

**SECTION 05500
MISCELLANEOUS METALS**

PART 1 - GENERAL

1.01 WORK INCLUDED.

A. This Section includes furnishing and installing miscellaneous metal work as shown on the Drawings and specified in this Section.

1.02 REFERENCES.

A. The publications and standards referenced herein form a part of the Specifications.

B. When a date is given for reference standards, that edition shall be used. Where no date is given for the reference standards, the latest edition shall be used.

1.03 SUBMITTALS.

A. Submittals shall be made in accordance with Specifications Section 01300, Submittals, and the following special provisions provided herein.

B. Shop Drawings

1. Before beginning fabrication of miscellaneous metal articles, the Contractor shall submit complete shop and erection drawings showing details of methods, materials, and finishes proposed for use. Shop drawings shall give complete information necessary for the fabrication of the component parts of the articles, including the location, type, and size bolts and welds. They shall clearly distinguish between shop and field bolts and welds.

C. Test Reports and Certifications

1. The following documents shall be submitted:
 - a. Welding Procedure Specifications (WPS), per AWS D1.1, for welding procedures proposed for use in making production welds.
 - b. Welding Procedure Qualification Record (PQR) to support welding procedures proposed for production welds not otherwise prequalified.
 - c. Welding Performance Qualification for welders and welding operators to be employed on the Work.
 - d. Certified mill test reports for chemistry and mechanical properties.
 - e. Manufacturer's certification verifying conformance to these Specifications and that all products in contact with potable water are NSF-approved.

1.04 DELIVERY, STORAGE, AND HANDLING.

A. The Contractor shall take reasonable care in the proper handling and storage of articles or materials during erection operations to avoid accumulation of dirt and foreign matter. The Contractor shall remove from the articles or materials, dust, dirt, or other foreign matter that accumulates during construction. Coated surfaces shall be protected from abrasion or other

damage during handling, storing, and erecting.

B. Materials taken from stock by the Contractor shall be of a quality at least equal to that required by the ASTM specifications applicable to the classification covering the intended use and shall be supported by test reports prepared at the mill where the material was manufactured or at a testing laboratory approved by the District Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS.

A. Carbon Steel

1. Structural shapes shall be in accordance with ASTM A36.
2. Bars and shapes shall be in accordance with ASTM A36 or ASTM A108 Grade 1018.
3. Plate 2 inches and less in thickness shall be in accordance with ASTM A36 or ASTM A283 Grade C or Grade D.

B. Stainless Steel

1. All welded stainless steel materials shall be pickled and passivated after fabrication in accordance with the requirements of ASTM A380. The Contractor shall use Avesta, or equal, pickling and passivating solution, for fieldwork.
2. Unless otherwise shown on the Drawings, materials in contact with water, intermittently or continuously, or in a wet or moist environment shall be stainless steel, Type 316 or 316L, where welding is required.
3. Stainless steel bars and shapes shall be in accordance with ASTM A276 Type 316 or Type 316L where welding is required, unless otherwise specified or shown on the Drawings.
4. Stainless steel plate, sheet, and strip shall be in accordance with ASTM A167 Type 316 or Type 316L where welding is required, unless otherwise specified or shown on the Drawings.
5. Rolled stainless steel shapes shall be in accordance with the requirements of ASTM A479, Type 316, or 316L where welding is required, heat treatment waived, unless otherwise specified or shown.
6. Stainless steel pipe shall be in accordance with ASTM A312 Type 316L.
7. Stainless steel tubing shall be in accordance with ASTM A554 Type MT316L.
8. Where shown on the Drawings, age-hardened stainless steel shall be in accordance with ASTM A564 Type 630, cold finished. Heat-treatment or age hardening shall be conducted at 900°F.
9. Stainless steel wire cloth shall conform to the requirements of ASTM E2016, Type 316.

