SECTION 05 73 00.70

DECORATIVE METAL RAILINGS - STRUCTURAL GLASS

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\*\* NOTE TO SPECIFIER \*\* Hollaender Mfg. Co.; decorative metal and glass railings.  
This section is based on the products of Hollaender Mfg. Co., which is located at:10285 Wayne Ave., P. O. Box 156399Cincinnati, OH 45215-6399Toll Free Tel: 800-772-8800Tel: 513-772-8800Fax: 800-772-8806Email: [request info (sales@hollaender.com)](https://arcat.com/rfi?action=email&company=Hollaender%252BMfg.%252BCo.&message=RE%253A%2520Spec%2520Question%2520(05727hol)%253A%2520&coid=33096&spec=05727hol&rep=&fax=800-772-8806)  
Web: <https://architecturalhandrail.hollaender.com> | <https://www.hollaender.com>   
 [ [Click Here](https://arcat.com/company/hollaender-mfg-co-33096) ] for additional information.  
With more than 75 years of American-made experience and superior manufacturing technology has resulted in the most reliable, durable, and high-quality products hand railing systems.  
Our pipe fittings and handrail systems today can be found all over the world. From rocket launch pads to oil rigs, from Hollywood movie studios and modern amusement parks to the fixtures in your favorite retail stores, and from water treatment plants to powergen facilities around the globe.  
Why? The reasons are simple:  
- We manufacture handrail systems to meet any application.  
- Our slip-on fittings are cost effective, easy to install, and reusable.  
- We are vertically integrated: all our design, casting, and manufacturing is under one roof.  
- Aluminum-magnesium alloy is strong, corrosion resistant, and usable with any metal pipe.  
- We pursue innovative ideas in-house.

1. GENERAL
   1. SECTION INCLUDES
      1. Structural glass railing systems.
   2. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 05 73 00.10 - Decorative Metal Railings - KLEAR.
    2. Section 05 73 00.20 - Decorative Metal Railings - VUE
    3. Section 05 73 00.30 - Decorative Metal Railings - VISION.
    4. Section 05 73 00.40 - Decorative Metal Railings - INTERNA RAIL 3-LINE.
    5. Section 05 73 00.50 - Decorative Metal Railings - INTERNA RAIL 2-LINE.
    6. Section 05 73 00.60 - Decorative Metal Railings - SPEED RAIL.
    7. Section 05 73 00.80 - Decorative Metal Railings - Button Glass.
    8. Section 08 80 00 - Glazing: Glass panels for Infill Panels.
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
    2. ASTM International (ASTM):
       1. ASTM A 167 - Stainless and heat resisting Chromium-Nickel steel plate, sheet and strip.
       2. ASTM A 269 - Stainless and heat resisting Chromium-Nickel steel plate, sheet and strip.
       3. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
       4. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
       5. ASTM B 26 - Standard Specification for Aluminum-Alloy Sand Castings.
       6. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
       7. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
       8. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
       9. ASTM B 247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
       10. ASTM B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
       11. ASTM C 1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
       12. ASTM D 1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
       13. ASTM E 935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
    3. Code of Federal Regulations (CFR):
       1. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
    4. International Building Code (IBC).
  1. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's data sheets on each product to be used, including:
        1. Railing, grout, anchoring cement and paint products.
        2. Preparation instructions and recommendations.
        3. Storage and handling requirements and recommendations.
        4. Installation methods.
     3. Shop Drawings: Prior to fabrication submitted which include the following:
        1. Plan views showing location of handrail required for the project with all necessary dimensions.
        2. Detail drawings which show standard handrail elevations, typical railing connections, anchoring systems and expansion joints.
        3. Drawings shall be signed and sealed by a structural engineer indicating compliance with design loads specified.
     4. Samples for Initial Selection: For products involving selection of color, texture, or design.
     5. Verification Samples: For each finish product specified, two samples, minimum size 6 inch (152 mm) square, representing actual product, color, and patterns.
     6. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
     7. Qualification Data: For professional engineer.
     8. Product Test Reports: Supplier shall submit calculations and test reports for complete system. Test Data perASTM E 935.
  2. QUALITY ASSURANCE
     1. Design railings, including engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. Railing supplier will indicate preferred method of attachment to building construction.
     2. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.
     3. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
     4. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

\*\* NOTE TO SPECIFIER \*\* Include mock-up if the project size or quality warrant the expense. The following is one example of how a mock-up on might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project.

