

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Structural steel.

B. Related Sections:

- 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
- 2. Division 05 Section "Buckling - Restrained Braces" for seismic bracing requirements.
- 3. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
- 4. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
- 5. Division 05 Section "Metal Stairs."
- 6. Division 09 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel that resist seismic forces, including columns, beams, and braces and the interconnections between those elements.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
 - 2. Welded built-up members with plates thicker than 2 inches (50 mm).
 - 3. Column base plates thicker than 2 inches (50 mm).

- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those weld that are part of the Seismic Force Resistig System (Category A-H, as defined by FEMA 353).

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. Identify members and connections of the seismic-load-resisting system.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.
- D. Qualification Data: For qualified Installer and fabricator .
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. Mill test reports for structural steel, including chemical and physical properties.
- H. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.

I. Source quality-control reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.

2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 1. W-Shapes: 60 percent.
 2. Channels, Angles: 60 percent.
 3. Plate and Bar: 25 percent.
 4. Cold-Formed Hollow Structural Sections: 25 percent.
 5. Steel Pipe: 25 percent.
 6. All Other Steel Materials: 25 percent.
- C. W-Shapes: ASTM A 992/A 992M.
- D. Channels, Angles: ASTM A 36/A 36M.
- E. Plate and Bar: ASTM A 36/A 36M.
- F. Plates Part of the SFRS: ASTM A572 / A572M, Grade 50 (345).
- G. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B C, structural tubing.
- H. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Weight Class: Standard.
 2. Finish: Black.

- I. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened.
 - 3. Finish: Plain.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780.

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning SSPC-SP 2, "Hand Tool Cleaning SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.6 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 (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: *Contractor* will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete 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 anchor rods after supported members have been positioned and plumbed.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Pretensioned or Slip critical (where indicated).
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
- C. Supplemental Welding Requirements - Seismic Force Resisting System (SFRS) Seismic Weld Categories A - H:
 - 1. Separate Welding Procedures Specifications (WPSs) shall be prepared for each electrode brand and electrode diameter that is to be used for seismic welding. The WPS shall be based on FEMA 353, Appendix A lot tests. WPS shall show specific amperage, voltage and travel speed ranges which will not exceed lot test minimum and maximum heat input values. Fabricator and Erector QC personnel shall verify and document actual production welding variables on a daily basis
 - 2. Welders and Welding Operators: Pass supplemental welder qualification testing per FEMA 353, Appendix B, on special test joint mock-ups.

- a. Perform testing using WPS at set at highest deposition rate to be used in work.
 - b. Provide separate welder personal qualification tests for FCAW-S and FCAW-G.
 - c. Testing required for all personnel performing welds of beam flange to column flange through a weld access hole.
3. Intemix of Filler Metals: Provide supplemental toughness testing when FCAW-S filler metals are used in conjunction with filler metals for other processes including FCAW-G.
4. Electrode Storage:
 - a. Do not use FCAW electrodes where manufacturer's packaging has been damaged.
 - b. Do no modify or lubricate electrodes after opening of packaging. Drying as specified by the manufacturer is permitted.
5. Exposure Limits:
 - a. Limit exposure of FCAW electrodes based upon the results of exposure tests prescribed in FEMA 353, Appendix D. These tests may be conducted by the electrode manufacturer, supplier, the Contractor, or by an independent testing agency or laboratory with suitable equipment.
 - b. In lieu of testing, when welding is to be suspended for more than 8 hours, remove electrodes from the machines and store in an electrode wire oven maintained at a temperature between 250 degrees and 550 degrees F, or as recommended by the manufacturer.
 - c. Unless testing per FEMA 353, Appendix D, demonstrates longer exposure limits, do not use electrodes not consumed within 24 hours of accumulated exposure outside closed or heated storage for welds in Seismic Weld Demand Category A or B.
 - d. Identify electrode spools to facilitate monitoring of total atmospheric exposure time.
 - e. FCAW electrodes exposed for periods exceeding an accumulated 24 hours may be dried if manufacturer's testing and recommendations show that drying is effective at removing moisture and restoring electrodes to their designated diffusible hydrogen level.
6. Minimum Preheat and Interpass Temperature:
 - a. Provide minimum preheat and interpass temperatures for all welds, including tack welds, in accordance with AWS D1.1, Table 3.2. The contractor may specify higher preheat minimum temperatures, if desired, as part of the Contractor's WPS for a particular application. In such cases, provide the WPS minimum preheat and interpass temperatures. For welds in Seismic Demand Categories A-H, preheat and interpass temperatures shall be in the range tested in accordance with FEMA 353, Appendix A.

- b. Verify minimum preheat and interpass temperatures at a distance of 3 inches from the weld, at the point of arc initiation or for materials over 3 in. in thickness, at a distance equal to the thickness of the part.
- 7. Maximum Preheat and Interpass Temperature:
 - a. Limit maximum preheat and maximum interpass temperature to 550 degrees Fahrenheit, measured at a distance of 1 inch from the point of arc initiation. Do not increase this maximum temperature regardless of qualification testing.
- 8. Nonfusible Backing:
 - a. Nonfusible backing materials, including ceramic and copper: permitted only with satisfactory welder qualifications testing performed using the type of backing proposed for use, using the test plate shown in AWS D.1 1-98, Figure 4.21, except that groove dimensions shall be as provided in the WPS and PQR. Should the joint include welding a beam flange to a column flange through an access hole, perform Supplementary Welder Qualification Test of FEMA 353 Appendix B using the type of proposed backing material. Welding Procedures Specifications which incorporate nonfusible backing shall be qualified by testing, using the test plate shown in AWS D1. 1-02, Figure 4.10. The weld joint geometry shall be the same as proposed for production welds including the maximum root gap that will be allowed. Five Charpy V-Notch (CVN) specimens shall be tested in accordance with AWS D1.1-02, Annex III. The CVN test location shall be in the root pass of weld metal. The high and low CVN values shall be discarded and the average of the remaining 3 tests shall meet 40 ft-lbs @ 70 F.
 - b. Nonfusible weld tabs and short segments of nonfusible backing bars may be used at the ends of welds between shear tabs and column faces, or at the ends of continuity plate welds. The welder shall be trained in the proper welding technique for using such nonfusible weld tabs and backing bars prior to performing such welding on the project.
- 9. Peening: permitted at the Contractor's option, but not required. Provide a written procedure for performing peening incorporated into the WPS for the joints to be peened.
- 10. Controlled Cooling: permitted at Contractor's option but not required.
 - a. Provide written procedure for controlled cooling incorporated into the WPS for joints including method of heating, maximum temperature, cooling rate range, and method of temperature measurements.
 - b. Insulation blankets without addition of heat are permitted but not required. Written procedures or temperature measurements are not required.

11. Restricted Area for Reduce Beam Section (RBS): No welding, cutting, drilling or welded attachments, including stud welds is permitted in the plastic hinge region as indicated on the drawings. Arc spot welds (puddle welds) for the attachment of metal decking are permitted.
12. Welding in the K-Area: Welding in the K-area shall be avoided. The K-area is defined as the region within 1.5 inches of the K-radius on the web. If welding is performed in the K-area, after welding the web shall be tested for cracks using magnetic particle testing (MT) by QA inspector. The MT inspection area shall include the K-area base metal within 3 inches of the weld.
13. Tack Welds: All tack welds to members in the plastic hinge region that attached fusible backing bars to the steel prior to the welding of the joint shall be made within the joint.
14. Weld Tabs: Weld tabs shall be used for all complete penetration weld joints. Where practicable, weld tabs shall extend a minimum of one inch of the thickness of the part, whichever is greater beyond the edge of the joint. For Seismic Demand Category A-H welds, weld tabs are to be removed and the end of the weld finished to a surface roughness of 500 microinches or better. The contour of the weld shall provide a smooth transition, free of notches and sharp corners. Weld dams are prohibited.
15. Reinforcing Fillet Welds: When reinforcing fillet welds are on drawings for SFRS beam to column welds, they shall have a minimum size of 5/16 inch. Additionally the leg of the fillet weld adjacent to the beam flange shall be such that the fillet toe is located on the beam flange base metal.
16. Welder Identification: Each welder shall mark or stamp their identification symbol near each weldment completed.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: *Contractor* will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.

- b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200