C. Aluminum

1. Plate and sheet shall be in accordance with ASTM B209, Alloy No. 5052 H32.

D. Fasteners

1. Threads for bolts and nuts shall be in accordance with ANSI B1.1.
 - a. Threads for bolts 1-inch and less in diameter shall be coarse-thread series and threads for bolts 1 1/8-inch and greater in diameter shall be the 8pitch thread series. Anti – Seize shall be applied to all threads prior to installation.
 - b. The fit shall be Class 2 free fit; except that Class 3 medium fit shall be provided in holes tapped for studs.
2. Unless otherwise shown on the Drawings, bolts shall have heavy hexagon heads and heavy hexagon nuts.
3. The lengths of studs and bolts, excluding anchor bolts, shall provide a projection of not less than ¼-inch nor more than ½-inch through the nut when it is drawn tight; however, in exposed locations the projection shall be not more than ¼-inch.
4. Carbon Steel Nuts and Bolts
 - a. Carbon steel bolts, anchor bolts, and U-bolts, not in contact with water shall be in accordance with ASTM A307, Grade A.
 - b. Carbon steel nuts not in contact with water shall be in accordance with ASTM A563.
 - c. Steel washers shall be in accordance with ASTM F436.
 - d. Carbon steel bolts greater than 1-inch in diameter shall be the 8-pitch thread series and shall be ferritic steel in accordance with ASTM A193, Grade B7. Accompanying nuts shall be in accordance with ASTM A194, Grade 2H. Anti – Seize shall be applied to all threads prior to installation.
5. Stainless Steel Fasteners
 - a. Except as otherwise specified or shown on the Drawings, stainless steel fasteners shall be used where the material will be immersed in water, intermittently or continuously, or in moist-environment installations.
 - b. Stainless steel studs, bolts, nuts, and washers shall be stamped indicating the type of stainless steel.
 - c. Type 316 or 316N stainless steel fasteners shall be in accordance with ASTM A193 Grade B8MA or Grade B8MNA for bolting and stud material, and ASTM A194 Grade 8MA or Grade 8MNA for nuts. Fasteners for age-hardened stainless steel shall be manufactured in accordance with ASTM F593 and F594 Type 630. Anti – Seize shall be applied to all threads on all types of fasteners.
 - d. Stainless steel washers shall conform to ASTM F436 except that they shall be punched from steel conforming to ASTM 167 Type 316 or machined from bar stock conforming to ASTM A276 Type 316.

E. Welding Rods

1. Welding rods for welding carbon steel shall be E70XX low-hydrogen, in accordance with AWS A5.1 or A5.17 for welding carbon steel
2. Electrodes for welding stainless steel shall be Type E316L in accordance with AWS A5.4 or AWS A5.9
3. Electrodes for welding stainless steel to carbon steel shall be Classification

Number E309L or E312 in accordance with AWS A5.4 or A5.9.

4. Electrodes for welding aluminum shall be filler alloy 5356 in accordance with AWS A5.10.

F. Concrete Anchors

1. Concrete anchors shall be in accordance with Specifications Section 03250, Concrete Anchors. Stainless steel fasteners shall be used where the material will be immersed in water, intermittently or continuously, or in moist-environment installations..

G. Anti-Galling Compound

1. The anti-galling compound to be used on threads of carbon steel and stainless steel fastener assemblies shall be a compound certified by ANSI/NSF or EPA, for use in potable water systems.
2. Acceptable Products:
 - a. Ramco TRX-Synlube, Ramco Anti-Seize
 - b. Husk-It, Husky Lube-O-Seal
 - c. Or approved equal.

2.02 FABRICATION OF MISCELLANEOUS METALWORK.

A. The Contractor shall take the necessary precautions as described in ASTM A143 and ASTM A384 during fabrication of articles to be galvanized, to properly fabricate and prepare the material to prevent embrittlement, warpage, and distortion.

1. Violation of the provisions of this paragraph will be sufficient cause for rejection of the Work.
2. Steel tubing with cover plates welded at both ends or other enclosed assemblies shall have vent and drain holes drilled at locations on the assembly approved by the District Engineer. The holes shall be drilled during fabrication and before galvanizing.

B. All edges, corners, and welds shall be struck and deburred.

2.03 FABRICATION - WELDING OF CARBON STEEL.

A. Except for the modifications set forth in this Section, the welding of structures or articles fabricated from carbon steel shall be in accordance with the AISC Manual of Steel Construction and AWS D1.1 as referenced therein.

1. Electroslag and electrogas welding procedures will not be permitted.
2. Allowable unit stresses for base metals and for effective areas of weld metal for application to structures shall be as shown in the AISC Manual of Steel Construction.
3. Joints to be welded by automatic machines shall be abrasive-blasted to white metal in accordance with SSPC-SP5. Weld flux residue, weld splatter, and minor weld defects not removed by the abrasive blasting shall be removed in accordance with SSPC-SP-11 Power Tool Cleaning to Bare Metal.

4. The depth of each pass shall not exceed 1/8-inch for manual welding, and the weld puddle width shall not exceed three times the electrode diameter or 3/8inch, whichever is less.
5. Welding of pipe or tubing shall be in accordance with the recommendations of AWS D10.12.
6. Runoff tabs shall be removed by hand flame-cutting or other means as close to the edge or the finished member as practical, followed by grinding to a smooth surface contiguous with the adjacent metal.
7. Runoff tabs shall be removed by hand flame-cutting or other means as close to the edge or the finished member as practical, followed by grinding to a smooth surface contiguous with the adjacent metal.

2.04 FABRICATION - WELDING OF STAINLESS STEEL.

A. Welding of structures or articles fabricated from stainless steel shall be in accordance with the following:

1. Welding on austenitic stainless steel shall be performed by the shielded metal arc process using direct current.
2. Electrodes for welding austenitic stainless steels shall be in accordance with AWS A5.4 Classification Number E316L. Electrodes for welding stainless steel to carbon steel shall be Classification Number E309L or E312 electrodes.
3. Weld procedures shall be qualified in accordance with AWS B2.1.
4. Welding of stainless pipe or tubing shall be in accordance with the recommended practices of AWS D10.4.
5. Stainless steel to carbon steel welds performed in the field will not require stress-relieving heat treatment provided the interpass temperature does not exceed 350°F.
6. Stress-relieving of austenitic stainless steel where deemed necessary by District Engineer, shall be performed at 750°F for 4 hours, plus an additional 30 minutes for each additional inch over ½-inch weld section thickness, or a full solution anneal at 1900°F shall be performed with rapid quench.
7. Stainless steel welds shall be deburred and ground smooth using grinding wheels of aluminum oxide. Carborundum or other carbon bearing wheels are not acceptable for use on stainless steel surfaces. Wire brushing of stainless steel surfaces shall be performed only with stainless steel brushes. Grind wheels and brushes used to clean stainless steel shall not have been used on carbon steel surfaces.
8. After shop fabrication stainless steel shall be cleaned, descaled, and passivated in accordance with ASTM A380.

2.05 SHOP FINISHES.

A. Galvanizing

1. Galvanizing shall have an average weight per square foot of 2.0 ounces and not less than 1.8 ounces per square foot.

2. Except where otherwise specified, galvanizing shall be performed after fabrication, including cutting, punching, welding, and drilling, has been completed.
 3. Prior to galvanizing, items shall be cleaned by abrasive blasting to white metal in accordance with SSPC-SP5.
 - a. Weld flux residue, weld splatter, and minor weld defects not removed by the abrasive blasting shall be removed in accordance with SSPC-SP-11 Power Tool Cleaning to Bare Metal.
 - b. After abrasive blasting and mechanical cleaning, items shall be fluxed and immediately hot dipped.
 4. Galvanizing shall be done in the largest possible subassemblies consistent with the appearance of the completed item and with the prevention of warpage of the product.
 5. Galvanizing shall be repaired in accordance with one of the methods specified in Part 3 of this Section.
 6. Where galvanized light-gauge sheet goods are specified, upset edges of factory die-punched holes need not have the bare edges re-galvanized and the galvanized coating adjacent to such die-punched edges need not be repaired.
- B. Aluminum:
1. Aluminum shall be coated in accordance with Specifications Section 09910, Reservoir Painting and Protective Coating Systems.
 2. Where specified, aluminum materials shall receive a hard anodized finish after all fabrication work (holes, bends, etc.) has been completed.

PART 3 - EXECUTION

3.01 INSTALLATION.

A. Installation and anchorage details for miscellaneous metal items shall be as shown on the Drawings. Details not shown shall be developed by the Contractor and indicated on the submittal shop drawings.

B. Anti-galling compound shall be used each time carbon steel or stainless steel fasteners are assembled or reassembled and shall be applied in the fastener threads in accordance with the manufacturer's printed recommendations.

3.02 REPAIR OF GALVANIZED SURFACES.

A. Areas of galvanizing damaged during fabrication, shipping, erection, or any other time prior to acceptance of the Work shall be prepared and recoated by one of the following methods:

1. Parts damaged in the shop shall be removed from the site, stripped of existing coating, cleaned, and re-galvanized in accordance with ASTM A123 or A153 as applicable.
2. Field or shop repair areas shall be cleaned and recoated with a 2.0 mil coating of

zinc alloy using meltable zinc-based alloy bars (hot bar process).

3. The damaged area shall be thoroughly cleaned using a wire brush, a light grinding action in accordance with SSPC-SP3 Power Tool Cleaning or mild abrasive blasting in accordance with SSPC-SP 7 Brush-off Blast Cleaning. The cleaning shall extend beyond the damaged area to lap the undamaged galvanized coating at least ½-inch.
4. Weld flux residue, and weld splatter of a size or type that cannot be removed by blast cleaning shall be removed in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal. .
5. The cleaned area shall be preheated to at least 600°F but not more than 750°F. The surrounding galvanized area shall not be burned. The area to be repaired shall be wire brushed during this preheat.
6. The cleaned preheated area shall be rubbed with the repair alloy stick to deposit an evenly distributed layer of the zinc alloy.
7. The repaired area shall be wiped with a damp cloth to remove flux residue.
8. Dry-film thickness shall be verified using a magnetic or electromagnetic-type gauge, in accordance with ASTM D1186.
9. Dry-film thickness shall be verified using a magnetic or electromagnetic-type gauge, in accordance with ASTM D1186.
10. Zinc wire used in repair shall contain not less than 99.98% zinc.
11. The surface to be repaired shall be blast cleaned to white metal in accordance with SSPC-SP5. The area to be blast cleaned shall extend at least ½-inch onto the surrounding sound coating area.
12. Weld flux residue and weld splatter of a size or type that cannot be removed by blast cleaning shall be removed in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal. .
13. Sprayed coating shall be applied within 2 hours after surface preparation has been completed and before any visible deterioration (flash-rust) has occurred.
14. Sprayed coating shall be applied within 2 hours after surface preparation has been completed and before any visible deterioration (flash-rust) has occurred.
15. The coating shall be applied to the clean and dry surface by metal spraying pistols fed with zinc wire or zinc powder.
16. The surface of the sprayed zinc shall be of uniform texture, free of lumps, coarse areas, and loosely adhered particles.
17. Dry film thickness shall be verified using a magnetic or electromagnetic-type, gauge, in accordance with ASTM D1186.
18. In the field, for areas where the hot bar or metalizing process methods cannot be used, and with the permission of the District Engineer, the damaged areas shall be repaired with multiple coats of an approved coating such as Rustoleum Zinc Rich Cold Galvanizing Aerosol; CRC Zinc-It; Spray-on #740 zinc-rich; Sherwin Williams #140 Zinc-Rich; or equal.
19. The damaged area shall be cleaned and recoated with a organic zinc-rich paint to a minimum dry film thickness (DFT) of 6.0-mils applied in two coats.

20. The surface to be repaired shall be blast cleaned to white metal in accordance with SSPC-SP5. The area to be blast cleaned shall extend at least ½-inch onto the surrounding sound coating area.
21. Weld flux residue and weld splatter of a size or type that cannot be removed by blast cleaning shall be removed in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal.
22. Dry film thickness shall be verified using a magnetic or electromagnetic-type gauge, in accordance with ASTM D1186.
23. In areas where abrasive blasting cannot be used or cannot effectively clean the required area, power disk sanding or other cleaning methods shall be used, subject to the approval of the District Engineer.
24. Apply paint containing zinc dust to the prepared area as recommended by the paint manufacturer.

END OF SECTION 05500