* + 1. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
       1. Unless indicated otherwise on the Drawings, approximate size of mockup shall be 25 to 50 percent of full size required, using full size components.
       2. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
       3. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
       4. Retain mock-up during construction as a standard for comparison with completed work.
       5. Do not alter or remove mock-up until work is completed or removal is authorized.
       6. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  1. PRE-INSTALLATION CONFERENCE
     1. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.
  2. DELIVERY, STORAGE, AND HANDLING
     1. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
     2. Protect from damage due to weather, excessive temperature, and construction operations.
  3. PROJECT CONDITIONS
     1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
     2. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
     3. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
  4. COORDINATION AND SCHEDULING
     1. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.
     2. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.
  5. WARRANTY
     1. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: Hollaender Mfg. Co., which is located at:10285 Wayne Ave., P. O. Box 156399Cincinnati, OH 45215-6399Toll Free Tel: 800-772-8800Tel: 513-772-8800Fax: 800-772-8806Email: [request info (sales@hollaender.com)](https://arcat.com/rfi?action=email&company=Hollaender%252BMfg.%252BCo.&message=RE%253A%2520Spec%2520Question%2520(05727hol)%253A%2520&coid=33096&spec=05727hol&rep=&fax=800-772-8806);Web: <https://architecturalhandrail.hollaender.com> | <https://www.hollaender.com>

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
  1. PERFORMANCE REQUIREMENTS
     1. Railing must conform to apply to pertinent sections of the following codes:
        1. Applicable state and local building codes, including IBC.
        2. ADAAG.
     2. Handrail for Ramps and Stairs:
        1. Ramps with a rise greater than 6 inch (152 mm) shall have handrails on both sides.
        2. Handrail Height: Installed height of 34 to 38 inch (864 to 965 mm) above ramp surface.
        3. A curb, rail, wall, or barrier shall be provided to serve as edge protection.
           1. Curb: 4 inch (102 mm) minimum height.
           2. Barrier: Constructed to prevent the passage of a 4 inch (102 mm) diameter sphere above ramp grade level.
        4. Circular Cross Section Handrails: Gripping surface diameter between 1-1/2 inch (38 mm) and 2 inch (51 mm).
        5. Clearance between Wall or Post Surface and Handrail: 1-1/2 inch (38 mm) minimum.
        6. At the top and bottoms of handrail sections that stop at a landing, handrail shall extend 12 inch (305 mm) horizontally beyond the top riser and 12 inch (305 mm) horizontally beyond the bottom tread.
        7. Ramps with 30 inch (762 mm) or more drop off to grade shall require guards.
        8. Handrail shall be continuous, without interruption by newel posts or other obstructions.
        9. Handrails shall return to a wall, guard or walking surface.
     3. Structural Performance: Railings capable of withstanding effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
        1. Handrails:
           1. Uniform load of 50 lbf per ft (729.7 N per m) applied in any direction.
           2. Concentrated load of 200 lbf (889.6 N) applied in any direction.
           3. Uniform and concentrated loads need not be assumed to act concurrently.
        2. Top Rails of Guards:
           1. Uniform load of 50 lbf per ft (729.7 N per m) applied in any direction.
           2. Concentrated load of 200 lbf (889.6 N) applied in any direction.
           3. Uniform and concentrated loads need not be assumed to act concurrently.
        3. Infill Area of Guards:
           1. Horizontal concentrated load of 50 lbf per sq ft (2394 N per sq m)
           2. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.
           3. Glass infill panels shall have a safety factor of 4 included in the calculation.
     4. Thermal Movement: Exterior railings shall allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
        1. Temperature Change (Range): 120 degrees F (48.9 degrees C), ambient; 180 degrees F (82.2 degrees C), material surfaces.
     5. Corrosion Control: Prevent galvanic action and other corrosion types. Insulate metals and other materials from direct contact with incompatible materials.
  2. METALS
     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. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

\*\* NOTE TO SPECIFIER \*\* Delete metal options not required.

* + 1. Aluminum:
       1. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
       2. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52, 6005-T5.
       3. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6061-T6. Provide 1.90 inch (48 mm) OD Standard Weight, Schedule 40 pipe for rails, Schedule 80 for posts, unless otherwise indicated.
       4. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832
       5. Plate and Sheet: ASTM B 209, Alloy 6061-T6
       6. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6
       7. Base Flange Castings: ASTM B 26/B 26M, Alloy Almag 535
       8. Structural Fittings and Panel Clips: Alloy 6063-T6.
    2. Stainless Steel:
       1. Type: 304.
       2. Stainless and heat resisting Chromium-Nickel steel plate, sheet and strip,ASTM A 167.
       3. Seamless and welded austenitic stainless steel tubing for general service,ASTM A 269.
       4. Seamless and welded austenitic stainless steel pipe,ASTM A312.
    3. Steel: Perforated Sheet: ASTM A1008.
  1. STRUCTURAL GLASS RAILING SYSTEM
     1. Basis of Design: Structural Glass Railing System as manufactured and assembled by Hollaender Manufacturing.
     2. Base Shoe:
        1. Aluminum base shoe, 6063-T6 alloy.
        2. Basis of Design: NBH400 for glass up to 3/4 inch (19 mm) thick.

\*\* NOTE TO SPECIFIER \*\* Delete cladding option not required.

* + - 1. Cladding, Stainless steel:
         1. Thickness: 0.050 inch (1.3 mm).

\*\* NOTE TO SPECIFIER \*\* Delete finish option not required.

* + - * 1. Finish: No. 4 brushed.
        2. Finish: No. 8 polished.
      1. Cladding, Aluminum:
         1. Thickness: 0.050 inch (1.3 mm).
         2. Finish: Powder coated to match aluminum top rail or cap.

\*\* NOTE TO SPECIFIER \*\* Delete top rail or cap options not required.

* + 1. Top Rail or Cap: Stainless steel tubing.

\*\* NOTE TO SPECIFIER \*\* Delete options not required.

* + - 1. Outside Diameter: 1.66 inches (42.2 mm).
      2. Outside Diameter: 2 inches (51 mm).
      3. Outside Diameter: 3 inches (76 mm).
      4. Wall Thickness: 0.059 inches (1.5 mm).
      5. Wall Thickness: 0.062 inches (1.6 mm).
      6. Finish: No. 4 brushed.
    1. Top Rail or Cap: Aluminum pipe, 6063-T52 alloy.
       1. Outside Diameter: 1.9 inches (48 mm).
       2. Wall Thickness: 0.109 inches (2.77 mm).
       3. Finish: Powder coat.
    2. Top Rail or Cap: Stainless steel U-channel, No. 4 brushed finish.
    3. Top Rail or Cap: Aluminum U-channel, powder coat finish.

\*\* NOTE TO SPECIFIER \*\* Delete assist rail option not required.

* + 1. Assist Rail: Stainless steel tubing.
       1. Outside Diameter: 1.5 inches (38 mm).
       2. Wall Thickness: 0.059 inches (1.5 mm).
       3. Finish: No. 4 brushed.
    2. Assist Rail: Aluminum pipe, 6063-T52 alloy.
       1. Outside Diameter: 1.9 inches (48 mm).
       2. Wall Thickness: 0.109 inches (2.77 mm).
       3. Finish: Powder coat.

\*\* NOTE TO SPECIFIER \*\* Type 304 is standard. Delete assist rail bracket option not required.

* + 1. Assist Rail Brackets: Type 304 stainless steel, Model Q 0117 - 304.
    2. Assist Rail Brackets: Type 316 stainless steel, Model Q 0117 - 316.
    3. Flanges and Anchors: Concrete adhesive anchors where indicated or necessary.
    4. Glass Infill Panels for Railings:
       1. Tempered Glass: ASTM C 1048, Fully Tempered, Condition A, Type 1 (Transparent Flat Glass), Quality Q3.
          1. Comply with properties indicated for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C1048 and for impact strength according to16 CFR 1201for category 2 materials.

\*\* NOTE TO SPECIFIER \*\* Delete glass types not required.

* + - * 1. Glass Type: 1/2 inch (13 mm) tempered.
        2. Glass Type: 3/4 inch (19 mm) tempered.
        3. Glass Type: 9/16 inch (14 mm) tempered and laminated.

\*\* NOTE TO SPECIFIER \*\* Delete tint options not required.

* + - * 1. Tint: Clear.
        2. Tint: Bronze.
        3. Tint: Grey.
        4. Laminated Glass Tint: One lite.
        5. Laminated Glass Tint: Two lites.
    1. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
  1. FASTENERS
     1. Type 304 stainless-steel fasteners.
     2. Fasteners Anchoring Railings to Other Construction: Select type, grade, and class required to produce connections suitable for anchoring railings to construction types indicated and capable of withstanding design loads.
     3. Anchors: Provide concrete adhesive anchors where indicated or necessary.
  2. FABRICATION
     1. 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.
     2. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
     3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.79 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
     4. Form work true to line and level with accurate angles and surfaces.
     5. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
     6. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
     7. Connections: Fabricate railings with nonwelded connections, unless otherwise indicated.
     8. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
        1. Fittings to be of the internal double tang type activated by a reverse knurl cup point set screw.
        2. Reverse knurl is required to ensure that screw does not come loose under vibration. Plain cup point screws will not be accepted.
        3. Fittings to be fastened to pipe by means of a 5/16 inch (7.9 mm) tubular rivet nut and socket head cap screw.
     9. Form Changes in Direction as Follows: By flush bends or by inserting prefabricated flush-elbow fittings.
     10. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
     11. Close exposed ends of railing members with prefabricated end fittings.
     12. 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 (6.4 mm) or less.
     13. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated. Flanges to be sand cast from aluminum alloy 535 with anodized finish and fastened directly to the post by means of two reverse knurl cup point set screws.
     14. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
  3. FINISHES
     1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
     2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
     3. Appearance of Finished Work:
        1. Acceptable Variations: Appearance of abutting or adjacent pieces must be within one-half of the range of approved samples.
        2. Noticeable variations in the same piece are not acceptable.
        3. 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.

\*\* NOTE TO SPECIFIER \*\* Delete finish types not required on this project.

* + 1. Aluminum:
       1. Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.
       2. Aluminum Pipe Finish: Anodize to AA-M10C22A41, Architectural class, 0.7 mil (0.02 mm) thickness or greater, unless indicated otherwise.
    2. Steel:
       1. Primer: Approximately 0.04 inch (1 mm) coating provided by minimum 4 step electrocoat process.
       2. Finish: Powdercoat.

\*\* NOTE TO SPECIFIER \*\* Delete color options not required.

* + - * 1. Color: As selected by Architect from manufacturer's full line.
        2. Color: As indicated on Drawings.
        3. Color: \_\_\_\_\_.
    1. Stainless Steel

\*\* NOTE TO SPECIFIER \*\* Stain finish is standard. Delete finish not required.

* + - * 1. Satin No. 4 Polish.
        2. Mirror No. 8 Polish.

1. EXECUTION
   1. EXAMINATION
      1. 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.
      2. Do not begin installation until substrates have been properly constructed and prepared.
      3. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.
   2. PREPARATION
      1. Clean surfaces thoroughly prior to installation.
      2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   3. INSTALLATION
      1. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.
      2. Fit exposed connections together to form tight, hairline joints.
         1. 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 without further cutting or fitting.
         2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (1.6 mm in 1 m).
         3. 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 3.6 m).
      3. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
      4. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2 inch (38 mm) clearance from inside face of handrail and finished wall surface.
      5. Once installed, all handrails must be in compliance with the requirements of applicable federal, state and local building codes.
      6. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.
      7. 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 beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.
      8. Anchoring Railing Ends:
         1. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
         2. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.
      9. Attaching Handrails to Walls:
         1. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2 inch (38 mm) clearance from inside face of handrail and finished wall surface.
         2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
         3. Secure wall brackets to building construction as indicated, or if not indicated, as follows:
            1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
            2. For hollow masonry anchorage, use toggle bolts.
            3. Provide blocking between studs in stud wall construction.
   4. CLEANING AND PROTECTION
      1. Protect installed products until completion of project.
      2. Remove all stains, dirt, grease, or other substances by washing all railings thoroughly using clean water and soap; rinse with clean water.
      3. Do not use acid solutions, steel wool, and other harsh abrasives.
      4. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION