

## SECTION 050520 - POST INSTALLED STRUCTURAL ANCHORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wedge anchors
  - 2. Cartridge injection adhesive anchors
- B. This specification section is only intended for use when specifically required by the drawings or other referencing specifications and structural applications. This section is not intended for use in non-structural applications or where not specifically referenced by the drawings or other specification sections.
- C. Related Sections include the following:
  - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2. Division 13 Section "Grandstands and Bleachers" for anchorage of structural steel elements that are part of the Bleachers
  - 3. Division 05 Section "Engineered Cold Formed Metal Framing" for anchorage of performance based cold form metal framing.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. The basis of design products are as specified in this specification or the contract documents. Product substitutions must have capacities equal to or greater than values calculated for each specific condition calculated when calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code. See requirements for substantiating products other than basis of design product. Any increase in material labor cost resulting from the use of products other than basis of design shall be the responsibility of the contractor.

#### 1.4 DEFINITIONS

- A. Post Installed Structural Anchors: Anchors supporting and/or anchoring structural elements of the building which are installed into hardened concrete or masonry and that are specified in the contract documents or performance based shop drawing design submittals for structural elements.
- B. Wedge Anchors: A torque-controlled anchor, with an integral cone expander and single piece steel expansion clip providing 360-degree contact with the base material while not requiring oversized holes for installation and an impact section to prevent thread damage with required nuts and washers.

- C. Cartridge Injection Adhesive Anchors: An anchor system consisting of rod insert, nut, washer and a cartridge type, two-component polymer or hybrid mortar adhesive system dispensed and mixed through a static mixing nozzle supplied by the manufacturer.

#### 1.5 SUBMITTALS

- A. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"
- B. Product Data:
  - 1. Wedge Anchors (as used)
  - 2. Cartridge Injection Adhesive Anchors (as used)
- C. Research/Evaluation Reports:
  - 1. Submit ICC reports for the following:
    - a. Wedge Anchors (as used)
    - b. Cartridge Injection Adhesive Anchors (as used)
- D. Calculations
  - 1. Use of products other than basis of design may only be made using products with ICC-ESR reports for the product in the specific substrate.
  - 2. Use of products other than basis of design request shall include signed and sealed calculations demonstrating that the product is capable of providing equivalent performance of the specified product for each specific location and condition when calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code.
  - 3. Calculations for products other than basis of design shall specify the diameter and embedment depth of the substituted product
- E. Manufacturer's Instruction: Manufacturer's Installation Instructions
- F. Qualification Data: Submit installer qualification data as stated in Quality Assurance section. Qualifications shall be submitted in a letter format for each type of anchor to be installed, and shall include the following:
  - 1. The specific product to be used
  - 2. Complete description of installation procedure
  - 3. Personnel to be trained on anchor installation
  - 4. Date of Manufacturer training
  - 5. Manufacturer's training certificates or letter from manufacturer certifying training was complete with a list of individuals that were trained.

#### 1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
  - a. Coordinate meeting with individual preinstallation conferences for the following:
    - 1) Bleacher and Grandstands

## 2) Cold-Formed Metal Framing

- B. Installer Qualifications: The installer shall be experienced in installing anchors equal to type, and into the substrate material required for this project
- C. Installer Training: Conduct a thorough training session with the manufacturer's representative. Each individual responsible for the installation of anchors shall attend the training session. Training shall consist of a review of the complete process for the installation of the anchors and the use of proper equipment for drilling and installing the anchors, to include but not limited to:
  - 1. Hole drilling procedure. Clarify acceptability of rotary hammer drilling and/or core drilling.
  - 2. Hole drilling equipment
  - 3. Type and diameter of drill bits
  - 4. Hole preparation and hole cleaning technique
  - 5. Hole cleaning equipment
  - 6. Adhesive injection technique
  - 7. Adhesive injection equipment
  - 8. Anchor rod, nut and washer material requirements and associated cleaning requirements
  - 9. Anchor and Anchor rod installation
  - 10. Anchor tightening
  - 11. Adhesive curing requirements
- D. Certifications: All anchors shall have an ICC ESR Evaluation report indicating conformance with the current applicable Acceptance Criteria for the building code applicable to the project.
- E. 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.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Keep anchors, rod materials, nuts and washers in manufacturer's packaging with label intact until needed for use.
- B. Keep anchors free of dirt and debris.
- C. Store anchors in a clean dry area
- D. Protect anchors from corrosion and deterioration.
- E. Store anchors and adhesives in strict accordance with manufacturer's requirements.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Nuts: Having a proof load stress equal or greater than the minimum tensile strength of the associated anchor where type and strength is not specifically indicated by anchor or adhesive manufacturer.
- B. Washers: Of type and material compatible with nuts unless specifically indicated by anchor or adhesive manufacturer.

- C. Plate Washers: Provide ASTM A 36 plate washers of size and configuration specifically indicated.

## 2.2 CORROSION RESISTANCE

### A. Anchors and Anchor Bodies

1. Uncoated Carbon Steel: Carbon steel anchors uncoated and free from oil, lubricants and other deleterious substances. Acceptable for use as follows:
  - a. Interior dry conditions
2. Zinc Plated: Zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) Acceptable for use as follows:
  - a. Interior dry conditions
3. Hot Dip Galvanized: Carbon steel anchors with hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
  - a. Interior dry conditions
  - b. Exterior conditions
  - c. Anchoring galvanized steel elements
4. Stainless Steel: AISI Type 304 or 316 stainless steel and complying with ASTM F 593. Acceptable for use as follows:
  - a. Anchoring treated lumber elements
  - b. Anchoring stainless steel elements

### B. Nuts

1. Uncoated carbon steel: Acceptable for use as follows:
  - a. With Uncoated Anchors
2. Hot Dip Galvanized: Hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
  - a. With Zinc Plated Anchors
  - b. With Hot Dip Galvanized Anchors
3. Stainless Steel: ASTM F594. Acceptable for use as follows:
  - a. With Stainless Steel Anchors

### C. Washers

1. Uncoated carbon steel: Acceptable for use as follows:
  - a. With uncoated anchors

2. Hot Dip Galvanized: Hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
  - a. With Hot Dip Galvanized Nuts
3. Stainless Steel: AISI Type 304 or 316 stainless steel. Acceptable for use as follows:
  - a. With Stainless Steel Nuts

D. Plate Washers:

1. Uncoated carbon steel: Acceptable for use as follows:
  - a. With Uncoated Nuts
2. Hot Dip Galvanized: Hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
  - a. With Hot Dip Galvanized Nuts

2.3 WEDGE ANCHORS

- A. Provide anchors with length identification markings conforming to ICC-ES AC01 or ICC-ES AC193 as appropriate based on the anchor substrate..
- B. Size: As required for performance
- C. Embedment depth: As required for performance, but not less than the manufacturer's documented minimum embedment depth. Where not specifically indicated use manufacturer's minimum documented embedment depth.
  1. Embedment depth is from surface of concrete or masonry. Anchor lengths and extent of threads shall account for embedment depth, connected elements, plate washers, washers, nut and appropriate stick thru.
- D. Concrete Anchors:
  1. Anchors shall be tested in accordance with ACI 355.2 and the most recent issue of ICC-ES AC193 including the following:
    - a. All mandatory testing
    - b. Shear and tension in cracked concrete.
    - c. Critical and minimum edge distances and spacing
  2. Anchors design shall be in accordance with ACI 318-14 Chapter 17
  3. Basis of design product:
    - a. Hilti Kwik Bolt TZ with nut and washer, of required finish, ICC ESR-1917
  4. Manufacturers: Subject to compliance with all requirements and performance criteria provide equivalent products manufactured by one of the following:
    - a. Hilti
    - b. Simpson Strong Tie
    - c. Dewalt/Powers

E. Masonry Anchors:

1. Anchors for masonry shall be tested in accordance with most recent edition of ICC-ES AC01 including the following
  - a. All mandatory testing
  - b. Seismic tension and shear
  - c. Critical and minimum edge distances and spacing
2. Anchors design shall be in accordance with ACI 530
3. Basis of design product:
  - a. Hilti Kwik Bolt 3 with nut and washer, of required finish, ICC ESR-1385.
4. Manufacturers: Subject to compliance with all requirements and performance criteria provide equivalent products manufactured by one of the following:
  - a. Hilti
  - b. Simpson Strong Tie
  - c. Dewalt/Powers

2.4 TRIDGE INJECTION ADHESIVE ANCHORS

- A. Provide anchors with length identification markings conforming to ICC-ES AC58 or ICC-ES AC308.
- B. Size: As required for performance
- C. Embedment depth: As required for performance, but not less than the manufacturer's documented minimum embedment depth. Where not specifically indicated use manufacturer's minimum documented embedment depth.
  1. Embedment depth is from surface of concrete or masonry. Anchor lengths and extent of threads shall account for embedment depth, connected elements, plate washers, washers, nut and appropriate stick thru.
- D. Adhesive: Two component epoxy or two component hybrid system.
- E. Concrete Anchors:
  1. Anchors shall be tested in accordance with the most recent issue of ICC-ES AC308 including the following:
    - a. All mandatory testing
    - b. Shear and tension in cracked concrete.
    - c. Critical and minimum edge distances and spacing
  2. Anchors design shall be in accordance with ACI 318-14 Chapter 17 as amended by the specific design provisions of ICC-ES AC308
  3. Basis of design product:
    - a. Rods, washers, and nuts of required finish with Hilti HIT RE 500 V3 Adhesive Anchorage System for anchorage to concrete, ICC ESR-3814.

