

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shear stud connectors, shop welded.
3. Shrinkage-resistant grout.

B. Related Sections:

1. Section 053100 – Steel Decking.
2. Section 099113 – Exterior Painting.
3. Section 099123 – Interior Painting.

C. Reference and Industry Standards

1. The following reference standards shall be applicable to this Section:
 - a. The current Enterprise Green Communities (EGC) Criteria, and the current New York City Overlay.
 - b. New York City Building Code **current** edition, as amended, inclusive of:
 - Chapter 16 Structural Design.
 - Chapter 17 Structural Tests and Special Inspections.
 - Chapter 22 Steel.
2. Industry Standards
 - AISC (American Institute of Steel Construction)
 - ANSI (American National Standards Institute)
 - ASTM (American Society for Testing and Materials)
 - AWS (American Welding Society)
 - RCSC (Research Council on Structural Connections)
 - SSPC (Society for Protective Coatings)

D. The current NYC Overlay of the current Enterprise Green Communities Criteria:

1. Mandatory Requirements: See the NYC Overlay of the EGC reference standard for full specification.
 - a. All projects must achieve compliance with the mandatory criteria measures that are applicable:
 - Criterion 6.4: Healthier Material Selection

- Criterion 6.8: Managing Moisture: Foundations
- Criterion 6.9: Managing Moisture: Roofing and Wall Systems
- Criterion 6.10: Construction Waste Management

2. Optional Project Requirements for Certification Points

- a. Additionally, rehab projects are required to achieve **55** optional points. Criteria with optional points related to this Specification Section include, but may not be limited to:
 - Criterion 6.1: Ingredient Transparency for Material Health
 - Criterion 6.2: Recycled Content and Ingredient Transparency
 - Criterion 6.3: Chemical Hazard Optimization
 - Criterion 6.4: Healthier Material Selection
 - Criterion 6.5: Environmentally Responsible Material Selection
 - Criterion 6.7: Regional Materials
 - Criterion 6.10: Construction Waste Management

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Environmental Product Declaration (EPD) for:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Shear stud connectors.
 - 4. Anchor rods.
 - 5. Threaded rods.
 - 6. Forged-steel hardware.
 - 7. Shop primer.
 - 8. Galvanized-steel primer.
 - 9. Etching cleaner.
 - 10. Galvanized repair paint.
 - 11. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
- C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data [**signed and sealed by the qualified professional engineer responsible for their preparation**].

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill test reports for structural-steel materials, including chemical and physical properties.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Documentation for compliance with Enterprise Green Communities Criteria.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 360.
 - 3. RCSC's Specification for Structural Joints Using High-Strength Bolts.
- B. Connection Design Information:
 - 1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
 - 2. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
 - a. Select and complete connections using **[schematic details indicated] [and] [ANSI/AISC 360] <Insert source>**.
 - b. Use **[Load and Resistance Factor Design; data are given at factored-load level] [Allowable Stress Design; data are given at service-load level]**.
 - 3. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.

- a. Use [**Load and Resistance Factor Design; data are given at factored-load level**]
[**Allowable Stress Design; data are given at service-load level**].
- 4. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
 - a. Use [**Load and Resistance Factor Design; data are given at factored-load level**]
[**Allowable Stress Design; data are given at service-load level**].
- C. Moment Connections: [**Type PR, partially**] [**Type FR, fully**] restrained.
- D. Construction: [**Moment frame**] [**Braced frame**] [**Shear wall system**] [**Combined system of moment frame and braced frame**] [**Combined system of moment frame and shear walls**] [**Combined system of braced frame and shear walls**] [**Combined system of moment frame, braced frame, and shear walls**].

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: [**ASTM A992**] [**ASTM A572, Grade 50**].
- B. Channels, Angles[, **M-Shapes**] [, **S-Shapes**]: [**ASTM A36**] [**ASTM A572, Grade 50**].
- C. Plate and Bar: [**ASTM A36**] [**ASTM A572, Grade 50**].
- D. Cold-Formed Hollow Structural Sections: [**ASTM A500, Grade B**] [**ASTM A500, Grade C**] structural tubing.
- E. Steel Pipe: ASTM A53 Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125, Grade A490, Type 1, heavy-hex steel structural bolts[**or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends**]; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959, Type 490-1, compressible-washer type with plain finish.

- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
 - 1. Finish: **[Hot-dip zinc coating] [Mechanically deposited zinc coating] [Hot-dip or mechanically deposited zinc coating]**.
 - 2. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with **[mechanically deposited zinc coating] [mechanically deposited zinc coating, baked epoxy-coated]** finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Grade F1852, Type 1, **[heavy-hex] [round]** head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
 - 1. Finish: **[Plain] [Mechanically deposited zinc coating]**.
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

2.4 RODS

- A. Unheaded Anchor Rods: **[ASTM F1554, Grade 36] [ASTM F1554, Grade 55, weldable]**.
 - 1. Configuration: **[Straight] [Hooked]**.
 - 2. Finish: **[Plain] [Hot-dip zinc coating, ASTM A153, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50]**.
- B. Headed Anchor Rods: **[ASTM F1554, Grade 36] [ASTM F1554, Grade 55, weldable]**, straight.
 - 1. Finish: **[Plain] [Hot-dip zinc coating, ASTM A153, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50]**.
- C. Threaded Rods: **[ASTM A36] [ASTM A193, Grade B7]**.
 - 1. Finish: **[Plain] [Hot-dip zinc coating, ASTM A153, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50]**.

2.5 FORGED-STEEL STRUCTURAL HARDWARE

- A. **[Clevises] [and] [Turnbuckles]**: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.

2.6 PRIMER

- A. Steel Primer:
 - 1. Comply with *Section 099113 – Exterior Painting and Section 099123 – Interior Painting*.

2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer compatible with topcoat.

B. Galvanized-Steel Primer:

1. Etching Cleaner: for galvanized steel.
2. Galvanizing Repair Paint: [**SSPC-Paint 20**] [**ASTM A780**].

2.7 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
- B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1 and manufacturer's written instructions.

2.9 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's Specification for Structural Joints Using High-Strength Bolts for type of bolt and type of joint specified.
 1. Joint Type: [**Snug tightened**] [**Pretensioned**] [**Slip critical**].
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.10 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123.
 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.11 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces [**unless indicated to be painted**].
 6. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7 (WAB)/NACE WAB-4.
 4. SSPC-SP 6 (WAB)/NACE WAB-3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner [**or in accordance with SSPC-SP 16**].
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect [**and test**] shop-bolted connections in accordance with RCSC's Specification for Structural Joints Using High-Strength Bolts.
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94.
 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1
 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates [**Bearing Plates**] [**and**] [**Leveling Plates**]: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. [**Snug-tighten**] [**Pretension**] anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. [**Comply with manufacturer's written installation instructions for grouting.**]
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's Specification for Structural Joints Using High-Strength Bolts for bolt and joint type specified.
 - 1. Joint Type: [**Snug tightened**] [**Pretensioned**] [**Slip critical**].
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: **[Owner will engage]** **[Engage]** a qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect **[and test]** bolted connections in accordance with RCSC's Specification for Structural Joints Using High-Strength Bolts.
 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94.

END OF SECTION 051200