

SECTION 05500METAL FABRICATIONSPART 1 - GENERAL1.1 SECTION INCLUDES

- A. Other items fabricated of metals shown to be provided on the Contract Drawings and not included in other sections.
- B. Surface Preparation and Shop Coatings and Galvanizing

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Steel lintels for masonry construction.
- B. Edge Angles

1.3 RELATED SECTIONS

- A. Section 01340 - Submittals
- B. Section 03300 - Cast-in-Place Concrete
- C. Section 04200 - Masonry
- D. Section 09900 - Painting

1.4 REFERENCES

- A. ASTM A36/A36M-01 - Specification for Carbon Structural Steel
- B. ASTM A48/A48M-00 - Specification for Gray Iron Castings
- C. ASTM A53/A53M-02 - Specification for Pipe, Steel, Black and Hot-dipped Zinc-coated welded and Seamless,
- D. ASTM A123/A123M-02 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
- E. ASTM A153/A153M-01a - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- F. ASTM A276-02a - Specification for Stainless Steel Bars and Shapes
- G. ASTM A307-02 - Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- H. ASTM A325-02 - Specification for Structural Bolts, Steel, Heat treated 120/105 KSI minimum Tensile Strength
- I. ASTM A490-02 - Specifications for Heat-Treated Steel Structural Bolts, 150KSI Minimum Tensile Strength
- J. ASTM A500-01a - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- K. ASTM A563-00 - Specification for Carbon and Alloy Steel Nuts.
- L. ASTM A992/A992M-02 - Standard Specification for Steel for Structural Shapes for Use in Building Framing

- M. ASTM A1011/A1011M-02- Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, and High Strength Low Alloy with Improved Formability.
- N. ASTM B209-02ei - Specification for Aluminum and Aluminum - Alloy Sheet & Plate
- O. ASTM B221-00 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes
- P. ASTM B308/B308M-02 - Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded
- Q. ASTM B429-00 - Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
- R. ASTM F436-02 - Specification for Hardened Steel Washers
- S. ASTM F593-02 - Specification for Stainless Steel Bolts, Hex Cap screws and Studs
- T. ASTM F594-02 - Specification for Stainless Steel Nuts
- U. ASTM F1554-02 - Specification for Anchor Bolts, Steel 36, 55 and 105 KSI Yield Strength
- V. SSPC - Steel Structures Painting Council
- W. SSPC-SP1 - Solvent Cleaning
- X. SSPC-SP2 - Hand Tool Cleaning
- Y. SSPC-SP3 - Power Tool Cleaning
- Z. SSPC-SP4 - Flame Cleaning of New Steel
- AA. SSPC-SP5 - White Metal Blast Cleaning
- BB. SSPC-SP6 - Commercial Blast Cleaning
- CC. SSPC-SP7 - Brush Off Blast Cleaning
- DD. SSPC-SP8 - Pickling
- EE. SSPC-SP10 - Near-White Blast Cleaning
- FF. Designation System for Aluminum Finishes - Aluminum Association
- GG. Specifications for Aluminum Structures - Aluminum Association
- HH. Engineering Data for Aluminum Structures - Aluminum Association
- II. Manual of Steel Construction - American Institute of Steel Construction (AISC)
- JJ. The National Association of Architectural Metal Manufacturers (NAAMM) Standard Amp 510-92 Metal Stairs Manual.
- KK. AWS D1.1-2002 - American Welding Society, Structural Welding Code-Steel.

1.5 DESIGN REQUIREMENTS

- A. Aluminum Grating: Live Loads indicated on Drawings.

1.6 SUBMITTALS

- A. Submit complete shop drawings showing fabrication, welding, connections, erection, finishes, materials and dimensions including plans, elevations, sections and details of all metal fabrications and connections and location of item in structure. Photocopies of Contract Drawings, in whole or part, will not be accepted as shop drawings.

- B. Submit product data and other items as required.
- C. Submit design computations when required.
- D. Submit certification from galvanizer that galvanizing is in accordance with Specifications.
- E. Submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificates shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

1.7 QUALITY ASSURANCE

- A. Conform to AISC Specification for the Design, Fabrication and Erection of Structural Steel.
- B. Conform to AWS Standard Code for Arc and Gas Welding in Building Construction.
- C. Conform to Specifications for Aluminum Structures by the Aluminum Association.

1.8 COORDINATION

- A. The Contractor shall coordinate with the work of other Sections. Verify at the site both the dimensions and the work of other trades adjoining items before fabrication and installation of items herein specified.
- B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.9 FIELD MEASUREMENTS

- A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.
- B. Templates of channel and tank configuration shall be made for the installation of grating or checkered plate for the existing areas to be covered or after the construction of the channel walls and slab.

1.10 DELIVERY, STORAGE, HANDLING

- A. Coordinate delivery of products.
- B. Protect products from damage prior to and after installation.
- C. Remove damaged material from the site.

PART 2 - PRODUCTS

2.01 MISCELLANEOUS FABRICATIONS

- A. Aluminum: 6061-T6
- B. Structural Steel Shapes and Plates: ASTM A36 or ASTM A992
- C. Welded and Seamless Steel Pipe ASTM A53, Grade B
- D. Cold Formed Welded and Seamless Steel Tubing: ASTM A500, Grade B

E. Stainless Steel Shapes: AISI Type 316.

2.02 WEIRS AND BAFFLES

A. Material: Aluminum - Aluminum alloy 6061 temper T6: ASTM B209

2.03 FASTENERS

A. Concrete anchorage:

1. Expansion Anchors - Stainless steel AISI Type 316 for galvanized and aluminum fabrications; cadmium plated for painted steel fabrications. Kwik-Bolt II by Hilti Fastening Systems or Tru Bolt Stud Anchor by Ramset Fastening System or equivalent.
2. Anchor Rods - ASTM F 1554 Grade 55.
3. Epoxy Capsule Anchors. Non-expanding chemical AISC Type 316 Stainless Steel Anchor Rod, 6" minimum projection and nut; HVA Adhesive Anchor by Hilti Fastening Systems or Chemset Injection 800 Series by Ramset Fastening Systems, or equivalent.

B. Bolted Joints: stainless steel ASTM F593 & F594 Alloy group 2 for aluminum fabrications; ASTM A325 for painted steel; galvanized ASTM A325 for galvanized steel.

C. Provide all fasteners with nuts, flat washers and lock washers of the same material as the anchors or bolts. Provide beveled washers for sloped surfaces.

D. Provide a minimum of 2 fasteners per connection.

2.04 MISCELLANEOUS STAINLESS STEEL FABRICATIONS

A. Material: Bolts, bars and shapes AISI, Type 304.

B. Material: Plate and sheet AISI, Type 302.

PART 3 - EXECUTION

3.1 FABRICATION

A. All miscellaneous metal members shall fit closely together and shall be straight and true, and the finished work shall be free from burrs, bends, twists, and open joints.

B. Tolerances:

1. Squareness: 1/8 inch maximum difference in diagonal measurements.
2. Maximum Offset between faces: 1/16 inch.
3. Maximum misalignment of adjacent members: 1/16 inch.
4. Maximum Bow: 1/8 inch in 48 inches.
5. Maximum Deviation From Plane: 1/16 inch in 48 inches.

C. All holes, angles, supports, and braces shall be provided as required.

D. Except as otherwise indicated on the drawings, gusset plates shall have a minimum thickness of 3/8-inch.

E. Holes shall be made in steel members for attachment of wood blocking, nailers, etc. Holes shall be sized to suit the fasteners indicated on the drawings: where size and spacing are not indicated, holes shall be 9/16-inch diameter, at 3 feet o.c.

- F. Sheared and flame cut edges shall be true to line and free from rough corners and projections.
- G. Re-entrant cuts/corners shall be filleted to a radius of not less than ½ inch.
- H. Holes shall be punched, subpunched and reamed, or drilled in accordance with AISC "Specifications for Structural Steel." Holes shall not be made by flame cutting.
- I. Holes shall be 1/16 inch larger than the nominal bolt diameter, except holes for cast-in-place anchor bolts which shall be 5/16 inch larger than the nominal bolt diameter and as otherwise shown on the Drawings.
- J. The use of oversize or slotted holes not shown on the Drawings shall be subject to prior review by the ENGINEER.
- K. Bent plate shall be in accordance with AISC "Minimum Radius for Bending."
- O. Welding shall be done in a sequence which minimizes distortion and shrinkage.
- P. Fabrication holes, notches, etc. not required by nor shown on the Drawings shall be subject to prior review by the ENGINEER.

3.2 CONNECTIONS (GENERAL)

- A. Connections shall be designed by the fabricator subject to the provisions of the design drawings, specifications and the referenced AISC Specifications. Such connections shall be designed as framed beam connections, and shall be selected from the appropriate AISC Manual Tables to support one-half the total uniform load capacity of the beam.
- B. At the time of connecting, all bearing surfaces shall be free from loose or nonadherent rust, loose mill scale, oil, grease, dirt, mud, and any foreign matter, coating, or defect that adversely affects the connection.
- C. At the time of connecting, all faying surfaces at high strength friction-type bolted A325F connections shall be free from loose or nonadherent rust, loose mill scale, oil, grease, dirt, mud, and any foreign matter, coating, or defect that adversely affects the connection.

3.3 CONNECTIONS (BOLTED)

- A. Unfinished bolts shall conform to ASTM A307. The nuts of all unfinished bolts shall be secured against loosening by denting the bolt threads with a chisel, or by other means reviewed and no exceptions taken by the Engineer.
- B. High strength bolted connections shall conform to the AISC Joint-Specification. The connections shall be bearing type, unless noted otherwise on the drawings. Erector shall furnish with his proposal a full and detailed description of all installation and inspection procedures for high strength bolting.
- C. Bolts shall be tightened with calibrated power wrenches adjusted to stall or cut-out at the selected bolt tension; wrenches shall not be used with this feature inoperative or out of adjustment. At locations inaccessible for calibrated wrenches, manual wrenches may be used to tighten bolts.
- D. All bolts have a washer under the element (nut or bolt head) turned in tightening. Beveled washers shall be used where flange slope exceeds 1:20.

- E. The sockets used to tighten high strength bolts shall score or mark the nuts so that nuts have been tightened can be easily identified. High strength bolts or nuts once tightened shall not be loosened then re-used. Care shall be taken not to damage the threads of high strength bolts during installation. Joints shall be properly aligned and drifted and holes reamed, if required, to permit bolts to be slipped into place by hand. No burning is allowed for hole adjustment.
- F. The recommendation of the wrench manufacturer shall be followed in the operation and maintenance of the power wrenches.

3.4 CONNECTIONS (SHOP WELD FERROUS METALS)

- A. Welding shall be only for the connections and assemblages shown on the drawings or specified herein, and shall be performed in the shop, except where specifically noted otherwise.
- B. Welders employed on the work shall be experienced structural welders, previously qualified by tests and prescribed in the AWS Code, using the base metals and electrodes specified herein.
- C. Welding materials and workmanship shall conform to the AWS code.
- D. All welds shall be free of undercut, unfilled craters, and cracks, and shall have smoothly faired contours. Flux and loose scale shall be-removed from previous weld bead before succeeding bead is laid.
- E. Welds other than those indicated on the design drawings may be used only if reviewed and no exceptions are taken by the Engineer.

3.5 CONNECTIONS (FIELD WELDED FERROUS METALS)

- A. Welding shall be in accordance with the Structural Welding of the AWS D1.1 and shall only be done where shown, or specified. Welding terms shall be interpreted in accordance with the Standards of the AWS. All welding shall be done only by certified welders using welding procedures and welding equipment.
- B. No welding will be allowed when surfaces are wet or exposed to rain, or wind, or when operators are exposed to inclement conditions that will hamper good workmanship.
- C. All welds, including tack welds that are to be incorporated in the final welds, shall be made by a certified welder and shall be of as sound quality as final welds. Tack welds shall be cleaned and thoroughly fused with final weld. Defective, cracked or broken tack welds shall be removed before final welding. Tack welds must be removed from points where stress is primary if welding is to be manual.
- D. All weld metal shall be sound throughout and there shall be no cracks in any weld or weld pass. All craters shall be filled to the full cross-section of the welds. The construction crew shall remove weld scale or slag, spatter, burrs, and other sharp or rough projections in a manner that will leave the surface suitable for any required non-destructive testing and the subsequent cleaning and painting operation.
- E. When welding is unsatisfactory or indicates inferior workmanship, corrective measures shall be required. Where requirements prescribe the removal of part of the weld or a portion of the base metal, such removal shall be by chipping or grinding. Where corrections require the deposition of additional weld metal, the sides of the area to be

welded shall have no less than 1 to 1 slope to allow sufficient room for depositing new metal. Defective or unsound welds shall be corrected either by removing and replacing the entire weld, or as follows:

1. Excessive convexity. Reduce to size by removal of excess weld metal by grinding.
 2. Shrinkage cracks, cracks in base metal, craters, and excessive porosity. Remove defective portions of base and weld metal down to sound metal, and deposit additional sound weld metal.
 3. Undercutting, undersize, and excessive concavity. Clean and deposit additional weld metal.
 4. Overlapping and incomplete fusion. Remove and replace the defective portion of weld.
 5. Slag inclusions. Remove those parts of the weld containing slag and fill with sound weld metal.
 6. Removal of, adjacent base metal during welding. Clean and form full size by depositing additional weld metal.
- F. Where corrections require the deposition of additional weld metal, the electrode used shall be smaller than the electrode used for making the weld. Surface shall be cleaned thoroughly before rewelding.
- G. Cracked welds shall be removed throughout their length.
- H. Improperly fitted and misaligned parts shall be cut apart and rewelded.
- I. In the event that faulty welding or its removal for rewelding, shall so damage the base metal that in the judgement of the Engineer its retention is not in accordance with the intent of the Drawings and Specifications, the Contractor shall remove and replace the damaged material at no additional cost to the Owner.
- J. Where welding is performed in the proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks and spatter.

3.6 CONNECTIONS (WELDING ALUMINUM)

- A. All aluminum welding shall be done by the inert gas shielded arc or fluxless resistance techniques.
- B. Welded assemblies to be anodized shall be designed so that faying surfaces are free-rinsing and will not trap anodizing solutions.
- C. Where at all possible, welds in assemblies to be anodized shall be located so as to conceal visible discoloration in the heat-affected zone.
- D. Where weld metal must be exposed after anodizing, filler alloys shall be selected to closely match the composition of the base metal. Follow parent metal manufacturer's recommendations for such filler alloys.
- E. Where weldments are to be made on materials that have been previously anodized, the area of fusion shall be free of the anodic film prior to welding. Parts to be so welded shall be masked during anodizing, or sanded clean in the weld areas. Only weldments that will be concealed may be so made. Crazeing or discoloring of the anodic coating in the weld area will not be acceptable in exposed areas.
- F. Weldments on exposed finished surfaces shall be ground and/or polished to match and blend with finish of adjacent parent metal.

- G. Structural welds shall be made by qualified welders and shall conform to the general recommendations and regulations of the references Aluminum Association Publications.
 - 1. Dirt, grease, lubricant, or other organic material shall be removed by vapor degreasing or suitable solvent.
 - 2. Joints rejected because of welding defects may be repaired only by rewelding. Defective welds shall be removed by chipping or machining. Flame cutting shall not be used.
- H. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter, or tramp metal.

3.7 ERECTION AND INSTALLATION

- E. All unmatched holes in shop assembly of field connections shall be reamed and the pieces match marked before disassembly. Drift pins shall be used only for bringing members into position and not to enlarge or distort holes. Any piece weakened by reaming to compensate for eccentricity to a point where the strength of the joint is impaired shall be rejected and a new and satisfactory piece shall be provided by the Contractor at his own expense. Slotted holes and washers shall be provided for truing up steel requiring accurate alignment.
- F. Camber of beams and girders shall be that indicated on the design drawings. Where no camber is indicated, any minor camber resulting from rolling or shop assembly shall be upward.
- G. The use of a gas cutting torch in the field for correcting fabrication errors will not be permitted upon any primary member of the structural framing. The use of a gas cutting torch will be permitted only on secondary members, and then only after the review and no exceptions taken by the Engineer.
- H. Layout, locate, level and plumb items, to be installed. Coordinate items to be installed in substrates.
- I. Drill and otherwise prepare substrates for fastening. Install non-shrink grout as required.
- J. Top edge of weir plates shall be set straight, true and accurately to the elevations indicated on the Drawings.
- K. Weir crests shall be adjusted level after filling the tanks with water.
- L. Coat surfaces of aluminum in contact with masonry, concrete or dissimilar metals with Polyamide Epoxy Primer.

3.8 GALVANIZING

- A. Blast clean to near white metal in accordance with SSPC-SP10.
- B. Hot-dip galvanize fabricated items in accordance with ASTM A123 and hardware items in accordance with ASTM A153.
- C. Assembled and non-assembled steel as indicated on Drawing shall be galvanized.
- D. Galvanize items after assembly when possible.
- E. Thickness of galvanizing shall be as specified in ASTM A123 and A153 except coating shall not be less than 2 oz. (3.3 mils) per square foot.

- F. Galvanizing shall provide a visually acceptable substrate for applied coatings and shall be free of lumps, globules, sharp edges or heavy deposits which will interfere with intended use or a esthetic appearance of materials.
- G. After erection touch-up all damaged galvanized surfaces and field welds as follows:
 - 1. Surfaces to be reconditioned with zinc-rich paint shall be clean, dry, and free of oil, grease and corrosion.
 - 2. Areas to be repaired shall be power disc sanded to bright metal. To ensure that a smooth reconditioned coating can be effected, surface preparation shall extended into the undamaged galvanized coating.
 - 3. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A780. Galvanizing repair paint shall have 65 percent zinc by weight.
 - 4. The paint shall be spray applied in multiple coats until a dry film thickness of 4-6 mils minimum has been achieved. A finish coat of aluminum paint shall be applied to provide a color blend with the surrounding galvanizing.
 - 5. Coating thickness shall be verified by measurements with a magnetic or electromagnetic gauge.
 - 6. Acceptable Repair Paint:
 - a. ZIRP by Duncan Galvanizing.
 - b. Or equal.

3.9 SURFACE PREPARATION AND SHOP COATINGS

- A. Provide Surface Preparation and Shop Coatings in accordance with specification Section 09905, except for areas which to be field welded shall be protected with a shop coat of linseed oil.
- B. Shop coats shall be compatible with and made by the same manufacturer as the field top coats as specified in Section 09900. Contractor shall coordinate.
- C. After erection touch-up all abrasions and field welds with same material used on shop coating.

3.10 CLEANING

- A. Clean surfaces of all work of this section as well as the areas in the vicinity.

3.11 PROTECTION

- A. Protect installed work.
- B. Protect from splatter or debris from adjacent construction.
- C. Protect work from excess construction loading.

END OF SECTION