

## SECTION 05120 - STRUCTURAL STEEL

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SECTION INCLUDES

- A. Structural steel columns, beams, angles, base plates, plates, stiffeners, and grouting under base plates.
- B. Related Sections include, but are not limited to:
  - 1. Section 03300 - Cast-In-Place Concrete.
  - 2. Section 05120 - Structural Steel.
  - 3. Section 05310 - Steel Deck.
  - 4. Section 05500 - Metal Fabrications.
  - 5. Section 09900 - Painting.

#### 1.3 SUBMITTALS

- A. Shop Drawings detailing fabrication of structural steel components.
  - 1. Include details of cuts, connections, splices, holes, and other pertinent data.
  - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
  - 4. Provide setting drawings, templates, and dimensions for installation of anchor bolts and other anchorages to be installed as work or other sections.
- B. Qualification data for firms and persons specified in the "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.
- C. Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified in "Quality Assurance" Article.

#### 1.4 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. Comply with applicable provisions of the following specifications, codes, and documents:
  - 1. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."

2. Florida Building Code, 2007 Edition.
- C. Comply with applicable portions of the following ASTM Standards:
  1. ASTM A 36 - "Standard Specification for Carbon Structural Steel".
  2. ASTM A 325 - "Standard Specification for High Strength Bolts for Structural Steel Joints, including Suitable Nuts and Plain Hardened Washers."
  3. ASTM A307 - "Standard Specification for Carbon Steel Externally Threaded Standard Fasteners."
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."
  1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
  2. Where the provisions of AWS are in conflict with AISC, the provisions of AISC will control.
- E. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

## **1.5 DELIVERY AND STORAGE**

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

## **1.6 COORDINATION**

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Structural Steel Members: Wide Flange Shapes - ASTM A 572 or A 992 Grade 50; other shapes - ASTM A 36.
- B. Bolts, Nuts, and Washers: ASTM A325.
- C. Anchor Bolts: ASTM A307 or A36 threaded rods, of size indicated on the drawings.

- D. Welding Materials: AWS D1.1; E-70, type required for materials being welded.
- E. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, non-corrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time, 5000 psi minimum.
  - 1. Emaco Grip manufactured by BASF (800) 243-6739 [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com) .
  - 2. Super Por-Rok manufactured by Lambert Company [www.lambertusa.com](http://www.lambertusa.com)
  - 3. NS Grout manufactured by Euclid Chemical Company [www.euclidchemical.com](http://www.euclidchemical.com) .
- F. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide; compatible with sprayed fire-resistive material.

## 2.2 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
  - 1. Mark and match-mark materials for field assembly.
  - 2. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
  - 3. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown.

## 2.3 FINISH

- A. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. Prepare structural component surfaces in accordance with SSPC SP 2 (Hand Tool Cleaning) or SSPC SP3 (Power Tool Cleaning); unless otherwise noted or recommended by manufacturer.
- B. Shop and Touch-Up Primer: SSPC Paint 15, Type 1; compatible with sprayed fire-resistive material; Tnemec Series 10-99 modified alkyd rust-inhibitive primer manufactured by Tnemec Company, Inc. [www.tnemec.com](http://www.tnemec.com) is an approved product.
- C. Zinc-Rich Primer for painted steel exposed to the elements: SSPC Paint 20, Type II; Tnemec Zinc-Rich Series 90-97 aromatic urethane, two-component.
  - 1. Surface Preparation: SSPC SP6 (Commercial Blast Cleaning).
- D. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to

- a depth of 2 inches.
- 2. Surfaces to be field welded.
- E. Field painting is specified in Section 09900.
- F. Hot-dip Galvanize all steel permanently exposed to the exterior including bolts, nuts, washers, etc.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION AND PREPARATION**

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

### **3.2 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
  - 1. Clean concrete bearing surface of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
  - 2. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
  - 3. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
  - 4. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
    - a. Comply with manufacturer's instructions for proprietary grout materials.
- C. Field weld components indicated on Drawings.
- D. Do not field cut or alter structural members without approval of Engineer.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

- F. Apply concrete enclosure to columns as indicated in the Architectural Drawings.
- G. Grout under base plates in accordance with manufacturer's recommendations.

### **3.3 WELDING**

- A. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
  - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.

### **3.4 SHOP PAINTING**

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials.
  - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the SSPC standards specified in Article 2.3A.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Prime paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

### **3.5 FIELD QUALITY CONTROL**

- A. Field inspection of members, connections, and torquing.
- B. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- C. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

- D. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- E. Field-bolted connections will be tested and inspected according to AISC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

**3.6 CLEANING**

- A. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.
- B. Touchup Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9 Section 09900 "Painting."

END OF SECTION 05120

## SECTION 05210 - STEEL JOISTS

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SECTION INCLUDES

- A. Steel joists with bridging, attached seats and anchors at locations indicated on the structural drawings.
  - 1. Open-web K-series steel joists.
  - 2. Joist accessories.
- B. Related Work Specified Elsewhere:
  - 1. Section 03300 - Cast-In-Place Concrete.
  - 2. Section 05120 - Structural Steel.
  - 3. Section 05310 - Steel Deck.
  - 4. Section 05500 - Metal Fabrications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide joists, special joists and connections capable of withstanding design loads within limits and under conditions indicated on drawings, including joists subject to wind net uplift.
  - 1. Chord and web tension and compression forces are reversed in joists subject to wind net uplift. Modify joist elements if required by analysis, possibly including increasing bottom chord, reducing bridging spacing, and/or increasing the size or quantity of web elements. Refer to SJI Technical Digest No. 6, "Structural Design of Steel Roof Joists to Resist Uplift Loads."
  - 2. Carefully investigate the design of seats of joists subject to wind net uplift. Standard joist seats are often inadequate to resist wind uplift forces.
- B. Design joists to withstand design loads, with live and wind load deflections each no greater than 1/360 of the span.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joist length, camber, joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.
  - 1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
  - 2. Indicate loads on all special joists, including loading diagrams and wind net uplift pressures.

3. Do not fabricate or erect joists prior to the approval of shop drawings.
- B. Product Data: catalogs, data sheets, material specifications, and shop painting specifications.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel. Submit to Project Manager and Special Inspector.
- D. Certification that engineering design and calculations for steel joists conform to standard specifications of the Steel Joist Institute.
- E. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.
- F. Field quality-control test and inspection reports.
- G. Design Letter: The Fabricator is responsible for designing and detailing all joists and seats, particularly special joists, in accordance with the Contract Documents and SJI requirements. This work shall be done by a Florida Licensed Engineer experienced in similar work and retained by the Fabricator. Prior to the first submittal, this Engineer shall submit a signed and sealed letter stating that the Engineer accepts responsibility for design and detailing of all joists on the Project. The drawings do not require signature and seal.

## 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance SJI's "Standard Specifications" and "Standard Load Tables", applicable to types of joists indicated. Comply with "Recommended Code of Standard Practice for Steel Joists and Joist Girders".
- B. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
  1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- C. Perform design under direct supervision of a Professional Structural Engineer licensed in the State of Florida.
- D. Certification Labels: Provide evidence of compliance with applicable material specifications in appropriate standards herein.
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code- - Steel"; and SJI Technical Digest #8, "Welding of Open Web Steel Joists".
- F. Inspection: Members shall be inspected by the manufacturer before shipment to insure compliance of materials and workmanship with the requirements of these specifications.

## 1.6 PRODUCT DELIVERY AND STORAGE

- A. Do not deliver material to project site until proposed method and sequence of erection has been reviewed and accepted by Engineer. Plan methods and sequence of operations to avoid delay or

damage to work of other trades.

- B. Store joists above ground on platforms, skids, or other appropriate supports. Place joists while in storage in an upright position with a minimum of three support points falling at panel points. Stack joist bundles a maximum of three high and prevent introduction of localized stresses and damage while in storage.

## 1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete construction.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Steel joist numbers indicated on the drawings are in accordance with the standard designations of the SJI. All joists shall be manufactured in strict compliance with SJI standards.
- B. Accessories and fittings, Including End Supports, Anchors, Bridging and Bolting: Provide in accordance with the standard specifications under which the joists were designed.
- C. Steel Bearing Plates: ASTM A 36.
- D. Anchor Bolts, Nuts and Washers: ASTM A 307 and A 325.
- E. Welding Materials: AWS D1.1; type required for materials being welded.

### 2.2 FINISH

- A. Hot-dip galvanize exterior steel joists to comply with ASTM A 123.
- B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel or repairing damage to galvanized surfaces, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC Paint-20. Application to comply with ASTM A 780. Approved products include:
  - 1. ZiRP manufactured by Duncan Galvanizing Corp. [www.duncangalvanizing.com](http://www.duncangalvanizing.com) .
  - 2. Aquapon manufactured by PPG Industries [www.ppgaf.com](http://www.ppgaf.com) .
  - 3. ZRC manufactured by ZRC Worldwide [www.zrcworldwide.com](http://www.zrcworldwide.com) .
  - 4. Or approved equal.
- C. Steel - Shop Primed:
  - 1. Touch-up with alkyd primer; PPG # 7-858.
  - 2. Two coats of alkyd enamel, gloss; PPG # 7-282.
- D. Steel - Galvanized:
  - 1. One coat of galvanize primer; PPG # 90-712 Series.
  - 2. One coat of acrylic coating, gloss; PPG # 52-110 Series Manor Hall.

## 2.3 OPEN WEB STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K series," in SJI's "Specifications," with steel-angle top and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.
  - 1. Joist Type: K-series steel joists.
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- D. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- E. Header Units: Any situation requiring heading of joists not shown on the structural drawings shall be referred to engineer for framing.
- F. Splices in Chord Members: All splices shall be designed and provided in accordance with SJI Specifications. The splices in each of the two angles or bars of all members shall not be at the same location, but shall be staggered a minimum of 6 inches.
- G. Joist Bearing: Provide minimum end bearing of joists and joist girders as required by SJI Specifications but subject to requirements below, unless detailed otherwise on the drawings:
- H. Camber members according to SJI's "Specifications" unless otherwise indicated.

## 2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type as indicated or, where not indicated, as required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required. Where applicable, adjust bridging to meet the requirements of OSHA.
- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Hot dip zinc coat according to ASTM A 123.
- C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.
- D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

## PART 3 EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

### 3.2 ERECTION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
  - 1. Before installation, splice joists delivered to Project site in more than one piece.
  - 2. Space, adjust, and align joists accurately in location before permanently fastening.
  - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
  - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Erection Stability and Handling: When it is necessary for the erector to climb on the joists, extreme caution must be exercised since unbridged joists may exhibit some degree of instability under the erector's weight. Use only lightweight erectors during the construction period. The contractor shall provide means for adequate distribution of concentrated loads so that the carrying capacity of any joist is not exceeded. Erection must comply with OSHA requirements and SJI Technical Digest #9, "Handling and Erection of Steel Joists and Joist Girders". Construction safety is the sole responsibility of the Contractor.
- D. Field weld joists to supporting steel bearing plates where indicated. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- E. Bolt joists to supporting steel framework using high-strength structural bolts, where noted in the Structural Drawings. Comply with RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" or "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before decking is erected or construction loads are applied, to ensure lateral stability during construction. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

1. For joists 40' and longer and other joists required by OSHA, install a center row of bolted bridging before slackening of hoisting lines to provide lateral stability.
2. After erection, remove temporary bridging as required for architectural, structural and mechanical clearance.

### 3.3 ATTACHMENT TO JOISTS

- A. The Contractor shall ensure that no cuts or holes are made in the members of the erected joists for attachment of ducts, pipes, or any other items not specifically shown in the contract drawings. Use of powder driven fasteners in joist diagonal and bottom chord members is prohibited.
- B. The Contractor shall not hang any elements from joists except ceiling, ducts, pipes or other items specifically shown on the Contract Documents. Heavy pipes, ducts, or other equipment hung from steel joists may require additional joist reinforcement and shall be referred to the Engineer for framing.
- C. Ceiling weighing 3 psf or less may have the grid hung anywhere along the joist bottom chord. Ceilings weighing more than 3 psf and all pipes, ducts and other mechanical, electrical, and plumbing equipment suspended from the joists shall have the hanger attached at a joist panel point only, except as approved otherwise in writing by the Engineer.

### 3.4 WELDING

- A. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
  1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.

### 3.5 FIELD QUALITY CONTROL

- A. Field inspection of members, connections, and torquing.
- B. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- C. Correct deficiencies in or remove and replace steel joists that inspections and test reports indicate do not comply with specified requirements.
- D. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- E. Field welds will be visually inspected according to AWS D1.1/D1.1M.

- F. Bolted connections will be visually inspected.
  - 1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts." or "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

### **3.6 REPAIRS AND PROTECTION**

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touch-up Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates and abutting structural steel.
  - 1. Clean with solvent and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.
  - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210



**SECTION 05310 - STEEL DECK****PART 1 GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SECTION INCLUDES**

- A. Steel roof deck and accessories.
- B. Supplementary framing for openings up to and including 18 inches.
- C. Bearing plates and angles.
- D. Related Sections include, but are not limited to:
  - 1. Section 03300 - Cast-In-Place Concrete.
  - 2. Section 05120 - Structural Steel.
  - 3. Section 05210 - Steel Joists.
  - 4. Section 06100 - Rough Carpentry.
  - 5. Section

**1.3 REFERENCES, CODES, AND STANDARDS**

- A. Florida Building Code, 2007 Edition.
- B. "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction (AISC).
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2004a.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2004 and errata.
- E. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 1998.
- F. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2001.
- G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); The Society for Protective Coatings; 2002 (Ed. 2004).
- H. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).

## 1.4 SUBMITTALS

- A. Shop Drawings: Indicate deck plan, support locations, projections, openings, pertinent details, and accessories. Obtain reviewed structural steel shop drawings and verify all conditions before preparing shop drawings for steel deck.
- B. Product Data: Deck profile characteristics and dimensions, structural properties, finishes, and product certifications complying with specified requirements.
- C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article of this Section.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. All steel decking installation and all related field welding shall be inspected by the Owner's testing laboratory.
- D. Welding Standards: AWS D 1.1 and AWS D 1.3. Use certified welders complying with the Welder Qualification procedures of AWS.
  - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- E. Fire-Resistance: Provide steel deck panels identical to those tested as part of the assembly indicated on the Drawings and in compliance with ASTM E 119.
- F. Provide steel deck panels approved for use in UL assemblies.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Protect with a waterproof covering and ventilate to avoid condensation.
- C. Store deck on dry wood sleepers; slope for positive drainage.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, are limited to, the following, based on UL assembly approval:

1. IMSA Building Products, (800) 726-2727 [www.bhpsbp.com](http://www.bhpsbp.com)
2. Vulcraft Div. of Nucor, Corp. (843) 662-0381 [www.vulcraft.com](http://www.vulcraft.com)
3. Wheeling Corrugating Co., (304) 234-2223 [www.wpsc.com](http://www.wpsc.com)

## 2.2 MATERIALS

- A. Sheet Steel: ASTM A 446, grade as required to comply with SDI specifications; with G 60 galvanized coating conforming to ASTM A 525.
  1. Deck profile and gauge is indicated on the Structural Engineer's drawings.
- B. Roof Deck: Non-composite type, fluted steel sheet:
  1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

## 2.3 ACCESSORIES

- A. Miscellaneous Steel Shapes, Plates and Angles: ASTM A 36/A 36M steel..
- B. Welding Materials: Welding electrodes shall conform to AWS D1.1 and to Table 5.1 of AWS D1.3. Electrodes shall be as recommended by their manufacturers for the position or other conditions of actual use.
- C. Fasteners: Galvanized hardened steel, self tapping, as indicated on the Structural Drawings.
- D. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.
- E. Shop and Touch-Up Primer: SSPC-Paint 25, zinc oxide, complying with VOC limitations of authorities having jurisdiction and Federal Specification TT-P-641, Type II.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- G. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel or repairing damage to galvanized surfaces, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC Paint-20 complying with VOC limitations of authorities having jurisdiction. Application to comply with ASTM A 780. Approved products include:
  1. ZiRP manufactured by Duncan Galvanizing Corp. [www.duncangalvanizing.com](http://www.duncangalvanizing.com) .
  2. Aquapon manufactured by PPG Industries [www.ppgaf.com](http://www.ppgaf.com) .
  3. ZRC manufactured by ZRC Worldwide [www.zrcworldwide.com](http://www.zrcworldwide.com) .
- H. Flexible Fluted Closures: Closed cell, manufacturer's standard; profiled to fit tight to the decking.
- I. Sheet Metal Accessories: ASTM 526, commercial quality galvanized.
- J. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in

accordance with procedures specified in ASTM A 780.

