

SECTION 05 51 36

METAL GRATE PLATFORMS STAIRS AND RAILS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engineered Metal Grate Platforms and Secondary Support members.
2. Engineered Industrial Class stairs and ramps with steel grating treads and any integral platforms or landings.
3. Engineered Steel railings attached to metal grate platforms and stair systems.
4. Engineered Steel handrails attached to walls adjacent to metal stairs.
5. Engineered connections of all Work of this Section and to the building structure.

B. Information herein pertains to Add Alternate No. 2 as follows:

1. Base Scope of Work shall 05 51 36 Metal Grate Platforms Stairs and Rails as specified herein for all access platforms stairs and railings.  
Alternate No. 2 shall include providing FRP access platforms stairs and railings as specified in Section 06 74 10

1.2 SUBMITTALS

- A. Submit a single submittal package with all metal grate platforms, stairs, railings ladders and all related accessories including design calculations for review by the Architect.
- B. Product Data: Submit technical data for engineered Metal Grate Platforms Stairs and Rails including structural framing, railings, supports, and accessories.
- C. Shop Drawings: Submit shop drawings detailing the fabrication and erection of each platform, platforms railings and stairs, including structural framing, railings, and supports. Show plans, elevations, sections, details, and connections. Show anchorage and accessory items.
  1. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Delegated Design Submittal: Submit for Metal Grate Platforms Stairs and Rails indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Submittals for the Work of this Section shall be complete in a single package when submitted to the Architect for review. Incomplete submittals shall be returned without consideration.

1. Design Calculations: Submit structural calculations for members and connections, stairs and railings. The system shall lend itself to a rational structural analysis with section properties of framing members demonstrated by calculations.
  2. Delegated Design requirements apply to all Work of this Section and shall incorporate all attached items. Provide full delegated design services for all such items including but not limited to
    - a. Engineered Metal Grate Platforms and Secondary Support members.
    - b. Engineered Industrial Class stairs with steel grating treads and any integral platforms or landings.
    - c. Engineered Steel railings attached to metal grate platforms and stair systems.
    - d. Engineered Steel handrails attached to walls adjacent to metal stairs.
- 1.3 ATTACHMENTS OF ALL WORK OF THIS SECTION TO THE METAL GRATE PLATFORM, OTHER COMPONENTS AND ATTACHMENT TO THE BUILDING CONSTRUCTION AND STRUCTURE. INFORMATIONAL SUBMITTALS
- A. Seismic Qualification Certificates: For access platform components all vibration control items and accessories from manufacturer.
  - B. Qualification Data: Submit data for professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
  - C. Welding certificates.
  - D. Coordination Drawings Rooftop Metal Grate Platforms Stairs and Rails: Roof plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
    1. Structural members to which platform and ladder framing system will be attached.
    2. MEP items in the immediate vicinity.
    3. Items penetrating the roofing system assembly and fully coordinated with the Work of Section 07 54 00.
  - E. Evaluation Reports: ICC-ES report for framing assembly, anchor, and fastener type.
  - F. Certificates and Reports:
    1. Welding certificates.
    2. Mill certificates.
    3. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- 1.4 QUALITY ASSURANCE
- A. Regulatory Requirements:
    1. American Iron and Steel Institute: *Cold Formed Steel Design Manual* (and Specifications).

2. American Iron and Steel Institute: *Steel Construction Manual* (and Specifications) ASD.
  3. RCSC (Research Council on Structural Connections): Specification for Structural Joints Using ASTM A325 or A490 Bolts.
  4. Welding: Qualify procedures and personnel according to the following:
    - a. AWS D1.1/D1.1M Structural Welding Code - Steel.
    - b. AWS D1.2/D1.2 M Structural Welding Code - Aluminum.
    - c. AWS D1.6/D1.6M Structural Welding Code - Sheet Steel.
    - d. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Fabricator/Installer Qualifications: Entity having minimum 10 years documented experience in the design, manufacture, production, and installation of platforms, railings and stairs.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated in material, design, and extent.
- D. Sole Source Responsibility: Provide framing system components from a single manufacturer.
- E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- F. Reports and Test Data: Submit mill certificates or testing data from a qualified independent testing agency or in house testing for calibrated test equipment indicating steel sheet complies with requirements, including base metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic coating thickness.
- G. Preinstallation Conference: Conduct preinstallation conference at the project site.

## 1.5 COORDINATION

- A. Coordinate installation of anchorages for metal stairs and railings.
1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall mounted handrails, and items with integral anchors, embedded in concrete or masonry.
  2. Deliver to site in time for installation.
- B. Schedule installation of railings so wall attachments are made to completed walls.
1. Do not support railings temporarily by means that do not satisfy structural performance requirements.

## 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

## 1.7 STORAGE, DELIVERY AND HANDLING

- A. Store system components in a dry, well ventilated, weathertight place and to permit easy access for inspection and identification. Deliver and handle to prevent damage to the fabricated work.
  - 1. Keep steel members off ground and spaced by using pallets, dunnage, or supports and spacers.
  - 2. Protect steel members and packaged materials from corrosion and deterioration.
  - 3. Do not store materials on structure that might cause distortion, damage, or overload to members or supporting structures.
    - a. Repair or replace damaged materials or structures as directed.

## 1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of platform, stair and railing assemblies anchored to or that receive other Work. 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 items to project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design all Work and related components of this Section. Delegated design services apply to all Work of this Section and shall include all components including but not limited to metal grate platforms, stairs, railings, ladders and all accessories and related items, including attachment to building construction and framing members. Provide comprehensive engineering analysis by a qualified professional engineer, using Performance Requirements and design criteria indicated in accordance with the General Conditions and General Requirements.

- B. Metal Grate Platforms Stairs and Rails framing assembly: Framing assembly capable of withstanding structural loads complying with design criteria without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the framing assembly.
- C. Code Compliance Requirements: For platforms and stairs along an egress path, at entrances, exits and areas of refuge, fabricate treads and platforms with openings in gratings no more than 1/2 inch in least dimension.
- D. Structural Performance of Platforms: Provide platform framing capable of withstanding design loads within limits and under conditions indicated.
  - 1. Design Loads: As indicated on the Drawings, with the following as minimum requirements:
    - a. Walkways and Elevated Platforms other than exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).
    - b. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft..
  - 2. Limit deflection to L/240 or 3/8 inch (9.6 mm) , whichever is less.
  - 3. Seismic Loads: Indicated on Drawings.
- E. Structural Performance of Stairs and ramps: Metal Grating stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: Designed and constructed to carry a load of five times the normal live load anticipated but not less strength than to carry safely a moving concentrated load of 1,000 pounds (454 kg).
  - 2. Concentrated Load: Minimum 1000 lbf (454 kg) applied on an area of 4 sq. in. (2580 sq. mm).
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified.
- F. Structural Performance of Railings: 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:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
- G. Structural Performance of Guardrails: 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:
  - 1. Guardrails and Top Rails of Guards: Capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied in a downward or outward direction within 2 inches (5 cm) of the top edge, at any point along the top rail.

- a. When a 200 pound (890 N) test load is applied in a downward direction, the top rail of the guardrail system shall not deflect to a height of less than 39 inches (99 cm) above the walking/working surface.
  - b. Height: Not less than 42 inches (1070 mm) from leading edge of stair tread to top of surface of top rail.
    - 1) Top Edge Height: Permitted to exceed 45 inches (1140 mm) provided all criteria is met.
2. Infill or Midrails of Guards:
- a. Midrails, intermediate vertical members, and intermediate members capable of withstanding, without failure, a force of at least 150 pounds (667 N) applied in any downward or outward direction at any point along the intermediate member.
  - b. Height: Installed midway between top edge of guard rails and walking/working surface.
- H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
- I. Seismic Performance: All assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- J. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M Structural Welding Code - Steel.
- K. Coordinate building structural members, elevations, and roof layout for the design of platforms. Support platforms from structural members and distributed accordingly.
- L. Overall Assembly Safety Factor: Minimum of 3.

## 2.2 MATERIALS

- A. Manufacturer: Subject to compliance with requirements, provide platform, stair and railing assemblies by one of the following:
1. Karnel Incorporated.
  2. McNichols Company.
  3. Steel Solutions, Inc.
  4. Unistrut Corporation.
- B. Manufacturer of stairs and railings: Subject to compliance with the requirements of this Section, Contractor option of the selected manufacturer for manufactured platform, stair and railing assemblies, or fabricated to meet the criteria included herein.
- C. Ferrous Metals:
1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  2. Steel Bars for Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

3. Wire Rod for Grating Crossbars: ASTM A 510 (ASTM A 510M).
  4. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205).
  5. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.
  6. Steel Tubing for Railings: ASTM A 500/A 500M (cold formed) or ASTM A 513/A 513M.
  7. Provide galvanized finish for all exterior installations and where indicated.
- D. Cast Abrasive Nosings: Cast iron, with an integral abrasive, as cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.
- E. Fittings: Cold formed fittings ASTM A 575, ASTM A 576, or ASTM A 36, or ASM A653.
1. Minimum Fitting Thickness: 1/4 inch (6mm).
  2. Minimum Yield Strength: 33 ksi.
- F. Anchors, Clips, and Fasteners: Unless otherwise indicated, provide Type 304 or Type 316 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls and interior locations. Select fasteners for type, grade, and class required.
1. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot dip process in accordance with ASTM A 123/A 123M.
  2. Channel Nuts: ASTM A1011 SS GR 33.
  3. Bolts and Fasteners: Minimum SAE Grade 5, EG finish; threaded Rod Grade B7.
  4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- G. Post Installed Anchors: chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- H. Miscellaneous Materials:
1. Welding Electrodes: Comply with AWS requirements.
  2. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
  3. Galvanizing Repair Paint: High zinc dust content galvanizing repair paint ASTM A 780/A 780M or SSPC-Paint 20.
  4. Nonmetallic, Nonshrink Grout: Factory packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30 minute working time.
  5. Shims: Load bearing, high density, multimonomer, nonleaching plastic; or cold formed steel of same grade and metallic coating as framing members supported by shims.

6. Sealer Gaskets: Closed cell neoprene foam, 1/4 inch (6 mm) thick, selected from widths to match width of bottom track or rim track members as necessary.

## 2.3 FABRICATION METAL GRATE PLATFORMS

- A. Fabricate all platforms, supports and hangers, and arrangement of members as shown on drawings.
- B. Shop Assembly: Fabricate platform sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch material 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.
- D. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- E. Fit exposed connections accurately together to form hairline joints.
- F. Welding: Comply with AWS recommendations and the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
- G. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
  2. Fabricate toeplates for attaching in the field.
  3. Toeplate Height: 4 inches (100 mm) unless otherwise indicated.
- H. Metal Bar Grating Stairs and stair platforms: Form stair treads and stair platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531 Metal Bar Grating Manual.
  1. Fabricate treads and platforms from pressure-locked steel grating with Grating Mark W-19-4 (1-1/2 x 3/16) STEEL: 1-1/2 inch by 3/16 inch (38 mm by 4.8 mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
    - a. Surface: Serrated.
    - b. Finish: Galvanized.
  2. For platforms and stairs along an egress path, at entrances, exits and areas of refuge, fabricate treads and platforms from pressure-locked steel grating with openings in gratings no more than 1/2 inch in least dimension.

- a. Surface: Serrated.
  - b. Finish: Galvanized.
- I. Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or recommended by manufacturer for attaching to supports.
- 1. Provide no fewer than four weld lugs for each heavy duty grating section, with each lug shop welded to two bearing bars.
    - a. Furnish threaded bolts with nuts and washers for securing grating to supports.
- J. Do not notch bearing bars at supports to maintain elevation.

## 2.4 FABRICATION OF STEEL FRAMED STAIRS AND RAMPS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510 Metal Stairs Manual for Industrial Class, unless more stringent requirements are indicated.
- B. Stair and Ramp Framing:
- 1. Fabricate stringers of steel plates or channels.
    - a. Stringer Size: As indicated on Drawings and as required to comply with performance requirements.
    - b. Provide closures for exposed ends of channel stringers.
    - c. Finish: Galvanized.
  - 2. Construct platforms and tread supports of steel channel headers and miscellaneous framing members required to comply with performance requirement.
    - a. Provide closures for exposed ends of channel framing.
    - b. Finish: Galvanized.
  - 3. Weld stringers to headers; weld framing members to stringers and headers.
  - 4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Bar Grating Stairs and stair platforms: Form stair treads and stair platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531 Metal Bar Grating Manual.
- 1. Fabricate treads and platforms from pressure-locked steel grating with openings in gratings no more than 3/4 inch in least dimension.
    - a. Surface: Serrated.
    - b. Finish: Galvanized.
  - 2. For platforms and stairs and ramps along an egress path, at entrances, exits and areas of refuge, fabricate treads and platforms from pressure-locked steel grating with openings in gratings no more than 1/2 inch in least dimension.

- a. Surface: Serrated.
  - b. Finish: Galvanized.
3. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections.
    - a. Secure treads to stringers with bolts.
  4. Fabricate grating platforms with nosing matching that on grating treads.
    - a. Secure grating to platform framing with bolts.
- D. Risers: Open unless otherwise indicated on the Drawings.
- E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
1. Material and Finish: Steel plate to match finish of other steel items.
  2. Fabricate to dimensions and details indicated.

## 2.5 FABRICATION OF STAIR RAILINGS

- A. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: 1-5/8 inch (41 mm) diameter top and bottom rails and 1-1/2 inch (38 mm) square posts.
  2. Picket Infill: 3/4 inch (19 mm) round pickets spaced less than 4 inches (100 mm) clear.
  3. Intermediate Rails Infill: 1-5/8 inch (41 mm) diameter intermediate rails spaced less than 21 inches (533 mm) clear unless noted otherwise..
- B. Welded Connections: Fabricate railings with welded connections.
1. Fabricate connections that are exposed to weather in a manner that excludes water.
    - a. Provide weep holes where water may accumulate internally.
  2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
  3. Weld around at connections, including at fittings.
  4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  5. Obtain fusion without undercut or overlap.
  6. Remove flux immediately.
  7. Finish welds to comply with NOMMA Voluntary Joint Finish Standards for Finish #3 - Partially dressed weld with spatter removed as shown in NAAMM AMP 521.
- C. Form changes in direction of railings as follows:

1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.
  1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall mounted handrails unless otherwise indicated.
  1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
  1. Furnish inserts and anchorage devices for connecting to concrete or masonry work.
  2. Provide galvanized fittings, brackets, fasteners, sleeves, and ferrous metal components.
  3. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2 inch (38 mm) clearance from inside face of handrail to finished wall surface.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
  1. Size fillers to suit wall finish thickness and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

## 2.6 FINISHES

- A. Steel Finishes:
  1. Galvanizing: Hot dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
    - a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
  2. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
  3. Preparation for Shop Priming: Prepare surfaces to comply with requirements:
    - a. Exterior Items: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
    - b. Items Indicated to Receive Zinc Rich Primer: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.

- c. Items Indicated to receive primers specified for high performance Coatings: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
- d. Other Items: SSPC-SP 3 Power Tool Cleaning.
- 4. Shop Priming: Apply shop primer to comply with SSPC-PA 1 Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel for shop painting.
- 5. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.
- B. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
  - 1. For wall mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

### 3.2 INSTALLATION

- A. Install steel framing in accordance with manufacturer written instructions, design calculations and criteria and seismic requirements.
- B. Install shop fabricated framing and securely anchor to supporting structure. Screw, bolt, or weld framing to produce flush, even, true to line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.5 mm).
  - 1. Comply with *ASIC Specifications for Structural Joints Using ASTM A325 or A490 Bolts* for bolted connections to structural steel joints.
- C. Adjust platform framing to avoid interferences.

### 3.3 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
  - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen to improve bond to surfaces.
  - a. Clean bottom surface of baseplates.
  - b. Set steel stair baseplates on wedges, shims, or leveling nuts.
  - c. After stairs have been positioned and aligned, tighten anchor bolts.
  - d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
  - e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
    - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
    - 2) Comply with manufacturer's written installation instructions for shrinkage resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
  1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  3. Comply with requirements for welding.

### 3.4 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
  1. Space posts at spacing required by design loads.
  2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
  4. Secure posts and rail ends to building construction as follows:
    - a. Anchor posts to steel by welding to steel supporting members.
    - b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post installed anchors and bolts.
- B. Attach handrails to wall with wall brackets.
  1. Locate brackets at spacing required to support structural loads.
  2. Secure wall brackets to building construction as required to comply with performance requirements.
    - a. For concrete and solid masonry anchorage, use chemical anchors and hanger or lag bolts.
    - b. For hollow masonry anchorage, use toggle bolts.

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

### 3.5 CLEANING

- A. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions acceptable to manufacturer ensuring steel channel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION