SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 STANDARDS

The following Standards are listed in this specification:

ASTM A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, Sheet Piling
ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardwork
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A449	Standard Specification for Quenched and Tempered Steel Bolts and Studs
ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A529	Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572	Standard Specification for High Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992	Standard Specification for Steel for Structural Shapes for Use in Building Framing
ASTM C1107	Standard specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D4745	Standard Specification for Filled Compounds of Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials
ASTM F436	Standard Specification for Hardened Steel Washers
ASTM F959	Standard Specification for Compressible Washer-Type Direct Tension Indicators for use with Structural Fasteners”

ASTM F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1852	Standard Specification for "Twist-Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASCE 7-98	Minimum Design Loads for Buildings and Other Structures
OSHA	29 CFR Part 1926, Part R, Safety Standards for Steel Erection

1.3 DESCRIPTION OF WORK

A. Extent of structural steel work is shown on drawings including schedules, notes and details that show size and location of members, typical connections, and type of steel required. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel defined below. Include all supplementary parts, members and connections necessary to complete the structural steel work, regardless of whether all such items are specifically shown or specified on the drawings.

B. Structural steel shall be defined as that work prescribed in Section 2.1 of the AISC Code of Standard Practice and the following items: all steel supports for elevator guide rails, and catwalks (including support members and attached structural steel shapes and plates such as hangers).

C. Miscellaneous metal fabrications, architecturally exposed structural steel, metal stairs and ladders, cold-formed metal framing, and metal deck are specified elsewhere in these Specifications.

1.4 QUALIFICATIONS

A. Fabricator: The structural steel fabricator shall have not less than 5 years experience in the successful fabrication of structural steel similar to this project.

The structural steel fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant in Category Sbd, Conventional Steel Building Structures.

B. Erector: The structural steel erector shall have not less than 2 years successful experience in the erection of structural steel of a similar nature to this project.

C. Professional Engineer: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

1.5 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated. Certain sections in this specification contain requirements that are more restrictive and/or different than contained in the standards listed. In such cases, the requirements of this specification shall control.

1. All federal (OSHA), state and local laws that govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below. OSHA requirements include regulation 29 CFR 1926, Part R, “Safety Standard for Steel Erection”.
2. AISC "Code of Standard Practice for Steel Buildings and Bridges," adopted March 7, 2000, except as noted herein.
3. AISC "Load and Resistance Factor Design Specification for Structural Steel Buildings," dated December 1, 1993, and supplements thereto as issued.
4. AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts” approved by the Research Council on Structural Connections, June 23, 2000.
5. ANSI/AWS D1.1 "Structural Welding Code - Steel".
6. "Steel Structures Painting Manual", Volumes 1 and 2, Society for Protective Coatings, formerly Steel Structures Painting Council.

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code - Steel". All welding shall be performed in accordance with a written Welding Procedure Specification (WPS) as required in ANSI/AWS D1.1 that is approved by the Engineer.

C. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Owner's testing laboratory. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The Contractor shall promptly remove and replace materials or fabricated components that do not comply.

D. Question about Contract Documents: The Contractor shall promptly notify the Architect/Engineer whenever design of members and connections for any portion of the structure are not clearly indicated or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.

E. Testing Laboratory Services: See Testing Laboratory Services section of these Specifications for requirements relating to structural steel.

Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.

1.6 SUBMITTALS

A. 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 the specified standards):

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washers, including certified copies of mill reports covering chemical and physical properties.
3. Shrinkage-resistant grout.
4. Unfinished bolts and nuts.
5. Welding electrodes (each type).
6. Structural steel primer paint.
7. Inorganic or other protective paint.
8. Shear studs.
9. Direct tension indicators.

B. Shop Drawings:

1. General Requirements: Submit shop drawings prepared under the supervision of and sealed by, for connection design only, a professional engineer licensed in the state where the project is located detailing fabrication of structural steel components. Structural steel shop drawings shall include the following minimum information:

   a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify the type of high-strength bolted connection (slip-critical, direct-tension, or bearing connections).
   b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

2. All fabricated material and connections shall fit within architectural constraints.
3. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed and approved.

C. Calculations: The design of all steel connections for the project shall be performed under the direct supervision of a professional engineer licensed in the state where the project is located, employed by the fabricator. The fabricator's engineer shall submit complete design calculations showing all information as specified in Part 2-Connections. The Engineer reserves the right to reject all shop drawings submitted without complete design calculations.

D. Test Reports: Submit copies of reports of tests conducted on all material and on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results. See Testing Laboratory Services section of these Specifications for additional requirements.

E. Qualification Data:

1. Submit qualification data for firms and persons specified in Article 1.03 “Qualifications” 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.
2. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.
3. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in section 1.05-B. If recertification of welders is required, retesting will be at Contractor's responsibility.

F. Substitutions:

1. Substitutions for the member sizes, type(s) of steel connection details or any other modifications proposed by the Contractor will be considered by the Architect/Engineer only under the following conditions:

    a. That the request has been made and accepted prior to the submission of shop drawings. All substitutions shall be clearly marked and indicated on the shop drawings as a substitute.
    b. That there is a substantial cost advantage or time advantage to the Owner; or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.
    c. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect/Engineer, including cost reductions or savings in time to complete the work.
    d. In no case shall such revisions result in additional cost to the Owner.

1.7 DELIVERY, STORAGE AND HANDLING

A. 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 corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.

B. Furnish all fuel, maintenance, and equipment required for hoisting and placement of materials under this contract.

C. Process, pay for and maintain all permits and certificates of on-site inspection required for derricks, cranes and hoisting equipment. No derrick, crane or hoisting equipment shall be operated without a certificate of operation and a certificate of on-site inspection, as required by governing authorities.

1. In addition to the above, all hoisting equipment shall be installed, operated and maintained in accordance with all applicable regulations of authorities having jurisdiction.
2. The Contractor shall furnish street storage and sidewalk crossing permits.

1.8 JOB CONDITIONS

The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel: All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM A6.

Structural steel shall comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:

1. Structural Steel Wide Flange and WT Shapes - High Strength Steel, ASTM A992. ASTM A572, Grade 50 may be acceptable as a substitute for A992.
2. M-Shapes, S-Shapes, and Channels - Carbon Steel, ASTM A36.
3. Angle Shapes – Carbon Steel, ASTM A36.
4. Structural Steel Plates and Bars - Carbon Steel, ASTM A36.
5. Steel Pipe - ASTM A53 (Type E or S) Grade B(Fy = 35 ksi).
6. Square and Rectangular HSS – ASTM A500, Grade B (Fy = 46 ksi).
7. Connection Material: Unless noted otherwise on the drawings, column stiffener plates and doubler plates at moment connections shall be the same grade of steel as the beam connecting the column (highest grade if more than one grade is used). All other connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless a higher or matching grade of steel with the members connected is

required by strength or stiffness calculations and provided the resulting sizes are compatible with the members connected.

B. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:

1. ASTM A325 Type 1.
2. Alternative Design Fasteners: Fasteners that incorporate a design feature intended to indicate a predetermined tension or torque (load indicator bolts or “twist-off” bolts) shall conform to the requirements of section 2(d) of the RCSC “Specification for Structural Joints Using ASTM A325 or A490 Bolts”. Bolts that are manufactured to conform to ASTM A325 shall additionally conform to ASTM F1852.

   Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:

   a. Nucor Fastener, A Division of Nucor Corporation, Conway, AR and St. Joe, IN
   b. Lake Erie Screw Corp., Lakewood, OH.
   c. Vermont Fasteners Manufacturing, Swanton, VT

3. Threaded Round Stock: ASTM A36
4. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A563.
5. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F436.
6. Galvanized Bolts: Provide bolts, nuts and washers that are hot dip galvanized according to ASTM A153, Class C when used to connect steel called for on the drawings or in the specifications as hot dip galvanized after fabrication.
7. Direct Tension Indicators: Compressible washer-type direct-tension indicators conforming to ASTM F959.

   Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:

   a. Applied Bolting Technology, Ludlow, VT.
   b. Turnasure, LLC., Langhorne, PA.

8. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.
9. New Bolts: All bolts shall be new and shall not be reused.

C. Electrodes for Welding: Comply with AWS D1.1, "Structural Welding Code - Steel" with a minimum Charpy V-notch toughness of 20 ft-lbs at 0° F. Electrodes for various welding processes shall be as specified below:

1. SMAW: E70XX low hydrogen
2. SAW: F7X-EXXX
3. GMAW: ER70S-X
4. FCAW: E7XT-X

Electrodes shall be compatible with parent metal joined.

D. Shear Connectors (Headed Studs): Shear connectors and their installation shall meet all requirements specified in Section 7 of AWS D1.1 "Structural Welding Code-Steel".

Sizes of shear connectors shall be as specified on the drawings.

E. Anchor Rods:

1. All anchor rods shall conform to ASTM F1554, Grade 55
2. Anchor rods used with galvanized baseplates shall be galvanized.
3. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A563.
4. Washers: Washers for all base plates shall be 1/4" thick plates extending minimum 1" from edge of base plate holes on each side with holes 1/16 inch larger than the nominal bolt diameter. Washers shall conform to ASTM A36 steel.

F. Structural Steel Primer Paint: SSPC-Paint 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning) unless noted otherwise in this specification. Refer to Architect's drawings and specifications for final paint finish requirements of structural steel. Primer paint shall be compatible with final paint requirements.

G. Non-Shrink Grout: Provide grout type(s) as specified on the drawings:

1. Non-Metallic Non-Shrink Grout: Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to ASTM C1107. Provide the minimum strength as shown below as determined by grout cube test at 28 days. :

   a. 6,000 PSI for supporting concrete 3000 psi and less.
   b. 8,000 PSI for supporting concrete greater than 3000 psi and less than or equal to 4000 psi.
   c. Unless noted otherwise on the drawings, grout strength on supporting concrete greater than 4000 psi shall be 8000 psi.

Subject to conformance with specified requirements, acceptable non-shrink grouts include:

"14k Hy Flow" and "Sonogrout 10k" as manufactured by Sonneborn-ChemRex, Inc.

"Crystex" and “Duragrout” as manufactured by L&M Construction Chemicals, Inc.

"Sure Grip High Performance Grout," and “1107 Advantage Grout” as manufactured by Dayton-Superior Corporation.

"Masterflow 555", “Masterflow 928” and "Set Grout" as manufactured by ChemRex, Inc., MBT Protection and Repair Division. "Five Star Grout" as manufactured by U.S. Grout Corp.

"NS Grout" and "Hi-Flow Grout" as manufactured by The Euclid Chemical Company.

H. Hot Dip Galvanizing:

1. Scope: Hot dip galvanize after fabrication all structural steel items and their connections permanently exposed to exterior conditions or that are within areas of unconditioned airspace, whether specified on the drawings or not.

   Examine the architectural and structural drawings for other items required to be hot dipped galvanized.

   Galvanize all nuts, bolts, and washers used in the connection of such steel. Field welded connections shall have welds protected with "Z.R.C. Cold Galvanizing Compound" as manufactured by Z.R.C. Products Company.

2. Surface Preparation: All steel to be hot dip galvanized shall undergo the following surface preparation as specified by the Steel Structures Painting Council (SSPC), Volume 2.

3. Zinc Coating: The zinc coating for steel shapes and plates shall conform to ASTM A123.

I. Galvanizing Repair Paint: Galvanizing repair paint shall be "ZRC Cold Galvanizing Compound" as manufactured by ZRC Chemical Products or a paint complying with SSPC-Paint 20.

2.2 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings.
2. Milled surfaces of built-up sections shall be completely assembled or welded before milling.
3. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.

B. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.

C. Camber:

1. Camber of structural steel members is indicated on the drawings.
2. Where indicated on the drawings in a camber diagram, cantilever or double cantilever beams shall be cambered for the main span and cantilever end separately, either by a staged cold bending process or by the application of heat.
3. Cambers indicated on the drawings are intended to be final cambers at time of erection.

D. Splices in Structural Steel: Splicing of structural steel members in the shop or the field is prohibited without prior approval of the Engineer. Any member having a splice not shown and detailed on approved shop drawings will be rejected.

E. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

F. 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 the contract documents, and/or the final shop drawings.

1. Provide specialty items as indicated to receive other work.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. Lifting and Erection Devices: The fabricator shall be responsible for designing, detailing and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.

2.3 WELDING

A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code - Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS).

B. Welder Certification: All shop and field welders shall be certified according to AWS procedures for the welding process and welding position used.

C. Welding Procedure Specification: All welding shall be performed in accordance with a Welding Procedure Specification (WPS) as required in AWS D1.1 and approved by the Owner's Testing Laboratory and the Architect/Engineer The WPS variables shall be within the parameters established by the filler-metal manufacturer.

2.4 BOLTING

A. Minimum Bolt Diameter: Minimum bolt diameter shall be 3/4 inch.

B. Connection Type: Unless noted otherwise on the drawings, all bolted connections shall be snug-tightened using high-strength bolts in standard holes (hole diameter nominally 1/16 inch greater than the nominal bolt diameter) with threads included in the shear planes. Notwithstanding, the contractor shall be responsible to adhere to provisions of AISC Specification Section J1.11, which lists circumstances under which certain connections require fully-tightened high strength bolts.

C. Fastener Tension:

1. High strength bolts in snug-tightened joints shall be tightened to a snug tight condition only. Do not pretension bolts in snug-tightened joints the same as if they were in slip-critical joints. The snug-tightened condition is defined as the tightness that exists when all plies are in firm contact. This may usually be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
2. High strength bolts in slip-critical and pretensioned joints shall be tightened to achieve the minimum bolt tension as specified in the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" when all the fasteners of a joint are tight.

   Any of the four methods to tighten bolts specified in the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" may be used to achieve the minimum bolt tension. The tightening procedure that uses direct tension indicator washers shall conform to the requirements of ASTM F959.

D. Minimum Strength of Bolted Connections: Except as specified below in "Connections" or noted otherwise on the drawings, all shop and field bolted connections shall develop the full tensile strength of the member. All members with bolted moment connections, noted on the drawings with "MC", shall be bolted to

develop the full flexural capacity of the member, unless noted otherwise on the drawings.