## 2.4 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gage thick sheet steel; of profile and size required; finished same as deck.
- B. Roof Sump Pans: 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

## 2.5 FABRICATION

- A. All fabrication, bevel cuts, etc., shall be done in the shop and shall be equal to a high standard of workmanship. All deck units shall be shipped to the field in standard widths and in precut lengths so that end joints occur over supporting members.
- B. Deck sections shall be cut to fit all openings which are shown on the Drawings. Dimensions of openings and holes required for the work of other trades will be provided by the respective trades for cutting of deck, and cutting and welding of deck shall be performed by the deck erector.
- C. Misalignment of deck sections and cuts, short lengths and poor workmanship shall be cause for rejection by the Architect. All rejected work shall be replaced at the Contractor's expense.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Locate decking bundles to prevent overloading of supporting members.
- B. Coordinate deck penetrations with other trades.

### 3.2 INSTALLATION

- A. Workmanship:
  - 1. Decking shall be installed in the field by an approved steel deck applicator with at least 5 years demonstrated successful experience in this type of work.
  - 2. Installation of work shall be performed by workers skilled in their trade, in conformance with established standards of good practice.
- B. Erect metal decking in accordance with Steel Deck Institute Design Manual for Composite Decks, Form Decks, Roof Decks, manufacturer's instructions, approved shop drawings, and as specified herein.
- C. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.
- D. Weld deck in accordance with AWS D1.3.

- E. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- F. Immediately after welding deck and other metal components in position, all welds, burned areas, and damaged surface coatings, shall be thoroughly cleaned to bright metal by wire brushing and coated with zinc-dust oxide touch-up primer.
- G. Installation:
  - 1. The steel deck units shall be placed on the supporting framework, aligned and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting members. If the supporting members are not properly aligned or sufficiently level to permit proper bearing of the steel units, the Contractor shall notify the Architect prior to taking corrective action to ensure properly aligned work.
  - 2. Deck units shall be placed in straight alignment for the entire length of run with close registration of the cells of one unit with those of abutting and adjoining units, and with a 2 inch minimum end bearing of open-section abutting units.
  - 3. Deck units shall not be placed on supporting members until all connections of the structural steel assembly are completed.
  - 4. Welding:
    - a. Make all welds as indicated on the drawings. Button punching or clinching of deck for final attachment will not be permitted, except as specifically indicated on the drawings.
    - b. Steel deck units shall be fastened to the steel framework by the arc welding process. Welds shall be free of sharp points or edges.
    - c. All welding shall be done by competent, experienced welders thoroughly familiar with the metal to be welded, and certified for welding of light-gage metal.
    - d. Deck sheets shall be welded to the supporting member and to each other with welds as indicated on the drawings.
  - 4. Decking shall be installed in a continuous operation to avoid delays in the construction.
  - 5. Cut holes and provide opening reinforcement as detailed on the Drawings. Holes other than those detailed on the Drawings shall be done only as specifically approved by the Architect. In general, reinforcing is not required for holes less than 6 inches in diameter. See details on Drawings for limitations.
- H. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on the Structural Drawings.
- I. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Butted.
- J. Closures: Provide closures where required. Closure pieces shall be cut same shape as deck profile as indicated on the drawings. Fasten in place by welding.
- K. Openings:
  - 1. Provide metal reinforcement and closure pieces as as indicated on the drawings.
  - 2. Openings larger than 24 inches shall be supported with structural framing as specified in Section 05120 - Structural Steel and Section 05500 - Metal Fabrications, and as indicated

- on the drawings.
3. Openings not indicated on the drawings, such as openings required for ducts, stacks, conduits, plumbing vents, etc., shall be cut, closed, supported and reinforced. Opening reinforcing shall be as as indicated on the drawings. Reinforcing framing shall be supplied by trades needing penetrations and openings in the deck.
- L. Touch -up Painting: After decking installation, wire brush, clean, and paint scarred areas, and rust spots on top and bottom surfaces of decking units and supporting steel members.
1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
  2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.
  3. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

### 3.3 DEFECTIVE WORK

- A. All work not in conformance with these specifications and generally accepted standards of the trade will be deemed defective by the Architect and will be rejected. All work which is defective shall be corrected or replaced as directed by the Architect. Corrections, redesign and replacement of defective work shall be at the Contractor's expense.

### 3.4 CLEAN UP

- A. After erection, erector shall sweep deck clean and remove all debris from the deck.
- B. Immediately in front of the roofing or concrete crew, the deck erector shall recheck all welds and other fastenings to ascertain that installation is complete, intact, and ready for roofing or concrete crew.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Laboratory: A qualified independent testing laboratory employed and paid by the Owner will perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Twenty five percent of full penetration groove welds shall be randomly inspected by ultrasonic testing by a qualified independent testing firm. All fillet welds shall be visually inspected by the testing firm.
- D. Mechanical attachment of steel deck to trusses will be subject to inspection.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional testing will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05310

**SECTION 05500 - METAL FABRICATIONS****PART 1 GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SECTION INCLUDES**

- A. Shop fabricated ferrous metal items, galvanized and prime painted.
- B. Rough hardware.
- C. Miscellaneous framing and supports for the following:
  - 1. Overhead doors.
  - 3. Applications where framing and supports are not specified in other sections.
- D. Miscellaneous steel trim, including the following:
  - 1. Steel angle cast-in-place corner guards.
- E. Exterior Aluminum Roof Access Ladders.
- F. Related Sections include, but are not limited to:
  - 1. Section 03300 - Cast In Place Concrete.
  - 2. Section 05310 - Steel Deck.
  - 4. Section 08360 - Overhead Garage Doors.
  - 5. Section 09900 - Painting.

**1.3 SUBMITTALS**

- A. Product data for grout, pre-manufactured products, primers, and bituminous paint.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Florida,
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.
- D. Samples representative of materials and finished products as may be requested by Owner.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

- F. Welding certificates.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this Section by same firm that fabricated them.
- C. Welding Standards: Comply with applicable provisions of 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. AWS D1.6 "Structural Welding Code--Stainless Steel."
- D. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- E. Fabrication and installation of fixed ladders at elevator pits shall comply with applicable subsections of OSHA 29 CFR 1910.27.
- F. Compliance with applicable ASTM Standards for aluminum products, including, but not limited to:
  - 1. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM B 221 - Standard Specification for Aluminum - Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

#### 1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

#### 1.6 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.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

## 1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Submit written agreement on manufacturer's standard form, signed by manufacturer, installer, and contractor, agreeing to repair or replace defective parts and components and/or finishes that do not comply with referenced quality standards.
  - 1. Warranty Period: one (1) year from date of Substantial Completion and Owner Final Acceptance.

## PART 2 PRODUCTS

### 2.1 FABRICATORS/MANUFACTURERS

- A. Materials are specified by brand names to establish a basis for quality and design, or by performance requirements and general description of product. The Architect reserves the right to reject any material which, in his opinion, will not produce the quality of the work specified herein.
- B. One substitute manufacturer may be submitted for each product specified in this section, to Architect for review following procedures established in Section 01600 and upon receipt of completed Substitution Form.

### 2.2 MATERIALS

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness; and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Steel Sections: ASTM A36.
- C. Steel Plate: ASTM A283.
- D. Steel Tubing: ASTM A501.
- E. Pipe: ASTM A53, Grade B Schedule 40.
  - 1. Black finish, unless otherwise indicated.
  - 2. Galvanized finish for exterior installations and where indicated.
  - 3. Type E, OR S, Grade B, Fy = 35 KSI, unless otherwise indicated, or another weight, type, and grade required by structural loads.
- F. Sheet Steel: ASTM A446, Grade B Structural Quality with galvanized coating.
- G. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123 - Specification for Zinc Coatings on Iron and Steel Products.
  2. ASTM A 153 - Specification for Zinc Coatings on Iron and Steel Hardware.
- H. Aluminum: Shapes and dimensions shown on the drawings.
1. Finish For Exposed Surfaces is specified in Section 05520.
- I. Stainless Steel: Chromium-nickel alloy, Type 304; Type 316 for exterior exposure. Do not use sheet materials with gage smaller than 22.
1. Finish: Unless otherwise noted, give exposed surfaces a #4 (satin) finish.
  2. Welded Connections: Made in the shop, ground and finished to match the adjacent surfaces and present a smooth, invisible seam.
- J. Bolts, Nuts, and Washers: ASTM A325 [galvanized to ASTM A153 for galvanized members].
- K. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A153.
- L. Welding Materials: AWS D1.1.
- M. Shop and Touch-Up Primer: SSPC Paint 15, Type 1; compatible with sprayed fire-resistive material; Tnemec Series 10-99 modified alkyd rust-inhibitive primer manufactured by Tnemec Company, Inc. [www.tnemec.com](http://www.tnemec.com) is an approved product.
- N. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel or repairing damage to galvanized surfaces, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC Paint-20. Application to comply with ASTM A 780. Approved products include:
1. ZiRP manufactured by Duncan Galvanizing Corp. [www.duncangalvanizing.com](http://www.duncangalvanizing.com) .
  2. Aquapon manufactured by PPG Industries [www.ppgaf.com](http://www.ppgaf.com) .
  3. ZRC manufactured by ZRC Worldwide [www.zrcworldwide.com](http://www.zrcworldwide.com) .
- O. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 and Federal Specification TT-C-494B Type II, except containing no asbestos fibers, Karnak 118 Black Asphaltum, Karnak Corp. (800) 526-4236; [www.karnakcorp.com](http://www.karnakcorp.com) or approved equal.

### 2.3 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Gypsum-Free, Cement-Based Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621 or ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section. Approval products include, but are not limited to:
1. Emaco Grip manufactured by BASF (800) 243-6739 [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com)
  2. Super Por-Rok manufactured by Lambert Company [www.lambertusa.com](http://www.lambertusa.com)
  3. NS Grout manufactured by Euclid Chemical Company [www.euclidchemical.com](http://www.euclidchemical.com) .
- B. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic

controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

## 2.4 FASTENERS

- A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls, unless specified as stainless steel in other specification sections. Select fasteners for the type, grade, and class required for each application and complying with applicable standards.
1. Bolts and Nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex nuts ASTM A563; and, where indicated, flat washers.
  2. Anchor Bolts: ASTM F1554, Grade 30
  3. Lag Bolts: Square head type, ASME B18.2.1
  4. Machine Screws: Cadmium plated steel, ASME B18.6.3
  5. Wood Screws: Flat head carbon steel, ASME B18.6.1
  6. Plain Washers: Round, carbon steel, ASME B18.22.1
  7. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1
  8. 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 E488, conducted by a qualified independent testing agency.
    - a. Interior Use - Material: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
    - b. Exterior and Swimming Pool Use - Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F593 and nuts complying with ASTM F594.
  9. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.
- B. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, consistent with design of component.
- C. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication.

## 2.5 FABRICATION

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Fit and shop assemble components in largest practical sizes, for delivery to site.
1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. 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. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts. Locate joints where least conspicuous.

- D. Weld corners and seams continuously to comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- F. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

## 2.6 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
  - 1. Hot-dip galvanize miscellaneous framing and supports in exterior locations and where shown to be painted.

## 2.7 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.

## 2.8 ALUMINUM ROOF ACCESS 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.
  - 3. Extrusions: AA-M10 (Mechanical Finish: as fabricated, unspecified), mill finish.
- B. Siderails: Continuous, Extruded aluminum, 6063-T6 alloy:
  - 1. 1/2" X 2 1/2" X 1/8" .
  - 2. 1/8" molded polyurethane safety cap provided at top.
  - 3. 2 1/2" X 2" X 3" floor bracket if required.

4. Wall Brackets: Bent aluminum plate, 2 inches wide by 3/16 inch thick.
- C. Treads: Extruded aluminum, 6063-T6 alloy, with self-cleaning serrated top surface and rounded front and back edges; fastened to handrails with concealed stainless steel screws; capable of withstanding 1200 pounds load per tread without damage.
1. Width: 24 inches, unless indicated otherwise on the drawings.
  2. Tread Size: 2 1/4" X 3/4" X 1/4".
  3. Spacing: 12 inches vertically.
  4. 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.

## 2.9 FINISHES

- A. Prepare surfaces in accordance with SSPC SP 2, Hand Tool Cleaning and/or SP 3, Power Tool Cleaning.
- B. Shop prime items with one coat. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Galvanize to ASTM A123, structural steel members; provide minimum 1.25 oz/sq ft galvanized coating.

## PART 3 EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- C. Make provisions for erection loads with temporary bracing. Keep work in alignment.
- D. Supply items required to be cast into concrete or embedded in masonry with setting templates.
- E. Confirm that unfinished concealed aluminum in contact with dissimilar metals, cementitious materials, masonry, and wood has been treated with a protective coating as specified in Part 2 of this specification section.

### 3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

- C. 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.
- D. Field weld components as indicated. Perform field welding in accordance with AWS D1.1.
  - 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. Obtain Architect/Engineer approval prior to site cutting.
- F. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### **3.3 BEARING AND LEVELING PLATE INSTALLATION**

- 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.

### **3.4 LADDER INSTALLATION**

- A. Installation and placement of fixed ladders at elevator pits and/or roof access shall comply with applicable subsections of OSHA 29 CFR 1910.27.

### **3.5 ADJUSTING AND CLEANING**

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

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces: clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500



## SECTION 05520 - ALUMINUM HANDRAILS & RAILINGS

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SECTION INCLUDES

- A. Post-supported handrails and railings of configuration illustrated in the drawings.
- B. Aluminum picket railings and handrails, balusters, and fittings, in locations indicated on the drawings.
  - 1. All exterior and public area handrails and railings shall be fabricated by welded construction.
  - 2. Railings at non public areas shall be fabricated by bolted construction.
- C. Related Sections include, but are not limited to:
  - 1. Section 03300 - Cast-in-Place Concrete.
  - 2. Section 04810 - Unit Masonry.
  - 3. Section 05500 - Metal Fabrications.

#### 1.3 SYSTEM DESCRIPTION

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. For aluminum: AA "Specifications for Aluminum Structures."
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
  - 1. Exterior handrails and railings to comply with Florida Building Code, 2007 Edition.
  - 2. Top Rail of Railing Systems: Capable of withstanding the following loads applied as indicated:
    - a. Uniform load of 50 lbs. per linear ft. applied in any direction.
    - b. Concentrated load of 200 lbs applied at any point and in any direction.
    - c. Concentrated load need not be assumed to act concurrently with uniform loads.
  - 3. Intermediate rails, balusters, pickets, and other fillers: Capable of withstanding the following loads applied as indicated:
    - a. Concentrated horizontal load over the gross area of not less than 25 lbs/ft.
    - b. Concentrated and uniform loads need not be assumed to act concurrently.
  - 4. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as

indicated:

- a. Concentrated load of 200 lb/ft applied at any point and in any direction.
  - b. Concentrated and uniform loads need not be assumed to act concurrently.
- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating aluminum components, metals and other materials from direct contact with incompatible materials.

#### 1.4 SUBMITTALS

- A. Product Data: Provide material specifications, characteristics, and instructions for installation.
- B. Samples: Submit two samples, 12 inch length illustrating each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work.
- C. Railing & Handrail Shop Drawings: Submit shop drawings, consisting of dimensions and Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work, and methods of installation. Florida Registered Professional Engineer to prepare structural computations for handrail and railing systems to determine compliance with structural performance requirements. Shop drawings to be signed and sealed.
- D. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of railing components and systems.
- E. Test reports from independent testing laboratory evidencing compliance of handrails and railing systems with ASTM E 985 for structural performance.
- F. Submit certification that finish complies with AAMA 2605.

#### 1.5 QUALITY ASSURANCE

- A. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- B. Conform to State of Florida Accessibility Code for Building, Chapter 11, Florida Building Code, 2007 Edition for installing work in conformance with ANSI A117.1 and applicable sections of the Fair Housing Act.
- C. Comply with OSHA 29 CFR 1910.23 for the anchoring of handrails and top rails and the loads such rails must withstand.

- D. Compliance with applicable ASTM Standards, including, but not limited to:
1. ASTM B 221 - Aluminum - Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
  2. ASTM B 429 - Aluminum - Alloy Extruded Structural Pipe and Tube.
  3. ASTM B 483 - Aluminum & Aluminum Alloy Drawn Tubes for General Purpose Applications.
  4. ASTM E 894 - Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
  5. ASTM E 985 - Specification for Permanent Metal Railing Systems and Rails for Buildings.
- E. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.2, "Structural Welding Code--Aluminum."
- F. Single Source Responsibility: Obtain handrails and railing systems of each type and material from a single fabricator.
- G. Installer Qualifications: Engage an experienced Installer who has successfully completed metal railings of same materials and extent to that indicated for Project.
- H. Field-Constructed Mock-Up: Before installing the work of this section, erect mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
1. Locate mock-ups on site in location and size indicated or, as directed by Owner.
  2. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work. Minimum length of mock-up shall be 6 feet.
  3. **Owner's acceptance of mock-ups before start of railing and/or handrail work is required and must be obtained prior to the start of fabrication and installation.**

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site ready for use. Fabricate in as large sections and assemblies as practical.
- B. Storage: Store materials in a clean, dry area away from uncured concrete and masonry, preferably indoors, protected from damage and in accordance with manufacturer's recommendations. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering. Stacking should be done in a manner that will prevent bending.
- C. Handling: Protect materials and finishes during handling and installation to prevent damage. Remove materials that are damaged or otherwise not suitable for installation from job site and replace with acceptable material at no additional cost to Owner.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions

- correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

## 1.8 COORDINATION AND JOB SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Sequence and coordinate installation of wall handrails as follows:
  1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
  2. Mount handrails only on gypsum board assemblies reinforced to receive anchors and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

## 1.9 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Submit written agreement on railing and handrail manufacturer's standard form, signed by manufacturer, installer, and contractor, agreeing to repair or replace defective parts and components that do not comply with referenced quality standards.
  1. Warranty Period: one year from date of Substantial Completion and Owner Final Acceptance.
- C. Special Finish Warranty for Fluoropolymer Three-Coat System: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
  1. Warranty Period: Twenty (20) years from date of Substantial Completion and Owner Final Acceptance.

## PART 2 PRODUCTS

### 2.1 FABRICATORS

- A. Materials are specified by brand names to establish a basis for quality and design, or by performance requirements and general description of product. The Architect reserves the right to reject any material which, in his opinion, will not produce the quality of the work specified herein.
- B. In order to establish design intent the manufacturers named have been approved for use:
  1. Hernandez Ornamental (305) 592- 7296
  2. Alufab, Inc. (800) 858-7066 (305) 681-4701 [www.alufabfenceandrailing.com](http://www.alufabfenceandrailing.com)

3. Grundman Fabricators (954) 581-0320 [www.grundfab.com](http://www.grundfab.com) .
4. Dixie Metal Products (5610) 731-4555 [www.dixiemetal.com](http://www.dixiemetal.com) .

- C. One substitute manufacturer may be submitted for each product specified in this section, to Architect for review following procedures established in Section 01631 and upon receipt of completed Substitution Form.

## 2.2 MATERIALS

- A. General: Provide metal forms and types that comply with requirements of referenced standards and that are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.
1. Extruded Posts & Tubes: ASTM B 221, 6061-T6.
  2. Extruded Bar and Shapes: ASTM B 221, 6063-T5/T52.

## 2.3 RAILING COMPONENTS

- A. Rails and Posts: Extruded tubing sizes, as indicated on the drawings.
- B. Fittings: Elbows, Tee-shapes, wall brackets, escutcheons; machined aluminum.
- C. Pickets: size and shape as indicated on the drawings.
- D. Mounting: Brackets and flanges, with steel inserts for casting in concrete. Prepared backing plate for mounting in drywall partitioning.
- E. Splice Connectors: Concealed spigot; machined aluminum.
- F. Decorative Scroll Work: as indicated on the Drawings to be approved by Architect.

## 2.4 FINISHES

- A. Aluminum: Cast or extruded. Alloys recommended by Aluminum Association for use and finish required, unless otherwise approved.
- B. Finish for Exposed Aluminum Surfaces: Electrostatically applied thermosetting Kynar or Duranar flouropolymer resin coating with inhibitive flash primer over chromate conversion coating. Meet or exceed AAMA 2605 standard. Color to be selected by Owner. Submit color samples for approval.
1. Chemical Pretreatment (AA-C12C40R1X): Aluminum shall be cleaned with inhibited chemicals and the surface chemically converted to amorphous chromium phosphate to conform to ASTM D 1730, Type B, Method 5, prior to coating. Conversion coating weight must exceed 40 milligrams/square foot. No substitutions for amorphous chromium phosphate (conversion coat) will be permitted. Nominal coating thickness: 0.25 +/- 0.05 mil.

2. Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and a clear fluoropolymer top coat, with both the color and clear coats containing not less than 70 percent polyvinylidene fluoride resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions. Provide coating which has been field tested under normal range of weathering conditions for a minimum of 20 years without significant peel, blister, flake, chip, crack, or check in the finish, and without chalking in excess of 8 (ASTM D 4214) and without fading in excess of 5 NBS units (ASTM D 2244).
3. Paint system to be tested and certified by the handrail and railing manufacturer to comply with AAMA 2605.
4. Paint system shall provide 1.60 mil dry film thickness consisting of 0.25 (+/- .05) mil primer, minimum 1.0 mil colorcoat, 0.60 (+/- .20) mil clear top coat.
5. Samples shall be provided to sealant contractor for required adhesion testing.

## 2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Gypsum-Free, Cement-Based Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section. Approval products include, but are not limited to:
  1. Emaco Grip manufactured by BASF (800) 243-6739 [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com) .
  2. Super Por-Rok manufactured by Lambert Company [www.lambertusa.com](http://www.lambertusa.com)
  3. NS Grout manufactured by Euclid Chemical Company [www.euclidchemical.com](http://www.euclidchemical.com) .
- B. 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.
- C. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.
  1. All fasteners fabricated from type 304 stainless steel.
- D. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
  1. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment to other work, except where otherwise indicated.
- E. Cast-In-Place and Post -installed Anchors in Concrete: Anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.
- F. Primer: epoxy type.

- G. Bituminous Paint: Cold-applied asphalt coating complying with MIL-C-16173D Type I and Federal Specification TT-C-494B Type II, except containing no asbestos fibers, Karnak 118 Black Asphaltum, manufactured by Karnak Corp. (800) 526-4236; [www.karnakcorp.com](http://www.karnakcorp.com) or approved equal.
1. Apply bituminous paint to properly cleaned concealed unpainted surfaces in contact with cementitious or dissimilar materials. Apply 2 coats, minimum 16 mils DFT total thickness, according to manufacturer's instructions. Do not dip or over apply bituminous paint.

## 2.6 FABRICATION

- A. Verify dimensions on site prior to shop fabrication. When fabrication must precede construction and field measurements are not practical, make sure construction conforms to fabricated dimensions. Ill fitting work due to failure to coordinate will not be accepted.
- B. Fill and shop assemble sections in largest practical sizes, for delivery to site and installation.
- C. Supply components required for secure anchorage of handrails and railings.
- D. Grind exposed welds smooth and flush with adjacent surfaces.
- E. Make exposed joint butt tight, flush and hairline.
- F. Provide caps or matching profile fittings at exposed ends. Finish to match ending member.
- G. Accurately form components required for anchorage of railings to each other and to building structure.
- H. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weep holes or other means for evacuation of entrapped water in hollow sections of railing members.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water.
- J. Cast aluminum wall brackets and pipe handrails, as detailed:
1. Brackets: Curved top, 3" projection from wall to centerline of railing, J. G. Braun No. 4394 or Julius Blum No. 498, finish to match handrail.
  2. Handrail: 1 1/4" pipe, 1.660" o.d., Schedule 40, finish as specified herein.
- K. Close exposed ends of handrail and railing members by use of manufacturer's standard prefabricated end fittings.

## 2.6 FABRICATION TOLERANCES

- A. Top Rail and Post Dimensions: +/- 1/4"
- B. Pickets and Bottom Rail Dimensions: +/- 1/8".

## **PART 3 EXECUTION**

### **3.1 EXAMINATION AND PREPARATION**

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.
- B. Secure clearance from Structural Engineer before drilling in post-tensioned concrete.
- C. Confirm that unfinished concealed aluminum in contact with dissimilar metals, cementitious materials, masonry, and wood has been treated with a protective coating as specified in Part 2 of this specification section.

### **3.2 INSTALLATION**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
- B. Corrosion Protection: Coat concealed surfaces of properly cleaned aluminum components, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Field welding: Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Field welding will not be permitted unless shown and approved in shop drawings, in concealed locations.
  - 1. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- D. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by structural loads. Provide concealed fittings unless otherwise approved by Owner.
- E. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts. Grout cells as specified on the Structural Drawings.
- F. Attach handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2-inch clearance from inside face of handrail and finished wall surface.
  - 1. Aluminum ends to be embedded in concrete will be coated with a bituminous paint or dipped in approved epoxy coating, following paint/coating manufacturer's recommendations for coating thickness and application.
- G. Weld field connections and grind smooth to complete assembly. Touch-up welds with primer.

- H. Anchoring Posts into concrete by one of the following two methods (Contractor's option) unless indicated otherwise on the Structural Engineer's Drawings:
1. Anchor posts in sleeves: Insert posts in preset PVC or other non-corrosive sleeves cast into concrete and fill annular space between posts and sleeve solid with nonshrink, non-metallic, gypsum-free grout, mixed and placed to comply with grout manufacturer's directions.
  2. Anchor posts in core-drilled holes: Core-drill concrete to produce holes with diameter at least 3/4" larger than outside dimensions of post and not less than 5-in. deep and 3/4-in. greater than outside dimension of posts. Clean holes of all loose material, insert posts and fill annular space between post and concrete with nonshrink, non-metallic, gypsum-free grout, mixed and placed to comply with grout manufacturer's directions.
  3. Assure the posts do not come in contact with any reinforcing steel embedded in concrete slab.
  4. Strike grout flush with the surface of the concrete. Do not leave a recess where water may collect. Build-up grout 1/8 inch sloping away from post.
  5. Cover anchorage joint with flange or escutcheon plate attached to post after filling of annular space unless noted otherwise on the drawings.
- I. Upon completion of the work, touch up minor abrasions and defects. Work damaged or defaced to the extent that in the opinion of the Owner constitutes an unsightly condition may not be corrected by field touching up. Invisible field repair, removal and shop refinishing, or replacement, will be required.

### 3.3 CLEANING AND PROTECTION

- A. Cleaning: Clean aluminum in accordance with recommendations of metal finisher in a manner that leaves an undamaged and uniform finish matching approved sample.
- B. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion and Owner Final Acceptance.
- C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of paint finish shall match paint finish of railings and handrails.
- D. Protective coverings to be supplied by subsequent subtrades installing their work in or around the railing systems.

END OF SECTION 05520