- b. Rods
        - 1) Carbon Steel Rods: ASTM A193 B7 coated as required for use
        - 2) Stainless Steel Rods: ASTM F593, CW
    - 4. Manufacturers: Subject to compliance with all requirements and performance criteria provide equivalent products manufactured by one of the following:
      - a. Hilti
      - b. Simpson Strong Tie
      - c. Dewalt/Powers
- F. Masonry Anchors:
- 1. Anchors for masonry shall be tested in accordance with most recent edition of ICC-ES AC58 including the following
    - a. All mandatory testing
    - b. Seismic tension and shear
    - c. Critical and minimum edge distances and spacing
  - 2. Anchors design shall be in accordance with ACI 530
  - 3. Basis of design product:
    - a. Grouted Masonry: HAS-E Standard or HAS SS rods, washers, and nuts of required finish with Hilti HIT HY 70 Adhesive Anchorage System for anchorage to masonry, ICC ESR-2682.
  - 4. Manufacturers: Subject to compliance with all requirements and performance criteria provide equivalent products manufactured by one of the following:
    - a. Hilti
    - b. Simpson Strong Tie
    - c. Dewalt/Powers

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 2. Installation constitutes acceptance of existing conditions and responsibility of satisfactory performance.

### 3.2 INSTALLATION, GENERAL

- A. Where manufacturer recommends the use of special tools for installation of anchors, such tools shall be used.
- B. Match mark and drill, match drill or use other methods to ensure anchors are properly located.

- C. Do not adjust anchor location after installation. Coordinate with EOR for modifications to connected element where anchors are incorrectly located.
- D. All facets of hole drilling, hole cleaning, anchor installation, anchor torqueing shall be in strict accordance with the ICC-ESR report and manufacturer's data.
- E. Drill holes perpendicular to substrate surface.
- F. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits as indicated in the ICC-ESR report.
- G. Drill bits and core bits shall be of diameters indicated in the ICC-ESR report.
- H. All holes shall be cleaned with compressed air to remove all drilling dust and other deleterious substances.
- I. Remove water from holes to attain a surface dry condition unless specifically permitted otherwise by ICC-ESR report.
- J. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- K. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
- L. Perform anchor installation in strict accordance with manufacturer instructions and ICC-ES report.
- M. Anchors shall be installed perpendicular to the substrate face within plus or minus 5 degrees unless specifically permitted otherwise by ICC-ESR report.
- N. Install plate washers where specifically indicated or where connected elements have oversized holes.
- O. Install a round washer under nuts. Round washers are in addition to plate washers where plate washers are required.

### 3.3 WEDGE ANCHORS

- A. Protect threads from damage during anchor installation.
- B. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

### 3.4 CARTRIDGE INJECTION ADHESIVE ANCHORS

- A. Clean all holes per manufacturer instructions using manufacturer's approved tools to remove loose material and drilling dust prior to installation of adhesive.



- B. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- C. Follow manufacturer recommendations to ensure proper mixing of adhesive components.
- D. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface.
- E. Remove excess adhesive from the surface.
- F. Shim anchors with suitable device to center the anchor in the hole.
- G. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- H. Observe manufacturer recommendations with respect to installation temperatures.

### 3.5 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.6 REPAIRS AND PROTECTION

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.
- B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 050520

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

##### A. Section Includes:

1. Structural steel.
2. Embed Plates
3. Bearing Plates
4. Loose Lintels
5. Steel Joist Framing Struts
6. Shelf Angles anchored to steel structure
7. Brick Shelf Angles, Brick Relieving Angles and Hung Lintels anchored to masonry walls
8. Hung Lintels attached to the steel frame
9. Nonshrink Grout.

##### B. Products furnished, but not installed under this Section:

1. Loose Steel Lintels, installed under Division 04 Section "Brick Masonry"
2. Brick Shelf Angles, Brick Relieving Angles and Hung Lintels anchored to masonry walls and associated anchors, installed under Division 04 Section "Concrete Unit Masonry"
3. Anchor rods and embed plates indicated to be built into masonry, installed under Division 04 Section "Concrete Unit Masonry".
4. Anchor rods and embed plates indicated to be cast into cast-in-place concrete, installed under Division 03 Section "Cast-in-place-Concrete"

##### C. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Metal Stairs."
3. Division 05 Section "Post Installed Structural Anchors" for wedge, and adhesive anchors
4. Division 09 painting Sections for special surface-preparation and priming requirements.

#### 1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" and as modified herein.
- B. Seismic-Force-Resisting System: Elements of structural-steel frame designated as "SFRS" or along grid lines designated as "SFRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
  1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
  2. Welded built-up members with plates thicker than 2 inches.
  3. Plates thicker than 2 inches.

- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Force-Resisting System.
  - 1. PJP and CJP welds of columns to column base plates.
  - 2. PJP and CJP welds of SFRS beam flanges to columns
  - 3. PJP and CJP welds of SFRS sing plate shear connections to columns
  - 4. PJP and CJP welds of SFRS beam webs to columns
  - 5. PJP and CJP welds of SFRS column splices
  - 6. Other welds specifically noted as demand critical in the applicable sections of the AISC Seismic Provisions
  - 7. Other welds specifically indicated on drawings
  - 8. Other welds specifically noted as demand critical in prequalified connection criteria.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using AISC 360 .
  - 2. Use LRFD; data are given at factored-load level.
  - 3. All bolted connections for bracing members shall be designed and fabricated as slip critical connections to allow for field reaming of holes to address fit up issues.
  - 4. All bolted connections for axial loaded members shall be designed and fabricated as slip critical connection to allow for field reaming of holes to address fit up issues.
  - 5. The minimum number of bolts for any connection shall be two.
  - 6. All steel to steel connections shall extend at least two thirds of the depth of the supported member being connected.
  - 7. All connections shall be designed to fit within the confines of concealed spaces unless specifically noted as acceptable to be exposed to view.
  - 8. Connections shall allow for flush deck bearing at top flange of all beams beneath deck. If cover or flange plates are used a method for flush deck support around the cover/flange plate shall be provided at no cost to the owner.

#### 1.5 SUBMITTALS

- A. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"
- B. Fabricator's Certificate of Compliance Per Division 01 Section "Quality Requirements"
- C. Quality Control Plan: Job specific Quality Control Plan for Fabricator and Erector including qualification data for the following:
  - 1. Testing and inspection personnel.
  - 2. Testing agency testing and inspection personnel
- D. Weekly Inspection reports for Shop Fabricated Steel
- E. Nonconformance reports for Shop Fabricated Steel

F. Product Data:

1. Primers
2. Paints
3. Electrodes
  - a. Indicate what welding process will be used with each electrode
  - b. Submit electrodes for both shop and field welding
  - c. Indicate compliance with AWS D1.8 Clause 6.3 for electrodes used in both SFRS Connections and Demand Critical Welds
4. Bolts, nuts, and washers including mechanical properties and chemical analysis.
5. Direct-tension indicators.
6. Tension-control, high-strength bolt-nut-washer assemblies.
7. Shear stud connectors.
8. Deformed bar anchors.
9. Nonshrink grout.
10. Post installed structural anchors: See specification section 050520

G. Shop Drawings: Show fabrication of structural-steel components.

1. Coordinate with Dimensional control notes included in the contract documents and field verify all necessary dimensions associated with existing elements prior to commencing with shop drawings.
2. All anchor rods shall be detailed with a minimum 2" projection above top of nut in the final installed condition unless noted otherwise.
3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
4. Include embedment drawings showing plan location and elevation of all embedded items.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
7. Include scale drawings of all gusset plates.
8. Provide minimum 1/4" thick cap plates at the ends of all exposed HSS members, and at the top of all HSS columns.
9. Equally space filler beams or joists between columns and/or other dimensioned beams unless noted otherwise.
10. Where professional design submittals are required the professional design submittal must be included with associated shop drawings or the submittal will not be reviewed.
11. Identify members and connections of the seismic-force-resisting system.
12. Indicate locations and dimensions of protected zones.
13. Identify demand critical welds.

H. Professional Design Services Submittal:

1. Steel to Steel Connections:
  - a. For structural steel connections indicated to comply with design loads provide structural design data signed and sealed by the qualified professional design services engineer responsible for their preparation.
    - 1) Each individual calculation shall be clearly labeled in coordination with erection drawings such that it identifies the member(s) that the connection applies to.

- b. Professional Design Certification Statement: A written statement indicating that the for fabrication shop drawings incorporate all the connection requirements included in the calculations submitted for approval inclusive of any corrections required in response to shop drawing review comments. The statement shall be prepared by, and signed and sealed by the professional engineer that completed the calculations submittal.
  - c. The calculations must be included with the associated shop drawing submittal or the submittal will not be reviewed.
  
- I. Slip Critical Bolt Installation Statement: A written statement indicating the means and equipment to be used to achieve the tightening requirements for clip critical bolt installation. Statement shall identify the specific pre-installation required by the special inspections and acknowledge that this testing must be coordinated and completed prior to commencement of erection.
  
- J. As-built anchor rod and embed survey
  
- K. Welding certificates
  - 1. Submit welding certificates for all individuals expected to be performing field welding
  
- L. Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each field welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).
  - 2. Electrode manufacturer and trade name, for demand critical welds.
  
- M. Qualification Data:
  - 1. Fabricator
  - 2. Structural Steel Erector
  - 3. Post Installed Structural Anchor Installer: See specification section 050520
  
- N. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
  
- O. Research/Evaluation Reports:
  - 1. Post Installed Structural Anchors per specification section 050520
  
- P. Material Test Reports
  - 1. Heavy Sections:
    - a. Charpy V-Notch Testing
  
- Q. Minutes of preinstallation conference.
  
- 1.6 QUALITY ASSURANCE
  - A. Quality Control Plan: Each fabricator and Erector shall provide a job specific Quality Control plan.
    - 1. The plan shall specifically identify all QC and QA inspections the fabricator and erector will be completing, the frequency of those inspections and the contractor's personnel and/or contractor's testing agency that will be completing the specific inspections.

2. AISC Code of Standard Practice
  3. The plan shall comply with AISC 360-10 chapter N modified as follows:
    - a. 100% UT of CJP groove welds without reduction.
  4. The plan shall comply with AWS D1.1
  5. The plan shall comply with the requirements of AISC 341-10 Chapter J,
  6. The plan shall comply with AWS D1.8.
  7. The plan shall include any additional inspections or testing identified in the contract documents.
- B. Professional Design Services Engineer
1. Responsibility: Preparation of design calculations for structural steel connections
  2. 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.
- C. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category SBD (Conventional Steel Building Structures) and which employs personnel or an independent testing agency that are qualified to complete all the required inspections and testing. Personnel shall be qualified as required by AWS D1.1 where completing weld testing and inspection.
1. Fabricator Responsibility
    - a. The structural steel fabricator shall be responsible for enlisting the Steel Deck fabricator for steel deck bearing on structural steel as a direct subcontractor.
    - b. The structural steel fabricator shall be responsible for enlisting the steel erector as a direct subcontractor.
    - c. The structural steel fabricator shall be responsible for enlisting the steel deck erector for steel bearing on structural steel as a direct subcontractor.
- D. Fabricator's Testing Agency (as required to supplement fabricator personnel): An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated. Personnel shall be qualified as required by AWS D1.1 where completing weld testing and inspection.
- E. Structural Steel Installer Qualifications: The erector shall be experienced in installing structural steel equal in material, design and scope to the structural steel required for this project.
- F. Post Installed Structural Anchor Installer: See specification section 050520 for requirements
- G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- H. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
  2. AISC 341-10
  3. AISC 360.
  4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- I. Preinstallation Conference: Conduct conference at Project site.

1. Review special inspection and testing and inspecting agency procedures for field quality control.
2. Review items requiring special inspection and testing that must be tested and inspected prior to installation of decking, concrete slabs, or other items that might limit access to the item to be tested or inspected
3. Review welding requirements
4. Review electrode storage requirements
5. Review pre-construction bolt installation verification
6. Review bolt installation calibration requirements
7. Review requirements for protected zones

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

#### 1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of 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 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes and Tees: ASTM A 992.
  1. In addition Heavy shapes shall have a minimum Charpy V-notch toughness of 20ft-lb at 70 degrees tested in alternate core locations as described in ASTM A6 Supplementary Requirement S30
- B. Channels, Angles-Shapes:
  1. ASTM A 36 unless noted otherwise
  2. ASTM A 572/A 572M, Grade 50 where indicated.
- C. Plate and Bar:
  1. ASTM A 36 unless noted otherwise

2. ASTM A 572/A 572M, Grade 50 where indicated.
3. In addition Heavy shapes shall have a minimum Charpy V-notch toughness of 20ft-lb at 70 degrees tested in alternate core locations as described in ASTM A6 Supplementary Requirement S30

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

1. Square or Rectangular HSS:  $F_y=46$  KSI
2. Round HSS:  $F_y=42$  KSI

E. Welding Electrodes:

1. Comply with AWS D1.1 requirements.
2. In addition all weld filler metal for SFERS connections shall comply with AWS D1.8 Clause 6.3
3. In addition all weld filler metal for Demand Critical Welds shall comply AWS D1.8 Clause 6.3

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM A 490 as indicated or as required, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish:

- a. Plain for primed or painted steel
- b. Hot-dip zinc coating, ASTM A 153/A 153M, Class C for hot dip galvanized steel.

2. Direct-Tension Indicators (At Contractor's option for Pretensioned or Slip Critical Connections: ASTM F 959, Type 325 or Type 490 corresponding to bolt type, compressible-washer type.

a. Finish:

- 1) Plain for unprimed steel or steel receiving standard shop primer.
- 2) Mechanically deposited zinc coating, ASTM B 695, Class 50 for hot galvanized steel or steel to receive high performance top coating.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852 or ASTM F 2280 as indicated or as required, Type 1, heavy hex or round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish:

- 1) Plain for unprimed steel or steel receiving standard shop primer.
- 2) Mechanically deposited zinc coating, ASTM B 695, Class 50 for hot galvanized steel or steel to receive high performance top coating.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, or ASTM F 1554, Grade 105 as indicated.

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish:



- a. Plain for unprimed steel or steel receiving standard shop primer.
    - b. Hot-dip zinc coating, ASTM A 153/A 153M, Class C for hot galvanized steel or steel to receive high performance top coating.
  - D. Thread Studs: ASTM A 108, Grades 1015 through 1020, Full Threaded-stud type, cold-finished carbon steel; AWS D1.1, Type B.
  - E. Headed Stud Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
  - F. Deformed Bar Anchors (DBA's): ASTM A496; AWS D1.1
  - G. Threaded Rods: ASTM A 36 unless noted otherwise.
    - 1. Nuts: ASTM A 563 heavy hex carbon steel.
    - 2. Washers: ASTM A 36/A 36M carbon steel.
    - 3. Finish:
      - a. Plain for unprimed steel or steel receiving standard shop primer.
      - b. Hot-dip zinc coating, ASTM A 153/A 153M, Class C for hot galvanized steel or steel to receive high performance top coating.
  - H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
    - 1. Finish:
      - a. Plain for unprimed steel or steel receiving standard shop primer.
      - b. Hot-dip zinc coating, ASTM A 153/A 153M, Class C for hot galvanized steel or steel to receive high performance top coating.
  - I. Post Installed Structural Anchors: See specification section 055020 for products
- 2.3 PRIMER
- A. Special Primer: Provide shop primer that complies with Division 09 painting sections as applicable.
- 2.4 PAINT
- A. Column Base Paint: A single component, self-priming cold applied Coal Tar Mastic suitable for corrosion protection of below grade steel.
    - 1. Typical at column bases at exterior locations and/or as specifically noted on drawings.
  - B. Galvanizing Repair Paint: ASTM A 780.
- 2.5 NONSHRINK GROUT
- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- 2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- F. Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of deformed bar anchors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type:
    - a. Snug tightened unless noted otherwise
    - b. Slip critical, class "A" for all members of the SFRS.
- B. Weld Connections:
  - 1. Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
3. Elements that are part of the SFRS:
  - a. Comply with AISC 341-10, AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
4. Demand Critical Welds:
  - a. Comply with AISC 341-10, AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.8 CLEANING

- A. Clean and prepare steel surfaces that are to receive special primer after galvanizing according to the associated painting specification.

## 2.9 SPECIAL PRIMING:

- A. All steel indicated as hot dip galvanized and shop primed shall be shop primed per Division 09 painting sections.

## 2.10 GALVANIZING

- A. All structural steel on the project shall be hot-dip galvanized unless noted otherwise.
- B. Coordinate shop priming of galvanized steel where indicated on drawings and in specifications.
- C. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
  1. Fill vent and drain holes that will be exposed to the environment or that will be exposed in the finished work by plugging with zinc solder and filing off smooth.
  2. Galvanized elements to be shop primed and field top coated shall not be quenched, and shall be swept blast to ensure proper adhesion of top coats. Coordinate substrate treatment and preparation with priming and painting specifications.

## 2.11 SOURCE QUALITY CONTROL

- A. All source quality control and source quality assurance shall be completed by the fabricator's qualified personnel and/or the fabricator's qualified testing agency and shall be in accordance with the submitted and approved job specific quality control manual.
  1. Additional weld inspections as noted herein or in the contract documents.
  2. Payment for shop testing and inspection shall be the responsibility of the fabricator.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified as-built survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required. All shims shall be steel material.
  - 2. Weld plate washers to top of baseplate as indicated.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed.
  - 4. Bearing plates and loose column base plates shall be grouted and cured prior to erecting the steel to be supported by the plate
  - 5. Base plates attached to columns shall be grouted as soon as possible after the column has been plumbed. Base plates shall be grouted and cured before any elevated slabs are cast or before any column splices are made.
  - 6. Prior to grouting all loose and latent material shall be removed from bearing surfaces and base or bearing plates. Concrete or masonry surfaces shall be broom clean. All shims or wedges shall be left in place and cut flush to the edge of the base or bearing plate.