2.5 CONNECTIONS

A. Typical connection details are indicated on the drawings.

B. Design Procedure:

1. Unless noted otherwise or specifically detailed on the drawings, end connections of beams, girders, and trusses shall be designed as flexible and the connection shall accommodate end rotations of the unrestrained beams. Restrained end connections, noted on the drawings as “MC”, shall be designed for the combined effect of bending moment and shears induced by the rigidity of the connection. Forces to be used in the design are described below.
2. The design of all steel connections for the project except those specifically detailed on the drawings, shall be performed under the direct supervision of a qualified professional engineer licensed in the state where the project is located, employed by the fabricator.
3. The fabricator's licensed professional engineer shall submit complete design calculations for each connection, including connections completely detailed on the drawings (if any). Such calculations shall show details of the assembled joint with all bolts and welds required. Where predesigned connections are taken directly from the AISC Manual or related publications, calculations need not be submitted provided the project design conditions precisely match those assumed in the referenced publications, all data extracted from the tables is clearly identified with the table number, and such connections are so indicated in the calculations submitted.
4. The fabricator, his detailer and supervising engineer shall coordinate all connection requirements with the erector. The fabricator is responsible to detail connections that contain the adjustability and all other requirements that allow the erector to erect the structural steel in conformance to all specified tolerances.
5. The fabricator’s licensed professional engineer shall seal all design calculations.
6. The Engineer reserves the right to reject all shop drawings submitted without complete design calculations. Failure to adhere to the requirements of this section obligates the Contractor to take responsibility for any and all resulting delays in the detailing and fabrication of structural steel.

C. Flexible (Simple) Beam Connections:

1. All typical beam simple connections shall conform to requirements of the AISC specifications. Refer to the drawings for typical connection types.

2. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.
3. Simple Beam Design Capacity: Design the connection to support, at a minimum, the design reaction shown on the plans. Notify the engineer and request a reaction for any beam where no reaction is shown.

    a. Minimum reaction capacity shall be 10.0 kips service load or 15 kips factored load and each connection shall contain not less than the minimum number of bolts shown in the AISC connection tables for each beam size.

D. Restrained (Moment) Connections:

1. Refer to the drawings for Moment Connection Details.
2. Design Reactions for Moment Connected Beams: Shear connections for moment-connected beams shall be designed for the reaction shown on the drawings.
3. Design and Furnishing of Reinforcement in Moment Connected Joints: As part of the design responsibility outlined above, the fabricator shall design and furnish all additional reinforcement in moment connected joints to resist the specified design forces unless otherwise specifically detailed on the drawings. Column sections shall be investigated for web shear, web yielding, web buckling, and tension. Stiffeners and/or doubler plates shall be furnished as required by the AISC Specification Section K1.

E. Tightening of Bolts in Welded Moment Connections. At moment connections where beams are complete-joint penetration welded directly to columns or girders in the field, welds shall be made after installation of erection bolts to draw the pieces together and before the final shear connection bolts are tightened

F. Column Splices: Bearing and Fit-Up of Column Compression Joints: Compression joints of all columns shall have bearing surfaces finished to a common plane by milling, sawing, or other suitable means. Lack of contact bearing must not exceed 1/16" or corrective measures as defined by AISC Specification M4.4 shall be required.

G. Base Plates and Bearing Plates:

1. Attachment to Column: Unless shown otherwise on the drawings, all baseplates and bearing plates shall be welded all around to the column with minimum fillet welds as specified in AISC Specification Table J2.4.
2. Setting Base Plates: Baseplates shall be set to the elevation indicated on the drawings and leveled using steel shims (plastic shims will not be

allowed) or by three leveling screws with weldments at the plate edges. Plates shall be grouted using specified non-shrink non-metallic grout after all protruding plates have been trimmed. Tighten anchor bolts after supported members have been positioned and plumbed.

3. Anchor Rod Holes in Baseplates: Hole sizes in baseplates for anchor rods shall be made oversize as described in the AISC Manual of Steel Construction.

H. Struts and Braces: Connections for all struts, hangers, and braces shall have connections designed to develop the full allowable tensile strength of the member.

I. Stiffeners: Provide stiffeners finished to bear under all load concentrations on supporting members, on all members framing over columns, at beam column joints (as required by the AISC Specification Section K1) and where shown on the drawings.

J. Steel Shelf Angles: Shelf angles supporting veneer shown on the drawings to be continuous shall be furnished in approximately 8'-0" lengths with two supports per section. Provide a 1/4" gap at each joint. The gap shall not be welded. Locate joints halfway between supports. Shelf angles shall be continuous around corners with corner joint complete penetration welded.

2.6 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Specification: Surface preparation, paint, and painting practices shall conform to the "Steel Structures Painting Manual", Volumes 1 and 2, as published by the Society for Protective Coatings (formerly the Steel Structures Painting Council (SSPC)).

B. Scope: All steel shall be shop primed.

1. Shop paint surfaces that are to remain exposed to view in the final construction.
2. Shop paint any steel other than weathering steel that, in the final construction, will not be in a controlled environment and is therefore subject to moisture or high humidity infiltration and that has not been specified to be galvanized.
3. Shop paint any steel that is shown on the drawings to receive a finished paint system as defined in Specification Section 9900.
4. Extend shop paint to 2" from location of welds on surfaces that are to be field welded.
5. Extend shop paint to no closer than 2" from location of bolts on surfaces that are to receive high strength slip-critical bolts unless the paint system is certified as a Class A or greater coating.

Coordinate all shop painting of structural steel with Architect's painting requirements as specified on the architectural drawings and in the specifications.

The fabricator shall complete structural steel assemblies, including welding of units before starting shop-priming operations.

C. Surface Preparation and Primer Paint - Shop Painted Steel:

1. Surface Preparation: Prepare the surface of all structural steel specified to be shop painted as required by the paint manufacturer or the Society for Protective Coatings specifications, but not less than the following:

   a. SSPC-SP 2, “Hand Tool Cleaning” or SSPC-SP 3, “Power Tool Cleaning”
   b. SSPC-SP 6, “Commercial Blast Cleaning” shall be applied to the faying surfaces of connections that are noted on the drawings as slip-critical connections requiring a Class B surface or a Class A surface if the faying surface is not to be masked per Section 2.06.B.5. Apply this surface preparation to the area surrounding all bolt holes including the area up to 2” outside the outer-most holes.

2. Priming: Immediately after surface preparation, apply primer to all structural steel specified to be shop primed in strict accordance with manufacturers instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer’s written instructions and to provide a dry film thickness of not less the 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and all exposed surfaces. Apply two coats to surfaces that are inaccessible after assembly or erection. Change the color of the second coat to distinguish it from the first coat.
3. Finish Coat: Coordinate shop primer paint requirements with architectural drawings and specifications. The primer selected must be compatible with any specified finish coat.

D. Touch-Up Painting: The General Contractor shall provide for cleaning and touch-up painting of welds, bolted connections, and abraded areas. Apply paint to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

PART 3 - EXECUTION

3.1 ERECTION

A. The Erection work shall comply with the requirements of AISC Specification Section M4.

B. Inspection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.

C. Surveys: The General Contractor shall employ a qualified land surveyor to insure accuracy in structural steel erection.

D. Temporary Shoring and Bracing:

1. The lateral-load resisting system and connecting diaphragms are identified on the drawings. Comply with the provisions of the Code of Standard Practice regarding stability of the structure during the erection process.
2. Design and provide all required shoring and bracing to safely withstand all loads as specified in the Code of Standard Practice unless larger loads are required by the local building code or specified herein. Provide all bracing, any additional structural members, and increase member sizes and/or connections shown on the drawings as required to accommodate the erection loads, methods, sequence of erection, and equipment.

    a. For all projects located along the hurricane coastline as defined by the ASCE 7 load standard and erected during hurricane season (June 1 through October 31), also design the shoring and bracing to withstand the wind loads not less than as defined by the ASCE 7 load standard for Exposure C conditions and as modified herein. The design wind pressure shall be based on design wind velocities taken as the basic wind speed in ASCE 7 times the factor noted in the table below.

Construction Period	Factor
Less than six weeks	0.75
From six weeks to one year	0.80
From one year to two years	0.85
From two to five years	0.90

    b. For all projects located in seismic areas, also design for seismic loads if required by the local building code or building official.

3. Provide all required erection bracing and supports to hold structural steel framing securely in position until the lateral-load resisting or stability-providing system is completely installed.

E. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work.

F. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be

made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.

G. Miscellaneous Framing: Provide supplemental structural steel support framing for metal deck where normal deck bearing is interrupted by columns, or other framing members or floor openings whether shown or not on the architectural, mechanical, or structural drawings.

H. Removal of Erection Aids and Devices: The erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.

I. Touch-Up Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas that have been shop painted. Apply paint to exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
2. Immediately after erection, clean and repaint field welds, bolted connections and abraded areas that have been galvanized. Prepare surfaces by power disk sanding to bright metal and apply specified galvanizing repair paint in accordance with ASTM A780.

J. Shear Connector Installation:

1. Composite Beams:

a. Studs shall be welded in the field (not the shop) using automatically timed stud welding equipment.
b. The top flange of the beams must be unpainted and free of heavy rust, mill scale, dirt, sand or other foreign material which will interfere with the welding operation.
c. The metal deck must be free of dirt, sand, oil, or other foreign material and must be dry and free of moisture. Metal deck must rest tightly on the beam flange. Welding must take place through only one thickness of deck.
d. Stud Spacing: Studs shall be spaced on uniformly loaded beams having deck flutes across the span, beginning with one stud per flute spaced evenly along the span. Additional studs shall be spaced beginning from the ends of the beam and repeating until all studs are placed. Beams with concentrated loads shall be spaced as shown on the drawings with studs placed in the zones indicated, in the same manner as described above. Girders with deck flutes parallel to the span shall have studs placed uniformly within the zones indicated on the drawings.
e. Maximum Stud Spacing:
(1) Beams Perpendicular to Deck Span: The maximum spacing of studs shall be 36” o.c.

(2) Beams or Girders Parallel to Deck Span: The maximum spacing of studs shall be 36" o.c.

f. Minimum Studs for All Composite Beams and Girders: All floor and roof beams and girders supporting composite deck shall have shear studs spaced in a zone along the length as specified in (e) above whether indicated on the drawings or not.

g. Shear Studs on Cantilever Beams: Shear studs marked on plan for cantilever beams shall be placed only on the interior span with minimum studs as specified in (g) above placed on the cantilever end.

2. Steel Plates Embedded in Concrete:

a. Studs shall be welded using automatically timed stud welding equipment.

b. Plates must be unpainted and free of heavy rust, mill scale, dirt, sand or other foreign material that will interfere with the welding operation.

K. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

L. Tests and Inspections: Refer to Testing Laboratory Services section of this specification for required tests and inspections.

END OF SECTION 05120

SECTION 05310 - STEEL ROOF DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 STANDARDS

The following Standards are listed in this specification:

ASTM A611	Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

1.3 SCOPE OF WORK

A. Supplier: The metal deck supplier shall furnish all metal deck materials and accessories indicated on the Architectural, Structural, and Mechanical Drawings required to produce a complete job including but not necessarily limited to deck units, cover plates, metal deck edge closures, cell closures, cant strips, sump pans, and all related accessories.

B. Erector: The Subcontractor responsible for erecting the metal deck shall provide all labor and equipment as required to place all metal deck components and accessories as described above.

1.4 QUALIFICATIONS

The metal deck supplier shall be a manufacturer with a minimum of two years successful experience and with a minimum of two successful jobs of a comparable size and scope to this project.

1.5 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of the following codes and standards except as otherwise indicated or specified:

1. "Design Manual for Composite Decks, Form Decks, and Roof Decks", as published by the Steel Deck Institute (SDI).
2. "Specification for the Design of Cold Formed Steel Structural Members", as published by the American Iron and Steel Institute (AISI).
3. "Structural Welding Code – Sheet Steel", D1.3 as published by the American Welding Society (AWS).

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS procedures.

C. Underwriters Label: Provide metal deck units which are listed and conform to Underwriters Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific fire-resistant system detailed. Provide units and construction which are found in UL "Roofing Materials & Systems Directory" and conform to UL Wind Uplift Class 90 construction and with each deck unit bearing the UL label and marking for specific wind-rated system detailed.

D. Factory Mutual Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Research Corporation and are listed in "Factory Mutual Research Approval Guide 2000- Building Materials" for "Class 1"fire rated construction and 1-90 Windstorm Classification .

1.6 SUBMITTALS

A. Product Certification: Submit manufacturer's specifications and installation instructions for each type of deck specified. Also submit a certificate of product compliance with SDI Standards as specified.

B. Shop Drawings: Submit detailed shop drawings showing type of deck, complete layout, attachment details, closures, edge strips, supplementary framing, and all other accessories. The shop drawings shall be sealed by the same registered professional engineer who seals the calculations.

C. Calculations: The metal deck manufacturer shall submit design calculations sealed by a registered professional engineer in the state where the project is located verifying compliance with the specifications for all load and span conditions shown on the drawings. Calculations that show the deck attachment procedure and pattern meets the specified design criteria shall also be submitted.

D. Insurance Certification: Assist Architect and Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire, windstorm, and extended coverage insurance.

E. Welding Certificates: Submit Copies of certificates for welding procedures and personnel.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. See General Notes on the drawings for the location, depth of deck, design thickness, and type of deck required.

2.2 GRADES OF STEEL

Steel deck shall be manufactured from steel conforming to ASTM A611 Grades C, D, or E for painted deck or A653, Structural Steel Grade for galvanized deck or Engineer approved equal, having a minimum yield strength of 33,000 PSI.

2.3 FINISH

A. Galvanizing: Steel deck shall be galvanized with a protective zinc coating conforming to ASTM A653 G90.

B. Painting: Shop prime deck with gray or white baked-on, lead- and chromate-free rust inhibitive primer complying with performance requirements of FS TT-P-664. See Architect's drawings and painting specifications for metal deck finish paint requirements.

C. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Department of Defense Specifications DOD-P-21035.

2.4 ROOF DECK ACCESSORIES

Provide minimum 20 gauge ridge and valley plates, minimum 20 gauge cant strips, minimum 14 gauge sump pans, minimum 20 gauge inside or outside closure channels angles or plates, minimum 20 gauge butt strips at change of deck directions, minimum 20 gauge filler sheets, and rubber closures as required to provide a finished surface for the application of insulation and roofing.

2.5 MECHANICAL FASTENERS

A. Powder-Actuated or Pneumatically Driven Pins: Provide corrosion-resistant, powder-actuated or pneumatically driven fasteners manufactured from steel conforming to AISI 1060 or 1061 steel, austempered to a core hardness of 52 to 58 Rockwell C. Fasteners shall have a knurled shank and shall be zinc-plated in accordance with ASTM B633, Sc. I, Type III.

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

Hilti, Inc., Tulsa, OK
ITWBuildex, Itasca, IL

Pneutek, Inc., Hudson, NH

B. Self-Drilling Screw Fasteners: Provide corrosion-resistant, hexagonal head, steel self drilling screws, austempered to a core hardness of Rockwell C 50.

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

ITWBuildex, Itasca, IL

2.6 SIDE-LAP FASTENERS:

Provide Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

2.7 FABRICATION

A. General: Fabricate deck panels, without top-flange stiffening grooves, to comply with “SDI Specifications and Commentary for Steel Roof Deck”, in SDI Publication No. 29, and the following.

B. Metal Deck Spans: Metal deck spans shall not exceed the maximum center to center spans as recommended by SDI. Where possible, all metal deck shall extend over three or more supports. Single span deck is prohibited.

C. Metal Deck Spans: Metal deck spans shall not exceed the maximum center to center spans as required by the Factory Mutual Research Corporation Approval Guide 2000 – Building Materials or as recommended by SDI, whichever is less. Where possible, metal decks shall extend over three or more supports. Single span deck is prohibited.

D. Underwriters Laboratories Wind Uplift Classification: Provide metal deck panels meeting the requirements of Construction No. (i) 58 (ii) 157 (iii) 192 (iv) 234 (v) 241 (vi) 266 as listed in the 2000 UL Roofing Materials & Systems Directory under Roof Deck Constructions (TGKX) and rated as a Class (i) 30 (ii) 60 (iii) 90 assembly.

2.8 ROOF OPENINGS

Provide a 20 gage galvanized flat plate to reinforce openings in roof deck that are greater than 6” and less than 10” in any one direction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units as accessories in accordance with manufacturers recommendations and approved shop drawings, and as specified herein:

1. Place deck units on supporting framework and adjust to final position with accurately aligned side laps and ends bearing 2" minimum on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks. Place the end joint over a chord angle for deck bearing on steel bar joists.
2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
5. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
6. Do not use roof deck units for storage or working platforms until permanently secured.

B. Attachment of Roof Deck:

1. The method of attachment, attachment pattern, and side lap fastener type and spacing, shall be designed to resist the net uplift load and the diaphragm shear as shown on the drawings but not less than the minimum requirements noted below.
2. Method of Attachment: The deck shall be fastened to the structural support members using one of the following methods.

    a. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work. Weld metal shall penetrate all layers of deck material at end laps and side joints and shall have good fusion to the supporting member. Welding washers shall be used only when welding steel deck less than 0.028" thickness. The diameter of the puddle weld on the supporting member shall be, at a minimum, the diameter stated in the specification but no less than 1/2 inch.
    b. Powder-Actuated or Pneumatically Driven Pins: An operator licensed by the pin manufacturer shall install all pins. Comply with the manufacturer's requirements to install the pins through all layers of the deck material and the manufacturer’s required embedment into the supporting member.
    c. Self-Drilling Fasteners: Comply with the manufacturer's requirements to install the screws through all layers of the deck material and the manufacturer's required embedment into the supporting member.

3. Side Lap Fastening: Unless required otherwise by provisions of this specification, side laps of adjacent units shall be fastened by welding (on 20 gauge or heavier deck only) or #10 (min.) TEK screws at 12” O.C.. Button Punching is not allowable as a side-lap fastener.
4. End Bearing: Provide a minimum end bearing of 2" over supports.

5. End Joints: End joints of sheets shall be lapped 2” minimum over supports. Decks that slope 1/4 inch or more in 12 inches in the long direction shall be erected beginning at the low side to insure that end laps are shingle fashion.
6. Definition of Perimeter and Corner: Unless shown otherwise on the drawings, the definition of corner and perimeter areas shall be as noted below.

    a. Definition of Roof Height: Roof height shall be defined as eave height for roofs that slope less than 10% and mean roof height for roofs with a greater slope.
    b. Buildings with roof heights of 60 feet or less

        i. Perimeter: The width of the perimeter strip shall be the smaller of one-tenth the least building dimension and four-tenths the roof height but not less than 4 feet. The strip either side of a ridgeline shall be considered as a perimeter strip for the purposes of deck fastening for roofs that slope between 10° and 45°.
        ii. Corner: On an exterior (not re-entrant) corner, a strip the width of a perimeter strip defined above and extending for a length equal to the dimension of one perimeter strip each direction from the exterior corner.

7. Minimum Attachment Requirements: Unless a more stringent attachment requirement is specified elsewhere in this specification or on the drawings, roof deck units with ribs spaced at 6” or less on center shall be attached to each structural support member at each rib where the sides lap and at a maximum of 12 inches on center in the typical condition in the field of the roof and at a maximum of 12 inches on center at eave overhangs, perimeter strips and corners. Roof deck units with ribs spaced at greater than 6” shall be attached at each rib throughout. One of the following fastening methods shall be used as a minimum requirement:

    a. 5/8” diameter puddle welds
    b. Powder-Actuated or Compressed-air Actuated pins, by Hilti, Inc.
    c. BX 12 or BX 14 pins, by ITWBuildex, Inc.
    d. K***** or SDK***** pins by Pneutek, Inc.
    e. # 12 ICHTraxx self-drilling fasteners, by ITWBuildex, Inc.

8. Minimum Attachment Requirements: Unless a more stringent attachment requirement is specified elsewhere in this specification or on the drawings, roof deck units shall be attached to each structural support member at each rib where the sides lap and at a maximum of 12 inches on center in the typical condition in the field of the roof. Along the perimeter and at corners of the roof, the fastening pattern shall be reduced to a maximum of 6 inches on center. In decks with ribs greater than 6 inches on center this requirement will be met by placing two fasteners per rib. One of the following fastening methods shall be used.

    a. 5/8” diameter puddle welds
    b. Powder-Actuated or Compressed-air Actuated pins, by Hilti, Inc.

c. BX 12 or BX 14 pins, by ITWBuildex, Inc.
d. K***** or SDK***** pins by Pneutek, Inc.
e. # 12 ICHTraxx self-drilling fasteners, by ITWBuildex, Inc.

9. Underwriters Laboratories Wind Uplift Classification Requirements: Unless a more stringent attachment requirement is specified elsewhere in this specification or on the drawings, roof deck units shall be attached to the supporting structure as required by the Construction Number specified elsewhere in this section.
10. Attachment to Girders: At locations where the deck flutes are parallel to the span of the steel framing and the top of the framing is at the bottom of the deck elevation, the deck shall be attached to the girder using one of the specified fastening methods at 18 inches on center. See the drawings for attachment details when the deck flute does not engage the top of the steel framing.

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

D. Reinforcement at Openings: Roof openings less than 6" square or diameter require no reinforcement. Openings 6" to 10" inclusive shall be reinforced with a 20 gauge galvanized plate welded to the deck at each corner and 6" maximum centers with a 5/8" diameter puddle weld or sheet metal screws. For openings greater than 10" in diameter or width, refer to the drawings and structural steel specifications for additional framing to support the deck around the opening.

E. Hanger Slots or Clips: Provide UL approved punched hanger slots between cells or flutes of lower element where roof deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.

1. Hanger clips designed to clip over male side lap joints of roof deck units may be used instead of hanger slots.
2. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.
3. Provide manufacturer's standard hanger attachment devices.
4. Loads hanging from metal deck slabs shall not exceed 100 pounds unless specifically detailed otherwise on the drawings.

F. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld in each corner.

G. Joint Covers: Provide metal joint covers at changes in direction of deck units, except where taped joints are specified.

H. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, and reinforcing channels according to deck manufacturer’s written instructions. Weld to substrate to provide a complete deck installation.

I. Flexible Closure Strips: Install flexible rubber closure strips that seal the flutes of the deck when the deck cantilevers over an exterior beam and the flutes are exposed to weather and over interior partitions where there is no ceiling present and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.2 TOUCH-UP PAINTING

After deck 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 galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

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

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

3.3 INSPECTION

A. Welded decking in place is subject to inspection and testing by designated Testing Laboratory. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work. Cost of such removal and replacement shall be borne by the Contractor.

B. The nail head stand-off distance from the top of the deck for Powder-Actuated or Compressed-Air fasteners shall be in accordance with the manufacturer's requirements and shall be verified with an inspection gauge supplied by the manufacturer. The cost of re-fastening deck that is found to be inadequately fastened shall be borne by the Contractor.

END OF SECTION 05310

SECTION 05314 - STEEL COMPOSITE DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 STANDARDS

The following Standards are listed in this specification:

ASTM A611	Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

1.3 SCOPE OF WORK

A. Supplier: The metal deck supplier shall furnish all metal deck materials and accessories indicated on the Architectural, Structural, and Mechanical Drawings required to produce a complete job including but not necessarily limited to deck units, cover plates, pour stops, hanger slots or clips, metal deck edge closures, cell closures, and all related accessories.

B. Erector: The Subcontractor responsible for erecting the metal deck shall provide all labor and equipment as required to place all metal deck components and accessories as described above.

1.4 QUALIFICATIONS

The metal deck supplier shall be a manufacturer with a minimum of two years successful experience and with a minimum of two successful jobs of a comparable size and scope to this project.

1.5 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of the following codes and standards except as otherwise indicated or specified:

1. "Design Manual for Composite Decks, Form Decks, and Roof Decks", as published by the Steel Deck Institute (SDI).

2. "Specification for the Design of Cold Formed Steel Structural Members", as published by the American Iron and Steel Institute (AISI).
3. "Structural Welding Code – Sheet Steel", D1.3, as published by the American Welding Society (AWS).

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS procedures.

C. Underwriters Label: Provide metal deck units which are listed and conform to Underwriters Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

D. Cellular Decks: Provide cellular floor deck units complying with UL 209 and listed in UL "Electrical Construction Equipment Directory" with each cellular metal floor deck unit bearing UL labels and marking. Provide units which will permit use of standard header ducts and outlets for electrical distribution systems.

1.6 SUBMITTALS

A. Product Certification: Submit manufacturer's specifications and installation instructions for each type of deck specified. Also submit a certificate of product compliance with SDI Standards as specified.

B. Shop Drawings: Submit detailed shop drawings showing type of deck, complete layout, attachment details, closures, edge strips, pans, deck openings, special jointing, supplementary framing, and all other accessories.

C. Calculations: The metal deck manufacturer shall submit design calculations sealed by a registered professional engineer in the state where the project is located verifying compliance with the specifications for all load and span conditions shown on the drawings.

D. Welding Certificates: Submit Copies of certificates for welding procedures and personnel.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

See General Notes on the drawings for location of metal deck types and for depth of deck, minimum deck thickness, concrete type, total slab thickness, slab reinforcing, and design superimposed loads. The average rib width to depth of deck ratio shall be greater than or equal to 2.0. The deck thickness specified shall be considered the minimum thickness. The deck manufacturer shall be responsible for selecting the required deck thickness to carry the design superimposed load indicated for all the

spans shown on the drawings and for meeting all performance criteria as specified by the SDI. Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with “SDI Specifications and Commentary for Composite Steel Floor Deck”.

Acceptable manufacturers include the following:
BHP Steel Building Products USA, Inc.
Canam Steel Corp.
Consolidated Systems, Inc.
Epic Metals Corp.
United Steel Deck, Inc.
Valley Joist, Inc.
Vulcraft/Div. Nucor Corp.
Wheeling Corrugating Co.

Other manufacturers may be used only with Architect/Engineer approval.

2.2 GRADE OF STEEL

Composite metal deck shall be cold formed from steel sheets conforming to ASTM A611 Grade C or D or ASTM A653, Structural Steel Grade, with a minimum yield strength of 33 ksi. The delivered thickness of the uncoated steel shall not be less than 95% of design thickness. Sheet metal accessories shall conform to the same material specification as the deck product.

2.3 FINISH

A. Galvanized: Composite metal deck shall be galvanized with a protective zinc coating conforming to ASTM A653 G60.

B. Painting: Shop prime deck with gray or white baked-on, lead- and chromate-free rust inhibitive primer complying with performance requirements of FS TT-P-664. See Architect's drawings and painting specifications for metal deck finish paint requirements.

C. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Department of Defense Specifications DOD-P-21035.

2.4 RELATED PRODUCTS

A. Flexible Closure Strips: Provide manufacturers standard vulcanized closed cell, synthetic rubber.

B. Acoustic Sound Barrier Closures: Provide manufacturers standard mineral fiber closures.

2.5 FABRICATOR

A. Metal Deck Spans: Metal deck spans shall not exceed the maximum clear spans as required by SDI criteria. Where possible, all metal deck shall extend over three or more spans. Simple span deck will not be permitted unless it is shored at midspan. All metal deck shall be designed as unshored construction unless indicated otherwise on the drawings. Any additional concrete topping specified over the composite slab shall be placed after the slab has reached 75% of its design strength.

B. Cell Closure at Ends of Metal Deck Flutes: Fabricate metal closure strips of not less than 0.0358" minimum (20 gage) cold formed sheet steel. Form to provide tight fitting cell closures at open ends of cells or flutes to prevent wet concrete from leaking through open cells.

C. Pour Stop Closures at Slab Edges: Provide sheet metal pour stop closures at all slab edges, columns, walls, and openings unless steel angles or bent plates are specified in details on the drawings. The closures shall be fabricated from light gage steel not less than the thickness shown in the table below. Provide a return lip on the vertical leg in accordance with the SDI Design Manual. The overhang dimension is measured from the edge of the flange to the edge of the slab.

Overhang =	0”-2”	2”-4”	4”-6”	6”-8”	8”-10”
Slab Thickness					
5.25	18	16	14	12	10
6.25	16	14	12	12	10
6.5	16	14	12	12	10
8.0	12	12	10	10	NA

2.6 COMPOSITE SLAB REINFORCEMENT

See Section 3200, “Concrete Reinforcement”, for reinforcement in composite slabs.

2.7 OPENINGS IN METAL DECK

For unframed openings, provide blockout in slab for opening with deck uncut. Cut deck at opening after concrete has reached 75% of its design strength. See Section 3200, “Concrete Reinforcement”, for reinforcing in the slab around all unframed openings in metal deck that are greater than 10" in width in either direction.

2.8 CHLORIDE ADMIXTURES

The use of admixtures in concrete containing chloride salts shall not be permitted for metal deck concrete.

2.9 EXTRA CONCRETE REQUIRED BY DECK DEFLECTION

The General Contractor shall include in his bid additional concrete required for metal deck slabs to account for deck deflection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units as accessories in accordance with manufacturers recommendations and approved shop drawings, and as specified herein:
   1. Place deck units on supporting framework and adjust to final position with ends accurately aligned and bearing 1 1/2" minimum on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
   2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
   3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
   4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
   5. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
   6. Do not use floor deck units for storage or working platforms until permanently secured.

B. Attachment of Composite Deck:

   1. Typical Welding of Deck: Metal deck units shall be welded to the structural support members with 5/8" puddle welds at each end of sheet and each intermediate support at each low flute, unless more frequent attachment is specified on the drawings. Where two deck units abut each other, each unit shall be so welded.
   2. Side Laps: Unless noted otherwise on the drawings, side laps of adjacent units shall be fastened by welding (1-1/2 inch long), sheet metal screws (No. 10 or larger) or button punching at maximum intervals not exceeding the lesser of ½ of the span or 36".
   3. Welding to Girder: Metal deck units shall be welded to girders (steel framing that is parallel to span of deck) with 5/8" ø puddle welds at 12" o.c. If the metal deck is not continuous across the girder, the deck on each side of the girder shall each be welded to the girder with 5/8" ø puddle welds at 12" o.c.
   4. Welding Washers: Welding washers shall be used when welding steel deck units less than 0.028" thickness.
   5. Welding of Composite Deck used on Roof: In addition to the minimum attachment specified above, typical areas of the roof deck shall be welded to resist the net uplift pressures as specified in the General Notes on the drawings
   6. Minimum Bearing: Provide a minimum deck bearing of 1 1/2" over all supports with butted end joints.

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

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

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

F. Hanger Slab or Clips: Provide UL approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.

1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
2. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.
3. Provide manufacturer's standard hanger attachment devices.
4. Loads hanging from metal deck slabs shall not exceed 100 pounds unless specifically detailed otherwise on the drawings.

G. Joint Covers and Cell Closures: Weld steel sheet joint covers at abutting ends, except where taped joints are specified. Weld steel sheet column closures, cell closures and Z-closures to deck with 1" long weld at 12" maximum centers to provide tight-fitting closures at open ends of ribs, unless shown otherwise on the drawings.

H. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated. Provide minimum 2" bearing over steel support.

3.2 TOUCH-UP PAINTING

After deck 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 galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.
In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.3 INSPECTION

Welded decking in place is subject to inspection and testing by the Owner's Testing Laboratory. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work. Cost of such removal and replacement shall be borne by the Contractor.

END OF SECTION 05314

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Steel ladders.
2. Steel shelf angles.
3. Support angles for elevator door sills and machine beams where required.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Miscellaneous metal trim.
7. Pipe bollards.
8. Sump pit grate.
9. Cast metal nosings.
10. Bike racks.

1.2 SUBMITTALS

A. Material Safety Data (MSD): MSD Sheets are required for all materials with detailed information on content, product safety, and potentially harmful characteristics. MSD Sheets shall be submitted by Contractor to the Architect for review prior to delivery or use of such materials on the project site. Product approval will depend, in part, upon meeting the environmental requirements of this specification, based upon MSD information submitted to the Architect for review.

B. Product Data:

1. Grout.
2. Cast nosings.

C. Samples for Verification: For nosings.

D. Shop Drawings: Detail 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.

1. Provide templates for anchors and bolts specified for installation under other Sections.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. 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.

G. Products - Recycled Content: Provide certification from manufacturer on product's recycled content.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.5 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

PART 2 - PRODUCTS

1.6 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

1.7 FERROUS METALS

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

B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1.8 ALUMINUM

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

1.9 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1.10 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Plain Washers: Round, carbon steel, ASME B18.22.1.

1.11 GROUT

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

1.12 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Section 03300 - Cast-in-Place Concrete: Normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi.

1.13 FABRICATION, GENERAL

A. 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.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. 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.

D. Weld corners and seams continuously to comply with 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.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

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

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

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

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

J. Remove sharp or rough areas on exposed traffic surfaces.

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

1.14 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Siderails: Continuous steel flat bars, with eased edges.

C. Bar Rungs: Steel bars as indicated.

D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

F. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

G. Galvanize ladders, including brackets and fasteners.

1.15 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

1.16 LOOSE STEEL LINTELS

A. 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.

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

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

1.17 SHELF ANGLES

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

B. Galvanize shelf angles to be installed in exterior walls.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

1.18 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports indicated and as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.

2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

C. Fabricate supports for operable partitions as follows:

1. Beams: Continuous steel shapes of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

1.19 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches on center, unless otherwise indicated.

C. Galvanize all miscellaneous steel trim.

1.20 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 40 steel pipe.

1.21 SUMP PIT GRATE

A. Fabricate sump pit grate from swage locked aluminum bars and rods.

1. Product and Manufacturer: Series GAL-2, Swage Locked Aluminum Grating; McNichols Co.
2. Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

1.22 CAST NOSINGS

A. General: Fabricate units of metal indicated below in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions. Provide units with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both.

1. Metal: Cast aluminum.

B. Configurations: Provide units in the following configurations, unless otherwise indicated:

1. Nosings: Crosshatched units, profile as indicated, for casting into concrete steps.

C. Anchors: Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Protections: Apply bituminous paint to concealed bottoms, sides, and edges of units set into concrete.

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

1. American Safety Tread Co., Inc.
2. Balco/Metalines, Inc.
3. Wooster Products Inc.

1.23 BIKE RACKS

A. Bike Racks: University standard.

1. Size: As indicated.
2. Finish: Painted.

1.24 FINISHES, GENERAL

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

B. Finish metal fabrications after assembly.

1.25 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. 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:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

1.26 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing 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.

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

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

D. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

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

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

1.27 SETTING BEARING AND LEVELING PLATES

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

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

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1.28 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

1.29 INSTALLING PIPE BOLLARDS

A. Set bollards in place and fill solidly with concrete. Mount top surface and finish smooth.

1.30 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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

END OF SECTION 05500

SECTION 05511 - METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel stairs with concrete-filled treads.
2. Handrails and railings attached to metal stairs.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal stairs capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.

1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 lbf/sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress.
2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
3. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

B. Structural Performance of Handrails and Railings: Comply with the requirements of the Standard Building Code. Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:

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

a. Concentrated load of 200 lbf applied at any point and in any direction at the top of the guardrail.
b. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

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

    a. Concentrated load of 200 lbf applied at any point and in any direction.
    b. Uniform load of 50 lbf/ft. applied in any direction.

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

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

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

1.3 SUBMITTALS

A. Material Safety Data (MSD): MSD Sheets are required for all materials with detailed information on content, product safety, and potentially harmful characteristics. MSD Sheets shall be submitted by Contractor to the Architect for review prior to delivery or use of such materials on the project site. Product approval will depend, in part, upon meeting the environmental requirements of this specification, based upon MSD information submitted to the Architect for review.

B. Product Data: For metal stairs and the following:

1. Paint products.
2. Grout.

C. Shop Drawings: Show fabrication and installation details for metal stairs. Include plans, elevations, sections, and details of metal stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

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

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. 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.

F. Products - Recycled Content: Provide certification from manufacturer on product’s recycled content.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. ADA Requirements: Comply with the Florida Accessibility Code for Building Construction, October 1997 Edition.

B. Installer Qualifications: Arrange for metal stairs specified in this Section to be fabricated and installed by the same firm.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project 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 stairs (including handrails and railing systems) that are similar to those indicated for this Project in material, design, and extent.

D. Fabricator Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 COORDINATION

A. Coordinate installation of anchorages for metal stairs. 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.

PART 2 - PRODUCTS

1.6 MANUFACTURERS

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

1. Preassembled Stairs:

a. Alfab, Inc.
b. American Stair Corp., Inc.
c. Sharon Companies, Ltd. (The).

1.7 FERROUS METALS

A. Metal Surfaces, General: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Uncoated, Cold-Rolled Steel Sheet: Commercial quality, complying with ASTM A 366/A 366M; or structural quality, complying with ASTM A 611, Grade A, unless another grade is required by design loads.

F. Uncoated, Hot-Rolled Steel Sheet: Commercial quality, complying with ASTM A 569/A 569M; or structural quality, complying with ASTM A 570/A 570M, Grade 30, unless another grade is required by design loads.

G. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial quality or structural quality, Grade 33, unless another grade is required for design loads.

H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1.8 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Machine Screws: ASME B18.6.3.

D. Lag Bolts: ASME B18.2.1.

E. Plain Washers: Round, carbon steel, ASME B18.22.1.

F. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below 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.

1. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

1.9 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers or cold-applied asphalt emulsion complying with ASTM D 1187.

1.10 GROUT

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

1.11 CONCRETE FILL AND REINFORCING MATERIALS

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

B. Nonslip-Aggregate Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

C. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.

1.12 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Commercial class, unless otherwise indicated.

C. Shop Assembly: Preassemble stairs 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.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.

E. 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.

F. Weld connections to comply with 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.
4. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

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

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

1.13 STEEL-FRAMED STAIRS

A. Stair Framing: Fabricate stringers of structural-steel channels, plates, or a combination of both, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

1. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods to support landings from floor construction above. Locate hanger rods within stud space of shaft-wall construction.
2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal Risers, Subtread Pans, and Subplatforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
2. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
3. Directly weld metal pans to stringers; locate welds on side of subtreads to be concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. Provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.

7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with smooth soffits.

C. Formed-Metal Risers, Treads, and Platforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0966 inch.

1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish. Provide material with coefficient of friction of 0.6 or higher when tested according to ASTM C 1028.

1.14 STEEL TUBE HANDRAILS AND RAILINGS

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

B. Interconnect members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections, cope ends of intersecting members to fit contour of tube to which end is joined, and weld all around.

C. Form changes in direction of handrails and rails as follows:

1. As detailed.

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

E. Close exposed ends of handrail and railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting railings and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

H. 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. Size fillers to suit wall finish thickness and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

I. For nongalvanized handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

1.15 STAIR HANDRAILS AND RAILINGS

A. General: Comply with applicable requirements in Division 5 Section "Pipe and Tube Railings" for handrails and railings, and as follows:

1.16 FINISHES

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

B. Finish metal stairs after assembly.

C. 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 products:
   1. Interiors (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."

D. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

   1. Do not apply primer to galvanized surfaces.
   2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

1.17 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. 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 from rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

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

E. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

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

G. Install precast treads with adhesive supplied by manufacturer.

1.18 INSTALLING METAL STAIRS WITH GROUTED BASE PLATES

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

B. Set steel stair base plates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1.19 INSTALLING STEEL TUBE RAILINGS AND HANDRAILS

A. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

1.20 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05511

SECTION 05521 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel pipe and tube handrails and railings.
2. Guardrails.
3. Gates.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails and Railings and Guardrails:

1. Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

a. Top Rail of Guards: Concentrated load of 200 lbf applied at any point and in any direction, and a uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
b. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf applied at any point and in any direction, and a uniform load of 50 lbf/ft. applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.

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

1.3 SUBMITTALS

A. Material Safety Data (MSD): MSD Sheets are required for all materials with detailed information on content, product safety, and potentially harmful characteristics. MSD Sheets shall be submitted by Contractor to the Architect for review prior to delivery or use of such materials on the project site. Product approval will depend, in part, upon meeting the environmental requirements of this specification, based upon MSD information submitted to the Architect for review.

B. Product Data: For the following:

1. Manufacturer's product data for prefabricated handrails and railings and accessories.

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

1. 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.

D. Products - Recycled Content: Provide certification from manufacturer on products recycled content.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. ADA Requirements: Comply with the Florida Accessibility Code for Building Construction, October 1997 Edition.

B. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.5 STORAGE

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

1.6 PROJECT CONDITIONS

A. 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.

1.7 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

1.8 METALS

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

B. Steel: Provide steel in the form indicated, complying with the following requirements:

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

a. Type F, or Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.

2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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

1.9 WELDING MATERIALS, FASTENERS, AND ANCHORS

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

B. 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.

1. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

C. Postinstalled Anchors: Anchors 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.

1.10 PAINT

A. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."

1.11 FABRICATION

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

1. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

2. Form changes in direction of railing members as follows:

    a. As detailed.

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

4. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

    a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    b. Obtain fusion without undercut or overlap.
    c. Remove flux immediately.
    d. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

B. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

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

C. Gate Hardware:

1. Hinge: Pivot type, self closing.
2. Latch: Self-latching; handicap accessible.
3. Bumpers: Rubber.
4. Hardware Finish: To match gate.

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

E. 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 the Work.

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

G. Close exposed ends of handrail and railing members with prefabricated end fittings.

H. 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 or less.

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. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

1.12 FINISHES, GENERAL

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

1.13 STEEL FINISHES

A. 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 handrails and railings:

1. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

B. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Stripe paint edges, corners, crevices, bolts, and welds.

PART 3 - EXECUTION

1.14 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. 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.

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

D. 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.

1.15 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

1.16 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets, unless otherwise indicated. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

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

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in anchors.
2. For hollow masonry anchorage, use toggle bolts.

1.17 CLEANING

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

1.18 PROTECTION

A. 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.

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

END OF SECTION 05521