

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SUMMARY:

Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.

Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

Refer to Division 3 for anchor bolt installation in concrete; Division 4 for masonry.

Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

Promptly remove and replace materials or fabricated components which do not comply.

Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

SUBMITTALS:

General: Submit the following in accordance with conditions of the Contract and Division 1 Specifications

Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

High-strength bolts (each type), including nuts and washers.

Structural Steel primer paint.

Shrinkage-resistant grout.

Shop Drawings: Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams. Reproduction of contract drawings is prohibited.

Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.

Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of this section.

Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

#### QUALITY ASSURANCE:

Steel Fabricators must have American Institute of Steel Construction (AISC) Quality Certification.

See Structural drawings for Related Information.

Codes and Standards: Comply with provisions of following, except as otherwise indicated:

American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges."

AISC "Code of Standard Practice for Steel Buildings".including "Commentary".

Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence:  
"This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings".

Steel must be fabricated by an AISC certified fabricator.

AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.

AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".

ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

No steel fabrication will be permitted without prior "approved" shop drawings from the Architect/Engineer.

Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

If recertification of welders is required, retesting will be Contractor's responsibility.

### DELIVERY, STORAGE AND HANDLING:

Deliver, store and handle steel joists as recommended in SJI "Specifications". Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

### PART 2 - PRODUCTS

#### MATERIALS:

Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

Structural Steel Shapes, Plates and Bars: ASTM A 572, ASTM A 36.

Cold-Formed Steel Tubing: ASTM A 500, Grade B.

Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.

Finish: Black, except where indicated to be galvanized.

Masonry Expansion Anchors or Wedge Angles: ASTM A 36 and ASTM A 307.

Anchor Bolts: ASTM A 307, nonheaded type unless otherwise indicated.

High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.

Direct tension indicator washers may be used at Contractor's option.

Electrodes for Welding: Comply with AWS Code.

Structural Steel Primer Paint: Fabricators standard lead free and chromate free non asphaltic, rust-inhibiting primer.

Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

100 Non-Shrink Grout (Non-Metalic); Conspec, Inc.  
Crytex; L&M Construction Chemicals, Inc.  
Euco N.S.; Euclid Chemical Co.  
Five Star Grout; U.S. Grout Corp.  
Masterflow 713; Master Builders  
Propak; Protex Industries, Inc.  
Sealtught 588 Grout; WR Meadows.  
Set Non-Shrink; Set Products, Inc.  
Supreme grout: Cornmix, Inc.  
Sure Grip Grout; Dayton Superior.

#### FABRICATION:

Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

Connections: Weld or bolt shop connections, as indicated.

Bolt field connections, except where welded connections or other connections are indicated.

Provide high-strength threaded fasteners for principal bolted connections.

High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts".

Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

#### SHOP PAINTING:

General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.

Do Not paint top of flanges of beams or surfaces to which shear studs are to be applied.

Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.

Do not paint surfaces which are scheduled to receive sprayed on fireproofing.

Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC):

Painting: Provide a one coat, shop-applied paint system complying with Steel Structures Painting Council (SSPC) Paint System Guide No. 7.00.

### PART 3 - EXECUTION

#### INSPECTION:

#### ERECTION:

Surveys: Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect/Engineer.

Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

For Proprietary grout materials, comply with manufacturer's instructions.

Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Level and plumb individual members of structure within specified AISC tolerances.

Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

Splice members only where indicated and accepted on shop drawings.

Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

#### FIELD CONNECTIONS

Install and tighten high strength bolts, as indicated.

Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Bolts: ASTM A 325 high strength bolts, unless otherwise indicated.

Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

#### QUALITY CONTROL:

The Architect's Structural Engineer will conduct visual inspections of snug-tight bolted connections and single-pass fillet welds.

If required, the Owner will pay for testing (Testing Allowance) of critical connections such as slip-critical bolted connections, bolted moment connections, and full penetration welds. Inspections required by the North Carolina State Building Code for Chapter 17 "Special Inspections" will be paid for by the Owner utilizing the Testing Allowance. **Additional testing required due to non-compliance shall be paid by the Contractor.**

Testing Procedure: High strength bolts in slip-critical connections to include - Fasteners and washers shall be installed in properly aligned holes and tightened by one of the methods described in section 8, subsections 8(d)(1) through 8(d)(4), of RCSC's "Specification For Structural Joints Using ASTM A 325 or A 490 Bolts". Bolts in slip critical connections shall be installed to at least the minimum tension as specified in Table 4 of the RCSC's Specification.

The inspection agency employed by the Owner (but scheduled by the General Contractor) shall determine that the requirements of RCSC's "Specification For Structural Joints Using ASTM A 325 or A 490 Bolts" are met in the work.

For slip-critical connections, the inspector shall assure that the specified procedure was followed to achieve the minimum fastener tension as specified in Table 4 of the RCSC's Specification. The inspector shall observe the calibration testing of the fasteners using the selected installation procedure and shall monitor the work in progress to assure that the procedure which was demonstrated to provide the specified tension is followed and adhered to during erection and installation of high strength bolts in slip-critical connections.

Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

END OF SECTION 05120

## SECTION 05310 - STEEL DECK

### PART 1 - GENERAL

#### RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### SUMMARY

This Section includes steel deck units for floor and roof applications.

Roof deck (1-1/2" "B" 20 ga. galvanized deck typical)

#### SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data including manufacturer's specifications and installation instructions for each type of decking and accessories. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

Shop drawings showing layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and other accessories.

Welder certificates signed by the Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

#### QUALITY ASSURANCE

Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."

American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel."

Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."

Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.

Welded decking in place is subject to inspection and testing. Contractor will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.



Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-- Steel" and AWS D1.3 " Structural Welding Code-- Sheet Steel."

Provide copies of current welding certificates for all welding personel used on the project.

## PART 2 - PRODUCTS

### MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:

Consolidated Systems, Inc.  
Epic Metals Corp.  
Roll Form Products, Inc.  
Roof Deck, Inc.  
United Steel Deck, Inc.  
Vulcraft Div., Nucor Corp.  
Wheeling Corrugating Co.

### MATERIALS

Steel for Painted Metal Deck Units: ASTM A 611, grade as required to comply with SDI specifications.

Steel for Galvanized Deck Units: ASTM A653/A653M structural steel with zinc coating

Miscellaneous Steel Shapes: ASTM A 36.

Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.

Paint: Manufacturer's baked-on, rust-inhibitive gray paint, for application to metal surfaces that have been chemically cleaned and phosphate chemical treated.

Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

### FABRICATION

General: Form deck units in lengths to span three or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as indicated.

Roof Deck Units: Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck".

Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6 inches wide.

Metal Closure Strips: Fabricate metal closure strips, for cell raceways and openings between decking and other construction, of not less than 0.045-inch min. (18 gage) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

## PART 3 - EXECUTION

### INSTALLATION

General: Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified herein.

See installation notes on Structural Drawings.

Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.

Place deck units flat and square, secured to adjacent framing without warp or deflection.

Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

Do not use floor deck units for storage or working platforms until permanently secured.

#### Fastening Deck Units:

Fasten roof deck units to steel supporting members by not less than 5/8-inch-diameter fusion welds using welding washers or elongated welds of equal strength, spaced not more than 12 inches at every support, and at closer spacing where indicated. In addition, secure deck to each supporting member in ribs where side laps occur.

Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Use welding washers where recommended by deck manufacturer.

Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 18 inches o.c., using self-tapping No. 10 or larger machine screws.  
Uplift Loading: Install and anchor roof deck units to resist gross uplift loads of 45 lbs. at eave overhangs and 30 lbs. psf for other roof areas.

Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.

Closure Strips: Provide metal closure strips at open uncovered ends and edges of decking and in voids between decking and other construction. Weld into position to provide a complete decking installation.

Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

Touch-up Painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.

Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

Galvanized Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (ships).

In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

END OF SECTION 05310

SECTION 05400 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of cold-formed framing is shown on drawings.

Types of lightgauge metal framing units include the following:

Locations: Exterior wall framing and ceiling/mechanical platform joist framing.

"C"-shaped steel studs.

"C"-shaped steel joists.

See Division 9 "Gypsum Drywall" section for interior nonstructural drywall partition metal stud framing.

SUBMITTALS:

Product Data: Submit manufacturer's product information and installation instructions for each item of cold-formed metal framing and accessories. Certify products manufactured in compliance with ASTM C 645, including requirements for minimum thickness.

Design Data: Submit copies of design data and structural calculations for selection of all studs and framing components sealed by an engineer registered in the state of North Carolina and employed by the manufacturer. Calculations shall support all member selection and connections, and shall include all wind and/or seismic bracing calculations.

It is the Contractor's responsibility to hire an licensed Engineer to calculate the required gage of metal studs and joists and submit all specified data, calculations, etc. for work of this section.  
**HOWEVER, the minimum gage of studs and joists shall be 18 gage.**

Certificate of Compliance: Submit certificate evidencing compliance of studs and components and installation with referenced standards.

Shop Drawings: Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.

Include placing drawings for framing members showing size and gage designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

### QUALITY ASSURANCE:

Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel Structural Members".

Design Criteria: Cold-formed metal framing shall be designed to withstand wind pressures as stated in Section 1609 of the 2012 North Carolina Building Code for a minimum wind velocity of 90 mph. Increased pressures for height variation and applicable shape factors shall be included. The maximum allowable deflection for exterior studs shall be  $L/600$  with deflection based on the section properties of the stud only.

Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

### DELIVERY, STORAGE AND HANDLING:

Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with breathable waterproof coverings.

## PART 2 - PRODUCTS

### METAL FRAMING:

System Components: Manufacturers; standard load-bearing steel studs and joists of type, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system. Studs and joist to be of "C" configuration with a minimum 1-5/8 inch flange and minimum 1/2 inch return lip. Runner tracks to be unpunched with 1-1/4 inch flanges unless noted otherwise.

### Materials and Finishes:

For 16 gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 50,000 psi; ASTM A 446, Grade D.

For 18-gage (minimum gage allowed), fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 446, Grade A.

Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 coating.

Finish of installation accessories to match that of main framing components.

"C"-Shape Studs: Manufacturer's standard load-bearing steel studs of size and shape, indicated, with 1.625" or 2 1/2" flange and flange return lip.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering "C"-shaped, load-bearing steel studs which may be incorporated in the work include, but are not limited to, the following:

Alabama Metal Industries Corp.  
Clark Steel Framing Industries

Consolidated, Systems, Inc  
Dale Industries, Inc.  
Dietrich Industries, Inc.  
Marino Ware; Division of Ware Industries, Inc.  
Unimast, Inc.  
United Metal Products, Inc  
Ceco Corp.  
Inryco/Milcor.  
U.S. Gypsum Co.

Joists: Manufacturer's standard C-shape sections of size and shape gage indicated.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering "C"-shaped steel joists which may be incorporated in the work include, but are not limited to, the following:

Manufacturer: Subject to compliance with requirements, provide "C"-shaped steel joists of one of the following:

Ceco Corp.  
Inryco/Milcor.  
U.S. Gypsum or Equal

#### FABRICATION:

General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

Wire tying of framing components is not permitted.

Fabrication Tolerances: Fabricate panels to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8" in 10'-0".

#### PART 3 - EXECUTION

##### INSPECTION AND PREPARATION:

Pre-Installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

##### INSTALLATION:

Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, or 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

Installation of Wall Stud System: Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Provide for vertical structural movement at the attachment points for the stud system at floors and roof.

Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.

Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-6" o.c. Weld at each intersection.

Installation of Joists: Install level and plumb, complete with bracing and reinforcing as indicated on drawings. Provide not less than 1-1/2" end bearing.

Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section, end grain wood block, or as otherwise recommended by joist manufacturer.

Where required, reinforce joists at interior supports with single short length of joist section located directly over interior support, snap-on shoe, 30% side-piece lapped reinforcement, or other method recommended by joist manufacturer.

Secure joists to interior support systems to prevent lateral movement of bottom flange.

Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical Junctures) to produce flush, even, true-to-line joints.

Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

Field Painting: Touch-up shop-applied protective coatings damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION 05400

## SECTION 05500 - METAL FABRICATIONS

### PART 1 - GENERAL

#### RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

#### SUMMARY

This section includes the following metal fabrications:

- Loose bearing and leveling plates.
- Loose steel lintels.
- Miscellaneous framing and supports for applications not specified in other sections.
- Suspension rods, connectors, and straps
- Miscellaneous steel trim.
- Shelf and relieving angles.

**Note to Steel fabricators and Erectors: Miscellaneous steel angles and steel sub framing is utilized as support work through out the wall sections of the drawings. These miscellaneous steel pieces may or may not show up on the Structural drawings. Estimators must look through both architectural and Structural drawings to see the full extent of the work.**

Related Sections: The following sections contain requirements that relate to this section:

- Division 5 Section "Structural Steel" for structural steel framing system components.

#### DEFINITIONS

Definitions in ASTM E 985 for railing-related terms apply to this section.

#### SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for products used in miscellaneous metal fabrications, including paint products and grout.

Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

Samples representative of materials and finished products as may be requested by Architect.

Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, and other information specified.

#### QUALITY ASSURANCE



Fabricator Qualifications: Firms experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

## PROJECT CONDITIONS

Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

## SEQUENCING AND SCHEDULING

Sequence and coordinate installation of wall handrails as follows:

Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.

## PART 2 - PRODUCTS

### FERROUS METALS

Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

Steel Plates, Shapes, and Bars: ASTM A 36.

Stainless Steel sheet, strip, rod, plate, flat bar: ASTM A 666, Type 304

Rolled Steel Floor Plates: ASTM A 786.

Steel Tubing: Product type (manufacturing method) and as follows:

Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:

Grade A, unless otherwise indicated or required for design loading.

Hot-Formed Steel Tubing: ASTM A 501.

For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:

Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:

Grade A, unless otherwise indicated or required by design loading.

Hot-Rolled Structural Steel Sheet: ASTM A 570, grade as follows:

Grade 30, unless otherwise indicated or required by design loading.

Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

Cold-Rolled Steel Sheet: ASTM A 366.

Hot-Rolled Steel Sheet: ASTM A 569.

Galvanized Steel Sheet: Quality as follows:

Structural Quality: ASTM A 446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.

Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

Black finish, unless otherwise indicated.

Galvanized finish for exterior installations and where indicated.

Type F, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.

Gray Iron Castings: ASTM A 48, Class 30.

Malleable Iron Castings: ASTM A 47, grade 32510.

Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

Extruded Aluminum: ASTM B221, Alloy 6063 temperT-6.

#### GROUT AND ANCHORING CEMENT

Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include but are not limited to the following:

##### Nonshrink Nonmetallic Grouts:

“Euco N-S Grout”; Euclid Chemical Co.

“Kemset”; Chem-Masters Corp.

“Masterflow 713”; Master Builders.

“SonogROUT”; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.

“Stoncrete NMI”; Stonhard, Inc.

“Five Star Grout”; U.S. Grout Corp.

##### Erosion-Resistant Anchoring Cement:

“Super Por-Rok”; Minwax Construction Products Division.

## FASTENERS

General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

Lag Bolts: Square head type, FS FF-B-561.

Machine Screws: Cadmium plated steel, FS FF-S-92.

Wood Screws: Flat head carbon steel, FS FF-S-111.

Plain Washers: Round, carbon steel, FS FF-W-92.

Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, [nondrilling]), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.

Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

Lock Washers: Helical spring type carbon steel, FS FF-W-84.

## PAINT

Shop Primer for Ferrous Metal: Manufacturer’s or fabricator’s standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

Zinc Chromate Primer: FS TT-P-645.

