JOINT BASE LEWIS McCHORD DESIGN STANDARD DIVISION 05 - METALS SECTION

05 52 00 METAL RAILINGS

# 07/18

PART 1 GENERAL

* 1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 314 (1990; R 2013) Standard Specification for Steel Anchor Bolts

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)

Structural Welding Code - Steel ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical

Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch

Series)

 ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2012) Standard Specification for Steel,

Sheet, Cold-Rolled, Carbon, Structural,

High-Strength Low-Alloy and High-Strength

Low-Alloy with Improved Formability,

Solution Hardened, and Bake Hardened

ASTM A1011/A1011M (2012) Standard Specification for Steel,

Sheet, and Strip, Hot-Rolled, Carbon,

Structural, High-Strength Low-Alloy and

High-Strength Low-Alloy with Improved

 Formability and Ultra-High Strength

ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A283/A283M (2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A325M (2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A449 (2014) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

ASTM A500/A500M (2013) Standard Specification for

Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A512 (2006; R 2012) Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM C636/C636M (2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

ASTM E488 (2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521 (2001; R 2012) Pipe Railing Systems Manual

* 1. SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G

 Iron and Steel Hardware;

 SD-03 Product Data

Structural-Steel Tubing

Protective Coating;

Steel Railings and Handrails;

SD-07 Certificates

Welding Procedures;

Welder Qualification;

* 1. QUALITY CONTROL
		1. Welding Procedures

 Submit results of welding procedures testing in accordance with

AWS D1.1/D1.1M made in the presence of the Contracting Officer and by an approved testing laboratory at the Contractor's expense.

* + 1. Welder Qualification

Submit certified welder qualification by tests in accordance with

AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

* 1. FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 to 12 scale 1 inch to 1 foot. Provide details of sections and connections at not less than 1 to 4 scale 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 0.8 millimeter 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

* + 1. Aluminum Railings

Fabrication: Provide fabrication jointing by one of the following methods:

* + - 1. Use flush-type rail fittings, welded and ground smooth with splice locks secured with 10 mm 3/8 inch recessed-head set screws.
			2. Ensure that mitered and welded joints made by fitting; post to top rail; intermediate rail to post; and corners, are groove welded and ground smooth. Where allowed by the Contracting Officer, provide butt splices reinforced by a tight-fitting dowel or sleeve not less than 150 mm 6 inches in length. Tack-weld or epoxy-cement the dowel or sleeve to one side of the splice.
			3. Assemble railings using slip-on aluminum-magnesium alloy fittings for joints. Fasten fittings to pipe or tube with 6 or 10 mm 1/4 or 3/8 inch stainless-steel recessed-head setscrews. Provide assembled railings with fittings only at vertical supports or at rail terminations attached to walls. Provide expansion joints at the midpoint of panels. Provide a setscrew in only one side of the slip-on sleeve. Provide alloy fittings to conform to ASTM B26/B26M.

 Provide removable railing sections as indicated. Provide toe-boards and brackets where indicated, using flange castings as appropriate.]

2.1.2 Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

1. Flush-type rail fittings of commercial standard, welded and ground smooth, with railing splice locks secured with 10 mm 3/8 inch hexagonal-recessed-head setscrews.
2. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 150 mm 6 inches long.
3. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

d. Provide removable sections as indicated.

2.1.3 Protective Coating

 Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

1. steel surfaces encased in concrete
2. steel surfaces for welding
3. high-strength bolt-connected contact surfaces
4. crane rail surfaces

Provide hot-dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.2 COMPONENTS

2.2.1 Structural Steel Plates, Shapes and Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

2.2.2 Structural-Steel Tubing

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

2.2.3 Hot-Rolled Carbon Steel Bars

Provide bars and bar-size shapes conforming to ASTM A575, grade as selected by the fabricator.

2.2.4 Cold-Finished Steel Bars

Provide cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

2.2.5 Cold-Drawn Steel Tubing

Provide tubing conforming to ASTM A512, sunk-drawn, butt-welded, cold-finished, and stress-relieved.

2.2.6 Steel Pipe

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.2.7 Concrete Inserts

 Provide threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive M20 3/4 inch diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M, hot-dip galvanized in accordance with

ASTM A153/A153M.

Provide wedge-type concrete inserts consisting of galvanized box-type ferrous castings designed to accept M20 3/4 inch diameter bolts having special wedge-shaped heads, made of either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M and hot-dip galvanized in accordance with ASTM A153/A153M.

2.2.8 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

 Provide lead expansion shields for machine screws and bolts larger than

6 millimeter 1/4 inch in size; head-out embedded nut type, multiple-unit class, Group I, Type 1, Class 2.

 Provide bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.

 Provide tumble-wing-type toggle bolts conforming to ASTM A325M

ASTM F3125/F3125M, ASTM A449 and ASTM C636/C636M, type, class, and style as required.

2.2.9 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

 Provide standard hexagon-head bolts, conforming to ISO 898-1 ASTM A307, Grade A.

2.2.10 Steel Railings and Handrails

Design handrails to resist a concentrated load of 200 lb or as indicated in any direction at any point of the top of the rail or 50 lb per foot or as indicated applied horizontally to the top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.

2.2.10.1 Steel Handrails

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A53/A53M. Provide steel railings of 1-1/2 or 2 inch nominal size, hot-dip galvanized and shop-painted.

Provide kickplates between railing posts where indicated, and consisting of

4 millimeter 1/8 inch steel flat bars not less than 150 millimeter 6 inches high. Secure kickplates as indicated.

 Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings.

 Provide galvanized exterior and interior railings where indicated, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings not indicated as galvanized.

2.2.11 Aluminum Railings and Handrails

Provide railings and handrails consisting of1 ½ or 2 inch nominal schedule 40 pipe ASTM B429/B429M. Provide color finish as indicated. Ensure that all fasteners are Series 300 stainless steel.

2.2.12 Safety Chains and Guardrails

Provide safety chains of galvanized steel, straight-link type, 5 mm 3/16 inch diameter, with at least 12 links per 300 mm foot, and with snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide snap hooks of boat type. Provide galvanized 10 mm 3/8 inch bolt with 20 mm 3/4 inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 100 mm 4 inches longer than the anchorage spacing, for each guarded area. Provide bolts and nuts as indicated, conforming to the requirements of ASTM A307. Locate guardrails safety chain where indicated. Mount the top chain rail 1050 mm feet 6 inches above the floor or ground and mount the lower chain rail 600 mm

2 feet above the floor or ground.

PART 3 EXECUTION

* 1. PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8 feet on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

 a. Anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 150 millimeter 6 inches long, and having an inside diameter not less than 13 millimeter 1/2 inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 25 millimeter 1 inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with non-shrink grout or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

b. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.

c. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

d. Anchor rail ends to steel with oval or round steel flanges welded to tail ends and bolted to the structural-steel members.

 Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 75 millimeter 3 inch projection from the finished wall surface to the center of the pipe, drilled to receive one M10 3/8 inch bolt. Locate brackets not more than 1525 millimeter 60 inches on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

 a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

 b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

c. Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

* 1. INSTALLATION

 Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications cited in this section.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --