

SECTION 05500
METAL FABRICATIONS

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PART 1 - GENERAL

1.1 REFERENCES

- A. American Institute of Steel Construction (AISC)
 - 1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. American National Standards Institute, Inc. (ANSI)
 - 1. A14.3 - Safety Requirements for Fixed Ladders.
- C. American Society for Testing and Materials (ASTM)
 - 1. A36/A36M - Specification for Carbon Structural Steel.
 - 2. A47 - Specification for Ferritic Malleable Iron Castings.
 - 3. A47M - Specification for Ferritic Malleable Iron Castings [Metric].
 - 4. A48 - Specification for Gray Iron Castings.
 - 5. A53 - Specification for Pipe, Steel, Black and Hot -Dipped Zinc -Coated, Welded and Seamless.
 - 6. A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - 7. A123 - Specification for Zinc (Hot -Dip Galvanized) Coatings on Iron and Steel Products.
 - 8. A153 - Specification for Zinc Coating (Hot -Dip) on Iron and Steel Hardware.
 - 9. A234/A234M - Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
 - 10. A283 - Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 11. A307 - Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 12. A325 - Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 13. A325M - Specification for High-Strength Bolts for Structural Steel Joints [Metric].

14. A366/A366M - Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
15. A413/A413M - Specification for Carbon Steel Chain.
16. A490 - Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
17. A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
18. A501 - Specification for Hot -Formed Welded and Seamless Carbon Steel Structural Tubing.
19. A513 - Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
20. A653/A653M - Specification for Steel Sheet, Zinc -Coated (Galvanized) or Zinc -Iron Alloy -Coated (Galvannealed) by the Hot -Dip Process.
21. A569/A569M - Specification for Steel, Carbon (0.15 Maximum, Percent), Hot -Rolled Sheet and Strip Commercial Quality.
22. A570/A570M - Specification for Steel, Sheet and Strip, Carbon, Hot -Rolled, Structural Quality.
23. A780 - Practice for Repair of Damaged and Uncoated Areas of Hot -Dip Galvanized Coatings.
24. A786/A786M - Specification for Rolled Steel Floor Plates.
25. C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

D. American Welding Society (AWS)

1. D1.1 - Structural Welding Code - Steel.

E. Federal Specification (Fed. Spec.)

1. FF-S-325 - Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry).

F. Michigan Department of Transportation (MDOT)

1. Standard Specifications for Construction.

G. Military Specification

1. DOD-P-21035A - Paint, High Zinc Dust Content, Galvanizing Repair.

H. National Association of Architectural Metal Manufacturers (NAAMM)

1. Architectural Metal Handbook.
2. MBG 531 - Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads.

I. National Fire Protection Association (NFPA)

1. 82 - Incinerators and Waste and Linen Handling Systems and Equipment.

J. Research Council on Structural Connection (RCSC)

1. Specification for Structural Joints Using ASTM A325 or A490 Bolts.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit Shop Drawings for each item. Show sizes, methods of fabrication,

finishes and installation details, including location of holes and anchors.
Submit engineering calculations supporting member size selection for specified performance loading.

1.3 PROJECT CONDITIONS

A. Field Measurements

1. Take field measurements to verify or supplement dimensions indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel

1. Bars and structural shapes, hot rolled: ASTM A36.
2. Bars, cold finished: ASTM A108, Grade 1018.
3. Bars for steel gratings: ASTM A569.
4. Structural tubing, cold formed welded and seamless: ASTM A500.
5. Structural tubing, hot formed welded and seamless: ASTM A501.
6. Finished tubing: ASTM A513, electric resistance-welded, low carbon, MT1010, bright finish pickled and oiled strip, outside welding flash removed.
7. Sheet: ASTM A366, thickness as specified in U.S. Standard gage. Exposed panels shall be stretcher leveled.
8. Galvanized sheet: ASTM A653/A653M, commercial quality, thickness as specified in U.S. Standard gage, G90 coating designation.
9. Hot -rolled strip: ASTM A570.
10. Plate: ASTM A283, Grade C.
11. Pipe: ASTM A53, seamless, weight as specified.
12. Welding fittings for steel pipe: ASTM A234.
13. Chain: ASTM A413/413M, Grade 30.

B. Inserts

1. Threaded inserts: Gateway Building Products "Type J".
2. Threaded hanger inserts: Star Anchors and Fasteners "P.D. Concrete Insert" No. P45-T with adapter plug No. P-45A, or as approved.
3. Slotted inserts: Gateway Building Products "Type G"; Hohmann & Barnard, Inc. "Type CS-H"; or as approved.
4. Cable vault inserts: Unistrut Corp. "No. P 3352" for ceiling; "No. P 3252" for floor.

C. Cast Iron

1. Uniform quality, free of blow holes, porosity, hard spots, shrinkage defects, cracks and other injurious defects.
2. Malleable iron castings: ASTM A47, Grade No. 35018.
3. Gray iron castings: ASTM A48, Class 30.

D. Zinc Coating

1. On iron and steel products: ASTM A123.
2. On hardware: ASTM A153.

E. Fasteners

1. Expansion shields: Fed. Spec. FF-S-325, machine bolt type, tubular type, or self-

- drilling tubular type.
- 2. Capsule anchors: Hilti Corp. "HVA Adhesive Anchor System"; ITW Ramset/Redhead "EPCON System"; Powers Fasteners, Inc. "Chem-Stud"; or as approved.
- 3. Steel bolts, standard fasteners : ASTM A307.
- 4. Steel bolts, high strength: ASTM A325.

F. Paint

- 1. Prime paint for shop coat and field touch-up: Tnemec Co., "Tnemec Primer 10-99 Red"; ICI "Devguard Multi-Purpose Metal Primer"; Standard Paint Co. "IPR-139 Rust Inhibitive Primer"; or Valspar Corp. "13-R-78 Shop Primer Red".
- 2. Zinc -rich paint: ZRC Products Co., "Z.R.C." or other acceptable product complying with DOD-P-21035A.

G. Nonshrink Grout

- 1. A factory premixed and packaged non-metallic compound complying with ASTM C1107, Grade C, at all flow levels, and one of the following, or as approved:

Dayton Superior Corp. "Sure-Grip High Performance Grout"
Euclid Chemical Co. "Hi-Flow Grout"
L & M Construction Chemicals, Inc. "Crystex".
Symons Corp. "Symons Multi-Purpose".

- 2. Nonshrink grout exposed to view: pigmented to match color of concrete.

2.2 FABRICATION - GENERAL

A. Painting

- 1. Thoroughly clean and prime paint ferrous metal items, except galvanized items and items to be encased in concrete and areas adjacent to field welds.
- 2. Clean surfaces by power brushing free of loose mill scale, loose rust, accessible weld slag and flux deposit, dirt and other foreign matter. Remove oil and grease deposits by solvent.
- 3. After cleaning, apply one shop coat of prime paint thoroughly and evenly to dry surfaces to a minimum dry film thickness (dft) of 0.05 mm (2.0 mils).
- 4. After erection, brush touch-up with prime paint members where shop coat has been damaged, welds, areas adjacent to welds and field bolts.
- 5. Touch-up damaged zinc coating in the field with zinc -rich paint applied in accordance with manufacturer's instructions.

B. Galvanizing

- 1. For items specified to be galvanized, including their anchors, provide zinc coating by the hot -dip process in accordance with the applicable ASTM designation.
- 2. Do not cut, drill, or weld galvanized items in the field.

C. Anchors

- 1. Provide anchors and fastenings required to secure Work in place.
- 2. Wherever possible, embed anchors in new concrete and masonry. Use expansion shields only where anchors cannot be located before concrete is poured and for anchoring to existing concrete and masonry.
- 3. Unless otherwise indicated or specified, provide 13-mm-diameter (1/2-inch-diameter) anchor bolts. Cut off projecting ends of bolts within 3 mm (1/8 inch) of face of nut and grind or file smooth after installation.

D. Workmanship

1. Weld permanent shop connections in accordance with AWS code with shielded-arc electrodes. Finish welds flush and smooth where exposed.
2. Provide concealed fastenings where possible. Drill or punch holes in shop. Holes made or enlarged in field are subject to approval by the Architect.
3. Provide holes for bolted connections with allowance for field adjustment.
4. Provide members which are straight and in alignment at joints. Mill exposed ends smooth. Remove shear burrs from edges of sheet steel.
5. Replace or correct members having errors which prevent proper assembling.

2.3 STEEL RAILINGS

A. General

1. Design handrails, guardrails and posts to resist a concentrated load of 1110 newtons (250 pounds) in any direction at any point of the top of the rail or 730 newtons per meter (50 pounds per foot) applied horizontally to top of the rail, whichever is more severe, without exceeding allowable design working stresses of materials for railings, anchors, and connections.
2. Provide steel railings for both sides of stairs and ship ladders and for other locations as indicated, complete with sleeves, flanges and wall brackets.
3. Galvanize exterior railings, sleeves, brackets and flanges after fabrication.

B. Fabrication

1. Fabricate pipe railings of Type S, Grade B, standard weight (Schedule 40) pipe, unless another weight is required by structural loads, size indicated, with flush fittings and assembled with full welded connections. Provide short radius weld elbows in place of mitered connections.
2. Fabricate tubular railings of steel tubing, 3-mm (0.120-inch) minimum thickness by 38-mm (1-1/2-inch) minimum diameter and cold finished bars of size indicated, assembled with full welded connections.
3. Fabricate wall brackets of malleable iron with single exposed 10-mm (3/8-inch) hex -head machine bolt connection.
4. Fabricate sleeves of 63-mm-diameter (2-1/2-inch-diameter) galvanized steel tube with bottom capped and temporary top cap, such as supplied by R & B Wagner, Inc.

2.4 STEEL STAIRS

A. Fabrication

1. Design and fabricate stair members to support dead load plus live load as follows without exceeding deflection of 1/240 span:
 - a. Treads - non-concurrent live loads of:
 - 1) 4.8 kPa (100 psf)
 - 2) 14.4 kPa (300 lbs), applied at midspan.
 - b. Landings - 7.2 kPa (150 psf) live load.
2. Fabricate stairs, including joints in stringers, of all-welded construction, except concealed field connections to structure may be bolted. Close open ends of stringers with 5-mm (3/16-inch) steel plate.
3. Fabricate stringers and supports for landings of rolled steel sections. Make

- connections with rolled steel sections.
4. Fabricate metal pan treads and risers of steel sheet, minimum 12 gage, carried on brackets. Fabricate landing platforms of steel sheet, minimum 10 gage, with stiffeners as required for allowable deflection.

B. Abrasive Nosings

1. Provide abrasive nosing on each tread and landing edge at riser 100 mm (4 inches) wide by length of tread, anchored to concrete with embedded aluminum anchors:
 - a. Aluminum oxide filler and epoxy binder on extruded aluminum base; American Abrasive Metals Co. "Type BF4"; Wooster Products Inc. "Type WP4J"; or as approved.
2. Protect abrasive nosings during construction with protective tape, shop-applied. Remove tape just prior to preliminary acceptance.

2.5 WOVEN WIRE INFILL PANELS

- A. Woven wire railing insert panels as manufactured by the G-S Company; Indiana Wire Products, Inc.; Kentucky Metal Products Co.; Miller Wire Works, Inc.; or as approved.
 1. Completely assembled insert units for attachment to handrail and guardrail systems and including all necessary mounting accessories, fittings and fastenings.
 2. Frames: 25-mm by 13-mm by 3-mm (1-inch x 1/2-inch x 1/8-inch) channel with 25-mm (1-inch) closure strip.
 3. Mesh: No. 8 gage crimped wire woven into 50 by 50-mm (2 by 2-inch) square mesh, securely clinched to frames.
 4. Attachment clips: 50-mm by 50-mm by 6-mm (2-inch x 2-inch x 1/4-inch) plate welded to frame and railing in quantities as recommended by manufacturer.
 5. Exterior wire mesh panel, fittings and accessories: galvanized after fabrication.

2.6 STEEL LADDERS

- A. Fabricate vertical steel ladders of round bar rungs capable of supporting 1560 newtons (350 pounds) at any point extending full size through holes in rails and welded in place. Space rungs 300 mm (12 inches) apart. Comply with ANSI A14.3.
- B. Provide hoop safety cages consisting of steel bar hoops, vertical bars and diagonal braces welded together and to ladder rails.
- C. Fabricate splices and connections without sharp projections.
- D. Galvanize exterior ladders and hoop cages after fabrication.

2.7 LOOSE LINTELS

- A. Provide rolled steel loose lintels for support of masonry above openings for which other types of lintels are not indicated or specified, sized for support of each 100 mm (4 inches) of masonry in accordance with the following schedule:

<u>Width of opening</u>	<u>Angle size, long leg vertical</u>
0 to & including 1200 mm (4 feet)	88 x 88 x 6 mm (3-1/2 x 3-1/2 x 1/4) inches
1200 to & including 1800 mm (4 to & including 6 feet)	100 x 88 x 6 mm (4 x 3-1/2 x 1/4 inches)
1800 to 2400 mm (6 to 8 feet)	125 x 88 x 8 mm (5 x 3-1/2 x 5/16 inches)

- B. Fabricate lintels to provide a minimum bearing at each end of 150 mm (6 inches) and not less than 83 mm per meter (one inch per foot) of span.
- C. [Galvanize lintels after fabrication.]

2.8 ITEMS FOR FINISH CARPENTRY

- A. Fabricate steel framing and supports for finish carpentry with a minimum of field joints.
- B. Exposed members: cold finished.
- C. Tubular sections: steel tubing of sizes and shapes indicated.
- D. Weld shop connections and joints. Mill field joints for flush connection with flat -head machine screws. Drill and countersink for connection to wood framing.

2.9 PIPE BUMPERS

- A. Fabricate pipe bumpers of steel pipe, standard weight, nominal diameter indicated.
- B. Weld square plate, two inches larger than the outside diameter of the pipe, to the bottom for anchorage to the concrete base. Concrete is specified in Division 3, "Concrete".
- C. Provide sleeves of steel pipe, standard weight, of nominal diameter one size larger than the pipe bumper, closed at bottom with a welded steel plate, and fitted with set screws at top.

PART 3 - EXECUTION

3.1 GENERAL

- A. Welding
 - 1. Weld field connections in accordance with AWS code with shielded-arc electrodes. Finish welds flush and smooth where exposed.
- B. Field Touch-up
 - 1. After erection, brush touch-up with prime paint members where shop coat has been damaged, welds, areas adjacent to welds and field bolts.
 - 2. Touch-up damaged zinc coating in the field with zinc -rich paint applied in accordance with manufacturer's instructions, or other method specified in ASTM A780, and in accordance with ASTM A780.

3.2 INSTALLATION

- A. Steel Railings
 - 1. Set non-removable posts on concrete stairs and floors in sleeves embedded in concrete and anchored with nonshrink grout covered with slip flanges. Weld slip flanges to posts.
 - 2. Weld non-removable posts on steel stairs, ladders and platforms to steel framing.
 - 3. Set removable posts in sleeves, anchored with set screws.
 - 4. Space wall brackets not more than 1500 mm (60 inches) apart.
- B. Steel Stairs
 - 1. Where landings abut wall construction, support stringers from hangers welded to structural steel or to anchors embedded in concrete. Conceal hangers in wall construction, unless otherwise indicated. Anchor stringers to floor with clip angles, expansion bolted to floor.

- C. Steel Ladders
 - 1. Anchor brackets to wall and framing.
- D. Loose Lintels
 - 1. Bolt or weld pairs of angles together. Bed lintels in mortar or grout as approved.
- E. Precast Lintel Support
 - 1. Where precast concrete or masonry lintels abut concrete columns or walls, provide rolled steel angle seat attached to concrete with bolts and threaded inserts.
- F. Pipe Bumpers
 - 1. Install pipe bumper in concrete foundation to depth indicated. Form slot at juncture of pipe and concrete surface for installation of sealant specified in "Joint Sealants" Section.
 - 2. After installation of the bumper, fill with concrete, making a smooth rounded top.

3.3 MISCELLANEOUS FRAMING

- A. Provide steel bars or structural shapes shown, but not indicated as part of structural steel, including, but not limited to, the following:
 - 1. Reinforcement for unframed openings in metal roof deck.
 - 2. Framing for support of precast concrete deck.
 - 3. Supports for aluminum entrance door frames.
 - 4. Door frames for
 - a. overhead doors,
 - b. and as indicated.
 - 5. Framed openings in walls for
 - a. windows,
 - b. doors,
 - c. air ducts,
 - d. conduit clusters,
 - e. duct banks,
 - f. and as indicated.
 - 6. Supports for rough carpentry.
 - 7. Members supporting expansion joint covers or flashing.
 - 8. Support framing for mechanical equipment not indicated as part of mechanical equipment.
 - 9. Roof curb framing for
 - a. roof hatches,
 - b. roof ventilators,
 - c. roof duct openings,
 - d. and as indicated.
 - 10. Sign support framing.
 - 11. Emergency siren alarm support framing.
 - 12. Sill beams at window openings.

END OF SECTION