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4		<b>PIPE AND TUBE RAILINGS</b>
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27 **PART 1 – GENERAL**

28 **1.1 SUMMARY**

- 29 A. Section Includes:
- 30 1. Stainless-steel pipe and tube railings.
- 31 B. Related Requirements:
- 32 1. Section 03 41 23 "Precast Concrete Stairs" for steel tube railings associated with cast concrete stairs.

33 **1.2 COORDINATION**

- 34 A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating
- 35 manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one
- 36 another.
- 37 B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for
- 38 installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that
- 39 are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- 40 C. Schedule installation so wall attachments are made only to completed walls. Do not support railings
- 41 temporarily by any means that do not satisfy structural performance requirements.

42 **1.3 ACTION SUBMITTALS**

- 43 A. Product Data: For the following:
- 44 1. Manufacturer's product lines of mechanically connected railings.
- 45 2. Railing brackets.
- 46 3. Grout and anchoring cement.
- 47 B. Sustainable Design Submittals:
- 48 1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and
- 49 cost.

- 1           2. Regional Materials Certificate.
- 2           C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- 3           D. Samples: For each type of exposed finish required.
- 4           E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified
- 5           professional engineer licensed in the State of Wisconsin responsible for their preparation.

6   **1.4    INFORMATIONAL SUBMITTALS**

- 7           A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency,
- 8           according to ASTM E 894 and ASTM E 935.

9   **1.5    QUALITY ASSURANCE**

- 10          A. Welding Qualifications: Qualify procedures and personnel according to the following:
- 11           1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

12   **1.6    DELIVERY, STORAGE, AND HANDLING**

- 13          A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary
- 14          protective covering before shipping.

15   **1.7    FIELD CONDITIONS**

- 16          A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal
- 17          fabrications by field measurements before fabrication.

18   **PART 2 – PRODUCTS**

19   **2.1    MANUFACTURERS**

- 20          A. Stainless Steel Pipe and Tube Railings:
- 21           1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that
- 22           may be incorporated into the Work include, but are not limited to, the following:
- 23           2. Indigenous Materials: Materials and products shall be manufactured within 300 miles (482 km) of
- 24           Project site.
- 25           a. Wagner, R & B, Inc.
- 26           b. McMaster-Carr
- 27           c. Steele Solutions, Inc.

28   **2.2    PERFORMANCE REQUIREMENTS**

- 29          A. Delegated Design: Engage a qualified professional engineer licensed in the State of Wisconsin, as defined
- 30          in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.
- 31          B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of
- 32          gravity loads and the following loads and stresses within limits and under conditions indicated:
- 33           1. Handrails and Top Rails of Guards:
- 34           a. Uniform load of 50 lbf / ft. applied in any direction.
- 35           b. Concentrated load of 200 lbf applied in any direction.
- 36           c. Uniform and concentrated loads need not be assumed to act concurrently.
- 37           2. Infill of Guards:
- 38           a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
- 39           b. Infill load and other loads need not be assumed to act concurrently.

40   **2.3    METALS, GENERAL**

- 1 A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails  
2 unless otherwise indicated.  
3 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that  
4 provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

5 **2.4 STAINLESS STEEL**

- 6 A. Tubing: ASTM A 554, Grade MT 316L.  
7 B. Castings: ASTM A 743/A 743M, Grade CF 8M or CF 3M.  
8 C. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316L.

9 **2.5 INFILL (For use in elevator shafts as indicated)**

- 10 **A. Woven Wire: Framed stainless steel 2 x 2 mesh.**  
11 **B. Loading Requirements: See infill load requirements above.**  
12 **1. Framing and framing attachments to structure are to meet loading requirements for guardrails.**

13 **2.6 FASTENERS**

- 14 A. General: Provide the following:  
15 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941,  
16 Class Fe/Zn 5 for zinc coating.  
17 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel.  
18 B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load  
19 equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when  
20 installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified  
21 independent testing agency.  
22 1. Material Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593  
23 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

24 **2.7 MISCELLANEOUS MATERIALS**

- 25 A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

26 **2.8 FABRICATION**

- 27 A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and  
28 spacing, details, finish, and anchorage, but not less than that required to support structural loads.  
29 B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble  
30 units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and  
31 coordinated installation. Use connections that maintain structural value of joined pieces.  
32 C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of  
33 approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.  
34 D. Form work true to line and level with accurate angles and surfaces.  
35 E. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this  
36 purpose. Weld all around at connections, including at fittings.  
37 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of  
38 base metals.  
39 2. Obtain fusion without undercut or overlap.  
40 3. Remove flux immediately.  
41 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after  
42 finishing and welded surface matches contours of adjoining surfaces.  
43 F. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate  
44 members and fittings to produce flush, smooth, rigid, hairline joints.  
45 G. Form changes in direction by bending or by inserting prefabricated elbow fittings.

- 1 H. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive
- 2 configuration required. Maintain cross section of member throughout entire bend without buckling, twisting,
- 3 cracking, or otherwise deforming exposed surfaces of components.
- 4 I. Close exposed ends of railing members with prefabricated end fittings.
- 5 J. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- 6 K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors
- 7 to interconnect railing members to other work unless otherwise indicated.
- 8 L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate
- 9 anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with
- 10 supporting structure.
- 11 M. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside
- 12 dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom
- 13 closure.
- 14 N. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided
- 15 floors and platforms. Fabricate to dimensions and details indicated.

16 **2.9 STAINLESS-STEEL FINISHES**

- 17 A. Remove tool and die marks and stretch lines, or blend into finish.
- 18 B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross
- 19 scratches. Run grain with long dimension of each piece.
- 20 C. Stainless Steel Tubing Finishes:
- 21 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
- 22 D. Stainless Steel Sheet and Plate Finishes:
- 23 1. Directional Satin Finish: ASTM A 489/A 480, No. 4.
- 24 E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave
- 25 surfaces chemically clean.

26 **PART 3 – EXECUTION**

27 **3.1 INSTALLATION, GENERAL**

- 28 A. Fit exposed connections together to form tight, hairline joints.
- 29 B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location,
- 30 alignment, and elevation; measured from established lines and levels and free of rack.
- 31 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication
- 32 and that are intended for field connection by mechanical or other means without further cutting or fitting.
- 33 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- 34 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps
- 35 and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- 36 C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other
- 37 materials from direct contact with incompatible materials.
- 38 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with
- 39 grout, concrete, masonry, wood, or dissimilar metals.
- 40 D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- 41 E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing
- 42 railings and for properly transferring loads to in-place construction.

43 **3.2 RAILING CONNECTIONS**

- 44 A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components.
- 45 Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- 46 B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with
- 47 requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in
- 48 the field.