## CONCRETE FILL AND REINFORCING MATERIALS

Concrete Materials and Properties: Comply with requirements of Division 3 section “Concrete Work” for normal weight, ready-mix concrete with minimum 28-day compressive strength of 2,500 psi, 440 lb cement per cu. ft. minimum, and W/C ratio of 0.65 maximum, unless higher strengths indicated.

Nonslip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits ; rust-proof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.

## FABRICATION, GENERAL

Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling,

opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

Temperature Change (Range): 100 deg F (55.5 deg C).

Shear and punch metals cleanly and accurately. Remove burrs.

Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Remove sharp or rough areas on exposed traffic surfaces.

Weld corners and seams continuously to comply with AWS recommendations and the following:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

#### LOOSE BEARING AND LEVELING PLATES

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

#### LOOSE STEEL LINTELS

Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

Weld adjoining members together to form a single unit where indicated.

Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.

Galvanize loose steel lintels located in exterior walls.

#### MISCELLANEOUS FRAMING AND SUPPORTS

**General:** Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

**Equip** units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

### MISCELLANEOUS STEEL TRIM

Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

Galvanize miscellaneous framing and supports in the following locations:

Exterior locations.

Interior locations where indicated.

### SHELF AND RELIEVING ANGLES

Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.

For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated expansion joints in cavity wall exterior wythe.

Galvanize shelf angles to be installed on exterior concrete framing.

### FINISHES, GENERAL

Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

Finish metal fabrications after assembly.

### STEEL AND IRON FINISHES

**Galvanizing:** For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:

ASTM A 153 for galvanizing iron and steel hardware.

Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

Interiors (SSPC Zone 1A): SSPC-SP3 “Power Tool Cleaning.”

Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 “Paint Application Specification No. 1” for shop painting.

### PART 3 - EXECUTION

#### PREPARATION

Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

Center nosings on tread widths with noses flush with riser faces and tread surfaces.

Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

#### INSTALLATION, GENERAL

Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

### SETTING LOOSE PLATES

Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### ADJUSTING AND CLEANING

Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting" of these specifications.

For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05720 – ALUMINUM ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

This Section includes the following:

Aluminum ornamental handrails and railings.

Related Sections include the following:

Division 5 Section "Metal Fabrications" for metal stairs and other metal fabrications.

PERFORMANCE REQUIREMENTS

General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

Aluminum: AA 30, "Specifications for Aluminum Structures."

Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections. Requirements in paragraph and subparagraphs below are based on current BOCA Code.

Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:

Top Rail of Guards: Capable of withstanding the following loads applied as indicated:

Concentrated load of 200 lbf (890 N) applied at any point and in any direction.

Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.

Concentrated and uniform loads above need not be assumed to act concurrently.

Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:

Concentrated load of 200 lbf (890 N) applied at any point and in any direction.

Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.

Concentrated and uniform loads above need not be assumed to act concurrently.



Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

Thermal Movements: Provide handrails and railings that allow for thermal movements 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.

Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

## SUBMITTALS

Product Data: For manufacturer's product lines of handrails and railings assembled from standard components.

Include Product Data for grout, anchoring cement, and paint products.

Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.

For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.

Samples for Initial Selection: Short sections of railing or flat sheet metal Samples showing available mechanical finishes. **PREFINISHED BLACK RAILING REQUIRED**

Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

6-inch- (150-mm-) long sections of each different linear railing member, including handrails, top rails, posts, and balusters.

Fittings and brackets.

Welded connections.

Brazed connections.

Assembled Samples of railings, 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.

Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

Product Test Reports: Indicating products comply with requirements, based on comprehensive testing of current products.

Product Test Reports: Indicating handrails and railings comply with ASTM E 985, based on comprehensive testing of current products.

### QUALITY ASSURANCE

Mockups: Before installing handrails and railings, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

Build mockups in the location indicated or, if not indicated, as directed by Architect.

Build mockups as shown on Drawings.

Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches (600 mm) in length.

Notify Architect seven days in advance of dates and times when mockups will be constructed.

Obtain Architect's approval of mockups before fabricating ornamental handrails and railings.

Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

Demolish and remove mockups when directed.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### STORAGE

Store handrails and railings in a dry, well-ventilated, weathertight place.

### PROJECT CONDITIONS

Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

### COORDINATION

Coordinate installation of anchorages for handrails and 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.

### SCHEDULING

Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

## PART 2 - PRODUCTS

## MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Aluminum Ornamental Handrails and Railings:

Aluminum Tube Railings, Inc.  
Architectural Metal Works.  
Blum: Julius Blum & Co., Inc.  
Blumcraft of Pittsburgh.  
Braun: J.G. Braun Co.  
CraneVeyor Corp.  
Livers Bronze Co., Inc.  
Newman Brothers, Inc.  
Poma Corporation.  
Rippel Architectural Metals, Inc.  
Sterling Fabricated Systems, Inc.  
Superior Aluminum Products, Inc.  
Wagner: R & B Wagner, Inc.  
Wylie Systems.

## METALS

General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.

Extruded Bar and Tube: ASTM B 221 (ASTM B 221M), alloy 6063-T5/T52.  
Extruded Structural Pipe and Tube: ASTM B 429, alloy 6063-T6.  
Drawn Seamless Tube: ASTM B 210 (ASTM B 210M), alloy 6063-T832.  
Plate and Sheet: ASTM B 209 (ASTM B 209M), alloy 6061-T6.  
Die and Hand Forgings: ASTM B 247 (ASTM B 247M), alloy 6061-T6.  
Castings: ASTM B 26/B 26M, alloy A356-T6.

Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.  
Provide formed or cast brackets with predrilled hole for exposed bolt anchorage.  
Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.  
Provide brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.  
MISCELLANEOUS MATERIALS

Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as required for color match, strength, corrosion resistance, and compatibility in fabricated items.

## FASTENERS

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

For aluminum handrails and railings, use fasteners fabricated from Type 304 or Type 316 stainless steel.

**Fasteners for Interconnecting Handrail and Railing Components:** Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless otherwise indicated.

Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.

**Cast-in-Place and Post installed Anchors:** Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

Cast-in-place anchors.

**PAINT:** Provide prefinished electrostatic powder coat factory painted railings.

#### GROUT AND ANCHORING CEMENT

**Nonshrink, Nonmetallic Grout:** Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

**Erosion-Resistant 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. 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.

#### FABRICATION

Assemble handrails and railings in 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.

Form changes in direction of railing members as follows:

As detailed.

By bending.

By inserting prefabricated flush elbow fittings.

By any method indicated above, applicable to change in direction involved.

Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

**Mechanical Connections:** Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.

**Brackets, Flanges, Fittings, and Anchors:** Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

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

For railing posts set in concrete, provide preset sleeves of steel not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) larger than outside dimensions of post, and steel plate forming bottom closure.

Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

Fabricate joints that will be exposed to weather in a watertight manner.

Close exposed ends of railing members with prefabricated end fittings.

Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

## FINISHES, GENERAL

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

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

**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. Noticeable variations in same piece are not acceptable. 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.

## ALUMINUM FINISHES

Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker).

Color: Black.

### PART 3 - EXECUTION

#### EXAMINATION

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.

#### INSTALLATION, GENERAL

Fit exposed connections together to form tight, hairline joints.

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

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.

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 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).

Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

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

#### RAILING CONNECTIONS

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. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

Expansion Joints: Install expansion joints at locations indicated but not further 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; locate joint within 6 inches (150 mm) of post.

#### ANCHORING POSTS

Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:

Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) greater than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:

Nonshrink, nonmetallic grout.

Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch (3-mm) build-up, sloped away from post.

For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.

### ANCHORING RAIL ENDS

Anchor rail ends to concrete and masonry with brackets on underside of rail connected to rail ends and anchored with post installed anchors and bolts.

Anchor rail ends to metal surfaces with flanges bolted to metal surfaces.

Weld flanges to rail ends.

### ATTACHING HANDRAILS TO WALLS

Attach handrails to wall with wall brackets. Provide bracket 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.

Secure wall brackets 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.

For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

### CLEANING

Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

PROTECTION

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

Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05720