SECTION 057300 - DECORATIVE METAL RAILINGS

This section is based on the following products:

Lavi Industries

27810 Avenue Hopkins
Valencia, CA 91355-3409

Phone: 888-285-8605

Fax: 661-257-4938

sales@lavi.com

www.lavi.com

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format, including MasterFormat, SectionFormat, and PageFormat, as described in The Project Resource Manual—CSI Manual of Practice, Fifth Edition.

This section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete all “Specifier Notes” after editing this section.

Section numbers are from MasterFormat 2016 Edition.

**Lavi Industries’ Pre-Fabricated Stainless Steel Railing System** meets or exceeds the UBC and BOCA requirements for structural loading and infill spacing.The long-lasting, low maintenance and corrosive resistance of the pre-fabricated 316 stainless steel posts and components provides attractive architectural detail, structural integrity and saves time during installation. Lavi offers a variety of railing styles with round and square tubing and a number of mounting solutions. The railing systems are available in polished or satin surface finishes. Contact manufacturer for additional information and specifications.

1. GENERAL
	* + 1. SUMMARY

Section Includes:

Delete items below not required for project.

Decorative Stainless Steel Cable Railing System: engineered, pre-fabricated, stainless steel posts, stainless-steel cable infill, top rail [**, handrail**], mounting brackets, connectors, and fasteners.

Decorative Stainless Steel Cross-Bar Railing System: engineered, pre-fabricated, stainless steel posts, stainless-steel cross bar infill, top rail[**, handrail**], connectors, and fasteners.

Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

[**Section 061000 "Rough Carpentry"**] [**Section 061053 "Miscellaneous Rough Carpentry"**] for wood blocking for anchoring railings.

Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

* + - 1. REFERENCES

Americans with Disabilities Act Accessibility Guidelines (ADAAG).

ASTM International:

ASTM A 240/240 M (16a)Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

ASTM A 276/ 276M (17) Standard Specification for Stainless Steel Bars and Shapes.

ASTM A 312/312M (17) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

ASTM A 492– 95 (2013)Standard Specification for Stainless Steel Rope Wire

ASTM A 554 (16) [Standard Specification for Welded Stainless Steel Mechanical Tubing](https://www.astm.org/Standards/A554.htm).

ASTM A 743/A743M (13ae1) [Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application](https://www.astm.org/Standards/A743.htm).

ASTM E 894 (2010) [Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings](https://www.astm.org/Standards/E894.htm).

ASTM E 935 (13e1) [Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings](https://www.astm.org/Standards/E894.htm).

ASTM E 985 Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

ANSI:

ANSI A 1264.1 - Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems.

ANSI/ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

BOCA National Building Code; Building Officials and Code Administrators International, Inc.

* + - * 1. 29 CFR 1910.23: Guarding floor and wall openings; Occupational Safety and Health Administration.
				2. ICBO Uniform Building Code; International Conference of Building Officials.
				3. ICC: International Code Council; 2003 International Codes.
				4. SBCCI Standard Building Code; Southern Building Code Congress International, Inc.
			1. DEFINITIONS

Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

* + - 1. SYSTEM DESCRIPTION

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

* + - * 1. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

Stainless Steel: 60 percent of minimum yield strength.

Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

Subparagraphs below are based on the International Building Code; revise to suit Project and to comply with requirements of authorities having jurisdiction.

Handrails and Top Rails of Guards:

Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.

Concentrated load of 200 lbf (0.89 kN) applied in any direction.

Uniform and concentrated loads need not be assumed to act concurrently.

Infill of Guards:

Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).

Infill load and other loads need not be assumed to act concurrently.

* + - 1. SUBMITTALS

Product Data: For the following:

Manufacturer's product line of decorative railings assembled from pre-fabricated posts, standard tubing and components.

Adhesive.

Polish.

Stainless steel cleaner.

Polishing cloth.

Anchoring cement.

Installation methods.

Storage and handling requirements.

LEED Submittals: Submittals that are required to comply with the requirements for LEED certification include, but shall not be limited to the following:

Recycled Content: Provide product data and certification letter indicating percentages by weight of post-consumer and pre- consumer recycled content for products having recycled content.

Regional Materials: Provide product data for regional materials indicating location and distance from the project of material manufacture and point of extraction, harvest or recovery for each material.

Shop Drawings: Include plans, elevations, sections, and attachment details.

Delete paragraph below if samples are not required.

* + - * 1. Samples: For each type of exposed finish required.

Fittings and brackets.

Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

"Delegated-Design Submittal" Paragraph below is defined in Section 013300 "Submittal Procedures" as a "Delegated-Design Submittal." Retain if Work of this Section is required to withstand specific design loads and design responsibilities have been delegated to Contractor or if structural data are required as another way to verify compliance with performance requirements. Professional engineer qualifications are specified in Section 014000 "Quality Requirements."

Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

Qualification Data: For [**professional engineer**] [**testing agency**].

* + - * 1. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
				2. Preconstruction test reports.
				3. Evaluation Reports: For post-installed anchors, from ICC-ES.
				4. Certifications: Furnish certifications that all components and fittings are furnished by the same manufacture or approved by the primary component manufacture.
			1. QUALITY ASSURANCE

Manufacturer Qualifications: Manufacture shall be a firm engaged in the manufacture of Stainless Steel Handrails and Railings of types and sizes required and whose products have been in satisfactory use in similar service for a minimum of 5 years.

* + - * 1. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

Installer Qualifications: Experience with installation of decorative, architectural metals.

Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and

Build mockups as shown on Drawings.

Retain subparagraph below if the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

* + - 1. PRECONSTRUCTION TESTING

Project-specific preconstruction testing of assemblies can be expensive but may be the best means of proving that performance requirements are met.

Preconstruction Testing Service: [**Owner will engage**] [**Engage**] a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made [**by Owner**] [**from the testing and inspecting allowance, as authorized by Change Orders**] [**by Contractor**]. Retesting of products that fail to meet specified requirements shall be done at Contractor's expense.

Indicate size and other details of laboratory mockups on Drawings or by inserts.

Assemble and install laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.

Test railings according to ASTM E 894 and ASTM E 935.

Notify Architect [**seven**] days in advance of the dates and times when laboratory mockups will be tested.

* + - 1. DELIVERY, STORAGE, AND HANDLING

Deliver and store materials at the site in the manufacturer's original, unopened containers and packaging, with labels clearly identifying content of packaging.

* + - * 1. Store products in clean, dry area away from chemicals, indoors until ready for installation.
				2. Protect materials and finish from damage during handling and installation. Railings should be protected from active construction activities such as welding, grinding, painting and chemical spraying.
			1. PROJECT CONDITIONS

If possible, design railings so they do not have to fit other construction, and delete this article.

Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

* + - 1. SCHEDULING

Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, structural backing, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

* + - * 1. Install decorative railing at the end of the construction project.
				2. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.
			1. WARRANTY

Manufacturer warrants products and accessories against defects in materials and workmanship when utilized for their intended use, in accordance with manufacturer’s published guidelines.

Warranty Period: Three years from date of Substantial Completion.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

* + - 1. MANUFACTURERS

Acceptable Manufacturer:

Lavi Industries, 27810 Avenue Hopkins Valencia, CA 91355-3409.

Tel: 661-257-7800; Toll Free: 800-624-6225; FAX: 661-257-4938.

Email: info@lavi.com.

Web: www.railings.lavi.com.

Substitutions: Not permitted.

* + - 1. METALS, GENERAL

Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

* + - * 1. Brackets, Flanges, Connectors and Anchors: Same metal and finish as rail system unless otherwise indicated.
				2. Mounting brackets, flanges and surface connectors: Pre-drilled and ready to accept the appropriate anchors and bolts.
			1. STAINLESS STEEL

Primary difference between round stainless-steel tubing and stainless-steel pipe is in outside dimensions. Pipe sizes are normally indicated by using nominal pipe size designator and weight class or schedule number. For tubing, OD and wall thickness are used.

Tubing: ASTM A 554, Grade MT 316.

* + - * 1. Pipe: ASTM A 312/A 312M, Grade TP 316.
				2. Castings: ASTM A 743/A 743M, Grade CF 8M or CF 3M.
				3. Bars and Shapes: ASTM A 276, Type 316.
				4. Wire Rope and Fittings: Type 316L.

Edit to suit project.

1/8-inch (3mm) minimum breaking strength 1,780 lbs. 3/16-inch: (5mm) minimum breaking strength 4,000 lbs. Tension cables to a minimum of 225 pounds (102.06 kilograms) each in sequence in accordance to manufactures instructions.

Wire Rope: [**1/8 inch- (3.2mm)**] [**3/16 inch- (4.8mm)**] diameter wire rope made from wire complying with ASTM A 492, Type 316.

Edit Article to suit project.

* + - 1. CROSSBAR POSTS AND CONNECTORS

Edit paragraph to suit project.

Short Adjustable Saddle Pre-fabricated Post

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.91m)**] [**42 inches (1.07m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Rod Diameter: 0.47 inch (11.94mm).

Post Diameter:

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

End Cap Fitting Type: 316L Stainless Steel.

Edit paragraph to suit project.

Short Saddle (Non-Adjustable) Pre-Fabricated Post.

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.9144m)**] [**42 inches (1.0668m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Rod Diameter: 0.47 inch (11.94mm).

Post Diameter:

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

End Cap Fitting Type: 316L Stainless Steel.

Edit pargraph to suit project.

Adjustable Ball Saddle Pre-Fabricated Post.

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.9144m)**] [**42 inches (1.0668m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Rod Diameter: 0.47 inch (11.94mm).

Post Diameter:

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.032mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.032mm)

End Cap Fitting Type: 316L Stainless Steel.

Edit paragraph to suit project.

Flush Fittings Pre-fabricated Post.

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.9144m)**] [**42 inches (1.0668m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Rod Diameter: 0.47 inch (11.94mm).

Post Diameter:

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

End Cap Fitting Type: 316L Stainless Steel.

Edit paragraph to suit project.

Crossbar Rod

Finish: [**Satin**][**Polished**].

Rod Diameter: 0.47 inch (11.94mm).

Rod Length: 20 feet (6.096m).

Edit paragraph to suit project.

Standoff Crossbar Holder

Position: [**Center**][**End-right**][**End-left**].

Finish: [**Satin**][**Polished**].

Tube: 0.47 inch (11.94mm).

Mounts on: 1.67 inch (42.418mm) diameter.

Edit paragraph to suit project.

Crossbar Finial.

Tube: 0.47 inch (11.94mm).

Finish: Machined.

Edit paragraph to suit project.

Crossbar Splice.

Tube: 0.47 inch (11.94mm): [**Floor**][**Fascia**].

Finish: [**Satin**][**Polished**].

Edit Article to suit project.

* + - 1. PREFABRICATED POSTS FOR CABLE

Adjustable Saddle Pre-fabricated Post.

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.9144m)**] [**42 inches (1.0668m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Cable Diameter: [**1/8 inch (3.2 mm)**][**3/16 inch (4.8mm)**]

Post Diameter:

Outside Diameter: 1.67 inch (42.418mm)

Wall Thickness: 0.080 inch (2.03mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

End Cap Fitting Type: 316L Stainless Steel.

Edit paragraph to suit project.

Fixed Saddle Pre-fabricated Post.

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.9144m)**] [**42 inches (1.0668m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Cable Diameter: [**1/8 inch (3.2 mm)**][**3/16 inch (4.8mm)**]

Post Diameter:

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

End Cap Fitting Type: 316L Stainless Steel.

Edit paragraph to suit project.

Corner Saddle Pre-fabricated Post.

Mounting: [**Floor**][**Fascia**].

Post Height: [**36 inches (0.9144m)**] [**42 inches (1.0668m)**].

Position/Connection: [**End**][**Center**].

Finish: [**Satin**][**Polished**].

Cable Diameter: [**1/8 inch (3.2 mm)**][**3/16 inch (4.8mm)**]

Post Diameter:

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

Top Rail Type: 316L Stainless Steel Round.

Outside Diameter: 1.67 inch (42.42mm)

Wall Thickness: 0.080 inch (2.03mm)

End Cap Fitting Type: 316L Stainless Steel.

* + - 1. FASTENERS

Fastener Materials: Unless otherwise indicated, provide the following:

Stainless-Steel Components: Type 316 stainless-steel fasteners.

Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated[ **and capable of withstanding design loads**].

* + - 1. MISCELLANEOUS MATERIALS

Anchoring Cement: As recommended by post manufacturer.

Adhesive: Loctite 326.

* + - * 1. Polish: Lavi metal polish.
				2. Primer: Loctite 7649.
				3. Stainless Steel Cleaner: MAAS Stainless Steel Cleaner.
				4. Polishing Cloth: MAAS Polishing Cloth.
			1. FABRICATION

General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage[**, but not less than that required to support structural loads**].

* + - * 1. Machine, weld and fabricate railing posts and components in a manufacturing facility to the greatest extent possible to minimize field on site fabrication and assembly. Package posts, railings and components as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
				2. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
				3. For C.A.T. (Captive Cable Anchoring and Tensioning) Wire Rope fittings, terminate and tension cables in accordance to manufacturer’s instructions.
				4. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
				5. Form work true to line and level with accurate angles and surfaces.
				6. Fabricate connections that will be exposed to weather in a manner to expel water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
				7. Cut, reinforce, drill, and tap to receive finish hardware, screws, and similar items.

Mechanical Connections: Connect members with manufacturer’s recommended fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

* + - * 1. Close exposed ends of hollow railing members with prefabricated end fittings.
				2. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
				3. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

Retain subparagraph below if any railings are supported from plaster or gypsum board walls.

For brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

* + - 1. GENERAL FINISH REQUIREMENTS

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

* + - * 1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

Retain "Appearance of Finished Work" Paragraph below for variable finishes, such as anodized or patina finishes.

* + - * 1. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Retain paragraph below if exposed fasteners are allowed, especially with color anodic finish.

* + - * 1. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
			1. STAINLESS-STEEL FINISHES

Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

* + - * 1. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

Retain subparagraph below for directional finishes.

Run grain of directional finishes with long dimension of each piece.

Retain one finish in first four paragraphs below that reference standard sheet finish designations.

Finish in "Directional Satin Finish" Paragraph below is 120 to 150 grit.

Directional Satin Finish: No. 4.

Finish in "Dull Satin Finish" Paragraph below is a non-directional finish produced from a No. 4 finish by brushing with an extremely fine abrasive to remove the grit lines without producing a reflective appearance.

* + - * 1. Dull Satin Finish: No. 6.

Finish in "Satin, Reflective, Directional Polish" Paragraph below is produced from a No. 4 finish by buffing enough to provide a reflective surface but not enough to remove grit lines entirely. A No. 7 finish will not show scratches as readily as a No. 8 finish will.

* + - * 1. Satin, Reflective, Directional Polish: No. 7.

Finish in "Mirror-like Reflective, Non-directional Polish" Paragraph below shows minor scratches and is easily damaged.

* + - * 1. Mirror-like Reflective, Non-directional Polish: No. 8.
				2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
1. EXECUTION
	* + 1. EXAMINATION

Delete this article if no handrails are attached to plaster or gypsum board assemblies.

Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

* + - 1. INSTALLATION, GENERAL

Fit exposed connections together to form tight, hairline joints.

* + - * 1. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.

Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means.

Revise subparagraphs below if closer tolerances are required. Both are from NAAMM's "Pipe Railing Systems Manual."

Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3 m).

Adjust railings before anchoring to ensure matching alignment at abutting joints.

* + - * 1. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
			1. RAILING CONNECTIONS

Non-welded Connections: Use manufactured fittings for permanently connecting railing components.

* + - 1. ANCHORING POSTS

Bolt flange to the ground or wall using hardware appropriate for the surface that it is being mounted on.

* + - 1. ATTACHING RAILINGS

Delete first two paragraphs below if railing ends are not returned to walls.

Anchor railing ends to concrete and masonry with [**sleeves concealed within**] [**flanges connected to**] [**brackets on underside of rails connected to**] railing ends and anchored to wall construction with anchors and bolts.

* + - * 1. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and [**welded to railing ends**] [**or**] [**connected to railing ends using non-welded connections**].
				2. Attach handrails to walls with wall brackets[ **except where end flanges are used**]. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

Use type of bracket with [**flange tapped for concealed anchorage to threaded hanger bolt**] [**predrilled hole for exposed bolt anchorage**].

Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

Secure wall brackets[ **and railing end flanges**] to building construction as follows:

For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

For hollow masonry anchorage, use toggle bolts.

For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

Retain one of three subparagraphs below if using steel studs.

For steel-framed partitions, use hanger or lag bolts set into[ **fire-retardant-treated**] wood backing between studs. Coordinate with stud installation to locate backing members.

For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

* + - 1. FIELD QUALITY CONTROL

Retain this article if field testing for compliance with performance requirements is required.

Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made [**by Owner**] [**from the testing and inspecting allowance, as authorized by Change Orders**].

Revise "Extent and Testing Methodology" Paragraph below if more extensive testing is required.

* + - * 1. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
				2. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
				3. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
			1. PROTECTION

Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

* + - * 1. Restore finishes damaged during installation and construction period so no evidence remains of correction work.

END OF SECTION 057300