SECTION 057313.24 - GLAZED DECORATIVE METAL RAILINGS - POST-SUPPORTED (SL 60X30)

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Specifier: Edit options below to suit Project. Coordinate with selections made in Part 2.

[**Interior**] [**Exterior**] [**Interior and exterior**] decorative stainless steel railings, [**with illuminated rail**].

[**Glass**] [**Tube**] [**Bar**] [**Cable**] railing infill.

* + - * 1. Related Requirements:

Section 055213 "Pipe and Tube Railings" for non-ornamental railings fabricated from standard pipe and tube shapes.

Division 06 rough carpentry section for wood blocking for anchoring railings.

* + - 1. REFERENCES
         1. References, General: Versions of the following standards current as of the date of issue of the project or required by applicable code apply to the Work of this Section.
         2. ASTM E894 - Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
         3. ASTM E2353 - Evaluation Performance of Glazing in Permanent Glass Railing System, Guards and Balustrades.
         4. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
         5. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
      2. ACTION SUBMITTALS
         1. Product Data: For the following:

Metal railings assembled from standard components.

Glass products.

Fasteners.

Bituminous paint.

Nonshrink, nonmetallic grout.

Anchoring cement.

Mechanical and chemical anchors.

* + - * 1. Shop Drawings:

Include layout, spacing, sizes, thicknesses, and types of metal components including fastening and anchorage details, and mechanical fasteners.

Show splices, accessories, connection details, and attachment to adjoining work.

Indicate design loads, design thickness, connection and bracing details, screw sizes and spacing, and anchors.

Indicate locations, dimensions, openings, and requirements of related work.

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

Sections of each different linear railing members. Include the following:

Handrails.

Top rails.

Posts.

Balusters.

Each type of glass required with finished edges.

Brackets and fittings.

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

Specifier: Retain "Delegated-Design Submittal" Paragraph when retaining requirements for engineering design of railings by Contractor. Q-Railing can provide qualified Professional Engineering through the Contractor for US and Canadian projects.

* + - * 1. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
      1. INFORMATIONAL SUBMITTALS
         1. Submit data covering the care, cleaning, and maintenance of finishes for incorporation in the maintenance manuals.

Specifier: Retain "Qualification Data" Paragraph below when retaining requirements for engineering design by Contractor.

* + - * 1. Qualification Data: For professional engineer.
        2. Mill Certificates: For Type 316 stainless steel, signed by manufacturers of stainless steel products, certifying that products comply with requirements.
        3. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
        4. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
      1. CLOSEOUT SUBMITTALS
         1. Maintenance Information: For maintenance requirements for metal railing components.
      2. QUALITY ASSURANCE
         1. Manufacturer: Company specializing in the engineering and manufacture of decorative railing systems and experienced in the fabrication and working of metal and other components of railing system, with a satisfactory track record of not less than five projects of similar size, materials, and complexity.
         2. Installer: Installer experienced in the installation and finishing of railing systems with a satisfactory track record of not less than five projects of similar size, materials, and complexity. Provide written record of qualifications upon request.

Specifier: Retain "Professional Engineer" Paragraph below when retaining requirements for engineering design by Contractor.

* + - * 1. Professional Engineer: Experienced professional engineer, licensed in the Project jurisdiction, and qualified by experience in designing railing assemblies similar to those specified.

Specifier: Retain "Mockups" Paragraph below when work is extensive or complex and simple samples of components are not adequate to verify assembly quality. Retain subparagraph when in-place mockups are acceptable.

* + - * 1. Mockups: Build mockups, as indicated on the Drawings or if not indicated, not less than one complete panel wide including a corner, to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

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

* + - * 1. Appearance of Finished Installation: Information on drawings and in specifications establishes requirements for system's aesthetic effects and performance characteristics:

Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction.

Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in‑service performance.

Do not modify intended aesthetic effects, as judged by Architect, except as directed and accepted by Architect.

Submit comprehensive explanatory data for review where modifications are proposed to meet performance characteristics.

* + - 1. DELIVERY, STORAGE, HANDLING AND PROTECTION
         1. Exercise care in storing, handling and erecting material. Support materials properly so that no piece will be bent, twisted, or damaged structurally or visually.
         2. Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.
         3. Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Inspect delivery. Keep materials in original, unopened containers and packaging until installation.
         4. Store materials in clean, dry area indoors in accordance with manufacturer’s written instructions and away from uncured concrete or masonry; cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation inside of covering. Do not store materials directly on floor.
         5. Correct damaged material and where damage is deemed irreparable by Architect; replace the affected item at no additional expense to the Owner.
         6. Apply protective covering to face of exposed finished metalwork before it leaves shop, covering to remain until item installed and ready for final finishing.
         7. Protect materials and finish during handling and installation to prevent damage.
         8. Protect glass infill panels from edge damage.
      2. FIELD CONDITIONS
         1. Field Measurements: Verify actual locations of construction contiguous with railings by taking field measurements before fabrication.
      3. WARRANTY
         1. Manufacturer’s Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace railing system components that fail in materials under normal use within the warranty period indicated.

Warranty Period: Two years from date of Substantial Completion.

* + - * 1. Glass Manufacturer’s/Fabricator's Special Warranty for Laminated Glass: On glazing manufacturer/fabricator's standard form, in which manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period under normal use. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

Warranty Period: Five years from date of Substantial Completion.

1. PRODUCTS
   * + 1. MANUFACTURER
          1. Basis of Design Manufacturer: Q-Railing USA, Tustin, CA 92780, (714)259-1372; [sales.us@q-railing.com](mailto:sales.us@q-railing.com); www.q-railing.com.
       2. PERFORMANCE REQUIREMENTS

Specifier: Retain "Delegated-Design Submittal" Paragraph when retaining requirements for engineering design by Contractor.

* + - * 1. Delegated Design: Engage a qualified professional engineer to design railing system.
        2. Design, fabricate, and install guardrails as indicated on Drawings.
        3. Design guardrails and connections to withstand lateral forces in accordance with International Building Code and requirements of authorities having jurisdiction.

[**When required by authorities having jurisdiction, test**] [**Test**] in accordance with ASTM A935.

* + - * 1. 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.

Requirements below are based on the IBC; 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.

Glass Balustrades and Infill Panels

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.

Base Shoe Supported Glass Railings: Support each section of top rail and handrails by a minimum of three glass panels or by other means so railings will remain in place if any one glass panel fails.

Support top rail and handrail ends such that railings remains in place if end glass panel fails.

* + - * 1. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the loads and stresses within limits and under conditions indicated and as required by authorities having jurisdiction.

<**Insert code-specific structural performance requirements**>.

* + - * 1. Wind Loads: For exterior glazed decorative metal railings, capable of withstanding the following wind loads in accordance with IBC, ASTM E1300, and authorities having jurisdiction:

Wind Load: [**As indicated on Drawings**] <**Insert wind load**>.

* + - * 1. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes of [**120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces**].
        2. Screws, anchors, and inserts: corrosion resistant cadmium plated stainless steel, sized to suit application, to hold glass in place and prevent chipping or breakage at fastener location.
      1. STAINLESS STEEL DECORATIVE RAILINGS

Specifier: **Q-Railing Square Line 60x30®** is all about straight lines and geometric shapes. Essentially, it is a heavy-duty version of the popular Square Line 40x40 balustrade system. The balusters are bigger and thicker and are therefore capable of carrying even heavier loads. Recommended for light to medium use for interior and exterior stairs and balustrades.

* + - * 1. Post-Supported Modular Railing System with Infill: Fully framed system with rails extending from post to post, concealed rail mechanical fastener inserts, and infill of type indicated.

Product: Q-Railing USA, [Square Line® 60x30](https://www.q-railing.com/en-us/systems/square-line-60x30/).

Baluster Uprights: 2.36 by 1.18 inches (60 by 30 mm).

Top Rail: 2.36 by 0.78 inches (60 by 20 mm).

Handrail: 1.57 by 0.39 inches (40 by 10 mm).

Mounting: [**Top mount**] [**Fascia mount**].

Finish: [**Satin**] [**Powder coated**].

Infill: [**Glazed**] [**Bar**] [**Tube**] [**Cable**]

Specifier: Available glass lengths range between 19.1 and 70.9 inches and is dependent on interior or exterior use, type and thickness of glass used, type of clamp or retaining system used, and whether used in a straight or corner configuration. Refer to Q-Railing’s literature for glass sizes based on system(s) selected. Consult Q-Railings' representative for recommended glazing and clamps.

* + - 1. METALS, GENERAL
         1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
         2. End Caps and Bases: Same metal and finish as vertical profiles unless otherwise indicated.
      2. Stainless Steel

Specifier: Second option in each subparagraph below is recommended for exterior and corrosive exposures.

* + - * 1. Tubing: ASTM A554, [**Grade MT 304**] [**Grade MT 316**].
        2. Castings: ASTM A743/A743M, [Grade CF 8 or CF 20] [Grade CF 8M or CF 3M].
        3. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, [**Type 304**] [**Type 316**].
        4. Flat Bar: ASTM A666, [**Type 304**] [**Type 316**].
        5. Bars and Shapes: ASTM A276/A276M, [**Type 304**] [**Type 316**].
        6. Wire Cable: Made from wire complying with ASTM A492, Type 316.
      1. Glass and Glazing PRODUCTS, GENERAL
         1. Glazing Publications: Comply with the following publications:

NGA/GANA Publications: "GANA Laminated Glazing Reference Manual" and "GANA Glazing Manual."

* + - * 1. Safety Glazing: Comply with 16 CFR 1201, Category II.
        2. Safety Glazing Labelling: Permanently mark glass with certification label acceptable to authorities having jurisdiction. Indicate manufacturer’s name, type of glass, thickness, and applicable safety glazing standard.

Specifier: Retain one or more of paragraphs below for primary float glass types because glass types in "Glass Handrails and Guards" Article depend on these primary glass standards and classifications..

* + - * 1. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Class 1 and low-iron clear, or Class 2 (tinted) as indicated, Quality-Q3.
        2. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Class 1 and low-iron clear, or Class 2 (tinted) as indicated, Quality-Q3.
        3. Glazing Gaskets for Glass-Infill Panels: As recommended or supplied by railing manufacturer for installing glass-infill panels in post-supported railings.
      1. GLASS INFILL PANELS

Monolithic tempered glass panels are only permitted to be used in handrails and guardrails where there is no walking surface beneath the glass, or the walking surface is permanently protected from the risk of falling glass.

* + - * 1. Tempered Glass Panels: Provide products that have been tested for surface and edge compression in accordance with ASTM C1048 and for impact strength in accordance with 16 CFR 1201 for Category II materials.

Glass Color: [**Clear**] [**Tinted <insert color>**].

Thickness for Glass-Infill Panels: As required by structural loads, but not less than [**6.0mm**] [**thickness indicated on Drawings**] <**insert thickness**>.

* + - * 1. Laminated Glass Panels: ASTM C1172, Type II with minimum of two plies of fully tempered or heat strengthened glass bonded together by an interlayer [**, windborne-debris-impact-resistant**].

Specifier: Consider specifying Ionoplast interlayer for exterior applications.

Construction: Laminate glass with [**polyvinyl butyral interlayer (PVB)**] [**ionoplast polymer interlayer (SGP)**] to comply with interlayer manufacturer's written instructions.

Unit Thickness: As required by structural loads, but not less than 6.0 mm thick.

Kind: [**LHS (laminated heat strengthened)**] [**LT (laminated tempered)**] [**As indicated on Drawings**].

Glass Color:

Inner-ply [**clear**] [**low-iron clear**] [**tinted <Insert color>**].

Outer-ply [**clear**] [**low-iron clear**] [**tinted <Insert color>**].

Interlayer Thickness: [**0.030 inch (0.76 mm)**] [**0.060 inch (1.52 mm)**] [**0.090 inch (2.29 mm)**] [**thickness required to meet Performance Requirements**].

Interlayer Color: [**Clear**] [**Obscure translucent**] <**Insert color description**>.

Interlayer Pattern: <**Insert pattern description**>.

* + - * 1. Glass Clamps: As selected by Architect from manufacturer's full line.
      1. CABLE INFILL

Specifier: Q-Railing offers 2 cable and fittings systems. 1/8 and 5/32 inch systems use Q-LINE Fast Fix cable and connector system. The 1/4 inch system uses a more generic connector system. Select options below, based on system selected.

* + - * 1. Stainless Steel Cable and Cable Fittings:

Cable: Type 316 stainless steel; [**1/8 inch (3.2 mm) 1-by-19**] [**5/32 inch (4 mm) 7-by-19**] [**1/4 inch (6 mm) 7-by-19**].

Cable Fittings (1/8 and 5/32 Cable).

Product: Q-LINE Fast Fix System.

Cable Fittings (1/4 Cable).

Product: Q-LINE Cable System.

* + - * 1. Connectors of types indicated, fabricated from Type 316 stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
      1. TUBE infill
         1. 5/8 inch round tube; stainless steel.
      2. bAR infill
         1. 1/2 inch round bar; stainless steel.
         2. 0.59 inch by 0.2 inch flat bar; stainless steel.
      3. FASTENERS
         1. Fastener Materials: Unless otherwise indicated, provide the following:

Stainless Steel Components: [**Type 304**] [**Type 316**] stainless steel fasteners.

* + - * 1. Fasteners for Anchoring to Other Construction: Select fasteners required to produce connections suitable for anchoring railings to other types of construction indicated [**and capable of withstanding design loads**].
        2. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
        3. Post-Installed Anchors: Fastener systems with load bearing capacity greater than or equal to design load, based on ICC-ES AC193 or ICC-ES AC308.

Interior Locations: Zinc plated steel to comply with ASTM B633 or ASTM F1941/ASTM F1941M, Class Fe/Zn 5.

Exterior Locations: Alloy Group 2 (A4) stainless steel bolts, ASTM F593, and nuts; ASTM F594 (ASTM F836M).

* + - 1. COMPONENTS
         1. Aluminum Edge Protection.
         2. U-Profile, [**Type 316 Stainless Steel**] [**Aluminum**].
         3. Metal Top Rail: [**Type [316] [304] Stainless Steel**] [**Aluminum**].

[**Round**] [**Angular**] [**and illuminated**].

* + - * 1. Custom Wood Top Rail <**Insert species or other cap material description**>.

Finish: [**Manufacturer's standard**] [**Transparent polyurethane**] [**Penetrating oil-treated**] [**Acrylic impregnated**].

Staining: [**None**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] <**Insert description or manufacturer's name and product designation**>.

Specifier: Delete paragraph below if no illuminated rails.

* + - * 1. Illuminated [**Top**] [**Hand**] Rails: Provide internal illumination using concealed, internally wired, integrated LED [**dimmable**] lamps to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service.

Specifier: If handrails are not required, retain bracketed text and delete 1-4 below.

* + - * 1. Handrail: [**Not required.**]

Stainless Steel: <**Insert requirements**>.

Wood: <**Insert requirements**>.

Mounting: [**Bracket**] [**Glass**].

Handrail Brackets: [**Stainless steel**] [**Aluminum**].

* + - * 1. Baluster and Railing Accessories: Base flanges, angles, brackets, cover caps, end caps, miscellaneous tubes: Manufacturer's recommended components required for complete application.
      1. FABRICATION
         1. Fabricate railing assembly to design dimensions, details, and specified requirements for compliance and structural performance. Fabricate members and fittings to provide flush, smooth, rigid hairline joints.
         2. Assemble railings in the shop to greatest extent possible.
         3. Exposed Mechanical Fastenings: Conceal fasteners and fitting where possible and locate exposed fasteners unobtrusively; consistent with design of component, except where specifically noted otherwise.
         4. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
         5. Accurately form components, to each other and to building structure. Contractor to verify dimensions on site prior to fabrication.
         6. Rails fabricated in the longest practical lengths to minimize installer joints.
         7. Fabricated work to be complete with components required for installation and anchoring.
         8. Cut, drill and punch metals cleanly and accurately. Machine edges smooth.
         9. Close exposed ends of hollow railing members with prefabricated end fittings.
         10. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
      2. FABRICATION OF GLASS PANELS
         1. Fabricate glass to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

Include holes as required by adapter for attachment of glass.

* + - * 1. Glass-Infill Panels: Provide [**tempered**] [**laminated, heat-strengthened**] [**laminated, tempered**] glass-infill panels.

Edge Finish: Clean-cut or flat-grind edges to produce smooth, square edges with slight chamfers at junctions of edges and faces.

* + - 1. ISOLATION COATING
         1. Isolate incompatible components by means of isolation coating as required.

Dissimilar metals.

Concrete, mortar, and masonry.

* + - 1. MISCELLANEOUS MATERIALS
         1. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.
         2. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

Water-Resistant Anchoring Cement: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

* + - 1. METAL FINISH REQUIREMENTS, GENERAL
         1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
         2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
         3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
      2. stainless steel finishES
         1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
         2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

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

When polishing is completed, passivate and rinse surfaces.

Remove embedded foreign matter and leave surfaces chemically clean.

* + - * 1. Stainless Steel Tubing Finish:

180-Grit Polished Finish: Uniform, directionally textured finish.

* + - * 1. Stainless Steel Sheet, Strip, Plate, and Bar Finish:

Directional Satin Finish: ASTM A480/A480M, No. 4.

Specifier: Delete powder coat below, if not required. If specifying powder coat, delete two paragraphs above.

* + - * 1. Powder Coat Finish: Prepare, treat, and coat stainless steel to comply with resin manufacturer's written instructions and as follows:

Prepare stainless steel surfaces to comply with SSPC-SP 6/NACE No. 3.

Treat prepared metal with iron-phosphate or zinc-phosphate pretreatment, as required by resin manufacturer. Rinse, and seal surfaces.

AAMA 2605 is available on request. Revise below from 2604 to 2605, if necessary.

Apply thermosetting polyester powder coating with cured-film thickness of not less than 1.5 mils (0.04 mm) and in compliance with AAMA 2604.

Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify that field conditions are acceptable and ready to receive work.
          2. Supply items required to be cast into concrete, embedded in masonry, and/or placed in partitions with setting templates and written instructions, to appropriate trades.
          3. Beginning of installation means installer accepts existing conditions.
          4. Examine areas to receive decorative metal railings and note conditions that adversely affect installation or subsequent use of decorative railing system; coordinate with Contractor for correction of unacceptable site conditions. Commencement of work by this section will signify acceptance of surface and conditions.
       2. Preparation
          1. Perform cutting, drilling, and fitting required for installing metal railings.
          2. Field check and verify that structural framing, enclosures, weld plates, blocking, and that size and location of pockets are placed in accordance with reviewed shop drawings.
          3. Report discrepancies to Architect and recommend corrective action.
       3. INSTALLATION, GENERAL
          1. Install in accordance with Reviewed shop drawings and manufacturer's instructions.
          2. Windborne-Debris Resistance: Anchor decorative metal railings to structure using method, fastener type, and fastening frequency identical to that used in windborne-debris-resistance testing.
          3. Install components plumb and level, with fitted hairline joints, free from distortion or defects detrimental to appearance and performance.

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 (5 mm in 3 m).

* + - * 1. Provide fasteners and anchors required for connecting railings to structure. Anchor railing to structure.
        2. Nonwelded Connections:

Use mechanical or adhesive joints for permanently connecting railing components.

Use wood blocks and padding to prevent damage to railing members and fittings.

* + - * 1. Expansion Joints: Install expansion joints at locations indicated, but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.
        2. Secure wall brackets to wall at 48 inches (1219 mm) O.C. maximum with through-bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.
        3. Grout bases of posts, balusters or newels occurring in concrete using non-shrink grout in accordance with manufacturer's instructions. Finish smooth, level and flush with surrounding finished surface.
        4. Fasten top rail sleeves and top rail to posts. Insert glass panels into bottom and top rail in accordance with the shop drawings and written instructions.
        5. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
        6. Grind off surplus welding materials and provide sharp profiles and arises.
      1. INSTALLATION OF GLASS PANELS
         1. Post-Supported Railings with Glass-Infill Panels:

Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles.

Erect posts and other metal railing components.

Set factory-cut glass-infill panels.

Do not cut, drill, or alter glass-infill panels in field. Protect edges from damage.

Delete field testing below, if not required.

* + - 1. FIELD QUALITY CONTROL
         1. Testing Agency: [**Engage**] [**Owner will engage**] a qualified testing agency to perform tests and inspections and to prepare test reports.
         2. Methodology: Testing agency will randomly select completed railing assemblies that are representative of different railing designs and conditions in the completed Work.

Test railings in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358 for compliance with performance requirements.

* + - * 1. Remove and replace railings that do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
        2. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
      1. CLEANING
         1. Clean installations and assemblies progressively and at completion of work.
         2. Remove protective coverings and clean metal work using cleaning solutions and methods to suit the metal and its finish at completion of work.
         3. Protect adjacent materials and finishes from damage or discoloring during cleaning.
         4. Wash railing using clean water and soap, rinse with water. Do not use acid solutions, steel wool, or other abrasives.
         5. Remove excess sealant by method acceptable to sealant manufacturer.
         6. Clean glass panels by removing dust and grit with generous application of water and, remove grease and film deposits with mild solution of soap and water and, rinse thoroughly.
      2. protection of finished work
         1. Protect finishes of railing from damage during construction with temporary protective coverings to ensure all materials do not incur any damage or deterioration.
         2. Restore finishes damaged during installation and construction so no evidence remains of corrected work. Replace damaged components that are irreparable.

END OF SECTION