

3. **Install a P/T plug at each water sensor which is an input point to the control system.**

4. **List and clearly identify on the as-built drawings the locations of all air-flow stations.**

5. **Prepare a preliminary schedule for Division 15 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.**

6. **Notify the OWNER or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the OWNER or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.**

C. Controls Contractor. The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. **Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:**

   a. **An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.**

   b. **All interactions and interlocks with other systems.**

   c. **Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.**

   d. **Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).**

   e. **Start-up sequences.**

   f. **Warm-up mode sequences.**

   g. **Normal operating mode sequences.**

   h. **Unoccupied mode sequences.**

   i. **Shutdown sequences.**

   j. **Capacity control sequences and equipment staging.**

k. Temperature and pressure control: setbacks, setups, resets, etc.

l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.

m. Effects of power or equipment failure with all standby component functions.

n. Sequences for all alarms and emergency shut downs.

o. Seasonal operational differences and recommendations.

p. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

q. Schedules, if known.

r. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

2. Control Drawings Submittal

a. The control drawings shall have a key to all abbreviations.

b. The control drawings shall contain graphic schematic depictions of the systems and each component.

c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

d. Provide a full points list with at least the following included for each point:

1) Controlled system

2) Point abbreviation

3) Point description

4) Display unit

5) Control point or setpoint (Yes / No)

6) Monitoring point (Yes / No)

7) **Intermediate point (Yes / No)**

8) **Calculated point (Yes / No)**

a. **Key:**

b. **Point Description: DB temp, airflow, etc.**

c. **Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)**

d. **Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).**

e. **Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.**

f. **Calculated Point: "Virtual" point generated from calculations of other point values.**

9) **The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.**

3. **An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.**

4. **Assist and cooperate with the TAB contractor in the following manner:**

a. **Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).**

b. **For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.**

c. **Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.**

5. **Assist and cooperate with the CA in the following manner:**

a. **Using a skilled technician who is familiar with this building, execute the functional testing of the controls system as specified for the**

controls contractor in following sections. Assist in the functional testing of all equipment specified in following Section. Provide two-way radios during the testing.

b. Execute all control system trend logs specified in following portions of the section.

6. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process in Part 5 through 7 below. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:

a. System name.

b. List of devices.

c. Step-by-step procedures for testing each controller after installation, including:

1) Process of verifying proper hardware and wiring installation.

2) Process of downloading programs to local controllers and verifying that they are addressed correctly.

3) Process of performing operational checks of each controlled component.

4) Plan and process for calibrating valve and damper actuators and all sensors.

5) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has "passed" and is operating within the contract parameters.

e. A description of the instrumentation required for testing.

f. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.

7. Provide a signed and dated certification to the CA and OWNER upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all

system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

8. **Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified in Section 15950.**

9. **List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).**

D. TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:

1. **Six weeks prior to starting TAB, submit to the OWNER the qualifications of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician on which was lead. The Owner will approve the site technician's qualifications for this project.**

2. **Submit the outline of the TAB plan and approach for each system and component to the CA, OWNER and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.**

3. **The submitted plan will include:**

   a. **Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.**

   b. **An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.**

   c. **All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.**

   d. **Discussion of what notations and markings will be made on the duct and piping drawings during the process.**

   e. **Final test report forms to be used.**

   f. **Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.**

g. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

h. Details of how total flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).

i. The identification and types of measurement instruments to be used and their most recent calibration date.

j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.

k. Confirmation that TAB understands the outside air ventilation criteria under all conditions.

l. Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).

m. Details of how building static and exhaust fan / relief damper capacity will be checked.

n. Proposed selection points for sound measurements and sound measurement methods.

o. Details of methods for making any specified coil or other system plant capacity measurements.

p. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.

q. Details regarding specified deferred or seasonal TAB work.

r. Details of any specified false loading of systems to complete TAB work.

s. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.

t. Details of any required interstitial cavity differential pressure measurements and calculations.

u. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

v. Plan for formal progress reports (scope and frequency).

w. Plan for formal deficiency reports (scope, frequency and distribution).

4. A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and OWNER at least twice a week.

5. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

6. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.

7. Provide the CA with any requested data, gathered, but not shown on the draft reports.

8. Provide a final TAB report for the CA with details, as in the draft.

9. Conduct functional performance tests and checks on the original TAB as specified for TAB in Part 5 through 7 below.

E. Mechanical Designer. Refer to Part 5 through 7 below for the responsibilities of the mechanical designer.

PART 2 –PRODUCTS

2.1 (NONE)

PART 3 -EXECUTION

3.1 SUBMITTALS

A. Division 15 shall provide submittal documentation relative to commissioning as required in this Section Part 1, Section 01300 and Part 5 through 7 below.

3.2 STARTUP

A. The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 17100. Division 15 has start-up responsibility and is required to complete systems and sub-systems so they

are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and OWNER. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.3 TAB

A. Refer to the TAB responsibilities in Part 1.2 above.

3.4 FUNCTIONAL PERFORMANCE TESTS

A. Refer to Part 5 through 7 below Part 1.4 for a list of systems to be commissioned and to Part 3.6 for a description of the process and to Part 5 through 7 below for specific details on the required functional performance tests.

3.5 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. Refer to Part 5 through 7 below Part 3.4 for specific details on non-conformance issues relating to prefunctional checklists and tests.

B. Refer to Part 5 through 7 below Part 3.7 for issues relating to functional performance tests.

3.6 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Division 15 shall compile and prepare documentation for all equipment and systems covered in Division 15 and deliver this documentation to the PRIME CONTRACTOR for inclusion in the O&M manuals, according to this section and Section 01730, prior to the training of owner personnel.

C. The CA shall receive a copy of the O&M manuals for review.

D. Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.

1. Three copies of the controls training manuals in a separate manual from the O&M manuals.

2. Operation and Maintenance Manuals containing:

a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions

shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.

b. Full as-built set of control drawings (refer to Submittal section above for details).

c. Full as-built sequence of operations for each piece of equipment.

d. Full points list. In addition to the updated points list required in the original submittals (Part 1 of this section), a listing of all rooms shall be provided with the following information for each room:

1) Floor
2) Room number
3) Room name
4) Air handler unit ID
5) Reference drawing number
6) Air terminal unit tag ID
7) Heating and/or cooling valve tag ID
8) Minimum cfm
9) Maximum cfm

e. Full print out of all schedules and set points after testing and acceptance of the system.

f. Full as-built print out of software program.

g. Electronic copy on disk of the entire program for this facility.

h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

j. Control equipment component submittals, parts lists, etc.

k. Warranty requirements.

l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

3. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:

a. Sequences of operation

b. Control drawings

c. Points lists

d. Controller / module data

e. Thermostats and timers

f. Sensors and DP switches

g. Valves and valve actuators

h. Dampers and damper actuators

i. Program setups (software program printouts)

4. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.

E. Special TAB Documentation Requirements. The TAB will compile and submit the following with other documentation that may be specified elsewhere in the Specifications.

1. Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.

2. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.

F. Review and Approvals. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Part 5 through 7 below, Part 3.8 for details.

3.7. TRAINING OF OWNER PERSONNEL

A. The PRIME CONTRACTOR shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Part 5 through 7 below for additional details.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment ~~or systems~~. Refer to Part 5 through 7 below for additional details.

C. Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:

1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Part 5 through 7 below.

2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers,

heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.

3. **Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.**

4. **During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.**

5. **The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.**

6. **The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.**

7. **The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.**

8. **Training shall include:**

    a. **Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.**

    b. **A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.**

    c. **Discussion of relevant health and safety issues and concerns.**

    d. **Discussion of warranties and guarantees.**

    e. **Common troubleshooting problems and solutions.**

    f. **Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.**

    g. **Discussion of any peculiarities of equipment installation or operation.**

    h. **The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1-1989R, 1996 is recommended.**

i. **Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.**

9. **Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.**

10. **The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.**

11. **Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.**

12. **Duration of Training. The mechanical contractor shall provide 8 hours of training on each piece of equipment listed on the drawing schedules.**

D. **Controls Contractor. The controls contractor shall have the following training responsibilities:**

1. **Provide the CA with a training plan four weeks before the planned training according to the outline described in Part 5 through 7 below.**

2. **The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.**

3. **Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays. Manuals will be approved by the CA. Copies of audiovisuals shall be delivered to the Owner.**

4. **The trainings will be tailored to the needs and skill-level of the trainees.**

5. **The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.**

6. **During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.**

7. **The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.**

8. There shall be three training sessions:

a. Training I. Control System. The first training shall consist of 8 hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

b. Training II. Building Systems. The second session shall be held on-site for a period of 8 hours of actual hands-on training after the completion of system commissioning. The session shall include instruction on:

1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

3) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.

4) Every screen shall be completely discussed, allowing time for questions.

5) Use of keypad or plug-in laptop computer at the zone level.

6) Use of remote access to the system via phone lines or networks.

7) Setting up and changing an air terminal unit controller.

8) Graphics generation

9) Point database entry and modifications

10) Understanding DDC field panel operating programming (when applicable)

c. Training III. The third training will be conducted on-site six months after occupancy and consist of 8 hours of training. The session will be structured

to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

E. TAB: The TAB contractor shall have the following training responsibilities:

1. TAB shall meet for 8 hours with facility staff after completion of TAB and instruct them on the following:

a. Go over the final TAB report, explaining the layout and meanings of each data type.

b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.

c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

e. Other salient information that may be useful for facility operations, relative to TAB.

3.8. DEFERRED TESTING

A. Refer to Part 5 through 7 below, Part 3.10 for requirements of deferred testing.

3.9 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described in Part 5 through 7 below and the filled out start-up, initial checkout and prefunctional checklists.

PART 4 - MECHANICAL TESTING REQUIREMENTS

4.1 INCLUDED SYSTEMS AND EQUIPMENT

A. The following is a list of the equipment and system test requirements included in this section:

1. Air handler system
2. Heating system
3. Building automation system
4. Chiller system
5. Exhaust fans
6.. Test and balance (TAB) work

4.2 DESCRIPTION

A. This section specifies the functional testing requirements for Division 15 systems and equipment. From these requirements, the Commissioning Authority (CA) shall develop

step-by-step procedures to be executed by the Subs or the Commissioning Authority. The general functional testing process, requirements and test method definitions are described in Part 5 through 7 below. The test requirements for each piece of equipment or system contain the following:

1. **The contractors responsible to execute the tests, under the direction of the CA.**
2. **A list of the integral components being tested.**
3. **Prefunctional checklists associated with the components.**
4. **Functions and modes to be tested.**
5. **Required conditions of the test for each mode.**
6. **Special procedures.**
7. **Required methods of testing.**
8. **Required monitoring.**
9. **Acceptance criteria.**
10. **Sampling strategies allowed.**

4.3 PREREQUISITES

A. The following applicable generic prerequisite checklist items are required to be listed on each written functional test form and be completed and checked off by CA prior to functional testing.

__ All related equipment has been started up and start-up reports and prefunctional checklists submitted and approved ready for functional testing:
__ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.

_____ _____
Controls Contractor Signature or Verbal Date

__ Piping system flushing complete and required report approved.
__ Water treatment system complete and operational.
__ Vibration control report approved (if required).
__ Test and balance (TAB) complete and approved for the hydronic system.
__ All A/E punchlist items for this equipment corrected.
__ These functional test procedures reviewed and approved by installing contractor.
__ Safeties and operating ranges reviewed by the CA.
__ Test requirements and sequences of operation attached.
__ Schedules and setpoints attached.
__ False loading equipment, system and procedures ready.
__ Crankcase heaters have been on long enough for immediate startup.
__ Sufficient clearance around equipment for servicing.

__ Record of all values for pre-test setpoints changed to accomodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).

__ Other miscellaneous checks of the prefunctinal checklist and start-up reports completed successfully.

4.4 MONITORING

A. Monitoring is a method of testing as a stand-alone method or to augment manual testing.

B. All points listed in the required monitoring section of the test requirements which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the CA using dataloggers. At the option of the CA, some control system monitoring may be replaced with datalogger monitoring. At the CA's request, the controls contractor shall trend up to 20% more points than listed herein at no extra charge.

C. Hard copies of monitored data must be in columnar format with time down the left column and at least 5 columns of point values on the same page.

D. Graphical output is desirable, and will be required for all output, if the system can produce it.

4.5 COMMISSIONING LISTING

4.5.1. AIR HANDLER UNITS (AHU)

A. Parties Responsible to Execute Functional Test

1. Controls contractor: operate the controls to activate the equipment as needed.

2. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested Prefunctional Checklist ID

1. AHU and components (fans, coils, valves, ducts, VFD) PC-_____

2. Heat recovery coil, humidifier or evaporative cooling sections PC-_____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are an addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both[3]	Required Seasonal Test[1]
General		

	Function / Mode	Test Method Manual, Monitoring, Either or Both[3]	Required Seasonal Test[1]
1.	Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unnoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:			
2.	Mixed & supply air, & reset temperature control functions.	Both	
3.	Economizer functions.	Both	Cooling
4.	SF, RF and exhaust fan interlocks.	Either	
5.	No CCV flow when there is HCV flow.	Both	
6.	CCV & HCV modulation & positive shutoff (no leak-thru).	Manual	
7.	Duct static pressure (SP) control.	Both	
8.	Return or exhaust fan tracking and building SP.	Monitoring	
9.	VFD (or inlet vanes) operation on SF and RF: modulation to minimum, control system PID, proportional band of speed vs controlling parameter, constancy of static pressure, verification of program settings, alarms, etc.	Both	[2]
10.	Damper interlocks and correct modulation in all modes, including smoke and fire dampers.	Manual	
11.	Temperature difference across HC & CC per specifications.	Manual	
12.	Verification of minimum OSA control through varying VAV box positions.	Either	[2]
13.	Heating and cooling coils freeze protection.	Manual	[2]
14.	Branch duct control damper control.	Manual	
15.	Night low limit, morning warmup cycle.	Either	
17.	Verify TAB reported SF cfm with control system reading.	Manual	[2]
18.	All alarms (low limits, high static, etc.).	Manual	
19.	Heating and cooling coil capacity test, optional.	Manual	Design
20.	Sensor and actuator calibration checks: on duct static pressure sensor on SAT, MAT, OSAT, OSA & RA damper and valve positions, SF cfm reading with TAB, and other random checks (EMS readout against hand-held calibrated instrument or observation must be within specified tolerances)	Manual	
21.	Verify schedules and setpoints to be reasonable and appropriate		

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

[2]Seasonal test not required if seasonal conditions can be adequately simulated.

[3]Refer to Special Procedures

E. Special Procedures (other equipment to test with, etc.; reference to function ID)

1. Reduced Testing for Smaller Units. For standard application AHU's less than 15 tons, the following modifications to the testing requirements apply: 1) either Manual or Monitoring will satisfy the verification requirement--where Both is listed, choose one.

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the CA using data loggers. Refer to the Monitoring section at the beginning of parts 5 thru 7 below for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each AHU being tested:					
RAT	5	5 days incl. weekend	Y	Y	1-3, 5
SAT	5	5 days incl. weekend	Y	Y	1-3, 5
CC LAT (optional)	5	5 days incl. weekend	Y	Y	1-3, 5
HC LAT (optional)	5	5 days incl. weekend	Y	Y	1-3, 5
MAT	5	5 days incl. weekend	Y	Y	1, 3
Indoor WB or enthalpy, if enthalpy economizer	5	5 days incl. weekend	Y	Y	1, 3
SF speed, if variable, else status	5	5 days incl. weekend	Y	Y	1, 5-9
RF speed, if variable, else status	5	5 days incl. weekend	Y	Y	1, 5-9
Duct SP	5	5 days incl. weekend	Y	Y	1, 7, 9
Building SP differential	5	5 days incl. weekend	Y	Y	8
OSAT	5	5 days incl. weekend	Y	Y	All
OSA-WB or enthalpy, if enthalpy economizer	5	5 days incl. weekend	Y	Y	1, 3
Indoor dry-bulb ___zones (expected to be most problematic)	5	5 days incl. weekend	Y	Y	All

Remarks:

CCV position (optional)
HCV position (optional)
SF cfm not required if not monitored
RF cfm not required if not monitored

G. Acceptance Criteria (referenced by function or mode ID)

1-21. For the conditions, sequences and modes tested, the AHU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. AHU with supporting systems shall be able to maintain the SA temperature within 1.0F either side of the deadband of the current setpoint without excessive hunting.

7. AHU and controls shall control the duct static pressure so that it does not drift more than an amount equal to 10% of the setpoint value either side of the deadband without excessive hunting.

H. Sampling Strategy for Identical Units

1. **All identical AHU's over 15 tons shall not have any sampling--test all units. However, 25% of the units may have monitoring be the verification method for modes listed with Monitoring or Both as testing methods, with no less than three units being fully tested per the above requirements.**
2. **All identical AHU's equal to or less than 15 tons shall be sampled: Randomly test at least 50% of each group of identical equipment (the 1st sample) per the above tests. In no case test less than three units in each group. If 20% of the units in the first sample fail the functional performance tests, test another the remaining 50%, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.**
3. **All units not included in the sampling testing and monitoring shall be fully monitored for the monitoring modes listed above in the monitoring section.**

END OF REQUIREMENTS FOR AHU TEST

4.5.2. HEATING SYSTEM

A. Parties Responsible to Execute Functional Test

1. **Controls contractor: operate the controls, as needed.**
2. **HVAC mechanical contractor or vendor: assist in testing sequences.**
3. **CA: to witness, direct and document testing.**

B. Integral Components or Related Equipment Being Tested — Prefunctional Checklist ID

1.	**Boiler**	**PC-____**
2.	**Primary HW supply pumps**	**PC-____**
3.	**Heating water piping system**	**PC-____**
4.	**Secondary HW supply pumps**	**PC-____**
5.	**VFD on secondary pumps**	**PC-____**

C. Prerequisites: The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test[1]
General		

	Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test[1]
1.	Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unnoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:			
2.	Primary Side. Lead/lag staging of heat exchangers, optimization, capacity modulation, and primary HW supply pumps.	Both	Heating
3.	Secondary Side. Secondary WH supply pump staging, bypass valve operation, if no VFD and HWT reset. VFD operation: modulation to minimum, control system PID, proportional band of speed vs controlling parameter, verification of program settings,, alarms, etc.	Both	Heating
4.	Check all alarms and safeties (high and low pressure and temperature, etc.), PRV and flow switch functions	Manual	
5.	Test each possible lead boiler as lead boiler, and each pump as lead pump. Test pump lockouts.	Manual	
6.	Flue gas analysis verification, optional	Manual	
7.	Efficiency and capacity tests, optional	Manual	Heating
8.	Verify heat exchangers inlet/outlet pressures with startup report and manufacturer's recommendations	Manual	
9.	Sensor and actuator calibration checks on: HWST, HWRT, pressure sensor controlling pump speed, mixing valve and other random checks (EMS readout against hand-held calibrated instrument must be within 0.5°F for temps. or within a tolerance equal to 10% of the pressure setpoint, with a test gage)	Manual	
10.	Constancy of differential pressure (pump control parameter)	Monitoring	Heating
11.	Verify schedules and setpoints to be reasonable and appropriate		

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

E. Special Procedures (other equipment to test with, etc.; reference to function ID)

1. False load boiler, if necessary.

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the CA using data loggers. Refer to the Monitoring section at the beginning of Part 5 through 7 below for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each boiler and pump:					
Boiler current or status	5	5 days incl. weekend	Y	Y	1-3

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
HWST	5	5 days incl. weekend	Y	Y	1, 3
HWRT	5	5 days incl. weekend	Y	Y	1, 3
OSAT-DB	5	5 days incl. weekend	Y	Y	1-3
HWS pump current or status	5	5 days incl. weekend	Y	Y	1, 2
HWS pump speed, if variable	5	5 days incl. weekend	Y	Y	1, 3
HWS pump flow rate, if in EMS	5	5 days incl. weekend	Y	Y	1, 3
HWS pump speed controlling parameter value	5	5 days incl. weekend	Y	Y	1, 3, 10

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1-11. For the conditions, sequences and modes tested, the boilers, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. Boiler shall maintain the supply water set point to within +/- 1.0F of set point dead band without excessive hunting.

9.-10. Pumping system and controls shall maintain the current desired pressure set point to within an amount equal to 10% of the set point value either side of the dead band without excessive hunting.

H. Sampling Strategy for Identical Units

1. No sampling, test all.

END OF REQUIREMENTS FOR HEATING SYSTEM TEST

4.5.3. BUILDING AUTOMATION SYSTEM (BAS)

A. Parties Responsible to Execute Functional Test

1. Controls contractor: operate the controls to activate the equipment.

2. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested Prefunctional Checklist ID

1. Building Automation System PC-_____

2. All prefunctional checklists of controlled equipment ---

D. Prerequisites The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

E. A significant part of the BAS functional testing requirements is the successful completion of the functional tests of equipment the BAS controls or interlocks with.

Uncompleted equipment functional tests or outstanding deficiencies in those tests lend the required BAS functional testing incomplete.

F. Integral or stand-alone controls are functionally tested with the equipment they are attached to, including any interlocks with other equipment or systems and thus are not covered under the BAS testing requirements, except for any integrated functions or interlocks listed below.

G. In addition to the controlled equipment testing, the following tests are required for the BAS, where features have been specified. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in the specifications.

Function / Mode	Test Method Manual (demonstration), Monitoring, Either or Both
MISC. FUNCTIONS	
1. All specified functions and features are set up, debugged and fully operable	**Verbal discussion of features**
2. Power failure and battery backup and power-up restart functions	**Demonstration**
3. Specified trending and graphing features demonstration	**See equipment trends**
4. Global commands features	**Demonstration**
5. Security and access codes	**Demonstration**
6. Occupant over-rides (manual, telephone, key, keypad, etc.)	**Demonstration**
7. O&M schedules and alarms	**Demonstration**
8. Scheduling features fully functional and setup, including holidays	**Observation in terminal screens or printouts**
9. Date and time setting in central computer and verify field panels read the same time	**Demonstration**
10. Included features not specified to be setup are installed (list)	**Demonstration**
11. Occupancy sensors and controls	**Demonstration**
12. Demonstrate functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad	**Demonstration of 100% of panels and 10% of ports**
13. All graphic screens and value readouts completed	**Demonstration**
14. Setpoint changing features and functions	**Done during equipment testing**
15. Communications to remote sites	**Demonstration**
16. Sensor calibrations	**Sampled during equipment tests**
17. "After hours" use tracking and billing	
18. Final as-builts or redlines (per spec) control drawings, final points list, program code, setpoints, schedules, warranties, etc. per specs, submitted for O&Ms.	**Observation**
19. Verify that points that are monitored only, having no control function, are checked for proper reporting to BAS.	**Observation**
INTEGRATED TESTS	
20. Fire alarm interlocks and response	**Demonstration**
21. Duty cycling (if specified)	**Monitoring**
22. Demand limiting (including over-ride of limiting)	**Monitoring**

	Function / Mode	Test Method Manual (demonstration), Monitoring, Either or Both
23.	Sequential staging ON of equipment	Either
24.	Optimum start-stop functions	Monitoring
25.	All control strategies and sequences not tested during controlled equipment testing	Either
26.	Other integrated tests specified in the contract documents	
27.	Security system interlocks	Demonstration
28.	Fire protection and suppression systems	Demonstration

H. Special Procedures (other equipment to test with, etc.; reference to function ID)
None

I. Additional Required Monitoring

1. Besides the trending and monitoring required with the functional testing of equipment, all points listed below which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the CA using dataloggers. Refer to the Monitoring section at the beginning of Part 5 through 7 below for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
Misc. equipment current or status for duty cycling and demand limiting	5	5 days incl. weekend	Y	Y	21-22
Equipment or building kW or current for demand limiting	5	5 days incl. weekend	Y	Y	21-22
Optimum start/stop equip.	5	5 days incl. weekend	Y	Y	24

Remarks:

J. Acceptance Criteria (referenced by function or mode ID)

1. All For the conditions, sequences and modes tested, the BAS, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

K. Sampling Strategy for Identical Units

1. Sample 10% of the field panels for procedure 9, and 10% of the local ports for procedure 12. If 10% fail, test another 10%. If 10% of those fail, test all remaining units at the contractor's expense.

END OF REQUIREMENTS FOR BAS TEST

4.5.4. CHILLER

A. Parties Responsible to Execute Functional Test

1. Controls contractor: operate the controls as needed.

2. HVAC mechanical contractor or vendor: assist in testing sequences as needed.

3. CA: to witness, direct and document testing.

B. Prerequisites The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

C. Integral Components or Related Equipment Being Tested Prefunctional Checklist ID

1. Chiller PC-_____
2. Primary CHW supply pumps PC-_____
3. Chilled water piping system PC-_____
4. Secondary CHW supply pumps PC-_____
5. VFD on secondary pumps PC-_____
6. Cooling tower PC-_____

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are an addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test[1]
General **1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. A full cycle from no load to full load and then to no load and compressors off shall be demonstrated.**	**Manual**	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Primary Side. Lead/lag staging of chillers, optimization, capacity modulation (loading and unloading), heat reclaim, and primary CHW supply pumps, all relating to maintaining CDW and CHW temperatures.	**Both**	**Cooling**
3. Secondary Side. Bypass valve operation, if no VFD and CHWT reset. VFD operation: modulation to minimum, control system PID, proportional band of speed vs controlling parameter, alarms, verification of program settings, etc.	**Both**	**Cooling**
4. All alarms: high and low pressure, low oil, etc.	**Manual**	
5. Test each possible lead chiller as lead chiller, and each pump as lead pump, including standby pumps.	**Manual**	
6. kW/ton and APLV efficiency test, optional	**Manual**	**Cooling**

	Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test[1]
7.	Capacity test, optional	Manual	Cooling Design
8.	Sensor and actuator calibration checks on: ECDWT, CHWST, pressure sensor controlling pump speed, 3-way valve, and other random checks (EMS readout against handheld calibrated instrument must be within 0.5°F for temps. or within a tolerance equal to 10% of the pressure setpoint, with a test gage)	Manual	
9.	Verify schedules and setpoints to be reasonable and appropriate		

[1]Cooling season, Heating season or Both. "Design" means within 5°F of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

E. Special Procedures (other equipment with which to test, etc.; reference to function ID)

1. Test in automatic mode.
2. False load chiller, if necessary.

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the CA using dataloggers. Refer to the Monitoring section at the beginning of Part 5 through 7 below for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each chiller and pump:					
Chiller current	5	5 days incl. weekend	Y	Y	1-3
ECDWT	5	5 days incl. weekend	Y	Y	1-3
LCDWT	5	5 days incl. weekend	Y	Y	1-3
CDW pump current or status	5	5 days incl. weekend	Y	Y	1-3
CHWST	5	5 days incl. weekend	Y	Y	1, 3
CHWRT	5	5 days incl. weekend	Y	Y	1, 3
OSAT-DB	5	5 days incl. weekend	Y	Y	1-3
CHWS pump current or status	5	5 days incl. weekend	Y	Y	1, 2
CHWS pump speed, if variable	5	5 days incl. weekend	Y	Y	1, 3
CHWS pump flow rate	5	5 days incl. weekend	Y	Y	1, 3
CHWS pump speed controlling parameter value	5	5 days incl. weekend	Y	Y	1, 3

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1-9. For the conditions, sequences and modes tested, the chillers, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. Chiller shall maintain the chilled water supply setpoint to within +/- 1.0F of setpoint deadband without excessive hunting.

9. Pumping system and controls shall maintain the current desired pressure setpoint to within an amount equal to 10% of the setpoint value either side of the deadband without excessive hunting.

H. Sampling Strategy for Identical Units

1. No sampling, test all.

END OF REQUIREMENTS FOR CHILLER TEST

4.5.5. EXHAUST FANS

The testing requirements apply to all exhaust fans in project.

A. Parties Responsible to Execute Functional Test

1. Controls contractor: operate the controls to activate the equipment, if BAS controlled.

2. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested Prefunctional Checklist ID

1. Exhaust fans PC-_____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both[1]	Required Seasonal Test
General **1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unnoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with.**	**Manual**	

Function / Mode		Test Method Manual, Monitoring, Either or Both[1]	Required Seasonal Test
In addition to, or as part of (1) above, the following modes or tests are required:			
2.	**Verify schedules and setpoints to be reasonable and appropriate**		
3.	**Function at fire alarm (off, depressurization, etc.)**	**Manual**	
4.	**Interlocks to building pressurization control**	**Manual**	
5.	**Speed controls**	**Either**	
6.	**Check TAB report record of sound power level tests and space pressures and compare to specifications**	**Review**	
7.	**Sensor calibration checks on any controlling temperature or pressure sensor**	**Manual**	

[1]Refer to Special Procedures

E. Special Procedures (other equipment to test with, etc.; reference to function ID)
None

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the CA using dataloggers. Refer to the Monitoring section at the beginning of Part 5 through 7 below for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each fan:					
Do be determined					

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1-6. For the conditions, sequences and modes tested, the fans, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

H. Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

1. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

END OF REQUIREMENTS FOR EXHAUST FAN TEST

4.5.6. INDOOR AIR CLIMATE CONTROL--MISC. SYSTEMS

At least 10% of all space zones shall be verified to be maintaining proper climate control. Specific test requirements for this may have been identified elsewhere in this specification (e.g., under terminal units). For all areas not specifically specified, otherwise, the following tests shall be conducted.

A. Parties Responsible to Execute Functional Test

1. **Controls contractor: operate the controls and provide trend logs**
2. **CA: to witness, direct and document testing.**

B. Integral Components or Related Equipment Being Tested

1. **Cooling plant (entire system)**
2. **Heating plant (entire system)**
3. **Air, water or steam distribution system**
4. **Control system**

C. Prerequisites All listed systems in Part B, above, shall have had successful functional tests completed prior to this test.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

This is a performance test to verify that the HVAC systems can provide and maintain the temperature and relative humidity levels specified, during normal and extreme weather and occupancy conditions. The test consists of monitoring, via trend logs, of various points during the cooling season when temperatures reach to within 5°F of season design (ASHRAE 2 1/2%).

E. Special Procedures (other equipment to test with, etc.; reference to function ID)

1. **Building should be normally occupied during the test.**

F. Required Monitoring

1. **All points listed below which are control system monitored points shall be trended by the controls contractor. Refer to the Monitoring section at the beginning of Part 5 through 7 below for additional monitoring details.**

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
Space temperature control:					
Space temperature	5	5 days incl. weekend	Y	Y	1-3
OSAT-DB	5	5 days incl. weekend	Y	Y	1-3

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1. **Space temperature during occupied modes shall average within +/- 1°F of setpoint and always remain within 1°F of the ends of the deadband without**

excessive hunting of either the applicable damper or coil valve, or complaints of drafts or stuffiness from occupants.

H. Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

1. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

END OF REQUIREMENTS FOR INDOOR AIR CLIMATE CONTROL TEST

4.5.7. <u>INDOOR AIR QUALITY CHECK (IAQ)</u>

IAQ checking activities are not technically "functional testing." However, they are included here for consistency. Indoor air quality (IAQ) commissioning does not ensure that indoor air quality will be adequate or without deficiency at building turnover or during occupancy, unless the owner has specifically specified that actual air quality testing be performed. Commissioning for indoor air quality entails performing tasks that minimize the potential for IAQ problems, but it does not eliminate their possibility. The primary source for this checklist was Annex C in ASHRAE Guideline 1-1989R The HVAC Commissioning Process, Public Review Draft, 1996.

A. <u>Parties Responsible to Perform IAQ Checks</u>

1. CA: performs and oversees checks, inspections and reviews.

2. TAB contractor: performs checks using test instruments for tasks under Part C

C. <u>Prerequisites</u> CA will perform each check and review as soon as the materials or work is such that IAQ related determinations can be made.

D. <u>Purpose.</u> The purpose of the IAQ check is to minimize the potential for IAQ problems in the facility during occupancy. The CA is not responsible for any IAQ issues during construction, nor for IAQ issues in the occupied part of the facility, if construction is being performed in other parts of the facility.

E. <u>The following tasks will be conducted and documented:</u>

1. Submittal Reviews: Compare specified data with submitted data sheets for the following:

a. Filtration and filter type.

b. Materials that had specifications for emissions rates as part of the contract documents.

c. HVAC materials that have a potential for airflow erosion, corrosion and

microbial contamination (HVAC insulation materials, etc.).

d. Manufacturer's safety data sheets (MSDS) for products specified in the contract documents that may be suspected contributors to indoor pollutants (carpets, flooring, fabrics, adhesives, wall coverings, partitions, and ceilings; insulating and fire-proofing materials; sealants on walls and floors; use of preservatives, paints, varnishes, and other finish materials).

2. Static Inspections and Checks

a. Review the code compliance calculations for accuracy.

b. Verify that the outdoor air intakes are sized and located according the plans and specifications.

c. Verify that no outside conditions exist that could compromise the quality of the air entering the outdoor intakes.

d. Inspect air intakes and exhausts for short-circuiting.

e. Document any required ductwork cleaning.

f. Prior to building turnover, verify that final filters are installed and coils, inside of units and ductwork is clean.

g. Inspect air supply system components to ensure control and minimization of the presence of free and standing water and to minimize microbial contamination (condensate trays, traps, humidifiers, water baffles, mist eliminators and cooling towers).

h. Verify proper access for cleaning of both sides of coils, condensate pans and/or humidifier reservoirs in all HVAC equipment.

i. Meet with contractors and review any specified manufacturer's recommended curing, drying and airing procedures (for minimizing emission rates). Document the compliance of the contractors.

j. When the building is partially occupied during construction, meet with the Contractor and issue a plan in writing for operation of the HVAC system. The plan will describe how the system can be operated at as close to normal operating conditions as possible, to minimize dust and dirt from contaminating the ductwork and coils and polluting the occupied areas, and to prevent damaging moisture migration.

k. Review TAB reports for consistency with the specifications.

l. After completion of TAB, review with the TAB contractor, any areas they may consider as being potentially problematic regarding maintaining adequate minimum outdoor air, proper exhaust or room pressure differential.

3. Air Flow and Pressurization Checks

a. Verify that the specified minimum ventilation rates are maintained during all occupied modes of operation, particularly during VAV terminal box turn-down.

b. Spot-check TAB supply air flow readings in critical areas.

c. Spot-check the TAB measurements and setup of the exhaust systems for each area. When purging is specified in the contract documents, develop

a plan for, and see that the Contractor purges the building prior to occupancy.

d. Verify that the total building pressurization criteria is met through varying HVAC loads and economizing conditions.

e. Verify that room pressure differentials are as specified between critical areas (clean rooms, bio-hazards, film developing rooms, chemical storage areas, etc.).

f. Verify that the design engineer's specification for interstitial and area pressurization differentials has been met.

4. Verification

a. Verify that the specified ventilation effectiveness throughout the various areas of the building is being met by: ___smoke tube testing for airflow patterns, ___flow hood readings, ___air contaminant monitoring, ___other_____.

b. Perform IAQ testing using the following methods (surface cultures for microbial contamination, airborne culture testing, CO2 monitoring, VOC monitoring, CO monitoring, etc.).

I. Acceptance Criteria

Unless noted in the requirements, the commissioning agent in concert with the OWNER will make determinations and interpretations for when IAQ issues are considered to be in compliance with the contract documents.

END OF IAQ REQUIREMENTS

4.5.8. TERMINAL UNITS

A. Parties Responsible to Execute Functional Test

1. Controls contractor: operate the controls to activate the equipment.

B. Integral Components or Related Equipment Being Tested Prefunctional Checklist ID

1. Terminal unit (TU) PC-_____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both[3]	Required Seasonal Test[1]
General **1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, warmup, shutdown, unoccupied & manual modes and power failure and restoration. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with, including all damper, valve and fan functions.**	**Manual**	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Sensor activator calibration checks on: SAT, MAT, zone air temperature damper position and other random checks (EMS readout against visual or hand-held calibrated instrument must be within 0.5°F for temps. or within a tolerance equal to 10% of static pressure setpoint, with an inclined manometer)	**Manual**	
3. Device and actuator calibration and stroke checks for heating coil valve and non-DDC dampers	**Manual**	
4. For the TU's tested, check the prefunctional checklist items.	**Observation**	
5. Verify control parameters and setpoints to be reasonable and appropriate by reviewing the full program of 5% of all the TU's with each other for consistency. Verify the max. and min. cfm setpoints of all tested TU's against the control drawing and TAB values. Verify other TU programming parameters such as K-factors, deadbands, setpoints, stroke times, etc.	**Observation**	
6. Verify no CCV flow when there is HCV flow	**Either**	
7. Verify no hunting or significant overshoot by damper or valves.	**Either**	
8. Verify by measurement, CCV & HCV positive shutoff (no leak-thru)	**Manual**	
9. Verification of minimum OSA control through varying VAV box positions, if applicable	**Either**	[2]
10. All alarms (fan status, low limits, high static, etc.)	**Manual**	
11. Verify that TU is maintaining space setpoint temperatures	**Monitoring**	**Both Design**
12. Verify airflows and pressures (this random test is part of the TAB test)	**--**	

NOTES:

[1]Cooling season, Heating season or both. "Design" means within 5°F of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

[2]Seasonal test not required if seasonal conditions can be adequately simulated.

[3]Refer to Special Procedures

E. Special Procedures (other equipment to test with, etc.; reference to function ID)

None

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the controls contractor. Other points shall be monitored by the

CA using dataloggers. Refer to the Monitoring section at the beginning of Part 5 through 7 below for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each zone thermostat and space sensor and other critical areas, monitor:					
Space temperature	10	3 weekdays, summer design	Y	Y	11
Space temperature	10	3 weekdays, winter design	Y	Y	11
Space temperature	2	8 hours, occupied	Y	Y	7
Heating coil valve	2	8 hours, occupied	Y	Y	7
Damper position or cfm	2	8 hours, occupied	Y	Y	7

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1-11. For the conditions, sequences and modes tested, the TU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

10. Space temperature during occupied modes shall average within +/- 1°F of setpoint and always remain within 1°F of the ends of the deadband without excessive hunting of either the damper or coil valve, or complaints of drafts or stuffiness from occupants.

H. Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

1. Testing. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

2. Monitoring. Ten percent of the total number of zones in the building, chosen by the Owner, shall be monitored. Within this 10%, shall be included a distribution of all air handlers, zones expected to have the greatest heating and cooling demand, perimeter and core zones and zones identified from the commissioning process that have exhibited potential problems.

END OF REQUIREMENTS FOR TERMINAL UNIT TEST

4.5.9. TEST AND BALANCE WORK (TAB)

A. Parties Responsible to Execute Functional Test

1. TAB contractor: perform checks using test instruments.

2. **Controls contractor: operate the controls to activate the equipment.**
3. **CA: to witness, direct and document testing.**

B. Integral Components or Related Equipment Being Tested Prefunctional Checklist ID

1. **TAB water-side PC-_____**
2. **TAB air-side PC-_____**

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Part 5 through 7 below shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

D. Purpose. The purpose of this test is to spot check the TAB work to verify that it was done in accordance with the contract documents and acceptable practice and that the TAB report is accurate.

E. The following tests and checks will be conducted. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

	Test or Check	Test Method	Required Seasonal Test[3]
1.	**A random sample of up to _____ % the TAB report data shall be selected for verification (air velocity, air or water flow rate, pressure differential, electrical or sound measurement, etc.). The original TAB contractor will execute the checks, witnessed by the commissioning authority. The TAB contractor will use the same test instruments as used in the original TAB work.** **A failure[1] of more than 10% of the selected items of a given system[2] shall result in the failure of acceptance of the system TAB report and the TAB contractor shall be responsible to rebalance the system, provide a new system TAB report and repeat random verifications of the new TAB report.** **The random testing will include the verification of minimum outdoor air intake flows at minimum, maximum and intermediate total airflow rates for _____% of the air handlers. Other selected data to be verified will be made known upon day of testing.**	**Demonstration**	
2.	**Verify that final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked by the TAB Contractor.**	**Demonstration**	

	Test or Check	Test Method	Required Seasonal Test[3]
3.	**Verification that the air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all TUs taking off downstream of the static pressure sensor, the TU on the critical leg has its damper 90% or more open.**	**Demonstration**	
4.	**Verification that the water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90% or more open.**	**Demonstration**	

[1]Failure of an item is defined as follows:
For air flow of supply and return: a deviation of more than 10% of instrument reading
For minimum outside air flow: 20% of instrument reading (30% for reading at intermediate supply flow for inlet vane or VFD OSA compensation system using linear proportional control)
For temperatures: a deviation of more than 1°F
For air and water pressures: a deviation of more than 10% of full scale of test instrument reading
For sound pressures: a deviation of more than 3 decibels. (Variations in background noise must be considered)

[2]Examples of a "system" are: the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system. Systems can be defined smaller if inaccuracies in TAB work within the smaller defined system will have little or no impact on connected systems.

[3]Cooling season, Heating season or both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

F. Special Procedures (other equipment to test with, etc.; reference to function ID)
None

G. Required Monitoring
None

I. Acceptance Criteria (referenced by function or mode ID)
Provided in footnote to test table above.

J. Sampling Strategy for Identical Units
Described in test table above.

END OF REQUIREMENTS FOR TAB TEST

4.6 PREFUNCTIONAL CHECKLISTS

4.6.1. GENERAL

A. This section contains representative Prefunctional Checklists in a form format (PC).

B. The PC procedures displayed in a form format here are intended to provide the CA with an example of a format and an indication of the rigor of the required prefunctional checklists and documentation for various equipment types. Though they were not developed specifically for this project, they are generally applicable.

C. The checklists contain items for both Division 15 and 16 contractors to perform. On each checklist, a column is provided that should be filled out by the Contractor assigning responsibility for that line item to a trade.

D. Those executing the checklists are only responsible to perform items that apply to the specific application at hand. These checklists do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant of some checkout procedures that will be documented on typical factory field checkout sheets. Double documenting is required in those cases.

E. Refer to Part 5 through 7 below for additional requirements regarding prefunctional checklists, startup and initial checkout. Items that do not apply should be noted along with the reasons on the form. If this form is not used for documenting, one of similar rigor and clarity shall be used. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off. "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

4.6.2. <u>PREFUNCTIONAL CHECKLISTS</u>

A. The prefunctional checklists referred to in this section are found later in the document under the "Prefunctional Checklists" tab.

B. The checklists are provided in electronic file format (Word 6.0 for Windows 3.1). The file name is at the bottom of each page. The file name extension "pc__" stands for Prefunctional Checklist and the last digit is the version number. Any MS Excel spreadsheet files are noted with their usual .xls extension.

<u>COMPONENT</u>	**<u>ELECTRONIC FILE NAME</u>**
<u>Mechanical Equipment</u> (checklists have both mechanical and electrical trade responsibilities)	
Air handler unit	**ahu.pc_**
Air cooled condenser and compressor	**aircndsr.pc_**
Calibration procedures (sensors; actuators)	**calibdir.pc_**
Chiller	**chiller.pc_**
Chiller system sample startup documentation plan	**chilrdoc.pc_**
Chilled water piping	**chwpipe.pc_**
Controls system (BAS)	**controls.pc_**
Exhaust fan	**exh_fan.pc_**
Heating water piping	**hwpipe.pc_**

Pump (water)	**pump.pc_**
Startup documentation plan template	**startpln.c08**
TAB	**tabplan.pc_**
Terminal unit	**tu_pc06.xls**
Variable frequency drive	**vfd.pc_**

4.6.3. SUGGESTED NUMBERING KEY FOR COMMISSIONING PROCEDURES

A. The checklists, functional tests, documentation and training use the following identification numbering:

B. At the beginning of the identification number is a text abbreviation for the following:

Document or Event Abbreviations

DOC	**=**	**Documentation**
PC	**=**	**Prefunctional Checklist**
SP	**=**	**Startup Plan**
SR	**=**	**Startup Report**
FT	**=**	**Functional Test**
R	**=**	**Review**
TR	**=**	**Training Record**

Prefunctional Checklist Numbering Key

FT-0102.3: The first four digits uniquely identify the piece of equipment to the component level. The first 2 digits are the System Type, the second 2 digits are an arbitrary component number (not necessarily the same as the specified ID number). The number after the decimal is the test number. For example, FT-0102.3 = Functional Test 3 of system Type 1, component number 2 (e.g., 0102.3 = Chiller #2, FT #3, because chillers are system Type 1). Other components under chillers are: additional chillers, pumps, valves, piping; VFDs. The component number of 00 means "general" or "all" components, as with the entire system. All tests, procedures, trainings and records should have the same first 4 digits for any given equipment component.

Another example. If there were only 1 TU type, then tests would be numbered FT-0500.1, 0500.2, etc. If there were 2 TU types TUs: FT-0501.1, 0501.2, etc and 0502.1, .2 etc.

An *example* of the number system follows:

0100	**Chilled Water System**	**0200**	**Heating System**
	0101 Chiller 1		**0201 Heat Exchanger 1**
	0102 Chiller 2		**0202 Heat Exchanger 2**
	0103 Pump CHWP-1		**0203 Pump HWP-1**
	0104 Pump CHWP-2		**0204 Pump HWP-2**
	0105 CHW piping		**0205 HW piping**
	0106 Sensor calibration		**0206 Sensor calibration**
		etc.	

Numbers for Primary System Types and Components

Components are in parentheses.

01 Chilled water system (chillers, cooling towers, pumps, condensers, piping, valves)
02 Hot water system (hot water pumps, valves, piping)
03 Air handler units (SF, RF, coils, valves, VFD, ducts, dampers)
04 Terminal units
05 Unit heaters or AC spot coolers
06 Heat exchangers
07 Service water system
08 Test and balance (TAB)
09 Building automation system (controls)
10 Exhaust fans

4.7 SAMPLE FUNCTIONAL TEST PROCEDURES

4.7.1. GENERAL

A. This section contains sample Functional performance Test procedures in a form format (FT).

B. The sample FT procedures displayed in a form format here, are to provide contractors and CA with an example of a format and an indication of the rigor of the required testing and documentation for various equipment types. They were not developed for this project. Other forms and formats are acceptable if they comply with the rigor, clarity and intent of all the commissioning specifications. The CA will use the functional testing requirements in Sections 15997 and 16997 and the testing protocols specified in Part 5 through 7 below for developing site-specific functional test procedures and forms for this project. For illustrative purposes, sequences of operation associated with a few pieces of the equipment for which tests are included are also provided.

4.7.2. SAMPLE FUNCTIONAL TESTS (Examples only, not for this project)

A. The sample functional tests referred to in this section are found later in the document under the "Functional Test Forms" tab.

B. The tests are provided in electronic file format (Word 6.0 for Windows 3.1). The file name is at the bottom of each page. The file name extension "ft__" stands for Functional Test and the last digit is the version number. Any MS Excel spreadsheet files are noted with their usual .xls extension. Some of the equipment also has a file with full sequences of operation, for reference when viewing the test procedures, and to illustrate the desired rigor of sequences of operation.

SYSTEM	ELECTRONIC FILE NAME
Air handler unit (cooling only)	ahu_cool.ft_
Heat Exchanger (packaged for heating water)	hxhw.ft_
Heat Exchanger system sequences	hxseq.004
Heat Exchanger system (multiple HW)	hxsys.ft_
Cabinet unit heater	cabunhtr.ft_
Chiller system	chiller.ft_
Chiller system sequences	chiller.seq
Economizer (airside)	econtest.ft_
Service water heater	srvc_wh.ft_
TAB spot check	tab.ft_

Terminal unit (Inflatable Dampers)	**tu_clg.ft_**
Unit heater	**unit_htr.ft_**
Variable speed drive (fan)	**vfdfan.ft_**
Variable speed drive (pump)	**vfdpump.ft_**

4.7.3. SUGGESTED NUMBERING KEY FOR COMMISSIONING PROCEDURES

A. The checklists, functional tests, documentation and training use the following identification numbering:

B. At the beginning of the identification number is a text abbreviation for the following:

Document or Event Abbreviations

DOC	**=**	**Documentation**
PC	**=**	**Prefunctional Checklist**
SP	**=**	**Startup Plan**
SR	**=**	**Startup Report**
FT	**=**	**Functional Test**
R	**=**	**Review**
TR	**=**	**Training Record**

Numbering Key

FT-0102.3: **The first four digits uniquely identify the piece of equipment to the component level. The first 2 digits are the System Type, the second 2 digits are an arbitrary component number (not necessarily the same as the specified ID number). The number after the decimal is the test number. For example, FT-0102.3 = Functional Test 3 of system Type 1, component number 2 (e.g., 0102.3 = Chiller #2, FT #3, because chillers are system Type 1). Other components under chillers are: additional chillers, pumps, valves, piping, VFDs. The component number of 00 means "general" or "all" components, as with the entire system. All tests, procedures, trainings and records should have the same first 4 digits for any given equipment component.**

Another example is TUs. If there was only 1 TU type, then tests would be numbered FT-0500.1, 0500.2, etc. If there were 2 types of TUs: FT-0501.1, 0501.2, etc and 0502.1, 0502.2, etc.

An *example* of the number system follows:

0100	**Chilled Water System**	**0200**	**Heating System**
	0101 Chiller 1		**0201 Heat Exchanger 1**
	0102 Chiller 2		**0202 Heat Exchanger 2**
	0107 CHW piping		**0203 Pump HWP-1**
	0109 Sensor calibration		**0204 Pump HWP-2**
			0205 HW piping
			0206 Sensor calibration
		etc.	

Numbers for Primary System Types and Components

Components are in parentheses.

01 Chilled water system (chillers, cooling towers, pumps, condensers, piping, valves)
02 Hot water system (boilers, hot water pumps, valves, piping)
03 Air handler units (SF, RF, coils, valves, VFD, ducts, dampers)
04 Terminal units
05 Unit heaters
06 Heat exchangers
07 Service water system
08 Test and balance (TAB)
09 Building automation system (controls)
10 Fans

PART 5 – COMMISSIONING REQUIREMENTS

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5.1.1 DESCRIPTION

A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate

the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents;

1. **Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.**
2. **Verify and document proper performance of equipment and systems.**
3. **Verify that O&M documentation left on site is complete.**
4. **Verify that the Owner's operating personnel are adequately trained.**

C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

D. Abbreviations. The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.6.

A/E-	**Architect and design engineers**	**FT-**	**Functional performance test**
CA-	**Commissioning authority**	**GC-**	**General or Mechanical or Prime (prime)**
CC	**Controls contractor**	**MC-**	**Mechanical contractor**
OWNER-	**Construction Manager (the owner's representative)**	**PC-**	**Prefunctional checklist**
Cx-	**Commissioning**	**PM-**	**Project manager (of the Owner)**
Cx Plan-	**Commissioning Plan document**	**Subs-**	**Subcontractors to General**
EC-	**Electrical contractor**	**TAB-**	**Test and balance contractor**

5.1.2 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning authority (CA), the Project Manager (PM), the designated representative of the owner's Construction Management firm (OWNER), the General or Mechanical or Prime (GC or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CA is hired by the PRIME CONTRACTOR Owner directly. The CA directs and coordinates the commissioning activities and the reports to the owner. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CA's responsibilities are the same regardless of who hired the CA. Refer to Part 5 through 7 below Part 1.6 for additional management details. The following organization chart clarifies the roles.

C. Scheduling. The CA will work with the OWNER and PRIME CONTRACTOR according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the OWNER and PRIME CONTRACTOR for scheduling commissioning activities. The PRIME CONTRACTOR will integrate all commissioning

activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

D. The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan—Construction Phase provides a format for this schedule. As construction progresses more detailed schedules are developed by the CA. The Commissioning Plan also provides a format for detailed schedules.

5.1.3 COMMISSIONING PROCESS

A. Commissioning Plan. The Commissioning Plan, Draft 2, shall be prepared by the CA. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. **Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.**
2. **Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.**
3. **Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.**
4. **The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with prefunctional checklists to be completed, during the startup process.**
5. **In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.**
6. **The Subs, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.**
7. **The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.**
8. **The procedures are executed by the Subs, under the direction of, and documented by the CA.**
9. **Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.**
10. **The CA reviews the O&M documentation for completeness.**
11. **Commissioning is completed before Substantial Completion.**

12. **The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that is was completed.**
13. **Deferred testing is conducted, as specified or required.**

5.1.4 RELATED WORK

A. Specific commissioning requirements are given in the earlier portions of this specification section.

5.1.5 RESPONSIBILITIES

A. The contractor is responsible for providing their services as per this section including hiring the CA.

B. All Parties

1. **Follow the Commissioning Plan.**
2. **Attend commissioning scoping meeting and additional meetings, as necessary.**

C. Engineer (of A/E)

Construction and Acceptance Phase

1. **Contractor manages the CA contract**
2. **Attend the commissioning scoping meeting and selected commissioning team meetings.**
3. **Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.**
4. **Provide any design narrative documentation requested by the CA.**
5. **Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.**
6. **Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.**

Warranty Period

1. **Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.**

D. Mechanical and Electrical Designers/Engineers (of the A/E)

Construction and Acceptance Phase

1. **Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.**
2. **Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.**

3. **Attend commissioning scoping meetings and other selected commissioning team meetings.**
4. **Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.**
5. **Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.**
6. **From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return and exhaust air systems and emergency power system.**
7. **Provide a presentation at one of the training sessions for the Owner's personnel.**
8. **__ Review, __ Approve the prefunctional checklists for major pieces of equipment for sufficiency prior to their use.**
9. **__ Review, __ Approve the functional test procedure forms for major pieces of equipment for sufficiency prior to their use.**
10. **__ Witness testing of selected pieces of equipment and systems:**

Warranty Period

1. **Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.**

E. Commissioning Authority (CA)

1. **The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General or Mechanical or Prime and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CA.**

Construction and Acceptance Phase

1. **Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.**
2. **Coordinate the commissioning work and, with the PRIME CONTRACTOR and OWNER, ensure that commissioning activities are being scheduled into the master schedule.**

3. **Revise, as necessary, the Draft 2, Commissioning Plan—Construction Phase.**
4. **Plan and conduct a commissioning scoping meeting and other commissioning meetings.**
5. **Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.**
6. **Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.**
7. **Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.**
8. **Write and distribute prefunctional tests and checklists.**
9. **Develop an enhanced start-up and initial systems checkout plan with Subs.**
10. **Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.**
11. **Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.**
12. **Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.**
13. **Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.**
14. **Approve systems startup by reviewing start-up reports and by selected site observation.**
15. **Review TAB execution plan.**
16. **Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.**
17. **Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.**
18. **With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to OWNER for review, and for approval if required.**
19. **Analyze any functional performance trend logs and monitoring data to verify performance.**

20. **Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. Perform actual functional testing without contractors on equipment so specified in Sections 15997 and 16997.**
21. **Maintain a master deficiency and resolution log and a separate testing record. Provide the OWNER with written progress reports and test results with recommended actions.**
22. **Witness performance testing of smoke control systems by others and all other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in Commissioning Record in O&M manuals.**
23. **Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.**
24. **Oversee and approve the training of the Owner's operating personnel.**
25. **Compile and maintain a commissioning record and building systems book(s).**
26. **Review and approve the preparation of the O&M manuals.**
27. **Provide a final commissioning report (as described in this section).**
28. **Develop a systems manual per ASHRAE HVAC Commissioning Guideline 1-1996.**
29. **Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The CA shall also provide any needed information on interpreting the trends.**

Warranty Period

1. **Coordinate and supervise required seasonal or deferred testing and deficiency corrections.**
2. **Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.**
3. **Optional: Assist in the development of a preventative maintenance plan, a detailed operating plan or an energy and resource management plan or as-built documentation.**

F. Construction Manager—Owner's Representative (OWNER)

Construction and Acceptance Phase

1. **Facilitate the coordination of the commissioning work by the CA, and, with the PRIME CONTRACTOR and CA, ensure that commissioning activities are being scheduled into the master schedule.**

2. **Review and approve the final Commissioning Plan—Construction Phase.**
3. **Attend a commissioning scoping meeting and other commissioning team meetings.**
4. **Perform the normal review of Contractor submittals.**
5. **Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.**
6. **Review and approve the functional performance test procedures submitted by the CA, prior to testing.**
7. **When necessary, observe and witness prefunctional checklists, startup and functional testing of selected equipment.**
8. **Review commissioning progress and deficiency reports.**
9. **Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.**
10. **Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of the commissioning process to the Project Manager.**
11. **Assist the PRIME CONTRACTOR in coordinating the training of owner personnel.**

Warranty Period

1. **Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.**

G. Owner's Project Manager (PM)

Construction and Acceptance Phase

1. **Manage the contract of the A/E and of the PRIME CONTRACTOR.**
2. **Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan—Construction Phase.***
3. **Provide final approval for the completion of the commissioning work.**

Warranty Period

1. **Ensure that any seasonal or deferred testing and any deficiency issues are addressed.**

H. General or Mechanical or Prime (PRIME CONTRACTOR)

Construction and Acceptance Phase

1. **Facilitate the coordination of the commissioning work by the CA, and with the PRIME CONTRACTOR and CA ensure that commissioning activities are being scheduled into the master schedule.**
2. **Include the cost of commissioning in the total contract price.**

3. **Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.**
4. **In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.**
5. **Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.**
6. **A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.**
7. **Coordinate the training of owner personnel.**
8. **Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.**

Warranty Period

1. **Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.**
2. **Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.**

I. Equipment Suppliers

1. **Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.**
2. **Assist in equipment testing per agreements with Subs.**
3. **Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.**
4. **Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.**
5. **Provide information requested by CA regarding equipment sequence of operation and testing procedures.**
6. **Review test procedures for equipment installed by factory representatives.**

5.1.6 DEFINITIONS

A. Acceptance Phase - phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

B. Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

C. Architect / Engineer (A/E) - the prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

D. Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

E. Commissioning authority (CA) - an independent agent, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the OWNER. The CA is part of the Construction Manager (OWNER) team or shall report directly to the OWNER.

F. Commissioning Plan - an overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

G. Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).

H. Contractor - the General or Mechanical or Prime or authorized representative.

I. Control system - the central building energy management control system.

J. Construction Manager (OWNER) –

1. **The Owner's representative in the day-to-day activities of construction. In general, the construction management services contractor (OWNER) is hired by the owner to assist the government in the overall management of the project including supervising and on-site managing authority over a project's construction. The General or Mechanical or Prime reports to the OWNER. The OWNER is the Owner's on-site representative.**

2. **When the CA is hired by the PRIME CONTRACTOR or A/E, the OWNER referred to in the commissioning process is a member of the OWNER team (staff or independent contractor) who shall have direct significant mechanical engineering and commissioning experience. That person designated from the OWNER team is the owner's representative verifying the adequacy of the commissioning process. In this case, the OWNER will be more involved in the commissioning work and in witnessing portions of the process (selected start-up and functional tests) and reviewing documents (test approvals, etc.) than in the following case.**

K. Datalogging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

L. Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

M. Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

N. Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

O. Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.

P. Factory Testing - testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

Q. Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.

R. General or Mechanical or Prime (PRIME CONTRACTOR) - the prime contractor for this project. Generally refers to all the PRIME CONTRACTOR's subcontractors as well. Also referred to as the Contractor..

S. Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

T. Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

U. Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

V. Non-Compliance - see Deficiency.

W. Non-Conformance - see Deficiency.

X. Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

Y. Owner-Contracted Tests - tests paid for by the Owner outside the PRIME CONTRACTOR's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

Z. Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

AA. Prefunctional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

BB. Project Manager (PM) - the contracting and managing authority for the owner over the design and/or construction of the project, a staff position.

CC. Sampling. - Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Part 5 through 7 below, Part 3.6, F for details.

DD. Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.

EE. Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

FF. Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

GG. Specifications - the construction specifications of the Contract Documents.

HH. Startup - the initial starting or activating of dynamic equipment, including executing prefunctional checklists.

II. Subs - the subcontractors to the PRIME CONTRACTOR who provide and install building components and systems.

JJ. Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

KK. Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents (Sections 15997; 16997, etc.).

LL. Trending - monitoring using the building control system.

MM. Vendor - supplier of equipment.

NN. Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

5.1.7 SYSTEMS TO BE COMMISSIONED

A. The following checked systems will be commissioned in this project.

Equipment and System	Equipment and System
HVAC System	**__ Testing, Adjusting and Balancing work**
__ Chillers	**__ Chemical treatment systems**
__ Pumps	**__ HVAC control system**
__ Piping systems	**__ Fire and smoke dampers**
__ Ductwork	**__ Indoor air quality[1]**
__ Variable frequency drives	**__ Equipment sound control**
__ Air handlers	**__ Equipment vibration control**
__ Terminal units (air)	**Other**
__ Unit heaters	**__ Service water heaters**
__ Heat exchangers	**__ Service water booster pumps**
__ Exhaust fans	

[1] Indoor air quality (IAQ) commissioning does not ensure that indoor air quality will be adequate or without deficiency at building turnover or during occupancy, unless the owner has specifically specified that actual air quality testing is performed. Commissioning indoor air quality entails performing tasks that minimize the potential for IAQ problems, but it does not eliminate their possibility.

PART 6 - PRODUCTS

6.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 15 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 15, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the Division Controller.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CA.

C. Datalogging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

E. Refer to Part 5 through 7 below, Part 3.6 E for details regarding equipment that may be required to simulate required test conditions.

PART 7 - EXECUTION

7.1 MEETINGS

A. Scoping Meeting. Within 30 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Draft 2 Commissioning Plan to its "final" version, which will also be distributed to all parties.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. For large projects, these meetings may be held monthly, until the final 3 months of construction when they may be held as frequently as one per week.

7.2 REPORTING

A. The CA will provide regular reports to the OWNER or PM, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the Commissioning Plan.

B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report (about four to six pages, not including backup documentation) by the CA will be provided to the OWNER or PM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Prefunctional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

7.3 SUBMITTALS

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to

the Commissioning authority. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.

B. The Commissioning authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the OWNER, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

7.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned, according to Section 1.7, Systems to be Commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and startup.

B. General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements in this section.

1. The CA adapts, if necessary, the representative prefunctional checklists and procedures from above portions of this section. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.

2. These checklists and tests are provided by the CA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.

3. **The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.**
4. **The full start-up plan could consist of something as simple as:**
    a. **The CA's prefunctional checklists.**
    b. **The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.**
    c. **The manufacturer's normally used field checkout sheets.**
5. **The subcontractor submits the full startup plan to the CA for review and approval.**
6. **The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.**
7. **The full start-up procedures and the approval form may be provided to the OWNER for review and approval, depending on management protocol.**
8. **As an option to above, the following is also acceptable**
    a. **The CA, (instead of the contractor), copies the manufacturer's startup and initial checkout procedures from O&M submittals.**
    b. **The CA marks the applicable areas in the procedures and makes initial and date lines at each procedure or section.**
    c. **The CA transmits these procedures and the original prefunctional checklist procedures (see 1 above) to the Contractor as the startup and initial checkout plan.**

D. Sensor and Actuator Calibration.

1. **All field-installed temperature, relative humidity, CO, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.**
2. **All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.**
3. **Sensor Calibration Methods**
    a. **All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within**

0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.

b. Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

c. Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

d. Critical Applications. For critical applications (process, manufacturing, etc.) more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)	Sensor	Required Tolerance (+/-)
Cooling coil, chilled and condenser water temps	0.4F	Flow rates, water	4% of design
		Relative humidity	4% of design
AHU wet bulb or dew point	2.0F	Combustion flue temps	5.0F
Hot water coil and boiler water temp	1.5F	Oxygen or CO_2 monitor	0.1 % pts
Outside air, space air, duct air temps	0.4F	CO monitor	0.01 % pts
Watthour, voltage & amperage	1% of design	Natural gas and oil flow rate	1% of design
Pressures, air, water and gas	3% of design	Steam flow rate	3% of design
Flow rates, air	10% of design	Barometric pressure	0.1 in. of Hg

Valve and Damper Stroke Setup and Check

e. EMS Readout. For all valve and damper actuator positions checked, verify the actual position against the BAS readout.

f. **Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).**

g. **Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.**

h. **Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.**

E. Execution of Prefunctional Checklists and Startup.

1. **Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the OWNER, PRIME CONTRACTOR and CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.**

2. **The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved by the OWNER). In no case will the number of units witnessed be less than four on any one building, nor less than 20% of the total number of identical or very similar units.**

3. **For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the prefunctional and start-up procedures. The sampling procedures are identified in the commissioning plan.**

4. **The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.**

5. **Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.**

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup.

1. **The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of**

the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

2. **The CA reviews the report and submits either a non-compliance report or an approval form to the Sub or OWNER. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the OWNER and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the OWNER using a standard form.**

3. **Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party. Refer to Part 3.7 herein for details.**

7.5 PHASED COMMISSIONING

A. The project will require startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, OWNER, mechanical, TAB and controls and the PRIME CONTRACTOR. Results will be added to the master and commissioning schedule.

7.6 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. The general list of equipment to be commissioned is found in Part 5 through 7 below, Part 1.4. The specific equipment and modes to be tested are found in Sections 15997, 16997 and [list other sections where tests requirements are found] .

C. The parties responsible to execute each test are listed with each test in Sections 15997, 16997 and [list other sections where tests requirements are found] .

D. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

E. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in Sections 15997, 16997 and [list other sections where tests requirements are found] .

F. Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and

parameters. Using the testing parameters and requirements in Sections 15997, 16997 and [list other sections where tests requirements are found] the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

G. The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.

H. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

I. Representative test formats and examples (not designed for this facility) are found in the appendices to Divisions 15 and 16. The test procedure forms developed by the CA shall include (but not be limited to) the following information:

1. **System and equipment or component name(s)**
2. **Equipment location and ID number**
3. **Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment**
4. **Date**
5. **Project name**
6. **Participating parties**
7. **A copy of the specification section describing the test requirements**
8. **A copy of the specific sequence of operations or other specified parameters being verified**
9. **Formulas used in any calculations**
10. **Required pre-test field measurements**
11. **Instructions for setting up the test.**
12. **Special cautions, alarm limits, etc.**
13. **Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format**
14. **Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.**
15. **A section for comments**
16. **Signatures and date block for the CA**

J. Test Methods.

1. **Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. Sections 15997, 16997 and [list other sections where tests requirements are found] specify which methods shall be used for each test. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the OWNER. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.**
2. **Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.**
3. **Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.**
4. **Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.**
5. **Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.**
6. **Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.**
7. **Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.**
8. **Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant**

application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. The specific recommended sampling rates are specified with each type of equipment in Sections 15997, 16997 and [list other sections where test requirements are found] . It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

9. **A common sampling strategy referenced in the Specifications as the "xx% Sampling—yy% Failure Rule" is defined by the following example.**
10. **xx = the percent of the group of identical equipment to be included in each sample.**
11. **yy = the percent of the sample that if failing, will require another sample to be tested.**
12. **The example below describes a 20% Sampling—10% Failure Rule.**
    a. **Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."**
    b. **If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).**
    c. **If 10% of the units in the second sample fail, test all remaining units in the whole group.**
    d. **If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.**

K. Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the OWNER, PRIME CONTRACTOR and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

1. **In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.**

L. Test Equipment. Refer to Part 5 through 7 below, Part 2 for test equipment requirements.

M. Problem Solving. The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the PRIME CONTRACTOR, Subs and A/E.

7.7 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the OWNER for review and approval and to the Subs for review. The CA will include the filled out forms in the O&M manuals.

B. Non-Conformance.

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the OWNER on a standard non-compliance form.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the OWNER.

4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the OWNER for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.

2) The CA reschedules the test and the test is repeated.

b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the OWNER and to the Sub representative assumed to be responsible.

2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.

3) The CA documents the resolution process.

4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA.

The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. **Cost of Retesting.**
    a. **The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the PRIME CONTRACTOR.**
    b. **For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CA and OWNER will direct the retesting of the equipment once at no "charge" to the PRIME CONTRACTOR for their time. However, the CA's and OWNER's time for a second retest will be charged to the PRIME CONTRACTOR, who may choose to recover costs from the responsible Sub.**
    c. **The time for the CA and OWNER to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the PRIME CONTRACTOR, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.**
    d. **Refer to the sampling section of Part 5 through 7 below, Part 3.6 for requirements for testing and retesting identical equipment.**
6. **The Contractor shall respond in writing to the CA and OWNER at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.**
7. **The CA retains the original non-conformance forms until the end of the project.**
8. **Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.**

C. **Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the OWNER or PM. In such case, the Contractor shall provide the Owner with the following:**
    1. **Within one week of notification from the OWNER or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the OWNER or PM within two weeks of the original notice.**
    2. **Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.**

3. **The OWNER or PM will determine whether a replacement of all identical units or a repair is acceptable.**
4. **Two examples of the proposed solution will be installed by the Contractor and the OWNER will be allowed to test the installations for up to one week, upon which the OWNER or PM will decide whether to accept the solution.**
5. **Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.**

D. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the OWNER, if necessary. The CA recommends acceptance of each test to the OWNER using a standard form. The OWNER gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

7.8. OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals.

1. **The specific content and format requirements for the standard O&M manuals are detailed in Section 01730. Special requirements for the controls contractor and TAB contractor are found Section 15995, Part 3.6.**
2. **A/E Contribution. The A/E will include in the beginning of the O&M manuals a separate section describing the systems including:**
    a. **The design intent narrative prepared by the A/E and provided as part of the bid documents, updated to as-built status by the A/E.**
    b. **Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include chillers, water system, heating system, supply air systems, exhaust systems and any other system included in the project. These shall show major pieces of equipment such as pumps, chillers, heat exchangers, control valves, expansion tanks, coils, service valves, etc.**
3. **CA Review and Approval. Prior to substantial completion, the CA shall review the O&M manuals, documentation and redline as-builds for systems that were commissioned and [list other systems documentation that the CA should review] to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the OWNER, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the OWNER, PM or A/E. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.**

B. Commissioning Record in O&M Manuals.

1. **The CA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the PRIME CONTRACTOR, to be included with the O&M manuals.**

Three copies of the manuals will be provided. The format of the manuals shall be:

a. **Tab I-1 Commissioning Plan**

b. **Tab I-2 Final Commissioning Report (see (B.2) below)**

c. **Tab 01 System Type 1 (chiller system, packaged unit, boiler system, etc.)**

d. **Sub-Tab A Design narrative and criteria, sequences, approvals for Equipment 1**

e. **Sub-Tab B Startup plan and report, approvals, corrections, blank prefunctional checklists**

f. **Colored Separator Sheets—for each equipment type (fans, pumps, chiller, etc.)**

g. **Sub-Tab C Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended recommissioning schedule.**

h. **Tab 02 System Type 2.....repeat as per System 1**

2. **Final Report Details. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.**

3. **Other documentation will be retained by the CA.**

7.9 TRAINING OF OWNER PERSONNEL

A. **The PRIME CONTRACTOR shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.**

B. **~~The CA shall oversee~~B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment ~~or systems~~.**

1. **The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for each piece of commissioned**

equipment. The CA shall communicate the results to the Subs and vendors who have training responsibilities.

2. **In addition to these general requirements, the specific training requirements of Owner personnel by Subs and vendors is specified in Division 15 and 16 and [list other sections where training requirements are found].**
3. **Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements ~~of the training~~:**
    a. **Equipment (included in training)**
    b. **Intended audience**
    c. **Location of training**
    d. **Objectives**
    e. **~~Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)~~Subjects covered (description, duration of discussion, special methods, etc.)**
    f. **Duration of training on each subject**
    g. **Instructor ~~and qualifications~~ for each subject**
    h. **Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)**
    i. **Instructor and qualifications**
4. **For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.**
5. **The CA develops an overall training plan and coordinates and schedules, with the OWNER and PRIME CONTRACTOR, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA recommends approval of the training to the OWNER using a standard form. The OWNER also signs the approval form.**
6. **At one of the training sessions, the CA presents a ____ hour presentation discussing the use of the blank functional test forms for re-commissioning equipment.**
7. **Videotaping of the training sessions will be provided by the CA with tapes cataloged by the CA and added to the O&M manuals.**
8. **The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be __8___ hours in length and include a review of all systems using the simplified system schematics (one-line drawings) including chilled water systems, condenser water or heat rejection systems, heating systems, fuel oil and gas supply systems, supply air systems, exhaust system and outside air strategies.**

7.10 DEFERRED TESTING

A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in Part 5 through 7 below shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.

7.11 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan—Construction Phase, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

Product		Developed By
1.	Final commissioning plan	CA
2.	Meeting minutes	CA
3.	Commissioning schedules	CA with PRIME CONTRACTOR and OWNER
4.	Equipment documentation submittals	Subs
5.	Sequence clarifications	Subs and A/E as needed
5.	Prefunctional checklists	CA (already in Specs)
6.	Startup and initial checkout plan	Subs and CA (compilation of existing documents)
7.	Startup and initial checkout forms filled out	Subs
8.	Final TAB report	TAB
9.	Issues log (deficiencies)	CA
10.	Commissioning Progress Record	CA
11.	Deficiency reports	CA
12.	Functional test forms	CA

Product		Developed By
13.	Filled out functional tests	CA
14.	O&M manuals	Subs
15.	Commissioning record book	CA
16.	Overall training plan	CA and OWNER
17.	Specific training agendas	Subs
18.	Final commissioning report	CA
19.	Misc. approvals	CA

END OF GUIDE SPECIFICATION SECTION

SECTION 230930 – CONTROLS SCHEDULES

PART 1 – GENERAL

1.01 **RELATED DOCUMENTS**

A. **Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.**

1.02 **WORK INCLUDED**

A. **Furnish and install temperature controls.**

1.03 **RELATED SECTIONS**

A. **Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.**

1.04 **SUBMITTALS**

A. **See Section 230900 and General Conditions for Additional Requirements.**

B. **Product Data: Provide data for duct materials.**

C. **Prepare and submit scaled coordination drawings.**

D. **Manufacturer's Installation Instructions.**

1.05 **QUALITY ASSURANCE**

A. **See Section 230900.**

PART 2 – PRODUCTS

2.01 **POINT SCHEDULE**

A. **Note: For point software association, see sequence of operation. All points shall be able to integrate to all trends, totalizations, etc., as applicable. For additional points, refer to PID drawings and sequences of operations. Additional points not specifically called for herein but required to perform the sequence as herein specified shall be provided at no additional cost to the Owner.**

B. **The points shall include those include herein and any others indicated in contract drawings.**

C. **INCLUDE ALL POINTS INDICATED HEREIN AS WELL AS THOSE SHOWN ON CONTRACT DRAWINGS. THE TOTAL NUMBER OF POINTS SHALL**

INCLUDE ALL POINTS INDICATED IN BOTH DOCUMENTS TAKEN TOGETHER.

D. **THE TEMPERATURE CONTROLS CONTRACTOR (TCC) CONTRACTOR SHALL CARRY AN ALLOWANCE FOR INSTALLING, WIRING AND SOFTWARE PROGRAMMING FOR 20 ADDITIONAL MONITORING AND CONTROL POINTS OF EACH TYPE (AI, AO, DI, DO) FOR OWNER'S USE (I.E. 80 POINTS). These 80 points are over and above points required that are not specifically listed below but will be required to provide the specified sequences.**

SYSTEM POINT	POINT				ALARMS			COMMENTS
	AI	AO	DI	DO	HI	LOW	OFF NORMAL	
TYPICAL FOR AHU-1 THROUGH 4								
START/STOP SUPPLY FAN				X			X	
START/STOP RETURN FAN (where Return Fans are provided)				X			X	
SUPPLY FAN STATUS	2				2	2		VIA AMPERAGE SENSOR & DIFF. PRESSURE SENSOR
RETURN FAN STATUS	2				2	2		VIA AMPERAGE SENSOR & DIFF. PRESSURE SENSOR
SUPPLY FANS HIGH STATIC SAFETY			2		X		X	VIA DELTA P SWITCH
RETURN FANS LOW STATIC SAFETY			2		X		X	VIA DELTA P SWITCH
OUTSIDE AIR INTAKE DAMPER			2	X				OPEN/CLOSE, WITH END SWITCHES
SUPPLY FAN ISOLATION DAMPER			2	X				OPEN/CLOSE, WITH END SWITCHES
RETURN FAN ISOLATION DAMPER			2	X				OPEN/CLOSE, WITH END SWITCHES
COOLING COIL LEAVING AIR TEMP.	X				X	X		
UNIT SUPPLY DISCHARGE TEMP.	X				X	X		
OUTSIDE AIR TEMP. AND HUMIDITY	X							
MODULATE O.A. DAMPER	X	X	2					POSITION FEEDBACK
MODULATE RETURN AIR DAMPER	X	X						POSITION FEEDBACK
MODULATE RELIEF AIR DAMPER	X	X						POSITION FEEDBACK
MODULATE COOLING COIL VALVE	X	X						PROVIDE VALVE POSITION FEEDBACK
MODULATE STEAM PREHEAT COIL VALVE	X	X						PROVIDE VALVE POSITION FEEDBACK
FREEZE THERMOSTATS (AT COOLING COIL)			X				X	
OUTSIDE AIR HUMIDITY AND TEMPERATURE	2							
SPACE RELATIVE HUMIDITY SENSOR (PROVIDE 2 PER AHU)	2							
STEAM PREHEAT COIL DISCHARGE AIR TEMP.	X				X	X		

SYSTEM POINT	POINT				ALARMS			COMMENTS
	AI	AO	DI	DO	HI	LOW	OFF NORMAL	
STEAM PREHEAT COIL PRESSURE.	X				X	X		
STEAM CONDENSATE TEMPERATURE	X				X	X		
CHILLED GLYCOL RETURN TEMP. AT COIL	X				X	X		
CHILLED GLYCOL SUPPLY TEMP. AT COIL	X				X	X		SHARE COMMON POINT FOR ALL AHU'S IN MAIN GLYCOL SUPPLY
CHILLED GLYCOL FLOW RATE								
CHILLED GLYCOL INLET PRESSURE AT COIL	X				X	X		
CHILLED GLYCOL OUTLET PRESSURE AT COIL	X				X	X		
SUPPLY SYSTEM STATIC PRESSURE (IN DUCTWORK)	X							
MODULATE SUPPLY FAN #1 SPEED VIA VFD		X	X				X	PROVIDE VFD TROUBLE ALARM AND ALL VFD POINTS SPECIFIED
MODULATE SUPPLY FAN #2 SPEED VIA VFD		X	X				X	PROVIDE VFD TROUBLE ALARM AND ALL VFD POINTS SPECIFIED
SUPPLY UNIT PREFILTER DIFFERENTIAL PRESSURE	X				X	X		
DISCHARGE HUMIDITY	X							REPLACEABLE RH SENSOR TIPS
SUPPLY AIR SMOKE DETECTOR		X					X	EACH AHU
RETURN AIR SMOKE DETECTOR		X					X	EACH AHU
SUPPLY FANS AIR VOLUME (FMS)	2							EACH AHU,2, FAN FMSs/UNIT
UNIT SMOKE ISOLATION DAMPER(S)			X				X	
TYPICAL FOR AHU-5 THROUGH 7								
START/STOP SUPPLY FAN				X			X	
START/STOP RETURN FAN (where Return Fans are provided)				X			X	
SUPPLY FAN STATUS	2				2	2		VIA AMPERAGE SENSOR & DIFF. PRESSURE SENSOR
RETURN FAN STATUS	2				2	2		VIA AMPERAGE SENSOR & DIFF. PRESSURE SENSOR
SUPPLY FANS HIGH STATIC SAFETY			2		X		X	VIA DELTA P SWITCH
RETURN FANS LOW STATIC SAFETY			2		X		X	VIA DELTA P SWITCH
OUTSIDE AIR INTAKE DAMPER			2	X				OPEN/CLOSE, WITH END SWITCHES
SUPPLY FAN ISOLATION DAMPER			2	X				OPEN/CLOSE, WITH END SWITCHES

SYSTEM POINT	POINT				ALARMS			COMMENTS
	AI	AO	DI	DO	HI	LOW	OFF NORMAL	
RETURN FAN ISOLATION DAMPER			2	X				OPEN/CLOSE, WITH END SWITCHES
COOLING COIL LEAVING AIR TEMP.	X				X	X		
UNIT SUPPLY DISCHARGE TEMP.	X				X	X		
OUTSIDE AIR TEMP. AND HUMIDITY	X							
MODULATE O.A. DAMPER	X	X	2					POSITION FEEDBACK
MODULATE RETURN AIR DAMPER	X	X						POSITION FEEDBACK
MODULATE RELIEF AIR DAMPER	X	X						POSITION FEEDBACK
MODULATE COOLING COIL VALVE	X	X						PROVIDE VALVE POSITION FEEDBACK
MODULATE STEAM PREHEAT COIL VALVE	X	X						PROVIDE VALVE POSITION FEEDBACK
FREEZE THERMOSTATS (AT COOLING COIL)			X				X	
OUTSIDE AIR HUMIDITY AND TEMPERATURE	2							
SPACE RELATIVE HUMIDITY SENSOR (PROVIDE 2 PER AHU)	2							
HOT GLYCOL PREHEAT COIL DISCHARGE AIR TEMP.	X				X	X		
HOT GLYCOL RETURN TEMP. AT COIL	X				X	X		
HOT GLYCOL SUPPLY TEMP. AT COIL	X				X	X		
HOT GLYCOL FLOW RATE	X				X	X		
HOT GLYCOL INLET PRESSURE AT COIL	X				X	X		
HOT GLYCOL OUTLET PRESSURE AT COIL	X				X	X		
CHILLED GLYCOL RETURN TEMP. AT COIL	X				X	X		
CHILLED GLYCOL SUPPLY TEMP. AT COIL	X				X	X		
CHILLED GLYCOL FLOW RATE	X				X	X		
CHILLED GLYCOL INLET PRESSURE AT COIL	X				X	X		
CHILLED GLYCOL OUTLET PRESSURE AT COIL	X				X	X		
SUPPLY SYSTEM STATIC PRESSURE (IN DUCTWORK)	X							
MODULATE SUPPLY FAN SPEED VIA VFD		X	X				X	PROVIDE VFD TROUBLE ALARM AND ALL VFD POINTS SPECIFIED
MODULATE RETURN FAN #2 SPEED VIA VFD		X	X				X	PROVIDE VFD TROUBLE ALARM AND ALL VFD POINTS SPECIFIED
SUPPLY UNIT PREFILTER DIFFERENTIAL PRESSURE	X				X	X		
DISCHARGE HUMIDITY	X							REPLACEABLE RH SENSOR TIPS
SUPPLY AIR SMOKE DETECTOR		X					X	EACH AHU
RETURN AIR SMOKE DETECTOR		X					X	EACH AHU

SYSTEM POINT	POINT				ALARMS			COMMENTS
	AI	AO	DI	DO	HI	LOW	OFF NORMAL	
SUPPLY FANS AIR VOLUME (FMS)	2							EACH AHU,2, FAN FMSs/UNIT
UNIT SMOKE ISOLATION DAMPER(S)			X				X	
CENTRAL HOT GLYCOL/WATER PREHEAT SYSTEM								
START/STOP GLYCOL PUMP (PRIMARY)	X			X			X	WITH STATUS VIA AMPERAGE AND FLOW SWITCH
START/STOP GLYCOL PUMP (STANDBY)	X			X			X	WITH STATUS VIA AMPERAGE AND FLOW SWITCH
MODULATE GLYCOL LOOP LOW TEMPERATURE BYPASS CONTROL VALVE	X	X						PROVIDE VALVE POSITION FEEDBACK
GLYCOL RETURN TEMP AT HEAT EXCHANGER	X				X	X		
GLYCOL SUPPLY TEMP AT HEAT EXCHANGER	X				X	X		
MODULATE GLYCOL HX STEAM VALVES (10% / 30% / 60% VALVES)	X	X						AT HEAT EXCHANGER WITH VALVE POSITION FEEDBACK
START/STOP & MODULATE VFD FOR DIFFERENTIAL PRESSURE CONTROL		X						SIGNAL TO VFD, PROVIDE ADDITIONAL FLOW PROOF VIA FLOW SWITCH
SYSTEM DIFFERENTIAL PRESSURE	2							TWO SEPARATE LOCATIONS
CHILLER								
CHILLED WATER SUPPLY TEMP.	2				2	2		
CHILLED WATER RETURN TEMP.	2				2	2		
CHILLER START/STOP				X				
CHILLER STATUS BY EACH MODULE	X							
CHILLED WATER PUMP #1 (PRIMARY) (START/STOP & STATUS)	X			X				VIA CURRENT SENSOR
CHILLED WATER PUMP #2 (STANDBY) (START/STOP & STATUS)	X			X				VIA CURRENT SENSOR
CHILLED WATER FLOW THROUGH EACH CHILLER MODULE	1							
MAIN CHILLED WATER FLOW	X							
MAIN CHILLED WATER RETURN	X							
BYPASS FLOW	X							
EXHAUST FANS (Typical for each fan)								
EXHAUST FANS START/STOP & STATUS			X	X			X	STATUS VIA ΔP SWITCH
CFM TRACKING AIR INFLATABLE DAMPERS (TYPICAL)								
SPACE TEMP.	X				X	X		

SYSTEM POINT	POINT				ALARMS			COMMENTS
	AI	AO	DI	DO	HI	LOW	OFF NORMAL	
AIRFLOW VOLUME	X				X	X		
MODULATE DAMPER								
ENERGY METERING								
ELECTRICITY DEMAND (KW)	2							TWO ELECTRIC SERVICES
ELECTRICITY CONSUMPTION (KWH)	2							TWO ELECTRIC SERVICES
CHILLED GLYCOL TON-HOURS/MONTH	3							GPM; CHS, CHR TEMPS.; PROVIDE CONVERSION CALCULATIONS
HOT GLYCOL TON-HOURS/MONTH	3							GPM; CHS, CHR TEMPS.; PROVIDE CONVERSION CALCULATIONS
STEAM FLOW & PRESSURE	2							POUNDS STEAM PER MONTH AND PEAK PER HOUR

PART 3 – EXECUTION

A. **Provide any other points required by the Sequences or other items specified in Division 24.**

B. **Provide any additional points required for systems to function correctly.**

END OF SECTION 250630

SECTION 232500 – CHEMICAL WATER TREATMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Furnish and install all equipment, controls, chemicals, labor and accessories to make a complete system for chemically treating the HVAC hydronic systems specified herein.

B. All chemicals shall be environmentally safe and compatible.

C. The Mechanical Contractor shall engage the services of a nationally recognized water treatment manufacturer with local representative of such manufacturer to provide a complete water treatment service, designed to minimize corrosion and scale formation in all water systems. This service shall include providing the equipment, controls, chemical feed pumps, shot feeders, all chemicals and consulting analysis service for the initial start-up of each system.

D. The Mechanical Contractor shall provide complete electrical control interlocking wiring for all chemical feeding and control equipment, for a complete system. All electrically driven equipment, such as pumps, shall be provided with starters and disconnect switches under this Contract.

1.03 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.04 REFERENCES

A. EPA Regulation.

B. FDA Requirements.

C. ASTM: American Society for Testing and Materials.

1. D596-83 - Standard methods of reporting results of analysis of water.

D. NEMA: National Electric Manufacturers Association.

E. NFPA: National Fire Protection Association.

F. UL: Underwriters Laboratory Inc.

1.05 SUBMITTALS

A. See Section 230500 and General Conditions for additional requirements.

B. Shall be in accordance with all other specified requirements as well as those following.

C. Product Data: Submit manufacturer's technical product data, indicating chemical treatment materials, chemicals and equipment. This shall include MSDS and technical data sheets as well as all EPA, FDA, and or other environmental approvals.

D. Shop Drawings: Submit the initial manufacturer of all components and drawings indicating system schematics, equipment locations, and control schematics. In addition a clear concise written sequence of operation shall be provided.

E. Water analysis.

F. A complete scale drawing of the equipment installation

G. Submit manufacturer's installation instructions.

H. Submit reports indicating pre-cleaning completed and submit analysis of system water after cleaning and after treatment.

I. Submit reports indicating start-up of system is completed and is operating properly.

J. Submit an Operations Manual providing equipment manuals, product MSDS and technical data sheets, treatment log sheets, testing program, and description of operating parameters.

K. Product Data: Provide chemical treatment materials, chemicals and equipment including electrical characteristics and connection requirements.

L. Shop Drawings: Indicate system schematic, equipment locations, control schematics, electrical characteristics and connection requirements.

M. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration and connection requirements.

N. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

O. Certificate: Submit certificate of compliance for authority have jurisdiction indicating approval of chemicals and their proposed disposal.

P. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

Q. Operations and Maintenance Data: Include data on chemical feed pumps, agitators and other equipment including spare parts lists, procedures and treatment programs. Include step-by-step instructions on test procedures including target concentrations.

1.06 QUALITY ASSURANCE

A. The water treatment company shall have at least (5) years experience in the treating and servicing of systems as outlined above. All service must be supervised by a chemist or a chemical engineer. The water treatment company shall have full time service located within the trading area of the job site. Manufacturers shall be insured for not less than $10,000,000.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum five (5) years of documented experience and approved by manufacturer.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL testing firm and acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 MAINTENANCE SERVICE

A. Service Period: Provide chemicals and service program for a period of one (1) year from start-up date of condensing equipment, including the following:

1. Initial water analysis of water supply and recommendations.

2. Systems start-up assistance.

3. Training of operating personnel.

4. Periodic field service and consultation.

5. Customer reports and log sheets.

6. Laboratory technical assistance.

B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements and corrective actions needed. Submit two copies of field service report after each visit.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Include two (2) hour training course for operating personnel, instructing them on installation, care, maintenance, testing and operation of water treatment systems. Arrange course at start up of systems.

E. Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program and make recommendations in writing based upon these inspections.

1.09 MAINTENANCE MATERIALS

A. Supply sufficient chemicals for treatment and testing during warranty period.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable manufacturers contingent upon compliance with the specifications.

1. Diversey Corp.

2. Nalco Chemical Company

3. Betz Laboratory

4. **or Approved Equal**

B. Description of Work

1. The HVAC Contractor shall engage the services of a nationally recognized water treatment manufacturer or local representative of such manufacturer to provide a complete water treatment service, designed to minimize corrosion and scale formation in all water systems. This service shall include providing the equipment, controls, chemical feed pumps, bypass feeders, all chemicals and consulting analysis service for the initial clean out and start-up period of each system.

2. Service Period: Provide chemicals and service program for period of (1) year from start-up date of condensing equipment, including the following:

a. Initial water analysis of water supply and recommendations.

b. Systems start-up assistance.

c. Training of operating personnel.

d. Periodic field service and consultation.

e. Customer reports and log sheets.

f. Laboratory technical assistance.

3. Refer to **Division 26** for the following work:

a. Power supply wiring from power source to power connection on water treatment equipment. Include starters, disconnects, and required electrical devices, except as specified as furnished, or factory installed, by manufacturer.

b. Interlock wiring between electrically operated equipment units; and between equipment and field installed control devices.

1) Interlock wiring specified as factory installed is work of this section.

4. Provide the following electrical work as work of this section, complying with requirements of **Division 26**.

a. Control wiring between field installed controls, indicating devices, and unit control panels.

C. Quality Assurance

1. The water treatment company shall have at least (5) years experience in the treating and servicing of systems as outlined above. All service must be supervised by a chemist or a chemical engineer. The water treatment company shall have full time service located within the trading area of the job site. Manufacturers shall be insured for not less than $10,000,000.

2. Codes and Standards

a. UL and NEMA Compliance: Provide electrical components required as part of condenser water treatment equipment, which are UL listed and labeled and comply with NEMA standards..

b. NEC Compliance: Comply with National Electrical Code as applicable to installation, electrical connections, and ancillary electrical components of condenser water treatment equipment.

c. Chemical Standards: Provide only chemical products which are acceptable under state and local pollution control regulations.

d. Provide any and all necessary safety and government approval literature on recommended products and assure compliance with federal, state and local regulations.

2.02 PRE-CLEANING

A. The HVAC Contractor shall closely coordinate with the water treatment company to insure that each piping system is properly cleaned prior to placing in use and that no system is filled with water without proper water treatment chemicals being added.

1. Pre-cleaning chemical shall be TSP based and shall contain a flash rusting protection package. Disposal shall be to an approved waste treatment system.

2. Procedures

a. Flush all systems and then install precleaning chemicals to remove construction deposits such as pipe dope, oils, loose mill scale, and other extraneous materials.

b. Add recommended dosages and circulate for 6 to 8 hours.

c. Drain and flush until total alkalinity of rinse water is equal to make-up water.

d. Remove, clean, and replace strainer screens.

e. Refill with clean water to start treatment procedures.

2.03 HOT WATER (GLYCOL) **AND CHILLED WATER (GLYCOL)** SYSTEMS (CLOSED LOOP)

A. Equipment

1. Provide a 5 gallon capacity, bypass feeder with the wide mouth opening and quick disconnect cap for each hot water and chilled water system. Pressure rating of shot feeders shall be at least 125 psi. Provide all piping, valves, and accessories as detailed on the drawings.

a. Feeder shall be steel

b. ASME rated for 125 psig

B. Chemicals

1. Hot Water (for loops operating at temperatures exceeding 120°F)

a. Provide a nitrite based program designed to provide metal corrosion and scale protection. Program must be designed to provide corrosion rates of not more than 5 mpy for mild steel and 1 mpy for copper.

2. **Chilled Water (for loops operating at temperatures below 120°F)**

a. **Provide a molybdenum based program designed to provide multi-metal corrosion and scale protection. Program must be designed to provide corrosion rates of not more than 5 mpy for mild steel and 1 mpy for copper.**

2.04 PROPYLENE GLYCOL SYSTEMS

A. Provide complete initial fill of 30% propylene glycol/70% water for all glycol systems. Propylene glycol solution shall be Dowfrost as manufactured by Dow Chemical Co. or Union Carbide UCAR-17. Top off, test and adjust system solution after all piping systems have been tested and received. Refer to details on the drawings for automatic glycol fill system schematic.

B. Tanks hall be 50 gallon H.D., self-supporting natural polyethylene having vertical embossed graduations, stainless steel cover divided at midpoint with full diameter stainless steel piano hinge and drilled for pump mounting, suction line, fresh water fill, agitator and liquid level monitor. Tank shall be CCS, CB50 or equal.

C. Chemical injection pump shall be 110 volt, minimum 1/3 HP drive, 3/8" positive displacement, to be used for charging of glycol and future additional inhibitor. Pump is to have a bronze housing with stainless or bronze liquid drivers and internal, discharge pressure gauge, and adjustable internal relief valve set so as not to exceed normal system operating pressures. Output is to be at least 5.0 gallons per minute at 100 psi. The pump discharge line is to be fitted with a ball or swing check valve to prevent system backflow (zero flow leakage) when valves are open to main headers. Unless otherwise specified, pump operation shall be initiated by a switch controlled 110 volt circuit. Pumps shall be CCS P283A series. Provide an electric transfer pump system to transfer concentrated propylene glycol to the moving tank. Provide a pre-pressurized diaphragm tank, pressure tank at least 15 gallons in size to maintain pressure on the main fluid system.

D. Accessory Switch: Provide adjustable pressure switch to prevent operation of glycol chemical pump above system PRV settings, as manufactured by Mercoid DA-31, United or approved equal.

PART 3 - EXECUTION

3.01 EQUIPMENT START-UP,FOLLOW-UP AND TRAINING

A. The Water Treatment Contractor shall provide:

1. Recommendations in writing for all chemical types to be used in each system depending on local water quality and suitability. Chemicals shall be listed in generic terms.

2. Recommendation in writing on procedures, logs book entry and correct chemical applications.

3. Complete training of maintenance and operating personnel.

4. Start-up consisting of at least (3) days with weekly visits for the first month of operation.

5. After start-up, monthly visits at least every (30) days for a period of (1) year to analyze all water systems. Each analysis to be submitted in writing containing all results and recommendations to the Owner for corrective action.

6. A microbiological dip slide culture kit shall be provided and testing, including incubation, shall be performed.

7. Monthly Service

   a. Provide weekly service checks during initial start-up month and bi-weekly service during the 2nd month.

   b. Run control tests and submit a written service report covering all aspects of chemical treatment.

   c. Recommended changes in chemical feed rate or blowdown/bleed schedule as indicated by control tests.

3.02 OTHER SERVICE

A. Provide in-service training of operating engineers on product testing and chemical performance.

1. Operator Training: Train operating personnel in use, operation, and maintenance of all water treatment systems.

2. A program administration manual shall be furnished encompassing all systems covered in this Section.

3. Three days of training for operating personnel shall be priced including all expenses. Document in bid tabulation form.

B. Inspect boiler and condenser water surfaces at their regular inspection intervals.

C. Provide all laboratory reports on corrosion or deposit analysis as needed.

D. Make available all test kits and testing reagents to assure accurate test results.

E. Provide all log books for all equipment rooms so test results may be recorded. Log Books should contain:

1. Product technical data sheets

2. Product Material Safety Data Sheets

3. Equipment Literature

4. Program Operating & Testing Parameters

5. Chemical Testing and Blowdown/Bleed Log Sheets

F. System Testing and Follow Up

1. Chemical treatment representative shall visit the site once every month during the guarantee period. The representative shall check and adjust water treatment system operation during each visit, check efficiency of chemicals and chemical applications, and instruct and advise operating personnel.

2. At each inspection during the guarantee period, samples of the water systems shall be taken by the chemical treatment representative. The samples shall be analyzed by an independent testing laboratory and certified. The analysis made on the water shall be submitted to owner. The analysis report shall include recommendations as to any changes in the water treatment required.

G. Provide any and all necessary safety and government approval literature on recommended products to assure compliance with federal, state and local regulations.

3.03 INSTALLATION

A. Install chemical feeders per manufacturer's instructions. Chemical treatment equipment manufacturer shall supervise installation to ensure proper installation.

B. Install chemical feeders and equipment per manufactures recommendations.

C. Provide 316 stainless steel drip pan under chemical tanks and pumps. Pan shall be a minimum of 10 gauge.

D. Provide relief valve in the discharge of each pump.

E. Provide hose end drain valves at low points in piping.

3.04 PIPING SYSTEMS PREPARATION

A. General: After piping systems are erected and proven free of leaks provide services for piping systems flushing, cleaning, disinfecting, purging, rinsing and treating in accordance with specification.

3.05 CLEANING

A. Each new water system shall have an industrial strength cleaner added and circulated for a minimum of 24 hours when the system is initially filled with water. Cleaner shall be equal to Barclay Flushout.

B. After a complete flushing, each system shall be chemically treated with an inhibitor. The Water Treatment Contractor shall provide the proper amount of cleaner and inhibitor for each system, supervise the cleaning procedure and issue a written report to the Owner and Architect that each system has been properly cleaned, chemically treated and tested. The Mechanical Contractor shall perform the cleaning and flushing procedure under the supervision of the Water Treatment Contractor. The result of the initial tests shall be included in the report. All test apparatus, equipment and labor shall be provided by the Mechanical Contractor under this Section. Tests and cleaning will be witnessed by the

Architect and Owner's representatives. Notify all parties 48 hours in advance of commencement of work.

END OF SECTION 232500

SECTION 23 31 00 – SHEET METAL WORK AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Furnish and install a complete system of air distribution, including accessories, to all areas indicated on the contractor drawings.

B. Create, coordinate and submit ¼" scale Coordination Drawing in accordance with Section 230500.

C. Provide all ductwork, fittings and accessories to make a complete and operational system in all respects.

1.03 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.04 REFERENCES

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.

B. Material standards shall be as specified or detailed hereinafter and as follows:

1. ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel.

2. ASTM A 1008/A 1008M – Standard Specification for Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.

3. ASTM A 1011/A 1011M – Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.

4. ASTM A 653/A 653M – Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

5. ASTM A 666 – Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

6. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

7. ASTM B 209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

8. ASTM C 443 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

9. ASTM C 443M – Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric).

10. NFPA 90A – Installation of Air Conditioning and Ventilating Systems.

11. NFPA 90B – Installation of Warm Air Heating and Air Conditioning Systems.

12. NFPA 96 – Installation of Equipment for the Removal of Smoke and Grease-laden Vapors from Commercial Cooking Equipment.

13. SMACNA (LEAK) – HVAC Air Duct Leakage Test Manual.

14. SMACNA (DCS) – HVAC Duct Construction Standards – Metal and Flexible.

15. UL 181 – Factory-Made Air Ducts and Connectors.

1.05 SUBMITTALS

A. See Section 230500 and General Conditions for Additional Requirements.

B. Product Data: Provide data for duct materials, duct connectors and all accessories. Include sound attenuator test data in accordance with ASTM E477.

C. The Sheet Metal Contractor shall submit duct fabrication standards and methods of installation, in compliance with SMACNA and these specifications, for review and approval by the Engineer, clearly indicating the combination of metal gauges and reinforcement intended for use for each pressure classification. Duct fabrication shall not be allowed until a satisfactory review of this Standard has been performed and fabrication drawings have been reviewed and coordinated. MERELY SUBMITTING COPIES OF THE SMACNA PRESSURE CLASS TABLES DOES NOT COMPLY WITH THIS REQUIREMENT.

D. Provide scaled ductwork fabrication drawings. Fabrication drawings shall be double line and as a minimum include elevations, dimensions, sizes, all offsets rises and drops, air distribution devices.

E. Provide scaled ductwork coordination drawings for all floors and systems in accordance with Section 230500, Submittals.

F. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA– HVAC Air Duct Leakage Test Manual.

G. Manufacturer’s Installation Instructions: Indicate special procedures for glass fiber ducts.

H. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed recommended fabrication and installation requirements.

I. Project Record Documents: Record actual locations of ducts, duct fittings and all accessories. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. All ducts and fittings shall be manufactured by a sheet metal fabrication company whose primary business experience is the manufacture of commercial and industrial quality ducts and fittings. Sheet Metal Contractor shall have adequate experience of building ductwork of the types required for this project as well as successful experience with projects of similar scope. Bids from sheet metal shops which do not meet the specified requirements shall not be acceptable.

B. No Ductmate, Ward, Nixon or similar factory made slip-on connections will be permitted.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 SHEET METAL WORK

A. General

1. Acceptable Manufacturers (Provided they are in compliance with these specifications)

a. Sheet Metal

1) All ducts and fittings shall be manufactured by a sheet metal fabrication company whose primary business experience is the manufacture of commercial and industrial quality ducts and fittings. Sheet Metal Contractor shall have adequate experience of building ductwork of the types required for this project as well as successful experience with projects of similar scope. Bids from sheet metal shops which do not meet the specified requirements shall not be acceptable.

b. Sheet Metal Accessories

1) Access Doors

a) Ruskin
b) Air Balance

c) Buckley Associates
d) Ductmate

2) Flexible Connectors

a) Ventlock
b) Elgen Manufacturing
c) Duro Dyne
d) Ventglass

3) Flexible Ductwork

a) Clevepak Corp.
b) Flexible Technologies
c) Unaflex Rubber Corp.
d) Flexmaster

4) Fire Dampers

a) Ruskin
b) Prefco
c) Air Balance
d) Greenheck Fan Corp.
e) Nailor Industries
f) NCA Manufacturing Inc.

5) Fire/Smoke Dampers

a) Ruskin
b) Prefco
c) Air Balance
d) Greenheck Fan Corp.
e) Nailor Industries

6) Smoke Dampers

a) Ruskin
b) Prefco
c) Air Balance
d) Greenheck Fan Corp.
e) Nailor Industries

7) Automatic Dampers Airfoil

a) Ruskin
b) Greenheck Fan Corp.
c) Nailor Industries
d) T.A. Morrison & Co. Inc. (TAMCO)
e) NCA Manufacturing Inc.

8) Balancing Dampers (OBD)

a) Ruskin
b) Young Regulator
c) Prefco
d) Greenheck Fan Corp.
e) Nailor Industries

f) NCA Manufacturing Inc.

9) Small Balancing Damper less than 48x12

a) Ruskin
b) Young Regulator
c) Ventlock
d) Duro Dyne

2. Unless otherwise noted, all supply, return and exhaust air ductwork of all types shall be constructed of galvanized sheet metal based on the "Pressure Class" indicated in the "Minimum SMACNA Construction Standards" table found hereinafter.

3. The drawings are diagrammatic and indicate the arrangements of the principal apparatus, ductwork and piping and shall be followed as closely as possible. Because of the scale of the drawings, it is not possible to show all offsets, rises, drops, rises, fittings, accessories, etc. The Contractor shall carefully investigate the structure, finish conditions, and the work of other trades affecting the work and arrange ductwork, piping, equipment, accessories, etc. accordingly. Provide the best possible arrangement so as to provide the maximum headroom and access to apparatus while providing the minimum resistance to airflow. This work and any extra fittings and offsets required shall be included in the project without extra charge.

4. In addition to sheet metal ductwork provided under this Contract furnish and/or install accessories and devices furnished by others, including but not limited to smoke detectors. Provide and install miscellaneous sheet metal work including safing, mixing baffles, and blank off panels at unused louver areas.

5. All duct systems specified to be installed under this Contract, shall conform to the drawings, specifications, Standards, details and recommendations of the latest Edition of SMACNA "HVAC Duct Construction Standards - Metal and Flexible"; and "Round and Industrial Duct Construction Standards" (hereinafter referred to as Duct Manual). Where the requirements under this Section exceed the requirements of the Duct Manual, the specification shall govern. Wherever the word "should" appears, replace with the word "shall".

6. The Sheet Metal Contractor shall submit duct fabrication standards and methods of installation, in compliance with SMACNA and these specifications, for review and approval by the Engineer, clearly indicating the combination of metal gauges and reinforcement intended for use for each pressure classification. Duct fabrication shall not be allowed until a satisfactory review of this Standard has been performed. MERELY SUBMITTING COPIES OF THE SMACNA PRESSURE CLASS TABLES DOES NOT COMPLY WITH THIS REQUIREMENT.

7. All galvanized steel sheet metal shall conform to ASTM A653/A653M (G-90) having not less than 1.25 oz. of zinc on each side of each square foot of sheet. All other duct materials shall be as hereinafter specified as applicable to this Contract.

8. The Sheet Metal Contractor shall install all duct mounted smoke detectors.

9. The Sheet Metal Contractor shall furnish and install all plenums with automatic or manual dampers attached to louvers.

10. The Sheet Metal Contractor shall fabricate and install all canopy hoods, flexible "elephant trunk" exhaust outlets as detailed or noted in the Construction Documents.

11. The Sheet Metal Contractor shall furnish and install exhaust ductwork from emergency generator outlet to exhaust louver including transitions, drains, access doors, flexible connections and baffles to isolate intake from exhaust.

12. There will be no supply and/or return air system ductwork internally lined unless otherwise noted.

13. The Sheet Metal Contractor shall clean and provide temporary caps on all ductwork during installation to prevent dust, dirt and debris from entering ducts during construction, including during shipping, handling and storage in the field.

14. All shop applied fabrication labels shall be applied to the exterior of the ducts. The Sheet Metal Contractor shall remove any material applied to the inside of the ducts before installation.

15. All inline fans shall have companion flanges intake and discharge for removal for servicing.

16. Seal all joints to VAV/VCV/SAV/EV in the field, including reheat coils and sound attenuators.

2.02 DUCT CONSTRUCTION

A. Duct Construction Schedule

Minimum SMACNA Construction Standards						
Ductwork Location	Pressure Class Inches W.G.	Seal Class	Leakage Class	Material	Sound Lining	Table Notes
Supply from Air Handling units to terminal boxes	±6	A	4	G-90	No	
Within 50'-0" from Air Handling units	±6	A	4	G-90	Yes	1
Supply from terminal boxes to outlets	±2	A	4	G-90	No	
Return from Air Handling units to terminal boxes	-6	A	4	G-90	No	
Return within 50'-0" of the Air Handling units	-6	A	4	G-90	Yes	1
Return from outlets to terminal boxes	-2	A	4	G-90	No	2
Exhaust from Exhaust Air Handling units to terminal boxes	-6	A	4	G-90	No	

Minimum SMACNA Construction Standards						
Ductwork Location	Pressure Class Inches W.G.	Seal Class	Leakage Class	Material	Sound Lining	Table Notes
Exhaust within 50'-0" of the Exhaust Air Handling units	-6	A	4	G-90	Yes	1
Exhaust from outlets to terminal boxes	-2	A	4	G-90	No	2
Return to Air Handling units constant volume systems.	-4	A	4	G-90	No	
Supply from Air Handling units constant volume systems	±4	A	4	G-90	No	
Toilet exhaust	-3	A	4	G-90	No	2
General exhaust	-3	A	4	G-90	No	2
Within 30'-0" of each side of exhaust fan (suction & discharge)	±3	A	4	G-90	Yes	2
Plenums	±4	A	4	Same as Ducts	As In-dictated	2
Other	±3	A	4	G-90	No	2

EDIT AS REQUIRED

Table Notes
1 Ductwork shall be double wall with solid metal liner.
2 Ductwork in the following locations shall be constructed of aluminum or stainless steel and continuously welded (Joints & Seams) and pitched back to the outlets. · Within 20'-0" of a shower area exhaust. · Within 20'-0" downstream and 5'-0" upstream of a duct humidifier. · Within 20'-0" of a sterilizer area exhaust. · Within 15'-0" of an outside air intake. · Within 20'-0" of a cartwasher exhaust. · Within 20'-0" of a locker room and within room (exhaust). · Within 20'-0" of a locker room and within room (supply).
3 Pitch horizontal duct back to hood equipment where exhaust originates.

2.03 ADDITIONAL CONSTRUCTION REQUIREMENTS

A. Minimum Requirements

1. The minimum gauge for any steel duct over 2" or under -2" pressure class shall be 24 gauge except when specified heavier.

2. The minimum gauge for black steel kitchen exhaust ductwork shall be 16 gauge.

3. The minimum diameter of any tie rod shall be 1/2".

4. The maximum tie rod spacing shall be 42" unless specifically engineered in accordance with the SMACNA Industrial Rectangular Duct Standard.

5. When tie rods intersect, they shall be welded to each other.

6. No ductwork shall be constructed to less than ±2" w.g. This means nothing is constructed to a standard between –2" w.g. and +2" w.g.

7. Duct dimensions indicated are clear inside dimensions. The sheet metal dimensions shall be increased to accommodate internal liner where liner is required.

B. All joints and seams in all ductwork and casings shall be sealed to SMACNA Seal Class "A". In finished areas, sealing compound shall be neatly applied to exposed ductwork and bands shall be provided over, to cover the sealant.

1. Some SMACNA constructions may not be suitable for the leakage classes specified even though they may meet the pressure class and should not be used.

2. Seal class A Welded means all welded (i.e. transverse joints, longitudinal seams, spiral seams, fire dampers, volume dampers or any accessories)and in addition it means continuously welded.

3. All sealants, adhesives and coatings shall be of approved kinds and qualities for each point of application, complying with recommendations for the use and storage.

4. The method of installation and materials for sealing the ductwork shall be submitted by the Sheet Metal Contractor for review and approval by the Engineer, as part of the ductwork construction standards and installation submittal.

C. All longitudinal seams in all ductwork in excess of +2" w.g. or less then -2" w.g pressure class shall be made with formed Pittsburgh locks.

D. Grooved seam/flat lock/pipe lock joining methods is restricted to 2" W.G. pressure class only.

E. Button punch-snap lock seams are not to be used.

F. Concealed stainless steel ductwork shall have an ASTM mill rolled No. 1 or No. 2 D finish. Exposed stainless steel ductwork shall have an ASTM mill rolled No. 2 B finish, or higher grade as required by the Engineer, with all welds ground smooth and final brushed with stainless steel wire brushes. All welds on exposed stainless steel ductwork shall be free of stain, burn-through, or discoloration to the satisfaction of the Engineer.

G. Tie rods shall not be used in any plenum or large duct requiring internal access or use as an access pathway.

H. All ductwork required to be removable shall be companion flanged SMACNA Type T-22 for ductwork constructed to SMACNA Metal Duct Standard and companion flanged in accordance with Industrial Standards for ductwork required to be constructed to Industrial Standards.

I. Elbows

1. All dust collection ductwork elbows shall be a centerline radius equal to (2) duct widths or diameters. No reduction shall be allowed.

2. Radius elbows shall be used wherever possible. Where it is impossible or impractical to install a 1.5 times width to centerline radius of elbow (full radius elbow) lesser radii configurations shall be used, each with "radius-proportional" splitter vanes permanently installed within. No radius shall be less than 1.0 times the width. Provide square elbows in rectangular ducts with double thickness vanes with a minimum radius of 4 1/2". Square elbows may only be used when radius elbows will not fit and where specifically approved by the Engineer prior to fabrication and/or as required by coordination shop drawings. All offsets shall be of the radium type.

J. Auxiliary drain pans.

1. Provide 1 ½: deep auxiliary drain pans under any units with cooling coils located above hung ceilings.

2. Pans shall be 6” larger then equipment in all directions.

3. This includes but not limited to all fan coil units.

4. Drains shall be piped to floor drains or utility sinks.

K. Ducts Exposed to Weather

1. For all ducts exposed to weather, after all ducts and joints are sealed and tested as specified herein, apply all over and around the same areas of possible leakage (joints), an approved sealer system, so that ductwork outside the building shall be installed in a manner to result in less then 0.5 leakage class.

2. Exposed ductwork shall be insulated and weather-protected by the Insulation Contractor after the installation is completed and tested.

L. Provide baffles and/or diffusion plates as required in all air handling units, to ensure proper air mixing, coil velocities and air distribution across filters or coils as determined in the field by the Engineer, at no additional cost to the Owner.

M. It is the intent of this specification to provide a duct system with minimum resistance to airflow. All take-offs shall be throated and transitions made as gradually as possible. "Bullhead" or sharp take-offs shall not be acceptable.

N. In addition to SMACNA requirements, ductwork in return systems without boxes, ductwork in supply systems without boxes, ductwork in exhaust systems without boxes, ductwork in any Constant Volume System and/or ductwork downstream of VAV Boxes shall be provided with:

1. Volume dampers in all branch takeoffs and in all main branches and ducts of all ductwork systems (supply, return and exhaust) for properly regulating and balancing airflow to all terminal outlets, for all duct sizes, whether shown on the drawings or not. The above requirement is mandatory.

O. All rectangular dampers shall be opposed blade and each shall be controlled by an approved galvanized locking quadrant indicating the damper position, as detailed on the drawings.

1. Volume dampers installed into ductwork that is specified to be externally insulated shall have extended activator/handle rods with extension bracket such that adjustment of the damper handle will not disturb the insulation.

P. Submit the sheet metal shop drawings to the Balancing Contractor of the project for his review and placement of dampers with the final balancing procedures and requirements in mind.

1. Coordinate the location and areas with the Balancing Contractor, and fabricate the ductwork system accordingly.

2. Provide any and all balancing dampers required by the balancing contractor at no additional cost.

Q. In addition to SMACNA requirements, all round ductwork, if used in lieu of rectangular supply and/or return/exhaust systems shall conform to SMACNA.

1. The use of flat oval ductwork shall be acceptable only with prior written approval of the Engineer. Note: Flat oval shall not be used under negative pressure.

2. Round duct shall be manufactured of spiral lock seam. Ductwork up to 12"ø and 2" w.g. pressure class can be manufactured with longitudinal lock seams.

3. All tees shall be conical.

4. All laterals shall be straight.

5. All taps through 10" diameter in size shall have a machine drawn entrance and all fittings shall have longitudinal seams, continuous-welded. Both sides of all welds shall be primed with zinc chromate.

6. All tap entrances shall be free of weld build-up.

7. Elbows in diameters 3" through 10" shall be 2-section stamped or pleated elbows. Larger elbows shall be gored construction. Elbows shall be fabricated to a centerline radius of 1.5 times the diameter. All gored elbows shall be fabricated according to the following schedule:

Elbows	# of Gores
Up to 35°	2
36° to 71°	3
Over 71°	5

8. All field joints in diameters through 48" shall be made with a 2" long slip-fit or sleeve coupling provided assembly is not hindered. Ductwork over 48", and for all sizes where disassembly and removal is required, shall be joined with Vanstone or shop fabricated flanges.

9. All flanges and taps into spiral ducts shall be factory or shop fabricated and installed as hereinbefore specified. Shipment of loose flanges or taps for field installation shall be avoided.

10. All access doors for round duct shall be furnished by the access door manufacturer. Round duct access doors shall be of low leakage sandwich type suitable for systems up to 8” pressure, positive or negative. Round duct access doors shall be insulated and shall be equivalent to Ruskin model ARDD.

11. Unless specifically noted otherwise or required by special constraints, all elbows on ductwork changing direction from vertical to horizontal shall be 1.5 times radius.

2.04 SHOP APPLIED DUCT LINER

A. Interior supply and return ducts and plenums (other than outside air plenums), as hereinbefore specified to have internal duct insulation shall be lined with 1" thick fiberglass duct liner equal to Manville Permacote Linacoustic R300.

B. Liner shall meet the requirements of UL 181, ASTM C665 Bacteriological Standards, UL 723 Flamespread and NFPA 90A for flamespread and smoke developed ratings as borne out by tests and ratings of UL. Liner shall have an NRC no less than 0.80, based on Type A mounting as tested in accordance with ASTM C423-90 "k" factor not to exceed 0.25 (1") at 75°F mean temperature in accordance with ASTM C-518.

C. Maximum air friction in straight 24" diameter duct conveying 6200 cfm airflow at 2000 fpm velocity shall be 0.36" per 100'-0"

D. No erosion of insulation material shall occur below 5000 fpm duct velocity. Rigid board liner shall be constructed of strong glass fibers bonded with thermosetting resin.

E. All surfaces shall be protected with an acrylic coating.

F. Liner shall be applied with 100% coverage of approved fire resistant adhesive. Ducts over 20" in size in any direction shall be secured with mechanical fasteners ("stick-clips") on 12" centers and within 3" of ends.

G. Leading and exposed edges of liner joints shall be coated with fire resistant adhesive. Permacote-coated surface shall face the airstream.

H. The ductwork system shall be lined/sealed and installed in a manner to allow for low temperature air operation.

I. Care shall be exercised to ensure that no gaps or bare sheet metal exist, which might create condensation.

J. Acoustical liner installed in medium pressure ductwork and wherever lining starts abruptly from unlined ductwork shall be "nosed" with sheet metal flanging at all joints in accordance with SMACNA liner nosing details.

K. Liner shall be coated with a surface coating that does not support the growth of fungus or bacteria as determined by tests in accordance with ASTM C1071 and ASTM G21 and G22. Liner shall be sound absorptive.

L. The smooth black surface of the liner shall face the airstream and top pieces shall support the side pieces.

M. Lining on double wall duct systems may be completely covered with a layer of perforated minimum 24 gauge sheet metal (3/16 sq.in. holes on 7/16" staggered centers). The perforated sheet metal inner liner shall be secured with rivets and washers at intermediary points maximum 12" on center on all spans greater than 12" in width or height. Sheet metal nosing shall be provided to cover all insulation exposed-to-airstream edges, by bending of the sheet metal liner. Other methods of nosing, if different than the one specified, shall be submitted for review by the Engineer prior to installation.

2.05 ACCESS DOORS

A. Provide access doors and frames in all supply, exhaust and return ductwork as required, to permit access to:

1. Automatic dampers
2. In-box heating coils
3. Fire dampers
4. In-duct coils
5. All plenums
6. In-duct humidifiers
    a. Provide sight doors
7. Other similar equipment
8. Fan Bearings enclosed in ducts.
9. Duct smoke Detectors
    a. Provide sight doors
10. For cleaning and inspection purposes
11. Where indicated on the drawings

B. Door construction

1. Door size
    a. Ductwork
        1) Minimum 20” x 16”
        2) In ducts smaller then 16” they shall be 20” x 2” less then duct width except:
            a) Terminal Box heating coil door may be 12” x 6”
    b. Plenums
        1) Shall be 20” x 56”
            a) 18” x 45” door may be used only when 20” x 56” will not fit.
        2) Larger door shall be provided if required for equipment removal. Coordinate with equipment.
2. Doors shall match material type and gauge of the duct system in which they are installed.
3. Minimum gauge shall be 22.
4. Provide a neoprene gasketed around their entire perimeter.
5. Where sight doors are required, a wire reinforced safety glass shall be utilized.
6. Insulated or lined ductwork shall have insulated door
7. Insulated plenums shall have insulated door
8. Insulated doors shall be double wall.
9. Insulation between the metal panels shall be of the same thickness as the duct or panel adjacent to the access doors.
10. All access doors shall be hung on heavy hinges and shall be secured in the closed position by means of cast zinc clinching type cam latches
11. Hinged doors shall be similar to Greenheck model HAD-10.
12. Where space conditions preclude hinges, a minimum of (2) cams shall be utilized in low pressure ductwork and a minimum of (4) heavy window type latches shall be utilized in ductwork over 2” pressure class. In all cases where hinged doors are not utilized, a safety retainer chain shall be provided.
13. Cammed doors shall be equivalent to Greenheck model CAD-10.

14. All fire damper access doors in all positive pressure supply ductwork of +3" w.g. or greater construction:

    a. Shall be of the pressure relief (negative pressure) spring loaded type. Design shall incorporate self-closing spring latch or be complete with secure retainer chain and "D" handle.

    b. These doors shall be mounted downstream (after shutoff) of fire dampers, fire/smoke dampers or smoke dampers or similar automatic shutting devices.

    c. These doors shall be of the automatic reset type and similar to Ruskin model ADHP-3.

2.06 FLEXIBLE CONNECTIONS (AHUS, FANS)

A. Provide flexible connections of 4" minimum fabric width

1. Between ductwork and the inlets and outlets of all fans except:

    a. Hazardous exhausts

    b. Lab exhaust fans located indoors.

2. Equipment equipped with fans

3. All ductwork that crosses building expansion joints

B. The connections shall be placed as close to the equipment as practical except at fan suction connections and the clear gap at rest shall be not less than 3". At fan suction connections, locate flexible duct connection at least 3 duct diameters away from fan inlet connection.

C. There shall be no tension of the fabric under static or dynamic loads

D. All fabric for flexible duct connections to equipment shall be a minimum of 22 oz. glass fabric, double coated with neoprene, fire retardant, waterproof, airtight, and approved by UL, similar to Ventfabrics or Ventglass.

E. Exterior flexible connection shall be insulated type similar to Duro Dyne.

F. Flexible connections shall be fabricated from approved flameproofed fabric conforming to NFPA 90A. Asbestos shall not be acceptable.

G. Flexible connections shall be installed further upstream from fan powered equipment (in the main duct size) to prevent obstruction of the fan inlet due to suction of the fabric into the airstream.

H. Ductwork shall be increased in size where the flexible connections are located to prevent fully drawn in connections from blocking any duct area. Submit detail for review.

2.07 BLANK OFF PANELS FOR UNUSED LOUVER AREAS

A. Provide minimum 20 gauge sheet metal blank off panels for all unused louver areas:

1. All louver areas not enjoined or connected to an active plenum.

B. Exterior/visible face of blank off panel shall be cleaned and painted flat black, prior to installation.

C. Panels shall be screwed to louver frames and caulked to provide a weathertight seal.

D. Provide insulation of blank off panels. See specification Section 15081 - Ductwork insulation.

2.08 FLEXIBLE DUCTWORK (USE FOR TEMPORARY DUCTWORK ONLY. ALL PERMANENT DUCTS RIGID TYPE ONLY)

A. General

1. Flexible ductwork shall be supported at a maximum spacing of 2'-6", and as detailed on the drawings. Ductwork must not be compressed. Duct elbows must not exceed 45°.

B. Flexible Duct (Rigid)

1. Flexible duct shall be similar to Flexmaster Triple Lock Buck Duct Flexible Air Duct. Flexible duct (insulated) shall be UL 181, Class 0 listed air duct and constructed in accordance with NFPA 90A and 90B. It shall have a smoke/flame spread rating of 50/25.

2. Triple Lock Buck Duct shall be made from a tape of dead soft aluminum sheet, spiral wound into a tube and spiral corrugated to provide strength and stability. The joint shall consist of a triple lock that is mechanically performed without the use of adhesives to make a durable airtight seam. A double lock is not acceptable.

3. Insulated flex shall have a gray fire retardant polyethylene outer jacket with an 8 oz. density, 1 1/2" thick fiberglass insulation blanket, factory wrapped.

4. The flexible duct shall be supported as required.

5. Flexible ductwork shall be rated at 12" positive pressure. Duct from 3" to 16" shall have a negative pressure 12" and duct from 18" to 20" shall have a negative pressure of 8".

6. All flexible ducts shall be individually cartooned and labeled for delivery to the job site for maximum protection.

7. Provide, where indicated in construction greater then +2” or less then –2”, and upstream of supply boxes or downstream of exhaust boxes.

C. Flexible Duct (Fabric)

1. Flexible duct shall be similar to Flexmaster Type 2. Flexible duct (insulated) shall be UL 181, Class 1 listed air duct and constructed in accordance with NFPA 90A and 90B. It shall have a smoke/flame spread rating of 50/25.

2. Duct fabric shall be of a heavy duty coated fiberglass cloth fabric. The fabric material shall be mechanically locked to the outside helix. (Use of adhesives to lock fabric in place is unacceptable.) The helix is constructed of a corrosive resistant galvanized steel, formed and mechanically locked to the duct fabric on the outside to prevent tearing of the flexible duct.

3. Insulated flex shall have a gray fire retardant polyethylene outer jacket with an 8 oz. density, 1 1/2" thick fiberglass insulation blanket, factory wrapped.

4. The flexible duct shall be supported as required to prevent sagging. Flexible duct with excessive sagging will not be approved.

5. Flexible ductwork shall be rated at 12" positive pressure and 10" negative pressure. Negative pressure for 14"R and 16"R shall be 5" and negative pressure for 18"R shall be 1".

6. All flexible ducts shall be individually cartooned and labeled for delivery to the job site for maximum protection.

7. Provide, where indicated in ±2” duct construction, downstream of supply boxes or upstream of exhaust boxes.

2.09 DAMPERS

A. General

1. The minimum damper requirements shall be as indicated in the following table:

Damper Construction Table						
Type	Approach Velocity (FPM)	Pressure Rating	Instantaneous Pressure Rating	UL555S Leakage Class	Blade Type	Listing
Fire dampers in ducts greater than +2" w.g. or less than -2" w.g. (FD)	2000	4”w.g.	10” w.g.	N/A	OBD 3V	UL555 Dynamic
Other fire dampers (FD)	2,000	4" w.g.	8" w.g.	N/A	Curtain or OBD	UL555 Dynamic
Fire smoke dampers in ducts greater than +2" w.g. or less than -2" w.g. and at all shafts (FSD)	3,000	4" w.g.	14" w.g.	I	Air Foil	UL555, UL555S Dynamic
Other fire smoke dampers (FSD or HFD)	2,000	4" w.g.	8" w.g.	I	OBD 3V	UL555, UL555S Dynamic
Smoke dampers (SD)	3,000	4" w.g.	14" w.g.	I	Air Foil	UL555S Dynamic
Isolation dampers (at units)	4.500	8" w.g.	20" w.g.	I	Air Foil	

Damper Construction Table						
Type	Approach Velocity (FPM)	Pressure Rating	Instantaneous Pressure Rating	UL555S Leakage Class	Blade Type	Listing
Automatic dampers (AD)	4.500	6" w.g.	14" w.g.	I	Air Foil	N/A
Balancing dampers in ducts wider than 48" and/or deeper than 12" (VD or as specified)	2,500	4" w.g.	N/A	N/A	OBD	N/A
Balancing damper in ducts less than 48" by 12" (VD or as specified)	2,500	2”	N/A	N/A	OBD	N/A
Smoke control damper (SCD)	3,000	4"	8"		OBD	UL555S Dynamic

2. Dampers in stainless steel ducts shall be stainless steel.

B. Automatic Dampers

1. See Automatic Temperature Control Specification.

C. Fire Dampers, Ceiling Radiation Dampers, Smoke Dampers, and Combination Smoke/Fire Dampers

1. Fire dampers, smoke dampers and combination smoke/fire dampers shall be provided as shown on the drawings and wherever Engineerural drawings indicate fire and/or smoke rated partitions. Devices shall be of the appropriate service for the partition class into which they are installed. Exact requirements and type of partition shall be coordinated with the Engineer.

2. All dampers shall meet the requirements of NFPA 90A and further shall be tested, rated and labeled in accordance with UL 555 (6^{th} Edition), UL555S (4^{th} Edition) and UL555C (1^{st} Edition).

3. All dampers shall be tested, rated and labeled as "Dynamic Rated" for closure against airflow in the following configuration:

   a. Vertical mount (horizontal airflow): Ducted and unducted.

   b. Horizontal mount (airflow up): Ducted and unducted.

   c. Horizontal mount (airflow down): Ducted and unducted.

   Note: Static rated dampers shall not be allowed.

4. Each damper shall be rated to close against maximum design airflow at its installed location, with 400 fpm and .5 in wg. safety factors and against 4" w.g. maximum pressure across the closed damper.

5. All dampers of all ratings and types shall be of the nominal 100% face area type, with blade package and all frame components out of the airstream. These dampers shall include the required oversize enclosures which shall be sealed by the damper manufacturer for the appropriate duct pressure class into which they are installed. All such dampers shall have appropriate rectangular, flat oval or round duct collars to facilitate connection of mating ductwork. The Contractor shall be responsible for any additional sealing of duct collars and connections required to maintain the duct seal class requirements but shall not jeopardize the UL breakaway connection when utilized.

6. The Contractor shall indicate the location and rating of all dampers on his shop drawings and shall provide access doors at each location of sufficient size and type to permit access to the damper components. A list of fire dampers shall be provided for review. The Contractor shall be solely responsible to coordinate all locations of duct access doors and dampers of all types.

7. Contractor shall include damper manufacturer's installation instructions as part of the damper submittal. These instructions shall describe the applicable requirements for damper sleeve thickness; retaining angles; sealing; duct-to-sleeve connections; preparation of wall, floor or ceiling openings; and all other requirements to provide an installation equivalent to that tested by the damper manufacturer during the UL 555, UL555S and UL555C qualification procedures. Contractor shall detail any proposed installations that deviate from these manufacturer's instructions and explain the needed deviations. All fire, smoke and ceiling radiation damper installations shall comply with the manufacturer's installation instructions. Any submitted deviations must be acceptable to the appropriate authority having jurisdiction.

8. Fire Dampers

    a. Fire dampers shall be provided as shown on the drawings and wherever Engineerural drawings indicate fire-rated partitions to the following schedule:

Partition Assembly Fire Rating	Penetration Type	Damper Rating
1 Hour	Ducted and Sprinklered	No damper; duct sleeved and packed only
1 Hour	Ducted and Non-Sprinklered	1.5 Hour
1 Hour	Open (Transfer)	1.5 Hour
1.5 to 2 Hours	Ducted or Open	1.5 Hour
3 Hour	Ducted *	3.0 Hour
4 Hour	Ducted *	3.0 Hour
*No open transfer will be permitted through these partitions.		

    b. Fire damper sleeves shall be manufactured with a metal sleeve of appropriate length and thickness for the required damper installation as shown in the table below:

Maximum Duct I.D.	Sleeve Gauge (U.S.)
Up to 84”	20 gauge
85” & Up	18 gauge

c. Fusible link temperature rating for all fire dampers shall be 212°F or 50°F above the highest system temperature, whichever is greater.

d. Dampers in stainless steel ducts shall be stainless steel.

e. Dampers located in welded systems shall be rigidly connected with welded connections (not breakaway).

9. Smoke Dampers and Combination Fire/Smoke Dampers

a. Smoke dampers and combination fire/smoke dampers shall be provided as shown on the drawings and wherever Engineerural drawings indicate smoke/fire rated partitions. Combination fire/smoke dampers shall be dynamically rated for 1.5 or 3 hours as determined by the Engineer.

b. Smoke dampers and combination fire/smoke dampers and actuators shall meet the requirements of NFPA 92A and NFPA 92B and further shall be tested, rated and labeled as a "Leakage Rated Damper for Use in Smoke Control Systems" in accordance with the 4th edition of UL 555S. All smoke dampers shall be of low leakage design qualified to UL 555S Leakage Class I (maximum leakage of 4 cfm/sq.ft. at 1" w.g. and 8 cfm/sq.ft. at 4" w.g.) and shall have a UL 555S elevated temperature rating of 350°F.

1) Each smoke damper/actuator combination shall be UL 555S rated to operate at maximum design airflow at its installed location with 400 fpm and .5 in wg. safety factors.

c. Each smoke damper and combination fire/smoke damper shall be supplied with an appropriate damper actuator installed by the damper manufacturer at the time of damper fabrication. Combination fire/smoke dampers shall be manufactured with a metal sleeve of appropriate length and thickness for the required damper installation, and the damper actuator shall be installed on the sleeve exterior. Smoke dampers may be installed in ductwork up to 24” from wall with no openings between the wall and the smoke damper.

1) Damper actuators shall be electric type for 120 volt operation.

2) Power wiring, including interlocking to smoke detectors and fire alarm system, and panels to effect the sequence of operation shall be by the Electrical Contractor.

3) Dampers shall be fail closed as follows:

a) Power to Damper: Open

b) No Power to Damper: Closed

d. Damper frame shall be galvanized steel formed into a structural hat channel shape with reinforced corners. The smoke and combination fire/smoke damper blades shall be airfoil type with Class 1 leakage rating. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450ºF (232ºC) and jamb seals shall be stainless steel flexible metal compression type.

e. Each damper shall be equipped with a remote open or closed position indication switch. The switch shall be over the shaft type using two independent rotary cams and adjustable switch points indicating open and closed positions. Switch can be factory or field applied to manufacturer's damper.

1) These switches shall be furnished by the damper manufacturer and wired by the Electrical Contractor, in a location approved by the Engineer.

2) Spare contacts shall be provided for additional remote (fire panel) operation.

f. Each combination fire/smoke damper shall also be equipped with a temperature limited re-openable feature equivalent to Greenheck model TOR providing the following operational sequence:

1) Temperature at damper fusible device reaches 165°F or 50°F above highest system temperature, whichever is greatest, and primary heat sensing device closes damper. Remote or local override command panel can then re-open damper.

2) If temperature at damper fusible device reaches 250°F, secondary heat sensing device will close the damper. Override and re-opening above this secondary temperature is not permitted. Both primary and secondary heat responsive devices shall incorporate a manual reset feature allowing restoration of normal operation after fire emergency has been cleared.

g. If utilizing system operation for smoke control purposes during the early phase of a fire emergency, each combination fire/smoke damper shall be equipped with a 286°F primary fusible device and 350°F minimum rated damper actuator. .

h. Dampers in stainless steel ducts shall be stainless steel.

i. Dampers located in welded systems shall be rigidly connected with welded connections (not breakaway).

10. Smoke Isolation Dampers at Air Handling Units

a. Provide smoke isolation dampers at air handling units as shown on drawings. Smoke dampers shall comply with NFPA 90A, UL 555S and the aforementioned requirements, except that dampers shall be pneumatically operated, with a minimum of (1) actuator for every 16 sq.ft. of damper or portion thereof.

1) Air to Damper: Open

2) No Air to Damper: Closed

b. The ATC Contractor shall provide all PE and EP switches, relays, etc., for ready wiring to the following schedule:

Device	Furnished By	Installed By	Actuator By	Actuator Type	End Switches	Control Air	Control Wires	Power	UL Assembly
Automatic Damper (AD) (When noted to be electric)	ATC	HVAC	ATC	Electric	ATC	N/A	ATC	ATC	No
Fire Smoke Damper (FSD)	HVAC	HVAC	Damper Manufacturer	Electric	ATC	N/A	ATC	Div 16	Yes
Smoke Damper (SD)	HVAC	HVAC	Damper Manufacturer	Electric	Damper Manufacturer	N/A	ATC	Div 16	Yes
Smoke Isolation Damper (SD)	HVAC	HVAC	Damper Manufacturer	Electric	Damper Manufacturer	N/A	ATC	Div 16	Yes
Fire Damper (FD)	HVAC	HVAC	N/A	N/A	N/A	N/A	N/A	N/A	Yes
Smoke Control Damper (SCD)	HVAC	HVAC	Damper Manufacturer	Electric	N/A	N/A	ATC	Div 16	Yes

11. Smoke Control Dampers shall be the same as specified for smoke dampers only without end switches and alarm.

2.10 INFLATABLE DAMPER SYSTEM

A. General Requirements

1. The temperature control system shall automatically monitor and regulate indoor temperature by means of HVAC equipment control and control of air distribution.

B. Description

1. Indoor temperatures shall be achieved by controlling HVAC equipment including but not limited to; furnaces, air handlers, condensers, heat pumps, unit heaters, etc.

2. The temperature control system shall have the ability to manage and schedule set points.

3. The system shall control each room/area as its own zone.

4. Every supply run shall utilize an inflatable damper/zone valve as means of zoning and dynamic balancing.

5. Every zone shall have at least one temperature sensor installed for dynamic feedback.

6. **Every supply duct in a room shall be individually controlled based on that room's temperature sensor.**
7. **The controls shall be Wi-Fi capable and allow remote access.**
8. **The controls shall be able to generate email alerts.**
9. **Controls shall be capable of controlling 3 stages of heat and two stages of cooling.**
10. **Controls shall be capable of controlling humidifier equipment.**
11. **Controls shall be capable of controlling fresh air introduction and/or related equipment.**
12. **Automated temperature control system shall comply with ASHRAE 62.1.**

C. Work By Others

1. **Division 26 (Electrical contractor) shall provide a 120-60-1 circuit with receptacle for each control system OR provide a hardwired connection with service switch where applicable.**

D. Submittals

1. **Shop drawings shall layout location of all system components including HVAC equipment, inflatable dampers and sizes, proposed routing of air tubing, zoning layout, sensor locations and equipment mounting locations.**
2. **System wiring diagrams to include field connections as well as proposed wire routing.**
3. **Product specific cut sheets to include electrical, mechanical, dimensional and relevant certification data.**
4. **Product specific manufacturer installation and operation manuals.**

E. Closeout Submittals

1. **Record of installed components to include physical hardware locations, wiring and tubing routes, damper sizes and locations, installation and commissioning dates.**
2. **Record of programmed data to include zoning schedule, climate schedule, system settings and password information.**

F. Operation And Maintenance

1. **Include product specific manufacturer literature covering operation and maintenance.**
2. **Repair and/or replacement parts must be readily available for installed system.**
3. **Installing contractor shall provide maintenance and repair of installed system for a period of no less than one year from commissioning date.**
4. **Maintenance by installing contractor shall adhere to the written practices covered in the manufacturer's operation and maintenance manual.**
5. **Repair by installing contractor shall include 24 hour emergency service.**

6. **Maintenance and repair work must be performed by installing contractor unless written notice of subcontractor has been previously agreed upon by building owner and/or system administrator.**

G. Quality Assurance

1. **Product manufacturer shall have a minimum of 4 years documented experience in manufacturing industry specific products.**

H. System Responsibility

1. **The automated temperature controls and all components of the system are to be furnished by a single manufacturer who shall be responsible for the entire system.**

I. Warranty

1. **The automated temperature controls manufacturer shall provide a minimum of two years warranty on all installed components provided by said manufacturer.**

J. Manufacturers

1. **The preferred manufacturer of inflatable damper controls shall be Emme Controls Inc., Bristol, CT.**
2. **Mechanical dampers and controls as manufactured by Honeywell, Belimo, Trox or approved equal.**
3. **Comparable systems manufacturers and methods must be approved and accepted for substitution by owner.**

K. Main Display

1. **Main display shall utilize a 7” high definition color touchscreen.**
2. **Configuration information for the HVAC equipment shall be accessible from the main display.**
3. **The main display shall have the ability to be password protected.**
4. **The main display shall be hardwired to the backend.**
5. **The main display shall be powered by the backend.**
6. **The main display shall have the ability to be securely connected to the network via Wi-Fi or Ethernet connection.**

L. Master Unit

1. **The master unit shall serve as the system backend.**
2. **A wired connection between the master unit and HVAC equipment shall be made.**
3. **A wired connection shall be made between the master unit and main display.**

4. **The master unit shall house the air control mechanism.**
5. **Air control shall be achieved via electro mechanical solenoid valves.**
6. **The master unit shall provide female RJ-45 terminals for the connection of peripheral equipment.**
7. **The master unit shall be wired to the air pump and power supply unit.**
8. **The master unit shall be low voltage and powered by 12VDC from the air pump and power supply unit.**

M. Air Pump and Power Supply Unit

1. **The air pump and power supply unit shall house the air pump and power supply.**
2. **The primary side of the power supply transformer shall be supplied 120V/60Hz via grounded, corded 3 prong plug OR hardwired for applications where necessary to meet electrical code.**
3. **The secondary side of the power supply shall provide 12VDC.**
4. **The air pump shall be able to simultaneously produce pressure and vacuum to .5 PSI.**

N. Smart Sensors/Controllers

1. **Smart sensors/controllers shall be hard wired and communicate via RF.**
2. **Smart sensors/controllers shall obtain power through the hard wired connection.**
3. **Smart sensors/controller communications shall conform to FCC ID RU7-HCZ-SC-02 standard.**

O. Hard Wired Receivers

1. **Hard wired receivers shall be hardwired to the master unit via CAT-5 cable and 24 volt twisted pair cables.**
2. **Receivers shall receive data from smart sensors/controllers and relay data back to the master unit.**

P. Supply Plenum Sensor

1. **The supply plenum sensor shall be installed in the supply plenum.**
2. **The supply plenum sensor shall be hardwired to the master unit OR daisy chained to a nearby wireless receiver via CAT-5 cable.**
3. **The supply plenum sensor shall measure and relay supply plenum temperature and pressure.**

Q. Inflatable Dampers

1. **Inflatable dampers shall be installed in every supply run between takeoff and diffuser for intended area of control.**
2. **Inflatable dampers shall be installed in accordance manufacturer’s install specification.**

3. Every inflatable damper shall be connected to the master units' air control mechanism via plenum rated ¼" pneumatic tubing.

4. Inflatable dampers shall

R Plenum Rated Air Tubing

1. Plenum rated air tubing may be installed inside or outside of the ductwork.

2. Tubing is to be properly supported.

3. Use of any tubing other than the tubing specified and sold by control manufacturer is prohibited.

4. Plenum rated tubing shall conform to the UL 1820 standard.

PART 3 - EXECUTION

3.01 SHEET METAL INSTALLATION

A. All ductwork shall be installed to true alignment, generally parallel or perpendicular to adjacent building walls, floors and ceilings, so as to present a neat and workmanlike appearance. All fabricated, stored and installed ductwork shall be protected with removable caps, plastic or other means to prevent dirt, water and debris from entering duct system. The Sheet Metal Contractor shall be responsible for maintaining a clean duct system and shall clean and/or replace any ductwork identified by the Owner or Engineer as being deficient or dirty. The Sheet Metal Contractor shall be responsible for all costs associated with the temporary protection cleaning and/or replacement of ductwork. All fabrication labels shall be applied to the exterior of the duct. The Sheet Metal Contractor shall be responsible for the removal of all internal labels if such labels were incorrectly applied.

B. Care shall be paid to the exact locations of all sheet metal work with respect to equipment, ducts, conduits, piping, slabs, beams, columns, ceiling suspension systems, lighting fixtures and electrical, plumbing and fire protection systems in the building. Close coordination and cooperation shall be exercised with other Trades in locating the piping and equipment in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements shall be made to avoid conflict.

C. The drawings shall be followed where they are definite and provided such procedures do not cause objectionable conditions for equipment provided installed under this Contract. The drawings are intended to indicate the sizes of ductwork and if certain sizes are omitted or unclear, obtain additional information before proceeding.

D. Locate and size all openings for ductwork in the building construction. Provide all sleeves as hereinbefore specified.

E. Provide access doors in ductwork at the following locations:

1. Both sides of all coils

2. Fire dampers

3. Smoke dampers

4. Fire/Smoke dampers

5. Both sides of automatic dampers

6. Both sides of filters

7. At a maximum of 20'-0" and at every change in direction in kitchen exhaust system and/or as required by code.

8. At all exhaust and intake plenums, doors shall allow full body access in all plenums over 4'-0" tall.

9. Otherwise indicated or specified

F. Provide labels with a minimum of 1" high red letters on white background. Each access door shall be labeled as follows (or worded as required by Code):

1. Fire Damper

2. Fire/Smoke Damper

3. Smoke Damper

4. Automatic Damper

5. Filter Access

6. Coil Access

G. The installation of special items of equipment in the duct systems, including automatic dampers, thermostats, thermometers, duct airflow measuring devices and other related controls, shall be done by this Contractor under the direct supervision of the manufacturer of such controls.

H. All elbows, tees and branch takeoffs in round ductwork shall be made of the same materials as the ductwork.

I. Duct connections to equipment shall be in no case smaller than the equipment openings.

J. All openings for pitot tube traverses shall be fitted with neat removable plugs or caps. As a minimum, such openings shall be provided at every fan inlet and at such other points as may be required for airflow measuring and balancing. Coordinate the location of plugs and caps with the Balancing Contractor.

K. All internally lined duct sections and joints shall be closely inspected by the contractor before and after each piece is erected. Loose edges, open joints, damaged areas and other defects shall be sealed securely so as to insulate all metal surfaces and so as to endure without falling in the presence of moving air. All liner applications shall comply with SMACNA "Duct Liner Application Standard".

L. Provide other miscellaneous sheet metal work shown on the drawings including blanking off portions of louvers not required for the specific usage and diffusion plates or mixing air scoops to allow for air mixing where job conditions require the provision of same. All above work shall be provided as part of this Contract at no extra cost to the Owner.

M. Where applicable and as approved by the Engineer, all exposed ductwork shall be installed in a workmanlike manner to result in a neat appearance with no visible penetrations, screws, or other sheet metal imperfections.

N. Install all UL classified devices in accordance with their UL approved installation sheets.

O. Counterflashing of duct penetrations through roof shall be provided under this Contract.

3.02 DUCT HANGERS AND SUPPORTS

A. Provide suitable angle iron/strap hangers and supports inside the mechanical shafts, mechanical rooms and in ceilings of the buildings, and on the roof(s) as shown on the drawings. This work shall be performed as required by job conditions and as instructed by the Engineer in the field to support all air distribution ductwork and devices in both horizontal and vertical planes.

B. When hanging and supporting the ductwork, the following shall be complied with:

1. Except as otherwise noted, ductwork up to 42" in greatest dimension shall be hung by using sheet metal bands secured as a minimum at (2) locations to the vertical sides of the ductwork and at (1) location under the duct. All support systems shall be compatible with the building structure and roofing system as approved by the Engineer.

2. Where ductwork major axis dimension is larger than 42", ductwork shall be hung by using rods of not less than 3/8" soft steel secured to angle iron trapeze support frame around ductwork with threaded nuts for securement and adjustment. All rods used on ductwork exposed in finished spaces shall be plain smooth rods threaded only at the ends.

3. Ductwork shall be securely attached to the building construction. The hanger design and spacing shall be governed by the major duct dimension and shall be in accordance with SMACNA Duct Manual, except as modified hereinbefore. Vertical ductwork shall be supported at each floor level in an approved manner using angles or channels attached to the ducts. The installation, when complete and under operating conditions, shall be free from chatter or vibration. If necessary to achieve this, additional supports and/or bracing shall be furnished without extra cost to the Owner. Supports and bars and similar items shall be primed and painted structural steel. Touch up with aluminum paint any surfaces where galvanizing is destroyed on indoor ductwork, zinc primer on exposed ductwork with a final coat of aluminum paint. Provide vibration isolation hangers where specified under Vibration Isolation Section of these specifications.

4. The Sheet Metal Contractor shall provide all supplemental steel required to support the ductwork in shafts, mechanical rooms or on the floor where structural steel is not properly positioned. Beam clamps shall be double sided.

5. The maximum hanger spacing shall be 10'-0" on centers and additionally on each side of an elbow or change-in-direction fitting.

6. In addition to the above, provide supports on each side of any duct mounted device, fans, coils, flow measuring stations, framed dampers, etc., to permit removal of the device without disconnecting adjacent duct sections.

7. Provide angle sway bracing to the structure wherever lateral loads would be imposed on the ductwork, including but not limited to:

   a. Elbows downstream of fan discharges.

   b. Ductwork exposed to the weather subject to wind loads.

8. Ductwork mounted on the roof or otherwise exposed to the elements shall be supported with frames constructed of steel angles and channels regardless of duct size.

   a. Coordinate all roof supports with General Contractor.

   b. Provide diagonal cross bracing between supports as required to sustain maximum area wind loads as dictated by the Engineer.

9. The Sheet Metal Contractor shall provide expansion compensators, anchors and guides on all high temperature ductwork (breeching, high temperature supply/exhaust) as required.

3.03 SHEETMETAL TESTING

A. General

1. All ductwork that is required to be tested shall be tested on regular intervals as the job proceeds and shall be completed prior to enclosure in shafts, above ceilings or behind walls.

2. The Sheet Metal Contractor shall keep an up-to-date log of the ductwork tested for review by the Engineer. The Sheet Metal Contractor shall notify all other Contractors when the testing is completed and accepted to permit enclosure of ducts.

3. The Sheet Metal Contractor shall furnish and install all blank off plates, blind flanges, safing, etc., necessary to isolate each section of duct being tested for leakage.

4. The Sheet Metal Contractor shall submit for review all proposed testing procedures, sample report, and equipment to the Engineer prior to proceeding.

Additionally, the Sheet Metal Contractor shall notify the Engineer when testing is to occur so that the test can be witnessed at the Engineer's option.

5. All test equipment shall be calibrated per ANSI Standards prior to testing. Certified test reports shall be submitted to the Engineer prior to commencement of the testing.

6. Testing Procedure

   a. The testing procedure shall be in accordance with SMACNA "HVAC Air Duct Leakage Test Manual".

   b. The test pressure shall be the specified construction pressure of the duct system.

7. Scope of Testing

   a. All ductwork (regardless of pressure class) that will be in inaccessible areas including, but not limited to, all ducts within shafts, above hard ceilings, and those that will be made inaccessible by the work of other Trades. (This shall include ±2" w.g. construction.)

   b. All ductwork constructed to greater than +2" w.g. or less than -2" w.g.

   c. All other sheet metal in duct systems constructed to ±2" w.g. shall be tested under normal fan pressure and shall not leak sufficiently to cause audible leaks or blowing detectable by hand. If, in the opinion of the Engineer, the ductwork does not appear to be constructed and/or sealed to the approved shop standards, the Engineer may request any or all of this ductwork to be tested at the specified construction pressure.

   d. Allowable Leakage

      1) The total allowable leakage shall be less than specified leakage class with no audible leaks.

      2) If no leakage class is listed elsewhere, the system shall meet leakage Class 4.

3.04 INFLATABLE DAMPER INSTALLATION

A. **Installation**

1. **System to be installed in accordance with supplied manufacturer’s installation instructions.**

2. **System to be installed by qualified contractor and meet all applicable code requirements.**

B. **Commissioning**

1. **System to be commissioned in accordance with manufacturer's instructions.**

2. **Contractor shall perform testing to ensure control of forced air at each supply register.**

3. **A representative from the control manufacturer shall be available for commissioning.**

END OF SECTION 23 31 00

SECTION 265100 - LED INTERIOR BUILDING LIGHTING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide luminaires, supports and accessories including plaster frames, trim rings and back boxes for plaster, drywall, or concrete ceilings as necessary.

B. The types of luminaires to be installed are indicated and detailed on the luminaire schedule on the Drawings, which also provides details on manufacturers, catalog numbers, lamping, etc.

C. Coordinate in field to avoid conflicts between installation of luminaires and supports with the installation of existing mechanical equipment, conduits, piping, ceiling structures, etc.

D. All luminaires shall operate on nominal 120-277 volts, 60 Hz single phase service as indicated on the Drawings and in the Specifications.

1.2 REFERENCE STANDARDS

A. National Energy Policy Act of 2005, Public Law No. 109-58.

B. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008, as modified by the 2011 NYC Electrical Code.

D. IESNA LM-79-08 IESNA - Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

E. IESNA LM-80-08 IESNA - Approved Method for Measuring Lumen Maintenance of LED Light Sources.

F. IESNA TM-21-2011 – Projecting Long Term Lumen Maintenance of LED Light Sources.

G. UL 1310 and 8750 – Light Emitting Diode (LED) Equipment for Use in Lighting Products.

H. OSHA 29CFR1910.7 – luminaires shall be listed by nationally recognized testing laboratory approved by United Stated Department of Labor, Occupational Safety and Health Administration (OSHA).

I. ANSI C82.11 – Performance requirement for high frequency ballasts.

J. **ANSI/IES RP-16-10 – Nomenclature and definitions for illuminating engineering.**

K. **ANSI C62.41 – Recommended practice in low power circuits.**

L. **IEC 61347-1 – General and safety requirements for lamp control gear.**

M. **IEC 61347-2-13 – Particular requirements for electronic control gear for LED modules.**

N. **IEC 62384 - DC or AC supplied electronic control gear for LED modules – performance requirements.**

O. **IEC 61000-3-2 - Harmonic current emissions.**

P. **IEC 61547 - EMC immunity requirements.**

Q. **IEC 62386-101/102/207 – Digital addressable lighting interface (DALI).**

R. **Federal Communications Commission (FCC) rules – Part 15 Class B: Radio Frequency Devices.**

S. **Entertainment Services and Technology Association**

1. **ESTA E1.3 - Entertainment Technology - Lighting Control System - 0 to 10V Analog Control Protocol.**

1.3 DEFINITIONS

CALiPER **DOE Commercially Available LED Product Evaluation and Reporting program for the testing and monitoring of commercially available LED Luminaires and lights.**
http://www1.eere.energy.gov/buildings/ssl/m/caliper.html

CCT **Correlated Color Temperature: The temperature in units of kelvin of a blackbody whose chromaticity most nearly resembles that of the light source in question.**

cd **Candela: SI Unit of luminous intensity, equal to 1 lumen per steradian (lm/sr).**

Chromaticity **The property of color of light defined by the dominant or complementary wavelength and purity aspects of the color taken together.**

CRI **Color Rendering Index – measure of the degree of color shift of reference objects when illuminated by the light source as compared to a reference source of comparable color temperature.**

fc **Footcandle: Unit of illuminance, equal to 1 lm/ft^2.**

L80 **The extrapolated life in hours of the luminaire when the luminous output depreciates 20 percent from initial values.**

LED	**Light Emitting Diode**
METS	**Material Engineering and Testing Services of the Translab**
MacAdam	**Shape on the CIE chromaticity diagram that illustrates how much one can "stray" from the target before perceiving a difference from the target color.**
NEMA	**National Electrical Manufacturers Association**
NRTL	**Nationally Recognized Testing Laboratory**
NVLAP	**National Voluntary Laboratory Accreditation Program - A program under the US DOE to accredit independent testing laboratories to qualify.**
PF	**Power Factor - The ratio of the real power component to the total (complex) power component.**
Rated Power	**Power consumption that the luminaire was designed and tested for at ambient temperature (70°F or 21°C).**
RoHS	**Compliance aims to restrict certain dangerous substances commonly used in electronic equipment, including Lead, Cadmium, Mercury and others.**
SPD	**Surge Protection Device - A subsystem or component(s) that can protect the unit against short duration voltage and current surges.**
SSL	**Solid State Lighting**
THD	**Total Harmonic Distortion - The amount of higher frequency power on the power line.**

1.4 SUPPLEMENTAL SUBMITTALS

A. Product Data

1. Provide standard print catalog sheets, Specifications, installation instructions, and photometric data from a recognized independent laboratory for each type of luminaire. Submittals that do not include distribution curves and photometric data will be rejected. All options and specified requirements shall be identified on submittal.

B. Mounting Details

Submit mounting details for each type of luminaire including attachments to structure, anchors, rods, hickeys, etc.

C. Samples

1. **Submit luminaire samples as requested by the DOC.**

2. **Submit mounting hardware as requested by the DOC.**

D. Submission of Substitute Luminaires (luminaires other than specified herein or on the Luminaire Schedule).

1. **Submittals for substitute luminaires shall be the standard print catalog sheets from the manufacturers (CADD drawings and computer printouts are not acceptable).**

2. **Substitute luminaires shall meet or exceed photometric quality of luminaires designated on the schedule. Photometric data of substitute luminaires shall be substantiated by an independent testing lab, such as I.T.L. Photometric data by Lumen Micro or similar software programs are not acceptable.**

3. **Substitute luminaires shall meet or exceed the quality of the luminaires designated on luminaires schedule in construction, finishing, materials, reflector, diffuser etc.**

4. **Substitute luminaires shall closely match the appearance, dimensions and features of the luminaires designated.**

5. **Submit one sample of each type of substitute luminaires as requested, with one set of mounting hardware for approval.**

6. **No more than three (3) submittals shall be permitted for substitution of each specific luminaire type. Should the third submittal be rejected, the Contractor shall be required to provide the luminaires specified on the luminaire schedule.**

7. **If the specified luminaire is substituted, the contractor will submit foot-candle calculations with the shop drawing to prove that it meets the lighting levels specified.**

E. Qualifications

1. **Manufacturer**

F. Mock-up

G. Spare parts

H. Warranty

1.5 QUALITY ASSURANCE

A. Qualifications

1. **Manufacturer: Provide products of firms listed in Part 2 that are regularly engaged in the manufacture of lighting fixtures and components of types and ratings required and whose products have been in satisfactory use in similar service for not less than 5 years. The manufacturer of the lighting fixtures and components shall comply with the provisions of the appropriate code and standards. All fixtures shall be pretested before shipping.**

B. Mock-Up

1. **The Contractor is to install a mock-up utilizing the proposed luminaire(s) to prove out the quantity and quality of light documented in the lighting submittals. The Contractor is responsible to arrange with the DOC to install the luminaires. After review by the DOC, the Contractor shall reinstall the original luminaires if the luminaire(s) is deemed not to be acceptable or the DOC does not desire to retain the luminaire.**

C. Design Qualification Testing

1. **Design Qualification Testing shall be performed by a National Voluntary Laboratory Accreditation Program (NVLAP) testing facility. Such testing may be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire designs and when a major design change has been implemented on an existing design. A major design change is defined as a design change (electrical or physical), which changes any of the performance characteristics of the luminaire, results in a different circuit configuration for the power supply, or changes the layout of the individual LEDs in the module.**

2. **A quantity of two units for each design shall be submitted for Design Qualification Testing.**

3. **Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but are not limited to):**

   a. **Maximum power in Watts.**

   b. **L80 in hours, when extrapolated for the worse case operating temperature. TM21 report shall be submitted to demonstrate this.**

   Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.

1.6 LUMINAIRE PROTECTION

A. The Contractor is required to protect luminaires from damage during installation and up to time of acceptance by the DOC. Broken luminaires, glassware, plastics, LED Modules, etc. shall be replaced by the Contractor with new parts, without any additional expense to the DOC until final acceptance.

1.7 SPARE PARTS

A. Provide complete luminaires to the DOC of 10% of the order Delivered

1. Spares shall be provided and delivered to the DOC's Representative with an itemized list and a receipt taken, certifying that these spare parts have been delivered securely packed and received in acceptable condition.

1.8 WARRANTY

A. The manufacturer shall provide a single source, 5 year limited warranty against loss of performance and defects in materials and workmanship for all components of the luminaire. Warranty is from the time of acceptance of the Luminaires. All warranty documentation shall be provided to customer prior to the first shipment.

B. Provide manufacturer's warranty covering 5 years on drivers from date of installation. Refer to manufacturer's terms and conditions on the website for detailed information.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide luminaires as designated on the luminaire schedule. Luminaires of the luminaire schedule are designated by types, manufacturers and catalog numbers. Substitute luminaires by approved manufacturers listed in these specifications will be approved, provided that all requirements are satisfied.

B. The requirements specified herein are minimum requirements and shall be supplemented by any other requirements indicated on the luminaire schedule. All luminaires, including those designated on the luminaire schedule on the drawings by Catalog Numbers, or Catalog Numbers mentioned in the Specifications, shall nevertheless be specially modified to meet the requirements of these specifications.

C. All luminaires and components shall be UL listed or listed by another nationally recognized Testing Agency approved by the NYC Department of Buildings and meet NYC Electrical Code.

2.2 MANUFACTURERS

A. LED luminaires For Building Interior: Fixtures shall be as specified or approved equal.

B. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.

C. Codes: Materials and installation shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State, and local codes and regulations.

D. **UL or ETL US Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL 8750 or others as they may be applicable. A listing shall be provided for each fixture type, and the appropriate label or labels shall be affixed to each fixture in a position concealing it from normal view.**

E. **Luminaire shall be DLC Certified (Design Lights Consortium)**

F. **Base Bid Manufacturers: Are listed on fixture schedule and specification. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards and photometric distribution set by the specified product.**

G. **Alternate Manufacturers: Identification by means of manufacturer's names and catalog numbers is to establish basic features, quality and performance standards. Any substitutions by other manufacturers listed must meet or exceed these standards and shall be approved by the DOC. Mock-ups in a sample workshop will be required in addition to submissions indicated to prove the quality of light prior to approval to manufacture for the project.**

H. **Luminaire shall carry the Lighting Facts label, verified based on LM-79 test reports. Refer to the following web site: www.lightingfacts.com.**

2.5 LUMINAIRES TYPE – LINEAR PENDANT

A. **Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification.**

B. **Each luminaire shall be designed to operate at an average operating temperature of 25°C.**

C. **The operating temperature range shall be 0°C to +25°C.**

D. **Each luminaire shall meet all parameters of this specification throughout the minimum operational life of 50,000 hours when operated at the average operating temperature .**

E. **Luminaire Construction**

1. **Luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LEDs, or plastic supports.**

2. **The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be integral to the unit.**

3. **Luminaires shall be fabricated from post painted cold rolled 22 GA steel and shall be a rigid structure with die cast end caps, mechanically attached with no visible fasteners. Luminaire may be mounted and wired in continuous rows.**

4. **Finish: Polyester powder coat painted in white.**

5. **Luminaire lengths in single sections of 4' or 8' shall have exact suspension spacing of 4' or 8'. Overall length – add 5/8" for flat end cap and 4" for sculpted end cap.**

6. **Luminaire lengths of 4' or 8' shall be joined to create a continuous run using internal joiners**

7. **Optics – Engineered optical systems of high performance lens, diffusers and metal reflectors.**

8. **Lens shall be single clear diffuser with advanced optical film and shall provide LED concealment and even illumination across the diffuser.**

9. **Polymeric materials (if used) of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. Luminaire lenses are excluded from this requirement.**

10. **The assembly and manufacturing process for the SSL luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration and prevent light leaks at all visible joints.**

F. LED Sources

1. **LEDs shall be manufactured by Nichia or Cree.**

   a. **Lumen Output – minimum initial delivered lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-360 degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.**

      1) **4' fixtures – 8¼" x 4' – 3400 (30 watts max.) or 4800 (45 watts max.) nominal delivered lumens @ 3500K per specification.**

      2) **8' fixtures – 8¼" x 8' – 6800 (60 watts max.) or 9600 (90 watts max.) nominal delivered lumens @ 3500K.**

      3) **Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours at the rated ambient operating temperature.**

b. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the all LEDs within the luminaire.

c. LED Boards shall be suitable for field maintenance and have plug-in connectors. LED boards shall be upgradable.

d. Light Color/Quality

1) Correlated Color Temperature (CCT) range as per specification, between 3000K, 3500K and 4000K shall be correlated to chromaticity as defined by the absolute (X, Y) coordinates on the 2-D CIE chromaticity chart. *(Edit color temperature per project specification)*

2) Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.

3) The Color Rendition Index (CRI) shall be 80 or greater.

4) LED boards to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.

2. Power Supply and Drive

a. Driver: Acceptable manufacturer: eldoLED or approved equal (Drivers to be compatible with the fixtures)

b. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

c. Driver shall be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that do not meet these requirements will not be accepted.

d. Electrical characteristics: 120 – 277 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.

f. Flicker: Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:

1) Less than 1 percent flicker index at frequencies below 120 Hz.

2) Less than 12 percent flicker index at 120 Hz, and shall not increase at greater than 0.1 percent per Hz to a maximum of 80 percent flicker index at 800Hz.

g. Driver disconnect shall be provided where required to comply with codes.

h. The electronics/power supply enclosure shall be internal to the SSL luminaire and be accessible per UL requirements.

i. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.

3. Electrical

a. Power Consumption: Maximum power consumption, +5% when operating between 120 – 277V (or 346V) shall be as follows:

1) 4' Fixtures – 8¼" x 4' – 30 watts and 45 watts nominal

2) 8' fixtures - 8¼" x 8' – 60 watts and 90 watts nominal

b. Operation Voltage - The luminaire shall operate from a 60 HZ ±3 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage of (+10%) shall have no visible effect on the luminous output.

1) Adjustment of forward LED voltage, supporting 3V through 60V.

2) Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA.

3) Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

c. Electrical connections between normal power and driver must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation and be replaceable without lowering the luminaire.

d. All electrical components shall be RoHS compliant.

4. Photometric Requirements

a. Luminaire performance shall be tested as described herein.

b. Luminaire performance shall be judged against the specified minimum luminance in the specified pattern for a particular application.

c. Luminaire lighting performance shall be adjusted (depreciated) for the minimum life expectancy

1) The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard TM-21 test report, which ever one results in a higher level of lumen depreciation.

2) The ratio of the peak-to-zenith maximum candela ratios shall be – 1.94:1 @ 127.5 degrees.

d. The luminaire may be determined to be compliant photometrically, if:

1) The initial minimum luminance level is achieved in 100% of the area of the specified lighting pattern.

2) The measurements shall be calibrated to standard photopic calibrations.

5. Thermal Management

a. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

b. The LED manufacturer's maximum junction temperature for the expected life shall not be exceeded at the average operating ambient

c. The LED manufacturer's maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient temperature

d. The luminaire shall have a UL or CSA rating.

e. The Driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating ambient temperature. Thermal management shall be passive by design. The use of fans or other mechanical cooling devices shall not be allowed.

6. Optics

a. **Optics shall consist of high performance advanced optical film, diffuser, and metal reflector.**
b. **Optics shall eliminate source image.**

8. **Luminaire Identification**

a. **Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside each unit and the outside of each packaging box.**

b. **The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in Watts and Volt-Ampere.**

9. **Luminaire manufacturing requirements**

a. **The luminaires shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of the modules built to meet this specification. These tests shall include: CCT, CRI, Lumen output, and wattage. Tests shall be recorded, analyzed and maintained for future reference.**

b. **QA process and test results documentation shall be kept on file for a minimum period of seven years.**

2.8 LUMINAIRE COMPONENTS/ACCESORIRES

A. **Equip luminaires with:**

1. **Finishing collar and/or combination finishing collar/outlet box.**

2. **Provide end caps positively attached for individually mounted luminaires and ends of continuous rows.**

B. **Stems and Hickeys**

1. **Stems for pendant luminaires shall be standard pipes not less than 3/8" diameter. Stems shall be no less than 6" long with a cut thread. Pipe stems at luminaire end shall have a length of threads of approximately $1^1/_2$" for luminaire alignment.**

2. **Each stem shall be provided with a brass/steel swivel or other self-aligning device of type approved by the DOC, a hickey, a malleable iron bushing, a**

canopy, minimum of three locknuts/washers (one locknut/washer above and two below for locking purpose) and other accessories for the safe support of pendant luminaires.

C. Luminaire Finishes

1. The finish of all luminaires not described on the luminaire schedule or in the Specifications shall be as selected by the DOC's Representative. The Contractor shall submit a color chart to the DOC's Representative for selection of finish.

2. Exterior Luminaires shall have an anodized or baked powder coat finish.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. General

1. The Contractor shall be responsible for the proper and safe mounting and support of all luminaires. Installation shall meet all the requirements of the National Electrical Code. Provide all items of equipment (stems, hangers, rods, inserts, boxes, brackets, yokes, channels, frames, etc.) required to adequately and safely support each luminaire in a manner acceptable to the DOC.

2. Provide a luminaire at each location shown on Drawings of the type indicated by symbol or other notation. If the type is not specifically noted on Drawings, the Contractor shall provide without extra cost luminaires of the same type called for under similar condition elsewhere on the Drawings as determined by the DOC.

3. The Contractor shall examine the drawings and coordinate closely with the all General Construction trades on all work involved with each type of luminaire to be installed. Contractor shall verify all sizes, locations and conditions under which luminaire are to be installed. Provide plaster frames and running bars (black iron) etc. as required.

4. The Contractor is required to protect luminaires from damage during installation, up to time of acceptance by the DOC. Any broken or marred luminaire, glassware, plastics, lamps, etc. shall be replaced by the Contractor at no additional cost to the DOC.

5. A suitable outlet box shall be provided by the Contractor for each luminaire provided. The box shall be cast into concrete or supported using two double split type anchors when installed in concrete walls or ceiling.

6. Number of supports for luminaires shall be as specified in "Luminaire Support Schedule" in Article 3.07.

7. A surface or pendant type luminaire, regardless of its weight, shall not be mounted directly on the concealed or exposed ceiling spline of a lightweight, mechanical acoustical ceiling system. Such luminaires shall be supported from the building structure.

8. For all pendant mounted luminaires, regardless of weight and ceiling types, provide outlet boxes capable of supporting up to 150 pounds, Westinghouse model 01050/01052 or equal.

3.2 PENDANT MOUNTED LUMINAIRES (NON-SUSPENDED CEILING)

A. **Support pendant mounted luminaires with stems, 3/8" in diameter minimum vertically attached to structural steel, concrete, beams, joists, and trusses or stainless steel wire.**

1. Contractor shall provide channel supports required to support the pendant luminaires.

2. Where approved, channel supports may span and rest upon the lower chord of trusses.

3. Where approved, channel supports may span and be attached to the underside of beams, joists, or trusses.

3.3 LUMINAIRE WORK IN EXISTING CONSTRUCTION

A. Canopies on Surface Mounted Outlet Boxes

Where luminaires are mounted upon surface-mounted outlet boxes with surface mounted conduit, the Contractor shall provide a luminaires canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by luminaires' manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.

B. Adapters

Where new luminaires are mounted on existing outlet boxes and mounting holes are not in proper position, suitable adapter or extension collars shall be provided.

C. Removed Luminaires

1. **Where the Drawings or Specifications call for the Contractor to remove existing luminaires, the Contractor shall also install a suitable blank face plate on the exposed outlet box.**

2. **If the outlet box is to be used in the extension of branch circuit wiring, this Contractor shall furnish and install a suitable extension collar that may be required to receive surface raceway or conduit.**

3.4 MOUNTING HEIGHT OF LUMINAIRES

A. Luminaires shall be hung in accordance with the mounting heights indicated on Drawings and meeting the NYC Electrical Code. Mounting heights A.F.F. (distance above finished floor) are detailed on the Luminaire Schedule, or elsewhere on the drawings.

B. The Contractor shall provide stems of sufficient length to assure luminaire mounting at the specified mounting height.

3.5 LUMINAIRE SUPPORT SCHEDULE

A. Unless otherwise indicated on drawings, provide the following number of supports for luminaires.

1. An adequately supported outlet box with luminaire stud may be utilized as one point of support for surface or recessed luminaires weighing less than 40 lbs. For all pendant mounted luminaires, regardless of weight and ceiling type, provide outlet boxes capable of supporting up to 150 lbs.; Westinghouse model 01050/01052 or equal.

B. Ceiling Mounted Luminaires (Surface Mounted, Pendant Mounted or Recessed Mounted)

1. Ceiling Mounted Luminaires:

a. Support individual luminaires less than 2 feet wide at 2 points.

b. Support continuous row of luminaires less than 2 feet wide at points equal to the number of luminaire sections plus one, except that supports shall not exceed 12 foot on centers and shall be evenly distributed over the entire length of the luminaire's row.

c. Support individual luminaires 2 feet or wider at 4 corners.

d. Support continuous row of luminaires 2 feet or wider at points equal to twice the number of luminaire sections plus 2. Uniformly distribute the points of support over the row of luminaires.

3.6 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting.

B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

C. Test and calibrate all controls associated with luminaires, i.e. daylighting, occupancy sensors, etc.).

3.7 LED CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from lens and enclosures

1. For cleaning acrylic lenses or diffusers, use a feather duster or dry cotton cheesecloth to rid the lens/diffuser of any minor dust. For fingerprints, smudges, or other dirt present, use an ammonia-based cleaner (such as Windex) and wipe carefully with cotton cheesecloth (so as to avoid injury from any prismatic texture of the lens).

2. Contractor shall replace the lens if Job site contamination cannot be removed using the above recommendations.

3. Clean photometric control surfaces as recommended by manufacturer.

END OF SECTION 26 51 00

SECTION 23 09 98 – SEQUENCES OF OPERATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Furnish and install temperature controls.

1.03 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.04 SUBMITTALS

A. See Section 250500 and General Conditions for Additional Requirements.

A. Product Data: Provide data for duct materials.

B. Prepare and submit sequences and drawings.

C. Manufacturer’s Installation Instructions.

1.05. QUALITY ASSURANCE

A. All sequences shall be made functional.

PART 2 – PRODUCTS

2.01 GENERAL

A. Sequences

1. Air Handling Units - 100% Outside Air

2. Air Handling Unit - Recirculating

3. Exhaust Air Fans

4. Differential Pressure Bypass Valve Arrangement

5. Variable Speed Pumping Systems (VFD)

6. Heat Exchanger Control

7. Chilled Water System

8. Variable Speed Drives

9. Optimized Start-Up After Power Failure

10. In-Duct Zone Heating Coils (Area Heating)

11. Chemical Treatment Systems

12. Post Fire Purge System

13. Pumps

2.02 AIR HANDLING UNITS - 100% OUTSIDE AIR AHU-1 AND AHU-2 WITH CHILLED WATER COILS AND LPS HEATING COILS (NORMAL)

A. Unit shall normally be run continuously. Upon initial starting of AHU, exhaust systems shall be directed to start prior to supply systems due to "exhaust" flow control basis of the pressurization control systems. When supply fans are started by the DDC panel, the following sequence shall occur:

1. The outside air damper shall open to full position, verify damper is open.

2. Unit shall be equipped with supply fan discharge and intake isolation dampers. The fan shall be ramp started to minimum fan speed of 15 Hz (adj.) via individual signal to fan's VFD. After fan is at 15 Hz, the fan isolation dampers shall open and when both dampers end switches prove the dampers are open the fans will be allowed to increase in speed. If differential pressure across fan has not reached 1.0" w.c. after 60 seconds, the fan shall be deactivated and its isolation dampers closed. The rate of fan speed ramp-up shall be adjustable. When fan is off, isolation dampers shall close. If at any time during operation of fan, the differential pressure across a fan is sensed as less than 1.0" w.c. (adj.), that fan shall be deactivated, its isolation dampers closed and alarm sent to the BAS (Building Automation System).

3. Damper actuators shall be by ATC. Outside air actuators shall be industrial grade electric.

4. When a fan is off, its isolation dampers shall be closed.

B. Averaging type temperature sensor sensing cooling coil, heating coil and discharge air temperature, will provide a signal to the DDC panel. The cooling coil and heating coil valves shall be controlled by the unit discharge air temperature sensor. On a rise in cooling coil discharge air temperature above 52°F setpoint (adj.), the cooling coil control valve will be modulated open. On a drop in discharge temperature the reverse sequence shall occur.

C. Upon a drop in discharge air temperature, the cooling coil valve shall close and the LPS heating coil shall modulate toward open to maintain 52°F (adj.) discharge air temperature.

D. Provide a series of low temperature thermostat freezestats at the downstream section of each of the heating coils which will stop the unit if the discharge temperature falls below 38°F (adj.). The sensor downstream of the heating shall announce an alarm condition if the temperature drops to 42°F or lower.

E. A smoke detector in each of the supply air discharge ducts shall be interlocked to fans through the DDC system to shut down upon activation. Smoke detectors shall be furnished, mounted and wired to fire alarm by Electrical Subcontractor.

F. When supply fan stop, the outside air dampers will close, and the cooling coil will be de-energized. The heating coil control valve shall be modulated to maintain 52°F (adj.) at the heating coil temperature sensor.

G. Cooling Coil Freeze Protection

1. Whenever the air temperature inside the cooling coil section of the air handling unit is <40°F (adj.), the cooling coil control valve shall be opened position to allow chilled water to flow through the coil and an alarm shall be sent to the BAS.

H. Air Volumetric Control

1. This portion of the specification includes the furnishing and installing of a complete air volume DDC control system, as herein described, for achieving air volume measurement for air handling unit supply air fan. The air volume control shall include all sensors for air volume, velocity and pressure as required. The supply air volume shall be controlled by varying the speed of the manually adjustable pitch vaneaxial fans through the associated VFDs.

2. The air volume control system shall be furnished and installed by the ATC Contractor, except that the airflow measuring stations shall be mounted in the built-up air handling units by the HVAC Contractor, but wired and controlled by the ATC Contractor who shall provide all control stations, selector relays, etc. Coordinate with the HVAC Contractor. Mount station from floor. Duct mounted static pressure sensing stations (SPSS) shall be furnished by the ATC Contractor and installed from 2/3 to 3/4 of the way along the longest duct run for each unit, in the vertical duct riser. Provide access to the sensors.

3. It is the intent of this portion of the specification to provide for a fully synchronized volume measurement system for each supply air unit. The ATC Contractor shall furnish and install a fan volume control center which shall include all arithmetic and logic functions and other auxiliary devices required to maintain airflow conditions in accordance with job requirements.

4. The fan volume control components shall be equipped with operating features described herein and capable of performing the outlined performances. The direct digital control shall be capable of 3-mode control, proportional, plus reset, plus gain. The velocity pressure sensors shall provide a signal to the DDC panel to

provide for control functions, and shall be equal to the Setra #261 differential pressure transmitter.

5. The fan volume control supplier (ATC Contractor) shall provide all necessary factory and field labor for the complete installation and calibration, and shall be responsible to provide an operating sequence to the complete satisfaction of the Mechanical Engineer. In addition, the fan volume control supplier shall guarantee the proper operation of the system and shall furnish all required service and maintenance from the local office to provide twelve (12) months, fully guaranteed system. Factory trained engineers and installers shall be located within a 75 mile radius of the job site so that proper service may be performed on this project.

6. Upon start-up of the supply fans, the static pressure sensor sends static pressure signal to the VFDs serving the fans to maintain the supply system at a constant static pressure. Each fan shall receive the same signal from the PLC loop, except during fan start-up and when a fan is off. Each fan VFD shall receive a separate speed signal from the PLC. All required auxiliary devices shall be provided by the ATC Contractor. Provide DDC panel face indication to indicate each unit's supply air volume and system static pressure.

7. Provide a differential pressure sensor across the fan and before the fan isolation damper. The VFD shall start to increase fan speed. When the differential pressure across the fan reaches 3.0" w.c. (adj.), the isolation damper shall start to open. If, when the fan is running and the differential pressure across the fan drops below 2.0" w.c. (adj.) setpoint, the fan shall be disabled and the isolation damper shall close, and trigger alarm. Additionally, a pair of differential pressure switches mounted across the supply fan shall shut down the fan should a differential pressure greater than 6.0" (adj.) be sensed. Hi-static and low-static conditions shall alarm the DDC system.

8. Furnish and install duct mounted static pressure sensors.

9. The BAS shall continuously monitor the airflow readings and motor amperage readings supply fan within each AHU. If the differences in flow/amperage of the fans vary by 15% (adj.) or more, an alarm shall be annunciated at the BAS.

10. The air volumetric control shall have a special feature to be reset for a higher CFM. See turbo mode sequence.

I. All control sequences as listed above shall fully function in either the hand or automatic modes as selected at the VFD drive control panel. The ATC Contractor will provide all required hardware, programming, wiring, relays, coordination, etc., to provide a complete fully functional system that operates automatically with no intervention beyond switching the drive mode switch at the VFD panel.

J. VFD bypass mode of operation, if VFD drives have bypass mode installed as an optional feature the ATC Contractor will provide “detailed” instructions as how the system, controls, VFD drives (s) etc., must be manipulated to allow system to operate in a safe manner. Instructions shall be attached to each affected VFD drive, printed and laminated for operators use.

2.03 AIR HANDLING UNIT - RECIRCULATING SINGLE FAN- (AHU-3 & 4, AHU- 5, 6 & 7)

A. Unit shall be run continuously. When supply fan(s) are started by the DDC panel, the following sequence shall occur: (normal)

1. Unit shall be equipped with outside air, return, the economizer (relief) dampers. When dampers open and after they reach 80% open position, as determined by an end switch, the supply fan shall start at low VFD speed. After the supply fan has started, the return fan shall start through a separate output from the DDC panel at low VFD speed.

2. The unit shall have modulating outside air damper. The outside air damper shall open to minimum position and the return air and exhaust air dampers will take corresponding positions as determined by an FMS in the return duct.

3. If either the supply fan or return fan stop, the other fan shall also stop.

B. An averaging temperature sensor sensing cooling coil discharge temperature will provide a signal to the DDC panel a unit discharge air temperature shall be used to control the cooling coil 2-way modulating control valve, the outside air dampers, return air damper and economizer air damper in sequence to maintain the (adjustable) discharge air temperature. Sensor shall be installed downstream of the cooling coil. On a rise in cooling coil discharge air temperature, the outside air damper, return air dampers and economizer air damper will modulate to the 100% outside air position. On a further rise in temperature, the cooling coil control valve will be modulated open. On a drop in discharge temperature, the reverse sequence shall occur. The discharge control sequence shall maintain a constant temperature of 52°F (adj.) in the cooling mode. An outside air sensor will provide a signal to the DDC panel to modulate the outside air damper to its minimum CFM position, the return air damper to its fully open position, and the economizer damper to its minimum position whenever the outside air enthalpy is greater than the return air enthalpy. At outside air temperature of 50°F (adj.) or lower, the cooling coil valve shall be shut (refer to cooling coil freeze-protection sequence).

C. A discharge air temperature sensor shall override the discharge control sequence and control the dampers to maintain 50°F (adj.) minimum mixed air temperature and signal an alarm condition.

D. The discharge temperature control shall modulate the unit's modulating 2-way LPS control valve for AHU-3 and 4 and hot water heating control valve for AHU- 5, 6 & 7 in sequence to maintain 52°F (adj.) heating coil leaving air temperature setpoint. At no time shall the heating coil and cooling coil be open at the same time Provide a heating coil leaving air temperature sensor which shall act as a low limit selector to prohibit leaving coil temperature from dropping to below 45°F (adj.).

E. Provide a series of low limit temperature thermostats in the leaving air section of each of the heating coils which will stop the unit if the discharge temperature falls below 38°F (adj.). An alarm shall be announced if the temperature drops below 42°F (adj.).

F. Smoke detectors in the supply and return plenums shall be interlocked to fans to shut down upon activation. Smoke detectors shall be furnished, installed in ductwork and wired to the

fire alarm by the Electrical Subcontractor. The supply and return fans shall stop when either the supply or return air smoke detector is activated via a signal from the fire alarm system to the BAS.

G. When the supply fan stops, the return fan will stop, the outside air and economizer air dampers will close, the cooling coil will be de-energized and the return air damper will be open. The heating coil control valve shall be modulated to maintain 55°F (adj.) at the heating coil temperature sensor. If the unit is off and the air temperature inside the cooling section of the unit is below 32°F (adj.), the chilled water valve shall be opened to 30% (adj.) flow position for freeze protection and an alarm shall be sent to the BAS.

H. Air Volumetric Control

1. This portion of the specification includes the furnishing and installing of a complete air volume DDC control system, as herein described, for achieving air volume DDC control for the air handling unit supply and return fans, and assuring minimum outside air quantities.

   The air volume control shall include all sensors for air volume, velocity and pressure, as required. The supply and return air fan volumes shall be controlled by varying the speed of manually adjustable pitch vaneaxial fans through their associated VFDs.

2. The air volume control system shall be furnished and controlled by the ATC Contractor, except that the airflow measuring stations shall be installed by the HVAC Contractor, but furnished by the ATC Contractor, and shall include all control stations, selector relays, etc.

3. It is the intent of this portion of the specifications for a fully synchronized control system between the supply air (VFD) volume and return air (VFD) volume. The ATC Contractor shall furnish and install a fan volume control center which shall include arithmetic and logic functions and other auxiliary devices required to maintain airflow conditions in accordance with job requirements.

4. The fan volume control components (via VFD) shall be equipped with operating features described herein and capable of performing the outlined performances. The direct digital control shall be capable of 3-mode control, proportional, plus reset, plus gain. The velocity pressure sensors shall provide a signal to the DDC panel to provide for control functions, and shall be equal to Setra Model #261.

5. The fan volume control supplier shall provide all necessary factory and field labor for the complete installation and calibration, and shall be responsible to provide an operating sequence to the complete satisfaction of the HVAC Engineer. In addition, the fan volume control supplier shall guarantee the proper operation of the system and shall furnish all required service and maintenance from the local office to provide for one (1) year, fully guaranteed system. Factory trained engineers and installers shall be located within a 75 mile radius of the job site so that proper service may be performed on this project.

6. Upon start-up of the supply fan and return fan, the fan volume control center shall place the supply and return fan VFD in the zero (0) speed mode. As the DDC panel receives static pressure signal, the speed of the supply fan and return fan shall increase the supply system static pressure to maintain setpoint at the duct mounted SPSS located 2/3 to 3/4 along the longest duct run. The supply air fan speed shall be controlled to maintain the desired duct static pressure. The supply fan volume (measured at the FMS in the duct provided by the ATC Contractor) shall be measured. The return fan volume shall be controlled (via speed control through the VFD) to maintain a pre-set (adj.) CFM offset between the supply and return air volume (return air volume shall be measured at the FMS, provided by the ATC Contractor, in the main return air duct). Upon startup, the return fan volume (cfm) shall match the supply fan volume until the supply fan reaches 50% of system rated cfm (adj.). On a decrease in supply air static or volume, the reverse sequence will occur. All required auxiliary devices shall be provided by the ATC Contractor. Provide DDC panel face indication to indicate supply air volume and return air volume.

7. Provide a differential pressure sensor across the fan. The VFD shall start to increase fan speed. If, when the fan is running and the differential pressure across the fan drops below 2.0" w.c. (adj.) setpoint, the fan shall be disabled and the isolation damper shall close, and trigger alarm. Additionally, pressure switches mounted across the supply fans and the return fan shall shut down the fan should a pressure greater than 6" (adj.) supply and 2.0" (adj.) return be sensed. Total of two (2) switches.

I. Automatically restart all fans after resumption of normal power following power outages and dropouts.

J. The air volumetric control shall have a special feature to be reset for a higher CFM. See turbo mode sequence.

K. All control sequences as listed above shall fully function in either the hand or automatic modes as selected at the VFD drive control panel. The ATC Contractor will provide all required hardware, programming, wiring, relays, coordination, etc., to provide a complete fully functional system that operates automatically with no intervention beyond switching the drive mode switch at the VFD panel.

L. VFD bypass mode of operation, if VFD drives have bypass mode installed as an optional feature the ATC Contractor will provide “detailed” instructions as how the system, controls, VFD drives (s) etc., must be manipulated to allow system to operate in a safe manner. Instructions shall be attached to each affected VFD drive, printed and laminated for operators use.

2.04 AIR HANDLING UNITS TURBO MODE SEQUENCE

A. AHU-1 and AHU-2

1. When AHU-1 fails an alarm in the building control automation system or in the facility’s office shall be activated.

2. Power to AHU-1 shall be switched off and AHU-2 shall be switched to turbo mode.

3. LPS and Chilled Water control valves shall close for AHU-1.

4. AHU-2 shall be switched to turbo mode and shall command supply fan motor through VFD to run at higher set RPM to deliver 9750 CFM, 100% OA.

5. When AHU-2 is in turbo, LPS and chilled water control valves shall modulate for greater volume as required by space demand.

6. When AHU-2 is in turbo, AHU-1 supply air motorized damper MD-1 and MD-T7 shall close, MD-T1 shall open to allow AHU-2 to serve both areas served by AHU-1 and AHU-2. Related motorized dampers (MD-T8, MD-2) shall adjust accordingly.

7. When AHU-1 is restored, AHU-2 shall be switched back to normal operation by slowing down the fan RPM through VFD, and motorized dampers MD-T1 shall close, and MD-1, MD-6, MD-T7 and MD-T8 shall be in normal open position.

8. When AHU-2 fails, AHU-1 shall be switched to turbo and will similarly operate as described for AHU-2.

B. AHU-3 & AHU-4

1. When AHU-3 fails, an alarm in the building automation system or in the facility's office shall be activated.

2. Power to AHU-3 and return fan RF-1 shall be switched off and AHU-4 and RF-2 shall be switched to turbo mode.

3. LPS and chilled water control valves shall close for AHU-3.

4. AHU-4 shall be switched to turbo mode and shall command supply fan motor through VFD to run higher set RPM to deliver 12,375 CFM. Return fan RF-2 shall modulate accordingly.

5. When AHU-4 is in turbo mode, LPS and chilled water control valves shall modulate for greater volume as required by space demand.

6. When AHU-4 is in turbo, motorized dampers MD-3, MD-5 and MD-7 shall close MD-T2 which shall open to allow AHU-4 to serve the areas served by AHU-3 and AHU-4. Motorized damper MD-T3 shall open to allow air to return from areas served by AHU-3 and AHU-4. Return fan RF-2 shall modulate accordingly. MD-4 and MD-6 shall remain open, MD-8, MD-10 and MD-12 shall remain energized to modulate accordingly.

7. When AHU-3 is restored, AHU-4 shall be switched to normal operation for 8250 CFM, and all related dampers shall return to normal positions.

8. When AHU-4 fails, AHU-3 shall be switched to turbo and will similarly operate as described for AHU-3.

9. When AHU-3 and RAF-2 fail at the same time, an alarm shall be activated at the facility's office or building automation system. AHU-3 and RAF-2 shall be off. AHU-4 and RAF-1 shall be switched to turbo. Motorized dampers MD-T3, MD-T5, MD-T2, MD-4 shall open. Motorized dampers MD-10, MD-12 and MD-7 to modulate accordingly, and motorized dampers MD-6, MD-T6, MD-8, MD-11, MD-9, and MD-3 shall close. Similar sequence will follow when AHU-4 and RAF-1 fails.

C. AHU-5, 6 & 7

1. When any of the 3 AHU's (AHU-5, 6, 7) fails, an alarm in the building automation system or in the facility's office shall be activated.

2. Power to the failed AHU and associated relief fan shall be switched off and the remaining air handling units shall be switched to turbo mode to deliver 2500 CFM EA.

3. Chilled water and hot water control valves to the failed AHU shall close. Chilled water and hot water valves to remaining operating AHU's shall modulate accordingly, but in the no case shall both open at the same time

4. When failed AHU is restored, the AHU's in turbo shall be switched to normal operation, and all associated dampers and fans shall be in normal position

2.05 EXHAUST AIR FANS/SUPPLY AIR FANS

A. For all exhaust/supply fans, which are not located in AHU's, furnish for installation by the HVAC Contractor, automatic supply and/or discharge air dampers and interlock with fans to "open/close" when fans are "on/off". For fan designations and areas served by each fan, see schedule on drawings.

B. Toilet exhaust fans shall run continuously 24/7.

C. Return fans RAF-1 and RAF-2 shall be interlocked with AHU-3 and AHU-4 accordingly with AHU's mode of operation.

D. Fan ER-8, EF-9 and EF-10 shall be interlocked with AHU-5, AHU-6 and AHU-7 and shall modulate accordingly with AHU's mode of operation.

2.06 DIFFERENTIAL PRESSURE BYPASS VALVE ARRANGEMENT

A. Provide a differential pressure sensor, reporting to the DDC panel and valve(s) to maintain constant pressure differential between supply and return piping mains, to automatically bypass water and compensate for pressure fluctuations in the systems. Pressure sensor shall have sensing tips in the supply and return water lines.

1. Hot Glycol System: One (1) Valve

2. Chilled Glycol System: One (1) Valve

2.07 VARIABLE SPEED PUMPING AND FAN SYSTEMS (VFD)

A. VFD's shall be furnished and installed by the HVAC Contractor. The Electrical Contractor shall provide power to each VFD. The ATC Contractor shall provide all control wiring for each VFD.

B. Provide two (2) pair differential pressure sensors for each VFD controlled pumping system. The ATC Contractor shall furnish and the HVAC Contractor shall install all sensors.

C. The VFD shall vary the speed of the pump or fan to maintain the differential pressure set point at the D.P. sensor in each of the two (2) major piping or duct branches (control to maintain pressure at lowest of the pressure at the [2] sensors).

D. Each VFD controlled pumping system shall also have a differential pressure bypass assembly provided to operate only in the event of a VFD malfunction. When full speed VFD bypass is selected. All VFD's on pumps shall have automatic full speed bypass enabled whenever a fault is sensed in the VFD or the pump motor.

2.08 HEAT EXCHANGER CONTROL

A. The heating systems share a common heat exchanger system which shall generate constant temperature (180° adj.) hot water (Glycol) year-round. Piping to the building serves a year-round constant temperature reheat loop and AHUs 5,6 and 7 heating coils served by VFD driven pumps, and with zone temperature valves.

B. Heat Exchanger/ Hot Water Loop

1. Provide temperature monitoring sensors at each heat exchanger hot water supply and return piping connection, reporting to the DDC panel. The common hot water supply and return piping temperatures shall be sensed. Hot water pumps shall be activated by the DDC system and shall run continuously, until deactivated by DOC system.

2. The DDC panel shall modulate the steam valve to maintain hot water supply temperature of 180°F (adj.).

3. When the hot water (Glycol) pump is off, the steam valves shall be closed.

4. Heat exchanger pair (primary/standby) will need only one (1) pair of steam control valves.

5. Provide a flow switch to indicate flow through heat exchanger. Steam valves shall be closed unless flow is proven.

2.09 SMOKE MANAGEMENT SYSTEM

A. The building is not required by Code to have an "Engineered Smoke Control System". However, various fan overrides and smoke detector systems are required.

B. Fire Alarm and DDC System Interface Panel

1. The Electrical Contractor shall provide a FAS/ATC interface panel. The ATC Contractor shall wire from the BAS to the interface panel. The Electrical Subcontractor shall wire to the various contacts from the fire alarm panel to this interface panel, to enable the ATC system to activate the following sequence/functions.

C. Fire Command Center Override

1. Each of the fans in the following systems shall be interlocked through the DDC system to an H/O/A switch within the fire command center, located on the first floor. The ATC Contractor shall receive a dry contact closure at the FCC for each H-O-A to represent "Hand", at which time the associated fan shall start. When "Off" is selected, the ATC system shall deactivate the associate fan. Provide an actual status feedback DO to the FCC indicating each fan's "actual" on-off status:

2. The Electrical Contractor shall furnish H/O/A switches, within the fire command center, for connections by the ATC Contractor. The ATC Contractor shall wire from the switches to the Building Automation System to control each of the above designated HVAC fan systems.

3. When "hand" is selected at the fire command center, all safeties except static pressure switches and static pressure control shall be overridden. Normal discharge temperatures shall be maintained as closely as possible.

2.10 CHILLED WATER SYSTEM

A. The ATC Contractor shall provide all interlocking wiring to the chiller control panel provided by the chiller manufacturer to activate/deactivate chiller, as hereinafter specified. All remote sensors, differential pressure switches and other control devices furnished as part of this control system shall be provided by the ATC Contractor. The HVAC Contractor shall install wells, etc., as directed by the ATC Contractor.

B. The chiller control system shall provide all sequences for chiller and interlocking provision with chilled water pumps. The ATC Contractor shall interlock each chiller and pump to the DDC control system.

C. Provide vapor tight flow switches for each chilled water pump and interlock to the chiller to prevent chiller operation until the chilled water pump is operating to provide flow through the chiller. Provide flow switches at the outlet of each chiller.

D. Provide all sensors, relays and other control devices necessary for a complete and workable chilled water system. Coordinate the entire chilled water control installation with the chiller manufacturer.

E. Chillers shall be controlled as follows:

1. The chilled water shall start via the DDC system. When flow is established by differential pressure and flow switches, the chiller will start. Pressure switches

shall be installed across each chiller and wired to the local DDC and chiller control panel to provide proof of flow.

2. When one chiller cannot maintain 40°F (adj.) leaving water temperature, the other chiller system shall be enabled. Provide lead-lag of chillers.

F. Chiller system as specified below shall be controlled by a dedicated PLC. Control of other major systems (i.e., air handling units, etc.) on this PLC shall not be acceptable.

G. The following information shall be permanently displayed at the DDC without the requirement of manual data retrieval.

1. Chilled water supply temperature

2. Chilled water return temperature

3. Chilled water pump status

2.11 VARIABLE SPEED DRIVES

A. For each VFD, provide the following through the PLC:

1. Motor run feedback points to provide run status in both VFD and bypass mode.

2. Provide mode feedback (VFD and bypass mode).

3. Speed control output signal to VFD.

4. Feedback indicating speed (Hz) and amperage.

5. General alarm from VFD.

6. Start/stop output to VFD.

2.12 OPTIMIZED START-UP AFTER POWER FAILURE

A. The ATC Contractor shall start systems and equipment in a staggered manner after a power failure such that systems and equipment do not start all at once and overload electrical service nor create an excess negative or positive pressure in the building. Provide a 5 second (adj.) delay between start-up of each system.

B. All equipment - any piece of equipment or system that is stopped for any reason other than loss of normal or emergency power must be alarmed and may only reset manually via the BAS. Power failure shall be as sensed by the undercurrent relays and normal/emergency power relays at the electrical automatic transfer switches.

2.13 IN-DUCT ZONE HEATING COIL (AREA HEATING)

A. Area heating coil normally open 2-way hot water coil shall be modulated to maintain space temperature at the DDC thermostat. Valve shall be normally open.

2.14 CHEMICAL TREATMENT

A. Chemical treatment systems shall be provided by the HVAC Contractor for all water systems. The ATC Contractor shall provide wiring between all components of the chemical treatment systems.

2.15 POST FIRE PURGE SYSTEM

A. Purge System sequence and operations shall be as indicated on contract drawing.

B. Post fire combination return fan and purge system shall operate as follows under control of the fire alarm system:

1. When system is indexed to purge by pruge enable switch at the fire alarm panel, the smoke pruge panel shall be activated,

2. The AHU supply fan shall energize with associated fire/smoke damper to provide makeup air, the fire/smoke damper serving the floor supply shall close, the supply air duct damper serving the floor not purged shall also be closed and only the damper serving the purged floor shall open, relief air damper shall open, outside air damper shall open fully.

3. The respective Return Fan shall start. All fire and smoke dampers in the return ductwork shall open to purge on a floor/zone basis.

4. The return fan shall energize with associated fire/smoke damper to provide purge of the space, the fire/smoke damper serving the floor return shall close, the return air duct damper serving the floor not purged shall also be closed and only the damper serving the purged floor shall open, relief air damper shall open.

5. Upon completion of the pruge sequence for the building. The purge panel shall be reset and the purge eable switch shall be deactivated at the fir ealm panel.

6. All the AHUs and RTUs shall be reset a the BMS system for normal mode operation.

2.16 PUMPS

A. Chilled water pumps CHW GP-1 and CHW GP-2

1. Chilled water pumps CHW GP-1 and CHW GP-2 shall be started manually or automatically and through a digital controller or building automation system.

2. Chilled water pumps shall operate with 1 active and 1 stand-by arrangement, and could be re-scheduled to alternate function.

3. When chilled water pump is indexed on, the active pump shall be energized and shall run when chilled water is demanded in the system through the chilled water control valve end switch.

4. Active pump shall run and modulate through UFD to meet chilled water demand.

5. When active pump fails, an alarm shall be activated, and stand-by pump shall operate.

6. When all chilled water control valves are closed, chilled water pumps shall be off.

B. Hot water pumps HWP-1 and HWP-2

1. Hot water pumps HWP-1 and HWP-2 shall be started manually or through a digital controller or building automation system.

2. Hot water pumps shall operate with 1 active and 1 stand-by arrangement, and could be re-scheduled to alternate function.

3. When hot water pump is indexed to on, the active pump shall be energized and shall run when hot water is demanded in the system- AHU's 5, 6 and 7 and reheat coils, though the hot water control valves end switches.

4. Active pump shall run and add water through UFD to meet hot water demand.

5. When active pump fails, an alarm shall be activated, and stand-by pump will operate when all hot water control valves are closed, hot water pump shall be off.

2.17 **INFLATABLE DAMPER**

A. **Inflatable damper shall be factory set to minimum outside air/exhaust air flow rate and maximum flow as per design drawings.**

B. **Damper shall at all times be under control of the Return/Exhaust air duct mounted smart sensor to modulate the damper to maintain space temperature.**

C. **A supply air duct pressure sensor installed in the main duct shall modulate the air handling unit fan speed.**

D. **Air handling unit shall optimize discharge air temperature in multiples of 2 deg F (adjustable) by modulating chilled water flow rate at the coil if the supply duct pressure consistently maintains at the minimum air flow setting of the air handling unit for more than 15 minutes (Adjustable)**

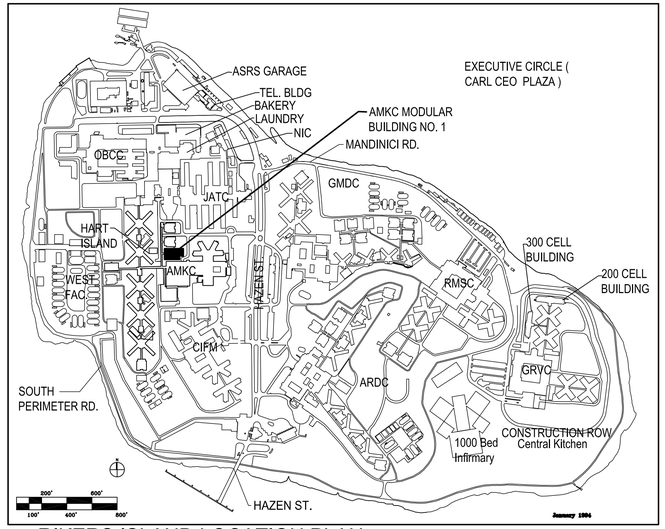
END OF SECTION 23 09 98

DIVISION OF CAPITAL POLICY AND DEVELOPMENT
ENGINEERING UNIT

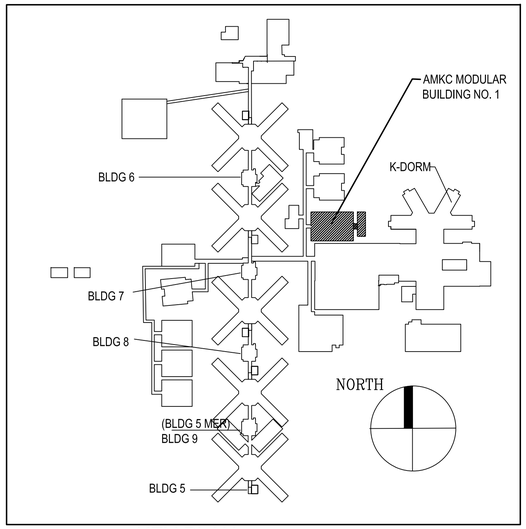
AIR CONDITIONING SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER

18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370
PIN: 072201723CPD

JOSEPH PONTE COMMISSIONER FRANK DOKA DEPUTY COMMISSIONER	CONSULTANT: IAQ SYSTEMS INC Consulting Engineers 630 9TH AVENUE, SUITE 1112 NEW YORK, NY 10036 T. 212 680 8945 F. 212 680 8946 WWW.IAQSYS.COM	SEAL	FRANK EILAM ASSISTANT COMMISSIONER



RIKERS ISLAND LOCATION PLAN
(N.T.S.)



KEY PLAN
(N.T.S.)

SUMMARY OF WORK

GENERAL:

THE FOLLOWING SUMMARY OF WORK PROVIDES A VERY GENERAL OVERVIEW OF THE SCOPE OF WORK. ALL SCOPE OF WORK SHALL BE AS INCLUDED IN THIS DESCRIPTION PLUS ALL OTHER WORK REQUIRED TO MEET THE INTENT OF THE CONTRACT DOCUMENTS INCLUDED AS PART OF THE PROJECT CONTRACT.

ARCHITECTURAL:

1. REPLACE SECURITY PAN CEILINGS AT LOCATIONS SHOWN ON HVAC DRAWINGS.
2. REPLACE WALL AND FLOOR SECTIONS TO THE EXTENT SHOWN ON STRUCTURAL DRAWINGS.
3. REMOVE AND REPLACE EXISTING WALL LOUVERS IN MER.
4. PATCH AND PAINT ALL FLOORS, CEILINGS, PARTITIONS , DOORS, WINDOWS, FRAMES FOR THE ENTIRE MOD. 1 BUILDING AND MER MODULAR BUILDING UPON COMPLETION OF ALL TRADES WORK SHOWN ON ALL TRADE DRAWINGS.

STRUCTURAL:

1. REMOVE AND REPLACE EXISTING FLOOR BEAM SECTIONS AS SHOWN ON FLOOR PLANS ALONG WITH FLOOR SECTIONS.
2. PROVIDE TEMPORARY SUPPORTS FOR ALL OTHER TRADE COMPONENTS PRIOR TO SUCH REMOVAL WORK.
3. PARTIALLY REMOVE EXISTING CONCRETE PAD FOR AHU.
4. PROVIDE NEW CONCRETE PAD FOR CHILLER AND AHU.
5. REMOVE EXISTING SUPPORT STRUCTURE SERVING EXISTING AHU IN SECOND FLOOR MECHANICAL ROOM.
6. PROVIDE NEW SUPPORT STRUCTURE FOR NEW AHU 5,6, & 7.

HVAC:

1. REMOVE EXISTING FOUR EXISTING SPLIT TYPE AIR CONDITIONING UNITS WITH STEAM HEATING COILS LOCATED IN THE MECHANICAL MODULAR BUILDING SERVING THE CELLS AND DAYROOMS AND THREE PIGGYBACK SPLIT TYPE AIR CONDITIONING UNITS WITH ELECTRIC HEATING COILS LOCATED IN THE SECOND FLOOR MECHANICAL ROOM THAT SERVE THE ADMINISTRATIVE SPACES AND CONTROL ROOMS.
2. REMOVE EXISTING RETURN FANS AND EXHAUST FANS, AIR INTAKE AND RELIEF VENTS SERVING THE MOD. 1 BUILDING.
3. CLEAN EXISTING AIR INLETS AND AIR OUTLETS IN PLACE THOROUGHLY. WIRE BRUSH AND COMB ALL APERTURES, PAINT AND FINISH RESTORE TO ORIGINAL CONDITIONAL SERVING MOD. 1 BUILDING.
4. REMOVE ALL ASSOCIATED SUPPORTS AND ISOLATORS RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
5. REMOVE ALL ASSOCIATED DUCTWORK, DUCT ACCESSORIES, INSULATION, RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
6. REMOVE ALL ASSOCIATED STEAM PIPING, REFRIGERANT PIPING, ACCESSORIES, INSULATION, RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
7. REMOVE ALL EXISTING FSD AND FD RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTEND SHOWN ON CONTRACT DOCUMENTS.
8. REMOVE ALL ASSOCIATED CONTROLS, ACCESSORIES, INSULATION, RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
9. PROVIDE NEW CHILLED GLYCOL PLANT AS SHOWN ON CONTRACT DOCUMENTS WITH ASSOCIATED PUMPS, EXPANSION TANKS, AIR SEPARATORS, ACCESSORIES, PIPING, INSULATION RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
9. PROVIDE NEW GLYCOL HOT WATER/STEAM HEAT EXCHANGERS AS SHOWN ON CONTRACT DOCUMENTS WITH ASSOCIATED PUMPS, EXPANSION TANKS, AIR SEPARATORS, ACCESSORIES, PIPING, INSULATION RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
10. PROVIDE NEW CHILLED GLYCOL AIR HANDLING UNITS WITH STEAM HEATING COILS LOCATED IN THE MECHANICAL MODULAR BUILDING SERVING THE CELLS AND DAYROOMS.
11. PROVIDE NEW CHILLED GLYCOL PIGGYBACK AIR HANDLING UNITS WITH HOT GLYCOL HEATING COILS LOCATED IN THE SECOND FLOOR MECHANICAL ROOM THAT SERVE THE ADMINISTRATIVE SPACES AND CONTROL ROOMS.
12. PROVIDE NEW RETURN FANS AND EXHAUST FANS, AIR INTAKE AND RELIEF LOUVERS SERVING THE MOD. 1 BUILDING.
13.
14. PROVIDE ALL ASSOCIATED SUPPORTS, CONCRETE PADS, AND ISOLATORS RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
15. PROVIDE ALL ASSOCIATED DUCTWORK, DUCT ACCESSORIES, INSULATION, RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
16. PROVIDE ALL ASSOCIATED STEAM PIPING, CONDENSATE RETURN, CHILLED PIPING, HOT GLYCOL PIPING, CONDENSATE DRAIN PIPING ACCESSORIES, INSULATION, RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
17. PROVIDE ALL ASSOCIATED CONTROLS, ACCESSORIES, INSULATION, RELATED TO THE ABOVE SCOPE OF WORK TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
18. PROVIDE NEW GLYCOL HOT WATER REHEAT COILS, PIPING ACCESSORIES, INSULATION AND CONTROLS.
19. PROVIDE NEW FSD AND FD AND CONNECT NEW FSD TO NEW SMOKE PURGE PANEL.
20. PROVIDE DUCT CLEANING FOR ALL DUCTWORK SERVING.
21. CONTRACTOR TO PROVIDE 50 TON AND 15 TON TEMPORARY COOLING UNITS WITH ELECTRIC HEATING WITH ALL ASSOCIATED DUCTWORK, SUPPORTS AND ACCESSORIES.
22. CONTRACTOR TO PROVIDE TEMPORARY SOUND WALL/BARRIER FOR TEMPORARY AC/HEATING UNITS DURING CONSTRUCTION.

ELECTRICAL

21. DISCONNECT ALL POWER TO THE HVAC SYSTEM BEING REMOVED UNDER THE CONTRACT ALONG WITH ASSOCIATED WIRING AND CIRCUIT BREAKERS FEEDING THE EQUIPMENT TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
22. PROVIDE NEW CIRCUIT BREAKERS ALONG WITH NEW CONDUIT, WIRING AND ACCESSORIES FOR THE NEW HVAC EQUIPMENT TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
23. DISCONNECT AND REMOVE EXISTING SMOKE DETECTORS IN THE DUCTWORK AND REPLACE WITH NEW DUCT DETECTORS AND CONNECT TO THE EXISTING BUILDING FIRE ALARM SYSTEM TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
24. DISCONNECT EXISTING FANS, DAMPERS AND CONTROLS FROM THE SMOKE PURGE PANEL AND RECONNECT NEW FANS, DAMPERS AND CONTROLS TO THE NEW SMOKE PURGE PANEL TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.

GENERAL

1. CONTRACTOR TO HIRE THIRD PARTY (INDEPENDENT) COMMISSIONING FIRM FOR ALL COMMISSIONING RELATED WORK.

ADDENDUM 2:

ALL WORK WHICH ARE MARKED UNDER ADDENDUM 2 ARE TO BE PART OF BASE BID PACKAGE, OTHER THAN ITEMS BELOW. THESE ITEMS SHALL BE CONSIDER AS ADD ALTERNATES TO THE CONTRACT.

ADD ALTERNATE 1 SUMMARY OF WORK:

INSTALL NEW MAXIMUM SECURITY ACCESS DOOR IN CEILING FOR ACCESS TO INFLATABLE DAMPER AND VOLUME DAMPER AS SHOWN

ADD ALTERNATE 2 SUMMARY OF WORK:

1. INSTALL NEW INFLATABLE DAMPER IN SUPPLY DUCTWORK WITH ASSOCIATED TUBING, CONTROL, SUPPORT.
2. TEMPERATURE SENSOR TO BE INSTALLED INSIDE RETURN / EXHAUST DUCTWORK AS INDICATED LOCATION ON PLANS.
3. INFLATABLE DAMPER TO BE CONNECTED TO MASTER UNIT AND AIR PUMP AS SHOWN ELSEWHERE ON CONTRACT DOCUMENTS.
4. PROVIDE NEW CIRCUIT BREAKERS ALONG WITH NEW CONDUIT, WIRING AND ACCESSORIES FOR THE SYSTEM EQUIPMENT TO THE EXTENT SHOWN ON CONTRACT DOCUMENTS.
5. INSTALL POWER DISTRIBUTION PANEL WITH ASSOCIATED WIRING, CONDUIT AND ACCESSORIES.

ADD ALTERNATE 3 SUMMARY OF WORK:

1. PROVIDE TEMPORARY 15 TON AIR COOLED AC/ HEATING UNIT AND ALL REQUIRED TEMPORARY CONNECTIONS FOR AHU-5,6 & 7 RELATED WORKS FOR 18 MONTHS.
2. PROVIDE TEMPORARY 50 TON AIR COOLED AC/HEATING UNIT AND ALL REQUIRED TEMPORARY CONNECTIONS FOR AHU-1,2,3 & 4 RELATED WORKS FOR 18 MONTHS

0 4 8 16

NOTE:
PATCH AND PAINT ALL SURFACES INCLUDING BUT NOT LIMITED TO FLOORS, CEILINGS, PARTITIONS , DOORS, WINDOWS, FRAMES FOR THE ENTIRE MOD. 1 BUILDING AND MER MODULAR BUILDING UPON COMPLETION OF ALL TRADES WORK SHOWN ON ALL TRADE DRAWINGS.

DRAWING LIST

Sheet No.	Total Sheet	Drawing No.			Title
1.	70	T	001.00	ARCH	TITLE SHEET 1 OF 4
2.	70	T	002.00	ARCH	TITLE SHEET 2 OF 4
3.	70	T	003.00	ARCH	TITLE SHEET 3 OF 4
4.	70	T	004.00	ARCH	TITLE SHEET 4 OF 4
5.	70	EN	001.00	HVAC	ENERGY CODE ANALYSIS COMPLIANCE SHEET 1 OF 2
6.	70	EN	002.00	HVAC	ENERGY CODE ANALYSIS COMPLIANCE SHEET 2 OF 2
7.	70	M	001.00	HVAC	SYMBOLS AND ABBREVIATIONS
8.	70	M	002.00	HVAC	GENERAL NOTES SHEET 1 OF 3
9.	70	M	003.00	HVAC	GENERAL NOTES SHEET 2 OF 3
10.	70	M	004.00	HVAC	GENERAL NOTES SHEET 3 OF 3
11.	70	DM	101.00	HVAC	FIRST FLOOR PLAN REMOVAL WORK
12.	70	DM	102.00	HVAC	SECOND FLOOR PLAN REMOVAL WORK
13.	70	DM	103.00	HVAC	PART PLAN MECHANICAL ROOMS REMOVAL PLAN
14.	70	PM	101.00	HVAC	PART PHASING PLAN SHEET 1 OF 2
15.	70	PM	102.00	HVAC	PART PHASING PLAN SHEET 2 OF 2
16.	70	M	201.00	HVAC	FIRST FLOOR CONSTRUCTION PLAN
17.	70	M	202.00	HVAC	SECOND FLOOR CONSTRUCTION PLAN
18.	70	M	203.00	HVAC	PART PLAN MECHANICAL ROOMS CONSTRUCTION PLAN
19.	70	M	204.00	HVAC	ROOF REMOVAL & CONSTRUCTION PLAN
20.	70	M	205.00	HVAC	PART PLAN MECHANICAL ROOMS PIPING PLAN
21.	70	M	301.00	HVAC	HVAC CONTROL LEGEND
22.	70	M	302.00	HVAC	AHU CONTROL SCHEMATIC (AHU-3 & 4)
23.	70	M	303.00	HVAC	CHILLER CONTROL SCHEMATIC
24.	70	M	304.00	HVAC	ELEC. UNIT HTR & AHU-1&2 CONTROL SCHEMATIC
25.	70	M	305.00	HVAC	HOT WATER CONTROL DIAGRAM
26.	70	M	306.00	HVAC	CONTROL TABLE
27.	70	M	401.00	HVAC	CHILLED WATER / GLYCOL FLOW DIAGRAM
28.	70	M	402.00	HVAC	AHU-1,2,3 & 4 & AHU- 5, 6 & 7 AIR FLOW DIAGRAM
29.	70	M	501.00	HVAC	HVAC SCHEDULE SHEET 1 OF 2
30.	70	M	502.00	HVAC	HVAC SCHEDULE SHEET 2 OF 2
31.	70	M	601.00	HVAC	DETAILS SHEET 1 OF 8
32.	70	M	602.00	HVAC	DETAILS SHEET 2 OF 8
33.	70	M	603.00	HVAC	DETAILS SHEET 3 OF 8
34.	70	M	604.00	HVAC	DETAILS SHEET 4 OF 8
35.	70	M	605.00	HVAC	DETAILS SHEET 5 OF 8

DRAWING LIST

Sheet No.	Total Sheet	Drawing No.			Title
36.	70	M	606.00	HVAC	DETAILS SHEET 6 OF 8
37.	70	M	607.00	HVAC	DETAILS SHEET 7 OF 8
38.	70	M	608.00	HVAC	DETAILS SHEET 8 OF 8
39.	70	E	001.00	ELECTRICAL	SYMBOLS & ABBREVIATIONS AND GENERAL NOTES
40.	70	E	002.00	ELECTRICAL	DEMOLITION NOTES AND DRAWING LIST
41.	70	DE	101.00	ELECTRICAL	FIRST FLOOR PLAN - REMOVAL
42.	70	DE	102.00	ELECTRICAL	SECOND FLOOR PLAN - REMOVAL
43.	70	DE	103.00	ELECTRICAL	PART PLAN MECHANICAL ROOMS - REMOVAL
44.	70	DE	104.00	ELECTRICAL	PHASING PLANS
45.	70	E	201.00	ELECTRICAL	FIRST FLOOR PLAN EXISTING LIGHTING PLAN
46.	70	E	202.00	ELECTRICAL	SECOND FLOOR PLAN EXISTING LIGHTING PLAN
47.	70	E	203.00	ELECTRICAL	PART PLAN MECHANICAL ROOMS
48.	70	E	204.00	ELECTRICAL	ROOF POWER PLAN REMOVAL AND NEW WORK
49.	70	E	401.00	ELECTRICAL	EXISTING SINGLE LINE RISER DIAGRAM
50.	70	E	501.00	ELECTRICAL	PANEL SCHEDULES 1 OF 2
51.	70	E	502.00	ELECTRICAL	PANEL SCHEDULES 2 OF 2
52.	70	E	601.00	ELECTRICAL	ELECTRICAL DETAILS 1 OF 2
53.	70	E	602.00	ELECTRICAL	ELECTRICAL DETAILS 2 OF 2
54.	70	FA	001.00	FIRE ALARM	SYMBOLS & ABBREVIATIONS
55.	70	FA	101.00	FIRE ALARM	FIRST FLOOR FIRE ALARM PLAN
56.	70	FA	102.00	FIRE ALARM	SECOND FLOOR FIRE ALARM PLAN
57.	70	DFA	103.00	FIRE ALARM	PART PLAN MECHANICAL ROOMS - REMOVAL
58.	70	FA	104.00	FIRE ALARM	PART PLAN MECHANICAL ROOMS
59.	70	FA	105.00	FIRE ALARM	ROOF POWER PLAN REMOVAL AND NEW YORK
60.	70	FA	201.00	FIRE ALARM	RISER DIAGRAM
61.	70	FA	202.00	FIRE ALARM	FIRE ALARM NOTES
62.	70	FA	301.00	FIRE ALARM	FIRE ALARM DETAILS
63.	70	S	001.00	STRUCTURAL	STRUCTURAL GENERAL NOTES
64.	70	S	002.00	STRUCTURAL	STRUCTURAL GENERAL NOTES 2
65.	70	S	100.00	STRUCTURAL	FOUNDATION PART PLAN, 1ST FLOOR PART PLAN AND SECTIONS
66.	70	S	101.00	STRUCTURAL	FIRST FLOOR PARTIAL FRAMING PLANS DEMO& NEW WORK
67.	70	S	102.00	STRUCTURAL	2ND FLOOR PART PLAN AND SECTIONS
68.	70	S	601.00	STRUCTURAL	TYPICAL DETAILS 1
69.	70	S	701.00	STRUCTURAL	TYPICAL DETAILS AND SECTIONS
70.	70	S	702.00	STRUCTURAL	TYPICAL DETAILS 2

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

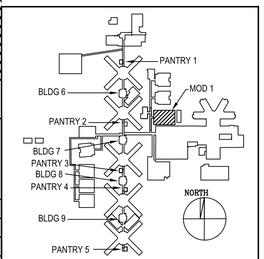
IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

Drawing Title:

TITLE SHEET

SHEET 2 OF 4

Seal:

Drawing No.:

T002.00

Scale: NONE

Sheet: 2 of 70

SYMBOLS LIST

- SINGLE LINE DUCTWORK OR EQUIP. (NEW)
- SINGLE LINE DUCTWORK OR EQUIP. (EXISTING)
- SINGLE LINE DUCTWORK OR EQUIP. TO BE REMOVED
- DUCT UNDER POSITIVE PRESSURE (SUPPLY AIR OR FAN DISCHARGE)
- DUCT UNDER NEGATIVE PRESSURE (RETURN, EXHAUST OR OUTSIDE AIR)
- VD — VOLUME DAMPER
- FD — FIRE DAMPER AND ACCESS DOOR
- BDD — BACK DRAFT DAMPER
- M — AUTOMATIC DAMPER (ELECTRIC)
- FSD — COMBINATION SMOKE & FIRE DAMPER WITH ACCESS DOOR (ELECTRIC)
- R — RISE IN DUCTWORK (AIR FLOW DIRECTION)
- D — DROP IN DUCTWORK (AIR FLOW DIRECTION)
- ℄ — CENTER LINE
- ℄ OR CFM — CUBIC FEET PER MINUTE
- ⌑ — SQUARE FEET
- L 1.0 ⌑ F.A. — LOUVER IN DOOR - MIN. 1.0 SF FREE AREA
- UC — UNDERCUT DOOR
- CD-A 400 ℄ — TYPE A CEILING DIFFUSER 400 CFM SUPPLY AIR
- 10x8 CR(CG) 300 ℄ — 10" BY 8" CEILING REGISTER (CEILING GRILLE) 300 CFM RETURN AIR
- RECTANGULAR DIFFUSER WITH BLANKING PLATE
- 10x6 TR 150 ℄ — 10" BY 6" TOP REGISTER, 150 CFM SUPPLY AIR
- 10x6 TR(TG) 150 ℄ — 10" BY 6" TOP REGISTER (TOP GRILLE) 150 CFM RETURN AIR
- VANED ELBOW (SEE DETAIL)
- VANED ELBOW (SEE DETAIL) OR RADIUS ELBOW
- RADIUS ELBOW
- SLOTTED LINEAR DIFFUSER WITH PLENUM
- SEE DUCT DETAILS FOR TYPE OF BRANCH CONN.

- VERTICAL DUCT DROP (IN DIRECTION OF AIRFLOW)
- VERTICAL DUCT RISE (IN DIRECTION OF AIRFLOW)
- CENTRIFUGAL FAN
- T — THERMOSTAT
- H — HUMIDISTAT
- H — HUMIDIFIER
- R — REFRIGERANT DETECTOR
- CO2 — CARBON DIOXIDE SENSOR
- OAS — OUTSIDE AIR SENSOR
- NEW PIPE WITH DIRECTION OF FLOW
- PIPING TO BE ABANDONED
- HEAT TRACING ON PIPE
- PIPE DROP
- PIPE RISE
- U — PITCH UP IN DIRECTION OF FLOW
- D — PITCH DOWN IN DIRECTION OF FLOW
- UNION
- FLANGED CONNECTION
- FLANGED END - BLIND FLANGE
- DEAD END - SCREWED CAP
- DEAD END - WELDED CAP
- PIPE ANCHOR
- GATE VALVE
- ANGLE GATE VALVE
- GLOBE VALVE
- ANGLE GLOBE VALVE
- LOCK SHIELD VALVE
- CHECK VALVE, SWING OR LIFT
- BUTTERFLY VALVE

- BALL VALVE
- BALANCING VALVE
- PLUG VALVE (TYPE AS NOTED)
- R — RELIEF VALVE
- S — SAFETY VALVE
- PRESSURE REDUCING VALVE
- AUTOMATIC CONTROL VALVE
- THREE-WAY AUTOMATIC CONTROL VALVE
- FLOW CONTROL VALVE
- AUTOMATIC AIR VENT
- MANUAL AIR VENT
- REFRIGERANT SIGHT GLASS
- VIBRATION ISOLATOR IN HANGER
- CHWS — CHILLED WATER SUPPLY (GLYCOL) (2)
- CHWR — CHILLED WATER RETURN (GLYCOL) (2)
- COND — CONDENSATE
- D — DRAIN
- HWR — HOT WATER RETURN (GLYCOL) (2)
- HWS — HOT WATER SUPPLY (GLYCOL) (2)
- LPC — LOW PRESSURE CONDENSATE
- LPS — LOW PRESSURE STEAM
- RHG — REFRIGERANT HOT GAS
- RL — REFRIGERANT LIQUID LINE
- RRV — REFRIGERANT RELIEF VENT
- RS — REFRIGERANT SUCTION LINE
- V — VENT OR ATMOSPHERIC RELIEF
- POINT OF CONNECTION
- POINT OF DISCONNECTION
- S — DUCT SMOKE DETECTOR
- ACCESS DOOR (2)
- INFLATABLE DAMPER
- TS — TEMPERATURE SENSOR (DUCTWORK OR SPACE MOUNTED SEE PLANS) (2)
- PUMP
- REVISION

ABBREVIATIONS LIST

A	AMPERES
AAV	AUTOMATIC AIR VENT
AC	AIR CONDITIONING
ACCU	AIR COOLED CONDENSING UNIT
ACU	AIR CONDITIONING UNIT
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AL	ALUMINUM
AP	ACCESS PANEL
BAD	BOTTOM ANGULAR DISCHARGE
BD	BLOW DOWN
BF	BOOSTER FAN
BG	BOTTOM GRILLE
BFP	BOILER FEED PUMP
BHP	BRAKE HORSEPOWER
BR	BOTTOM REGISTER
CC	COOLING COIL
CD	CEILING DIFFUSER
CFFC	CAP FOR FUTURE CONNECTION
CFM	CUBIC FEET PER MINUTE
CLG	CEILING
COMPR	COMPRESSOR
COND	CONDENSATE
COV	CHAIN OPERATED VALVE
CPA	CONTROL POINT ADJUSTMENT
CP	CONDENSATE PUMP
CR	CEILING REGISTER (RETURN)
CPU	CONDENSATE PUMP UNIT
CUH	CABINET UNIT HEATER
CV	CONSTANT VOLUME
CW	CLOCKWISE
DB	DRY BULB
DBD	DOWN BLAST DISCHARGE
DCDA	DOUBLE CHECK DETECTOR ASSEMBLY (2)
DMPR	DAMPER
DN	DOWN
DWG	DRAWING
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB TEMPERATURE
EDR	EQUIVALENT DIRECT RADIATION
EF	EXHAUST FAN
ELEC	ELECTRIC
ELEV	ELEVATOR
EQ	EQUAL
ET	EXPANSION TANK
EUH	ELECTRIC UNIT HEATER
EWB	ENTERING WET BULB
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
EXP	EXPANSION
EXIST	EXISTING
F	FILTER
°F	DEGREES FAHRENHEIT
FA	FREE AREA (SQ.FT.)
FC	FLEXIBLE CONNECTION
FSD	COMBINATION FIRE SMOKE DAMPER WITH ACCESS DOOR
FD	FIRE DAMPER WITH ACCESS DOOR
FG	FINISHED GRADE
FIN FL	FINISHED FLOOR
FLA	FULL LOAD AMPERES
FT	FEET
FTR	FINNED TUBE RADIATION
G	GAUGE
GAL	GALLON
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GX	GENERAL EXHAUST
HC	HEATING COIL
HRC	HEAT RECOVERY COIL
HT	HEIGHT
HTWP	HIGH TEMPERATURE WATER PUMP
HV	HEATING AND VENTILATING
HZ	FREQUENCY
IN	INCH OR INCHES
KW	KILOWATT
KX	KITCHEN RANGE HOOD EXHAUST
L	LENGTH
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LD	LINEAR DIFFUSER
LDB	LEAVING DRY BULB TEMPERATURE
LIN FT	LINEAR FEET
LR	LINEAR RETURN
LRA	LOCKED ROTOR AMPS
LV	LOW VELOCITY
LWB	LEAVING WET BULB TEMPERATURE
LWT	LEAVING WATER TEMPERATURE (2)
MAV	MANUAL AIR VENT
MAX	MAXIMUM
MB	MIXING BOX
MBH	THOUSAND BTU PER HOUR
MCC	MOTOR CONTROL CENTER
MD	MOTORIZED DAMPER (2)
MER	MECHANICAL EQUIPMENT ROOM
MHP	MOTOR HORSEPOWER
MIN	MINIMUM
MX	MECHANICAL ROOM EXHAUST
MP	MEDIUM PRESSURE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO.	NUMBER
OA	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
OD	OUTSIDE DIAMETER
OV	OUTLET VELOCITY
OBD	OPPOSED BLADE DAMPER
PCC	PRECOOLING COIL
PD	PRESSURE DROP
PDC	POWER DISTRIBUTION CABINET (2)
PF	PREFILTER
PHC	PREHEAT COIL
PSI	POUNDS PER SQUARE INCH
PSIG	PSI GAUGE
R	RISE
RA	RADIATION
RAD	RETURN AIR
REFR	REFRIGERANT
RF	RETURN FAN
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RHWP	REHEAT WATER PUMP
RLA	RUNNING LOAD AMPS
RPM	REVOLUTIONS PER MINUTE (2)
RPZ	REDUCE PRESSURE ZONE BACKFLOW PREVENTER
RR	WALL RETURN REGISTER
SA	SUPPLY AIR
SD	SMOKE DAMPER
SF	SUPPLY FAN
SP	STATIC PRESSURE
SPK	SPRINKLER (2)
SPEC	SPECIFICATION
THD	TOP HORIZONTAL DISCHARGE
TR	TOP REGISTER (SUPPLY)
TRD	TRANSFER DUCT
TF	TRANSFER FAN
TYP	TYPICAL
TX	TOILET EXHAUST
UON	UNLESS OTHERWISE NOTED
VAV	VARIABLE AIR VOLUME UNIT
VD	VOLUME DAMPER
VFD	VARIABLE FREQUENCY DRIVE
VF	VENTILATION FAN
VIV	VARIABLE INLET VANES
W	WIDTH
WC	WATER COLUMN
WG	WATER GAUGE
WMS	WIRE MESH SCREEN

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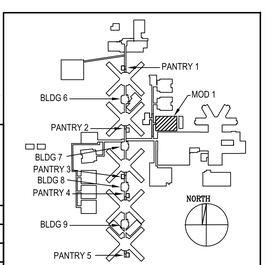

KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING SYSTEM REPLACEMENT

MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:
HVAC - SYMBOLS,
AND ABBREVIATIONS

Seal:

Drawing No.:
M001.00

Scale: NONE

Sheet: 7 of 70

HVAC GENERAL NOTES (APPLICABLE TO ALL DRAWINGS)

GENERAL

1. THE TERM "CONTRACTOR", "THIS CONTRACTOR", "HVAC CONTRACTOR" OR ANY TEXT AND DRAWINGS INCLUDED IN THIS CONTRACT DOCUMENT (WHICH INCLUDES DRAWINGS AND SPECIFICATIONS) SHALL BE MEANT AND DIRECTED TO THE CONTRACTOR PERFORMING THE HEATING, VENTILATING AND AIR CONDITIONING (HVAC) WORK IN THIS PROJECT.

2. THE ARCHTIECT/ENGINEER FOR THE PROJECT WHO WILL ALSO BE REFERRED TO AS THE ARCHTIECT/ENGINNEER OF RECORD WILL BE THE FIRM WHOSE NAME AND ADDRESS IS LISTED IN THE TITLE BLOCK OD THE DESIGN DOCUMENT.

3. ALL WORK SHOWN IN THE CONTRACT DRAWINGS AND INCLUDED IN THE SPECIFICATIONS SHALL BE CONSIDERED AS NEW WORK TO BE PROVIDED (DEFINED AS FURNISHED AND INSTALLED) BY THE HVAC CONTRACTOR. ONLY ITEM SPECIFICALLY INDICATED AS "EXISTING" OR "BY OTHERS" OR "BY OTHER TRADES" SHALL BE EXCLUDED FROM THE WORK PROVIDED BY THE HVAC CONTRACTOR. SYMBOL LIST SHOWING DIFFERENT LINE THICKNESS FOR EXISTING AND NEW COMPONENTS ARE MEANT ONLY FOR CLARITY. UNLESS SPECIFICALLY INDICATED AS "EXISTING" ALL COMPONENTS SHALL BE CONSIDERED TO BE NEW TO BE PROVIDED BY THE HVAC CONTRACTOR.

4. THE SCOPE OF WORK TO BE PROVIDED BY THE HVAC CONTRACTOR SHALL INCLUDE SCOPE OF WORK AS INDICATED IN THE CONTRACT DOCUMENTS. THE CONTRACT DOCUMENTS SHALL INCLUDE CONTRACT DRAWINGS, CONTRACT SPECIFICATIONS, CONTRACT ADDENDUMS, ANY OTHER WRITTEN DESCRIPTION OR MEETING MINUTES PROVIDED BY THE ARHCITECT/ENGINEER OF RECORD FOR THE PROJECT TAKEN TOGETHER. IN THE CONTRACT DRAWINGS, THE HVAC CONTRACTOR SHALL INCLUDE ALL WORK INDICATED IN INCLUDING BUT NOT LIMITED TO THE LEGENDS, SYMBOLS, ABBREVIATIONS, SPECIFIC AND GENERAL NOTES, INDEXES, FLOOR PLANS, SECTIONS AND ELEVATIONS, SCHEMATIC DIAGRAMS, RISER DIAGRAMS, FLOW DIAGRAMS, CONTROL DIAGRAMS, ONE LINE DIAGRAMS, SCHEDULE SHEETS, DETAILS, DRAWINGS SPECIFICATION SHEETS, PHASING PLANS, ETC. TAKEN TOGETHER.

5. IT SHALL BE EXPRESSEDLY UNDERSTOOD THAT ALL ITEMS INCLUDED IN THE CONTRACT DOCUMENTS ISSUED BY THE ARCHTIECTS/ENGINEERS SHALL BE INCLUDED IN THE BID PRICE OF THE CONTRACTOR UNLESS OTHERWISE, SPECIFIC ADD ALTERNATES ARE LISTED BY THE ARCHTIECT/ENGINEER IN THE DOCUMENTS.

6. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ASCERTAIN IN WRITING THAT HE HAS ALL THE CONTRACT DOCUMENTS FOR THE PROJECT FROM THE ARCHTIECT/ENGINEER. NO CLAIMS FOR ANY MISSING DOCUMENTATION WILL BE ACCEPTABLE.

7. WHERE INFORMATION IN DIFFERENT PARTS OF THE CONTRACT DOCUMENTS ARE INTERPRETED BY THE CONTRACTOR TO BE DUPLICATED, THE CONTRACTOR SHALL OBTAIN A WRITTEN APPROVAL OF HIS INTERPRETATION FROM THE OWNER BEFORE DELETING THE SCOPE OF WORK HE INTERPRETS AS BEING A DUPLICATION. IN THE ABSENCE OF SUCH WRITTEN APPROVAL, THE CONTRACTOR SHALL NOT EXCLUDE ANY ITEM SHOWN IN DIFFERENT PARTS OF THE CONTRACT.

8. FOR EITHER CONTRACTOR'S INTERPRETATION OF DUPLICATION OR CONTRADICTION AS INDICATED ABOVE, THE OWNER'S DETERMINATION SHALL BE FINAL AND SHALL NOT ENTITLE THE CONTRACTOR TO ANY ADDITIONAL COMPENSATION.

9. ALL WORK SHOWN ON THE CONTRACT DOCUMENTS ARE MEANT TO BE THE FINAL INTENT OF THE WORK. ANY WORK REQUIRED TO MEET THE FINAL INTENT OF THE DESIGN DOCUMENTS, INCLUDING BUT NOT LIMITED TO THE FOLLOWING SHALL BE PROVIDED BY THE HVAC CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER:
   a. CUTTING AND PATCHING OF WALLS, FLOORS, CEILING, ROOFS, PARTITIONS;
   b. REMOVAL AND REPLACEMENT OF SUSPENDED CEILINGS, ACCESS PANELS, ACCESS DOORS;
   c. REMOVAL AND REPLACEMENT OF EXISTING ARCHITECTURAL, STRUCTURAL, PLUMBING, ELECTRICAL, FIRE PROTECTION TRADES AND, TELECOMMUNICATION, COMPUTER, SECURITY, PUBLIC ADDRESS, INTERCOM SYSTEMS WHICH INTERFERE WITH THE FINAL INTENT OF THE HVAC WORK.

12. DETERMINE LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD. RELOCATE EXISTING WORK THAT INTERFERES WITH WORK OF THIS CONTRACT. UNLESS AND UNTIL SPECIFIC ITEMS ARE SHOWN IN OTHER TRADE DRAWINGS FOR REMOVAL AND REPLACEMENT FOR THE AREA WHERE THE FINAL HVAC DESIGN INTENT IS SHOWN, ALL WORK REQUIRED FOR OTHER TRADES TO PERFORM THEIR WORK TO ENABLE THE HVAC WORK SHOWN ON THESE DRAWINGS SHALL BE INCLUDED IN THE HVAC CONTRACTOR'S BID.

13. ALL WORK SHOWN ON THE CONTRACT PLANS INCLUDING SCALED DRAWINGS ARE SCHEMATIC AND ARE INTENDED TO CONVEY GENERAL INFORMATION ON THE MAGNITUDE OF WORK AND TO PROVIDE GENERAL ARRANGEMENT OF EQUIPMENT. THE CONTRACT DRAWINGS ARE NOT MEANT TO CONVEY ALL THE FIELD CONDITIONS, ALL BENDS, OFFSETS, ELEVATIONS ACCURATELY AND SHALL NOT BE USED AS THE BASIS TO ESTIMATE THE QUANTITY OF HVAC WORK. THE CONTRACTOR MAY MAKE CHANGES IN THE FORM OF SHOP DRAWINGS IF AND WHEN APPROVED IN WRITING BY THE ARCHITECT/ENGINEER AT NO ADDITIONAL COST TO THE OWNER.

14. THE CONTRACTOR SHALL SEEKING WRITTEN CLARIFICATIONS TO SCOPE OF WORK, VISIT AND CAREFULLY EXAMINE THE SITE OF THE PROPOSED WORK SO AS TO FAMILIARIZE HIMSELF OR HERSELF WITH EXISTING FIELD CONDITIONS, TO VERIFY DIMENSIONS AND TO VERIFY DIFFICULTIES THAT WILL BE ENCOUNTERED DURING THE EXECUTION OF THE WORK AND TO VERIFY EXACT EXTENT OF WORK REQUIRED, PRIOR TO SUBMITTING HIS PROPOSAL. ANY CHANGES RESULTING FROM CONDITIONS ARISING IN THE FIELD ARE TO BE MADE BY THIS CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

15. NEITHER ACCURACY NOR COMPLETION OF SERVICES AND UTILITY LOCATIONS SHOWN ON DRAWINGS IS GUARANTEED. DETERMINE EXACT LOCATIONS OF EXISTING SERVICES AND UTILITIES IN FIELD, WHETHER OR NOT SHOWN ON DRAWINGS. EXERCISE CAUTION AND IDENTIFY LOCATIONS OF UNMARKED UTILITY LINES AS NECESSARY TO PERFORM WORK OF THIS SECTION.

16. MANUFACTURERS MODEL NUMBERS ARE SPECIFIED SOLELY TO ESTABLISH STANDARDS OF QUALITY FOR PERFORMANCE AND MATERIALS.

17. GENERAL NOTES, SYMBOL LIST AND DETAILS ARE APPLICABLE TO ALL HVAC/MECHANICAL DRAWINGS.

18. DIMENSIONS SHOWN ON PLAN ARE HORIZONTAL. DIMENSIONS SHOWN IN ELEVATION ARE VERTICAL EXCEPT IN WAY OF STRUCTURAL STEEL, DIMENSIONS ARE MEASURED PERPENDICULAR TO FLANGE.

19. WHEREVER THE REQUIREMENTS AND REGULATIONS OF FEDERAL OR MUNICIPAL AUTHORITIES ARE MORE STRINGENT THAN THE REQUIREMENTS INDICATED ON THE DRAWINGS OR SPECIFICATIONS. THEN THESE MORE STRINGENT REQUIREMENTS SHALL TAKE PRECEDENCE OVER THE DRAWINGS OR SPECIFICATIONS AND SHALL BE MADE PART OF THE CONTRACT AT NO ADDITIONAL COST TO THE OWNER. HOWEVER, WHERE THE DRAWING OR SPECIFICATIONS ARE MORE STRINGENT THAN FEDERAL OF LOCAL AUTHORITY REQUIREMENTS AND REGULATIONS, THE MORE STRINGENT SHALL APPLY AND THE WORK SHALL BE INCLUDED IN THE CONTRACT.

20. THE CONTRACTOR SHALL PROVIDE PROTECTION FOR THE GENERAL PUBLIC AND CONSTRUCTION WORKERS IN AND AROUND THE CONSTRUCTION AREA. ADEQUATE BARRIERS SHALL BE PROVIDED TO EXERCISE CONTROL OF SAFE INGRESS AND EGRESS OF PREMISES. FIRE EXITS SHALL AT NO TIME BE BLOCKED.

21. ALL EXISTING CONSTRUCTION AND EQUIPMENT SHALL BE PROTECTED BY EACH CONTRACTOR DURING THE ENTIRE PERFORMANCE OF THEIR WORK. EXISTING AREAS DISTURBED OR DAMAGED BY CONTRACTORS SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

22. ALL UNUSED MATERIALS AND DEBRIS SHALL BE LEGALLY DISPOSED OF AWAY FROM THE PREMISES.

23. ALL COMPONENTS SHALL BE RUN AS HIGH AS POSSIBLE & AS CLOSE AS POSSIBLE TO EXISTING ROOF/ FLOOR STRUCTURE TO MAINTAIN EXISTING CEILING HEIGHTS SHOWN ON ARCHITECTURAL DRAWINGS AND TO MAINTAIN A MINIMUM OF 7'-6" HEADROOM IN ALL MECHANICAL EQUIPMENT ROOMS.

24. EQUIPMENT SIZE ARE BASED ON PRELIMINARY INFORMATION FROM THE SCHEDULED MANUFACTURER'S EQUIPMENT, VERIFICATION OF THIS SIZES WITH APPROVED SHOP DRAWINGS PRIOR TO INFORMING THE CONTRACTOR FOR GENERAL CONSTRUCTION OF THE FINAL PENETRATION SIZES AND BEFORE FABRICATING DUCTS.

25. HOUSEKEEPING PAD AND SPACE ALLOCATIONS FOR MECHANICAL EQUIPMENT ARE BASED ON THE SCHEDULED MANUFACTURER'S PHYSICAL EQUIPMENT SIZES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING ANY SUBSTITUTED EQUIPMENT SIZES FROM CERTIFIED MANUFACTURER'S DRAWINGS AND SHALL MAKE MODIFICATIONS AT NO ADDITIONAL COST TO THE OWNER. THIS CONTRACTOR SHALL COORDINATE EQUIPMENT SUPPLIED BY GENERAL CONTRACTOR.

26. ELECTRICAL POWER PROVISIONS FOR MECHANICAL EQUIPMENT ARE BASED ON PRELIMINARY INFORMATION FROM THE SCHEDULED MANUFACTURER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING ELECTRICAL RATING FROM APPROVED SHOP DRAWINGS & SHALL MAKE ANY CIRCUIT DISTRIBUTION MODIFICATION REQUIRED WITHOUT ANY ADDITIONAL COST TO THE OWNER FOR SUBSTITUTED EQUIPMENT. THE CONTRACTOR SHALL SUBMIT A SCHEDULE OF SUCH CHANGE FOR ACCEPTANCE BY THE ENGINEER. ALL ACCEPTED CHANGES SHALL BE RECORDED ON "AS-BUILTS" DRAWINGS.

27. HVAC AND MECHANICAL SYSTEMS/SERVICES SHALL BE MAINTAINED FULLY OPERATIONAL IN AREAS/SPACES OUTSIDE OF AREA OF WORK DURING CONSTRUCTION.

28. COORDINATE ACCESS DOOR LOCATIONS IN HUNG CEILINGS AND WALLS WITH THE OTHER TRADES. SEE ARCHITECTURAL DRAWINGS OR MECHANICAL SPECIFICATIONS FOR LOCATIONS REQUIRING FIRE RATED ACCESS IN SUCH PROVIDE 2 HR. RATED DOORS WITH MINIMUM 2" THICK FIRE RATED INSULATION.

29. COORDINATE ALL WORK WITH OTHER TRADES AND EXISTING CONDITIONS TO AVOID CONFLICTS.

30. WORK SHALL BE DONE IN ACCORDANCE WITH ALL APPLICABLE CODES INCLUDING THE CURRENT EDITION OF THE NEW YORK STATE CODES AND ALL LOCAL TOWNSHIP REQUIREMENTS.

31. SCHEDULE WORK OF THIS SECTION TO AVOID INTERFERING WITH EXISTING OPERATIONS IN THE FACILITY.

32. PROVIDE 36" CLEARANCE IN FRONT OF ALL ELECTRIC COMPONENTS SUCH AS PANELS, MOTORS, STARTERS, PULL BOXES, JUNCTION BOXES ETC. PER NATIONAL ELECTRIC CODE (NEC) AND MANUFACTURER REQUIREMENTS.

33. MANUFACTURERS TO BE USED FOR THE PROJECT - CONTRACTOR SHALL SUBMIT AND USE EQUIPMENT AND PRODUCTS MADE BY MANUFACTURERS INCLUDED IN THE DRAWING SCHEDULES ONLY. THIS SHALL BE THE BASIS FOR THE CONTRACT. ALL OTHER MANUFACTURES WHERE INCLUDED IN THE SPECIFICATIONS SHALL BE USED UNDER SPECIAL CIRCUMSTANCES SUCH AS LEAD TIME, DISCONTINUATION OF SCHEDULED PRODUCT ETC. OF THE SCHEDULED MANUFACTURER AND EVEN THEN ONLY IF ACCEPTABLE AND APPROVED BY THE ENGINEER. THE ENGINEER SHALL RESERVE THE RIGHT TO SELECT ANY SUBSTITUTE MANUFACTURER FOR THE PROJECT FROM THE LIST OF MANUFACTURERS INCLUDED IN THE SPECIFICATIONS IN THE VENT OF CHANGE OF MANUFACTURERS PER ABOVE CIRCUMSTANCES. ANY CONSEQUENTIAL IMPACT ON THE PROJECT COST DUE TO SUCH SUBSTITUTIONS SHALL BE BORNE BY THE HVAC CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER

PHASING

1. VERIFY AND CONFIRM WITH OWNER THE PHASING REQUIREMENTS OF THE PROJECT BEFORE BIDDING REGARDLESS OF WHETHER THE INFORMATION IS PRESENTED (OR OTHERWISE) IN THE CONTRACT DOCUMENTS.

PHASING

2. ANY PHASING INFORMATION WHERE PROVIDED IN THE CONTRACT DOCUMENTS ARE TO PROVIDE THE INTENT OF PHASING WORK ONLY AND MAY NOT INCLUDE ALL INFORMATION REQUIRED TO MEET THE INTENT OF THE OWNERS REQUIREMENTS. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY THE PHASING REQUIREMENTS, METHODOLOGY, SCHEDULE, COORDINATION WITH THE OWNER.

3. IN ALL ASPECTS OF PHASING WORK, ALL ITEMS SHALL BE IN FULL COMPLIANCE WITH THE CURRENT CODE AND STANDARDS.

4. ALL PHASES OF THE PROJECTS SHALL ENSURE STANDALONE FULLY FUNCTIONAL CODE COMPLIANT SYSTEM REQUIRED FOR AN OCCUPIED SPACE USE.

5. ALL PHASING COSTS SHALL BE INCLUDED IN THE PROJECT BID.

6. NYC DOC ANTICIPATES THE CONTRACTOR TO PREPARE A PHASING PLAN IN SUCH A WAY THAT IT AFFECTS ONLY ONE INMATE HOUSING AREA IN AMKC MODULAR BUILDING NO. 1. NYC DOC SHALL REQUIRE THAT THE CONTRACTOR COMPLETE EACH HOUSING AREA IN THREE (3) TO FOUR (4) MONTHS INCLUDING ONE (1) WEEK OF TRANSITION PERIOD TO OCCUPY THE COMPLETED INMATE HOUSING AREA AND ALLOCATING THE NEXT HOUSING AREA TO THE CONTRACTOR.

7. FOR ALL PHASING WORK DETAIL, SEE DRAWING M101.00. THIS IS FOR REFERENCE ONLY. FINAL PHASING WORK SHALL BE BASED UPON DOC APPROVAL OF A FINAL PLAN AND SCHEDULE

WATER SYSTEMS

1. PIPES SHALL BE RUN AS HIGH AS POSSIBLE & AS CLOSE AS POSSIBLE TO EXISTING ROOF/ FLOOR STRUCTURE TO MAINTAIN EXISTING CEILING HEIGHTS SHOWN ON ARCHITECTURAL DRAWINGS AND TO MAINTAIN A MINIMUM OF 7'-6" HEADROOM IN ALL MECHANICAL EQUIPMENT ROOMS.

2. ALL PIPING, CONDUITS AND TUBING SHALL BE RUN CONCEALED IN FINISHED AREAS. COORDINATE LOCATIONS WITH GENERAL CONSTRUCTION AND WITH EXISTING COMPONENTS. ALL RUNS SHALL BE APPROVED BY OWNER. ANY MODIFICATION REQUIRED BY OWNER DUE TO FIELD CONFLICTS SHALL BE DONE AT NO ADDITIONAL COST.

3. ALL GRAVITY FLOW LINES SHALL BE PITCHED AT 1/8" LINEAR FOOT OF PIPING IN THE DIRECTION OF RISERS, LOW POINT DRAINS, SERVICE SINKS, AND COOLING TOWER BASINS, AS APPLICABLE. ALL OTHER PIPING SHALL BE PITCHED 1" IN 20' IN DIRECTION OF FLOW, RISERS AND/OR LOW POINT DRAINS.

4. PROVIDE AUTOMATIC AIR VENTS WITH DRAIN PIPING TO THE NEAREST FLOOR DRAIN FOR ALL PIPE RISERS SERVING MORE THAN ONE FLOOR AND PROVIDE MINIMUM 1" DRAIN TAP WITH VALVE AND CAP AT THE BOTTOM OF ALL RISERS.

5. FOR ALL HOT WATER AND STEAM PIPING RUNNING MIN. 60 FT. HORIZONTALLY, PROVIDE EXPANSION LOOP OR EXPANSION JOINTS IF ALLOWED BY PROJECT ENGINEER AT THE MID POINT OF ALL SUCH RUNS.

6. PROVIDE THERMOMETERS AND PRESSURE GAGES AS PER SPECIFICATIONS IN ALL SUPPLY AND RETURN PIPING OF COILS, HEAT EXCHANGERS, CHILLERS, PUMPS WHETHER SPECIFICALLY INDICATED OR OTHERWISE. (2)

CONTROL SYSTEMS

1. PROVIDE ROOM THERMOSTATS FOR ALL AC UNITS, HEATING COILS, HEATING ELEMENTS SUCH AS RADIATORS, CONVECTORS, ETC.

2. NEW THERMOSTATS SHALL BE LOCATED NEXT TO THE DOOR, WHETHER SPECIFICALLY INDICATED ELSEWHERE OR NOT. ALL ROOM THERMOSTATS UNLESS OTHERWISE NOTED SHALL BE MOUNTED APPROXIMATELY 4'-6" ABOVE FINISHED FLOOR, OR IN COMPLIANCE WITH ADA REQUIREMENTS.

3. LOCATIONS OF ROOM THERMOSTATS, WHERE SHOWN, ARE APPROXIMATE AND FINAL LOCATIONS SHALL BE COORDINATED WITH THE PROJECT ARCHITECT.

4. ALL THERMOSTATS SHALL BE PROVIDED WITH TAMPER PROOF LOCK AND KEY TYPE ASPIRATING ENCLOSURES UNLESS OTHERWISE NOTED.

5. ALL CONTROL COMPONENTS SHALL BE PROVIDED FROM SINGLE SOURCE ONLY. CONTROLS WORK SHALL BE PERFORMED BY SPECIALIZED CONTRACTOR WHO SHALL SUBMIT ALL REQUIRED CONTROL COMPONENT SUBMITTALS, WIRING DIAGRAMS, LOGICS, SEQUENCE OF OPERATIONS TO ARCHITECT/ENGINEER FOR THEIR REVIEW AND COMMENT BEFORE PERFORMING ANY WORK.

6. DAMPER ACTUATORS SHALL BE ELECTRIC TYPE FOR 24 VOLT OPERATION UNLESS 120 VOLT POWER IS PROVIDED SPECIFICALLY BY THE ELECTRIC TRADE AND THE DAMPERS ARE ACCEPTED BY THE OWNER FOR 120 VOLT POWER.

7. ALL CONTROL COMPONENTS INCLUDING DAMPER MOTORS, VALVE ACTUATORS, AND ALL OTHER CONTROL COMPONENTS SHALL OPERATE ON 24 VOLT POWER, UNLESS 120 VOLT POWER IS PROVIDED SPECIFICALLY BY THE ELECTRIC TRADE, AND THE CONTROL COMPONENTS ARE ACCEPTED BY THE OWNER FOR 120 VOLT POWER, ANY AND ALL ITEMS NOT SHOWN ON ELECTRICAL DRAWINGS ON 120 VOLT POWER SHALL BE PROVIDED WITH 24 VOLT POWER COMPONENTS.

8. THE HVAC CONTRACTOR SHALL PROVIDE ALL REQUIRED STEP DOWN TRANSFORMERS AS REQUIRED BASED UPON ALLOWABLE VOLTAGE DROPS. OBTAIN POWER FOR THE CONTROL DEVICES FROM THE NEAREST ELECTRICAL PANEL IN THE ELECTRICAL CLOSET LOCATED IN THE PROJECT SCOPE AREA UNLESS SPECIFIC PANEL LOCATIONS ARE SHOWN ON ELECTRIC AL DRAWINGS

9. LOW VOLTAGE CONTROL WIRING SHALL BE MINIMUM 16 GAUGE, OR HEAVIER IF REQUIRED, TWISTED PAIR, 100% SHIELDED WITH PVC COVER BELDEN #9316 OR APPROVED EQUIVALENT PRODUCT OF OTHER MANUFACTURERS RUN IN CONDUIT WITH NO SPLICES, SEPARATE FROM ANY WIRING ABOVE 30 VOLTS.

DEMOLITION NOTES

1. ALL PIPING AND DUCTS IN WALLS AND FLOORS NOT TO BE REUSED WILL BE PLUGGED OR CAPPED AND CUTTING AND PATCHING WILL BE PERFORMED TO RESTORE SURFACE TO ORIGINAL CONDITION BY THIS CONTRACTOR.

2. AFTER REMOVING PIPES AND DUCTWORK THROUGH THE FLOOR SLABS, PACK OPENING WITH APPROVED FIRE-RATED PACKING AND RESTORE OPENINGS TO ORIGINAL CONDITIONS INCLUDING THE ORIGINAL STRUCTURAL INTEGRITY.

3. THE CONTRACTOR SHALL INCLUDE IN HIS PRICE ALL COSTS ASSOCIATED WITH REMOVALS AND RELOCATIONS OF HVAC WORK AS DESCRIBED ON THE DRAWINGS AND IN THE SPECIFICATIONS WITH ALLOWANCES FOR EXPECTED OR UNFORESEEN DIFFICULTIES WHEN CONCEALED WORK HAS BEEN OPENED. NO CLAIMS FOR ADDITIONAL WORK ASSOCIATED WITH DEMOLITION WILL BE ACCEPTED, EXCEPT IN CERTAIN CASES CONSIDERED JUSTIFIABLE BY THE OWNER/ENGINEER.

4. THE CONTRACTOR SHALL PERFORM DEMOLITION AND REMOVAL WORK WITH MINIMUM INTERFERENCE WITH FUNCTIONING HVAC SYSTEMS.

5. ALL AFFECTED SYSTEMS SHALL BE RECONNECTED AND RESTORED. DEMOLITION AND REMOVAL WORK SHALL BE PERFORMED IN A NEAT AND WORKMANLIKE MANNER. THE CONTRACTOR SHALL PATCH, REPAIR OR OTHERWISE RESTORE ANY DAMAGED INTERIOR OR EXTERIOR BUILDING SURFACE TO ITS ORIGINAL CONDITION.

6. THE CONTRACTOR SHALL REMOVE ALL DUCT & PIPING SUPPORTS, ETC. FROM PARTITIONS THAT ARE TO BE REMOVED. WHERE THE REMOVAL OF THESE ITEMS DISRUPTS EXISTING PIPING AND/OR DUCTWORK THAT IS TO REMAIN, THE CONTRACTOR SHALL INSTALL AND PROVIDE BYPASS CONNECTIONS NECESSARY.

7. ALL PIPING AND/OR DUCTWORK WHICH BECOMES EXPOSED DURING THE ALTERATION WORK SHALL BE REMOVED AND REROUTED CONCEALED BEHIND FINISHED SURFACES.

8. PORTIONS OF PIPING AND/OR DUCTWORK TO BE REMOVED OR ABANDONED AS A RESULT OF DEMOLITION WORK, BUT WHICH ARE REQUIRED TO REMAIN ACTIVE, SHALL BE CUT AT CONVENIENT LOCATIONS, REROUTED AND RECONNECTED.

9. THE CONTRACTOR SHALL NOTIFY THE OWNER AT THE APPROPRIATE TIME OF THE PROJECTED DEMOLITION AND PHASING SCHEDULE SO THAT REMOVAL OR RELOCATION OF AFFECTED UTILITIES MAY BE CARRIED OUT IN COORDINATION WITH THE PROJECT REQUIREMENTS.

10. ALL EXISTING MATERIAL AND EQUIPMENT IN USABLE CONDITION, WHICH IS TO BE REMOVED UNDER THIS CONTRACT, SHALL REMAIN THE PROPERTY OF THE OWNER OR SHALL BE DISPOSED OF BY THE HVAC CONTRACTOR, AS DIRECTED BY THE OWNER AT NO ADDITIONAL COST TO OWNER.

11. ARRANGE TO WORK CONTINUOUSLY, INCLUDING OVER TIME, IF REQUIRED, TO ASSURE THAT SYSTEMS WILL BE SHUT DOWN ONLY DURING THE TIME ACTUALLY REQUIRED TO MAKE THE NECESSARY CONNECTIONS TO THE EXISTING SYSTEMS.

12. THE SHUTDOWN OF EXISTING BUILDING HVAC SERVICES SHALL BE COORDINATED WITH THE OWNER.

13. MAKE ARRANGEMENTS AT LEAST 5 BUSINESS DAYS PRIOR TO A SHUTDOWN. CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE & LOCAL REQUIREMENTS REGARDING DISPOSAL OF REFRIGERANTS.

SECURITY NOTES

1. ALL EXPOSED FASTENERS SHALL BE TAMPER PROOF TYPE.

2. PROVIDE METAL SHROUD AND/OR SECURITY CAULKING AROUND SURFACE MOUNTED CONDUITS INSTALLED BELOW 8 FEET IN ALL INMATE ACCESSIBLE AREAS.

3. PROVIDE SECURITY BARS, ANEMOSTAT MODEL ABDG OR APPROVED EQUAL ON ALL HVAC COMPONENTS PENETRATING ON ALL PARTITIONS, WALLS, FLOORS, CEILING, ROOF, ETC. OR ANY OPENING EXCEEDING 6" IN ANY DIMENSION.

COMMISSIONING (2)

1. THE PROJECT WILL INCLUDE COMMISSIONING OF HVAC SYSTEM AS INDICATED IN REST OF THE CONTRACT DOCUMENTS.

2. THE CONTRACTOR SHALL ENGAGE THE SERVICES OF AN INDEPENDENT COMMISSIONING AGENT AS SPECIFIED IN THE SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS.

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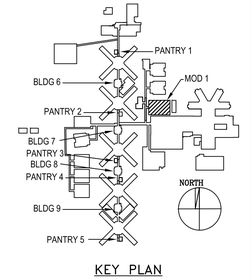

KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

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DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
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DESIGNED BY:

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MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

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HVAC
GENERAL NOTES
SHEET 1 OF 3

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Sheet: 8 of 70

HVAC GENERAL NOTES (APPLICABLE TO ALL DRAWINGS)

DISINFECTION NOTES

TESTING

1. THE CONTRACTOR IS TO ENGAGE A THIRD PARTY CERTIFIED BACK FLOW PREVENTER TESTER TO PERFORM TESTING AND INSPECTION OF ALL BACK FLOW PREVENTION DEVICES AND SYSTEM AND FILE THE APPROPRIATE FORMS WITH NYC DEP (NYC GEN 215B) FOR THE MAIN BACK FLOW PREVENTION DEVICE AND NYC DOB (OP_129) FOR THE SECONDARY DEVICES.

DOMESTIC WATER SYSTEM STERILIZATION

1. THE POTABLE WATER SYSTEM SHALL BE DISINFECTED AND WATER SAMPLES SHALL BE COLLECTED AND ANALYZED BY THE CONTRACTOR. THE REQUIREMENTS OF THIS SECTION INCLUDE DISINFECTION OF ALL PARTS OF NEW POTABLE WATER SYSTEMS INCLUDING, BUT NOT LIMITED TO, NEW SERVICE CONNECTIONS AS SPECIFIED.

2. THE CONTRACTOR SHALL ENSURE THAT ALL PIPES, FITTINGS, FIXTURES, AND RELATED APPURTENANCES ARE ALL SHIPPED, HANDLED, DELIVERED AND STORED IN AN ACCEPTABLE, SANITARY MANNER. DISINFECTION OF INTERIOR PARTS OF THE POTABLE WATER SYSTEM SHALL NOT BEGIN UNTIL ALL FIXTURES ARE INSTALLED AND FUNCTIONING PROPERLY AND AUTHORIZATION TO BEGIN DISINFECTION TO VERIFY IS ISSUED BY THE OWNER. AN OWNER REPRESENTATIVE MAY, AT THEIR DISCRETION, PERFORM A SITE INSPECTION TO VERIFY THAT ALL FIXTURES ARE INSTALLED AND OPERATING PROPERLY PRIOR TO PROVIDING AUTHORIZATION TO BEGIN DISINFECTION.

3. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF §141.11 OF THE NEW YORK CITY HEALTH CODE, THE NEW YORK STATE DEPARTMENT OF HEALTH STATE SANITARY CODE, AND SECTION PC 610 OF THE NEW YORK CITY PLUMBING CODE. "POTABLE WATER" AS USED IN THIS SECTION SHALL HAVE THE MEANING DEFINED IN ARTICLE 141 OF THE NEW YORK CITY HEALTH CODE, AS SET FORTH IN TITLE 24 OF THE RULES OF THE CITY OF NEW YORK. AS USED IN THIS SECTION THE POTABLE WATER SYSTEM INCLUDES, BUT IS NOT NECESSARILY LIMITED TO, THE HOT AND COLD WATER DISTRIBUTION SYSTEM PIPING, FITTINGS, FIXTURES, AND RELATED APPURTENANCES, AND SERVICE MAIN CONNECTIONS.

4. CHEMICALS, ADDITIVES, TREATMENT DEVICES, AND EQUIPMENT THAT MAY COME IN CONTACT WITH POTABLE WATER SHALL BE IN COMPLIANCE WITH THE REQUIREMENTS OF SUBPART 5-1 OF THE STATE SANITARY CODE, THE AMERICAN WATER WORKS ASSOCIATION (AWWA), NATIONAL SANITATION FOUNDATION (NSF)/AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) 60 DRINKING WATER TREATMENT CHEMICALS - HEALTH EFFECTS AND NSF/ANSI 61 DRINKING WATER SYSTEM COMPONENTS - HEALTH EFFECTS.

5. THE CONTRACTOR SHALL PREPARE DISINFECTION AND WATER QUALITY TESTING PLANS (DWQTPS) FOR REVIEW BY THE OWNER. APPROVAL OF THE DWQTPS BY THE OWNER SHALL BE REQUIRED PRIOR TO IMPLEMENTATION. SUBMITTAL OF SEPARATE DWQTPS IS REQUIRED FOR THE INTERIOR PARTS OF THE POTABLE WATER SYSTEM AND THE EXTERIOR SERVICE MAIN CONNECTIONS. PRIOR TO SUBMITTAL OF THE DWQTP(S) THE CONTRACTOR (SPECIFICALLY THE INDIVIDUAL RESPONSIBLE FOR PREPARING THE DWQTP(S)) SHALL VISIT THE SITE TO INSPECT ALL PARTS OF THE POTABLE WATER SYSTEM TO BE DISINFECTED AND TO DETERMINE SITE-SPECIFIC CONDITIONS TO BE ADDRESSED IN THE DWQTP(S).

6. EACH DWQTP SHALL INCLUDE, AT A MINIMUM, THE FOLLOWING, AS APPLICABLE TO DISINFECTION OF INTERIOR PARTS OF POTABLE WATER SYSTEM AND EXTERIOR SERVICE MAIN CONNECTIONS:
   a. DESCRIPTION OF PRE-DISINFECTION FLUSHING PROCEDURES. FLUSHING SHALL BE PERFORMED IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE USING CLEAN POTABLE WATER AND WILL BE PERFORMED UNTIL THE EFFLUENT IS CLEAR.

   b. CONCENTRATION AND FORM OF CHLORINE TO BE USED FOR DISINFECTION (CHLORINE GAS IS NOT ACCEPTABLE AND SHALL NOT BE USED).

   c. DESCRIPTION OF TESTING PROCEDURES TO VERIFY PH IS WITHIN ACCEPTABLE RANGE DURING DISINFECTION PROCEDURES. DWQTP SHALL INCLUDE A STATEMENT THAT PH RANGE WILL NOT RESULT IN DAMAGE TO THE POTABLE WATER SYSTEM AND PROVIDES FOR OPTIMAL DISINFECTION CONDITIONS.

   d. POINT(S) OF TREATMENT FOR THE POTABLE WATER DISTRIBUTION SYSTEM. THE CONTRACTOR SHALL PROVIDE THE OPERATIONAL PROCEDURE THAT WILL ENSURE CHLORINATED WATER IS DRAWN INTO ALL AREAS, FIXTURES, AND COMPONENTS OF THE POTABLE WATER SYSTEM AT THE CONCENTRATION APPROPRIATE TO ACHIEVE DISINFECTION. THE PROCEDURE SHALL DESCRIBE THE MEANS FOR PREVENTING BACKFLOW OF CHLORINE INTO PORTIONS OF THE DISTRIBUTION SYSTEM NOT SUBJECT TO DISINFECTION, IF ANY, AND FOR PREVENTING BACKFLOW INTO THE WATER SUPPLY SERVICE CONNECTION. FOR NEW ADDITIONS TO EXISTING SCHOOLS, THE DWQTP WILL INCLUDE A DESCRIPTION OF THE PROCEDURE FOR ISOLATION OF THE POTABLE WATER SYSTEM OF THE NEW ADDITION FROM THE POTABLE WATER SYSTEM OF THE EXISTING SCHOOL. THE CONCENTRATION RANGE APPROPRIATE TO ACHIEVE DISINFECTION IS EQUAL TO OR GREATER THAN 50 PPM FOR A CONTACT TIME OF 24 HOURS, OR EQUAL TO OR GREATER THAN 200 PPM FOR A CONTACT TIME OF 3 HOURS. ALL POTABLE WATER FIXTURES SHALL BE TESTED (USING FIELD TEST STRIPS OR PORTABLE CHLORINE METER)TO VERIFY THAT CHLORINATED WATER IS PRESENT THROUGHOUT THE SYSTEM.

   e. CONTACT TIME. THE CONTRACTOR SHALL IDENTIFY AND DESCRIBE TESTING EQUIPMENT, MEANS AND METHODS, AND POINTS OF TESTING THROUGHOUT THE POTABLE WATER SYSTEM, WHICH WILL BE USED TO ASCERTAIN THAT THERE IS SUFFICIENT CONCENTRATION OF CHLORINE REMAINING THROUGHOUT THE WATER SYSTEM TO ENSURE DISINFECTION AFTER THE CONTACT TIME HAS BEEN REACHED. THE CONTACT TIMES SPECIFIED IN SECTION PC 610 OF THE NEW YORK CITY PLUMBING CODE ARE MINIMUM REQUIRED CONTACT TIMES. THE CONTRACTOR SHALL PLACE SIGNS ON EACH FIXTURE/OUTLET INDICATING "DISINFECTION IN PROGRESS. DO NOT DRINK OR USE WATER."

   f. STEPS TO ACHIEVE DISINFECTION SHOULD THE CHLORINE CONCENTRATION REMAINING IN THE POTABLE WATER SYSTEM AT THE END OF THE CONTACT TIME BE BELOW THE ACCEPTABLE LEVEL.

   g. FLUSHING PROCEDURES (METHODS AND DURATION). ALL POTABLE WATER FIXTURES MUST BE TESTED FOR RESIDUAL CHLORINE CONCENTRATION AFTER DISINFECTION AND THOROUGH FLUSHING. FOLLOWING FLUSHING WITH CLEAN POTABLE WATER, RESIDUAL CHLORINE CONCENTRATIONS SHALL BE EQUAL TO OR LESS THAN THE RESIDUAL CHLORINE CONCENTRATION MEASURED AT POINT WHERE POTABLE WATER ENTERS THE PORTION OF THE SYSTEM BEING DISINFECTED. DISCHARGE OF EFFLUENT SHALL BE IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS.

   h. SAMPLING POINTS AND NUMBER OF SAMPLES FOR BACTERIOLOGICAL EXAMINATION. SAMPLES SHALL BE COLLECTED FROM A MINIMUM OF 10% OF POTABLE WATER FIXTURES PER FLOOR OR TWO OUTLETS PER FLOOR, WHICHEVER IS GREATER. ONE (1) SAMPLE IS ALSO REQUIRED FROM IMMEDIATELY DOWNSTREAM OF THE BACKFLOW PREVENTION DEVICE LOCATED WHERE THE SERVICE CONNECTION ENTERS THE SCHOOL. IF THE SCHOOL HAS MORE THAN ONE CONNECTION TO THE MUNICIPAL WATER SUPPLY, THEN AT LEAST ONE (1) SAMPLE SHALL BE COLLECTED IMMEDIATELY DOWNSTREAM OF EACH BACKFLOW PREVENTION DEVICE. SAMPLES SHALL BE COLLECTED A MINIMUM OF 24 HOURS AFTER FLUSHING.

   i. BACTERIOLOGICAL ANALYSES TO BE PERFORMED AND APPLICABLE REGULATORY STANDARDS. ANALYSIS OF WATER SAMPLES FOR TOTAL COLIFORM, E.COLI BACTERIA, AND HETEROTROPHIC PLATE COUNT (HPC) IS REQUIRED. THE CONTRACTOR SHALL CERTIFY IN THE DWQTP THAT SAMPLE ANALYSES WILL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, PUBLISHED JOINTLY BY THE AMERICAN PUBLIC HEALTH ASSOCIATION (APHA), AMERICAN WATER WORKS ASSOCIATION (AWWA), AND THE WATER ENVIRONMENT FEDERATION (WEF).

   j. SAMPLE COLLECTION TECHNIQUES AND HANDLING PROCEDURES.

   k. SAMPLE CONTAINERS, PRESERVATION, HOLDING TIMES, AND CHAIN-OF-CUSTODY PROCEDURES SHALL BE IN COMPLIANCE WITH NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH) REQUIREMENTS AND THE REQUIREMENTS OF THE ANALYTICAL METHOD.

   l. CERTIFIED LABORATORY MUST BE USED (WITH COPIES OF CURRENT CERTIFICATIONS PROVIDED). LABORATORY ANALYSIS SHALL BE PERFORMED BY A LABORATORY CERTIFIED FOR BACTERIOLOGICAL ANALYSES BY THE NYSDOH UNDER THE ENVIRONMENTAL LABORATORY APPROVAL PROGRAM (ELAP).

   m. STANDARD LABORATORY REPORTING FORMAT.

   n. NAME AND QUALIFICATIONS OF SPECIALTY CONTRACTOR PERFORMING THE DISINFECTION AND TESTING. MINIMUM CONTRACTOR QUALIFICATIONS ARE: SUCCESSFUL COMPLETION OF AT LEAST THREE PROJECTS SIMILAR IN SCOPE AND EXECUTION AND AT LEAST THREE YEARS' EXPERIENCE IN PERFORMING WATER DISINFECTION AND SAMPLING. IN ADDITION, DEMONSTRATE COMPLIANCE WITH MINIMUM QUALIFICATION REQUIREMENTS IN PARAGRAPHS (B)(1)OR B(2), AND (C) OF §141.11 OF THE NEW YORK CITY HEALTH CODE.

   o. WATER SUPPLY SERVICE CONNECTION DISINFECTION PROCEDURE. SEE SAMPLE TEMPLATE OF DISINFECTION AND WATER QUALITY TESTING PLAN AT THE END OF THIS SECTION AND PARAGRAPH 3.03.I.

   p. COPIES OF THE PERMITS OBTAINED IN ACCORDANCE WITH THE REQUIREMENTS OF ARTICLE 141 OF THE NEW YORK CITY HEALTH CODE, AND COPIES OF ALL APPLICATIONS AND SUBMITTALS MADE TO OBTAIN THE PERMITS AS WELL AS COPIES OF ANY AND ALL OTHER REGULATORY AGENCY SUBMITTALS AND APPROVALS IN CONNECTION WITH THE DISINFECTION WORK. COPIES OF PERMITS SHALL BE SUBMITTED TO THE OWNER AT LEAST 30 CALENDAR DAYS PRIOR TO START OF DISINFECTION. ADDITIONALLY, SUBMIT A CERTIFICATION STATING THE WORK WILL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF PARAGRAPHS (D) (PRODUCT STANDARDS), (E) (CROSS CONNECTION CONTROL), (F) (DESIGN, INSTALLATION AND MAINTENANCE), (H) (WATER QUALITY), (J) (CHEMICAL STORAGE) AND (K) (TERMINATION OF TREATMENT) OF §141.11 OF THE NEW YORK CITY HEALTH CODE. IDENTIFY ANY PROPOSED EXCEPTIONS TO THE REQUIREMENTS OF PARAGRAPHS (D), (E), (F), (H), (J), AND (K) OF §141.11. EXCEPTIONS TO §141.11 SHALL NOT BE PERMITTED WITHOUT THE EXPLICIT APPROVAL OF THE OWNER.

   q. DOCUMENTATION THAT ALL PERSONNEL TO BE INVOLVED IN THE ADDITION OF CHEMICALS TO THE DRINKING WATER SUPPLY HAVE SUCCESSFULLY COMPLETED THE APPROPRIATE COURSE APPROVED BY THE STATE UNDER SUBPART 5-4 OF THE STATE SANITARY CODE.

   r. STATEMENT THAT THE POTABLE WATER SYSTEM HAS BEEN CAREFULLY EVALUATED, THAT THE DISINFECTION PROCEDURES TO BE PERFORMED ARE COMPATIBLE WITH ALL COMPONENTS OF THE POTABLE WATER SYSTEM AND COMPATIBLE WITH ANY WATER TREATMENT CHEMICALS THAT HAVE BEEN OR WILL BE ADDED BY THE CONTRACTOR TO THE POTABLE WATER SYSTEM, AND THAT THE DISINFECTION PROCEDURES WILL IN NO WAY RESULT IN ANY DAMAGE TO THE POTABLE WATER SYSTEM.

   s. EXPLICITLY IDENTIFY EACH AND EVERY COMPONENT, IF ANY, OF THE BUILDING POTABLE WATER SYSTEM WHICH THE CONTRACTOR WOULD PROPOSE TO EXCLUDE FROM THE DISINFECTION PROCEDURES. DESCRIBE HOW EACH COMPONENT WOULD BE EXCLUDED. PROVIDE A JUSTIFICATION FOR ANY SUCH PROPOSED EXCLUSION, INCLUDING CITATIONS TO SUPPORTING REGULATIONS AND/OR GUIDANCE. THERE SHALL BE NO SUCH EXCLUSIONS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE OWNER.

7. THE DWQTPS MUST BE SUBMITTED TO THE OWNER AND APPROVED AT LEAST FIVE (5) BUSINESS DAYS BEFORE THE SCHEDULED DATE OF DISINFECTION. NO CLAIMS OF DELAY SHALL BE PERMITTED DUE TO THE LACK OF APPROVAL OF THE CONTRACTOR'S PLAN BY THE OWNER. THE DWQTPS MUST BE SIGNED BY AN INDIVIDUAL POSSESSING THE QUALIFICATIONS SPECIFIED IN PARAGRAPH (B)(1), OR (B)(2), AND (C) OF §141.11 OF THE NEW YORK CITY HEALTH CODE.

8. AS PART OF THE DWQTPS, THE CONTRACTOR SHALL PROVIDE THE OWNER WITH A COPY OF THE PIPING DISTRIBUTION PLAN APPROVED BY THE DESIGN ENGINEER, INCLUDING THE LOCATION OF THE SERVICE CONNECTION(S) RELATIVE TO THE WATER MAIN.

9. NEWLY INSTALLED DOMESTIC WATER SERVICE CONNECTIONS JOINING THE MUNICIPAL WATER MAIN TO THE BUILDING WATER SYSTEM SHALL BE DISINFECTED IN ACCORDANCE WITH THE PROCEDURES BELOW, APPLICABLE LAWS AND REGULATIONS, AND THE OWNER-APPROVED DWQTP. DISINFECTION SHALL BE PERFORMED PRIOR TO INSTALLATION OF THE SERVICE CONNECTION PIPING MATERIAL IN THE GROUND. DISINFECTION CAN BE PERFORMED IN SEGMENTS OR IN WHOLE, DEPENDING ON SITE-SPECIFIC REQUIREMENTS. IF CONTRACTOR PROPOSES TO PERFORM DISINFECTION IN SEGMENTS, CONTRACTOR MUST DESCRIBE IN THE DWQTP PROCEDURES FOR ISOLATING SEGMENTS. SERVICE CONNECTION DISINFECTION SHALL ONLY BE PERFORMED UNDER THE DIRECT, ON-SITE OBSERVATION OF A REPRESENTATIVE FROM THE OWNER.

   t. THE INTERIOR OF EACH PIPE SEGMENT, FITTINGS, VALVE(S), AND APPURTENANCES FOR THE NEW SERVICE CONNECTION SHALL BE SPRAY-DISINFECTED OR SWABBED WITH A MINIMUM 1 TO 5 PERCENT SOLUTION OF CHLORINE. SODIUM HYPOCHLORITE OR APPROVED EQUAL MAY BE USED FOR THIS PURPOSE. AFTER SPRAY-DISINFECTING OR SWABBING, ALL PIPE SEGMENTS, FITTINGS, VALVE(S), AND APPURTENANCES FOR THE NEW SERVICE CONNECTION SHALL BE FLUSHED CONTINUOUSLY FOR A MINIMUM OF FIVE (5) MINUTES WITH POTABLE WATER.

   u. AT THE CONCLUSION OF POST-DISINFECTION FLUSHING, WATERTIGHT PLUGS OR CAPS SHALL BE INSTALLED ON BOTH ENDS OF EACH PIPE SEGMENT OF THE NEW SERVICE CONNECTION AND THE SEGMENTS SHALL BE STAGED APPROPRIATELY.

   v. THE DISINFECTION, FLUSHING, AND CAPPING SHALL BE CONDUCTED LESS THAN 72 HOURS PRIOR TO INSTALLATION. LONGER TIMEFRAMES SHALL NOT BE PERMITTED WITHOUT THE EXPLICIT APPROVAL OF THE OWNER AND MAY REQUIRE ADDITIONAL CONTROLS SUCH AS MORE STRINGENT CAPPING AND/OR SEALING METHODS AND IDENTIFICATION OF STAGING LOCATIONS, ALL OF WHICH REQUIRE PRIOR APPROVAL OF THE OWNER.

   w. PRIOR TO THE INSTALLATION OF EACH NEW SERVICE CONNECTION SEGMENT, FITTINGS, VALVE(S), AND APPURTENANCES TO THE WATER MAIN, PLASTIC SHEETING OR GEOTEXTILE PRODUCT SHALL BE PLACED IN THE TRENCH. INSTALLED WATERTIGHT PLUGS OR CAPS SHALL ONLY BE REMOVED AT THE TIME THE "WET" CONNECTION IS MADE TO THE MUNICIPAL WATER MAIN. NEW SERVICE CONNECTION SEGMENTS ARE CONNECTED TO ONE ANOTHER AND THE FINAL SEGMENT IS CONNECTED TO THE INTERIOR PIPING. CARE SHALL BE TAKEN SO THAT SOIL AND/OR OTHER DELETERIOUS MATERIAL DO NOT ENTER THE SERVICE PIPING DURING PLACEMENT OF SAME.

   x. FOLLOWING INSTALLATION OF THE NEW SERVICE CONNECTION SEGMENTS, CONTINUOUS FLUSHING FOR A MINIMUM OF FIVE (5) MINUTES WITH POTABLE WATER SHALL BE COMPLETED. A MINIMUM OF ONE (1) SAMPLE SHALL BE COLLECTED FROM THE FLUSHING EFFLUENT OF EACH NEW SERVICE CONNECTION FROM A TEMPORARY HOSE BIB INSTALLED AT THE SCHOOL END OF THE NEW SERVICE CONNECTION. SAMPLES SHALL BE ANALYZED BY THE CONTRACTOR'S LABORATORY FOR TOTAL COLI FORM, E. COLI BACTERIA, AND HETEROTROPHIC PLATE COUNT (HPC). A DETERMINATION WILL BE MADE BY THE OWNER AS TO ACCEPTABILITY, IN ACCORDANCE WITH ARTICLE 3.03 K. THE VALVE ALLOWING FLOW TO THE POTABLE WATER SYSTEM OF THE SCHOOL MAY NOT BE OPENED UNTIL WRITTEN APPROVAL BY THE OWNER IS RECEIVED.

10. ALL DISINFECTION AND TESTING SHALL ONLY BE PERFORMED UNDER THE DIRECT, ON-SITE OBSERVATION OF A REPRESENTATIVE FROM THE OWNER. THE OWNER IS TO BE NOTIFIED A MINIMUM OF THREE (3) BUSINESS DAYS PRIOR TO THE START OF ALL DISINFECTION AND TESTING WORK.

11. ALL CHAIN OF CUSTODY FORMS AND SAMPLE ANALYSIS RESULTS SHALL BE SUBMITTED TO THE OWNER'S PROJECT OFFICER AND TO THE OWNER WITHIN 72 HOURS OF THE TIME THAT SAMPLES ARE DELIVERED TO THE LABORATORY. APPROVAL OF ALL SAMPLE ANALYSIS RESULTS BY THE OWNER MUST BE OBTAINED BY THE CONTRACTOR. ALL DISINFECTION PROCEDURES AND BACTERIOLOGICAL RESULTS SHALL BE REVIEWED AND A DETERMINATION MADE BY THE OWNER AS TO THE SUITABILITY OF THE WATER FOR DRINKING PURPOSES. THIS DETERMINATION WILL BE MADE UPON VERIFICATION THAT RESULTS ARE "NEGATIVE/ABSENT" FOR E. COLI AND TOTAL COLI FORM AND ARE LESS THAN 500 COLONY FORMING UNITS/MILLILITER (CFU/ML) FOR HPC AND THAT ALL WORK HAS BEEN CONDUCTED IN FULL COMPLIANCE WITH THE REQUIREMENTS OF THIS SECTION AND THE APPROVED DWQTPS. IF THE DISINFECTION AND/OR SAMPLING ARE DEEMED UNACCEPTABLE BY THE OWNER, THE PIPE SYSTEM FLUSHING (IN ACCORDANCE WITH ARTICLE 3.03 AND SECTION PC 610 OF THE NEW YORK CITY PLUMBING CODE), DISINFECTION AND SAMPLING PROCEDURES SHALL BE REPEATED UNTIL AN ACCEPTABLE WATER QUALITY IS DEMONSTRATED. THE OWNER MAY REQUIRE SUBMITTAL OF A REVISED DISINFECTION PROCEDURE TO THE OWNER FOR APPROVAL PRIOR TO ADDITIONAL DISINFECTION. POTABLE WATER SYSTEM SHALL NOT BE PUT INTO SERVICE UNTIL SUCCESSFUL COMPLETION OF THE DISINFECTION PLAN AND ACCEPTANCE BY THE OWNER.

HEAT TRACE NOTES

1. THE SELECTION OF THE APPROPRIATE HEAT TRACING FAMILY SHALL BE BASED ON THE MAXIMUM MAINTAIN TEMPERATURE AND MAXIMUM EXPOSURE TEMPERATURE. SELECTION OF SPECIFIC HEATERS WITHIN A FAMILY WILL BE BASED ON THE HEATER POWER OUTPUT BEING EQUAL TO OR GREATER THAN THE WORST-CASE HEAT LOSS AS CALCULATED IN SECTION 4.0. ADDITIONAL FACTORS SUCH AS REQUIRED MAINTAIN TEMPERATURE AND MAXIMUM SYSTEM DESIGN TEMPERATURES, I.E. MAXIMUM AND MINIMUM ALLOWABLE PRODUCT TEMPERATURE AND MAXIMUM ALLOWABLE MATERIAL TEMPERATURE, MUST ALSO BE CONSIDERED.

2. ALL HEAT-TRACING APPLICATIONS WITH CONTINUOUS EXPOSURE (MAINTAIN) TEMPERATURES FROM 150°F (65°C) TO 250°F (121°C) OR INTERMITTENT EXPOSURE TEMPERATURES FROM 185°F (85°C) TO 420°F (215°C) SHALL USE SELF-REGULATING CABLES.

HEAT TRACE NOTES

3. WHERE HEAT TRACING IS REQUIRED ON LINES THAT EXCEED THE MAXIMUM EXPOSURE TEMPERATURE OF SELF-REGULATING CABLES, MINERAL INSULATED ELECTRIC HEAT TRACING SHALL BE INSTALLED.

GENERAL

1. THE FOLLOWING WORST-CASE AMBIENT CONDITIONS SHALL BE USED IN THE HEAT LOSS DETERMINATION.
   a. MINIMUM AMBIENT TEMPERATURE = 0 °F
   b. MAXIMUM WIND SPEED = 20 MPH
   c. MAXIMUM MAINTAIN TEMPERATURE = 150°F
   d. MAXIMUM EXPOSURE TEMPERATURE = 185°F

6. THE ELECTRIC HEATING CABLE SHALL BE A PARALLEL, SELF-REGULATING HEATER SUCH THAT IT CAN BE CUT TO LENGTH IN THE FIELD WITHOUT EFFECTING POWER OUTPUT PER UNIT LENGTH. INITIAL DESIGN SHALL NOT EXCEED 75% OF MAXIMUM RATED CIRCUIT LENGTH, ALLOWING FOR ADDED FIELD CHANGES.

7. SELF-REGULATING HEATING CABLE SHALL VARY ITS POWER OUTPUT RELATIVE TO THE TEMPERATURE OF THE SURFACE OF THE PIPE OR THE VESSEL. THE CABLE SHALL BE DESIGNED SUCH THAT IT CAN BE CROSSED OVER ITSELF AND CUT TO LENGTH IN THE FIELD.

8. SELF-REGULATING HEATING CABLE SHALL BE DESIGNED FOR A USEFUL LIFE OF 20 YEARS OR MORE WITH "POWER ON" CONTINUOUSLY, BASED ON THE FOLLOWING USEFUL LIFE CRITERIA:
   a. RETENTION OF AT LEAST 75 PERCENT OF RATED POWER AFTER 20 YEARS OF OPERATION AT THE MAXIMUM PUBLISHED CONTINUOUS EXPOSURE (MAINTAIN) TEMPERATURE.
   b. RETENTION OF AT LEAST 90 PERCENT OF RATED POWER AFTER 1000 HOURS OF OPERATION AT THE MAXIMUM PUBLISHED INTERMITTENT EXPOSURE TEMPERATURE. THE TESTING SHALL CONFORM TO UL 7468, IEC 216-1 PART 1.

9. A WARRANTY AGAINST MANUFACTURING DEFECTS FOR A PERIOD OF 10 YEARS SHALL BE AVAILABLE.

10. ALL SELF REGULATING CABLES SHALL BE CAPABLE OF PASSING A 2500 VDC DIELECTRIC TEST FOR ONE MINUTE (ASTM 2633) AFTER UNDERGOING A 0.5 KG-M IMPACT (BS 6351, PART 1, 8.1.10).

11. FREEZE PROTECTION
   a. FREEZE PROTECTION CIRCUITS WITH MAXIMUM EXPOSURE TEMPERATURES 150°F OR LESS SHALL BE CONTROLLED WITH AN AMBIENT SENSING THERMOSTAT AND PROPERLY SIZED CONTACTOR FOR EACH POWER DISTRIBUTION PANEL. CIRCUITS SHALL BE ENERGIZED WHEN AMBIENT TEMPERATURE DROPS TO 40°F.

12. TEMPERATURE MAINTENANCE
   a. HEAT TRACING CIRCUITS FOR PIPES AND VESSELS HAVING MAINTAINED TEMPERATURES ABOVE 40°F AND/OR EXPOSURE TEMPERATURES ABOVE 150°F SHALL BE INDIVIDUALLY CONTROLLED.
   b. LOCAL TEMPERATURE CONTROL SHALL BE PROVIDED BY MECHANICAL, BULB AND CAPILLARY THERMOSTATS OR ELECTRONIC CONTROLLER APPROVED FOR THE AREA CLASSIFICATION. EACH HEAT TRACING CIRCUIT SHALL BE ENERGIZED WHEN PIPE OR VESSEL TEMPERATURE DROPS BELOW THE DESIRED MAINTAIN TEMPERATURE AS SPECIFIED ON THE LINE LIST OR VESSEL SCHEDULE. THERMOSTATS SHALL BE SELECTED IN ACCORDANCE WITH ELECTRICAL SWITCHING REQUIREMENTS PROVIDED IN THE HEAT TRACING MANUFACTURER'S TECHNICAL DOCUMENTATION.
   c. CONTROL OF CRITICAL HEAT TRACING CIRCUITS SHALL BE ACCOMPLISHED WITH THE USE OF A SINGLE OR DUAL CIRCUIT DIGITAL CONTROLLER. THE CONTROLLER SHALL CONFORM TO THE FOLLOWING CRITERIA:
      c.a. THE SYSTEM SHALL BE FIELD-MOUNTED AND SHALL HAVE FM OR CSA APPROVAL FOR CLASS I, DIVISION 2, GROUPS A, B, C, D WHEN USING A SOLID-STATE SWITCHING DEVICE.
      c.b. THE SYSTEM SHALL PROVIDE THE USER WITH THE OPTION OF LINE-SENSING CONTROL WITH A USER-SELECTABLE DEAD BAND, AMBIENT SENSING, PROPORTIONAL AMBIENT SENSING (PASC), AND POWER LIMITING CONTROL MODES.
      c.c. THE SYSTEM SHALL PROVIDE AN ISOLATED TRIAC ALARM RELAY OR A DRY CONTACT RELAY FOR ALARM ANNUNCIATION BACK TO A DISTRIBUTED CONTROL SYSTEM (DCS).
      c.d. ELECTRICAL CODE-APPROVED GROUND-FAULT DETECTION EQUIPMENT SHALL BE INTEGRAL TO THE CONTROLLER TO SIMPLIFY INSTALLATION AND REDUCE TOTAL COST.
      c.e. ENCLOSURE TYPE SHALL BE NEMA 4X FIBERGLASS REINFORCED PLASTIC (FRP) OR STAINLESS STEEL FOR CORROSION RESISTANCE AND PROTECTION FROM MOISTURE.
      c.f. DIGITRACE UNITS MAY BE NETWORK-READY TO PROVIDE COMMUNICATION TO A HOST PC RUNNING WINDOWS™-BASED SUPERVISOR SOFTWARE FOR CENTRAL PROGRAMMING, STATUS REVIEW, AND ALARM ANNUNCIATION. DIGITRACE UNITS SHALL SUPPORT THE MODBUS™ RTU OR ASCII/HTCBUS COMMUNICATIONS PROTOCOL AND BE SUPPLIED COMPLETE WITH RS-485 COMMUNICATIONS INTERFACE CAPABILITY.

13. THE SYSTEM SHALL BE DIGITRACE 910 OR DIGITRACE 920 HEAT-TRACING CONTROL SYSTEMS, AS MANUFACTURED BY TYCO THERMAL CONTROLS OR APPROVED EQUAL.

14. HEATER INSTALLATION AND ELECTRICAL DESIGN SHALL CONFORM TO THE MANUFACTURER'S PUBLISHED SPECIFICATIONS AND GUIDELINES.

15. ALL ELECTRICAL HEAT TRACING COMPONENTS, POWER CONNECTIONS, SPLICES, TEES AND END SEALS SHALL BE BY THE SAME MANUFACTURER AS THE HEAT TRACING CABLE AND SHALL BE APPROVED BY A CERTIFYING AGENCY FOR INSTALLATION IN THE DESIGNATED AREAS.

16. HEATING CABLE SHALL BE INSTALLED TO ALLOW EASY REMOVAL IN MAINTENANCE ITEMS SUCH AS PUMPS, VALVES, STRAINERS AND FILTERS.

17. HEATER CABLES SHALL NOT BE INSTALLED BEFORE COMPLETION OF HYDRO TESTS AND ANY PIPING REWORK TO AVERT POSSIBLE PHYSICAL DAMAGE TO THE CABLES.

18. ALL TERMINATIONS AND ELECTRICAL CONNECTIONS SHALL BE WATERPROOFED TO PREVENT MOISTURE TRACKING ELECTRICAL FAULTS.

19. SELF-REGULATING HEATERS SHALL BE ATTACHED TO METAL PIPE WITH ADHESIVE BACKED GLASS FIBER TAPE AT 1-FOOT INTERVALS. SELF-REGULATING HEATERS SHALL BE ATTACHED TO NON-METALIC PIPE WITH ADHESIVE BACKED ALUMINUM TAPE APPLIED LINEARLY OVER THE HEATING CABLE.

20. MI CABLE SHALL BE ATTACHED TO THE PIPE WITH STAINLESS STEEL TIE WIRE AT 1-FOOT INTERVALS.

21. NO HEAT TRANSFER CEMENT OF ANY TYPE SHALL BE PERMITTED.

22. CAUTION SIGNS SHALL BE INSTALLED AT 10-FOOT INTERVALS ALONG THE PIPE

23. UPON COMPLETION OF THERMAL INSULATION INSTALLATION THE HEATER CABLE SHALL BE MEGGERED TO VERIFY NO DAMAGE HAS OCCURRED. TESTS ON POLYMER HEATING CABLES SHOULD USE AT LEAST A 2,500 VDC MEGGER AND 500 VDC ON MINERAL INSULATED CABLES. DO NOT USE A MEGGER WITH AN EXCESS OF 2500 VDC FOR POLYMER HEATER CABLES AND 1000 VDC FOR MINERAL INSULATED HEATER CABLES. MINIMUM ACCEPTABLE READINGS SHOULD BE 20 MEGOHMS PER CIRCUIT, REGARDLESS OF LENGTH.

24. EACH CIRCUIT SHALL BE ENERGIZED AND VOLTAGE AND CURRENT MEASURED AND DOCUMENTED TO VERIFY THE INSTALLATION IS PROPERLY FUNCTIONING.

25. TEMPERATURE CONTROLS SHOULD BE OPERATED TO VERIFY FUNCTIONING.

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CONSTRUCTION INDOOR ENVIRONMENT QUALITY (IEQ) NOTES

1. WHERE PROJECT SPACE IS PART OF THE BUILDING WHERE REST OF THE BUILDING IS OCCUPIED, THE CONTRACTOR SHALL PROVIDE A HIGH EFFICIENCY PARTICULATE AIR (HEAP) FILTERED NEGATIVE PRESSURE FAN SYSTEM TO MAINTAIN MINIMUM 0.01" WATER GAGE NEGATIVE PRESSURE IN THE CONSTRUCTION AREA IN RELATION TO THE NON-CONSTRUCTION AREAS. THE EQUIPMENT AND DUCTWORK SHALL BE SIZED FOR SUCH PRESSURE RELATIONSHIP AND SHALL OPERATE FOR THE ENTIRE DURATION OF CONSTRUCTION UNLESS THE OWNER PROVIDES SPECIFIC EXEMPTION WRITING.

2. ALL SUCH EXHAUSTS SHALL TERMINATE OUTSIDE THE BUILDING. WHERE THE BUILDING EXTERIOR IS NOT ACCESSIBLE TO THE PROJECT SPACE, THE CONTRACTOR SHALL OBTAIN PERMISSION IN WRITING FROM THE OWNER ON THE ALTERNATE TERMINATION LOCATION.

3. ALL CONSTRUCTION SPACES SHALL BE PROVIDED WITH ACOUSTIC TREATED PARTITIONS TO ISOLATE ANY CONSTRUCTION NOISE FROM REST OF THE BUILDING. CONTRACTOR SHALL ALSO COORDINATE DAY TO DAY CONSTRUCTION TIME WITH THE OWNER IN WRITING BEFORE BID TO ENSURE NO DISTURBANCE TO REST OF THE NON-CONSTRUCTION AREA OCCUPANTS OF THE BUILDING. ACOUSTIC TREATMENT SHALL BE BASED UPON RECOMMENDATION BY NYS LICENSED ACOUSTIC CONSULTANT HIRED BY CONTRACTOR.

4. CONTRACTOR SHALL INSTALL A CONTINUOUS RUNNING AND TRACKING NOISE METER ON THE CONSTRUCTION PARTITION AT A LOCATION ACCEPTABLE TO OWNER TO ENSURE THAT EXCESSIVE NOISE IS NOT TRANSMITTED OUTSIDE THE CONSTRUCTION AREA. THE NOISE DATA SHALL BE STORED FOR A DURATION OF 30 DAYS AND HANDED OVER TO OWNER IN .AVI OR .MP3 FORMAT FOR RECORD KEEPING BEFORE THE NEXT CYCLE IS RECORDED.

5. CONTRACTOR SHALL NOT BE PROVIDED WITH ADDITIONAL COMPENSATION FOR TIME SCHEDULE RELATED COSTS DUE TO IEQ ISSUES.

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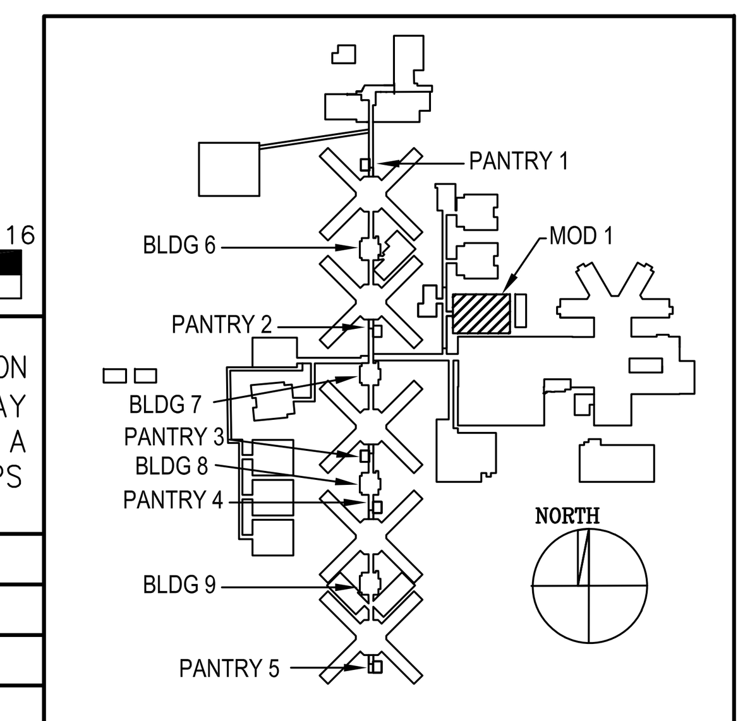


KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION

DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

IT IS A VIOLATION OF THE STATE EDUCATION LAW SECTION 7209 (2) FOR ANY PERSON TO ALTER AN ITEM IN ANY WAY UNLESS SUCH PERSON IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, AND THE ENGINEER STAMPS SUCH CHANGES

Director: HARDEE SAINI
Project Manager: BV
Project Engineer:
Drawn By: Checked By: SB
PIN # 072201723CPD Date: 01/21/2015

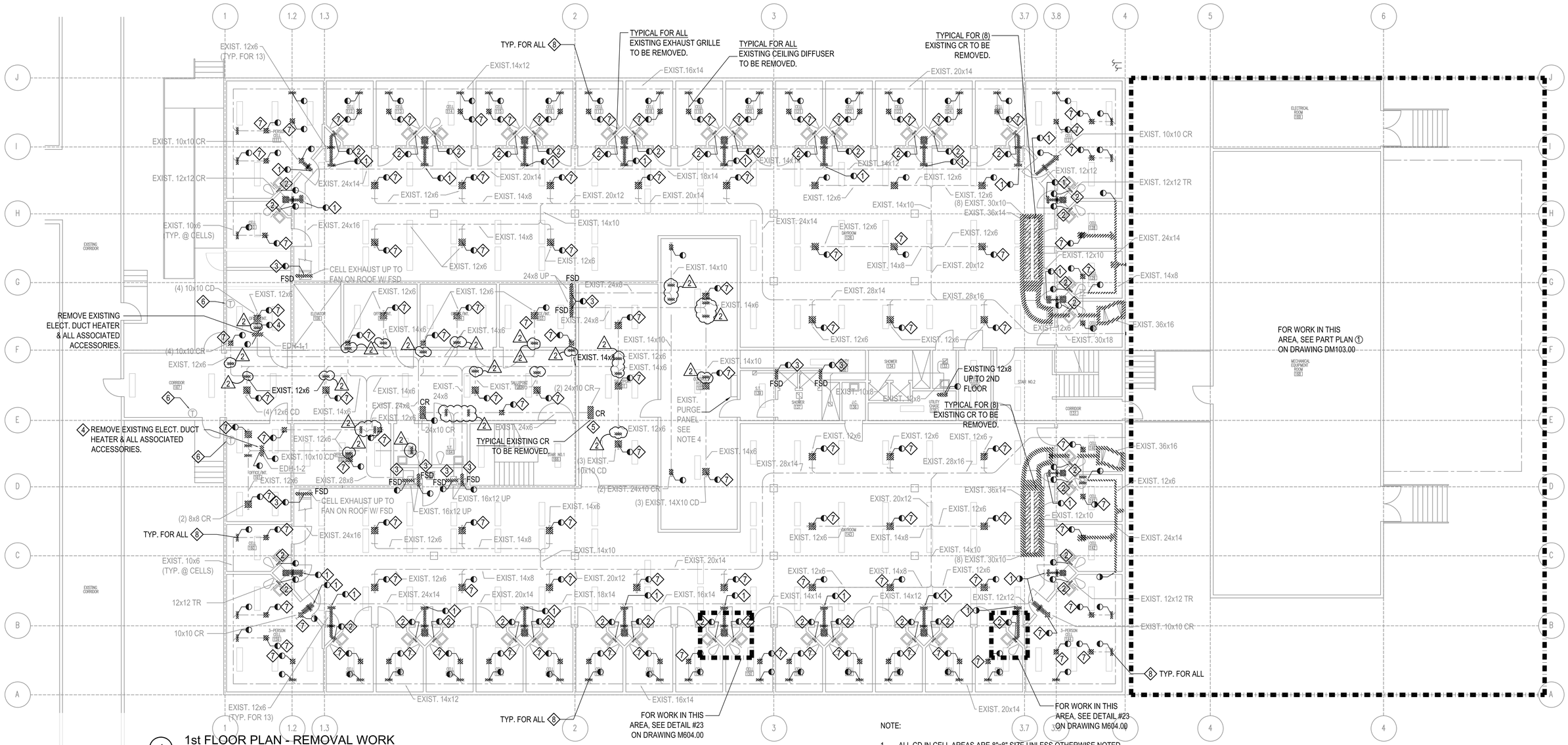
Drawing Title:
HVAC
GENERAL NOTES
SHEET 3 OF 3

Seal:

Drawing No.:
M004.00

Scale: NONE

Sheet: 10 of 70



1 1st FLOOR PLAN - REMOVAL WORK

SCALE: 1/8"=1'-0"

TAG NOTES:

1. REMOVE EXISTING DUCTWORK FROM MAIN TO POINT SHOWN INCLUDING FIRE DAMPER.
2. REMOVE EXISTING 12x6 RR UON. ALONG WITH SLEEVE, VOLUME DAMPER AND DUCT TO THE EXTENT SHOWN.
3. DISCONNECT EXISTING FSD FROM POWER/FIRE ALARM. REMOVE DAMPER WITH MIN. 4'-0" DUCT ON EITHER SIDE. TEMPORARILY CAP UNTIL REPLACEMENT.
4. DISCONNECT POWER AND CONTROL FROM DUCT HEATER AND MIN. 4'-0" DUCT ON EITHER SIDE OF HEATER. TEMPORARILY CAP UNTIL REPLACEMENT.
5. CEILING REGISTER.
6. DISCONNECT AND REMOVE EXISTING THERMOSTAT, ALL CONTROL WIRING IN ITS ENTIRELY. SEE M101 FOR NEW WORK. NOT ALL THERMOSTAT ARE SHOWN. VERIFY THERMOSTAT LOCATION IN FIELD. LOCATION SHOWN IS APPROXIMATE.
7. CLEAN AND WIRE BRUSH EXISTING AIR INLETS AND OUTLETS, COMB ALL APERTURES.
8. REMOVE EXISTING VOLUME DAMPER AT ALL DUCT BRANCH LOCATIONS. RELOCATE LIGHT FIXTURE / GRILLES / OR OTHER COMPONENT AS REQUIRED TO PERFORM WORK.

NOTE:

1. ALL CD IN CELL AREAS ARE 8"x8" SIZE UNLESS OTHERWISE NOTED.
2. ALL CD IN DAYROOM AREAS ARE 10"x10" SIZE UNLESS OTHERWISE NOTED.
3. EXISTING FIRE DAMPER AT EACH WALL PENETRATION TO BE REMOVED TYP.
4. DISCONNECT ALL FIRE SMOKE DAMPERS AND POWER, CONTROL, FIRE ALARM CONNECTIONS AND REMOVE EXISTING SMOKE PURGE PANEL ALONG WITH SUPPORTS.
5. CLEAN ALL EXISTING DUCTWORK IN THEIR ENTIRETY AS PER SPECIFICATIONS PRIOR TO PROVISION OF ANY NEW COMPONENTS. SEE NOTES ON DRAWING M003.00.
6. DISCONNECT AND REMOVE LIGHTING FIXTURES AS REQUIRED, REINSTALL AND RECONNECT AFTER COMPLETION OF WORK AND RESTORE TO ORIGINAL WORKING CONDITION.
7. SEE PHASING PLAN FOR WORK TO BE PERFORMED IN PHASES. PROVIDE CONTINUOUS AIR QUALITY AND NOISE MONITORING AND TRACKING FOR DURATION OF CONTRACT. CONTRACTOR SHALL HIRE AN ACOUSTIC CONSULTANT TO ENSURE THE CODE ALLOWED NOISE LEVEL IS NOT EXCEEDED. CONTRACTOR SHALL PROVIDE ALL NECESSARY COMPONENTS TO ENSURE SUCH COMPLIANCE.

REMOVE ALL CEILING/LIGHT FIXTURES, OTHER COMPONENTS AS NECESSARY TO PERFORM ALL WORK AS SHOWN WHETHER SPECIFICALLY INDICATED OR OTHERWISE.

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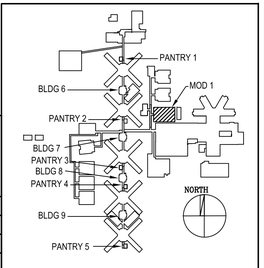

KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY AND DEVELOPMENT ENGINEERING UNIT

DESIGNED BY:

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Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING SYSTEM REPLACEMENT

MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

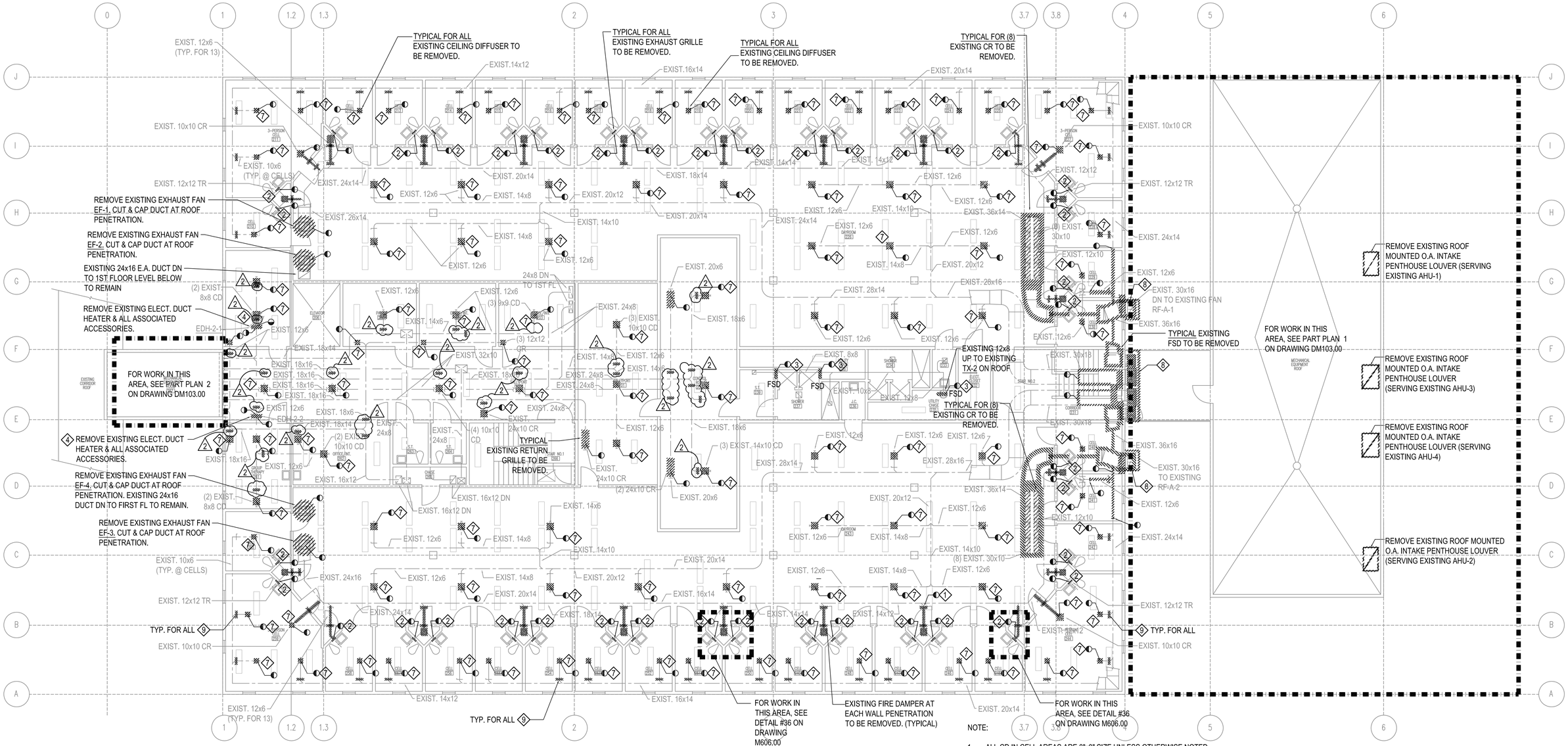
Drawing Title:
HVAC
FIRST FLOOR PLAN
REMOVAL WORK

Seal:

Drawing No.: DM-101.00

Scale: 1/8" = 1'-0"

Sheet: 11 of 70



1 2ND FLOOR - REMOVAL WORK

SCALE: 1/8"=1'-0"

TAG NOTES:

1. REMOVE EXISTING DUCTWORK FROM MAIN TO POINT SHOWN INCLUDING FIRE DAMPER.
2. REMOVE EXISTING 12x6 RR UON. ALONG WITH SLEEVE, VOLUME DAMPER AND DUCT TO THE EXTENT SHOWN.
3. DISCONNECT EXISTING FSD FROM POWER/FIRE ALARM. REMOVE DAMPER WITH MIN. 4'-0" DUCT ON EITHER SIDE. TEMPORARILY CAP UNTIL REPLACEMENT.
4. DISCONNECT POWER AND CONTROL FROM DUCT HEATER AND MIN. 4'-0" DUCT ON EITHER SIDE OF HEATER. TEMPORARILY CAP UNTIL REPLACEMENT.
5. CEILING REGISTER.
6. DISCONNECT AND REMOVE EXISTING THERMOSTAT, ALL CONTROL WIRING IN ITS ENTIRELY. SEE M101 FOR NEW WORK. NOT ALL THERMOSTAT ARE SHOWN. VERIFY THERMOSTAT LOCATION IN FIELD. LOCATION SHOWN IS APPROXIMATE.
7. CLEAN AND WIRE BRUSH EXISTING AIR INLETS AND OUTLETS, COMB ALL APERTURES. (2)
8. REMOVE EXISTING EXTERIOR ARCHITECTURAL DUCT ENCLOSURE IN ITS ENTIRELY CAREFULLY, STORED SAFELY AND REINSTALL UPON COMPLETION OF NEW WORK AS SHOWN ON CONSTRUCTION PLAN AND RESTORE TO ORIGINAL CONDITION.
9. REMOVE EXISTING VOLUME DAMPER AT ALL DUCT BRANCH LOCATIONS. RELOCATE LIGHT FIXTURE, GRILLES, OR OTHER COMPONENT AS REQUIRED TO PERFORM WORK.

NOTE:

1. ALL CD IN CELL AREAS ARE 8"x8" SIZE UNLESS OTHERWISE NOTED.
2. ALL CD IN DAYROOM AREAS ARE 10"x10" SIZE UNLESS OTHERWISE NOTED.
3. EXISTING FIRE DAMPER AT EACH WALL PENETRATION TO BE REMOVED TYP.
4. DISCONNECT ALL FIRE SMOKE DAMPERS AND POWER, CONTROL, FIRE ALARM CONNECTIONS AND REMOVE EXISTING SMOKE PURGE PANEL ALONG WITH SUPPORTS.
5. CLEAN ALL EXISTING DUCTWORK IN THEIR ENTIRETY AS PER SPECIFICATIONS PRIOR TO PROVISION OF ANY NEW COMPONENTS, SEE NOTES ON DRAWING M003.00.
6. DISCONNECT AND REMOVE LIGHTING FIXTURES AS REQUIRED, REINSTALL AND RECONNECT AFTER COMPLETION OF WORK AND RESTORE TO ORIGINAL WORKING CONDITION.
7. SEE PHASING PLAN FOR WORK TO BE PERFORMED IN PHASES. PROVIDE CONTINUOUS AIR QUALITY AND NOISE MONITORING AND TRACKING FOR DURATION OF CONTRACT. CONTRACTOR SHALL HIRE AN ACOUSTIC CONSULTANT TO ENSURE THE CODE ALLOWED NOISE LEVEL IS NOT EXCEEDED. CONTRACTOR SHALL PROVIDE ALL NECESSARY COMPONENTS TO ENSURE COMPLIANCE. (2)

REMOVE ALL CEILING/LIGHT FIXTURES, OTHER COMPONENTS AS NECESSARY TO PERFORM ALL WORK AS SHOWN WHETHER SPECIFICALLY INDICATED OR OTHERWISE.

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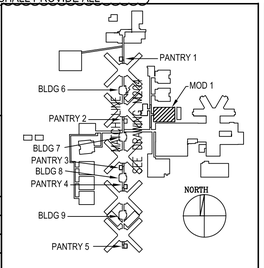

KEY PLAN

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DESIGNED BY:

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MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

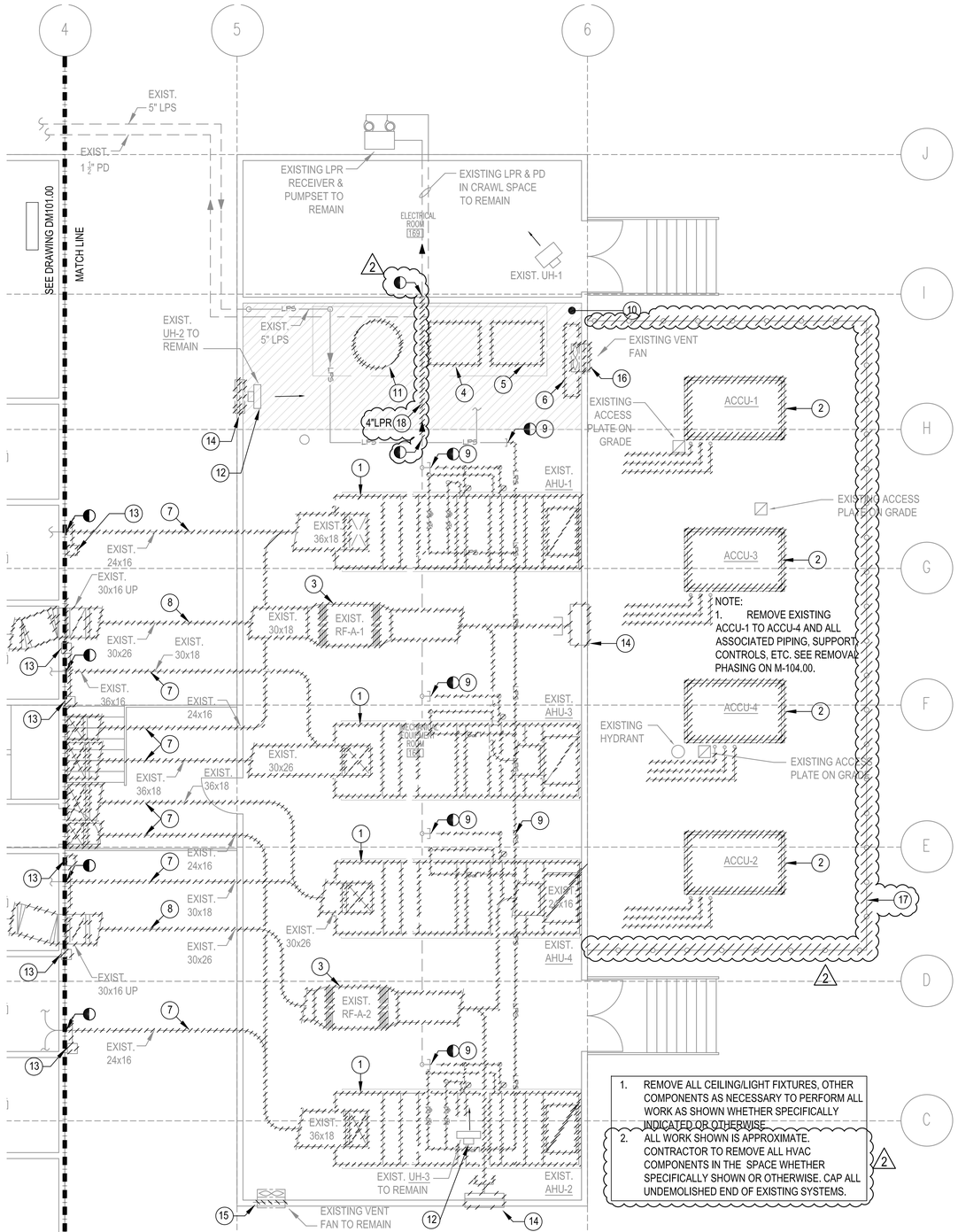
Drawing Title:
HVAC
SECOND FLOOR
REMOVAL WORK

Seal:

Drawing No.: DM102.00

Scale: 1/8" - 1'-0"

Sheet: 12 of 70

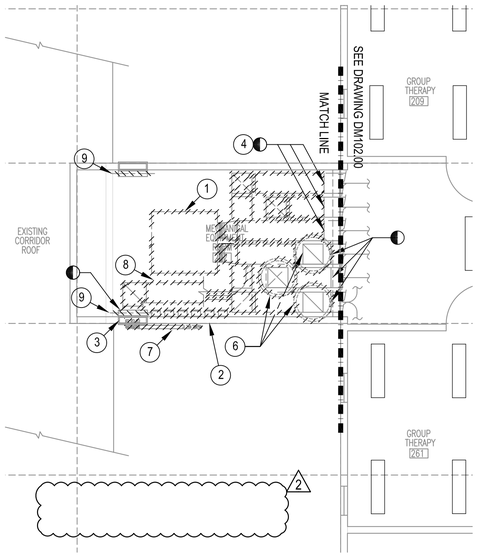


1 PART PLAN MAIN LEVEL MECHANICAL ROOM - REMOVAL WORK

SCALE: 3/16"=1'-0"

DEMOLITION NOTES: MAIN MECHANICAL ROOM

1. REMOVE EXISTING AHU-1 TO AHU-4, ALL ASSOCIATED PIPING, SUPPORT, CONCRETE PADS, CONTROLS, CONDUIT WIRING, ETC. SEE DWG # M-101 FOR PHASING.
2. REMOVE EXISTING ACCU-1 TO ACCU-4, ALL ASSOCIATED PIPING, SUPPORT, CONCRETE PADS DUNNAGES, CONTROLS, CONDUIT WIRING, ETC. SEE DWG # M-101 FOR PHASING. PACK ALL WALL OPENINGS WITH CODE COMPLIANCE MATERIAL.
3. REMOVE EXISTING RF-A-1 TO RF-A-2, ALL ASSOCIATED SUPPORT, CONTROLS, WIRING ETC. SEE DWG # M-101 FOR PHASING.
4. EXISTING HOT WATER HEATER (INSTA. HOT TYPE) TO BE DISCONNECTED AND REMOVED TEMPORARILY. REMOVE STRUCTURAL SUPPORT, FRAMING CAREFULLY. DISCONNECT REMOVE ALL PIPING. AFTER COMPLETION OF STRUCTURAL WORK, REINSTALL ALL COMPONENTS AND RESTORE TO ORIGINAL CONDITION.
5. EXISTING HOT WATER HEATER (INSTAHOT TYPE) TO BE RAISED & SUPPORTED TEMPORARILY. MODIFY ALL ASSOCIATED PIPING & CONTROLS TO KEEP UNIT IN OPERATION (COORDINATE WITH STRUCTURAL). UNIT TO BE SET IN ORIGINAL POSITION AFTER DECK SLAB WORK IS COMPLETED.
6. EXISTING RPZ AND DCDA TO BE DISCONNECTED CAREFULLY AND STORED SAFELY FOR REUSE. ALL OPENINGS TO BE CAPPED TO PERFORM STRUCTURAL SLAB REPLACEMENT REPLACEMENT WORK. SEE PLAN PART ④ ON THIS DRAWING FOR ADDITIONAL WORK
7. REMOVE EXISTING SUPPLY AIR DUCT SERVICING AHU-1 TO AHU-4, ALL ASSOCIATED SUPPORTS, ACCESSORIES, AND CAP EXISTING DUCT AT POINT OF DISCONNECTION.
8. REMOVE EXISTING RETURN AIR DUCT, EXHAUST AIR DUCT SERVICING RF-A-1 AND RF-A-2, ALL ASSOCIATED SUPPORTS, AND CAP EXISTING DUCT AT POINT OF DISCONNECTION.
9. REMOVE EXISTING LPS LINE & LPR LINE SUPPLYING AHU-1 THRU AHU-4 & CAP TO THE EXTENT SHOWN.
10. PORTION OF EXISTING FLOOR DECK TO BE REMOVED & REPLACED. SEE STRUCTURAL DRAWING.
11. EXISTING ABANDONED TANK TO BE REMOVED.
12. EXISTING HEATER TO REMAIN. CAP EXISTING CONNECTION FROM HEATER.
13. EXISTING FSD TO BE REMOVED.
14. EXISTING LOUVER & FD/AD TO BE REMOVED.
15. EXISTING FD TO REMOVED. REMOVE EXISTING WALL FAN AND ALL RELATED ACCESSORIES, SUPPORTS, WIRING AND STORE IN A SAFE LOCATION. PROVIDE TEMPORARY CAPS. REINSTALL AFTER COMPLETION OF ALL TRADE WORK.
16. REMOVE EXISTING WALL FAN AND ALL RELATED ACCESSORIES, SUPPORTS, WIRING. BLANK OFF EXISTING WALL OPENING WITH INSULATED PANELS. PAINT AND FINISH.
17. REMOVE EXISTING FENCES AND POLES INCLUDING FLOORS SUPPORT IN ITS ENTIRETY.
18. REMOVE EXISTING 4" LPR SECTION AS SHOWN. CAP ENDS OF REMAINING PIPING.



DEMOLITION NOTES: 2ND FLOOR MECHANICAL ROOM

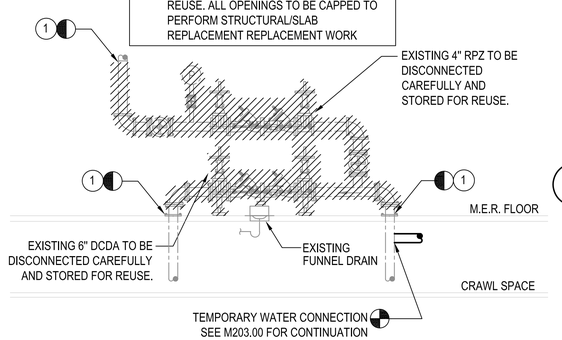
1. REMOVE EXISTING AC-A-1,AC-A-2, AC-A-3 (PIGGYBACKED), ALL ASSOCIATED SUPPORT, CONTROLS, CONDUIT WIRING, ACCESSORIES, ETC.
2. DISCONNECT & REMOVE ALL EXISTING CONTROL PANELS ALL ASSOCIATED SUPPORT, CONDUIT WIRING, ETC. ON WALL.
3. REMOVE EXISTING EXH. AIR DUCTS SERVING EXISTING AC-UNITS & ALL ASSOCIATED SUPPORTS. EXISTING LOUVERS TO REMAIN.
4. DISCONNECT & REMOVE ALL EXISTING S.A. DUCTS, ACCESSORIES SERVING AC UNITS. PROVIDE TEMPORARY COVERS TO OPENING OF EXISTING S.A. DUCTS TO REMAIN.
5. DISCONNECT & REMOVE ALL EXISTING R.A. DUCTS, ACCESSORIES SERVING AC UNITS. PROVIDE TEMPORARY COVERS TO OPENING OF EXISTING R.A. DUCTS TO REMAIN.
6. DISCONNECT & REMOVE EF-A-8, EF-A-9, EF-A-10 & CAP DUCT AT ROOF PENETRATION.
7. REMOVE EXISTING REFRIGERANT PIPING AND RELATED SUPPORT, FOR CONTINUATION, SEE 1ST FLOOR PART PLAN ③ BELOW.
8. EXISTING (3) O/A DUCT STACK ON TOP TO BE REMOVED
9. REMOVE EXISTING FIRE DAMPER.

2 PART PLAN 2ND FLOOR MECHANICAL ROOM - REMOVAL WORK

SCALE: 3/16"=1'-0"

DEMOLITION NOTE:

1. EXISTING BACKFLOW PREVENTION ASSEMBLY TO BE DISCONNECTED CAREFULLY AND STORED SAFELY FOR REUSE. ALL OPENINGS TO BE CAPPED TO PERFORM STRUCTURAL/SLAB REPLACEMENT REPLACEMENT WORK



4 PART PLAN 1ST FLOOR - REMOVAL WORK

SCALE: 3/16"=1'-0"

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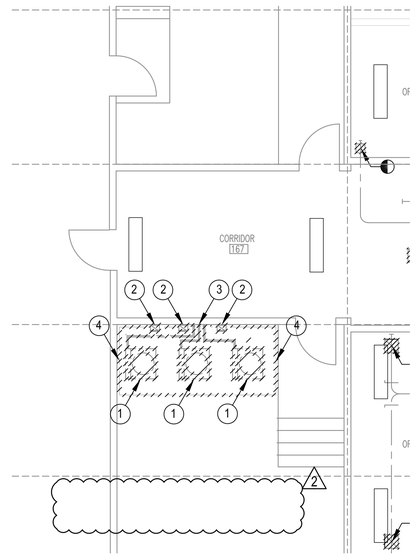

DEMOLITION NOTES: 1ST FLOOR

1. REMOVE EXISTING CU-A-1, CU-A-2, CU-A-3 ALL ASSOCIATED SUPPORT, CONTROLS, WIRING, ACCESSORIES, PADS, DUNNAGES, PIPING ETC. PATCH ALL WALL COMPONENTS WITH CODE COMPLIANCE MATERIAL.
2. DISCONNECT & REMOVE ALL EXISTING CONTROL PANELS ALL ASSOCIATED SUPPORT, WIRING, ETC. ON EXTERIOR WALL.
3. DISCONNECT AND REMOVE ALL EXISTING REFRIGERANT PIPING AND SUPPORTS BETWEEN CONDENSERS AND ASSOCIATED AC UNITS IN 2ND FLOOR MER. FOR CONTINUATION SEE DEMOLITION PART PLAN 2 ON THIS DRAWING. PROPER HANDLING AND REMOVAL OF REFRIGERANT AS PER SPECIFICATION
4. REMOVE EXISTING HOUSEKEEPING PAD

3 PART PLAN 1ST FLOOR - REMOVAL WORK

SCALE: 3/16"=1'-0"

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No.	Date	Revision
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Director:	HARDEE SAINI
Project Manager:	BV
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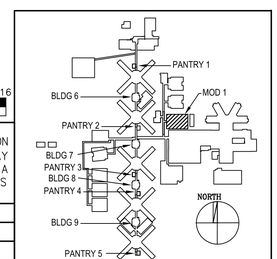
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

Drawing Title:

HVAC - PART PLAN
MECHANICAL ROOMS
REMOVAL PLAN

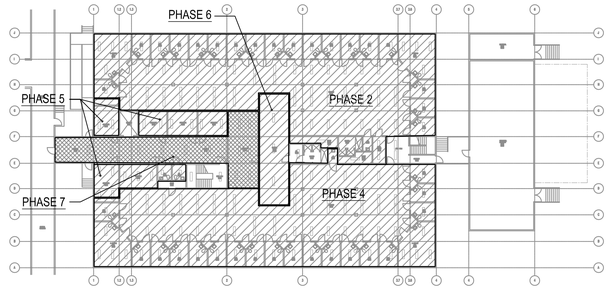
Seal:

Drawing No.:

DM103.00

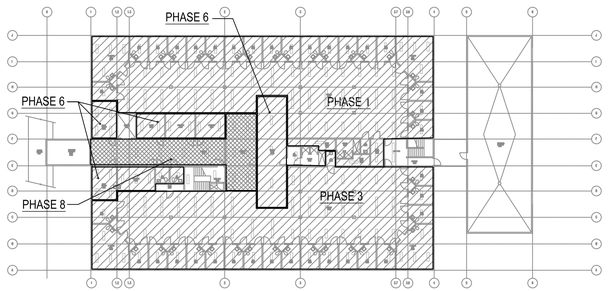
Scale: 1/4" = 1'-0"

Sheet: 13 of 70



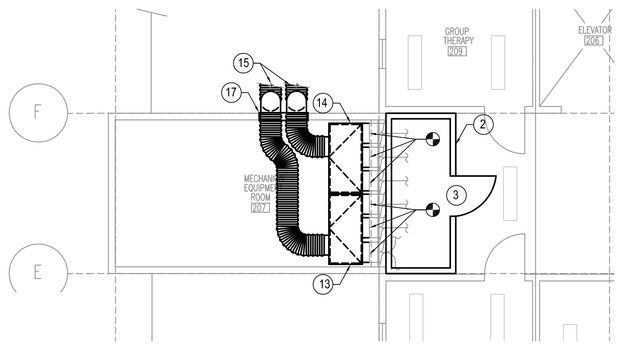
1 SECOND FLOOR PHASING PLAN

SCALE: N.T.S.



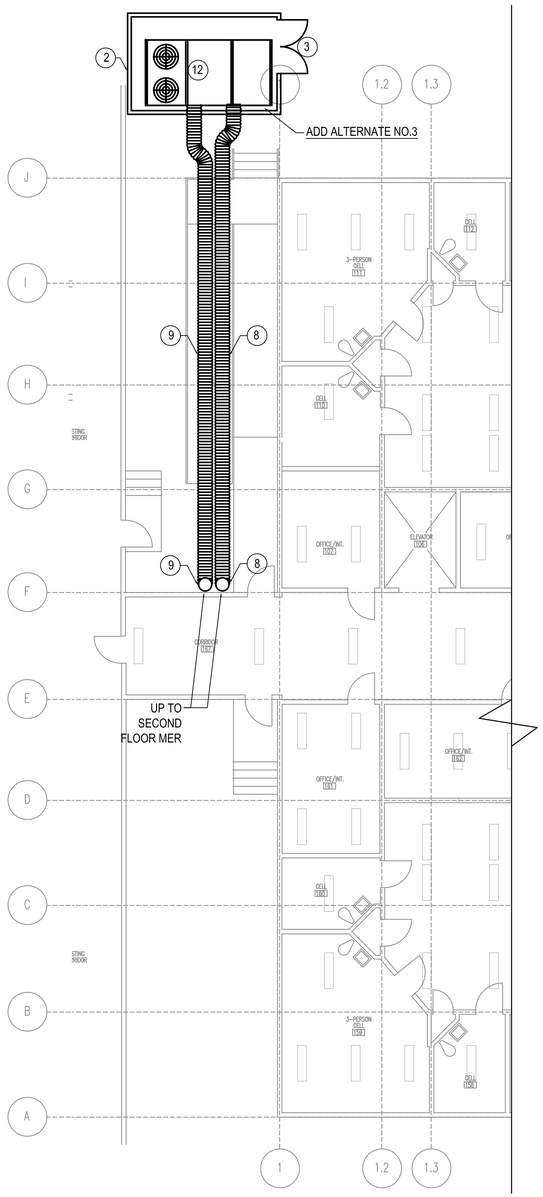
2 FIRST FLOOR PHASING PLAN

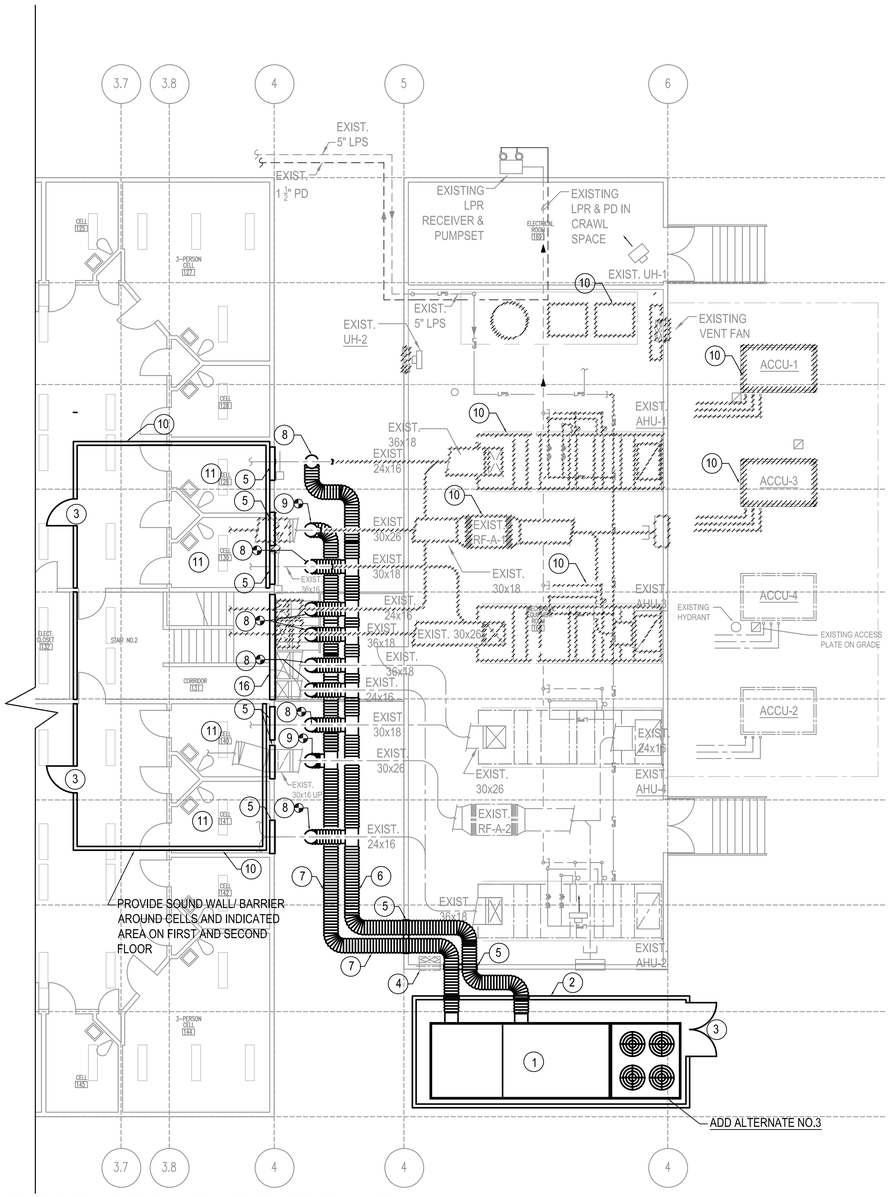
SCALE: N.T.S.



3 SECOND FLOOR MER PHASING PLAN

SCALE: 3/16"=1'-0"





4 FIRST FLOOR MER PHASING PART PLANS

SCALE: 1/8"=1'-0"

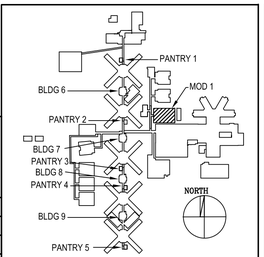
PHASING TAG NOTES:

1. ADD ALTERNATE NO.3
   TEMPORARY AIR COOLED AC/HEATING UNIT:
   50 TON AIR COOLED TEMP. A/C UNIT
   TOTAL CFM: 13,800
   O/A CFM: 7,300
   RETURN CFM: 6,500
   20 HP 460V-60HZ-3P
   170kW ELECTRIC HEATING
   PROVIDE FILTER (11 MERV)
   PROVIDE 565 MBH STEAM COIL
   CONTRACTOR RESPONSIBLE FOR FURNISHING, INSTALLATION AND OPERATION OF TEMPORARY HVAC UNIT.
2. CONTRACTOR TO PROVIDE SOUND WALL / BARRIER DURING CONSTRUCTION. CONTRACTOR TO HIRE NYS LICENSED ACOUSTIC CONSULTANT TO ENSURE CODE LIMITED SOUND LEVELS IN ADJACENT OCCUPIED SPACES.
3. PROVIDE ACCESS DOOR IN TEMPORARY SOUND WALL/ BARRIER FOR ACCESS.
4. TEMPORARILY REMOVE EXISTING FAN AND STORE IN SAFE LOCATION. SEE REMOVAL AND CONSTRUCTION DRAWING FOR DETAIL.
5. TEMPORARY OPENING TO RUN TEMPORARY DUCTWORK. OPENING TO BE PATCHED AND REPAIR TO ORIGINAL CONDITION AFTER ALL AHU 1,2,3 & 4 ARE INSTALLED AND FULLY FUNCTIONING. MAKE OPENING WEATHER TIGHT.
6. TEMPORARY FLEX MAIN SUPPLY DUCT.
7. TEMPORARY FLEX MAIN RETURN DUCT.
8. TEMPORARY FLEX SUPPLY DUCT TO BE CONNECTED TO EXISTING DUCTWORK.
9. TEMPORARY FLEX RETURN DUCT TO BE CONNECTED TO EXISTING DUCTWORK.
10. FOR DETAIL OF REMOVAL, SEE REMOVAL DRAWINGS.
11. TEMPORARILY REMOVE EXISTING CEILING, LIGHTING FIXTURES AND OTHER COMPONENTS AS NECESSARY FOR ACCESS ABOVE CEILING AND STORE IN A SAFE LOCATION. REINSTALL, PATCH AND PAINT AFTER COMPLETION OF ALL TRADE WORK.
12. ADD ALTERNATE NO.3
    TEMPORARY 15 TON AIR COOLED TEMP. A/C UNIT
    HEATING
    TOTAL 6000 CFM
    1200 CFM O.A
    2" STATIC EXTERNAL
    37kW ELECTRIC HEAT
    460V-60HZ-3PH
13. EXISTING TEMPORARY RETURN PLENUM TO BE CONNECTED TO EXISTING RETURN DUCTWORK IN 2ND FLOOR MER.
14. EXISTING TEMPORARY SUPPLY PLENUM TO BE CONNECTED TO EXISTING SUPPLY DUCTWORK IN 2ND FLOOR MER.
15. TEMPORARY DUCTWORK FROM TEMPORARY 15 TON UNIT RUNNING FROM 1ST FLOOR TO 2ND FLOOR MER.
16. TEMPORARY OPENING ON SECOND FLOOR TO RUN TEMPORARY DUCTWORK. OPENING TO BE PATCHED AND REPAIR TO ORIGINAL CONDITION AFTER ALL AHU 1,2,3 & 4 ARE INSTALLED AND FULLY FUNCTIONING.
17. TEMPORARY OPENING ON SECOND FLOOR TO RUN TEMPORARY DUCTWORK. OPENING TO BE PATCHED AND REPAIR TO ORIGINAL CONDITION AFTER ALL AHU 5,6,7 ARE INSTALLED AND FULLY FUNCTIONING.

GENERAL NOTES

1. PHASING PLAN INCLUDED IS PRELIMINARY AND SHOWS ONLY INTENT. CONTRACTOR SHALL PROVIDE DETAILED PHASING PLAN WITH TIMELINES UPON AWARD OF WORK TO OWNER FOR THEIR REVIEW AND REVISIONS. ALL DECISION OF PHASING BY THE OWNER SHALL BE FINAL AND BINDING ON CONTRACTOR. NO ADDITIONAL COST SHALL BE PROVIDED TO CONTRACTOR FOR THIS WORK.
2. PROVIDE ALL REQUIRED SUPPORTS, LEGAL ACCESS PADS FOR CONSTRUCTION AND OCCUPANT NORMAL AND EMERGENCY ACCESS AT ALL TIMES.
3. PROVIDE TEMPORARY PATITIONS ACOUSTICALLY TREATED AT ALL PHASING DEMARCATION LINE ON PLAN(1) AND(2) ON THIS DRAWING. SEE TAGE NOTE(2)FOR THIS WORK. PROVIDE HEPA FILTRATION EXHAUST SYSTEM IN CONSTRUCTION AT ALL TIME INCLUDING MONITORING, DATA LOGGING AS INDICATED ELSEWHERE IN CONTRACT DRAWINGS.

0 4 8 16



KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

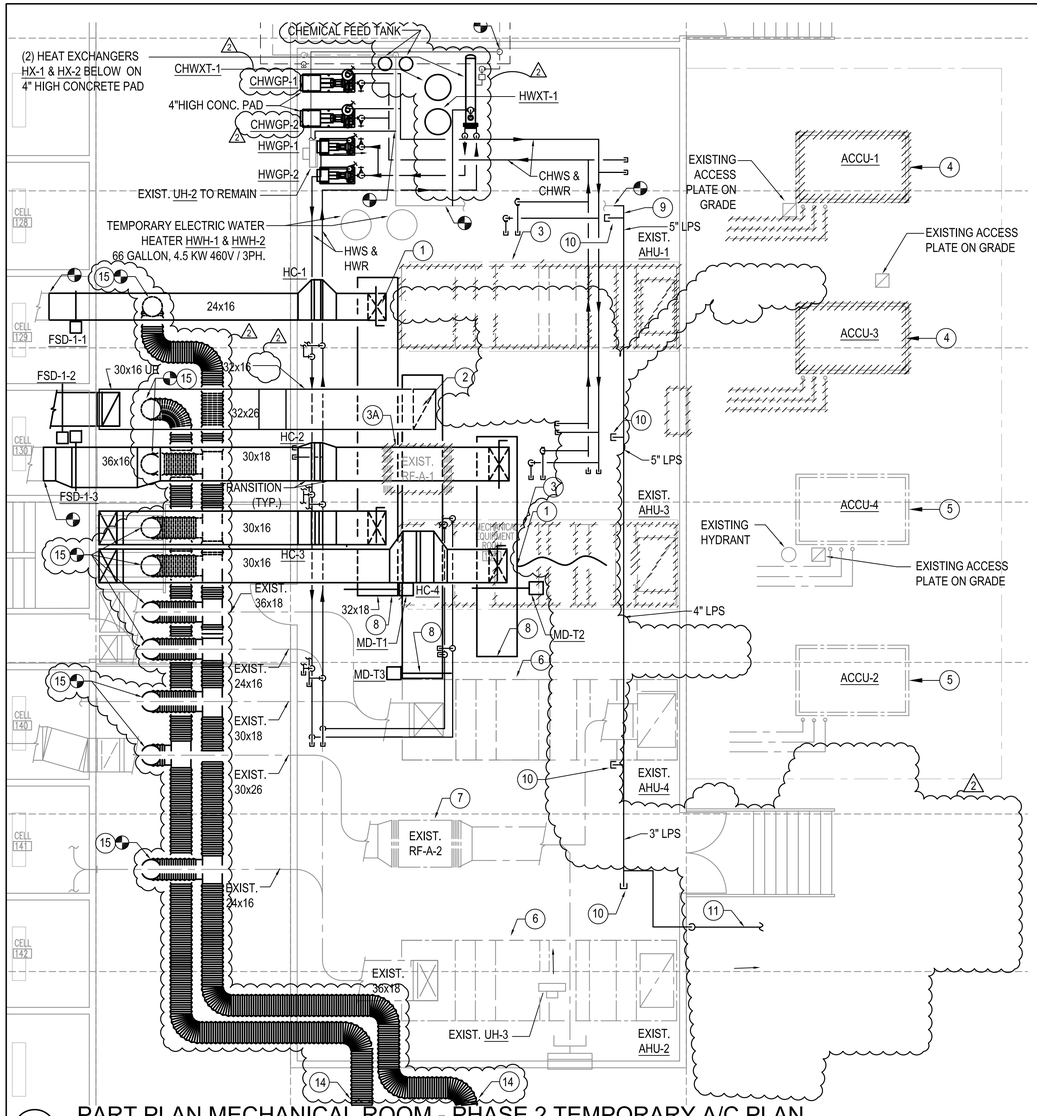
Drawing Title:
HVAC
PART PHASING PLAN
SHEET 1 OF 2

Seal:

Drawing No.: PM101.00

Scale: 3/16" = 1'-0"

Sheet: 14 of 70



2 PART PLAN MECHANICAL ROOM - PHASE 2 TEMPORARY A/C PLAN

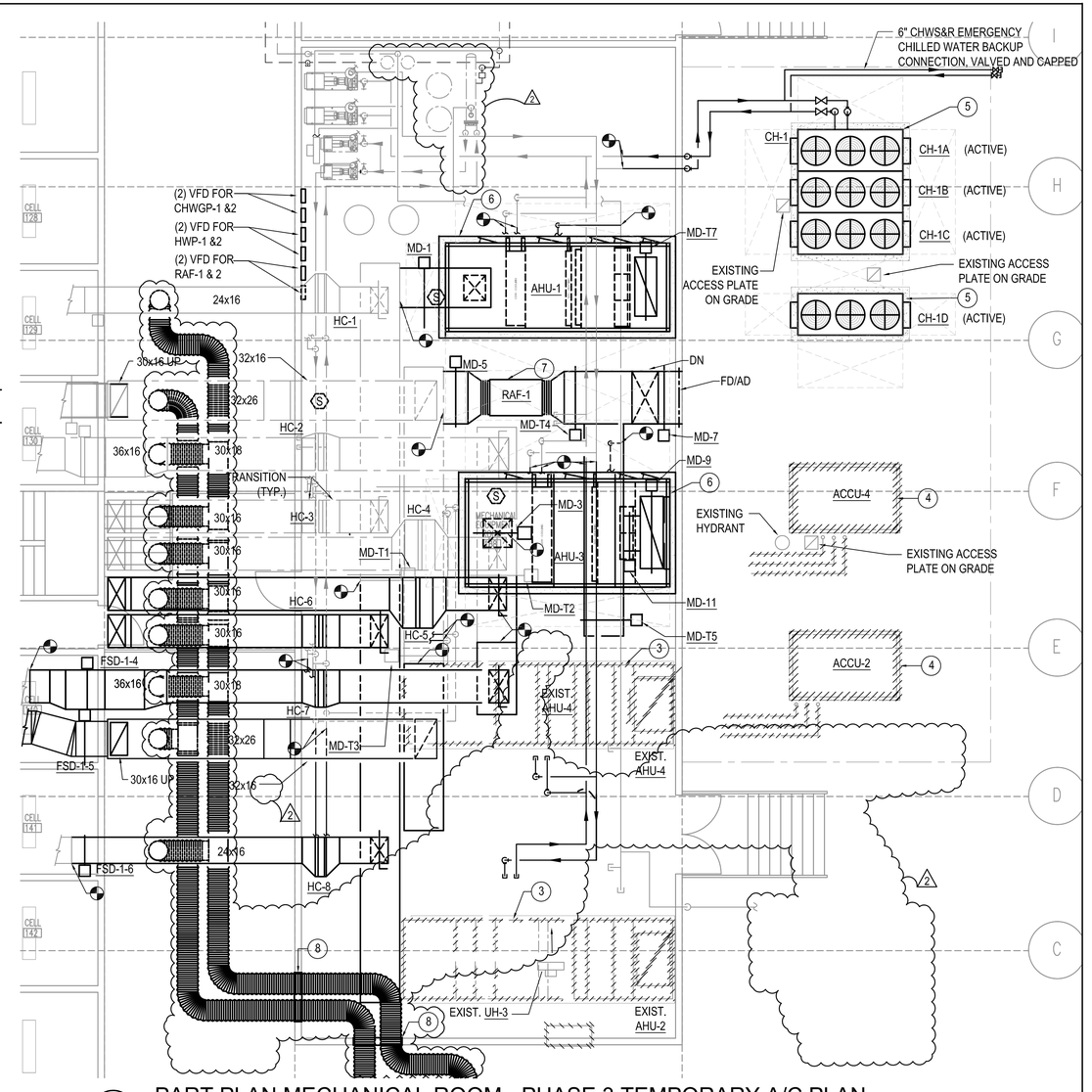
SCALE: 3/16"=1'-0"

TEMPORARY INSTALLATION NOTES: MAIN MECHANICAL ROOM (PHASE 2)

1. CONNECT TEMPORARY FLEXIBLE SUPPLY DUCT TO NEWLY INSTALLED SUPPLY PLENUM. REFER TO DWG. M-203.00 FOR ADDITIONAL INFORMATION.
2. CONNECT TEMPORARY FLEXIBLE RETURN DUCT TO NEWLY INSTALLED RETURN PLENUM. REFER TO DWG. M-203.00 FOR ADDITIONAL INFORMATION.
3. REMOVE EXISTING AHU & ALL ASSOCIATED ACCESSORIES. REFER TO DWG # DM-103.00 FOR REMOVAL PLAN & ADDITIONAL INFORMATION.
3A. RF-A-1 TO BE REMOVED. COORDINATE NEW DUCT WITH RF-A-1
4. REMOVE ACCU ALL ASSOCIATED ACCESSORIES. REFER TO DWG # DM-103.00 FOR REMOVAL PLAN & ADDITIONAL INFORMATION.
5. EXISTING ACCU -2 & 4 TO CONTINUE TO OPERATE.
6. EXISTING AHU -2 & 4 TO CONTINUE TO OPERATE.
7. EXISTING RETURN FAN RF-A-2 TO CONTINUE TO OPERATE.
8. PROVIDE AIR TIGHT CAP FOR FUTURE CONNECTION.
9. NEW LPS TO BE INSTALLED
10. NEW LPS TO BE CAPPED FOR FUTURE CONNECTION
11. TEMPORARY LPS CONNECT TO TEMP A/C UNIT.
12. NOT USED
13. CONTRACTOR TO PROVIDE TEMPORARY CHILL WATER GLYCOL FOR TEMPORARY CONSTRUCTION PHASE.
14. FOR CONTINUATION OF FLEX DUCTWORK SEE PM101.00
15. TEMPORARY FLEX DUCTWORK TO BE CONNECTED TO EXISTING DUCTWORK. SEE PM101.00 FOR PHASING DETAIL.

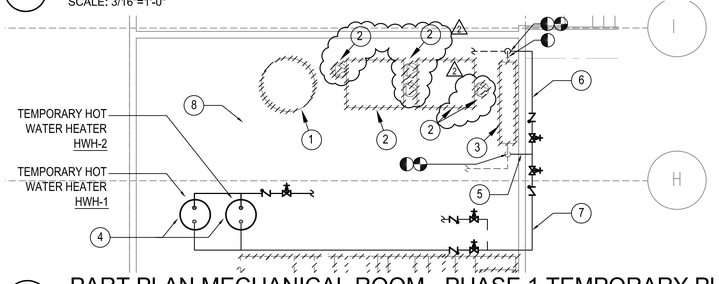
GENERAL NOTE (ALL PHASE):

1. CONTRACTOR TO PROVIDE CONTINUOUS CONSTRUCTION NOISE AND AIR QUALITY MONITORING AND DURING CONSTRUCTION WORK, DURATION OF CONTRACT AS PER CODE.
2. CONTRACTOR SHALL HIRE AN ACOUSTIC CONSULTANT TO ENSURE THE CODE ALLOWED NOISE LEVEL IS NOT EXCEEDED.
3. CONTRACTOR SHALL PROVIDE ALL NECESSARY COMPONENTS TO ENSURE SUCH COMPLIANCE.



3 PART PLAN MECHANICAL ROOM - PHASE 3 TEMPORARY A/C PLAN

SCALE: 3/16"=1'-0"



1 PART PLAN MECHANICAL ROOM - PHASE 1 TEMPORARY PLAN

SCALE: 3/16"=1'-0"

TEMPORARY INSTALLATION NOTES: MAIN MECHANICAL ROOM (PHASE 1)

1. EXISTING ABANDON TANK TO BE REMOVED.
2. EXISTING HOT WATER HEATER AND PUMPS. SEE REMOVAL PLAN FOR DETAIL.
3. EXISTING BACKFLOW PREVENTION ASSEMBLY TO BE REMOVED FOR THE STRUCTURAL WORK AND STORED FOR REUSE. . SEE REMOVAL PLAN FOR DETAIL.
4. PROVIDE (2) TEMPORARY ELECTRIC HEATER 4.5 KW EACH, 460V, 3PH, 60 HZ. INSTALL OUTSIDE THE STRUCTURAL WORK ZONE. CONNECT ALL POWER, WATER CONNECTION TO ENSURE UNINTERRUPTED WATER SUPPLY TO BUILDING. DISINFECT WATER SUPPLY AFTER WATER INSTALLATION. SEE DISINFECTION NOTE ON DRAWING M002.00.
5. CONTRACTOR SHALL PROVIDE TEMPORARY BYPASS CONNECTION AT CRAWL SPACE AND RUN PIPING TO THE M.E.R. OUTSIDE THE STRUCTURAL WORK AREA AND RECONNECT TO EXISTING DOMESTIC WATER AND FIRE PROTECTION SERVICE TO ENSURE UNINTERRUPTED WATER USAGE. PROVIDE TEMPORARY CHECK VALVE AND SHUTOFF VALVE ON BYPASS LINE. HEAT TRACE ALL EXPOSED PIPING. PROVIDE ELECTRIC POWER FOR ELECTRICAL HEAT TRACE CIRCUIT INTENDED FOR THE FINAL CHILLED WATER PIPE. DISINFECT WATER SUPPLY AFTER TEMPORARILY WORK INSTALLATION. SEE DISINFECTION NOTE ON DRAWING M004.00
6. TEMPORARY FIRE PROTECTION SERVICE
7. TEMPORARY DOMESTIC WATER SERVICE TO BE CONNECT TO EXISTING COLD WATER SERVICE & TEMPORARY HOT WATER HEATER.
8. ALL PIPING IN CRAWL SPACE SHALL BE REMOVED AND REPLACE WITH NEW IN THE AREA OF NEW STRUCTURAL SLAB. CONTRACTOR SHALL INCLUDE FOR PURPOSE OF CONTRACT 20'-0" OF THE FOLLOWING:
   - (1) 4" COND LPR
   - (1) 2" PD
   - (1) 12" SANITARY LINE
   - (1) 4" DOMESTIC WATER LINE
   - (1) 12" STORM LINE
   - (1) 6" DRAIN LINE
   - (1) 3" DRAIN LINE

TEMPORARY INSTALLATION NOTES: MAIN MECHANICAL ROOM (PHASE 3)

1. CONNECT TEMPORARY FLEXIBLE SUPPLY DUCT TO NEWLY INSTALLED SUPPLY PLENUM. REFER TO DWG. M-203.00 & PM101.00 FOR ADDITIONAL INFORMATION.
2. CONNECT TEMPORARY FLEXIBLE RETURN DUCT TO NEWLY INSTALLED RETURN PLENUM. REFER TO DWG. M-203.00 & PM101.00 FOR ADDITIONAL INFORMATION.
3. REMOVE EXISTING AHU & ALL ASSOCIATED ACCESSORIES. REFER TO DWG # DM-103.00 FOR REMOVAL PLAN.
4. REMOVE ACCU ALL ASSOCIATED ACCESSORIES. REFER TO DWG # DM-103.00 FOR REMOVAL PLAN.
5. NEW CHILLER SERVING NEW AHU-1 & 3. TO BE FULLY OPERATIONAL
6. NEW AHU -1 & 3 TO BE FULLY OPERATIONAL.
7. NEW RETURN FAN RAF-1 TO BE FULLY OPERATIONAL.
8. MAKE TEMPORARY OPENING TO RUN TEMPORARY DUCTWORK. OPENING TO BE PATCHED AND REPAIR TO ORIGINAL CONDITION AFTER ALL AHU 1,2,3 & 4 ARE INSTALLED AND FULLY FUNCTIONING.

SEE ADDITIONAL NOTES ON DRAWING PM-101.00

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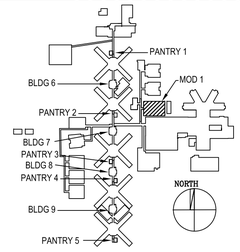

KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

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DESIGNED BY:

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Project:

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ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:

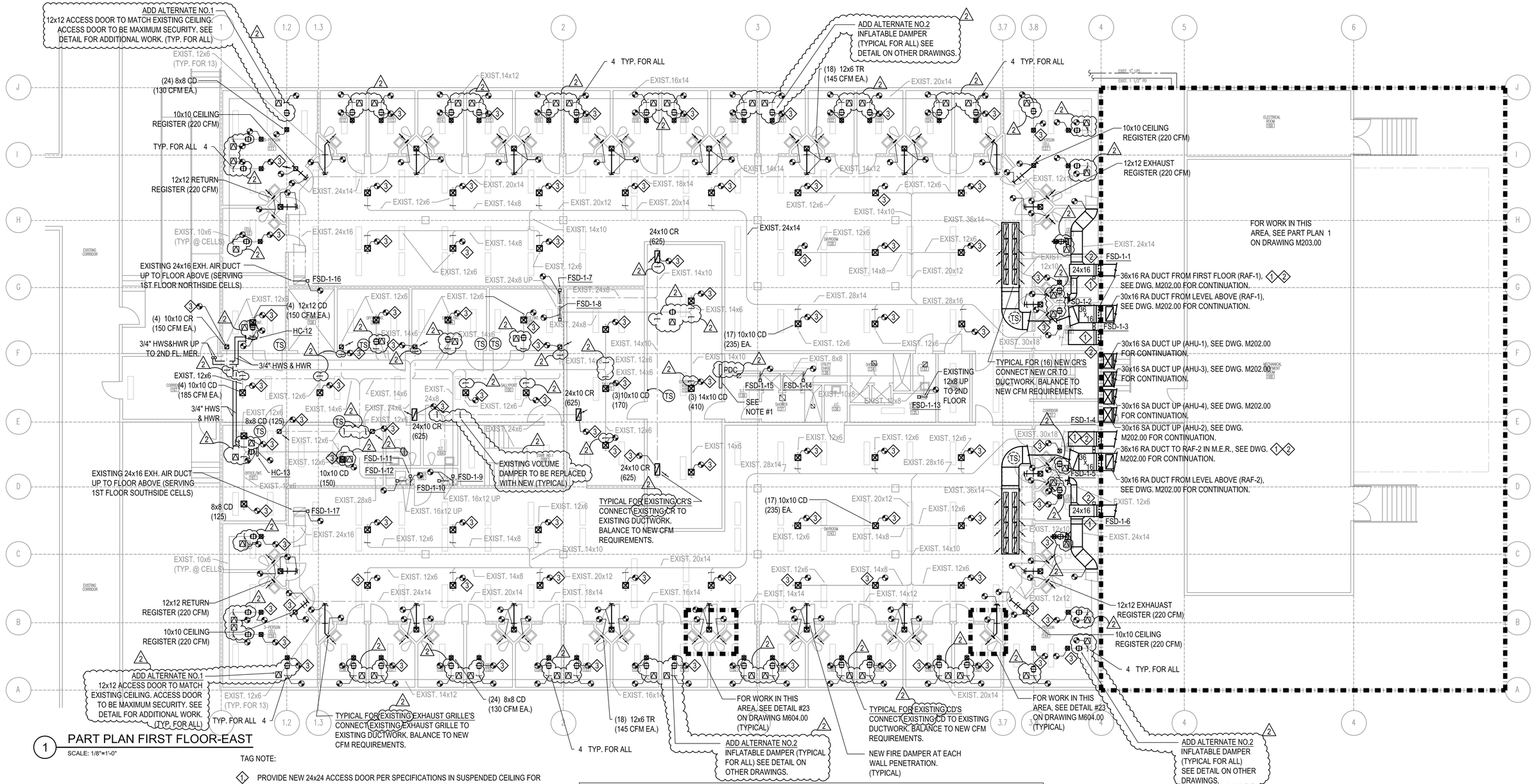
HVAC
PART PHASING PLAN
SHEET 2 OF 2

Seal:

Drawing No.: 2 PM102.00

Scale: 3/16" = 1'-0"

Sheet: 15 of 70



1 PART PLAN FIRST FLOOR-EAST

SCALE: 1/8"=1'-0"

TAG NOTE:

1. PROVIDE NEW 24x24 ACCESS DOOR PER SPECIFICATIONS IN SUSPENDED CEILING FOR ACCESS TO ALL DAMPERS. ACCESS DOOR CONSTRUCTION AND INSTALLATION SHALL BE FOR MAXIMUM SECURITY AND SHALL MATCH THE CEILING CONSTRUCTION.
2. SEE DUCTWORK PENETRATION DETAIL ON DRAWING M202.00 (2) DETAIL
3. CLEAN EXISTING AIR INLETS AND AIR OUTLETS IN PLACE THOROUGHLY. WIRE BRUSH AND COMB ALL APERTURES, PAINT AND FINISH RESTORE TO ORIGINAL CONDITION. PROVIDE SECURITY CAULKING AROUND THE AIR INLETS/OUTLET AND FLANGE ASSEMBLY FOR TIGHT SECURE INSTALLATION.
4. PROVIDE NEW VOLUME DAMPER AT ALL DUCT BRANCH LOCATIONS. RELOCATE LIGHT FIXTURES, GRILLES, OR OTHER COMPONENTS AS REQUIRED TO PERFORM WORKS. VOLUME DAMPERS SHALL BE INSTALLED IN CLOSE PROXIMITY TO INFLATABLE DAMPERS FOR ACCESS COMMON ACCESS DOOR.

NOTE:

1. PROVIDE NEW SMOKE PURGE PANEL TO BE INSTALLED IN CONTROL ROOM. SEE SEQUENCE ON SMOKE PURGE MATRIX AND SCHEDULE DWG. SMOKE PURGE PANEL TO BE INTERFACED WITH EXISTING FIRE ALARM SYSTEM. CONTRACTOR SHALL HIRE EXISTING FIRE ALARM SYSTEM VENDOR (SIMPLEX / GRINNELL) FOR INTERFACING SMOKE PURGE PANEL WITH EXISTING FIRE ALARM CONTROL PANEL.
2. PROVIDE FIRE SMOKE DAMPER AT EACH WALL PENETRATION (TYPICAL)
3. TYPICAL FOR EXISTING EXHAUST REGISTERS. CONNECT EXISTING EXHAUST REGISTERS TO EXISTING DUCTWORK. BALANCE TO CFM REQUIREMENTS. ENSURE TIGHT FIT WITH THE ARCHITECTURAL PORTION USING SECURITY FASTENERS. PROVIDE SECURITY CAULKING ON ALL SIDES OF THE REGISTER. OBTAIN APPROVAL FROM DOC.
4. PROVIDE NEW 12x12 ACCESS DOORS IN CEILING AS REQUIRED FOR ALL SERVICEABLE COMPONENTS SUCH AS DAMPERS, VALVES CONTROL ETC. FOR CONSTRUCTION ACCESS AND DUCT CLEANING CONTRACTOR.
5. ANY DUCT EXCEEDING 6" IN ANY DIMENSION SHALL BE PROVIDE WITH SECURITY BAR PER SPECIFICATION. MAXIMUM SECURITY AIR INLETS / AIR OUTLET SHALL BE EXCLUDED FOR HAVING SECURITY BARS.
6. CONTRACTOR TO PROVIDE CONSTRUCTION NOISE AND AIR QUALITY MONITORING DURING CONSTRUCTION WORK AS PER CODE.

1. REMOVE ALL CEILING/LIGHT FIXTURES, OTHER COMPONENTS AS NECESSARY TO PERFORM ALL WORK AS SHOWN WHETHER SPECIFICALLY INDICATED OR OTHERWISE.
2. ACCESS DOORS SHALL BE LOCATED FOR ACCESS TO BOTH INFLATABLE DAMPERS AND THE VOLUME DAMPERS. CUT CEILINGS AS REQUIRED TO INSTALL ALL DAMPERS AND RESTORE TO ORIGINAL CONDITION.

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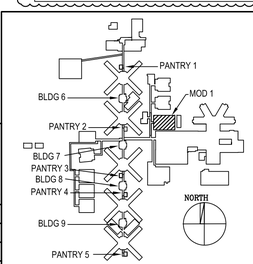

KEY PLAN

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DIVISION OF CAPITAL POLICY AND DEVELOPMENT ENGINEERING UNIT

DESIGNED BY:

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Project:

AIR CONDITIONING SYSTEM REPLACEMENT

MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:

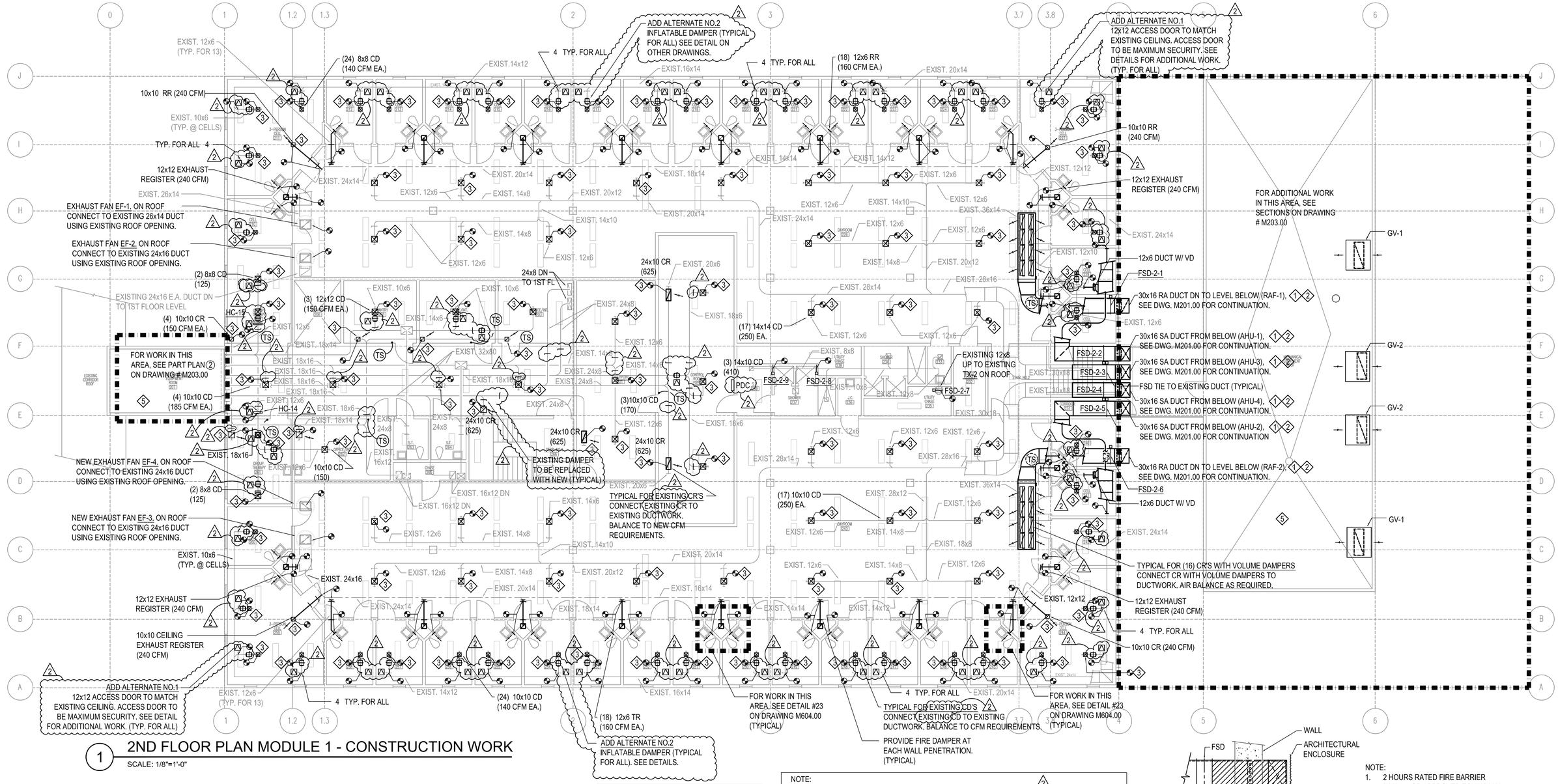
HVAC
FIRST FLOOR
CONSTRUCTION PLAN

Seal:

Drawing No.: M201.00

Scale: 1/8" = 1'-0"

Sheet: 16 of 70



1 2ND FLOOR PLAN MODULE 1 - CONSTRUCTION WORK

SCALE: 1/8"=1'-0"

TAG NOTE:

1. PROVIDE NEW 24x24 ACCESS DOOR PER SPECIFICATIONS IN SUSPENDED CEILING FOR ACCESS TO ALL DAMPERS. ACCESS DOOR CONSTRUCTION AND INSTALLATION SHALL BE FOR MAXIMUM SECURITY AND SHALL MATCH THE CEILING CONSTRUCTION.
2. SEE DUCT WORK PENETRATION INSTALLATION DETAIL 2 ON THIS DRAWING.
3. REINSTALL AND CLEAN EXISTING AIR INLETS AND AIR OUTLETS IN PLACE THOROUGHLY. WIRE BRUSH AND COMB ALL APERTURES, PAINT AND FINISH RESTORE TO ORIGINAL CONDITION. PROVIDE SECURITY CAULKING AROUND THE AIR INLETS/OUTLET AND FLANGE ASSEMBLY FOR TIGHT SECURE INSTALLATION.
4. PROVIDE NEW VOLUME DAMPER AT ALL DUCT BRANCH LOCATIONS. RELOCATE LIGHT FIXTURES / GRILLES / OTHER COMPONENTS AS REQUIRED TO PERFORM WALL
5. CONTRACTOR SHALL HIRE ROOFING CONTRACTOR TO PERFORM ALL ROOFING RELATED WORK TO ENSURE ROOF INTEGRITY IS MAINTAINED AFTER OTHER TRADE WORK IS INSTALLED.

1. REMOVE ALL CEILING/LIGHT FIXTURES, OTHER COMPONENTS AS NECESSARY TO PERFORM ALL WORK AS SHOWN WHETHER SPECIFICALLY INDICATED OR OTHERWISE.
2. ACCESS DOORS SHALL BE LOCATED FOR ACCESS TO BOTH INFLATABLE DAMPERS AND THE VOLUME DAMPERS. CUT CEILINGS AS REQUIRED TO INSTALL ALL DAMPERS AND RESTORE TO ORIGINAL CONDITION.

NOTE:
1. PROVIDE FIRE DAMPER AT EACH WALL PENETRATION (TYPICAL).
2. TYPICAL FOR EXISTING EXHAUST REGISTERS CONNECT EXISTING EXHAUST REGISTERS TO EXISTING DUCTWORK. BALANCE TO NEW CFM REQUIREMENTS. ENSURE TIGHT FIT WITH THE ARCHITECTURAL PORTION USING SECURITY FASTENERS. PROVIDE SECURITY CAULKING ON ALL SIDES OF THE REGISTER AND OBTAIN APPROVAL FROM DOC.
3. PROVIDE NEW 12x12 ACCESS DOORS IN CEILING AS REQUIRED FOR ALL SERVICEABLE COMPONENTS SUCH AS DAMPERS, VALVES CONTROL ETC. FOR CONSTRUCTION ACCESS AND DUCT CLEANING CONTRACTOR.
4. ANY DUCT EXCEEDING 6" IN ANY DIMENSION SHALL BE PROVIDE WITH SECURITY BAR PER SPECIFICATION. MAXIMUM SECURITY AIR INLETS / AIR OUTLET SHALL BE EXCLUDED FOR HAVING SECURITY BARS.
5. CONTRACTOR TO PROVIDE CONSTRUCTION NOISE AND AIR QUALITY MONITORING DURING CONSTRUCTION WORK AS PER CODE.

NOTE:
1. 2 HOURS RATED FIRE BARRIER (3M615+ OR APPROVED EQUAL) MIN. 24" INSIDE BUILDING. AND TOTAL MIN. LENGTH 8'-0"

2 DUCTWORK PENETRATION DETAIL

SCALE: N.T.S.

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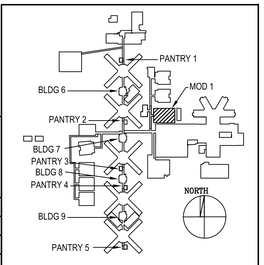

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Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

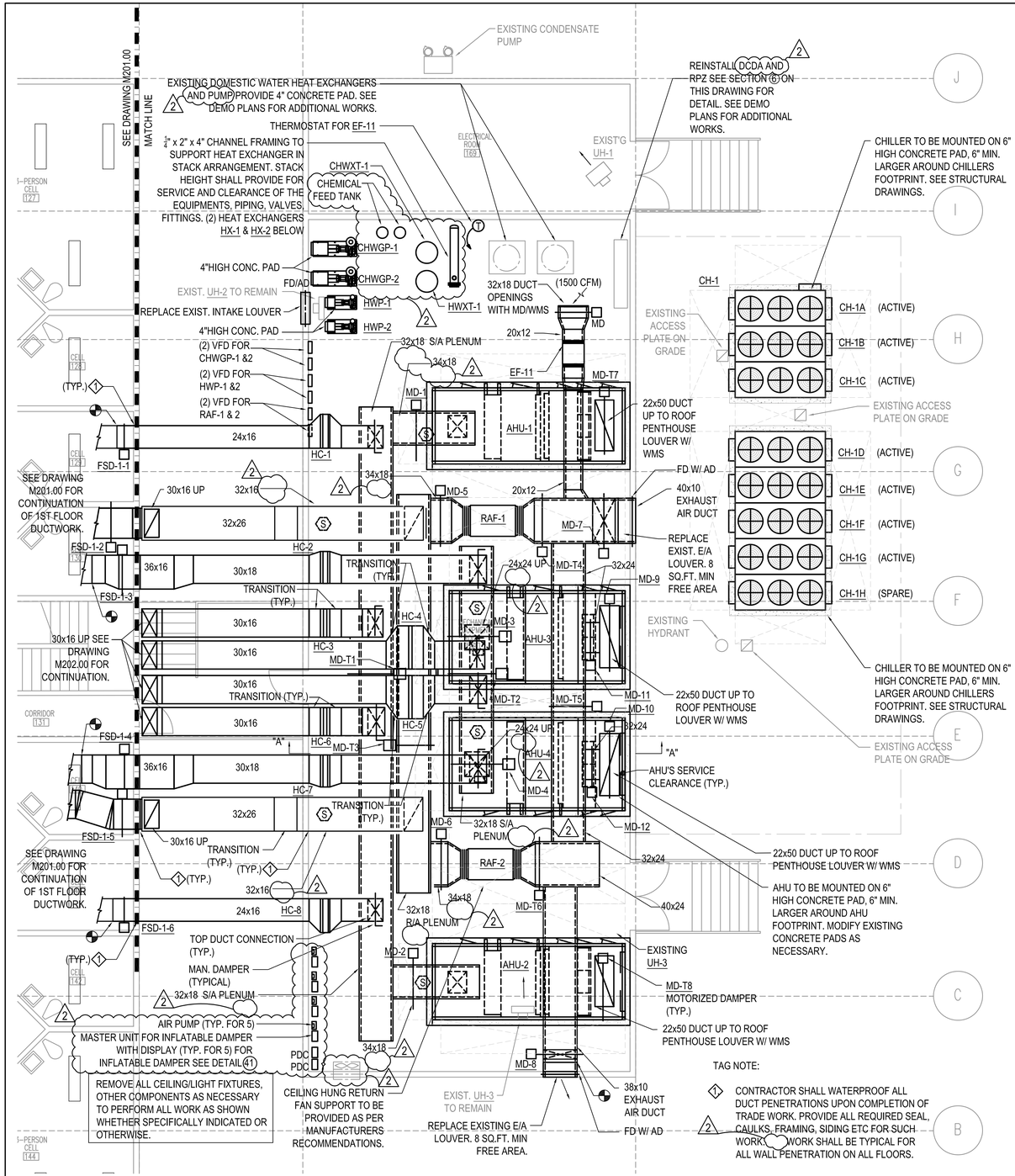
Drawing Title:
HVAC
SECOND FLOOR
CONSTRUCTION PLAN

Seal:

Drawing No.: M202.00

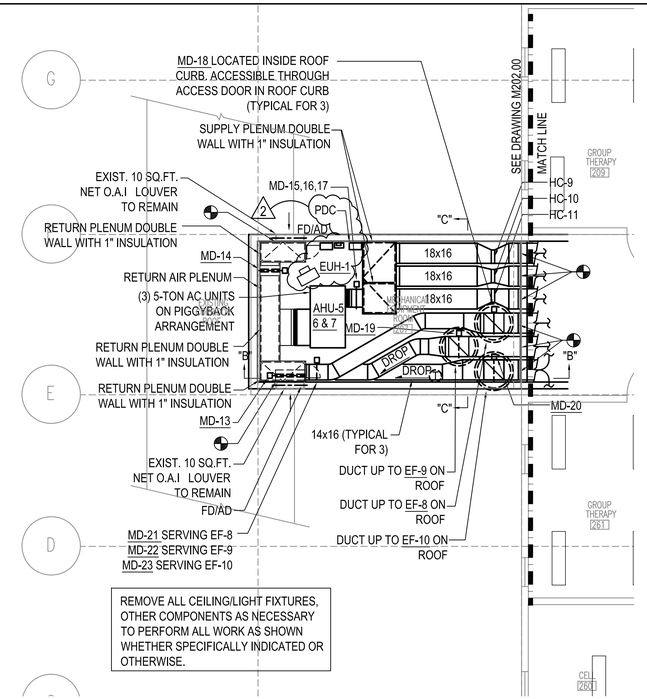
Scale: 1/8" = 1'-0"

Sheet: 17 of 70



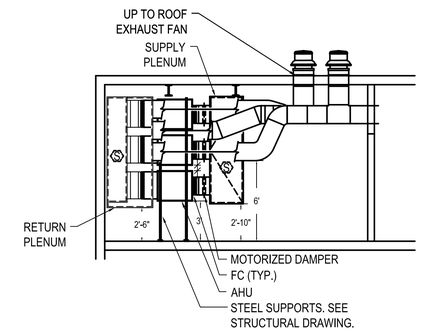
1 PART PLAN MECHANICAL ROOM - CONSTRUCTION WORK

SCALE: 3/16"=1'-0"



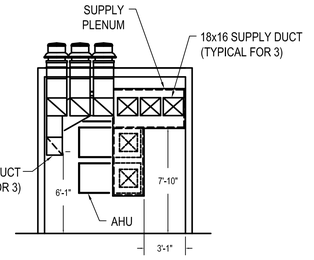
2 PART PLAN 2ND FLOOR M.E.R. - CONSTRUCTION WORK

SCALE: 3/16"=1'-0"



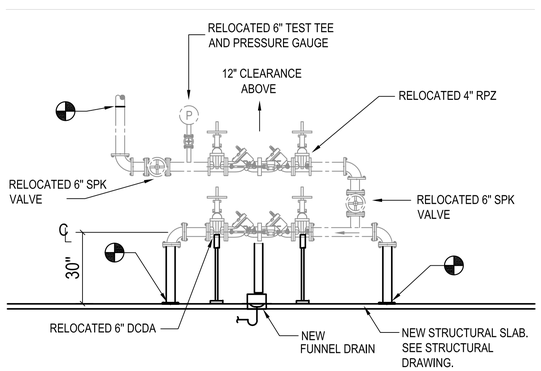
3 2ND FLOOR M.E.R. - ELEVATION "B-B"

SCALE: 3/16"=1'-0"



4 2ND FLOOR M.E.R. - ELEVATION "C-C"

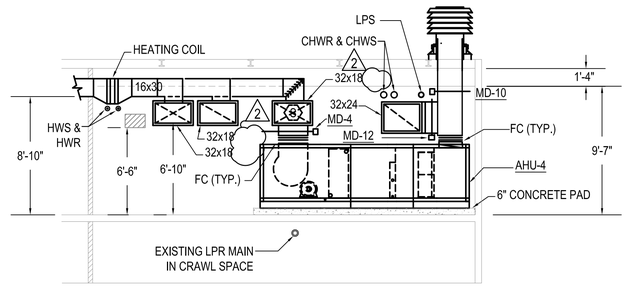
SCALE: 3/16"=1'-0"



1. REINSTALL DCDA-1 TO BE 30" ABOVE FLOOR LEVEL.
2. ELEVATION BETWEEN RPZ AND DCDA SHALL REMAIN
3. ALL VALVES, TEST TEE AND PRESSURE GAUGE SHALL RELOCATE ACCORDINGLY.
4. MINIMUM CLEARANCE TO FRONT OF DCDA & RPZ= 30"
5. MINIMUM CLEARANCE TO REAR OF DCDA & RPZ = 8"
6. SEE DISINFECTION NOTES ON GENERAL NOTES

6 MECHANICAL ROOM - ELEVATION "A-A"

SCALE: 3/16"=1'-0"



5 MECHANICAL ROOM - ELEVATION "A-A"

SCALE: 3/16"=1'-0"

GENERAL NOTE:
1. CONTRACTOR TO PROVIDE CONSTRUCTION NOISE AND AIR QUALITY MONITORING DURING CONSTRUCTION WORK AS PER CODE.

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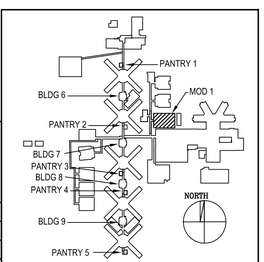

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Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:

HVAC - PART PLAN
MECHANICAL ROOMS
CONSTRUCTION PLAN

Seal:

Drawing No.: M203.00

Scale: 1/4" = 1'-0"

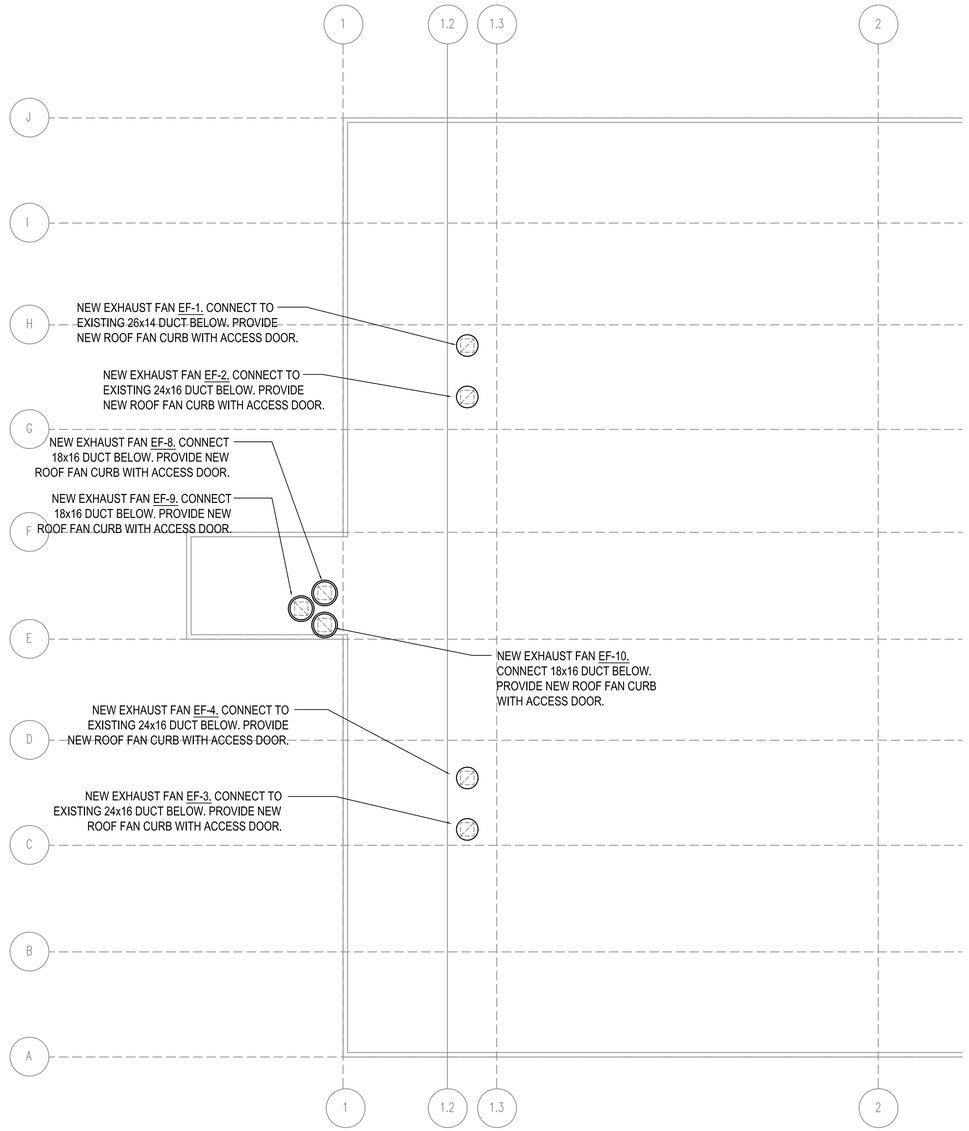
Sheet: 18 of 70

NOTE:

1. CONTRACTOR SHALL HIRE ROOFING CONTRACTOR TO PERFORM ALL ROOFING RELATED WORK TO ENSURE ROOF INTEGRITY IS MAINTAINED AFTER OTHER TRADE WORK IS INSTALLED.
2. CONTRACTOR TO PROVIDE CONSTRUCTION NOISE AND AIR QUALITY MONITORING DURING CONSTRUCTION WORK AS PER CODE. SEE ADDITIONAL NOTES IN REST OF CONTRACT DRAWINGS. (2)

1 ROOF PART PLAN - REMOVAL WORK

SCALE: 1/8"=1'-0"



NOTE:

1. CONTRACTOR SHALL HIRE ROOFING CONTRACTOR TO PERFORM ALL ROOFING RELATED WORK TO ENSURE ROOF INTEGRITY IS MAINTAINED AFTER OTHER TRADE WORK IS INSTALLED.
2. CONTRACTOR TO PROVIDE CONSTRUCTION NOISE AND AIR QUALITY MONITORING DURING CONSTRUCTION WORK AS PER CODE. SEE ADDITIONAL NOTES IN REST OF CONTRACT DRAWINGS. (2)

2 ROOF PART PLAN - CONSTRUCTION WORK

SCALE: 1/8"=1'-0"

REMOVE ALL CEILING/LIGHT FIXTURES, OTHER COMPONENTS AS NECESSARY TO PERFORM ALL WORK AS SHOWN WHETHER SPECIFICALLY INDICATED OR OTHERWISE.

0 4 8 16

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

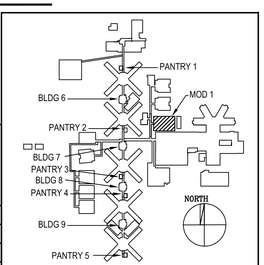
IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

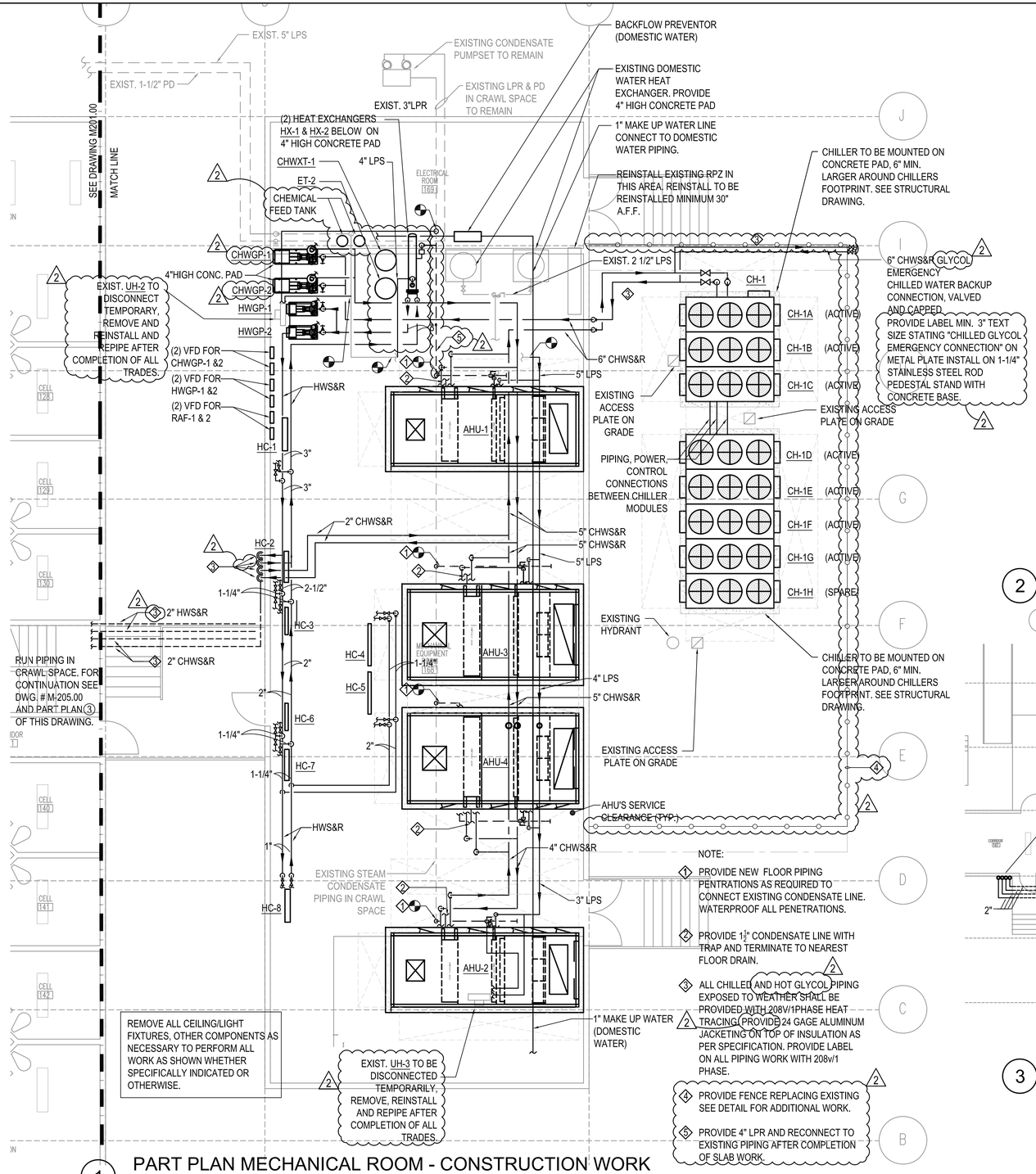
Drawing Title:
HVAC
ROOF REMOVAL &
CONSTRUCTION WORK

Seal:

Drawing No.:
M204.00

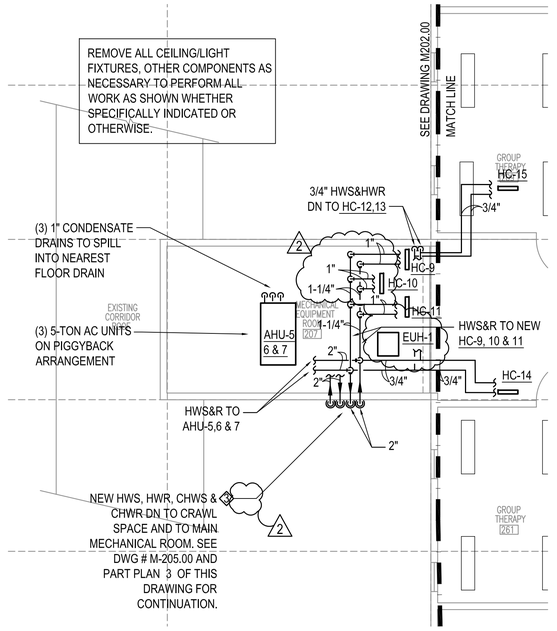
Scale: 1/8" = 1'-0"

Sheet: 19 of 70



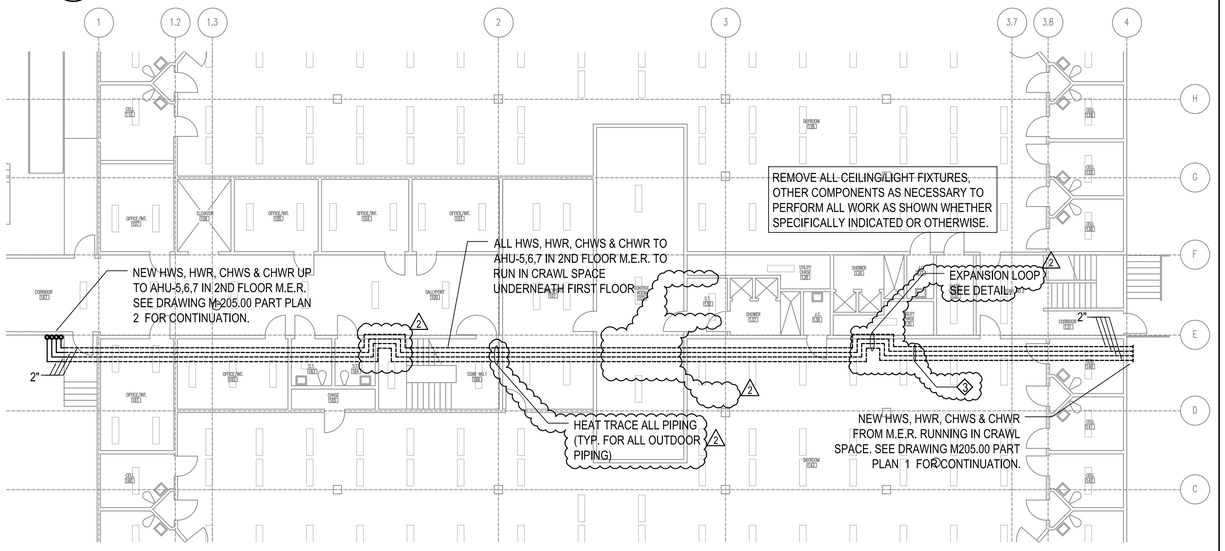
1 PART PLAN MECHANICAL ROOM - CONSTRUCTION WORK

SCALE: 3/16"=1'-0"



2 PART PLAN 2ND FLOOR M.E.R. - CONSTRUCTION WORK

SCALE: 3/16"=1'-0"

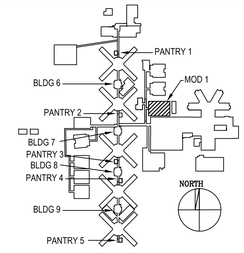


3 PART PLAN 1ST FLOOR. - CONSTRUCTION WORK

SCALE: 3/32"=1'-0"

GENERAL NOTE:
1. CONTRACTOR TO PROVIDE CONSTRUCTION NOISE AND AIR QUALITY MONITORING DURING CONSTRUCTION WORK AS PER CODE.

0 4 8 16



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No.	Date	Revision
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Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:

HVAC - PART PLAN
MECHANICAL ROOMS
PIPING PLAN

Seal:

Drawing No.: M205.00

Scale: 1/4" = 1'-0"

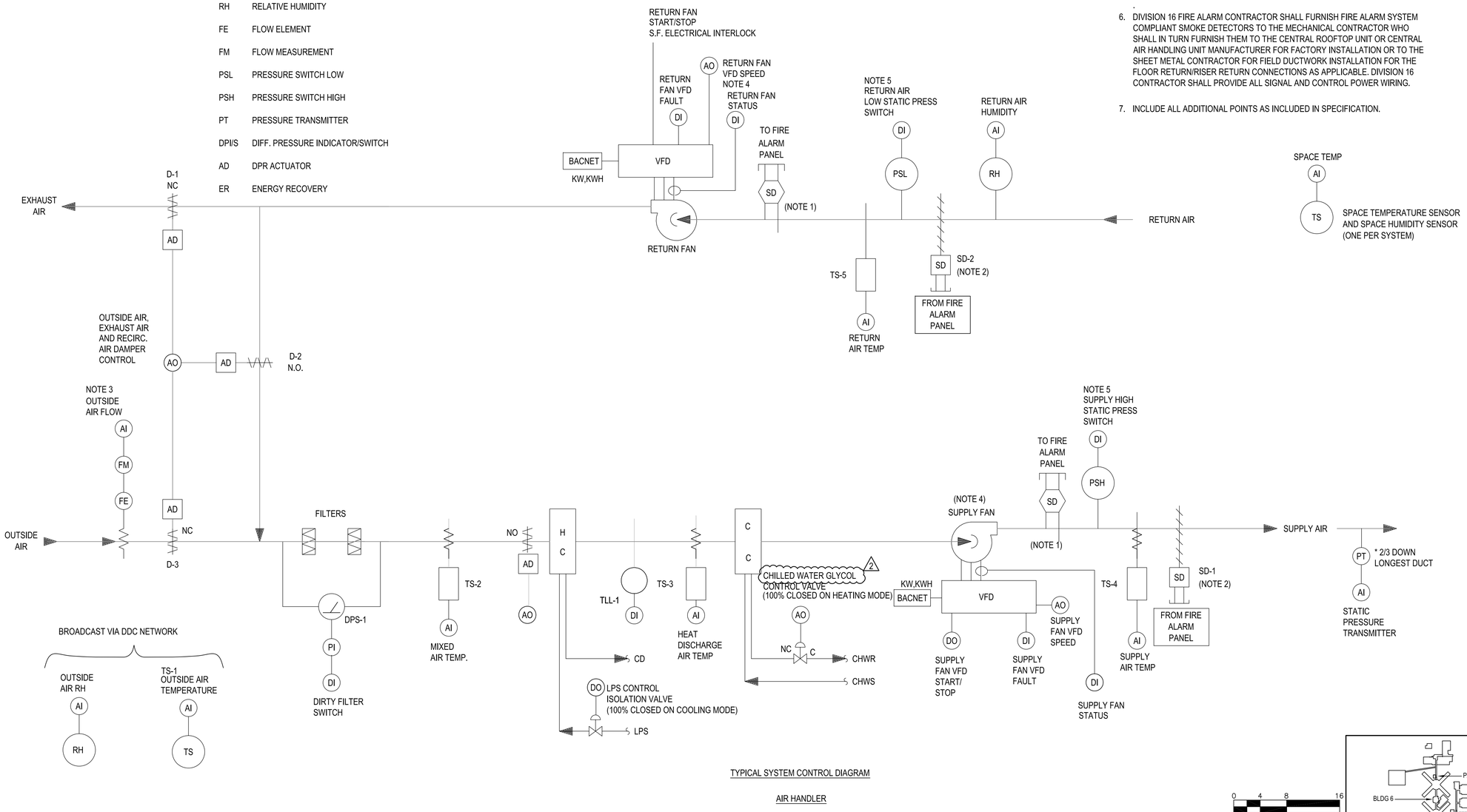
Sheet: 20 of 70

LEGEND

TLL-1	TEMPERATURE LOW LIMIT
TS-1	OUTSIDE AIR TEMP
TS-2	MIXED AIR TEMP
TS-3	PREHEAT DISCHARGE
TS-4	DISCHARGE AIR TEMP
TS-5	RETURN AIR TEMP
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
RH	RELATIVE HUMIDITY
FE	FLOW ELEMENT
FM	FLOW MEASUREMENT
PSL	PRESSURE SWITCH LOW
PSH	PRESSURE SWITCH HIGH
PT	PRESSURE TRANSMITTER
DPI/S	DIFF. PRESSURE INDICATOR/SWITCH
AD	DPR ACTUATOR
ER	ENERGY RECOVERY

NOTES:

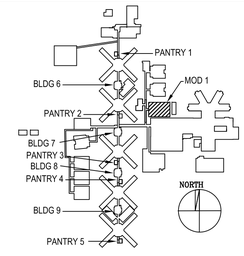
1. DUCT SMOKE DETECTORS SHALL BE PROVIDED IN MAIN SUPPLY AND RETURN DUCT FOR SYSTEMS OVER 2,000 CFM AND ALSO UPSTREAM OF EACH STORY RETURN DUCT/ RISER CONNECTION WHERE RETURN AIR RISERS SERVE TWO OR MORE STORIES FOR SYSTEMS OVER 15,000 CFM.
2. SMOKE DAMPERS SHALL BE PROVIDED IN MAIN SUPPLY AND RETURN DUCTS FOR SYSTEMS OVER 15,000 CFM.
3. INTEGRATE FLOW MEASURING APPARATUS INTO THE BMS/DDC NETWORK. PROVIDE ONE OUTSIDE AIR FLOW MEASURING STATION FOR EACH OUTSIDE AIR INTAKE PORT.
4. RETURN FAN VFD SHALL BE ELECTRICALLY INTERLOCKED WITH SUPPLY FAN VFD FOR START/STOP COMMAND AND SPEED TRACKING.
5. SAFETY DEVICES SHALL BE HARDWIRED TO THE FAN STARTER CIRCUIT IN ADDITION TO THE DDC SYSTEM. COORDINATE WITH THE VFD VENDOR FOR SHUTDOWN UNDER ALL MODES OF OPERATION.
.
6. DIVISION 16 FIRE ALARM CONTRACTOR SHALL FURNISH FIRE ALARM SYSTEM COMPLIANT SMOKE DETECTORS TO THE MECHANICAL CONTRACTOR WHO SHALL IN TURN FURNISH THEM TO THE CENTRAL ROOFTOP UNIT OR CENTRAL AIR HANDLING UNIT MANUFACTURER FOR FACTORY INSTALLATION OR TO THE SHEET METAL CONTRACTOR FOR FIELD DUCTWORK INSTALLATION FOR THE FLOOR RETURN/RISER RETURN CONNECTIONS AS APPLICABLE. DIVISION 16 CONTRACTOR SHALL PROVIDE ALL SIGNAL AND CONTROL POWER WIRING.
7. INCLUDE ALL ADDITIONAL POINTS AS INCLUDED IN SPECIFICATION.



TYPICAL SYSTEM CONTROL DIAGRAM

AIR HANDLER

0 4 8 16



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Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

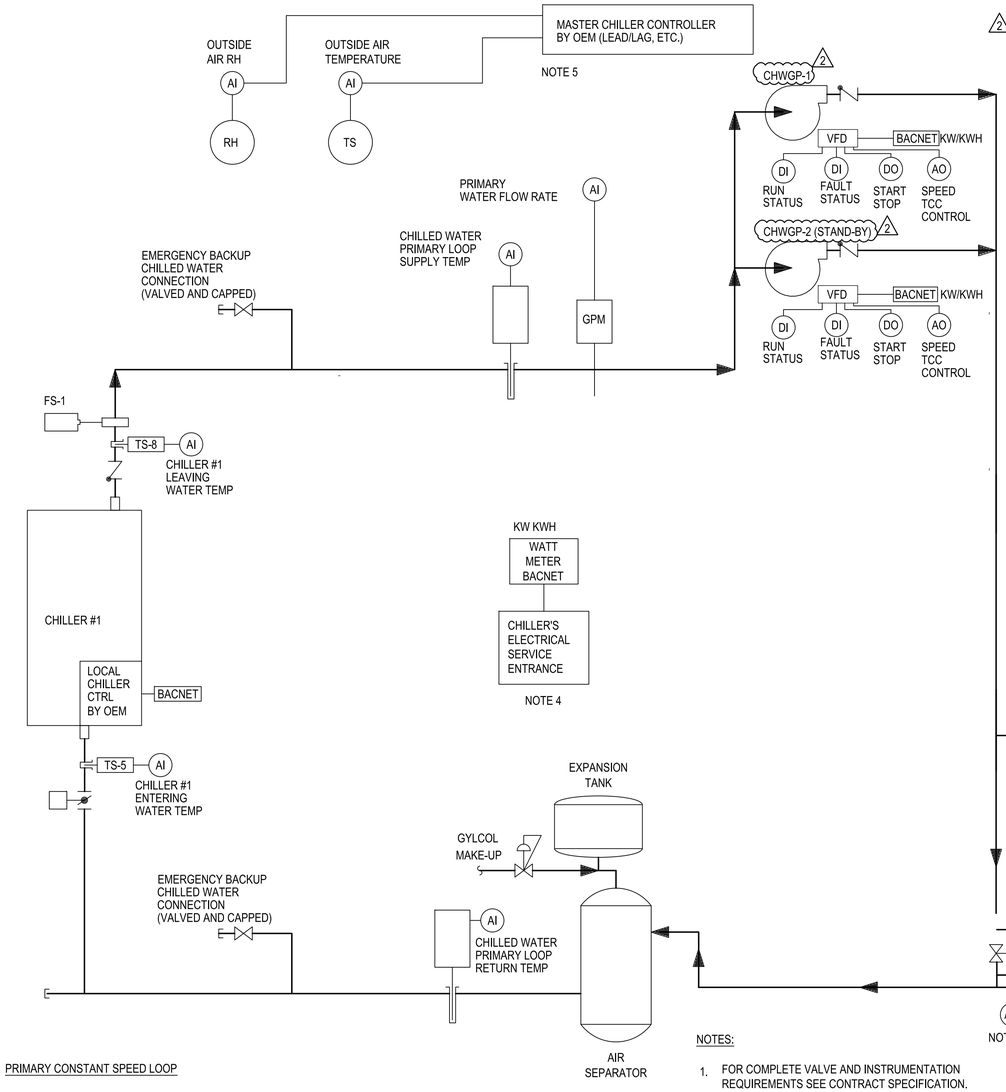
Drawing Title:
HVAC
AHU CONTROL
SCHEMATIC (AHU-3 & 4)

Seal:

Drawing No.: M302.00

Scale: NONE

Sheet: 22 of 70



CHILLED WATER PLANT MONITORING		INPUT/OUTPUT (NOTE 1)												SOFTWARE/FIRMWARE ARE FEATURES (NOTE: 2, 3)												
		SENSED				CALCULATED					CONTROL				ALARM AND ADVISORIES (WITH INSTRUCTIONS)							MISC. FEATURES				
REFERENCE NO.	POINT NAME	ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT	RATE OF VARIABLE	TOTALIZE VARIABLE	TOTALIZE RUNTIME	DEWPOINT	DIFFERENTIAL CO2	THERMAL EFFICIENCY	ANALOG CONTROL	DIGITAL CONTROL	SCHEDULED CONTROL	EVENT CONTROL	SUPERVISORY ALARM	CHANGE OF STATE	COS OFF-TO-ON	COS ON-TO-OFF	HIGH LIMIT ALARM	LOW LIMIT ALARM	RUNTIME LIMIT (HRS)	OTHER ALARM	MANUAL OVERRIDE	DIRECT LON COMMUNICATION	TRENDED VALUE	MISC. OTHER	NOTES
1	DIFFERENTIAL WATER PRESSURE	X																										
2	DIFFERENTIAL PRESSURE VALVE		X																									
3	DIFFERENTIAL WATER PRESSURE SETPOINT		X																									
4	CHILLER START/STOP				X							X		X												X		6
5	CHILLED WATER TEMPERATURE RESET	X									X									SP+10%	SP-10%					X		6
6	CHW SUPPLY TEMP	X									X															X		
7	CHW RETURN TEMP	X									X															X		
8	CHW SUPPLY TEMP-EACH CHILLER	X																								X		
9	CHW RETURN TEMP-EACH CHILLER	X																								X		
10	(NOT USED)																											
11	CHW PUMP VFD S/S				X							X		X														
12	CHW PUMP VFD STATUS			X				X							X							1000						
13	(NOT USED)																											
14	CHW PUMP VFD FAULT			X												X												
15	CHILLER CONTROLLER									X	X	X		X	X									X	X			4, 5
16	(NOT USED)																											
17	(NOT USED)																											
18	FLOW RATE	X				GPM				X																X		
19	CHILLER COMMOM ALARM			X																								

PRIMARY CONSTANT SPEED LOOP

KW KWH
WATT METER BACNET
CHW PUMP'S ELECTRICAL SERVICE ENTRANCE
NOTE 4

TYPICAL SYSTEM CONTROL DIAGRAM

CHILLED WATER PLANT

PRIMARY/SECONDARY PUMPING

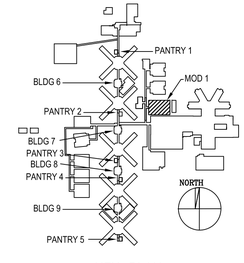
NOTES:

1. FOR COMPLETE VALVE AND INSTRUMENTATION REQUIREMENTS SEE CONTRACT SPECIFICATION.
2. USE 2-WAY VALVES FOR THROTTLING OF TERMINAL UNITS.
3. PROVIDE DIFFERENTIAL PRESSURE TRANSMITTER TO PROVIDE VARIABLE FLOW CONTROL SIGNAL TO OPERATING CHILLED WATER PUMPS AND DIFFERENTIAL PRESSURE VALVE. PROVIDE 2-WAY VALVE BYPASS SIZED IN THE AGGREGATE FOR THE FLOW REQUIRED TO SATISFY THE CRITICAL MINIMUM FLOW (40-45% VFD SPEED). TCC TO COORDINATE WITH WATER BALANCER.
4. THE TEMPERATURE CONTROLS CONTRACTOR SHALL PROVIDE AND INTEGRATE A WATT METER FOR THE ELECTRIC FEEDER THAT SERVES ALL OF THE CHILLERS. ONLY THE FEEDER THAT SERVES ALL OF THE CHILLERS (NOT EACH INDIVIDUAL CHILLER) REQUIRES KW AND KWH MONITORING VIA WATT METERING.
5. PROVIDE AND INTEGRATE A WATT METER FOR THE ELECTRIC FEEDER THAT SERVES ALL OF THE PRI. CHWP'S.
6. ENERGY MONITORING FOR EACH SECONDARY CHILLED WATER SUPPLY PUMP SHALL BE THROUGH THEIR RESPECTIVE VARIABLE FREQUENCY DRIVE AND SHALL BE INTEGRATED INTO THE BMS/DDC SYSTEM.
7. LOCAL CHILLER CONTROL PANELS AND MASTER CHILLER CONTROL PANEL BY OEM SHALL PROVIDE CONTROL OF PRIMARY PUMPS, FLOW SWITCH INTERFACE, ISOLATION VALVE CONTROL, LEAD/LAG CONTROL, ETC. SENSORS UTILIZED BY OEM CONTROL SYSTEM CAN ALSO BE UTILIZED FOR BMS/DDC SYSTEM BY MAPPING THROUGH GATEWAY. OTHER ALTERNATE IS FOR TCC TO PROVIDE THEIR OWN MONITORING SENSORS. OEM CONTROLS LEAD/LAG OF CHILLERS AND PRIMARY PUMPS. TCC CONTROLS ONLY MONITOR PRIMARY LOOP AND MONITOR/CONTROL SECONDARY LOOP.
8. PROVIDE ONE WATT METER TO MONITOR KW, KWH FOR ALL PRIMARY CONSTANT VOLUME PUMPS.
9. SECONDARY PUMP CONTROL/MONITORING BY TCC.
10. INCLUDE ALL ADDITIONAL POINTS AS INCLUDED IN SPECIFICATION.

LEGEND

DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
SSWT	SECONDARY SUPPLY WATER TEMPERATURE
SRWT	SECONDARY RETURN WATER TEMPERATURE
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
CHWPP	CHILLED WATER PUMP PRIMARY
CHWPS	CHILLED WATER PUMP SECONDARY
DP	DIFFERENTIAL PRESSURE TRANSMITTER
ECHWT	ENTERING CHILLED WATER TEMPERATURE
FS	FLOW SWITCH
LCHWT	LEAVING CHILLED WATER TEMPERATURE
PRWT	PRIMARY RETURN WATER TEMP
PSWT	PRIMARY SUPPLY WATER TEMP
VFD	VARIABLE FREQUENCY DRIVE
TS	TEMPERATURE SENSOR

0 4 8 16



KEY PLAN

THE CITY OF NEW YORK DEPARTMENT OF CORRECTION
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No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director: HARDEE SAINI
Project Manager: BV
Project Engineer:
Drawn By: Checked By: SB
PIN # 072201723CPD Date: 01/21/2015

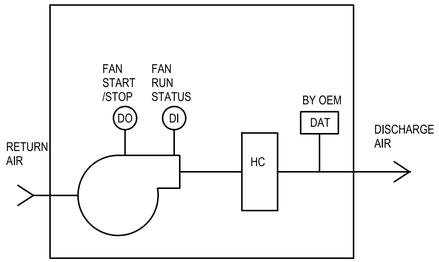
Drawing Title:
HVAC
CHILLER CONTROL
SCHEMATIC

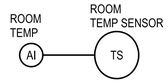
Seal:

Drawing No.: M303.00

Scale: NONE

Sheet: 23 of 70





ELECTRIC UNIT HEATER

AND CABINET UNIT HEATER

CONTROL DIAGRAM

LEGEND

TS-1	ROOM AIR TEMP
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
HC	ELECTRIC HEATING COIL
DAT	DISCHARGE AIR TEMPERATURE SENSOR

NOTES:

1. SMOKE DETECTORS AND FAN SHUTDOWN ARE NOT REQUIRED FOR TERMINAL UNIT HEATERS AND CABINET UNIT HEATERS ACTING IN A PURE RECIRCULATION MODE SINCE SUCH UNITS (SERVING ONE SPACE) ARE INCAPABLE OF SPREADING SMOKE BEYOND THE ENCLOSING WALLS, FLOORS AND CEILINGS OF THE ROOM OR SPACE IN WHICH THE SMOKE IS GENERATED (REFERENCE MC 606.2 EXCEPTION).
2. HOT WATER UNIT HEATER AND CABINET UNIT HEATER AQUASTAT IS BY OEM AND FUNCTIONS AS A LOW LIMIT CONTROL.
3. ELECTRIC UNIT HEATER AND CABINET UNIT HEATER DISCHARGE AIR TEMPERATURE SENSOR IS BY OEM AND FUNCTIONS AS A HIGH LIMIT CONTROL.

		INPUT/OUTPUT (NOTE 1)													SOFTWARE/FIRMWARE ARE FEATURES (NOTE:2,3)												
ELECTRIC UNIT HEATER		SENSED				CALCULATED						CONTROL				ALARM AND ADVISORIES (WITH INSTRUCTIONS)								MISC. FEATURES				
REFERENCE NO.	POINT NAME	ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT	RATE OF VARIABLE	TOTALIZE VARIABLE	TOTALIZE RUNTIME	DIFFERENTIAL CFM	DIFFERENTIAL CO2	OTHER CALCULATED	ANALOG CONTROL	DIGITAL CONTROL	SCHEDULED CONTROL	EVENT CONTROL	SUPERVISORY ALARM	CHANGE OF STATE	COS OFF-TO-ON	COS ON-TO-OFF	HIGH LIMIT ALARM	LOW LIMIT ALARM	RUNTIME LIMIT (HRS)	OTHER ALARM	MANUAL OVERRIDE	DIRECT BACNET COMMUNICATION	TRENDED VALUE	MISC. OTHER	NOTES
1	SPACE TEMP	X																			45°					X		
2	CONTROLLER/BACNET THERMOSTATS																								X			4
3	UNIT FAN START/STOP COMMAND				X																							
4	UNIT FAN STATUS			X												X												

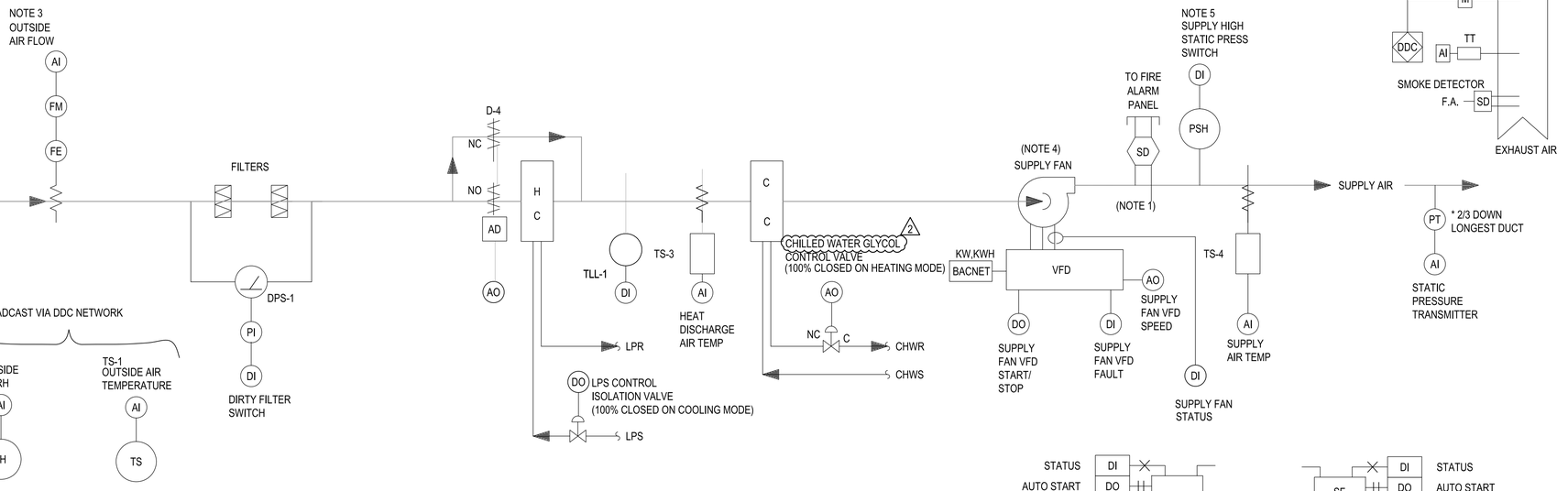
LEGEND:

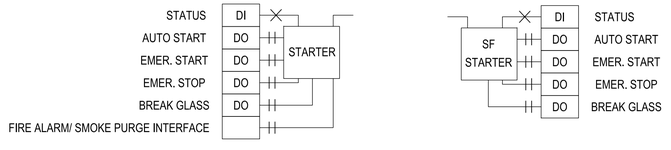
X= PROVIDE QUANTITY AS REQUIRED TO INCLUDE ALL INSTANCES OF THE INDICATED FEATURE. INCLUDE MULTIPLE POINTS WITHIN EACH MECHANICAL SYSTEM AS NECESSARY. COORDINATE WITH EQUIPMENT VENDOR.

NOTES:

1. THE POINT LISTED HEREIN ARE THE MINIMUM POINTS REQUIRED FOR THE CONTROL AND MONITORING OF THIS EQUIPMENT. THIS POINT LIST IS TYPICAL FOR EACH MECHANICAL/ELECTRICAL SYSTEM OF THIS TYPE. IF THE SEQUENCE OF OPERATION REQUIRES ADDITIONAL OR DIFFERING INFORMATION IT MUST BE PROVIDED BY THE RESPECTIVE PROVIDER OF THE CONTROLS FOR THIS TYPE OF EQUIPMENT AS COORDINATED BY THE GENERAL AND MECHANICAL CONTRACTORS.
2. THE TCC SHALL PROVIDE ALL DIGITAL ALARM LOGIC. ALL DIGITAL ALARMS SHALL BE PART OF THE LNS DATABASE.
3. THE FMSI SHALL PROVIDE ALL TRENDING AND ANALOG ALARMING VIA THE WONDERWARE SOFTWARE.
4. PROVIDE BACNET COMMUNICATION CONNECTION TO THIS DEVICE MAPPING ALL REQUIRED POINTS INTO THE LNS DATABASE.

ELETRIC UNIT HEATER CONTROL SCHEMATIC





LEGEND

TLL-1	TEMPERATURE LOW LIMIT	RH	RELATIVE HUMIDITY	AI	ANALOG INPUT
TS-1	OUTSIDE AIR TEMP	FE	FLOW ELEMENT	AO	ANALOG OUTPUT
TS-3	PREHEAT DISCHARGE	FM	FLOW METER	AD	DPR ACTUATOR
TS-4	DISCHARGE AIR TEMP	PSL	PRESSURE SWITCH LOW	ER	ENERGY RECOVERY
DI	DIGITAL INPUT	PSH	PRESSURE SWITCH HIGH	PI	PRESSURE INDICATOR
DO	DIGITAL OUTPUT	PT	PRESSURE TRANSMITTER		
		DPI/S	DIFF. PRESSURE INDICATOR/SWITCH		

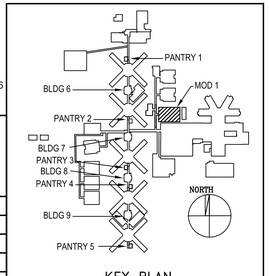
TYPICAL SYSTEM CONTROL DIAGRAM

FOR AIR HANDLING UNIT 1 & 2 (100% OUTSIDE AIR)

NOTES:

1. DUCT SMOKE DETECTORS SHALL BE PROVIDED IN MAIN SUPPLY AND RETURN DUCT FOR SYSTEMS OVER 2,000 CFM AND ALSO UPSTREAM OF EACH STORY RETURN DUCT/ RISER CONNECTION WHERE RETURN AIR RISERS SERVE TWO OR MORE STORIES FOR SYSTEMS OVER 15,000 CFM.
2. SMOKE DAMPERS SHALL BE PROVIDED IN MAIN SUPPLY AND RETURN DUCTS FOR SYSTEMS OVER 15,000 CFM.
3. INTEGRATE FLOW MEASURING APPARATUS INTO THE BMS/DDC NETWORK. PROVIDE ONE OUTSIDE AIR FLOW MEASURING STATION FOR EACH OUTSIDE AIR INTAKE PORT.
4. EXHAUST FANS VFD SHALL BE ELECTRICALLY INTERLOCKED WITH SUPPLY FAN VFD FOR START/STOP COMMAND AND SPEED TRACKING.
5. SAFETY DEVICES SHALL BE HARDWIRED TO THE FAN STARTER CIRCUIT IN ADDITION TO THE DDC SYSTEM. COORDINATE WITH THE VFD VENDOR FOR SHUTDOWN UNDER ALL MODES OF OPERATION.
6. DIVISION 16 FIRE ALARM CONTRACTOR SHALL FURNISH FIRE ALARM SYSTEM COMPLIANT SMOKE DETECTORS TO THE MECHANICAL CONTRACTOR WHO SHALL IN TURN FURNISH THEM TO THE CENTRAL ROOFTOP UNIT OR CENTRAL AIR HANDLING UNIT MANUFACTURER FOR FACTORY INSTALLATION OR TO THE SHEET METAL CONTRACTOR FOR FIELD DUCTWORK INSTALLATION FOR THE FLOOR RETURN/RISER RETURN CONNECTIONS AS APPLICABLE. DIVISION 16 CONTRACTOR SHALL PROVIDE ALL SIGNAL AND CONTROL POWER WIRING.
7. INCLUDE ALL ADDITIONAL POINTS AS INCLUDED IN SPECIFICATION.

0 4 8 16



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Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:

HVAC
ELEC. UNIT HTR. & AHU-1&2
CONTROL SCHEMATIC

Seal:

Drawing No.:

M304.00

Scale: NONE

Sheet: 24 of 70

		INPUT/OUTPUT (NOTE 1)														SOFTWARE/FIRMWARE FEATURES (NOTE 2, 3)												NOTES
"CONSTANT VOLUME AIR HANDLING UNIT"		SENSED				CALCULATED							CONTROL				ALARMS AND ADVISORIES (WITH INSTRUCTIONS)								MISC. FEATURES				
REFERENCE NO.	POINT NAME	ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT	RATE OF VARIABLE	TOTALIZE VARIABLE	TOTALIZED RUNTIME	DIFFERENTIAL CFM	DIFFERENTIAL CO2	OTHER CALCULATED	ANALOG CONTROL	DIGITAL CONTROL	SCHEDULED CONTROL	EVENT CONTROL	SUPERVISORY ALARM	CHANGE-OF-STATE	COS OFF-TO-ON	COS ON-TO-OFF	HIGH LIMIT ALARM	LOW LIMIT ALARM	RUNTIME LIMIT (HRS)	OTHER ALARM	MANUAL OVERRIDE	"DIRECT BACNET COMMUNICATION"	TRENDED VALUE	MISC. OTHER	NOTES
1	OUTSIDE AIR TEMP	B																										
2	OUTSIDE AIR HUMIDITY	B																										
3	OUTSIDE AIR CO2	B								C1																		6
4	MIXED AIR TEMP	X																			40.0F					X		
5	HEATING COIL DISCH TEMP	X																			40.0F					X		
6	SUPPLY AIR TEMP	X																								X		
7	RETURN AIR TEMP	X										X									55.0F							
8	RETURN AIR HUMIDITY	X										X																
9	SPACE TEMP	X										X									45.0F					X		
10	SPACE HUMIDITY	X										X								70.0%RH						X		8
11	SPACE CO2	X								C2										770ppm						X		6
12	DIRTY FILTER MONITOR	X															X			per Mfr								
13	FREEZESTAT ALARM			X													X				39.0F							
14	SF HIGH STATIC PRESSURE			X													X			[TBD]								5
15	RF LOW SUCTION PRESSURE			X									X				X				[TBD]							5
16	OUTSIDE AIR DAMPERS		X									X																
17	RETURN AIR DAMPERS		X									X																
18	SUPPLY AIR FLOW	X				cfm	CCF					X														X		NVO
19	COOLING COIL VALVE		X									X			X													
20	HEATING CONTROL		X									X			X													
21	OUTSIDE AIR FLOW	X				cfm	CCF					X								SP-10%	SP+10%					X		4, NVO
22	SUPPLY FAN STATUS			X				X								X						1,000						
23	SUPPLY FAN VFD				X									X	X	X									X			7
24	SUPPLY FAN VFD S/S																											
25	SUPPLY FAN VFD FAULT			X													X											
26	SUPPLY FAN VFD SPEED		X									X																
27	RETURN FAN STATUS			X				X								X						1,000						
28	RETURN FAN VFD																								X			7
29	RETURN FAN VFD FAULT			X													X											
30	RETURN FAN VFD SPEED		X									X																
31	COMMON FIRE ALARM (ONE/BLDG.)			X													X											
32	RETURN AIR FLOW	X				cfm	CCF					X														X		NVO
33	RETURN FAN VFD S/S				X									X	X	X												
34	HOA SWITCH NOT IN AUTO			X									X															
35	EXHAUST AIR DAMPERS		X									X																

LEGEND

X = PROVIDE QUANTITY AS REQUIRED TO INCLUDE ALL INSTANCES OF THE INDICATED FEATURE. INCLUDE MULTIPLE POINTS WITHIN EACH MECHANICAL SYSTEM AS NECESSARY. COORDINATE WITH EQUIPMENT VENDOR.

B = INFORMATION PROVIDED TO EACH SYSTEM VIA NETWORK BROADCAST.

TCC = TEMPERATURE CONTROLS CONTRACTOR

NOTES:

1. THE POINT LISTED HEREIN ARE THE MINIMUM POINTS REQUIRED FOR THE CONTROL AND MONITORING OF THIS EQUIPMENT. THIS POINT LIST IS TYPICAL FOR EACH MECHANICAL/ELECTRICAL SYSTEM OF THIS TYPE. IF THE SEQUENCE OF OPERATION REQUIRES ADDITIONAL OR DIFFERING INFORMATION, IT MUST BE PROVIDED BY THE RESPECTIVE PROVIDER OF THE CONTROLS FOR THIS TYPE OF EQUIPMENT AS COORDINATED BY THE GENERAL AND MECHANICAL CONTRACTORS.
2. THE TCC SHALL PROVIDE ALL DIGITAL ALARM LOGIC. ALL DIGITAL ALARMS SHALL BE PART OF THE LNS DATABASE.
3. THE TCC SHALL PROVIDE ALL TRENDING AND ANALOG ALARMING VIA THE WONDERWARE SOFTWARE.
4. PROVIDE ACCUMULATED AIR FLOW FOR VALIDATION OF PURGE-MODE AND FOR PERMANENT VALIDATION OF OCCUPANT VENTILATION.
5. PROVIDE MANUAL RESET DEVICE. NOTE THAT THIS DEVICE BOTH ALARMS IN THE BMS AND IS HARDWIRED TO THE VFDS FOR SHUTDOWN OF THE FANS IN ALL OPERATING CONDITIONS OF THE VFD.
6. PROVIDE THE ALARM INDICATED AT THE CALCULATED DIFFERENTIAL BETWEEN OUTSIDE AIR AND SPACE AIR CO2 VALUES.
7. PROVIDE BACNET COMMUNICATION CONNECTION TO THIS DEVICE MAPPING ALL REQUIRED POINTS INTO THE LNS DATABASE.
8. ALARM ONLY AFTER AN 8-HOUR CONSECUTIVE TIME PERIOD DURING WHICH THE RELATIVE HUMIDITY EXCEEDS ITS SETPOINT.

TYPICAL AHU SYSTEM CONTROL POINT SCHEDULE

		INPUT/OUTPUT (NOTE 1)														SOFTWARE/FIRMWARE ARE FEATURES (NOTE: 2, 3)												
LP STEAM / HOT WATER GLYCOL PLANT MONITORING		SENSED				CALCULATED						CONTROL				ALARM AND ADVISORIES (WITH INSTRUCTIONS)								MISC. FEATURES				
REFERENCE NO.	POINT NAME	ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT	RATE OF VARIABLE	TOTALIZE VARIABLE	TOTALIZE RUNTIME	DEWPOINT	DIFFERENTIAL CO2	THERMAL EFFICIENCY	ANALOG CONTROL	DIGITAL CONTROL	SCHEDULED CONTROL	EVENT CONTROL	SUPERVISORY ALARM	CHANGE OF STATE	COS OFF-TO-ON	COS ON-TO-OFF	HIGH LIMIT ALARM	LOW LIMIT ALARM	RUNTIME LIMIT (HRS)	OTHER ALARM	MANUAL OVERRIDE	DIRECT LON COMMUNICATION	TRENDED VALUE	MISC. OTHER	NOTES
1	DIFFERENTIAL WATER PRESSURE	X																										
2	DIFFERENTIAL PRESSURE VALVE		X																									
3	DIFFERENTIAL WATER PRESSURE SETPOINT		X																									
4	STEAM PRESSURE	X																		TBD	TBD					X		6
5	STEAM CONTROL VALVE % OPEN		X																									
6	HW (GLYCOL) SUPPLY TEMP	X									X															X		
7	HW (GLYCOL) RETURN TEMP	X									X															X		
8	HW SUPPLY TEMP-EACH CONVERTOR	X																								X		
9	HW RETURN TEMP-EACH CONVERTOR	X																								X		
10	(NOT USED)																											
11	HW (GLYCOL) PUMP VFD S/S				X							X		X														
12	HW (GLYCOL) PUMP VFD STATUS			X				X							X							1000						
13	(NOT USED)																											
14	HW (GLYCOL) PUMP VFD FAULT			X												X												
15	CONVERTOR CONTROLLER									X	X	X		X	X										X	X		4, 5
16	HW SUPPLY TEMP-EACH COIL	X																								X		
17	HW RETURN TEMP-EACH COIL	X																								X		
18	FLOW RATE	X				GPM				X																X		
19	CONVERTOR COMMOM ALARM			X																								

LEGEND:

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3. THE TCC SHALL PROVIDE ALL TRENDING AND ANALOG ALARMING VIA THE WONDERWARE SOFTWARE.
4. PROVIDE LON COMMUNICATION CONNECTION TO THIS DEVICE MAPPING ALL REQUIRED POINTS INTO THE LNS DATABASE.
5. PROVIDE REMOTE CHILLED WATER SETPOINT ADJUSTMENT.
6. WHEN USING THERMISTOR SENSORS USE MATCHED-PAIR ELEMENTS TO ELIMINATE INTER-SENSOR ERROR FACTOR.
7. INCLUDE ALL ADDITIONAL POINTS AS INCLUDED IN SPECIFICATIONS.

TYPICAL HEATING SYSTEM CONTROL POINT SCHEDULE

2

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CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
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ENGINEERING UNIT

DESIGNED BY:

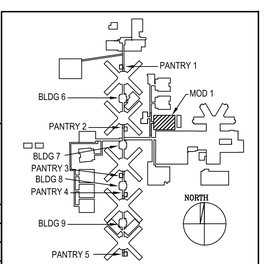
IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

Drawing Title:

HVAC
CONTROL TABLE

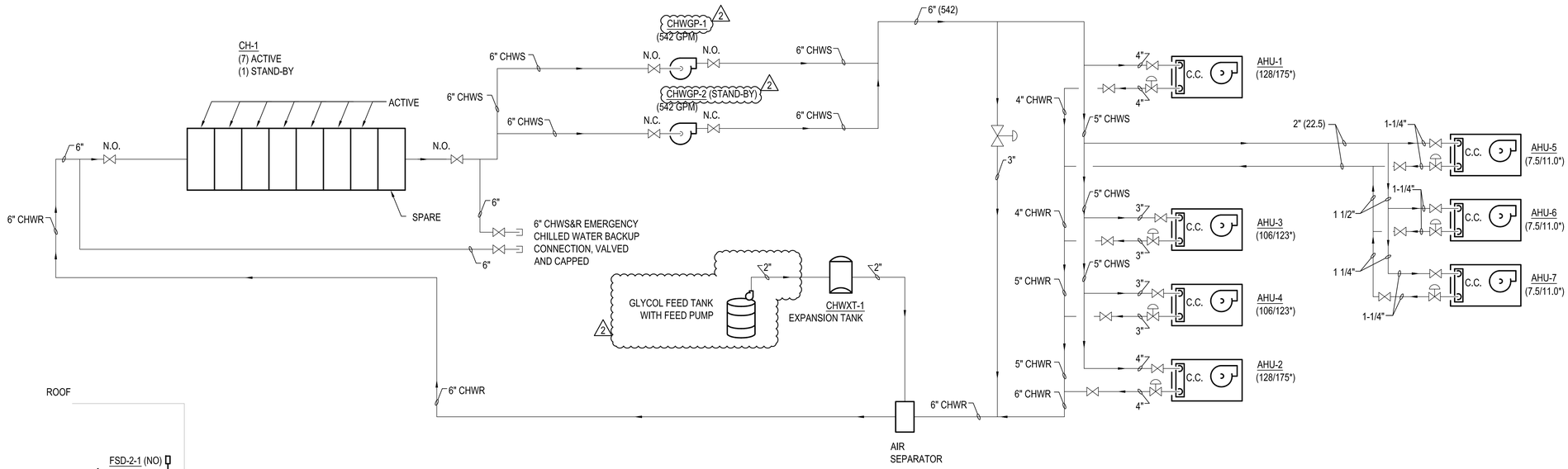
Seal:

Drawing No.:

M306.00

Scale: NONE

Sheet: 26 of 70

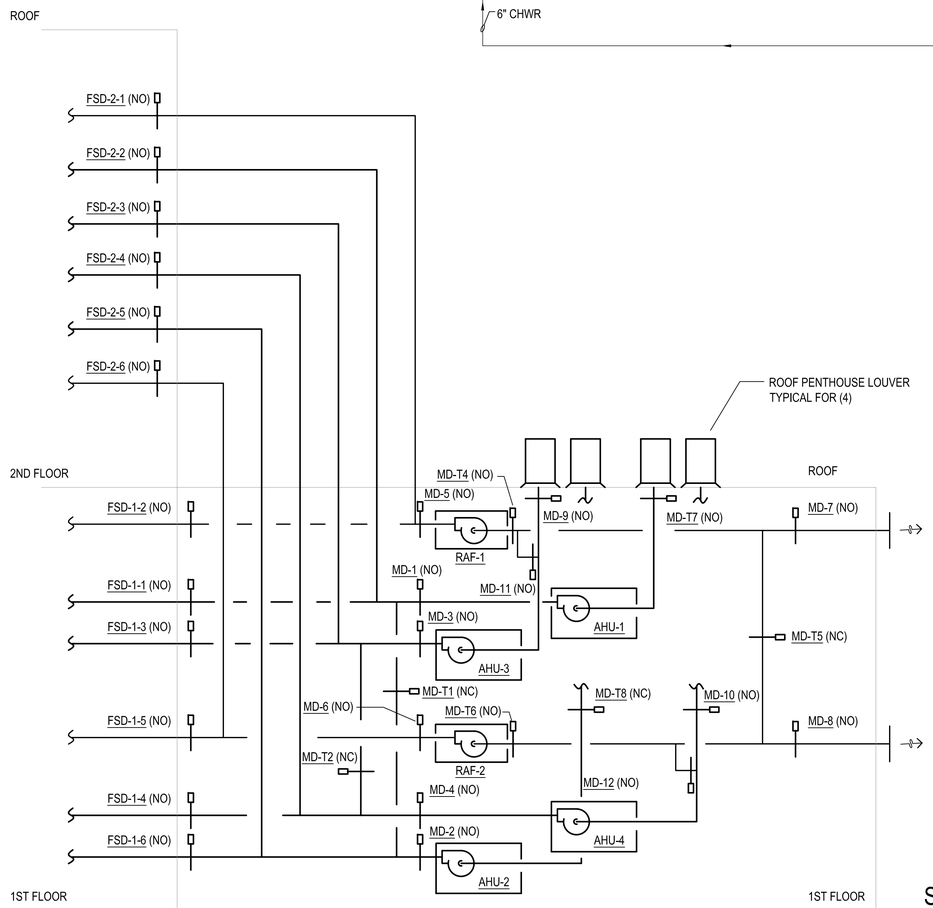


CHILLED WATER FLOW DIAGRAM

LEGEND

AHU	AIR HANDLING UNIT
CH	CHILLER
CHWHX	CHILLED WATER HEAT EXCHANGER
CHGP	CHILLED WATER GLYCOL PUMP
CHWXT	CHILLED WATER EXPANSION TANK
C.C.	COOLING COIL
N.O.	NORMALLY OPEN VALVE
N.C.	NORMALLY CLOSED VALVE
*	INDICATES GPM DURING BACK UP OPERATION

NOTE: THIS DRAWING INDICATES PIPING CONNECTIONS RELATIVE TO EACH EQUIPMENT ONLY. THE DRAWING DOES NOT INDICATE ALL VALVES, FITTINGS AND CONTROLS REQUIRED. SEE FLOOR PLANS FOR ACTUAL EQUIPMENT LOCATION, DETAILS, SPECIFICATIONS FOR VALVES, FITTINGS, CONTROLS AND OTHER COMPONENTS NECESSARY FOR A COMPLETE AND OPERATING SYSTEM.



SMOKE PURGE RISER DIAGRAM

SMOKE PURGE 1ST FLOOR NORTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-2, AHU-4, RAF-2 OFF.
FSD-1-2 OPEN.
RAF-1 ON.
FSD-1-1, FSD-1-3, OPEN.
MD-11 CLOSE.
AHU-1, AHU-3 ON.

SMOKE PURGE 1ST FLOOR SOUTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-1, AHU-3, RAF-1 OFF.
FAD-1-5 OPEN.
RAF-2 ON.
FSD-1-4, FSD-1-6 OPEN.
MD-12 CLOSE.
AHU-2, AHU-4 ON.

SMOKE PURGE 2ND FLOOR NORTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-2, AHU-4, RAF-2 OFF.
FSD-2-1 OPEN.
RAF-1 ON.
FSD-2-2, FSD-2-3, OPEN.
MD-11 CLOSE.
AHU-1, AHU-3 ON.

SMOKE PURGE 2ND FLOOR SOUTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-1, AHU-3, RAF-1 OFF.
FSD-2-6 OPEN.
RAF-2 ON.
FSD-2-4, FSD-2-5 OPEN.
MD-12 CLOSE.
AHU-2, AHU-4 ON.

LEGEND

AHU	AIR HANDLING UNIT
RAF	RETURN AIR FAN
FSD	COMBINATION FIRE SMOKE DAMPER
MD	MOTORIZED DAMPER
NO	NORMALLY OPEN
NC	NORMALLY CLOSED

0 4 8 16

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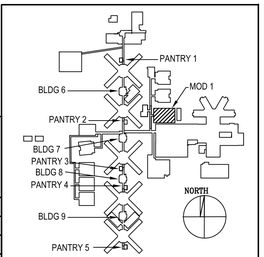

KEY PLAN

Drawing Title:
HVAC
CHILLED WATER / GLYCOL
FLOW DIAGRAM

Seal:

Drawing No.: M401.00

Scale: NONE

Sheet: 27 of 70

DUCT HEATING COIL SCHEDULE

BASIS OF SELECTION : GREENHECK

NO.	AREA SERVED	SYSTEM NO.	CFM	SIZE				PERFORMANCE DATE							REMARKS
				WIDTH INCH	HEIGHT INCH	ROWS	FINS PER INCH	EAT °F	LAT °F	CAPACITY MBH	APD IN. W.C.	EWT °F	LWT °F	FLOW RATE GPM	
HC-1	1ST FL CELLS	AHU-1	3130	36	20	1	10	70	95	84.5	0.12	180	160	8.5	
HC-2	1ST FL DAYROOM	AHU-3	4000	34	22.5	1	10	70	95	108	0.16	180	160	10.8	
HC-3	2ND FL CELLS	AHU-1	3370	30	22.5	1	10	70	95	91.0	0.16	180	160	9.1	
HC-4	2ND FL DAYROOM	AHU-3	4250	46	18	1	10	70	95	114.8	0.15	180	160	11.5	
HC-5	2ND FL DAYROOM	AHU-4	4250	46	18	1	10	70	95	114.8	0.15	180	160	11.5	
HC-6	2ND FL CELLS	AHU-2	3370	30	22.5	1	10	70	95	91.0	0.16	180	160	9.1	
HC-7	1ST FL DAYROOM	AHU-4	4000	34	22.5	1	10	70	95	108	0.16	180	160	10.8	
HC-8	1ST FL CELLS	AHU-2	3130	36	20	1	10	70	95	84.5	0.12	180	160	8.5	
HC-9	CONTROL ROOM	AHU-5, 6 & 7	2000	12	30	1	10	70	95	54.0	0.17	180	160	5.4	
HC-10	SALLYPORT	AHU-5, 6 & 7	2000	12	30	1	10	70	95	54.0	0.17	180	160	5.4	
HC-11	OFFICES	AHU-5, 6 & 7	2000	12	30	1	10	70	95	54.0	0.17	180	160	5.4	
HC-12	OFFICE/INT 107	AHU-5, 6 & 7	150	12	6	1	10	70	95	4.1	0.03	180	160	0.4	
HC-13	OFFICE/INT 161	AHU-5, 6 & 7	200	12	6	2	10	70	95	5.4	0.05	180	160	0.5	
HC-14	GROUP THERAPY 161	AHU-5, 6 & 7	200	12	6	2	10	70	95	5.4	0.05	180	160	0.5	
HC-15	GROUP THERAPY 209	AHU-5, 6 & 7	350	12	6	1	10	70	95	9.5	0.14	180	160	0.9	

PUMP SCHEDULE

BASIS OF DESIGN: BELL AND GOSSETT

NO.	LOCATION	SYSTEM SERVED	PERFORMANCE DATA				SELECTION DATA		MOTOR DATA				REMARKS
			GPM	TOT. DYN HD.FT	STAT. HD.FT	MODEL NO.	TYPE	%EFFCY	VOLT	PH	HP	RPM	
CHWGP-1	MER	CHILLED WATER	542	100	-	E-1510 - 4EB	END SUCTION	78.35	460	3	20	1800	ACTIVE
CHWGP-2	MER	CHILLED WATER	542	100	-	E-1510 - 4EB	END SUCTION	78.35	460	3	20	1800	STAND BY
HWGP-1	MER	HOT WATER	70	90	-	E-1510-1.5BC	END SUCTION	60.04	460	3	5	1800	ACTIVE
HWGP-2	MER	HOT WATER	70	90	-	E-1510-1.5BC	END SUCTION	60.04	460	3	5	1800	STAND BY

NOTES:

1. PROVIDE VARIABLE FREQUENCY DRIVES.
2. ALL VFDS SHALL BE INSTALLED IN THE RESPECTIVE MECHANICAL ROOMS AND ALL ELECTRICAL POWER SHALL BE PROVIDED TO THE VFDS AND FROM VFDS TO RESPECTIVE MOTORS. SEE CONTROL DIAGRAMS ON OTHER CONTRACT DOCUMENTS AND PROVIDE ALL REQUIRED CONTROLS AND LOGICS.
3. CHILLED WATER TO CONTAIN 40% PROPYLENE GLYCOL.

MODULAR AIR COOLED CHILLER SCHEDULE

BASIS OF DESIGN: ARCTICHILL

UNIT NO.	LOCATION	NOMINAL TONS	EVAPORATOR (40% GLYCOL)				COMPRESSOR DATA							AIR COOLED CONDENSER				TOTAL FLA AMPS	REFRIG.	MODEL NO.	REMARKS
			GPM	E.W.T. °F	L.W.T. °F	MAX P.D. FT. H2O	NO. OF COMPRESS.	HP PER COMPRES.	LRA AMPS	RLA AMPS	ELECTRICAL DATA VOLTS	PHASE	HERTZ	FANS QTY.	AMPS EA.	CFM EA.	EAT DEG. F	ELEC. DATA V/ PH/ HZ			
CH-1	OUTDOOR	240	542	48.5	37	5.5	2/MODULE	15.0	173	21.0 EA.	460	3	60	3/ MODULE	2.7	-	95/75	460/ 3/ 60	507.4	R-410A	(8) PACVMV0300D4-MM	EER - 10.3

NOTES:

1. CHILLERS SHALL BE MOUNTED ON 6" CONCRETE PAD, 6" MIN. LARGER AROUND CHILLER FOOTPRINT.
2. PROVIDE EACH CHILLER MODULE WITH VIBRATION ISOLATORS, SIZE, TYPE & QUANTITY AS PER MANUFACTURERS INSTRUCTIONS & RECOMMENDATIONS.
3. CHILLED WATER TO CONTAIN 40% PROPYLENE GLYCOL.
4. EACH MODULE SHALL BE WIRED INDIVIDUALLY FROM POWER SOURCE.
5. EACH MODULE SHALL BE PIPED ACCORDING TO MANUFACTURERS INSTRUCTIONS & RECOMMENDATIONS SUCH THAT FAILURE OF ONE OF THE MODULES WILL NOT AFFECT THE REMAINING MODULES.
6. INSTALL ACCORDING TO MANUFACTURERS INSTRUCTIONS & RECOMMENDATIONS.
7. CHILLER # 1 CONSISTS OF A TOTAL OF (8) MODULES: (7) ACTIVE MODULES & (1) SPARE MODULES.
8. MWSK (NYC ARCHTICHILL REP) TEL: 212-643-7700 TO PROVIDE FREE THE FOLLOWING:
   - 8.1. START-UP SUPERVISION.
   - 8.2. OPERATOR'S TRAINING
   - 8.3. INSTALLATION GUIDANCE IF NEEDED.
   - 8.4. LIFETIME TROUBLESHOOTING SUPERVISION (NO SERVICE, NO MAINTENANCE. CONTRACTOR TO PROVIDE ROUTINE MAINTENANCE AND SERVICE.)

EXPANSION TANK SCHEDULE

BASIS OF DESIGN: BELL AND GOSSETT

TYPE	MANUFACTURER	SYSTEM SERVED / FLUID	WATER TEMP °F	TYPE	MODEL	TANK VOL. (gal)	MAX. ACCEPT VOL. (gal)	REMARKS
CHWXT-1	BELL AND GOSSET	CHILLED WATER SYSTEM W/ 40% PROPLENE GLYCOL	40-50	VERTICAL	D-120V	68	34	TANK FITTING # ATF-12
HWXT-1	BELL AND GOSSET	HOT WATER SYSTEM W/ PROPYLENE GLYCOL	180-140	VERTICAL	D-144V	77	34	TANK FITTING # ATF-12

NOTES:

1. PROVIDE 4" MIN. CONCRETE PAD, 6" LARGER ALL AROUND THAN TANK FOOTPRINT.
2. TANK SIZE IS 16-1/4" X 56-1/4" HIGH, 516 LBS, 125 PSI ASME.
3. PIPE ACCORDING TO MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.

STEAM-TO-HYDRONIC HEAT EXCHANGER

BASIS OF DESIGN: BELL AND GOSSETT

ID	MANUFACTURER AND MODEL NUMBER	LOCATION	TYPE	USAGE	LOAD (MBH)	ENTERING PRESSURE (PSIG)	LBS STEAM PER HOUR	TRANSFER MEDIUM (HYDRONIC)			PHYSICAL		REMARKS
								FLOW RATE (GPM)	ENTERING/ LEAVING TEMP (°F)	WORKING FLUID (40% PROP. GLYCOL)	DIA./ LEGNTH (IN/IN)		
HX-1	BELL & GOSSET SU-85-2	1ST FL MER	SHELL & TUBE	HEATING	816	5	849.6	70	180/200	WATER	9"/66"		
HX-2	BELL & GOSSET SU-85-2	1ST FL MER	SHELL & TUBE	HEATING	816	5	849.6	70	180/200	WATER	9"/66		

NOTES:

1. INSTALL ACCORDING TO MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
2. PROVIDE STRUCTURAL SUPPORT AND CONCRETE PAD.

ELECTRIC UNIT HEATER SCHEDULE

BASIS OF DESIGN: QMARK

UNIT NO.	LOCATION AND AREA SERVED	PERFORMANCE DATA				SELECTION DATA		MOTOR DATA				REMARKS
		EDB 60 DEG F		ELECTRICAL		MANUFACTURER	MODEL NO.	HP	VOLT	PH	HZ	
		CFM	MBH	KW	VOLT/PH							
EUH-1	MER 2ND FLOOR	350	10.20	3.0	208/1	QMARK	MUH-HORZ.	1/100	208	1	60	

NOTES:

1. INSTALL ACCORDING TO MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
2. ELECTRIC UNIT HEATER SHALL BE THERMOSTATICALLY CONTROLLED.

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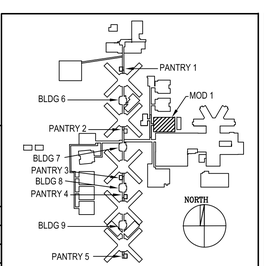


KEY PLAN

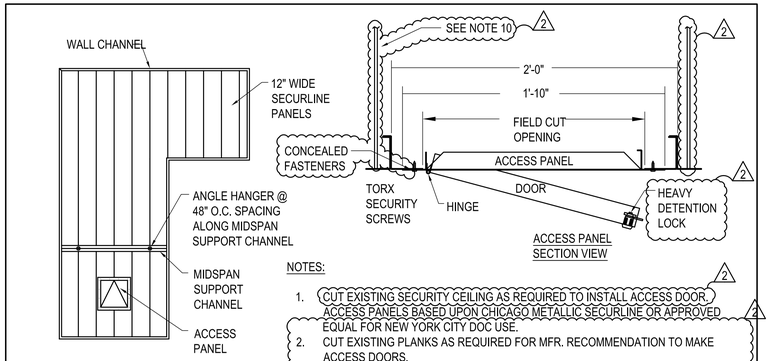
Drawing Title:
HVAC
SCHEDULE
SHEET 2 OF 2

Seal:

Drawing No.:
M502.00

Scale: NONE

Sheet: 30 of 70



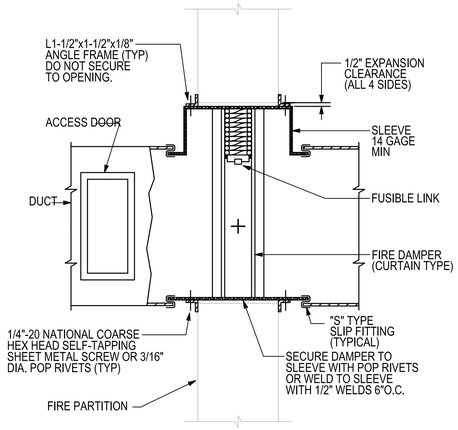
TYPICAL REFLECTED CEILING PLAN
SCALE: 1/4"=1'-0"

NOTES:

1. CUT EXISTING SECURITY CEILING AS REQUIRED TO INSTALL ACCESS DOOR. ACCESS PANELS BASED UPON CHICAGO METALLIC SECURLINE OR APPROVED EQUAL FOR NEW YORK CITY DOC USE.
2. CUT EXISTING PLANKS AS REQUIRED FOR MFR. RECOMMENDATION TO MAKE ACCESS DOORS.
3. INSTALL MAX. SECURITY TYPE ACCESS DOOR WITH TAMPER PROOF CONCEALED FASTENERS PER MRF. RECOMMENDATION.
4. PROVIDE SECURITY CAULKING FOR ALL EDGES AND ENSURE NO GAPS ARE PRESENT.
5. OBTAIN DOC-SECURITY SIGN OFF AFTER INSTALLATION.
6. PAINT AND FINISH TO MATCH EXISTING CEILING.
7. ALL CEILINGS SHALL BE CLEAN THOROUGHLY AND PAINTED.
8. ALL INSTALLATION SHALL BE SUICIDE PROOF.
9. SEE SPECIFICATION FOR ACCESS DOORS.
10. ACCESS DOOR SHALL BE INDEPENDENTLY SUSPENDED FROM STRUCTURAL SLABS.

(7) SCALE: NONE

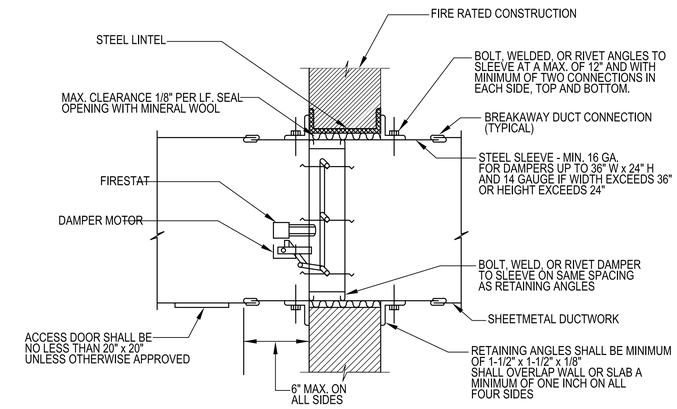
SECURITY METAL PAN CEILING ACCESS DOOR DETAIL



NOTE: ALL CONNECTIONS TO DUCT SHALL CONFORM TO UL555 AND NFPA 90A

(8) SCALE: NONE

VERTICAL FIRE DAMPER DETAIL

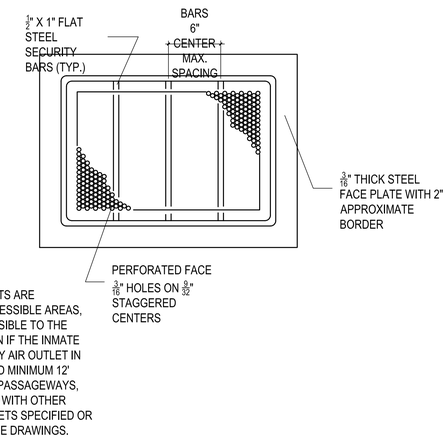


NOTES:

1. FIRESTAT AND DAMPER MOTOR TO BE OUTSIDE OF AIR STREAM.
2. DAMPER SHALL BE FACTORY PROVIDED WITH TWO (2) LIMIT SWITCHES, ONE N.O. AND ONE N.C.

(9) SCALE: NONE

COMBINATION FIRE & SMOKE DAMPER DETAIL

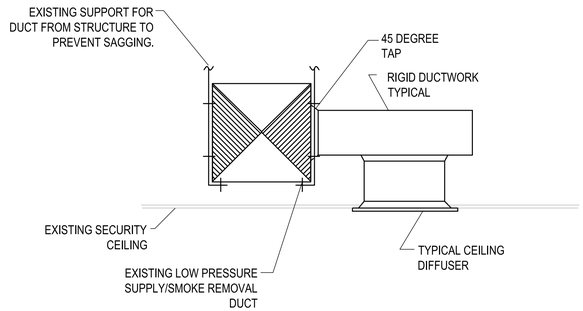


NOTES:

ONLY THIS TYPE OF AIR OUTLETS ARE PERMITTED IN ALL INMATE ACCESSIBLE AREAS, DEFINED AS ALL AREAS ACCESSIBLE TO THE INMATES AT THE FACILITY EVEN IF THE INMATE PRESENCE IS MOMENTARY. ANY AIR OUTLET IN DAYROOMS THAT ARE LOCATED MINIMUM 12' RADIALLY FROM ANY FLOORS, PASSAGEWAYS, STAIRWAYS MAY BE PROVIDED WITH OTHER TYPE OF AIR INLETS AND OUTLETS SPECIFIED OR SCHEDULED ELSEWHERE IN THE DRAWINGS.

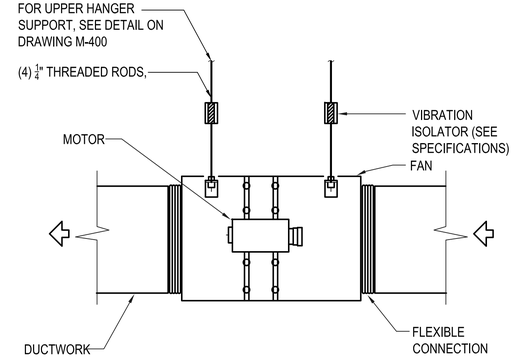
(10) SCALE: NONE

MAXIMUM SECURITY/PSYCHIATRIC TYPE RISK RESISTANT AIR INLET/OUTLET DETAIL FOR ALL INMATE ACCESSIBLE AREA



(11) SCALE: NONE

TYPICAL DAYROOM SUPPLY DIFFUSER DETAIL



(12) SCALE: NONE

INLINE FAN HANGING SUPPORT DETAIL

0 4 8 16

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
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DESIGNED BY:

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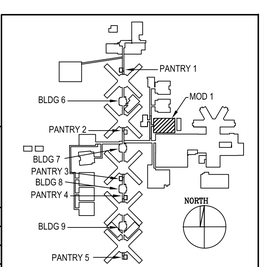
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

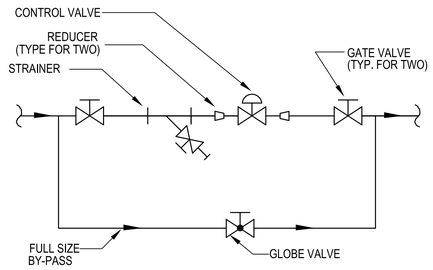
Drawing Title:
HVAC - DETAILS
SHEET 2 OF 8 (2)

Seal:

Drawing No.:
M602.00

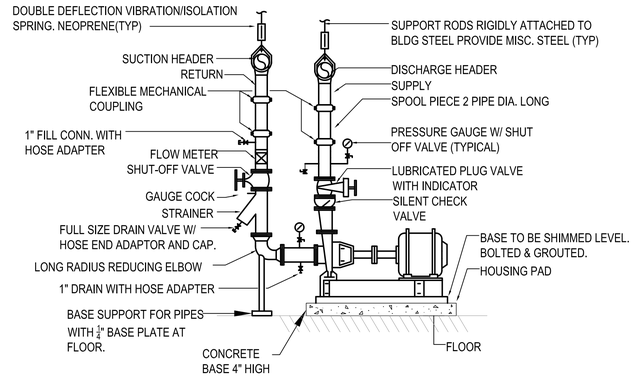
Scale: NONE

Sheet: 32 of 70



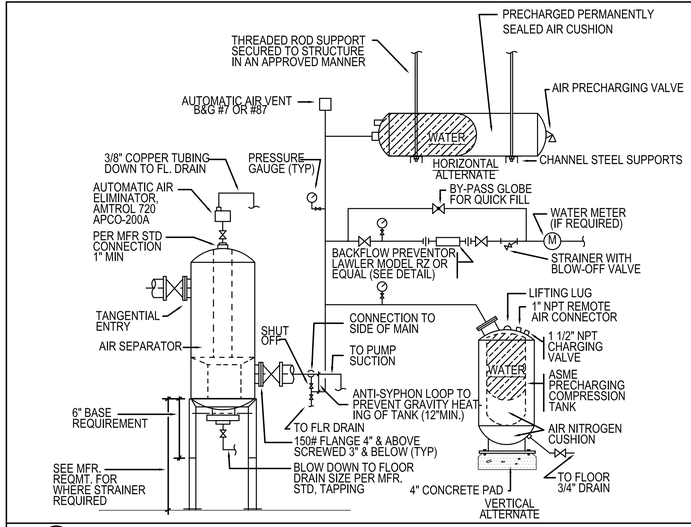
19 SCALE: NONE

CONTROL VALVE PIPING DETAIL



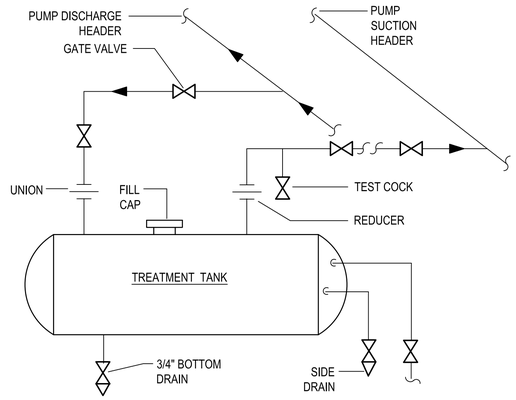
20 SCALE: NONE

END SUCTION PUMP DETAIL



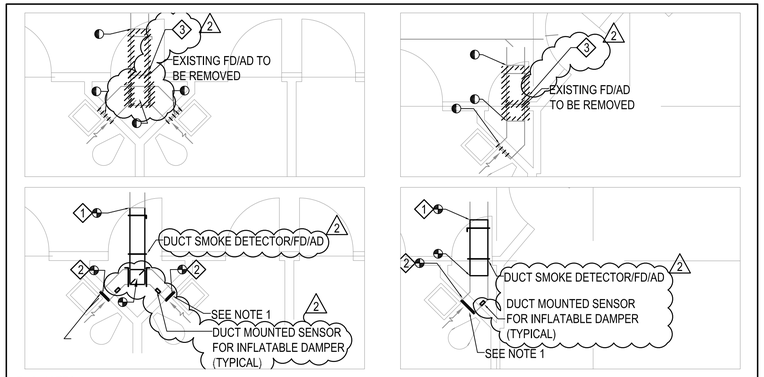
21 SCALE: NONE

EXPANSION/COMPRESSION TANK W/AIR SEPARATOR DETAIL



22 SCALE: NONE

CHEMICAL TREATMENT FOR HOT WATER SYSTEM



TAG NOTES:

1. REMOVE EXISTING DUCTWORK FROM MAIN TO POINT SHOWN INCLUDING FIRE DAMPER. REPLACE WITH NEW. COMPONENTS TO MATCH EXISTING.
2. REMOVE EXISTING 12x6 RR V.O.N. ALONG WITH SLEEVE, VOLUME DAMPER AND DUCT TO THE EXTENT SHOWN. RELACE SLEEVE, VOLUME DAMPER AND DUCT WITH NEW, COMMPONENTS TO MATCH EXISTING. CLEAN EXISTING RR AND REINSTALL. SEE NEW WORK & TAG NOTE 3 ON M201.00 FOR CLEANING DETAIL.
3. DUCT DETECTOR TO BE TEMPORARILY SUPPORT AND NOT DISCONNECT FOR FIRE ALARM SYSTEM.

NOTE:

1. TYPICAL FOR NEW EXHAUST REGISTERS CONNECT NEW EXHAUST REGISTERS TO EXISTING DUCTWORK. BALANCE TO NEW CFM REQUIREMENTS. ENSURE TIGHT FIT WITH THE ARCHITECTURAL STRUCTURE USING SECURITY FASTENERS. PROVIDE SECURITY CAULKING ON ALL SIDES OF THE REGISTER. OBTAIN APPROVAL FROM DOC.

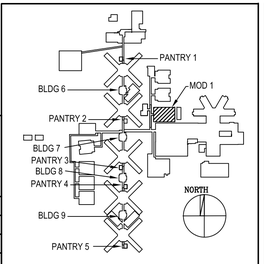
23 SCALE: NONE

RETURN DUCT DETAIL

24 SCALE: NONE

NOT USED

0 4 8 16



KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

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Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

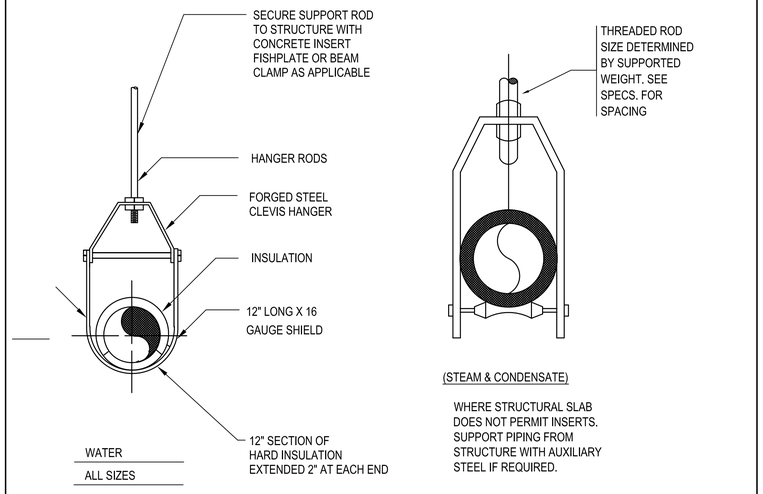
Drawing Title:
HVAC - DETAILS
SHEET 4 OF 8 2

Seal:

Drawing No.: M604.00

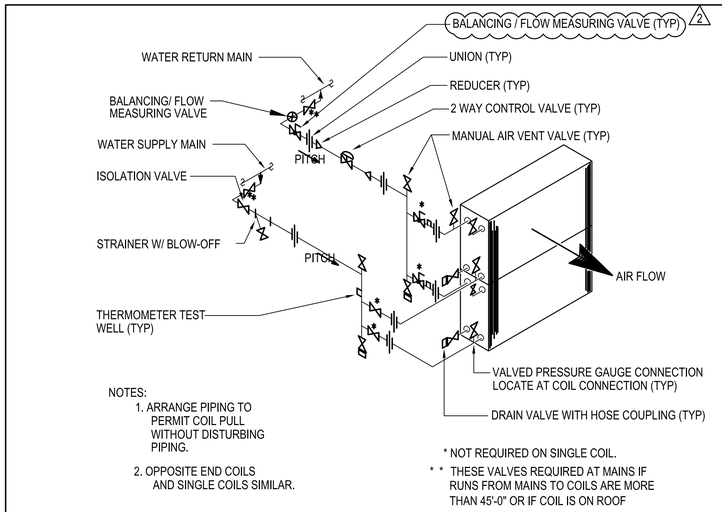
Scale: NONE

Sheet: 34 of 70



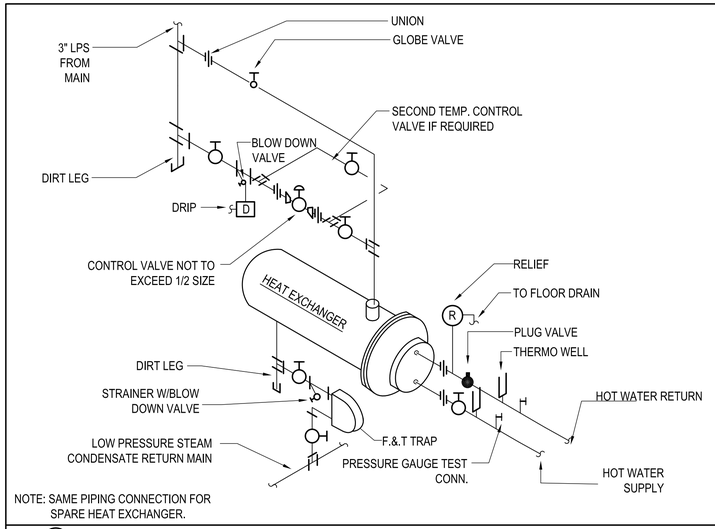
25 SCALE: NONE

PIPE HANGER DETAIL



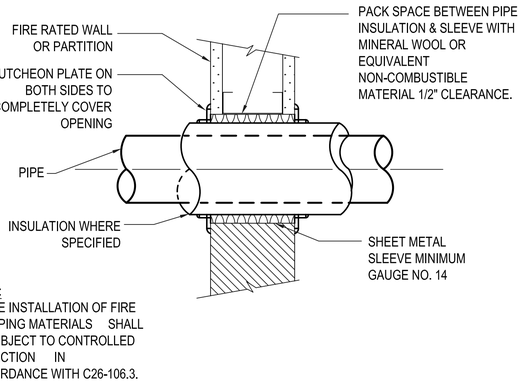
26 SCALE: NONE

HOTWATER HEATING COIL CONNECTION DETAIL



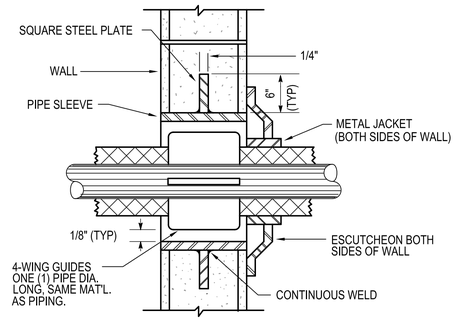
27 SCALE: NONE

STEAM TO HOT WATER CONVERTER



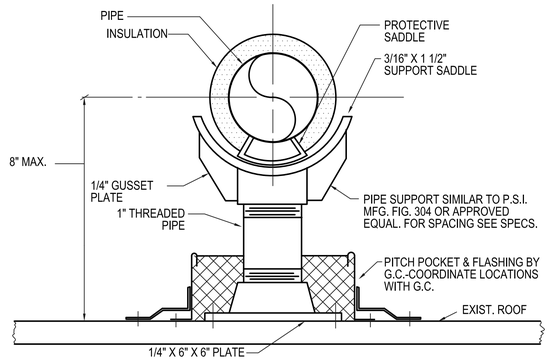
28 SCALE: NONE

INSULATED COLD PIPE PENETRATION THRU WALL DETAIL



29 SCALE: NONE

INSULATED HOT PIPE PENETRATION THRU WALL



30 SCALE: NONE

ROOF/GRADE MOUNTED PIPE SUPPORT DETAIL

0 4 8 16

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18-18 HAZEN STREET, RIKERS ISLAND,
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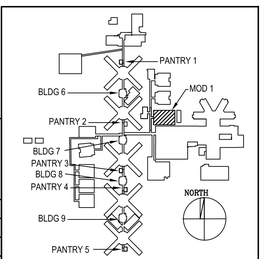
2	04-17-17	ADDENDUM 2
	01-30-15	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

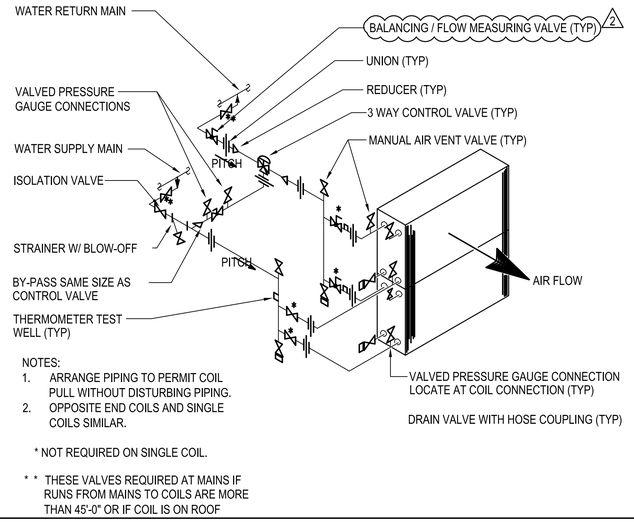
Drawing Title:
HVAC - DETAILS
SHEET 5 OF 8 2

Seal:

Drawing No.:
M605.00

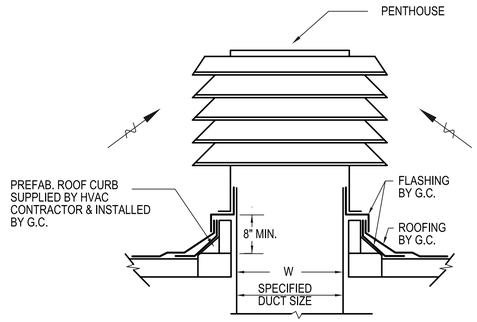
Scale: NONE

Sheet: 35 of 70



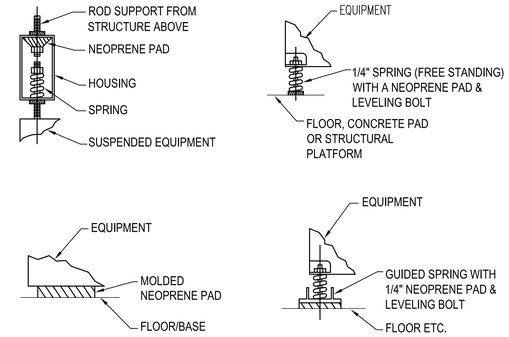
31
SCALE: NONE

CHILLED WATER COIL CONNECTION



32
SCALE: NONE

LOUVERED PENTHOUSE DETAIL

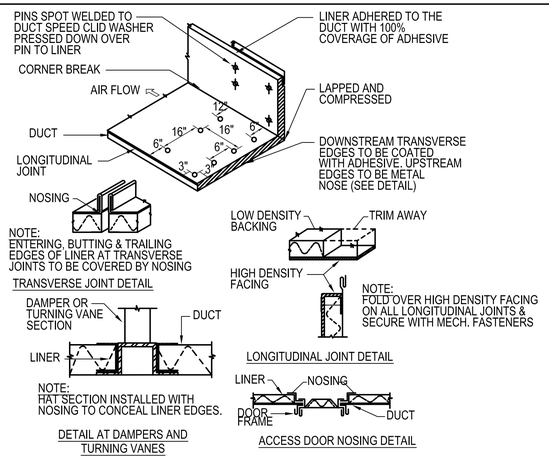


NOTES:

1. SEE PLANS AND SPECIFICATIONS FOR TYPE, LOCATIONS, ETC..
2. WHERE TYPE IS NOT IDENTIFIED IN PLANS AND SPECIFICATIONS USE EQUIPMENT MANUFACTURERS RECOMMENDATIONS.

33
SCALE: NONE

EQUIPMENT VIBRATION ISOLATORS DETAIL

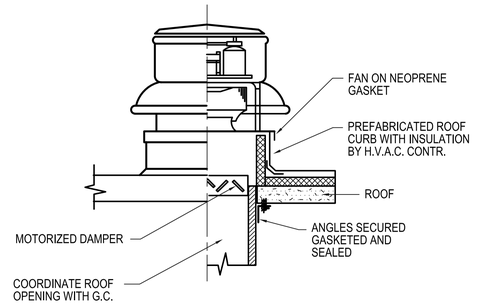


GENERAL NOTES:

1. NOSING ATTACHED TO DUCT BY RIVETS, SCREWS OR WELD
2. NOSING : 24 GA. UP TO 48", OVER 48", SAME GA. AS DUCT

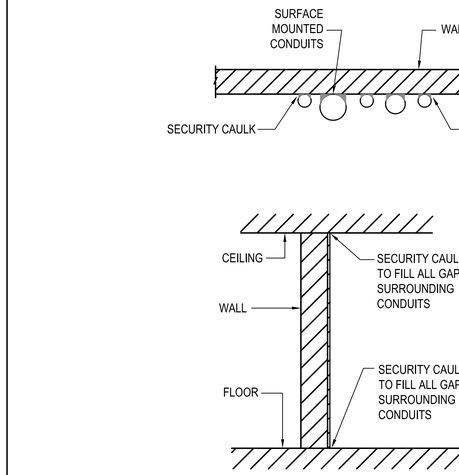
34
SCALE: NONE

ACOUSTICAL DUCT LINEAR DETAIL



35
SCALE: NONE

ROOF EXHAUSTER DETAIL



36
SCALE: NONE

EXPOSED CONDUITS WITH SECURITY CAULKING

0 4 8 16

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	01-30-17	ISSUED FOR BID

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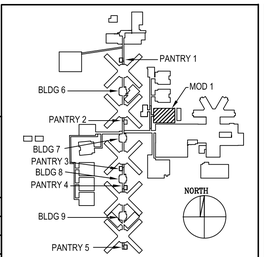
Project Manager: BV
Project Engineer:
Drawn By: Checked By: SB
PIN # 072201723CPD Date: 01/21/2015



KEY PLAN

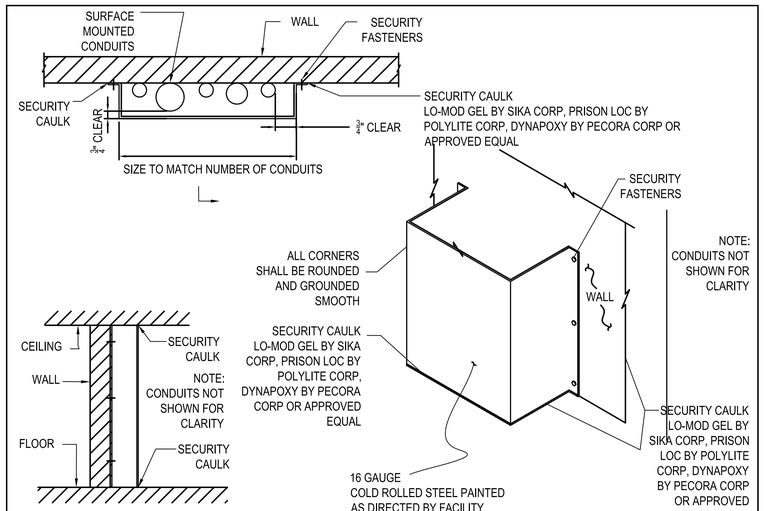
Drawing Title:
HVAC - DETAILS
SHEET 6 OF 8 2

Seal:

Drawing No.:
M606.00

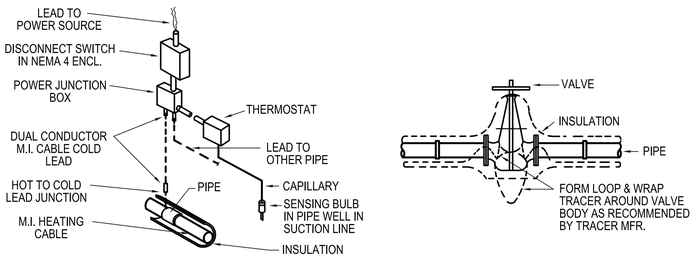
Scale: NONE

Sheet: 36 of 70



37
SCALE: NONE

EXPOSED CONDUITS WITH SECURITY SHROUD/SECURITY CAULKING



CONTROL INSTALLATION

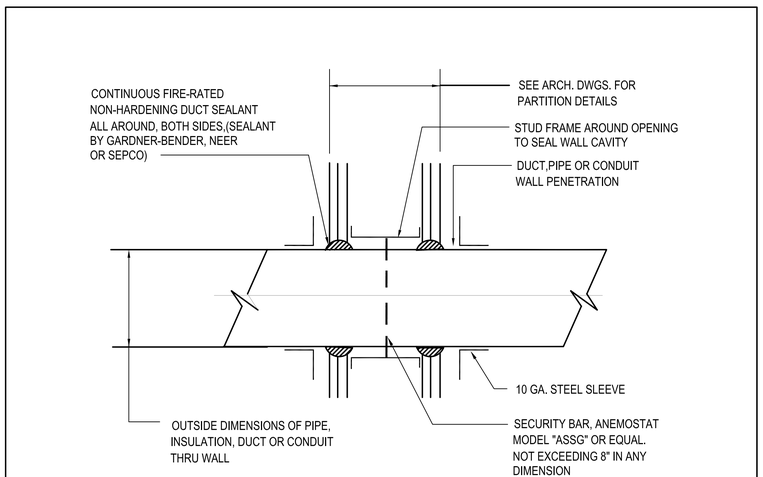
VALVE TRACING PATTERN

38
SCALE: NONE

PIPE HEAT TRACE

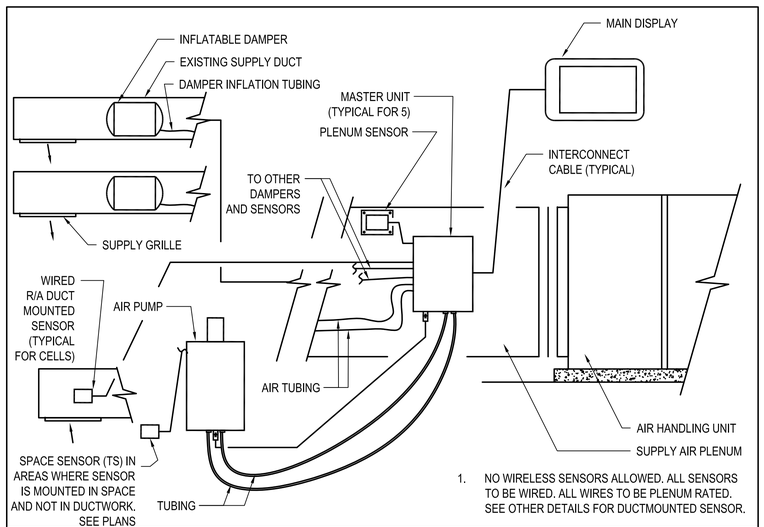
39
SCALE: NONE

NOT USED



40
SCALE: NONE

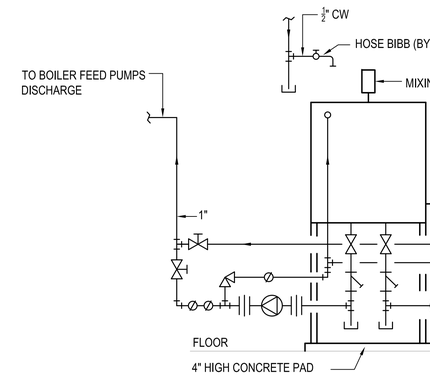
TYPICAL DUCT BARRIER DETAIL



1. NO WIRELESS SENSORS ALLOWED. ALL SENSORS TO BE WIRED. ALL WIRES TO BE PLENUM RATED. SEE OTHER DETAILS FOR DUCTMOUNTED SENSOR.

41
SCALE: NONE

INFLATABLE DAMPER CONTROL SYSTEM SCHEMATIC



42
SCALE: NONE

CHEMICAL FEED SYSTEM

2

0 4 8 16

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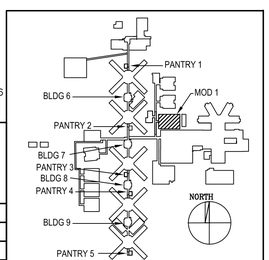


KEY PLAN

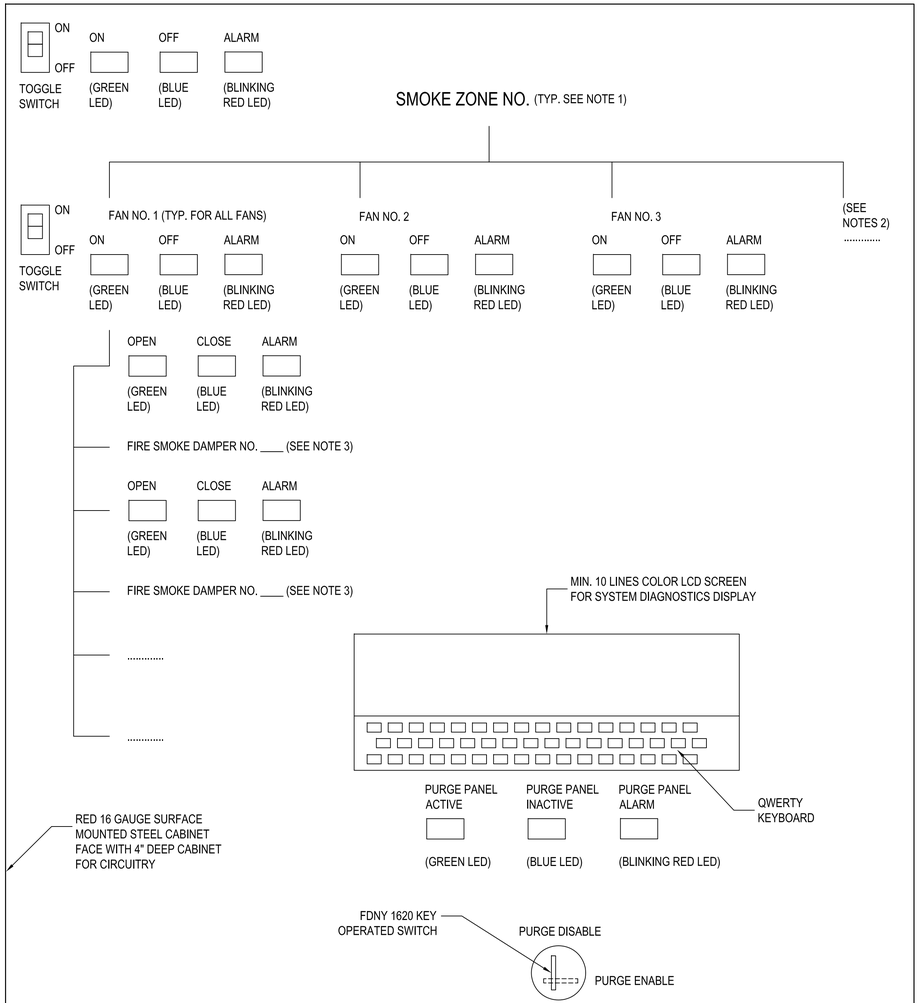
Drawing Title:
HVAC - DETAILS
SHEET 7 OF 8 2

Seal:

Drawing No.:
M607.00

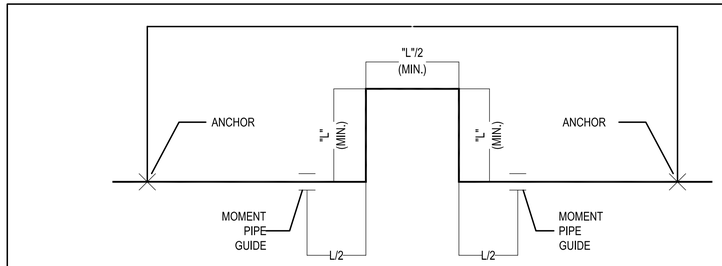
Scale: NONE

Sheet: 37 of 70



POST FIRE PURGE PANEL DETAIL

NOTES:
1) SEE SMOKE PURGE RISER DIAGRAM FOR ACTUAL NO. OF SMOKE ZONES IN BUILDING.
2) SEE SMOKE PURGE RISER DIAGRAM FOR ACTUAL NO. OF FANS SERVING RESPECTIVE SMOKE EMERGENCY.
3) SEE SMOKE PURGE RISER DIAGRAM FOR ACTUAL NO. OF FIRE SMOKE DAMPERS SERVING THE FAN SYSTEM ON ZONE BASIS.
4) PROVIDE ALL REQUIRED POWER, CONTROL, FIRE ALARM WIRING TO PURGE PANEL. SEE PANS FOR LOCATION.
5) MAINTAIN MINIMUM 42" CLEAR IN FRONT OF PANEL. PROVIDE PANEL WITH LOGIC AND HINGED FACE.
6) PANEL SIZE RAISED UP TO NO. OF EXHAUSTS, FANS, DAMPERS. FOR FSDS, IN LIEU OF INDIVIDUAL DAMPER WITH LED LIGHTS, A SCROLL DOWN LED SCREEN CAPABLE OF SHOWING EACH DAMPER STATUS SHALL BE ACCEPTABLE.



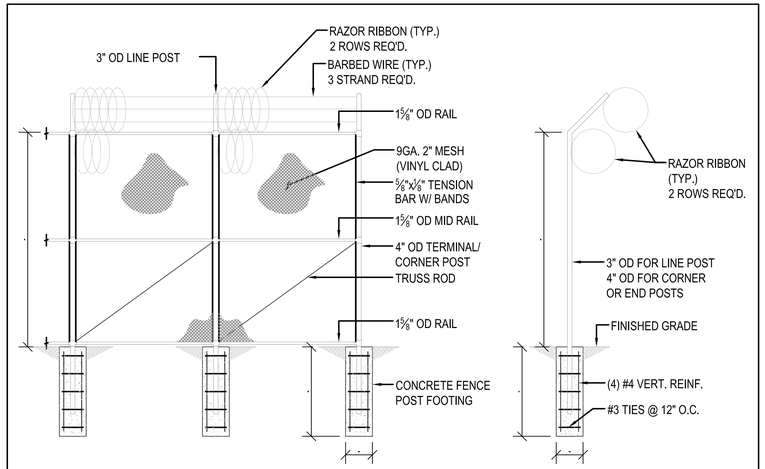
NOTES:
1. CALCULATE TOTAL EXPANSION ANCHOR TO ANCHOR. MAXIMUM ALLOWABLE DISTANCE IS 70 FT.
2. FIND MINIMUM REQUIRED "L" FOR THIS AMOUNT OF EXPANSION FROM THE CHART. THIS REPRESENTS THE MINIMUM REQUIRED EXPANSION LOOP SIZE.
3. DIMENSIONS SHOWN ARE FOR ASTM A53 Gr. B, STD. WT., SEAMLESS PIPE. THESE ARE THE MINIMUM FOOTAGE'S. REQUIRED TO MEET THE MAXIMUM ALLOWABLE STRESS. FOR LOWER STRESS LEVELS, ADD MORE FOOTAGE. ADJUST DIMENSIONS FOR OTHER PIPE MATERIALS AND/OR GREATER WALL THICKNESS.

MINIMUM EXPANSION LOOP "L"

PIPE SIZE	EXPANSION ANCHOR TO ANCHOR									
	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"
1"	3'	4'	5'	5'	6'	7'	7'	8'	8'	9'
1 1/2"	3'	5'	6'	7'	8'	9'	9'	10'	11'	12'
2"	4'	5'	7'	8'	9'	10'	11'	12'	13'	14'
2 1/2"	4'	6'	7'	8'	9'	10'	11'	12'	13'	14'
3"	4'	6'	8'	9'	11'	12'	13'	14'	15'	16'
3 1/2"	4'	6'	8'	10'	11'	12'	14'	15'	16'	17'
4"	5'	7'	9'	11'	12'	14'	15'	16'	18'	19'
5"	5'	8'	10'	12'	14'	16'	17'	19'	20'	22'
6"	5'	9'	11'	13'	15'	17'	19'	21'	22'	24'

(43) SCALE: NONE

PIPE FLEXIBILITY CHART (EXPANSION LOOP)



FENCE FRAMING ELEVATION
SCALE: ¾" = 1'-0"

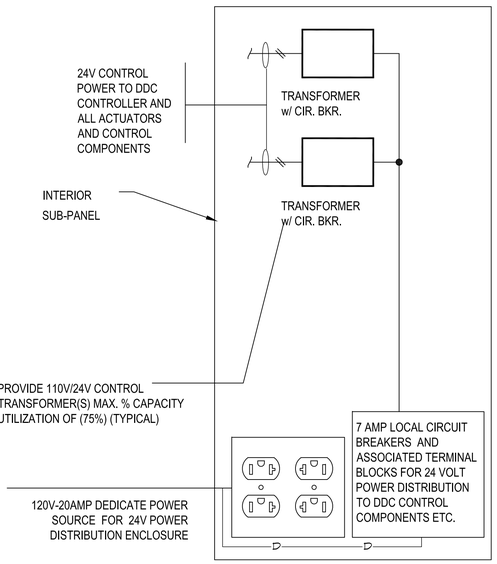
FENCE FRAMING SECTION
SCALE: ¾" = 1'-0"

(44) SCALE: NONE

FENCE FRAMING DETAIL

NOTE:

1. THE CONTRACTOR SHALL PROVIDE 24VAC TO THOSE MISC.. CONTROL DEVICES WHICH ARE NOT POWERED DIRECTLY FROM A UNITARY HVAC SYSTEM. CONTRACTOR TO COORDINATE WITH MECHANICAL CONTRACTOR AND EQUIPMENT VENDORS FOR CONTROL DEVICE POWER.



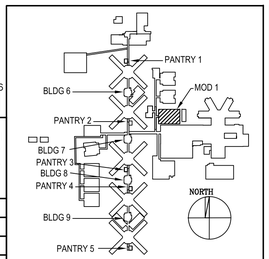
NOTE: 24 VOLT POWER DISTRIBUTION CABINET PROVIDED BY HVAC CONTRACTOR

24 V POWER DISTRIBUTION CABINET (INSIDE VIEW OF PANEL) NOT TO SCALE

(45) SCALE: NONE

POWER DISTRIBUTION CABINET

0 4 8 16



KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY AND DEVELOPMENT ENGINEERING UNIT

DESIGNED BY:
IAQ SYSTEMS INC Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:
AIR CONDITIONING SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	
Drawn By:	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:
HVAC - DETAILS
SHEET 8 OF 8

Seal:

Drawing No.:
M608.00

Scale: NONE

Sheet: 38 of 70

POWER SYMBOLS

SYMBOL	DESCRIPTION
———	SYMBOLS SHOWN WITH DARK SOLID LINES - INDICATES NEW WORK IN CONTRACT
– – – – – –	SYMBOLS SHOWN WITH LIGHT DASHED LINES - INDICATES EXISTING TO REMAIN
×——×——×	SYMBOLS SHOWN WITH CROSSED LINES - INDICATES EXISTING TO BE REMOVED
LP/1	CONCEALED HOME RUN. NOTATION INDICATES PANEL AND CIRCUIT NUMBER, No. OF ARROWS DENOTES No. OF CIRCUITS. GROUND WIRE IS NOT SHOWN BUT MUST BE PROVIDED FOR ALL BRANCH CIRCUITS. PROVIDE SHARED NEUTRAL (MIN #12) FOR EACH CIRCUIT AND GROUND WIRE FOR EACH HOMERUN. GROUND WIRE MIN. #12, U.O.N. (1,3) DENOTES 2 POLE CIRCUIT (1,3,5) DENOTE 3 POLE CIRCUIT
	CONTINUATION OF WIRING AND CONDUIT. (CONCEALED IN CEILING, WALL, OR FLOOR)
	RISER CONDUIT UP - WITH WIRING (PROVIDE CORE DRILLING IF REQUIRED)
	RISER CONDUIT DOWN - WITH WIRING (PROVIDE CORE DRILLING IF REQUIRED)
J J	JUNCTION BOX AND FINAL CONNECTION TO EQUIPMENT
2	WALL MOUNTED DUPLEX THREE WIRE GROUNDED RECEPTACLE, 20A, 125V. 18"AFF, UNLESS OTHERWISE NOTED. 2-DENOTES CIRCUIT # (TYP. ALL RECEPTACLES)
GFI	DUPLEX RECEPTACLE WALL MOUNTED IN A SINGLE GANG OUTLET BOX. 20-AMP, 125-VOLT, 2-POLE, 3-WIRE. WITH CLASS 'A' GROUND FAULT CIRCUIT INTERRUPTER.
	SURFACE OR RECESSED MOUNTED PANELBOARD. 120/208V OR 277/480V. 3ϕ, 4W, OR AS INDICATED ON THE DRAWINGS. DASHED LINES INDICATE REQUIRED CLEARANCE.
	EXISTING PANELBOARD
	CIRCUIT BREAKER. RATING AS INDICATED ON DRAWINGS
	FUSED DISCONNECT SWITCH. RATING AS INDICATED ON THE DRAWINGS.
	UNFUSED DISCONNECT SWITCH. RATING AS INDICATED ON THE DRAWINGS. 30/3 DENOTES 30 AMP, 3 POLE 30A/3P, U.O.N.
	FUSED DISCONNECT SWITCH. RATING AS INDICATED ON THE DRAWINGS. 60/40/3 DENOTES 60 AMP, 40 A FUSE, 3 POLE
	MAGNETIC MOTOR STARTER
	COMBINATION DISCONNECT SWITCH / MAGNETIC MOTOR STARTER
#	MOTOR, NUMBER INDICATES HORSE POWER RATING
	CONNECTION TO GROUND ELECTRODE
S_T	SINGLE POLE SWITCH WITH THERMAL OVERLOAD
MD	MOTORIZED DAMPER
VFD	VARIABLE FREQUENCY DRIVE, FURNISHED BY MECH CONTRACTOR, INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR.
FSD	FIRE SMOKE DAMPER (EXISTING TO BE REPLACED WITH NEW)
	EXISTING LIGHTING FIXTURE
PDC	POWER DIST. CABINET. FURNISHED BY MECH. CONTRACTOR, INSTALLED BY ELECTRICAL CONTRACTOR

DEMOLITION SYMBOLS

(U.O.N. EACH DEMOLITION SYMBOL DENOTES DISCONNECTION AND REMOVAL OF DEVICE AND ASSOCIATED CONDUIT AND WIRING BACK TO SOURCE)

SYMBOL	DESCRIPTION
	EXISTING MECH EQUIPMENT TO BE REMOVED BY MECH. CONTRACTOR. REMOVE ASSOCIATED DISCONNECT STARTER AND CONDUIT AND WIRING TO SOURCE.
	EXISTING SWITCH AND ASSOCIATED WIRING AND CONDUIT TO BE REMOVED
	EXISTING RECREPTACLE AND ASSOCIATED WIRING AND CONDUIT TO BE REMOVED
	REMOVE EXISTING DISCONNECT SWITCH AND ASSOCIATED CONDUIT AND WIRING BACK TO SOURCE
	REMOVE EXISTING STARTER AND ASSCIATED CONDUIT AND WIRING BACK TO SOURCE
MD	MOTORIZED DAMPER
CP	CONTROL PANEL
	COMBINATION STARTER/FUSED DISC.

ABBREVIATIONS

SYMBOL	DESCRIPTION
A, AMP	AMPERE
AC	ALTERNATING CURRENT
AIC	AMPERES INTERRUPTING CAPACITY
AF/AT	AMPERE FRAME/AMPERE TRIP
AFF	ABOVE FINISHED FLOOR
AFI	ARC FAULT INTERRUPTER
ARCH	ARCHITECTURAL
AS/AF	AMPERE SWITCH/AMPERE FUSE
A/V	AUDIO/VISUAL
AWG	AMERICAN WIRE GAUGE
BLDG.	BUILDING
BLR	BOILER
BMS	BUILDING MANAGEMENT SYSTEM
BR	BEDROOM
BTH	BATHROOM
C, CDT	CONDUIT
CB	CIRCUIT BREAKER
CELL	CELLAR
CKT(S)	CIRCUIT(S)
CL	CLOSET
CLG	CEILING
CO	CERTIFICATE OF OCCUPANCY, CARBON MONOXIDE
C/T	CURRENT TRANSFORMER
CU	COPPER
DISC	DISCONNECT
DIST	DISTRIBUTION
DWG	DRAWING
DN	DOWN
EC	EMPTY CONDUIT
ELEC	ELECTRIC
ELEV	ELEVATOR
EM	EMERGENCY
EMT	ELECTRIC METALLIC TUBING
EQUIP	EQUIPMENT
ETC	ETCETERA

ABBREVIATIONS

SYMBOL	DESCRIPTION
EXIST	EXISTING
FA	FIRE ALARM
FMC	FLEXIBLE METALLIC TUBING
FL	FLOOR
G, GND	GROUND
GA	GAUGE
GFI	GROUND FAULT INTERRUPTER
GWB	GYPSUM WALL BOARD
HP	HORSE-POWER
JB	JUNCTION BOX
K	x 1000
KIT	KITCHEN
KN	KEY NOTE
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWH	KILOWATT HOUR
L	LINE
LR	LOCKER ROOM
LTG	LIGHTING
MACH	MACHINE
MECH	MECHANICAL
MCB	MAIN CIRCUIT BREAKER
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MTD	MOUNTED
NEC	NATIONAL ELECTRICAL CODE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
N	NEUTRAL
No	NUMBER
NTS	NOT TO SCALE
NYC	NEW YORK CITY
OCPD	OVER CURRENT PROTECTION DEVICE
P	POLE(S)
PB	PULL BOX
PWR	POWER
PNL	PANEL
REC	RECEPTACLES
REF	REFRIGERATOR
RGS	RIGID GALVANIZED STEEL CONDUIT
RM	ROOM
RP	RECEPTACLE PANEL
S	SMOKE DETECTOR
SCH	SCHEDULE
SMK	SMOKE
SP	SPARE
STD	STANDARD
STOR	STORAGE
STV	STOVE GAS
SW	SWITCH
TCO	TEMPORARY CERTIFICATE OF OCCUPANCY
TEL	TELEPHONE
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
V	VOLT
VA	VOLT-AMPERE
VDC	DIRECT CURRENT VOLTAGE

ABBREVIATIONS

SYMBOL	DESCRIPTION
W	WATT, WIRE, WIDTH
W/	WITH
WP	WEATHERPROOF

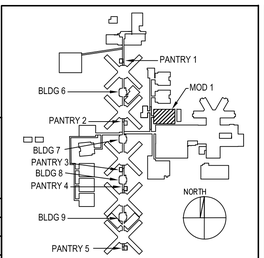
GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE 2011 NYC ELECTRICAL CODE AND THE NYC AMENDMENTS TO THE NEC-2008, THE APPLICABLE SECTIONS OF THE NFPA, THE 2014 NYC BUILDING CODE, DOC STANDARDS AND ALL GOVERNING LOCAL CODES, LAWS, AND REGULATIONS.
2. PROVIDE A COMPLETE OPERABLE SYSTEM IN A WORKMANLIKE MANNER. OUTLINE DESCRIPTION AND EQUIPMENT DO NOT LIMIT CONTRACTOR'S LIABILITY FOR THE INSTALLATION OF A COMPLETE OPERABLE SYSTEM.
3. ALL ELECTRICAL EQUIPMENT SHALL BE THE LATEST OF THE CURRENT YEAR IN DESIGN, MATERIAL AND WORKMANSHIP, AND SHALL BE THE TYPE OR MODEL CALLED FOR IN THESE DRAWINGS AND SPECIFICATIONS
4. CONTRACTOR TO BE RESPONSIBLE FOR REVIEWING THE FULL SET OF BID DOCUMENTS TO BE AWARE OF THE TOTAL SCOPE PRIOR TO SUBMITTING BID. ALL WORK SHOWN ON THE DRAWINGS NOT SPECIFICALLY CALLED OUT AS EXISTING SHALL BE CONSIDERED WORK TO BE PERFORMED UNDER THIS CONTRACT.
5. BIDDERS, BEFORE SUBMITTING A PROPOSAL, SHALL VISIT AND CAREFULLY EXAMINE THE SITE TO BECOME FAMILIAR WITH THE EXISTING CONDITIONS AND WITH THE DIFFICULTIES THAT WILL ATTEND THE EXECUTION OF THIS WORK. SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH EXAMINATION HAS BEEN MADE. LATER CLAIMS WILL NOT BE RECOGNIZED FOR EXTRA LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED. NO ALLOWANCE WILL SUBSEQUENTLY BE MADE TO THE CONTRACTOR BY REASON OF ANY ERROR DUE TO THE CONTRACTOR'S NEGLECT TO COMPLY WITH THIS REQUIREMENT. REPORT ANY DISCREPANCIES BETWEEN DRAWINGS AND FIELD CONDITIONS TO THE ENGINEER.
6. BEFORE COMMENCING WORK, THE CONTRACTOR SHALL FILE ALL REQUIRED CERTIFICATES OF INSURANCE WITH THE BUILDING DEPARTMENT. OBTAIN ALL REQUIRED PERMITS, TEST REPORTS, CERTIFICATIONS FOR T.C.O. AND C.O. AND PAY ALL FEES REQUIRED..
7. ELECTRICAL CONTRACTOR SHALL TAKE DELIVERY AND RESPONSIBILITY FOR ALL EQUIPMENT PRE-PURCHASED BY THE OWNER FOR THIS PROJECT. WORK SHALL INCLUDE RECEIVING EQUIPMENT AT STREET-SIDE, MOVING IT TO INTERIM ONSITE SECURE STORAGE LOCATION, PROTECTING EQUIPMENT FROM DAMAGE, MOVING THE EQUIPMENT FROM STORAGE TO ITS FINAL POSITION, SETTING IN PLACE, AND COMPLETION OF ALL INSTALLATION, TESTING AND COMMISSIONING PROCEDURES REQUIRED FOR APPLICABLE EQUIPMENT.
8. UPON COMPLETION OF ALL ELECTRICAL WORK, ELECTRICAL CONTRACTOR SHALL ADJUST AND TEST ALL CIRCUITS, WIRING DEVICES AND ANY OTHER ELECTRICAL ITEMS INSTALLED. ANY DEFECTIVE ITEMS SHALL BE IMMEDIATELY REPAIRED OR REPLACED WITH NEW EQUIPMENT OR MATERIALS AND THAT PORTION OF THE SYSTEM SHALL BE RETESTED. ALL SUCH REMEDIAL WORK SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
9. ALL NOTATIONS OF "SCALE" ARE INTENDED AS APPROXIMATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE TO ASCERTAIN THE EXACT DIMENSIONS IN FIELD.
10. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC, SIZES AND LOCATION OF EQUIPMENT AND WIRING ARE SHOWN TO SCALE WHERE POSSIBLE, BUT MAY BE DISTORTED FOR CLARITY ON THE DRAWINGS.
11. UNLESS OTHERWISE NOTED, ELECTRICAL EQUIPMENT INCLUDING BUT NOT LIMITED TO PULL BOXES, JUNCTION BOXES, WIRING DEVICES, PANELBOARDS, LOW VOLTAGE SYSTEMS DEVICES, ETC WHERE INDICATED ON DRAWINGS, SHALL BE CONSIDERED SHOWN AT THEIR APPROXIMATE LOCATION. THE CONTRACTOR SHALL LOCATE THESE ITEMS AS FIELD CONDITIONS DICTATE AND AS APPROVED BY THE ARCHITECT OR HIS REPRESENTATIVE. .
12. ALL CONDUIT RUNS, WHEN SHOWN ON THE DRAWINGS, ARE SHOWN DIAGRAMMATICALLY TO OUTLINE THE GENERAL ROUTING OF MAJOR FEEDERS AND BRANCH WIRING. IT IS NOT WITHIN THE SCOPE OF THESE DRAWINGS TO SHOW ALL NECESSARY BENDS, OFFSETS, PULL BOXES AND OBSTRUCTIONS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO INSTALL HIS WORK TO CONFORM TO THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE.

GENERAL NOTES

13. ADDITIONAL PULL AND JUNCTION BOXES NOT SHOWN ON DRAWINGS SHALL BE PROVIDED WHERE REQUIRED BY APPLICABLE CODE REQUIREMENTS OR WHERE CALLED FOR BY FIELD CONDITIONS. PULL AND JUNCTION BOXES SHALL BE SURFACE TYPE IN UNFINISHED AREAS AND FLUSH TYPE IN FINISHED AREAS.
14. CONDUIT RUNS SHALL CLEAR ALL ARCHITECTURAL FEATURES (DOORS, WINDOWS, ETC) AND STRUCTURAL MEMBERS. CONDUIT INSTALLATION SHALL ALSO BE MADE TO AVOID INTERFERENCE WITH PIPES, DUCTS, OR OTHER EQUIPMENT CORRESPONDING TO OTHER TRADES, INCLUDING BUT NOT LIMITED TO MECHANICAL, PLUMBING AND FIRE PROTECTION. SHALL ANY OF THIS ELEMENTS PREVENT THE INSTALLATION OF RACEWAY AS DELINEATED ON THE CONTRACT DOCUMENTS, DEVIATION MUST BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION. ANY VARIATION DUE TO FIELD CONDITIONS SHALL NOT REPRESENT AN ADDITIONAL COST TO OWNER.
15. CONCEAL CONDUIT AND TUBING WITHIN FINISHED WALLS, CEILINGS, AND FLOORS, UNLESS OTHERWISE INDICATED.
16. IN UNFINISHED PORTIONS OF BUILDING SUCH AS BOILER ROOM, FAN ROOMS, PIPE SPACES, ETC., LOCATIONS OF CONDUIT AND OUTLETS ARE APPROXIMATE AND SHALL CLEAR PIPING AND ALL OTHER CONSTRUCTION. ALL OUTLETS MUST BE UNOBSTRUCTED AND EXTENDED AS DIRECTED TO CLEAR ANY INTERFERENCE WITH FIXTURES, PIPING EQUIPMENT, ETC.
17. ALL CONDUIT IN INMATE AREAS SHALL BE RIGID GALVANIZED STEEL.
18. MINIMUM SIZE OF CONDUITS SHALL BE 3/4", UNLESS OTHERWISE NOTED.
19. SUPPORT ALL ELECTRICAL EQUIPMENT AND CONDUIT FROM BUILDING STRUCTURE AND/OR FRAMING IN AN APPROVED MANNER. WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING OF SUPPORTS FOR EQUIPMENT, FURNISH ADDITIONAL FRAMING. ALL ELECTRICAL EQUIPMENT AND RACEWAY SHALL BE SUSPENDED FROM SUPPLEMENTAL SLOTTED CHANNEL FRAME. ALL SUCH MOUNTS, DEVICES, FASTENERS SHALL BE OF SUFFICIENT THICKNESS TO CARRY THE LOAD SUSPENDED AND SHALL BE SEISMICALLY RESTRAINED. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ANY ADDITIONAL SUPPLEMENTAL STEEL REQUIRED TO SUPPORT THE EQUIPMENT OR DEVICES.
20. PROVIDE OUTLET BOXES AND ENCLOSURES APPROPRIATE FOR THE PURPOSE AT ALL LOCATIONS WHERE THE DRAWINGS REQUIRE THE INSTALLATION OF ELECTRICAL DEVICES OR ELECTRICAL EQUIPMENT.
21. INSTALL PULL WIRES IN EMPTY RACEWAYS. USE POLYPROPYLENE OR MONOFILAMENT PLASTIC LINE WITH NOT LESS THAN 200-LB (90-KG) TENSILE STRENGTH. LEAVE AT LEAST 12 INCHES (300 MM) OF SLACK AT EACH END OF PULL WIRE
22. CONTRACTOR TO FURNISH ALL REQUIRED SLEEVES TO GENERAL CONTRACTOR FOR COORDINATION AND INSTALLATION. FAILURE TO PROVIDE AND COORDINATE REQUIRED SLEEVES TO THE GENERAL CONTRACTOR WILL NECESSITATE CORE DRILLING OF SLEEVES IN FOUNDATIONS WALLS OR/AND CONCRETE SLABS AS REQUIRED. CONTRACTOR TO BE RESPONSIBLE FOR ALL CORE DRILLING, SEALING, WATERPROOFING, ETC.
23. ALL OPENINGS BETWEEN FLOORS, THROUGH RATED FIRE AND SMOKE WALLS, CREATED BY THE CONTRACTOR FOR CABLE OR CONDUIT PASS THROUGH SHALL BE SEALED WITH A FIRE STOPPING MATERIAL. FIRE STOPPING MATERIAL AND ITS APPLICATION SHALL BE ACCOMPLISHED IN SUCH A MANNER THAT IS ACCEPTABLE TO THE LOCAL FIRE AND BUILDING AUTHORITIES HAVING JURISDICTION OVER THIS WORK. ANY OPENINGS CREATED BY OR FOR THE CONTRACTOR AND LEFT UNUSED SHALL ALSO BE SEALED AS PART OF THIS WORK. REFER TO ARCHITECTURAL DRAWINGS FOR REQUIRED FIRE RATED WALLS AND SLABS.
24. ALL EXPOSED NONCURRENT-CARRYING METAL PARTS OF ELECTRICAL EQUIPMENT AND RACEWAYS SHALL BE GROUNDED. A SEPARATE GROUND CONDUCTOR SHALL BE RUN IN ALL CONDUITS IN ALL CASES. ENSURE CONTINUITY OF THE GROUNDING CIRCUIT FROM THE SUPPLYING PANELBOARD GROUNDING BUS TO THE LOAD GROUND TERMINAL. THE RESISTANCE FROM THE SERVICE EQUIPMENT GROUND BUS TO ANY LOAD GROUND TERMINAL SHALL NOT EXCEED 1 OHM.
25. CONDUITS IN INMATE AREAS WILL BE HIGH SECURITY (ALL CONDUIT RGS), ALL OTHER AREAS WILL BE MEDIUM SECURITY.
26. UNLESS OTHERWISE NOTED, CONDUCTORS FOR POWER AND LIGHTING CIRCUITS SHALL BE OF TYPE THHN/THWN AND MINIMUM SIZE SHALL BE #12 AWG. CONDUCTORS #10 AWG AND SMALLER SHALL BE COPPER, SOLID OR STRANDED; #8 AWG AND LARGER SHALL BE COPPER, STRANDED, TYPE.
27. FOR ALL BRANCH CIRCUIT RATED AT 120V, 20A THAT RUNS OVER 80'-0", No. 10 AWG WIRE SIZE SHALL BE USED TO COMPENSATE FOR VOLTAGE DROP.
28. NO LOW VOLTAGE WIRING SHALL BE PERMITTED IN THE SAME RACEWAY AS POWER WIRING.

0 4 8 16



KEY PLAN

Drawing Title:
ELECTRICAL - SYMBOLS, ABBREVIATIONS AND GENERAL NOTES

Seal:

Drawing No.: E001.00

Scale: NONE

Sheet: 39 of 70

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
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2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	TS
Drawn By: DB	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

GENERAL NOTES

29. ALL COPPER MATERIALS, LUGS, COPPER BUS DETAILS/LUGS KITS AS REQUIRED FOR OVER SIZED FEEDERS, AND DEVICES REQUIRED TO COMPLETE CONTRACT WORK, BUT NOT SHOWN, INCLUDING MODIFYING EXISTING OR NEW EQUIPMENT TO ACCEPT INCOMING AND OUTGOING CABLES, SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. CONTRACTOR TO PROVIDE ALL REQUIRED ELECTRICAL FINAL CONNECTIONS.

30. ELECTRICAL DRAWINGS INDICATE CIRCUIT NUMBERS FOR RECEPTACLES, LIGHTING FIXTURES AND OTHER EQUIPMENT FEEDS. UNLESS OTHERWISE NOTED PROVIDE 2#12, 1#12G IN 3/4" CONDUIT TO 15A OR 20A CIRCUIT BREAKERS IN PANELS INDICATED.

31. FURNISH AND INSTALL WIRING FOR EQUIPMENT FURNISHED BY OTHERS, AS SHOWN ON ARCHITECTURAL, HVAC, PLUMBING AND/OR ELECTRICAL DRAWINGS. COORDINATE WITH OTHER TRADES FOR DETAILS OF INSTALLATION AND WIRING REQUIREMENTS. THE TERM "WIRING" AS USED HEREIN SHALL INCLUDE FURNISHING AND INSTALLING CONDUIT, WIRES, JUNCTION/OUTLET BOXES, DISCONNECTS, OVERCURRENT PROTECTION DEVICES AND FINAL CONNECTIONS. COORDINATE FINAL CONDUCTOR SIZES, QUANTITIES, VOLTAGE REQUIREMENTS, AND OVERCURRENT DEVICE AND OUTLET RATINGS WITH ACTUAL EQUIPMENT TO BE FURNISHED TO THE SITE PRIOR TO FINALIZING WIRING INSTALLATION. MINOR ADJUSTMENTS TO WIRING REQUIREMENTS NECESSARY TO ACCOMMODATE ACTUAL FURNISHED EQUIPMENT SHALL BE PROVIDED AT NO ADDITIONAL COST TO OWNER.

32. VERIFY LOCATIONS OF ALL ELECTRICAL EQUIPMENT WITH ARCHITECTURAL DRAWINGS OR INTERIOR DETAILS. IN CENTERING OUTLETS AND LOCATING BOXES OR OUTLETS, ALLOW FOR OVERHEAD PIPES, DUCTS, MECHANICAL EQUIPMENT, VARIATIONS IN FIREPROOFING AND PLASTERING, WINDOW AND DOOR TRIM, PANELING, HUNG CEILING, ETC., AND CORRECT ANY INACCURACY RESULTING FROM FAILURE TO DO SO WITHOUT EXPENSE TO OWNER.

33. RECEPTACLES SHALL BE COMMERCIAL SPECIFICATION GRADE OF THE NEMA STANDARD CONFIGURATION FOR EACH APPLICATION USING A HORSESHOE SHAPED GROUNDING POLE,

34. UTILIZE THE FOLLOWING MOUNTING HEIGHTS UNLESS OTHERWISE NOTED (ALL DIMENSIONS TO CENTERLINE OF BOX U.O.N.):

    A. RECEPTACLES (WALL MOUNTED) - 18" AFF

35. ARCHITECTURAL FEATURES AS WELL AS OTHER TRADES EQUIPMENT SHOWN ON ELECTRICAL DRAWINGS ARE FOR BACKGROUND INFORMATION ONLY. COORDINATE WITH OTHER TRADES TO DETERMINE THE EXACT LOCATION OF MOTORS, MOTOR TERMINAL BOXES, AND OTHER EQUIPMENT TO BE INSTALLED BY OTHER TRADES BEFORE CONDUIT WORK IS STARTED.

36. ALL ELECTRICAL EQUIPMENT AND ACCESSORIES INSTALLED OUTSIDE OR EXPOSED TO WEATHER SHALL HAVE NEMA 3R ENCLOSURES AND SHALL BE TIGHTLY GASKETED FOR A COMPLETE RAINTIGHT INSTALLATION. ALL BUILDING EXTERIOR MOUNTED RECEPTACLES SHALL BE GFI RATED AND MOUNTED IN WEATHERPROOF ENCLOSURE.

37. ALL AREAS ABOVE PANEL BOARDS SHALL BE FREE FROM WORK OF OTHER TRADES.

38. ALL WORKING CLEARANCES FOR PANEL BOARDS AND OTHER ELECTRICAL EQUIPMENT SHALL COMPLY WITH THE NYC ELECTRIC CODE AND ASSOCIATED TABLES.

39. PROVIDE UNFUSED DISCONNECT SWITCHES FOR ALL MECHANICAL EQUIPMENT UNLESS OTHERWISE NOTED ON CONSTRUCTION DOCUMENTS OF HVAC SCHEDULES.

40. THE MINIMUM RATING OF DISCONNECT SWITCHES SHALL BE EQUAL TO OR GREATER THAN THE RATING OF THE PROTECTIVE DEVICES ON THE SUPPLY SIDE OF THE DISCONNECT SWITCH. MINIMUM DISCONNECT SWITCH SIZE IS 30 AMPERES. ALL DISCONNECT SWITCHES SHALL BE RATED FOR 480V, U.O.N.

41. ALL EQUIPMENT SHALL HAVE COPPER CURRENT CARRYING PARTS INCLUDING GROUND BUS AND TERMINALS.

42. PROVIDE 4-INCH HIGH CONCRETE HOUSING PADS FOR ALL FLOOR MOUNTED ELECTRICAL EQUIPMENT. COORDINATE WITH GENERAL CONTRACTOR.

43. REMOVE ALL DEBRIS RESULTING FROM REMOVAL AND/OR INSTALLATION OF ELECTRICAL WORK FROM THE PREMISES.

44. CONTRACTOR TO PROVIDE LABOR AND MATERIALS REQUIRED FOR THE INSTALLATION AND MAINTENANCE OF TEMPORARY LIGHTING AND REQUIRED POWER SOURCES

45. UNLESS OTHERWISE NOTED, "INSTALL" MEANS TO BE PROVIDED AND INSTALLED BY THIS CONTRACTOR.

46. PROVIDE SECURITY CAULKING AROUND SURFACE MOUNTED CONDUITS INSTALLED BELOW 8 FEET IN ALL INMATE ACCESSIBLE AREAS.

47. ALL EXPOSED FASTENERS IN INMATE ACCESSIBLE AREAS SHALL BE TAMPER PROOF TYPE AND APPROVED BY THE DESIGN PROFESSIONAL.

GENERAL NOTES

46. ALL STARTERS/VFD'S ARE FURNISHED BY MECHANICAL CONTRACTOR AND INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR.

47. DO NOT MOUNT ANY ELECTRICAL PANELS UNDER DUCTS OR PIPING ABOVE WITHIN 6 FEET. COORDINATE IN FIELD.

48. ALL DISCONNECT SWITCHES SHALL BE RATED FOR 480 VOLTS, U.O.N.

49. COORDINATE WITH PHASING PLAN ON MECH DWG.

50. PROVIDE SECURITY CAULKING AROUND SURFACE MOUNTED CONDUITS INSTALLED BELOW 8 FEET IN ALL INMATE ACCESSIBLE AREAS.

51. ALL EXPOSED FASTENERS IN INMATE ACCESSIBLE AREAS SHALL BE TAMPER PROOF TYPE AND APPROVED BY THE DESIGN PROFESSIONAL.

PHASING NOTES

1. VERIFY AND CONFIRM WITH OWNER THE PHASING REQUIREMENTS OF THE PROJECT BEFORE BIDDING REGARDLESS OF WHETHER THE INFORMATION IS PRESENTED (OR OTHERWISE) IN THE CONTRACT DOCUMENTS.
2. ANY PHASING INFORMATION WHERE PROVIDED IN THE CONTRACT DOCUMENTS ARE TO PROVIDE THE INTENT OF PHASING WORK ONLY AND MAY NOT INCLUDE ALL INFORMATION REQUIRED TO MEET THE INTENT OF THE OWNERS REQUIREMENTS. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY THE PHASING REQUIREMENTS, METHODOLOGY, SCHEDULE, COORDINATION WITH THE OWNER.
3. IN ALL ASPECTS OF PHASING WORK, ALL ITEMS SHALL BE IN FULL COMPLIANCE WITH THE CURRENT CODE AND STANDARDS.
4. ALL PHASES OF THE PROJECTS SHALL ENSURE STANDALONE FULLY FUNCTIONAL CODE COMPLIANT SYSTEM REQUIRED FOR AN OCCUPIED SPACE USE.
5. ALL PHASING COSTS SHALL BE INCLUDED IN THE PROJECT BID.
6. PHASING PLAN IS THE SUGGESTED PHASING. CONTRACTOR SHALL PREPARE HIS OWN PHASING PLAN AND COORDINATE / REVIEW WITH CMU.

TEMPORARY POWER

1. CONTRACTOR SHALL PROVIDE TEMPORARY POWER AND LIGHTING AS REQUIRED FOR ALL TRADES.

GENERAL DEMOLITION NOTES

1. U.O.N. PROVIDE ALL LABOR, EQUIPMENT AND MATERIALS AS REQUIRED FOR THE DEMOLITION AND REMOVAL OF THE FOLLOWING BUILDING SYSTEMS: IN THE AREA OF WORK. FIRE ALARM DEVICES WILL REMAIN. SEE NOTE 14.

    A) ELECTRICAL CONNECTIONS TO MECH EQUIPMENT AND ASSOCIATED WIRING AND CONDUIT TO SOURCE AS NOTED.

    B) REMOVAL OF STARTERS/ DISCONNECTS FOR MECH EQUIPMENT AS NOTED.

2. DEMOLITION WORK SHALL INCLUDE, BUT NOT BE LIMITED TO CONNECTION TO CONTROL PANELS, CABINETS, ENCLOSURES, SYSTEM DEVICES, DEVICES BACK BOXES, EXPOSED PULL BOXES AND RACEWAY AND ALL WIRING FROM EACH SYSTEM DEVICE BACK TO CORRESPONDING CONTROL OR POWER PANEL.
3. THE DEMOLITION WORK SHALL BE CARRIED ON IN EVERY RESPECT IN A THOROUGH AND WORKMANLIKE MANNER.
4. ALL DEMOLITION, REMOVAL, AND DISPOSAL WORK SHALL BE IN COMPLIANCE WITH THE REQUIREMENTS OF THE PREVAILING FEDERAL AND STATE CODES AND REGULATIONS.
5. REMOVE ALL DEBRIS NOT EXPLICITLY DESIGNATED TO BE SALVAGED (TO REMAIN) FROM THE PREMISES AND LEGALLY DISPOSE OFF AWAY FROM PREMISES.
6. ITEMS INDICATED TO BE SALVAGED SHALL BE REMOVED EITHER BEFORE DEMOLITION OR DURING THE PROCESS OF THE WORK, STORED AND PROTECTED ON THE SITE IN A LOCATION DESIGNATED BY PROJECT ENGINEER. THESE ITEMS WILL BE IDENTIFIED AND RETAINED BY THE PROJECT ENGINEER.
7. CAREFULLY REMOVE AND PROTECT ALL ITEMS TO BE SAVED AND REUSED AS INDICATED ON DRAWINGS. REPLACE ANY ITEMS THAT ARE DAMAGED BY REMOVAL AT YOUR OWN COST. NOTIFY THE AUTHORITY IN WRITING OF ANY ITEM THAT IS DAMAGED PRIOR TO REMOVAL SO THAT THEY MAY ASCERTAIN THE ITEM'S CONDITION
8. PROTECT BUILDING MATERIALS, SURFACES AND STRUCTURES, WHICH ARE TO REMAIN, FROM DAMAGE; IF DAMAGE OCCURS, REPAIR OR REPLACEMENT SHALL BE MADE BY THE CONTRACTOR, TO THE SATISFACTION OF THE AUTHORITY, AND AT THE EXPENSE OF THE CONTRACTOR. ALL DISTURBED AREAS SHALL BE FINISHED TO MATCH EXISTING CONDITIONS.
9. DISCONNECT, REMOVE AND RELOCATE ANY ELECTRICAL EQUIPMENT NOT SHOWN ON THESE DRAWINGS AS PART OF THIS CONTRACT, BUT INTERFERES WITH THE WORK UNDER THIS CONTRACT. THIS WORK SHALL NOT BE CONSIDERED EXTRA AND SHALL BE DONE AT NO ADDITIONAL COST TO THE OWNER.
10. VISIT AND EXAMINE CAREFULLY THE AREAS AFFECTED BY THIS WORK TO BECOME FAMILIAR WITH EXISTING CONDITIONS AND WITH THE DIFFICULTIES THAT ATTEND THE EXECUTION OF THIS WORK. LATER CLAIMS WILL NOT BE RECOGNIZED FOR EXTRA LABOR, EQUIPMENT, OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED.
11. RELOCATE AND/OR ALTER THE EXISTING BUILDING COMPONENTS AS DIRECTED BY OWNERS' REPRESENTATIVE. ALL RELOCATION OR ALTERATIONS TO BUILDING SHALL BE RESTORED TO THEIR ORIGINAL WORKING CONDITIONS AFTER SUCH RELOCATION OR ALTERATION WORK.
12. COORDINATE WITH SITE PERSONNEL TO MINIMIZE IMPACT OF OPERATION OF THE BUILDING DURING DEMOLITION AND CONSTRUCTION.
13. WHEN POWER SHUTOFF IS REQUIRED, CONTRACTOR IS TO MAINTAIN CONTINUOUS SERVICE ON FEEDERS SERVING THE AREAS AFFECTED DURING ALL THE PERIOD THE AREA IS UNDER CONSTRUCTION. NO OUTAGES WILL BE PERMITTED IN THESE AREAS DUE TO THE CONSTRUCTION PHASE. ALL WORK REQUIRING TEMPORARY SHUTDOWN SHALL BE PERFORMED AT NO ADDITIONAL COST TO THE OWNER. ANY APPROVAL FOR SHUTDOWNS SHOULD BE BROUGHT TO THE ATTENTION OF THE OWNER AND IT MUST BE NOTIFIED IN WRITING 72 (SEVENTY-TWO) HOURS IN ADVANCE.
14. ALL FIRE ALARM DEVICES TO REMAIN DURING CONSTRUCTION, SUPPORT TEMPORARILY AS REQUIRED.

DRAWING LIST

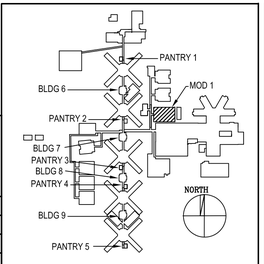
2

LIGHT FIXTURE SCHEDULE

DESIG.	MOUNTING	TYPE	LAMPS	DESCRIPTION
▭	RECESSED	LED	LED 74 W	RECESSED 1' x 4' LED LIGHTING FIXTURE 0.250 CLEAR TEMPERED GLASS, 0.156 KSH19 CLEAR ACRYLIC LENS ACRITUF, 16 GA. C.R.S. HOUSING, 14 GA. C.R.S. FRAME DOOR, 16 GA. INVISIBLE PIANO HINGE (8) 8 - 32 ALLEN HEAD, PLATED STEEL CAPTIVE FLUSH BOLTS, 16 GA. C.R.S. RETAINING RAIL LENS 20 GA. BAKED WHITE POLYESTER POWDER COAT PAINT, KENALL # RMCA - 4 - MP - % - 67L35K - DV - 1/A - 2 OR APPROVED EQUAL.

2

0 4 8 16



KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director: HARDEE SAINI
Project Manager: BV
Project Engineer: TS
Drawn By: DB
Checked By: SB
PIN # 072201723CPD
Date: 01/21/2015

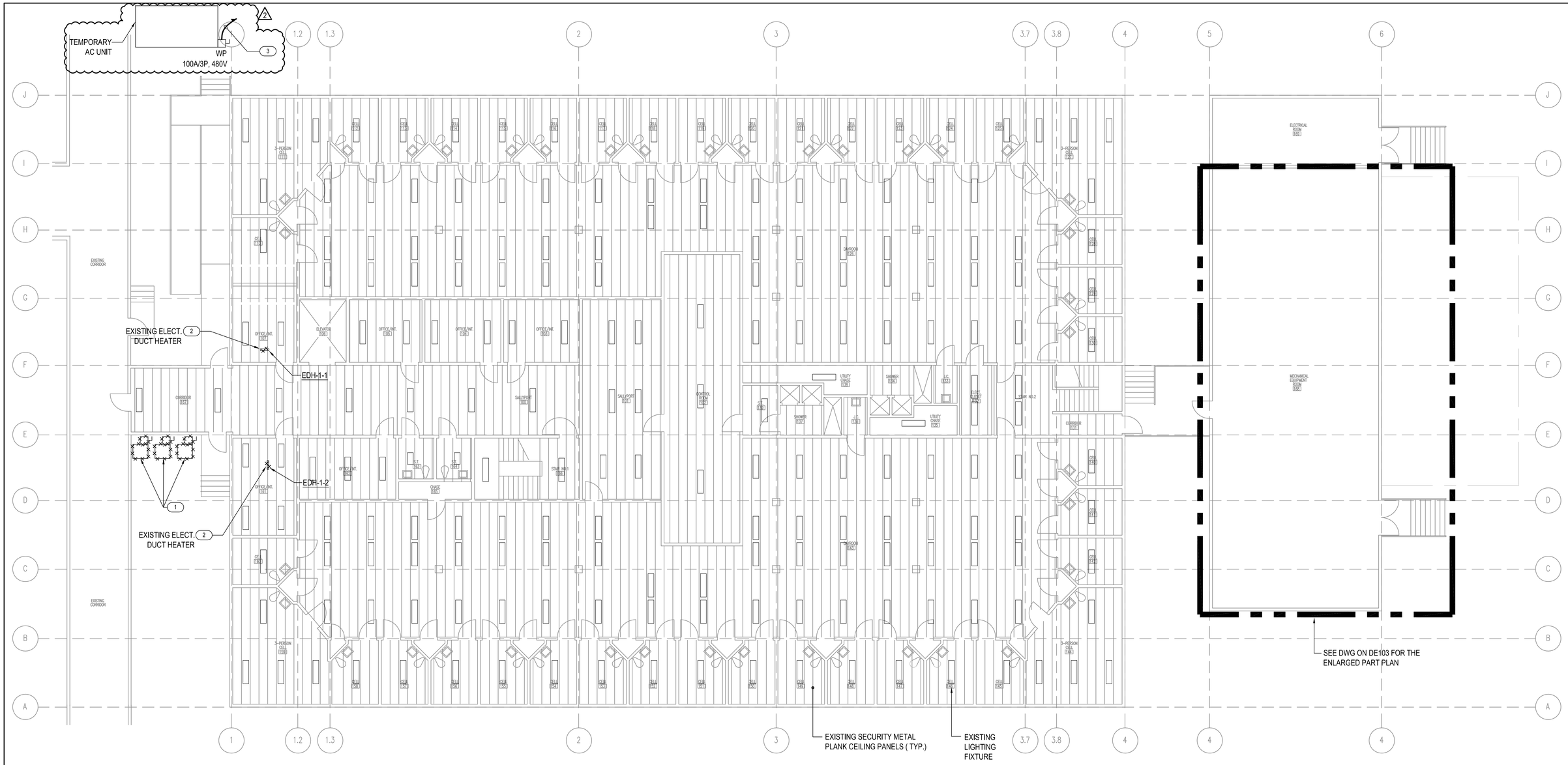
Drawing Title:
ELECTRICAL -
DEMOLITION NOTES
AND DRAWING LIST

Seal:

Drawing No.:
E002.00

Scale: NONE

Sheet: 40 of 70



1 FIRST FLOOR PLAN - REMOVAL

SCALE: 1/8"=1'-0"

NOTES

1. FOR GENERAL NOTES, DEMOLITION NOTES, ABBREVIATIONS AND SYMBOL LIST, REFER TO DRAWING E001.00 AND E002.00
2. DEMOLITION SHALL INCLUDE REMOVAL OF ALL WIRING AND EXPOSED CONDUIT UP TO SOURCE OF CONNECTION. CONTRACTOR SHALL SET SPARE BREAKERS TO THE "OFF" POSITION AND SHALL UPDATE ALL DIRECTORIES AFFECTED BY THE DEMOLITION.
3. WHEREVER MECHANICAL EQUIPMENT IS REMOVED. REMOVE ALL STARTERS. DISCONNECTS AND ASSOCIATED WIRING AND CONDUIT TO SOURCE.
4. ALL FIRE ALARM DEVICES SHALL REMAIN DURING CONSTRUCTION.

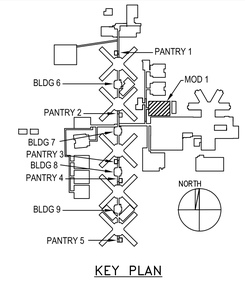
KEY NOTES

(1) DISCONNECT AND REMOVE EXISTING STARTER/DISCONNECT AND ASSOCIATED WIRING AND CONDUIT FOR EXISTING THREE CONDENSING UNITS TO BE REMOVED. VERIFY LOCATION OF EQUIPMENT IN FIELD.

(2) REMOVE EXISTING ELECTRICAL DUCT HEATER AND ASSOCIATED WIRING AND CONDUIT TO SOURCE.

(3) 3 # 2 + 1 # 8G - 1 ½"C TO 100/70A, 3P, 480V FUSED DISC SWITCH. SEE DWG DE104.00. (2)

0 4 8 16



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Project:

AIR CONDITIONING SYSTEM REPLACEMENT

MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	TS
Drawn By: DB	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

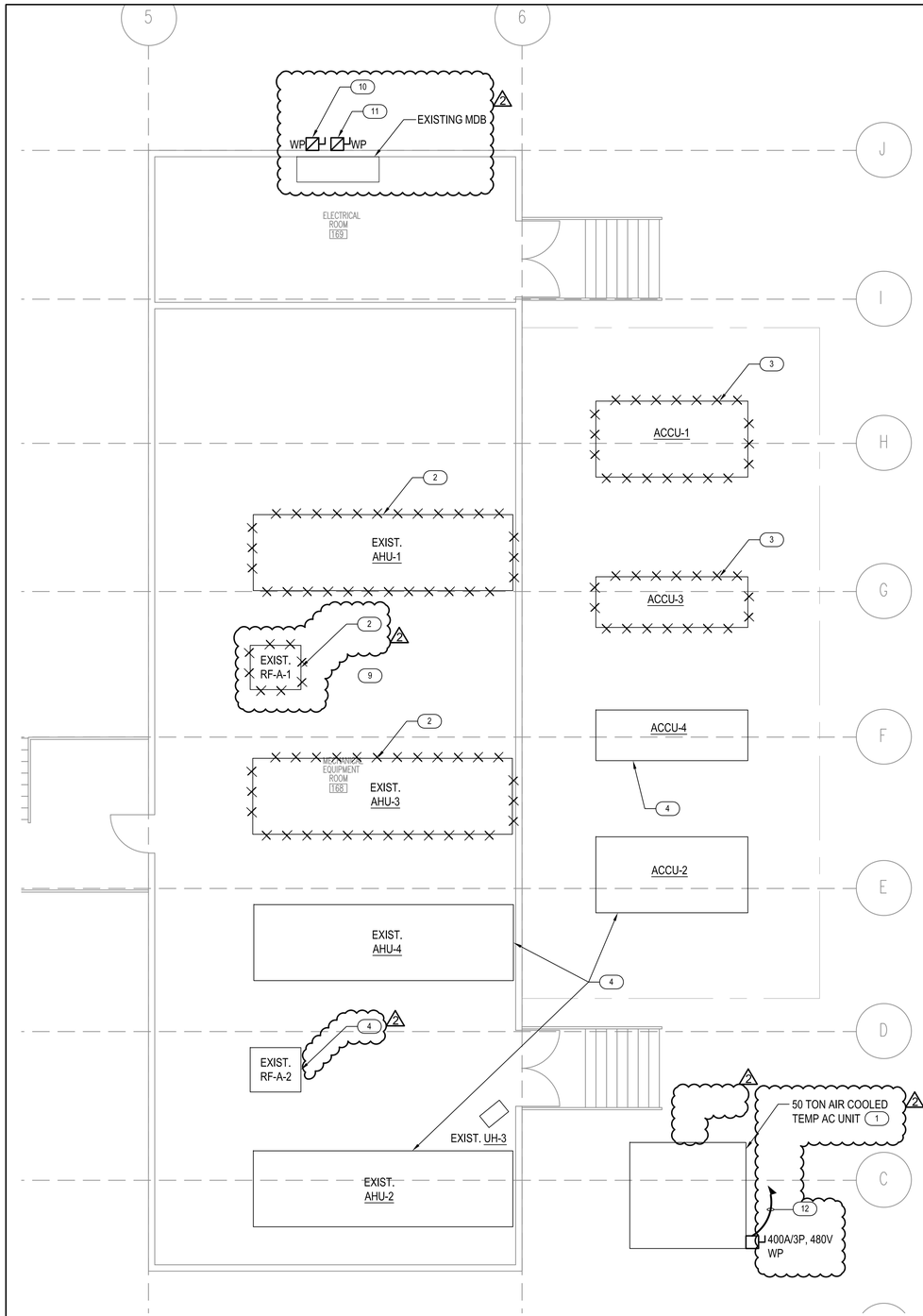
Drawing Title:
ELECTRICAL
1ST FLOOR PLAN
REMOVAL

Seal:

Drawing No.: DE101.00

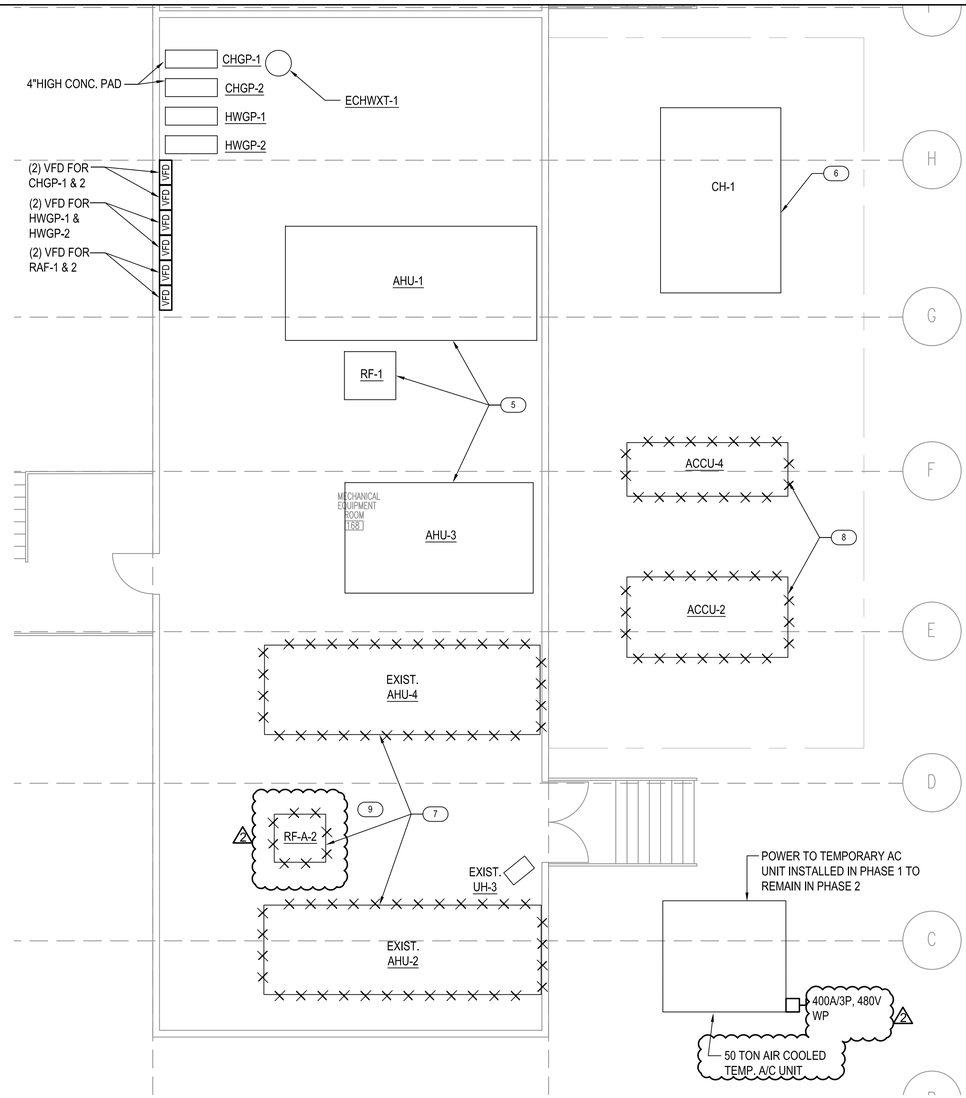
Scale: 1/8" = 1'-0"

Sheet: 41 of 70



1 PART PLAN MECHANICAL ROOM - PHASE 1 TEMPORARY A/C PLAN

SCALE: 3/16"=1'-0"



2 PART PLAN MECHANICAL ROOM - PHASE 2 TEMPORARY A/C PLAN

SCALE: 3/16"=1'-0"

NOTES

1. COORDINATE PHASING PLAN (REMOVAL AND NEW WORK) WITH MECHANICAL AND PROVIDE POWER TO TEMPORARY AC UNIT AS REQUIRED.
2. PROVIDE POWER TO TEMPORARY AC UNIT IN PHASE 1 AND 2.
3. MECH EQUIPMENT IS SHOWN FOR COORDINATION ONLY.
4. NOT USED. (2)
5. DISCONNECT AND REMOVE ALL TEMPORARY WIRING CONDUIT AND EQUIPMENT AT THE END OF PHASE 2 WHEN ALL NEW EQUIPMENT IS OPERATIONAL
6. PHASING PLAN IS THE SUGGESTED PHASING. CONTRACTOR SHALL PREPARE HIS OWN PHASING PLAN AND COORDINATE / REVIEW WITH CMU.

KEY NOTES

1. PROVIDE POWER TO TEMPORARY AC UNIT.
2. DISCONNECT AND REMOVE STARTER /DISC AND ASSOCIATED WIRING AND CONDUITS TO SOURCE FOR EXISTING AHU-1 AND AHU-3, RF-A-1 TO BE REMOVED.
3. DISCONNECT AND REMOVE STARTER /DISC AND ASSOCIATED WIRING AND CONDUITS TO SOURCE FOR EXISTING ACCU-1, ACCU-3 TO BE REMOVED.
4. UNITS AHU-4, AHU-2, ACCU-2, ACCU-4, RF-A-2 TO REMAIN IN PHASE 1.
5. PROVIDE POWER TO AHU-1, AHU-3, RF-1 (SEE E203.00)
6. PROVIDE POWER TO NEW CHILLER CH-1.
7. DISCONNECT AND REMOVE STARTER /DISC AND ASSOCIATED WIRING AND CONDUITS TO SOURCE FOR EXISTING AHU-2 AND AHU-4, RF-A-2 TO BE REMOVED.
8. DISCONNECT AND REMOVE STARTER /DISC AND ASSOCIATED WIRING AND CONDUITS TO SOURCE FOR EXISTING ACCU-2, ACCU-4 TO BE REMOVED.
9. CONTRACTOR SHALL REMOVE STORE AND REINSTALL EXISTING PENDANT MOUNTED INDUSTRIAL FLUORESCENT FIXTURES IN COORDINATION WITH NEW UNITS AND DUCTWORK. EXTEND WIRING AS REQUIRED.
10. 400/300A/3P, 480V WEATHERPROOF FUSED DISC. SWITCH. TAP MAIN BUS OF MAIN DISTRIBUTION BOARD-MDB WITH 3 # 350MCM + 1 # 3G - 3"C TO NEW FUSED DISC. SWITCH FOR POWER TO TEMPORARY AC UNIT. COORDINATE EXACT LOCATION IN FIELD WITH EXISTING EQUIPMENT. (2)
11. 100/70A/3P, 480V WEATHERPROOF FUSED DISC SWITCH. TAP MAIN BUS OF MAIN DISTRIBUTION BOARD-MDB WITH 3 # 2 + 1 # 8G - 1 ½ "C TO NEW FUSED DISC SWITCH FOR POWER TO TEMPORARY AC UNIT.
12. 3 # 350MCM + 1 # 3G - 3"C TO 400 / 300 A/3P, 480V FUSED DISC. SWITCH.

0 4 8 16

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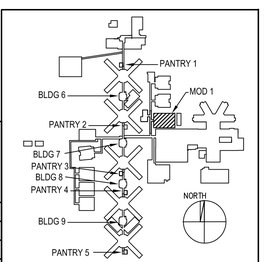
Project:

AIR CONDITIONING
SYSTEM REPLACEMENT
MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	TS
Drawn By: DB	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015



KEY PLAN

Drawing Title:

ELECTRICAL - PHASING PLANS

Seal:

Drawing No.:

DE104.00

Scale: 3/16" = 1'-0"

Sheet: 44 of 70

1 FIRST FLOOR PLAN

SCALE: 1/8"=1'-0"

KEY NOTES

1. CONTRACTOR SHALL DISCONNECT AND REMOVE CAREFULLY EXISTING RECESSED LIGHTING FIXTURES AND STORE SAFELY FOR OTHER TRADE CEILING ACCESS. RECONNECT AND REINSTALL REMOVED LIGHTING FIXTURES UPON COMPLETION OF CONSTRUCTION WORK. COORDINATE ALL WORK WITH HVAC CONTRACTOR.
2. CONTRACTOR SHALL REPLACE 70 LIGHTING FIXTURES (TOTAL) ON 1ST AND 2ND FLOORS WITH SECURITY TYPE LED FIXTURES. OWNER SHALL DIRECT THE ACTUAL LOCATIONS IN THE SITE.
3. EXISTING SMOKE DETECTORS, SPEAKERS, SPRINKLER HEADS SHALL BE PROVIDED WITH TEMPORARY SUPPORTS WITHOUT DISCONNECTION OF EXISTING SYSTEM FOR ALL TRADES. REINSTALL AFTER HVAC INSTALLATIONS.
4. EXISTING FSD TO BE REPLACED WITH NEW. PROVIDE POWER TO FSD'S FROM PANEL ERP-L1 OR RECONNECT BACK TO EXISTING POWER.
5. CONNECT PDC TO 15A/1P, 120V CIRCUIT BREAKER IN EXISTING PANEL RP-L1.
6. NEW SMOKE PURGE PANEL REPLACING EXISTING (BY MECHANICAL CONTRACTOR). RECONNECT TO EXISTING POWER WIRING.

NOTE: NOT ALL CEILING COMPONENTS ARE SHOWN ON PLAN. CONTRACTOR SHALL FIELD VERIFY AND COORDINATE FOR ALL REMOVAL AND CONSTRUCTION WORK FOR ALL TRADES.

0 4 8 16

KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

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No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

IT IS A VIOLATION OF THE STATE EDUCATION LAW SECTION 7209 (2) FOR ANY PERSON TO ALTER AN ITEM IN ANY WAY UNLESS SUCH PERSON IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, AND THE ENGINEER STAMPS SUCH CHANGES

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	TS
Drawn By: DB	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

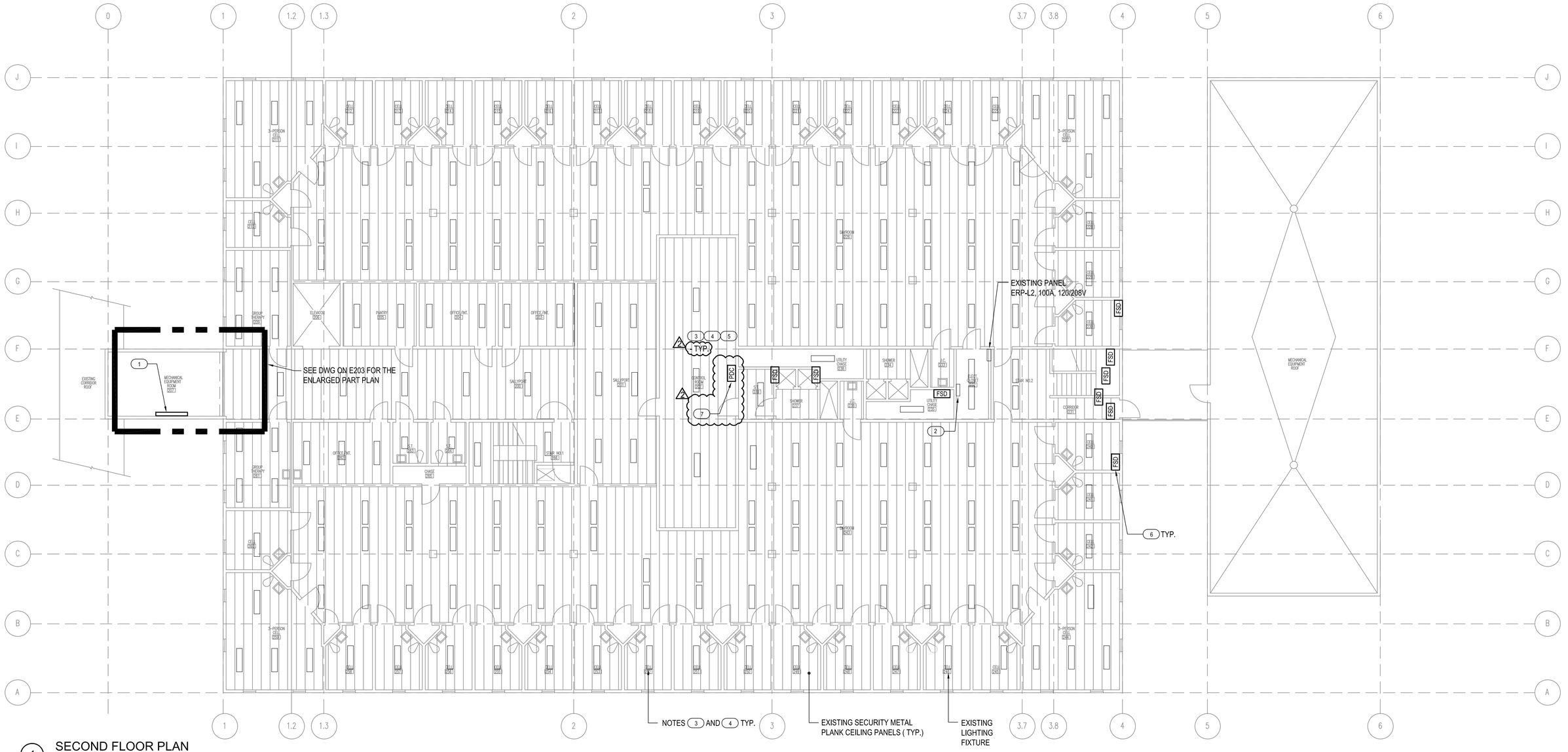
Drawing Title:
ELECTRICAL FIRST FLOOR
EXISTING LIGHTING PLAN

Seal:

Drawing No.: E201.00

Scale: 1/8" = 1'-0"

Sheet: 45 of 70



1 SECOND FLOOR PLAN

SCALE: 1/8"=1'-0"

NOTES

1. SEE NOTES ON DWG E203.00.

KEY NOTES

1. REPLACE EXISTING STARTERS FOR EXHAUST FANS FOR EF-1, EF-2, EF-3, EF-4 WITH NEW VFD AND RECONNECT BACK TO EXISTING WIRING AND CONDUIT. PROVIDE VFD'S FOR EXHAUST FANS EF-1A, EF-2A, EF-3A, EF-4A.
2. EXISTING PANEL RP-L2, 100A, 120/208V.
3. CONTRACTOR SHALL DISCONNECT AND REMOVE CAREFULLY EXISTING RECESSED LIGHTING FIXTURES AND STORE SAFELY FOR OTHER TRADE CEILING ACCESS. RECONNECT AND REINSTALL REMOVED LIGHTING FIXTURES UPON COMPLETION OF CONSTRUCTION WORK. COORDINATE ALL WORK WITH HVAC CONTRACTOR.
4. CONTRACTOR SHALL REPLACE 70 LIGHTING FIXTURES (TOTAL) ON 1ST AND 2ND FLOORS WITH SECURITY TYPE LED FIXTURES. OWNER SHALL DIRECT THE ACTUAL LOCATIONS IN THE SITE. (2)
5. EXISTING SMOKE DETECTORS, SPEAKERS, SPRINKLER HEADS SHALL BE PROVIDED WITH TEMPORARY SUPPORTS WITHOUT DISCONNECTION OF EXISTING SYSTEM FOR ALL TRADES. REINSTALL AFTER HVAC INSTALLATIONS.
6. EXISTING FSD TO BE REPLACED WITH NEW. PROVIDE POWER TO FSD'S FROM PANEL ERP-L2 OR RECONNECT BACK TO EXISTING POWER.
7. CONNECT PDC TO 15A/1P, 120V CIRCUIT BREAKER IN EXISTING PANEL RP-L2. (2)

NOTE: NOT ALL CEILING COMPONENTS ARE SHOWN ON PLAN. CONTRACTOR SHALL FIELD VERIFY AND COORDINATE FOR ALL REMOVAL AND CONSTRUCTION WORK FOR ALL TRADES.

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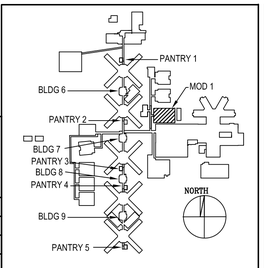

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DESIGNED BY:

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Project:

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MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI		
Project Manager:	BV		
Project Engineer:	TS		
Drawn By:	DB	Checked By:	SB
PIN #	072201723CPD	Date:	01/21/2015

Drawing Title:

ELECTRICAL SECOND FLOOR
EXISTING LIGHTING PLAN

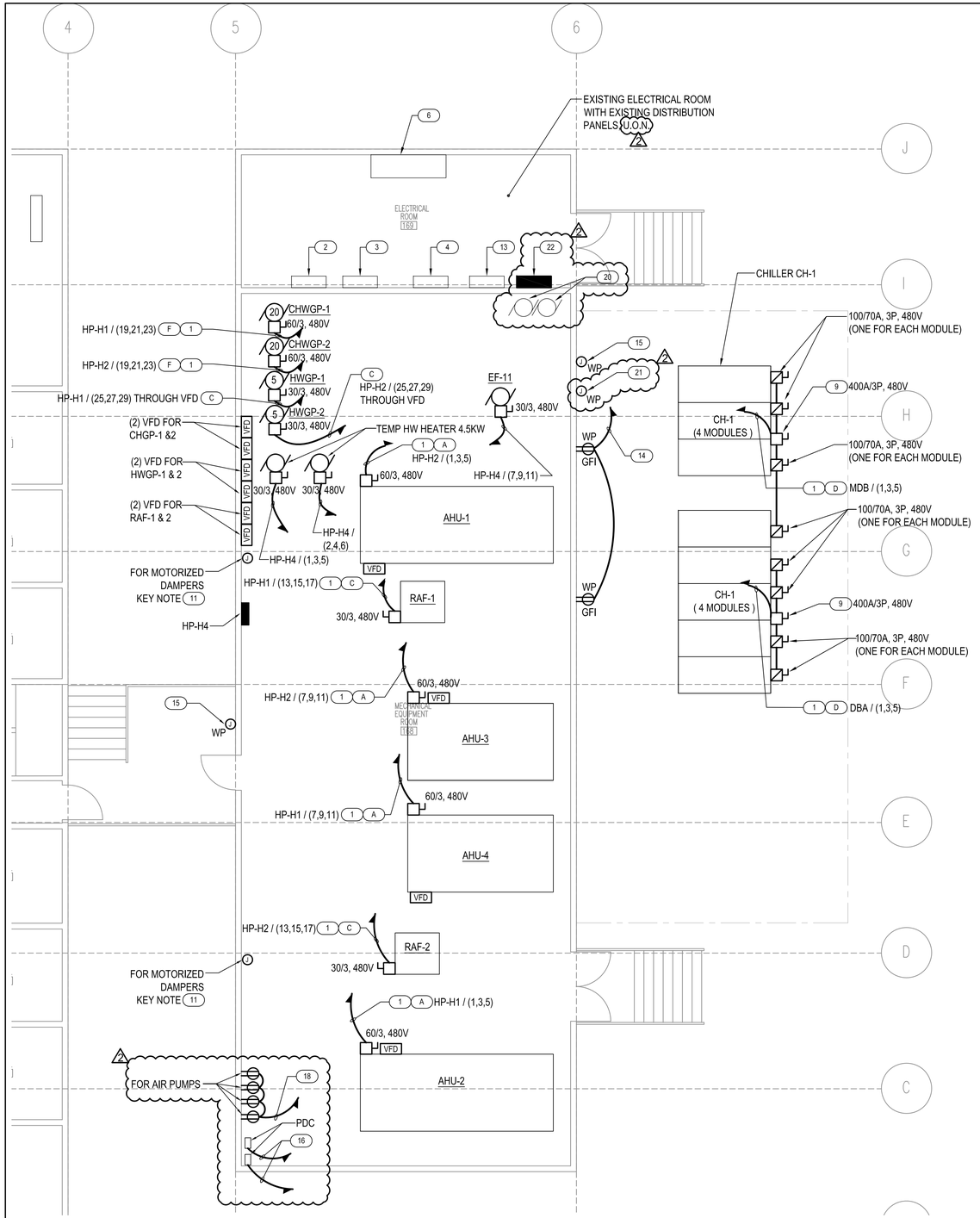
Seal:

Drawing No.:

E202.00

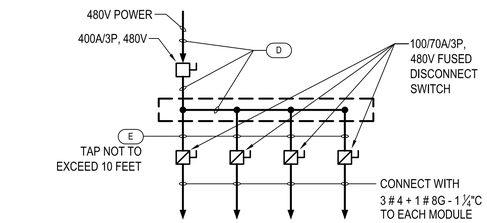
Scale: 1/8" = 1'-0"

Sheet: 46 of 70



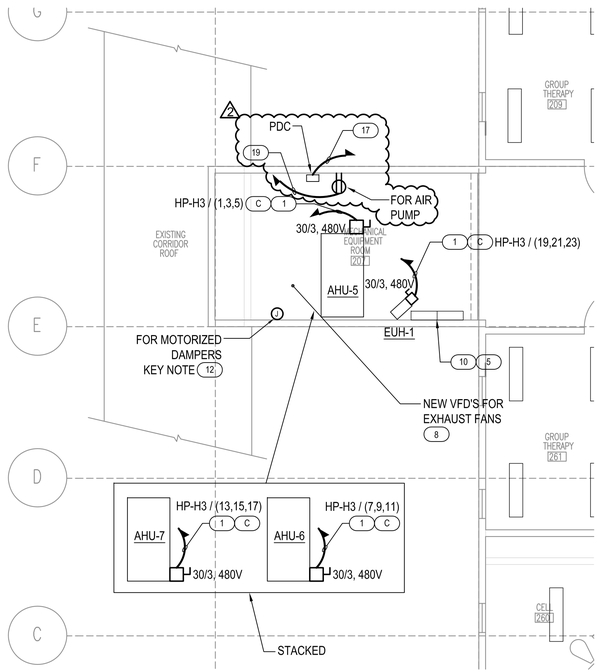
1 PART PLAN MAIN LEVEL MECHANICAL ROOM

SCALE: 3/16"=1'-0"



3 WIRING TO CHILLER CH-1 MODULES

SCALE: NTS



2 PART PLAN 2ND FLOOR MECHANICAL ROOM

SCALE: 3/16"=1'-0"

0 4 8 16

FEEDER SCHEDULE

- (A) 3 # 8 + 1 # 10G - ¾"C
- (B) 3 # 10 + 1 # 10G - ¾"c
- (C) 3 # 12 + 1 # 12G - ¾"C
- (D) 3 - 350MCM + 1 # 3G - 3"C
- (E) 3 # 4 + 1 # 8G - 1 ¼"C
- (F) 3 # 6 + 1 # 10G - ¾"C

NOTES

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOL LIST, REFER TO DRAWING E001.00
2. REFER TO E400 SERIES DRAWINGS FOR THE ELECTRICAL ONE LINE DIAGRAM AND FA SERIES DRAWINGS FOR FIRE ALARM RISER DIAGRAM.
3. REFER TO E500 SERIES DRAWINGS FOR PANEL SCHEDULES.
4. REFER TO E600 SERIES DRAWINGS FOR CONDUIT INSTALLATION DETAILS AND FIRE PROOFING METHODS.
5. UNLESS OTHERWISE NOTED ON THE DRAWING, CONDUIT USAGE SHALL BE AS FOLLOWS:
   - ALL UNDERGROUND AND OUTDOOR CONDUIT - RGS.
   - FURRED OR SUSPENDED CEILING AND IN WALLS - EMT.
   - FOR MOTORS AND VIBRATING EQUIPMENT - LIQUID TIGHT FLEXIBLE METAL CONDUIT (MAX. 6' IN LENGTH).
   - EXPOSED CONDUITS - RGS
6. SEE MECHANICAL DRAWINGS FOR EXACT LOCATION OF ALL EQUIPMENT AND STARTER/VFD'S LOCATIONS. WHEREVER STARTERS/VFD'S ARE REMOTELY MOUNTED, ELECTRICAL CONTRACTOR SHALL WIRE THROUGH STARTER/VFD'S.
7. ALL 3 POLE DISCONNECT SWITCHES ARE RATED AT 480V, U.O.N.
8. ALL EXTERIOR EQUIPMENT AND EQUIPMENT ON ROOF SHALL BE WEATHERPROOF.
9. RUN EXTERIOR FEEDER IN CONDUIT TO AIR COOLED CHILLER 12" BELOW GRADE.
10. ALL AHU UNITS, EXHAUST FANS, CHILLED AND HOT WATER PUMPS WILL BE PROVIDED WITH VFD'S CONTRACTOR SHALL INSTALL AND WIRE ALL VFD'S. VFD'S WILL BE FURNISHED BY MECH CONTRACTOR.

KEY NOTES

1. PROVIDE NEW FEEDER FOR MECHANICAL EQUIPMENT FROM EXISTING DISTRIBUTION PANEL FEEDING EXISTING EQUIPMENT TO BE REMOVED. REPLACE EXISTING CIRCUIT BREAKER IN EXISTING PANEL WITH NEW CIRCUIT BREAKER. WIRE THROUGH NEW VFD.
2. EXISTING PANEL DBA
3. EXISTING PANEL HP-H1 (LABELED MDP IN FIELD) (PANEL FEEDS EXISTING UNITS AHU-2, AHU-4, ACCU-1, ACCU-3, RF-A-1 TO BE REMOVED) PROVIDE NEW NAMEPLATE TAG HP-H1 ON THIS PANEL.
4. EXISTING PANEL HP-H2 (PANEL FEEDS EXISTING UNITS AHU-1, AHU-3, ACCU2, RF-A-2 TO BE REMOVED)
5. EXISTING PANEL HP-H3 (PANEL FEEDS EXISTING UNITS AC-A-1, AC-A-2, AC-A-3, AND 3 CONDENSING UNITS TO BE REMOVED)
6. EXISTING MAIN DISTRIBUTION BOARD 'MDB'
7. NOT USED.
8. REPLACE EXISTING STARTERS FOR EXHAUST FANS WITH NEW VFD'S IN MECH ROOM AND RECONNECT BACK TO EXISTING WIRING AND CONDUIT.
9. FOR POWER TO CH-1 PROVIDE WIREWAY FOR POWER TO CHILLER MODULES, SEE WIRING DETAIL TO EACH MODULE FROM MAIN DISCONNECT ON THIS DWG.
10. EXISTING PANEL HP-H3 (2 SECTION)
11. PROVIDE POWER TO MOTORIZED DAMPERS FROM 15A/1P CB IN PANEL RP-L3A.
12. CONNECT TO 15A/1P CIRCUIT BREAKER IN EXISTING PANEL RP-L2 FOR POWER TO MOTORIZED DAMPERS.
13. EXISTING PANEL RP-L3, 100A, 120/208V.
14. CONNECT RECEPTACLES TO 20A/1P CB IN PANEL RP-L3A.
15. JUNCTION BOX FOR POWER TO HEAT TRACING CABLE. CONNECT TO 20A/2P CB IN PANEL RP-L3A. SEE DWG M205.00 FOR PIPING IN CRAWL SPACE AND EXTERIOR CHILLED WATER PIPING TO BE HEAT TRACED.
16. CONNECT PDC TO 15A/1P, 120V CIRCUIT BREAKER IN PANEL RP-L3A.
17. CONNECT PDC TO 15A/1P, 120V CIRCUIT BREAKER IN EXISTING PANEL RP-L2.
18. CONNECT AIR PUMPS TO 15A/1P 120V CIRCUIT BREAKER IN PANEL RP-L3A.
19. CONNECT AIR PUMPS TO 15A/1P 120V CIRCUIT BREAKER IN PANEL RP-L2.
20. DISCONNECT AND RECONNECT TWO EXISTING PUMPS TO EXISTING WIRING AND CONDUIT FOR REMOVAL AND REINSTALLATION.
21. JUNCTION BOX FOR POWER TO HEAT TRACING CABLE. CONNECT TO 20A/2P CB IN PANEL RP-L3A. SEE DWG M205.00 FOR TEMP. DOMESTIC WATER PIPING TO BE HEAT TRACED.
22. NEW PANEL RP-L3A. COORDINATE WITH EXISTING EQUIPMENT IN FIELD.

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

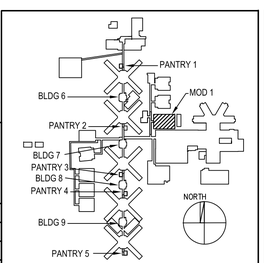
Project:

AIR CONDITIONING SYSTEM REPLACEMENT

MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI		
Project Manager:	BV		
Project Engineer:	TS		
Drawn By:	DB	Checked By:	SB
PIN #	072201723CPD	Date:	01/21/2015



KEY PLAN

Drawing Title:

ELECTRICAL - PART PLAN MECHANICAL ROOMS

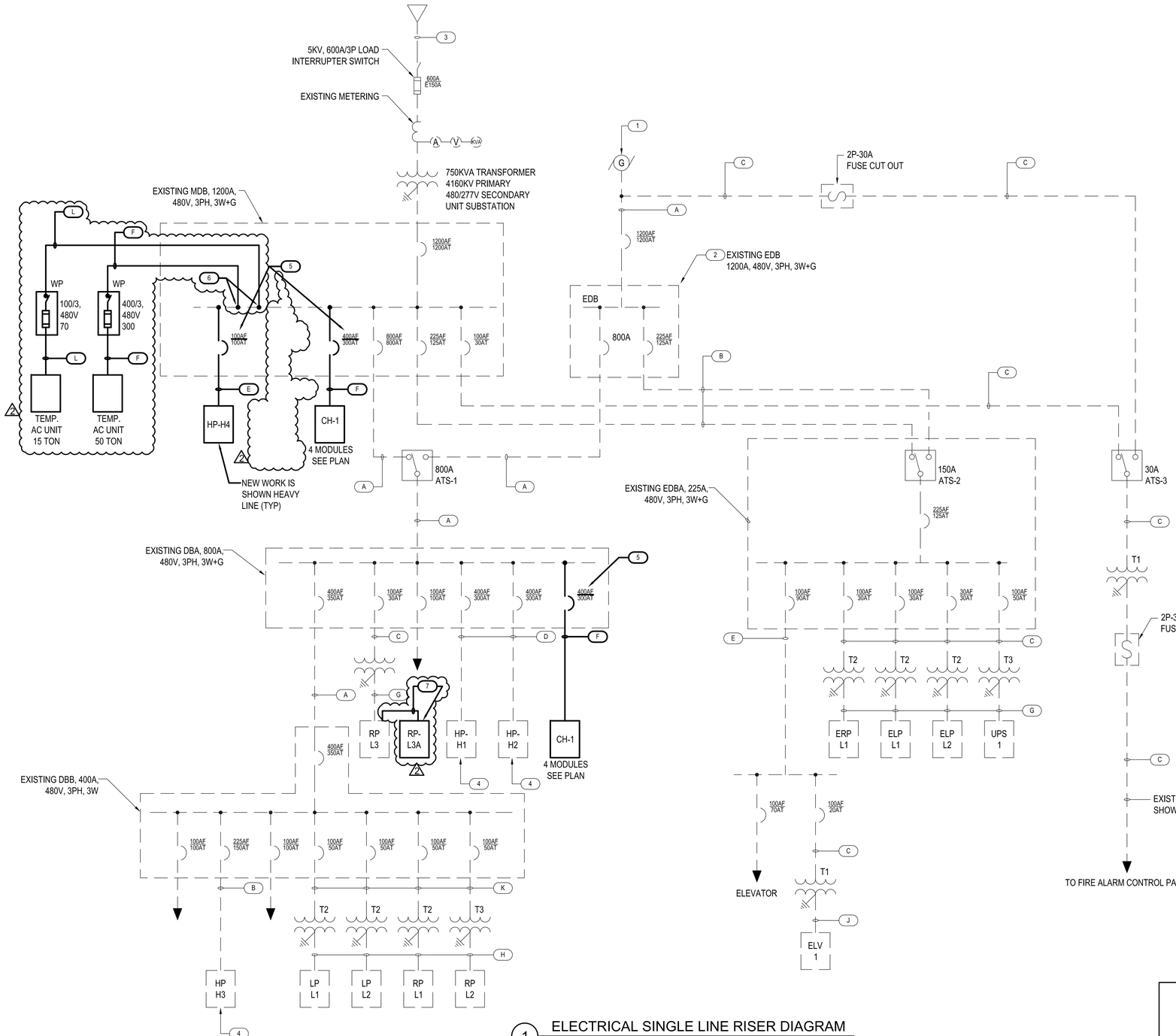
Seal:

Drawing No.:

E203.00

Scale: 3/16" = 1'-0"

Sheet: 47 of 70



KEY NOTES

1. EXISTING 600KW (750KVA), 277/480V, 3PH, 4' W EMERGENCY GENERATOR
2. EXISTING EMERGENCY DIST. PANEL EDB 1200A, 480V, 3PH , 3W + G
3. EXISTING 3-1/C # 1/0 RATED AT 5KV WITH INSTALLATION LEVEL OF 133 PERCENT. ETHYLENE-PROPYLENE RUBBER INSULATED FEEDER.
4. SEE PANEL SCHEDULES FOR PANELS HP-H1, HP-H2, HP-H3 ON E500 SERIES DRAWINGS.
5. PROVIDE NEW CIRCUIT BREAKERS IN EXISTING DISTRIBUTION BOARDS MATCHING EXISTING.
6. TAP NOT TO EXCEED 10'.
7. PROVIDE PANEL RP-L3A, WITH 40A/3P MCB AND 4-20A/1P, 8-15A/1P, 2-20A/2P BRANCH CIRCUIT BREAKERS. PROVIDE 40A/3P CIRCUIT BREAKER IN EXISTING PANEL RP-L3 TO FEED NEW PANEL RP-L3A WITH 4 # 8 + 1 # 10G - ¾"C.

FEEDER SCHEDULE

- A — 3 SETS OF 3 - 500 MCM + 1 # 3/0G - 3 ½"C
- B — 3 # 1/0 + 1 # 6G - 1 ½"C
- C — 3 # 10 + 1 # 10G - ¾"C
- D — 3 - 500 MCM + 1 # 1/0G - 3 ½"C
- E — 3 # 1 + 1 # 6G - 1 ½"C
- F — 3 - 350 MCM + 1 # 3G - 3"C
- G — 4 # 6 + 1 # 10G - 1"C
- H — 4 # 2 + 1 # 8G - 1 ½"C
- I — 2 SETS OF 3 - 250 MCM + 1 # 1G - 3"C
- J — 4 # 8 + 1 # 10G - ¾"C
- K — 3 # 6 - ¾"C
- L — 3 # 2 + 1 # 8G - 1 ¼"C

1 ELECTRICAL SINGLE LINE RISER DIAGRAM
SCALE: NTS

0 4 8 16

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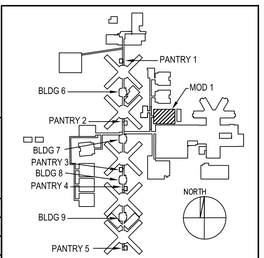

KEY PLAN

Drawing Title:

ELECTRICAL
SINGLE LINE RISER
DIAGRAM

Seal:

Drawing No.:

E401.00

Scale: NONE

Sheet: 49 of 70

PANEL: DBA (EXISTING)

SERVICE VOLTAGE: 480V, 3PH, 3W+G
MAIN BUS RATING: 800A
AIC RATING: 22k
PANEL FEEDER: SEE ONE LINE DIAGRAM

ENCLOSURE: NEMA-1
MOUNTING: SURFACE
LOCATION: ELEC ROOM, 1st FLOOR

EXISTING PANEL (EMERGENCY POWER)

MAIN RATING:
- [ ] MCB:
- [X] MLO:

OPTIONS:
- [X] BONDED GROUND BUS
- [ ] ISOLATED GROUND BUS
- [ ] 200% NEUTRAL BUS
- [ ] FEED THROUGH LUGS
- [ ] SUB FEED LUGS
- [ ] DOOR-IN-DOOR TRIM
- [ ] INTEGRAL TVSS DEVICE
- [ ] INTEGRAL RC SWITCH
- [ ] INTEGRAL METERING DEVICE

BRANCH FEEDER	LOAD DESCRIPTION	BRANCH DEVICE POLE (No)	FRAME (AMP)	TRIP (AMP)	CKT.	N / PHASE A B C / G	CKT.	BRANCH DEVICE POLE (No)	FRAME (AMP)	TRIP (AMP)	LOAD DESCRIPTION	BRANCH FEEDER
3 - 350 MCM + 1 # 3G -3"C	CH-1 (½ LOAD)	3	400	300	1		2					
					3		4	3			EXISTING LOAD	
					5		6					
	EXISTING LOAD	3			7		8					
					9		10	3			EXISTING LOAD	
					11		12					
	EXISTING LOAD	3			13		14					
					15		16	3			EXISTING LOAD	
					17		18					
	EXISTING LOAD	3			19		20					
					21		22	3			EXISTING LOAD	
					23		24					
	SPACE				25		26					
					27		28	3			EXISTING LOAD	
					29		30					
	SPACE				31		32					
					33		34	3			EXISTING LOAD	
					35		36					
	SPACE				37		38					
					39		40	3			EXISTING LOAD	
					41		42					

REMARKS: 1. SEE PANEL SCHEDULE NOTES.
2. PROVIDE NEW CIRCUIT BREAKERS IN EXISTING SPACES TO FEED CHILLER CH-1 AND TEMPORARY AC UNIT.

PANEL: MDB (EXISTING)

SERVICE VOLTAGE: 480V, 3PH, 3W
MAIN BUS RATING: 1200A
AIC RATING: 65k
PANEL FEEDER: SEE ONE LINE DIAGRAM

ENCLOSURE: NEMA-1
MOUNTING: SURFACE
LOCATION: ELEC ROOM, 1st FLOOR

EXISTING PANEL (NORMAL POWER)

MAIN RATING:
- [ ] MCB:
- [X] MLO:

OPTIONS:
- [X] BONDED GROUND BUS
- [ ] ISOLATED GROUND BUS
- [ ] 200% NEUTRAL BUS
- [ ] FEED THROUGH LUGS
- [ ] SUB FEED LUGS
- [ ] DOOR-IN-DOOR TRIM
- [ ] INTEGRAL TVSS DEVICE
- [ ] INTEGRAL RC SWITCH
- [ ] INTEGRAL METERING DEVICE

BRANCH FEEDER	LOAD DESCRIPTION	BRANCH DEVICE POLE (No)	FRAME (AMP)	TRIP (AMP)	CKT.	N / PHASE A B C / G	CKT.	BRANCH DEVICE POLE (No)	FRAME (AMP)	TRIP (AMP)	LOAD DESCRIPTION	BRANCH FEEDER
3 - 350 MCM + 1 # 3G -3"C	CH-1 (½ LOAD)	3	400	300	1		2					
					3		4	3			EXISTING LOAD	
					5		6					
	SPACE				7		8					
					9		10	3			EXISTING LOAD	
					11		12					
	SPACE				13		14					
					15		16	3			EXISTING LOAD	
					17		18					
	SPACE				19		20					
					21		22	3			EXISTING LOAD	
					23		24					
	SPACE				25		26					
					27		28				SPACE	
					29		30					
	SPACE				31		32					
					33		34				SPACE	
					35		36					
	SPACE				37		38					
					39		40				SPACE	
					41		42					

REMARKS: PROVIDE NEW CIRCUIT BREAKERS IN EXISTING SPACES IN PANEL.

PANEL: HP-H4

SERVICE VOLTAGE: 277/480V, 3PH, 3W
MAIN BUS RATING: 100A
AIC RATING: 22k
PANEL FEEDER: SEE ONE LINE DIAGRAM

ENCLOSURE: NEMA-1
MOUNTING: SURFACE
LOCATION: MECH. ROOM

NORMAL POWER

MAIN RATING:
- [ ] MCB:
- [X] MLO:

OPTIONS:
- [X] BONDED GROUND BUS
- [ ] ISOLATED GROUND BUS
- [ ] 200% NEUTRAL BUS
- [ ] FEED THROUGH LUGS
- [ ] SUB FEED LUGS
- [ ] DOOR-IN-DOOR TRIM
- [ ] INTEGRAL TVSS DEVICE
- [ ] INTEGRAL RC SWITCH
- [ ] INTEGRAL METERING DEVICE

BRANCH FEEDER	LOAD DESCRIPTION	BRANCH DEVICE POLE (No)	FRAME (AMP)	TRIP (AMP)	CKT.	N / PHASE A B C / G	CKT.	BRANCH DEVICE POLE (No)	FRAME (AMP)	TRIP (AMP)	LOAD DESCRIPTION	BRANCH FEEDER
3 # 12 + 1 # 12G - ¾C	HW HEATER	3	100	15	1		2					
					3		4	3	100	15	HW HEATER	3 # 12 + 1 # 12G - ¾C
					5		6					
3 # 12 + 1 # 12G - ¾C	EF-11	3	100	15	7		8					
					9		10	3	100	15	CH-1 CAB. HEATER	3 # 12 + 1 # 12G - ¾C
					11		12					
	SPARE	3	100	15	13		14					
					15		16	3	100	15	SPARE	
					17		18					
	SPACE				19		20				SPACE	
	SPACE				21		22				SPACE	
	SPACE				23		24				SPACE	
	SPACE				25		26				SPACE	
	SPACE				27		28				SPACE	
	SPACE				29		30				SPACE	

REMARKS:

PANEL SCHEDULE NOTES

1. SEE PANEL SCHEDULE NOTES ON DWG E501.00

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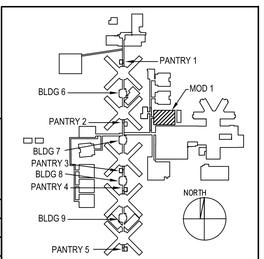

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PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:
ELECTRICAL - PANEL
SCHEDULES 2 OF 2

Seal:

Drawing No.:
E502.00

Scale: NONE

Sheet: 51 of 70

FIRE DETECTION AND ALARM SYSTEM

SYMBOL	DESCRIPTION
FACP	EXISTING FIRE ALARM CONTROL PANEL
SPP	SMOKE PURGE PANEL
S_D	SMOKE DETECTOR, SUBSCRIPT 'D' INDICATES DUCT MOUNTED.
CM	CONTROL MODULE
FSD	FIRE SMOKE DAMPER (SMOKE PURGE EXISTING) TO BE REPLACED WITH NEW
PB	FIRE ALARM PULL BOX
DACT	DIGITAL ALARM COMMUNICATION TRANSMITTER
	STARTER
R	RELAY
VFD	VARIABLE FREQUENCY DRIVE
	EXISTING TO REMAIN
	EXISTING TO BE REMOVED
	NEW WORK

DRAWING LIST

DRAWING #	DRAWING NAME	SHEET NUMBER
FA001.00	FIRE ALARM SYMBOLS AND ABBREVIATIONS	54 OF 70
FA101.00	FIRST FLOOR FIRE ALARM PLAN	55 OF 70
FA102.00	SECOND FLOOR FIRE ALARM PLAN	56 OF 70
DFA103.00	FIRE ALARM PART PLAN MECH. ROOM REMOVAL	57 OF 70
FA104.00	FIRE ALARM PART PLAN MECH. ROOM	58 OF 70
FA105.00	FIRE ALARM ROOF PLAN REMOVAL AND NEW WORK	59OF 70
FA201.00	FIRE ALARM RISER DIAGRAM	60 OF 70
FA202.00	FIRE ALARM NOTES	61 OF 70
FA301.00	FIRE ALARM DETAILS	62 OF 70

ABBREVIATIONS

SYMBOL	DESCRIPTION
A, AMPS	AMPERE
AC	ALTERNATING CURRENT
AIC	AMP INTERRUPTING CAPACITY
AFF	ABOVE FINISHED FLOOR
ARCH	ARCHITECTURAL
A/C	AIR CONDITIONING
B.O.E.	BOARD OF EDUCATION
C	CONDUIT
CAB	CABINET
CATV	CABLE TELEVISION
CB	CIRCUIT BREAKER
CKT(S)	CIRCUIT(S)
CL	CLOSET
CLG	CEILING
CONST.	CONSTRUCTION
COL	COLUMN
COMP	COMPUTER
CORR	CORRIDOR
CP	CONTROL PANEL
CV	CONSTANT VOLUME
DB	DISTRIBUTION BOARD
DISC	DISCONNECT
DIST	DISTRIBUTION

ABBREVIATIONS

SYMBOL	DESCRIPTION
DP	DISTRIBUTION PANEL
D.R.	DUPLEX RECEPTACLE
DWG	DRAWING
EC	EMPTY CONDUIT
ECL	ELECTRICAL CLOSET
ELEC	ELECTRIC
EMT	ELECTRIC METALLIC TUBING
E.O.	ELECTRICAL CONNECTION
EX	EXHAUST
EXIST	EXISTING
ER	EXISTING TO REMAIN
FACP	FIRE ALARM CONTROL PANEL
FL	FLOOR
FPB	FAN POWER BOX
HP	HORSEPOWER
HID	HIGH INTENSITY DISCHARGE
G	GUARD
G, GND	GROUND
GFI	GROUND FAULT INTERRUPTER
IG	ISOLATED GROUND
IDF	INTERMEDIATE DIST. FRAME
JB	JUNCTION BOX
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWH	KILOWATT HOUR
LDF	LOCAL DISTRIBUTION FRAME
LS	LOUDSPEAKER
LSR	LOCAL SOUND RACK
LTG	LIGHTING
MDB	MAIN DISTRIBUTION BOARD
MCB	MAIN CIRCUIT BREAKER
MECH	MECHANICAL
MER	MECHANICAL EQUIPMENT RM
MIC	MICROPHONE
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MTD	MOUNTED
N	NEUTRAL
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NTS	NOT TO SCALE
P	POLE(S)
PB	PULL BOX
PNL	PANEL
PRT	PRINTER
RC	REMOTE CONTROL
RGS	RIGID GALVANIZED STEEL
RM	ROOM
S/H	SMOKE HATCH
SP	SPARE
STD	STANDARD
SW	SWITCH
SWBD	SWITCHBOARD
TCL	TELECOMMUNICATION CLOSET
TEL	TELEPHONE
TV	TELEVISION
TYP	TYPICAL
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
V	VOLT
VDC	DIRECT CURRENT VOLTAGE
VAV	VARIABLE AIR VOLUME
W	WATT
WP	WEATHERPROOF
XP	EXPLOSION PROOF

GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE 2011 NEW YORK CITY ELECTRICAL CODE, THE NFPA, THE 2014 NEW YORK CITY BUILDING CODE, AND ALL GOVERNING LOCAL CODES, LAWS, AND REGULATIONS.
2. THE CONTRACTOR SHALL, IN A WORKMANLIKE MANNER, PROVIDE A COMPLETE OPERABLE SYSTEM. OUTLINE DESCRIPTION AND EQUIPMENT DO NOT LIMIT CONTRACTOR LIABILITY FOR THE INSTALLATION OF A COMPLETE OPERABLE SYSTEM.
3. THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH ALL EXISTING CONDITIONS THAT MAY AFFECT HIS WORK AND SHALL NOT BE ENTITLED TO ADDITIONAL COMPENSATION FOR HIS FAILURE TO DO SO.
4. CONTRACTOR SHALL BEAR THE COST OF ALL ELECTRICAL PERMITS INSPECTIONS, TEST REPORTS, AND CERTIFICATIONS FOR T.C.O. & C.O.
5. MINIMUM SIZE OF CONDUITS FOR BOTH LIGHTING AND POWER CIRCUITS SHALL BE 3/4"C U.O.N.
6. FOR ALL BRANCH CIRCUIT RATED AT 120V, 15A OR 20A THAT RUNS OVER 100'-0", No. 10 WIRE SIZE SHALL BE USED TO COMPENSATE FOR VOLTAGE DROP.
7. UNLESS OTHERWISE NOTED, PULL AND JUNCTION BOXES WHERE INDICATED ON DRAWINGS, SHALL BE CONSIDERED SHOWN AT THEIR APPROXIMATE LOCATION. THE CONTRACTOR SHALL LOCATE THEM AS FIELD CONDITIONS DICTATE. ADDITIONAL PULL AND JUNCTION BOXES NOT SHOWN ON DRAWINGS SHALL BE PROVIDED WHERE REQUIRED BY APPLICABLE CODE PROVISIONS OR FIELD CONDITIONS. PULL AND JUNCTION BOXES SHALL BE SURFACE TYPE IN UNFINISHED AREAS AND FLUSH TYPE IN FINISHED AREAS.
8. NO CONDUIT SHALL BE RUN IN ANY FLOOR IN CONTACT WITH THE EARTH UNLESS OTHERWISE DIRECTED ON THE PLAN. IN SUCH AREAS, CONDUIT FOR MOTORS AND STARTERS SHALL BE RUN OVERHEAD, SUPPORTED AS REQUIRED.
9. IN UNFINISHED PORTIONS OF BUILDING SUCH AS FAN ROOMS, PIPE SPACES, ETC., LOCATIONS OF CONDUIT AND OUTLETS ARE APPROXIMATE AND SHALL CLEAR PIPING AND ALL OTHER CONSTRUCTION. CONDUITS IN THESE PORTIONS OF THE BUILDING SHALL BE RUN EXPOSED BUT MAY BE RUN CONCEALED WITH THE UNDERSTANDING THAT ALL OUTLETS MUST BE EXTENDED AS DIRECTED TO CLEAR ANY INTERFERENCE WITH FIXTURES.
10. ALL PENETRATIONS THROUGH FIRE RATED WALLS AND FLOORS SHALL BE SMOKE/FIRE STOPPED.
11. THIS CONTRACTOR SHALL PROVIDE SEPARATE RACEWAYS FOR CONDUCTORS ON NORMAL AND EMERGENCY CIRCUITS.
12. THIS CONTRACTOR SHALL PROVIDE THE LOCATION, NUMBER, AND SIZE OF ALL CHASES REQUIRED FOR ALL WORK.
13. ALL WIRING AND CONDUIT LAYOUT ON DRAWINGS ARE SHOWN DIAGRAMMATIC. LOCATION OF EQUIPMENT AND RUNS MAY VARY DUE TO PHYSICAL CONDITIONS AT NO ADDITIONAL COST TO OWNER.
14. ALL EXPOSED NONCURRENT-CARRYING METAL PARTS OF ELECTRICAL EQUIPMENT AND RACEWAYS SHALL BE GROUNDED. THE CONTRACTOR SHALL ENSURE CONTINUITY OF THE GROUNDING CIRCUIT FROM THE SUPPLYING PANELBOARD GROUNDING BUS TO THE LOAD GROUND TERMINAL. THE RESISTANCE FROM THE SERVICE EQUIPMENT GROUND BUS TO ANY LOAD GROUND TERMINAL SHALL NOT EXCEED ONE (1) OHM.
15. ALL ELECTRICAL EQUIPMENT AND ACCESSORIES INSTALLED OUTSIDE OR EXPOSED TO WEATHER SHALL HAVE NEMA 3R ENCLOSURES AND SHALL BE TIGHTLY GASKETED FOR A COMPLETE RAIN TIGHT INSTALLATION.
16. ALL EQUIPMENT SPECIFIED OR REQUIRED SHALL HAVE COPPER CURRENT CARRYING PARTS INCLUDING GROUND BUS AND TERMINALS.
17. SPECIAL INSPECTIONS SHALL BE CARRIED OUT IN ACCORDANCE WITH APPLICABLE BUILDING CODE SECTIONS AND SHALL INCLUDE THE FOLLOWING:

    FIRE RESISTANT PENETRATIONS AND JOINTS - BC1704.27
18. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL RESTORATIONS, SEALING, WATERPROOFING, PENETRATIONS, CUTTING, PATCHING, AND PAINTING FOR THE COMPLETE CONTRACT WORK INDICATED. ALL RESTORATION WORK PERFORMED BY CONTRACTOR SHALL RESTORE DISTURBED SURFACES TO THEIR ORIGINAL CONDITION.
19. FIRE ALARM SYSTEM WIRING SHALL BE INSTALLED IN SEPARATE RACEWAYS FROM OTHER LOW VOLTAGE SYSTEMS.
20. ALL EXPOSED FASTENERS SHALL BE TAMPER PROOF TYPE.
21. PROVIDE METAL SHROUD AND/OR SECURITY CAULKING AROUND SURFACE MOUNTED CONDUITS INSTALLED BELOW 8 FEET IN ALL INMATE ACCESSIBLE AREAS.

GENERAL REMOVAL NOTES

1. CONTRACTOR SHALL DISCONNECT AND REMOVE EXISTING DUCT SMOKE DETECTORS FOR AHU UNITS, AC UNITS RETURN FANS TO BE REPLACED WITH NEW.
2. CONTRACTOR SHALL VISIT AND EXAMINE CAREFULLY THE AREAS AFFECTED BY THIS WORK TO BECOME FAMILIAR WITH EXISTING CONDITIONS AND WITH THE DIFFICULTIES THAT ATTEND THE EXECUTION OF THIS WORK. LATER CLAIMS WILL NOT BE RECOGNIZED FOR EXTRA LABOR, EQUIPMENT, OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED.
3. COORDINATE CONDUIT RUNS WITH EXISTING BUILDING COMPONENTS. RELOCATE AND/OR ALTER THE EXISTING BUILDING COMPONENTS AS DIRECTED BY CM. ALL RELOCATION OR ALTERATIONS TO BUILDING SHALL BE RESTORED TO THEIR ORIGINAL WORKING CONDITIONS AFTER SUCH RELOCATION OR ALTERATION WORK.
4. EXISTING FIRE ALARM SYSTEM SHALL REMAIN OPERATIONAL DURING CONSTRUCTION. SUPPORT DEVICES TEMPORARILY AS REQUIRED.

PHASING NOTES

1. COORDINATE PHASING WITH MECHANICAL.

FIRE ALARM SCOPE OF WORK

1. REPLACEMENT OF EXISTING DUCT SMOKE DETECTORS FOR UNITS AHU-1, AHU-2, AHU-3, AHU-4, RAF-1, RAF-2, AHU-5, AHU-6, AHU-7 WITH NEW.
2. FAN SHUTDOWN FOR UNITS AHU-1, AHU-2, AHU-3, AHU-4, RAF-1, RAF-2, AHU-5, AHU-6, AHU-7, EXHAUST FANS EF-1, EF-2, EF-3, EF-4.
3. CONNECT RETURN FANS RAF-1, RAF-2 TO EXISTING CONTROL WIRING FOR SMOKE PURGE CONTROL.
4. COORDINATE PHASING WITH MECHANICAL CONTRACTOR FOR REPLACEMENT OF ALL EQUIPMENT.
5. CONNECT CONTROL FOR RTU-1, RTU-2 TO SMOKE PURGE CONTROL PANEL FOR MAKE UP AIR FANS.

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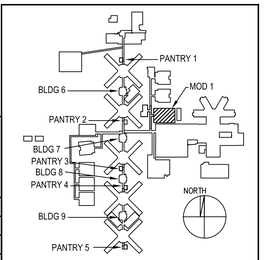

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Drawing Title:
FIRE ALARM SYMBOLS
AND ABBREVIATIONS

Seal:

Drawing No.:
FA001.00

Scale: NONE

Sheet: 54 of 70

KEY NOTES

(1) EXISTING FIRE ALARM CONTROL PANEL

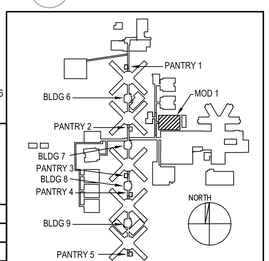
(2) DISCONNECT EXISTING FSD'S (TO BE REPLACED WITH NEW) FROM EXISTING CONTROL WIRING. RECONNECT NEW FSD'S BACK TO EXISTING CONTROL WIRING. CONTRACTOR MAY REUSE EXISTING CONTROL AND MONITOR MODULES. PROVIDE NEW CONTROL MODULES AS REQUIRED.

KEY NOTES

(3) NEW SMOKE PURGE PANEL REPLACING EXISTING (BY MECHANICAL CONTRACTOR). RECONNECT TO EXISTING POWER WIRING AND ALL NEW AND EXISTING CONTROL WIRING. SEE DWG. FA201.00. INTERFACE WITH EXISTING FIRE ALARM CONTROL PANEL.

1 FIRST FLOOR PLAN
SCALE: 1/8"=1'-0"

0 4 8 16



KEY PLAN

CITY OF NEW YORK DEPARTMENT OF CORRECTION

THE CITY OF NEW YORK
DEPARTMENT OF CORRECTION
DIVISION OF CAPITAL POLICY
AND DEVELOPMENT
ENGINEERING UNIT

DESIGNED BY:

IAQ SYSTEMS INC
Consulting Engineers
630 9th Avenue, Suite 1112
New York, New York 10036
Tel. 212.680.8945
www.iaqsys.com

Project:

AIR CONDITIONING SYSTEM REPLACEMENT

MODULAR BUILDING NUMBER 1
ANNA M. KROSS CENTER
18-18 HAZEN STREET, RIKERS ISLAND,
EAST ELMHURST, NEW YORK 11370

No.	Date	Revision
2	04-17-17	ADDENDUM 2
	01-30-17	ISSUED FOR BID

Director:	HARDEE SAINI
Project Manager:	BV
Project Engineer:	TS
Drawn By: DB	Checked By: SB
PIN # 072201723CPD	Date: 01/21/2015

Drawing Title:
FIRST FLOOR
FIRE ALARM PLAN

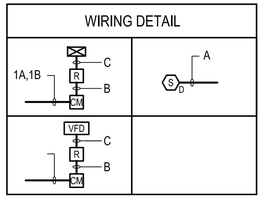
Seal:

Drawing No.:
FA101.00

Scale: 1/8" = 1'-0"

Sheet: 55 of 70

WIRING DETAIL



WIRING SCHEDULE	
A	(1) PAIR, #14 TWISTED SHIELDED (MAP DATA LOOP)
B	(1) PAIR, #14 (24VDC)
C	(1) PAIR, #14 (STROBES CKT.)
D	(1) PAIR, #14 (HORNS/BELLS CKT.)

SYMBOL	QUANTITY
(S)D	8

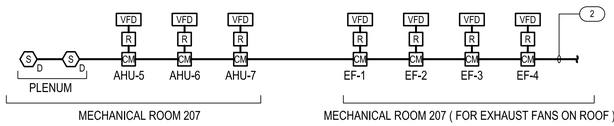
KEY NOTES

1. EXISTING FIRE ALARM CONTROL PANEL. ALL EQUIPMENT PROVIDED MUST BE COMPATIBLE WITH THIS PANEL. (2)
2. CONNECT TO EXISTING FIRE ALARM INITIATING LOOP SERVING THE AREA.
3. RECONNECT THE EXISTING CONTROL WIRING FOR SMOKE PURGE SYSTEM BACK TO THE RETURN FANS RAF-1 AND RAF-2.
4. ALL DUCT SMOKE DETECTORS MUST BE COMPATIBLE WITH EXISTING FIRE ALARM CONTROL PANEL (SIMPLEX 4100U). CONTRACTOR MAY USE EXISTING CONTROL MODULES AND RELAYS AS REQUIRED.
5. CONTRACTOR SHALL HIRE EXISTING FIRE ALARM SYSTEM VENDOR (SIMPLEX GRINNELL) FOR TIE OF DEVICES AND PROGRAMMING TOO EXISTING FIRE ALARM PANEL.
6. SMOKE PURGE PANEL SHALL BE FURNISHED AND INSTALLED BY MECHANICAL CONTRACTOR . ELECTRICAL CONTRACTOR SHALL RECONNECT TO EXISTING POWER AND RECONNECT ALL EXISTING AND NEW CONTROL WIRING TO NEW SMOKE PURGE PANEL. CONTRACTOR SHALL INTERFACE ALL WIRING WITH EXISTING FIRE ALARM PANEL. SEE KEY NOTE (5) (2)

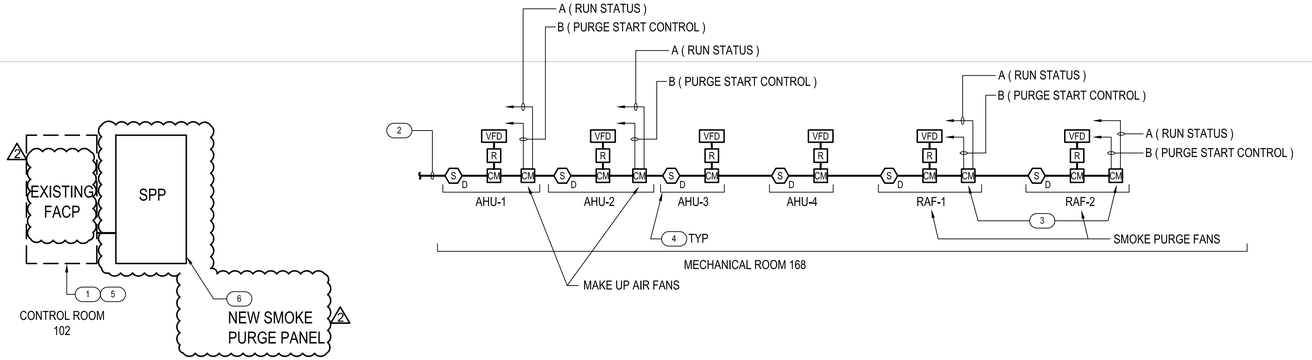
NOTES

1. REFER TO DWG FA001.00 FOR SYMBOLS, ABBREVIATIONS AND GENERAL NOTES.
2. PROVIDE ALL CONTROL AND MONITOR MODULES AS REQUIRED FOR EACH DEVICE FOR TIE INTO FIRE ALARM SYSTEM. SEE WIRING DETAIL FOR EACH DEVICE ON THIS DWG.
3. ALL WIRING SHALL BE PER MANUFACTURER'S REQUIREMENTS AND SHALL BE INSTALLED FROM APPROVED SHOP DRAWING.
4. SYSTEM TYPE: TEMPORAL 3 FIRE ALARM SYSTEM (NO VOICE).
5. ALL FIRE ALARM WIRING SHALL BE INSTALLED IN EMT CONDUIT WHERE CONCEALED IN WALLS OR ABOVE HUNG CEILINGS IN NON-INMATE AREAS AND SHALL BE INSTALLED IN RIGID GALVANIZED STEEL CONDUIT WHERE EXPOSED OR CONCEALED IN INMATE AREAS. ALL EXPOSED WIRING SHALL BE INSTALLED IN RIGID GALVANIZED STEEL CONDUIT.
6. SEE FLOOR PLANS FOR EXACT QUANTITY OF ALL FIRE ALARM DEVICES.

ROOF



SECOND FLOOR



FIRST FLOOR

1 FIRE ALARM RISER DIAGRAM

SCALE: NTS

0 4 8 16

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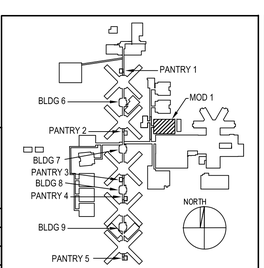

KEY PLAN

Drawing Title:
FIRE ALARM
RISER DIAGRAM

Seal:

Drawing No.:
FA201.00

Scale: NONE

Sheet: 60 of 70

FIRE ALARM RISER NOTES

1. FOR ABBREVIATIONS, GENERAL NOTES, SEE DRAWINGS FA001.00.
2. RISER DIAGRAM ON DRAWING FA201.00 IS FOR SCHEMATIC PURPOSE ONLY. CONTRACTOR SHALL PROVIDE A RISER DIAGRAM SHOWING ALL EQUIPMENT AND TYPES, ALL CONNECTIONS, AND NUMBER AND SIZE OF ALL CONDUCTORS.
3. CONTRACTOR SHALL PROVIDE ALL DEVICES' AND WIRE SIZES AS PER MANUFACTURER'S RECOMMENDATION. WIRING SHALL BE INSTALLED IN MINIMUM 3/4" EMT CONDUIT WHERE CONCEALED AND IN RIGID GALVANIZED STEEL CONDUITS WHERE EXPOSED, UNLESS OTHERWISE NOTED. ALL WIRING IN INMATE AREA ABOVE HUNG CEILING SHALL BE INSTALLED IN RIGID GALVANIZED STEEL CONDUIT. ALL FIRE ALARM WIRING UP TO 8' AFF AND VERTICAL RUNS IN SHAFT SHALL BE INSTALLED IN CONDUITS. ALL PENETRATION OF FLOOR SLABS AND FIRE RATED WALLS SHALL BE FIRE STOPPED IN ACCORDANCE WITH ALL LOCAL FIRE CODES.
4. LOCATION OF DEVICES AND EQUIPMENT ARE APPROXIMATE. FINAL LOCATIONS MUST BE DETERMINED ACCORDING TO THE SITE CONDITIONS.
5. PERFORM FIRE ALARM SYSTEM ELECTRICAL TEST AS PER SECTION BC 907, BC 1704.13 OF NEW YORK CITY BUILDING CODE.
6. FOR SEQUENCE OF OPERATION REFER TO THIS DRAWING.
7. PROVIDE ALL MONITOR AND CONTROL MODULES, RELAYS ETC. AND WIRING AS REQUIRED TO ACCOMPLISH THE FUNCTION AS SPECIFIED. THESE ARE NOT SHOWN ON THE FIRE ALARM RISER.
8. SUBMIT SEQUENCE OF OPERATION IN THE INPUT/OUTPUT MATRIX IN THE FORM PRESCRIBED BY NFPA72.
9. ALL FIRE ALARM WIRING UPTO 8' AFF AND VERTICAL RUNS IN SHAFT SHALL BE INSTALLED IN EMT CONDUIT. PROVIDE THE NUMBER OF CONDUITS AS REQUIRED. CONDUIT FILL OF ALL FIRE ALARM CABLES SHALL BE AS FOLLOWS:
   3/4" CONDUIT UP TO 6 F.A. CABLES (TYPE A OR B)
   1" CONDUIT UP TO 10 F.A. CABLES (TYPE A OR B)
   1 1/4" CONDUIT UP TO 17 F.A. CABLES (TYPE A OR B)
   1 1/2" CONDUIT UP TO 23 F.A. CABLES (TYPE A OR B)
10. ALL WIRING FOR FIRE ALARM SYSTEM SHALL BE FLUOROPOLYMER "TEFLON" TYPE CABLING AND SHALL MEET THE REQUIREMENTS UL 1424 AND UL 910 AS FOLLOWS.
    A. A MINIMUM TEMPERATURE RATING OF 150 DEGREES CELSIUS,
    B. A MINIMUM AVERAGE INSULATION THICKNESS OF 15 MILS.
    C. A MINIMUM AVERAGE JACKET THICKNESS OF 25 MILS.
    D. THE COLOR OF THE CABLE SHALL BE RED.
    E. THE CABLE SHALL BE A TYPE FPLP (PLENUM TYPE).
    F. THE CABLE SHALL BE VISUALLY MARKED EXTERNALLY THAT IT MEETS THE ABOVE REQUIREMENTS, CLASSIFIED NYC CERTIFIED FIRE ALARM ALARM CABLE AND IS LISTED BY UL.
11. THE RISER DIAGRAM INDICATES FIRE ALARM SYSTEM DEVICES, CONDUITS RUNS ETC. QUANTITY AND TYPE OF DEVICES SHALL BE AS INDICATED ON THE CONTRACT DRAWINGS AND/OR SPECIFICATIONS. SUBMIT ACTUAL RISERS, POINT-TO-POINT WIRING DIAGRAM INCLUDING WIRE AND CONDUIT SIZES AND INTERCONNECTIONS ON SHOP DRAWINGS. CONTRACTOR SHALL INSTALL FIRE ALARM SYSTEM ONLY AFTER ALL SHOP DRAWINGS ARE APPROVED BY THE ENGINEER OF RECORD.
12. CONTRACTOR SHALL PROVIDE A SIGNED AND SEALED A-433 FORM AND FILE THE SAME FORM WITH 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.
13. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE FINAL AS-BUILT DRAWING AT TIME OF FINAL INSPECTION. AS-BUILT DRAWING SHALL CONTAIN A COMPLETE INPUT/OUTPUT PROGRAMMING MATRIX THAT DEFINES THE SEQUENCE OF OPERATION, IT SHALL BE SIGNED BY THE ENGINEER OF RECORD AND SHALL CONTAIN A WRITTEN STATEMENT SIGNED BY THE INSTALLING LICENSED ELECTRICIAN CERTIFYING THAT A FUNCTIONAL TEST HAS BEEN CONDUCTED OF THE FIRE ALARM SYSTEM AND THE SYSTEM OPERATES AS DESIGNED AND IN ACCORDANCE OF THE INPUT/OUTPUT MATRIX. COORDINATE WITH FIRE DEPARTMENT FOR ANY ADDITIONAL REQUIREMENTS.
14. ALL FIRE ALARM CIRCUITS SHALL BE WIRED NFPA CLASS B WITH EXCEPTION OF THE NETWORK CIRCUIT WHICH SHALL BE NFPA CLASS X. ALL AUDIBLE AND VISUAL CIRCUITS SHALL BE CLASS B AND NYC SPLIT A/B. SPLIT A/B CIRCUITS SHALL BE WIRED SO THAT EVERY OTHER DEVICE IS WIRED ON AN ALTERNATE CIRCUIT.

FIRE ALARM SEQUENCE OF OPERATION

EXISTING FIRE ALARM SEQUENCE OF OPERATION SHALL BE MAINTAINED.

THE FIRE ALARM SYSTEM SHALL PERFORM AS DESCRIBED BELOW. ALL EQUIPMENT, COMPONENTS AND DEVICES ASSOCIATED WITH THE FIRE ALARM SYSTEM SHALL BE UL LISTED. THE ENTIRE SYSTEM SHALL CONFIRM TO ALL NEW YORK CITY BUILDING CODES AND LOCAL LAWS.

1. FIRE DETECTION SHALL BE ACCOMPLISHED BY:
   A. ACTIVATION OF AN DUCT SMOKE DETECTOR
2. ACTIVATION OF ANY FIRE DETECTION DEVICES SHALL IMMEDIATELY ALARM THE BUILDING AUDIBLY WITH CONTINUOUS ROUNDS OF TEMPORAL 3 AND VISIBLY BY FLASHING STROBES CONTINUOUSLY UNTIL MANUALLY RESET. ADDITIONALLY, THE ABOVE AUTOMATIC DEVICES SHALL SEND AN ALARM SIGNAL TO CENTRAL SUPERVISORY OFFICE.
3. OPERATION OF ANY AUTOMATIC FIRE DETECTION DEVICE SHALL PERFORM THE FOLLOWING:
   A. SHUTDOWN ALL FANS CONTROLLED BY SMOKE DETECTORS.
   B. CLOSE ALL SMOKE DAMPERS.
4. ACTIVATION OF ANY FIRE DETECTION DEVICE SHALL BE RECORDED (BY ITS LOCATION, CODE, DATE AND TIME) INDIVIDUALLY AND DISPLAY AT THE FIRE ALARM CONTROL PANEL.

FIRE ALARM SYSTEM INPUT/OUTPUT MATRIX

SYSTEM OUTPUTS

SYSTEM INPUTS	A: ACTIVATE COMMON ALARM SIGNAL INDICATOR	B: ACTIVATE AUDIBLE/ VISUAL FIRE ALARM SIGNAL	C: ACTIVATE AUDIBLE COMMON TROUBLE SIGNAL	D: DISPLAY/PRINT CHANGE OF STATUS	E: TRANSMIT FIRE ALARM SIGNAL TO SUPERVISING STATION	F: TRANSMIT TROUBLE SIGNAL TO SUPERVISING STATION	G: TRANSMIT SUPERVISORY SIGNAL TO SUPERVISING STATION	H: CLOSE ALL ASSOCIATED FIRE SMOKE DAMPERS	I: RELEASE ALL MAGNETICALLY HELD SMOKE DOORS	J: ACTUATE ELEVATOR RECALL TO PRIMARY RECALL FLOOR	K: ACTIVATE LOCAL ALARM AT DETECTOR	L: ACTIVATE MONITOR POINT AT FACP	M: ACTIVATE BOILER SHUT DOWN	N: ACTIVATE FAN SHUT DOWN (ALL FANS GREATER THAT 20000FM)	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
1 IN-DUCT SMOKE DETECTOR	X	X		X	X			X	X					X	1
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	

SMOKE PURGE SEQUENCE OF OPERATION

1. [2] SEE SMOKE PURGE SEQUENCE OF OPERATION ON THIS DRAWING AND MECHANICAL DRAWINGS.

SMOKE PURGE 1ST FLOOR NORTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-2, AHU-4, RAF-2 OFF.
FSD-1-2 OPEN.
RAF-1 ON.
FSD-1-1, FSD-1-3, OPEN.
MD-11 CLOSE.
AHU-1, AHU-3 ON.

SMOKE PURGE 1ST FLOOR SOUTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-1, AHU-3, RAF-1 OFF.
FAD-1-5 OPEN.
RAF-2 ON.
FSD-1-4, FSD-1-6 OPEN.
MD-12 CLOSE.
AHU-2, AHU-4 ON.

SMOKE PURGE 2ND FLOOR NORTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-2, AHU-4, RAF-2 OFF.
FSD-2-1 OPEN.
RAF-1 ON.
FSD-2-2, FSD-2-3, OPEN.
MD-11 CLOSE.
AHU-1, AHU-3 ON.

SMOKE PURGE 2ND FLOOR SOUTH

SMOKE PURGE PANEL ENABLE FROM FIRE ALARM PANEL
AHU-1, AHU-3, RAF-1 OFF.
FSD-2-6 OPEN.
RAF-2 ON.
FSD-2-4, FSD-2-5 OPEN.
MD-12 CLOSE.
AHU-2, AHU-4 ON.

0 4 8 16

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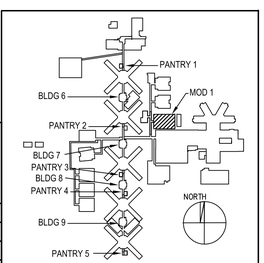


KEY PLAN

Drawing Title:

FIRE ALARM NOTES

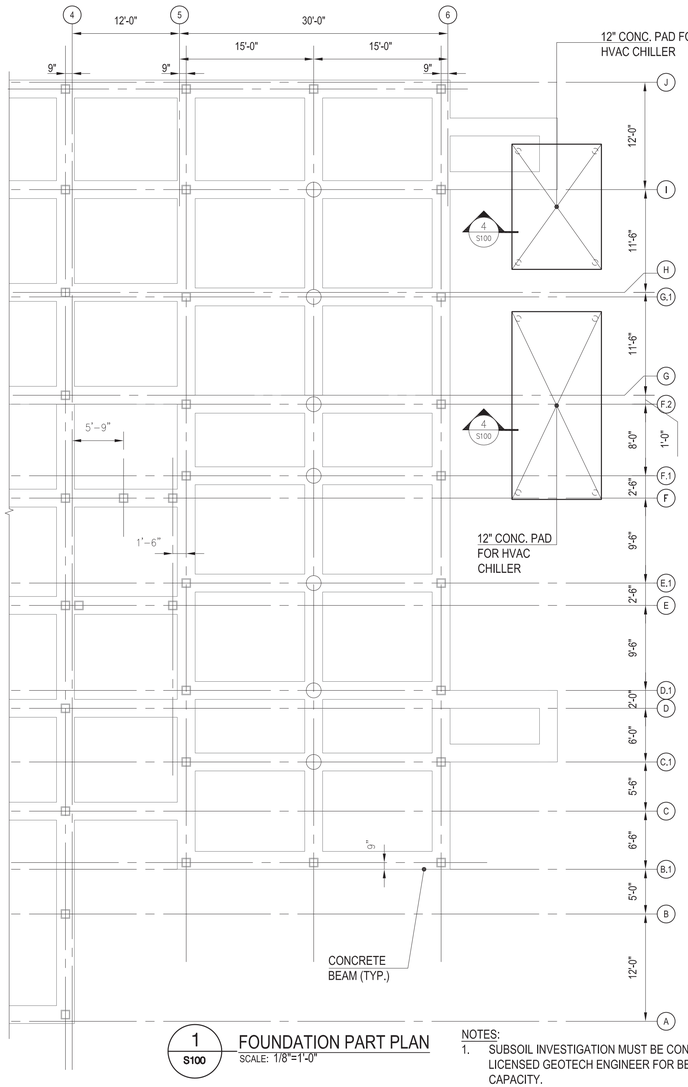
Seal:

Drawing No.:

FA202.00

Scale: NONE

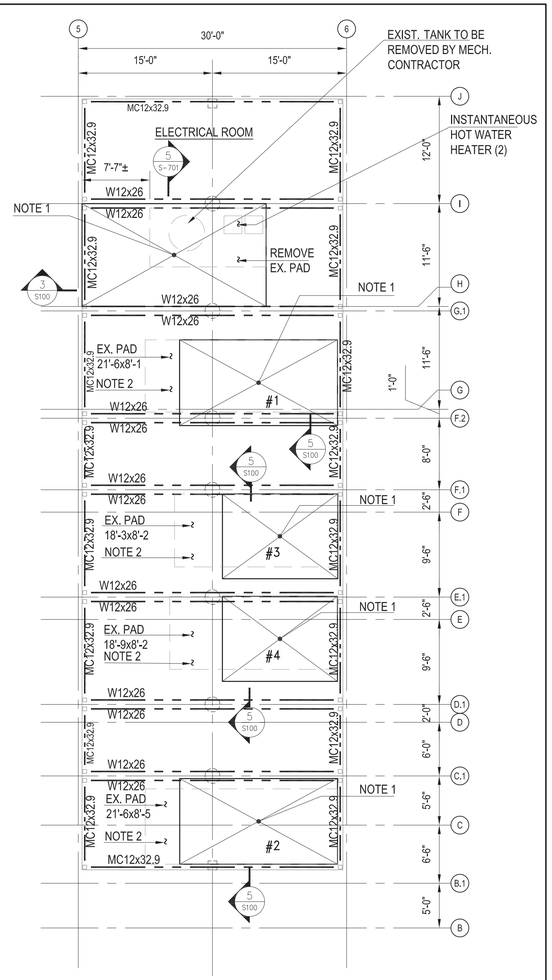
Sheet: 61 of 70



1 S100 FOUNDATION PART PLAN
SCALE: 1/8"=1'-0"

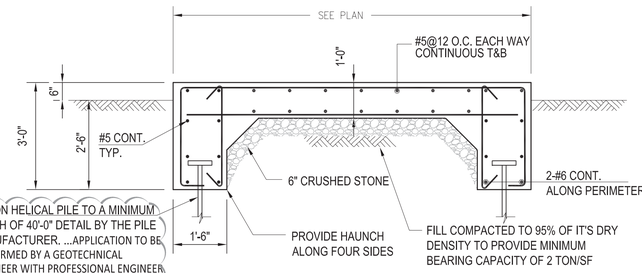
NOTES:
1. SUBSOIL INVESTIGATION MUST BE CONDUCTED BY ANY LICENSED GEOTECH ENGINEER FOR BEARING & SETTLEMENT CAPACITY.

○ - 20 TON HELICAL PILE TO BE CONFIRMED BY GEOTECH ENGINEER.



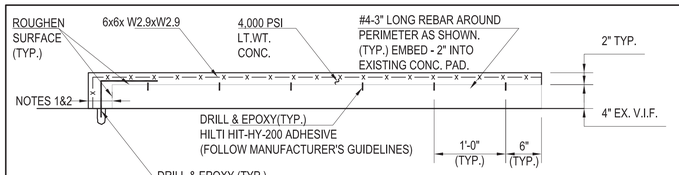
2 S100 1ST FLOOR PART PLAN
SCALE: 1/8"=1'-0"

NOTES:
1. NEW 6" CONC. PAD. COORD. W/ MEP DWGS.
2. PARTIALLY REMOVE THE EXISTING CONCRETE PADS TO THE SIZE (DIMENSIONS) REQUIRED BY HVAC EQUIPMENT. COORDINATE WITH MECHANICAL CONTRACTOR. DO NOT DAMAGE THE STRUCTURAL METAL DECK & CONCRETE SLAB.



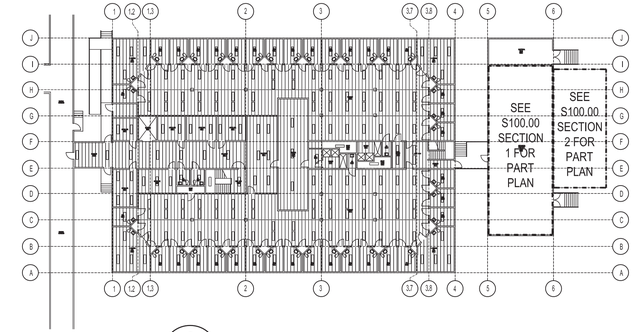
4 S100 TYPICAL DETAIL OF CONCRETE PAD
SCALE: 1/2"=1'-0"

NOTE:
1. FOR LAYOUT OF PADS SEE MEP AND ARCHITECTURAL DRAWINGS.
2. f'c = 4000 PSI. 6% AIR ENTRAINED CONCRETE. MAX. W.C=0.40

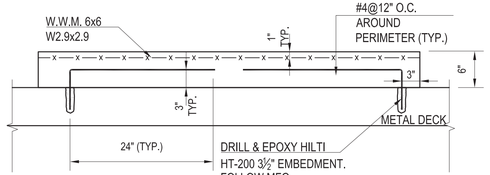


NOTES:
1. VERIFY REQUIRED DIMENSTIONS & LOCATION OF CONCRETE PADS.
2. COORDINATE WITH M.E.P. DRAWNGS.
3. ROUGHEN SURFACES.
4. PROVIDE #4x3" REBAR AROUND PERIMETER OF EXISTING PADS.
5. PROVIDE #4 BENT REBAR AT ALL REQUIRED PAD ENLARGEMENTS (EXTENSIONS).
6. PROVIDE NEW CONCRETE WITH W.W.F.

5 S100 TYPICAL CONCRETE PAD SECTION
SCALE: 1"=1'-0"

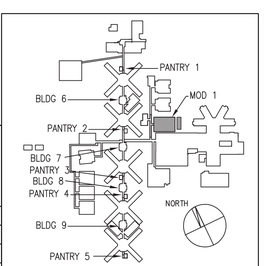


6 S100 1ST FLOOR PART PLAN
SCALE: 1/32"=1'-0"



3 S100 CONCRETE PAD
SCALE: 1"=1'-0"

0' 4' 8'
SCALE IN FEET



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FOUNDATION PART PLAN, 1ST FLOOR PART PLAN AND SECTIONS

Seal:

Drawing No.:
S-100.00

Scale: NONE

Sheet: 65 of 70