7. Grout shall be placed solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation and curing instructions for shrinkage-resistant grouts.
    - a. Use grout forms and grout surcharging as required to ensure that grout completely fills the space below bearing or base plate, and no voids remain.
  8. Paint base plates, anchor bolts and sections of columns below grade and below finished floor with Coal Tar Mastic Paint when indicated on drawings.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
1. For slip critical connections enlarge hole to next standard hole size and provide next standard bolt size.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- J. Shelf Angles anchored to steel frame:
1. Sequencing of shelf angle installation shall be as indicated in drawings
  2. Unless noted otherwise do not permanently attach shelf angles until concrete slabs have been poured and cured.
  3. Once slabs have been poured and cured coordinate final elevation of shelf angle with contract documents and masonry contractor and permanently fasten.
- K. Pour stops and edge angles: Pour stops and edge angles shall be field installed based on global building control lines to ensure overall building geometry is maintained.
1. Do not located based on local member geometry.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: As indicated on shop drawings.
- B. Finger Tight Bolts: All joints noted as finger tight shall be hand tightened as required to install elements. Do not tighten by mechanical means
  - 1. Provide jam nuts to prevent nut from backing off.
  - 2. After initial tightening turn nut and jam nut in opposite direction to bind them against one another.
- C. Weld Connections:
  - 1. Do not use welded connections for galvanized structural steel unless specifically noted or approved.
  - 2. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
  - 4. Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 5. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
  - 6. Elements that are part of the SFRS:
    - a. Comply with AISC 341-05 Appendix W, AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
- D. Post Installed Structural Anchors: See specification section 050520 for products

### 3.5 FIELD PAINTING

- A. Column bases: Paint column bases below grade and/or below finished floor at exterior conditions and/or conditions specifically noted on drawings with column base paint.
  - 1. Apply in strict accordance with manufacturer's recommendations
  - 2. Apply multiple coats as required by manufacturer, but not less than two individual coats allowing proper dry time between coats.
- B. Field painting of structural steel for finished appearance in exposed conditions or for high performance coating systems is specified in Division 09 painting sections.

### 3.6 FIELD QUALITY CONTROL

- A. The erector shall complete Field Quality control in accordance with AISC 360 Chapter N
- B. The erector shall complete Field Quality control in accordance with AISC 341-10 Chapter J
- C. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements when the work was deemed deficient upon initial testing or inspection.

### 3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: At all exterior and exposed interior conditions promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
  - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
  - 2. Apply a primer of same type as shop primer used on adjacent surfaces. Coordinate with Part 2 priming requirements

END OF SECTION 051200

## SECTION 052100 - STEEL JOIST FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. K and KCS-series steel joists.
  - 2. Joist accessories.
- B. Related Sections include the following:
  - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2. Division 09 painting sections for special surface-preparation and special priming requirements.

#### 1.3 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide joists and connections capable of withstanding design loads indicated. All joist indicated using standard SJI designations shall be designed for the standard SJI loading and as follows:
  - 1. Apply 750 lbs of the standard SJI service loading as a moving point live load. Complete the analysis with the 750lb point load applied at all locations along the span on the top chord and bottom chord, non-concurrent. The point load shall be concurrent with the balance of the standard SJI service loading. This load shall assume a joist strut to distribute the point load to the nearest panel point of the opposing chord, and does not require local chord bending to be investigating for moments associated with this specific load.
  - 2. Apply 250 lbs of the standard SJI service loading as a moving point live load. Complete the analysis with the 250lb point load applied at all locations along the span on both the top chord and bottom chord. The point load shall be concurrent with the balance of the standard SJI service loading. Chord bending shall be checked for moments associated with this specific loading.
  - 3. Apply a uniform wind uplift loading based on the specified components and cladding pressures for elements receiving internal pressure. The components and cladding pressures shall be based on the location and tributary area of each individual joist or joist girder. Where components and cladding pressures are not specifically indicated the bid shall allow for all cost associated with joists providing uplift resistance based on component and cladding forces in accordance with the governing building code. Uplift shall be designed for assuming an in place service dead load of 5 psf.
    - a. Uplift pressures for top chord extensions at all eaves and overhangs shall be based on the specified components and cladding pressures for overhangs.
  - 4. All joists sloped more than 1/4" per foot shall be designed for the additional top chord tension and compression loads created by the slope.
  - 5. See plans and details for specifically indicated rollover loadings to be used for seat design. Where



not specifically indicated otherwise all joist seats shall be designed for a factored ASD rollover force of 2,500 lbs.

6. See plans and details for specifically indicated top chord axial loadings. Where not specifically indicated otherwise all joist stop chords shall be designed for a factored ASD axial tension or compression force of 1,000 lbs.
7. All loads are service loads unless noted otherwise.

B. Design joists to withstand design loads with live load deflections no greater than the following:

1. Roof Joists:

- a. Live Load vertical deflection of 1/360 of the span.
- b. Dead Load plus Live Load vertical deflection of 1/240 of the span.
- c. Wind/Uplift Load (0.7 times actual load) vertical deflection of 1/240 of the span

## 1.5 SUBMITTALS

A. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"

B. Fabricator's Certificate of Compliance Per Division 01 Section "Quality Requirements"

C. Product Data:

1. Welding Electrodes for field welding
2. Primer.

D. Shop Drawings: Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Coordinate locations and details of bearing plates to be embedded in other construction.
2. Staggered joist spacing is allowed at adjacent bays where the bearing length is less than required by SJI.
  - a. When staggering is required coordinate required revisions to bearing plates with steel fabricator and EOR to ensure proper bearing width is provided.

3. Equally space joists between columns and/or dimensioned beams unless noted otherwise.

4. All dimensioning of masonry walls shall be based on actual masonry dimensions (i.e. 7 5/8" for 8" cmu).

5. Where delegated design submittals are required the delegated design submittal must be included with associated shop drawings or the submittal will not be reviewed.

E. Professional Design Services Submittal:

1. Comprehensive engineering analysis of all joists signed and sealed by the qualified professional engineer responsible for its preparation.
2. The calculations must be included with the associated shop drawing submittal or the submittal will not be reviewed.

F. Welding certificates

1. Submit welding certificates for all individuals expected to be performing field welding

G. Weld Procedure Specifications (WPS's) and Procedure Qualification Records (PQRs):

1. Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
    - a. Power source (constant current or constant voltage).
    - b. Electrode manufacturer and trade name
  2. Provide a WPS for welding of headed studs through deck and to galvanized base metal
  3. Submit weld procedure specifications for all welds to be completed in the field
- H. Professional Design Certification Statement: A written statement indicating that the for fabrication shop drawings incorporate all the fabrication requirements included in the calculations submitted for approval inclusive of any corrections required in response to shop drawing review comments. The statement shall be prepared by, and signed and sealed by the professional engineer that completed the calculations submittal.
- I. Qualification Data: For manufacturer.
- J. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats
- 1.6 QUALITY ASSURANCE
- A. 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 joists to comply with performance requirements.
- B. Erector Qualifications: The erector shall be experienced in installing steel joist equal in material, design and scope to the steel joist required for this project.
- C. Professional Design Services Engineer
1. Responsibility: Preparation of Shop Drawings, design calculations, and other structural data for elements requiring design to meet specified performance criteria
  2. 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.
- D. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.
- 1.8 COORDINATION
- A. Provide approved shop drawing submittals to steel decking supplier for coordination of decking layout.
- B. Provide final field use shop drawing to decking supplier for final coordination of decking layout.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Top Chord Members: All top chord members shall have a minimum gross width of 3 inches, with not less than 1 ½ inch per individual chord member.
- B. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
  - 1. Finish: Plain, uncoated.
- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
  - 1. Finish: Plain.
- E. Welding Electrodes: Comply with AWS standards.

### 2.2 PRIMERS

- A. Standard Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
  - 1. Typical all primed steel unless noted otherwise
- B. Special Primer: Provide shop primer that complies with Division 09 painting Sections.

### 2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members.
  - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
  - 2. End Arrangement: Underslung unless noted otherwise.
  - 3. Top-Chord Arrangement:
    - a. Parallel unless noted otherwise
    - b. Pitched as specifically indicated on plans.
  - 4. Seat Depth:
    - a. 2 1/2" unless noted otherwise
    - b. Provide special depth seats as indicated on drawings
    - c. Provide special depth seats along common bearing lines to match depth of seats for joist framing adjacent bays with different or non-standard seat depths.
    - d. Provide special seat depths as required to accommodate sloping joists.
    - e. At all conditions requiring special seats maintain the deck bearing plane. Coordinate change in bearing elevation with structural steel fabricator.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- D. Provide holes in chord members for connecting and securing other construction to joists.
- E. Provide a special seat where 4" long bearing is not provide where the supporting structure is masonry or concrete with a bearing plate and 2 1/2" long bearing is not provided on supporting steel structure.
- F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
  - 1. Extended end shall be designed for the standard SJI loading of the associated joist unless noted otherwise.
  - 2. Provide Extended Ends to extend the full width of the supporting element when the adjacent bay is not framed with bar joists unless noted otherwise.
- G. Camber Joist as follows:
  - 1. At pitched roofs with slope of 2 on 12 or greater camber joist for 5 psf uniform dead load unless noted otherwise.
  - 2. At low sloped roofs with slope of less than 2 on 12 camber joist for 10 psf uniform dead load.
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

#### 2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
  - 1. Coordinate bridging with specific locations indicated on plans to have ductwork or other items located within the space between joists.
- B. Steel bearing plates with integral anchorages are specified in Division 05 Section "Structural Steel Framing."
- C. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

#### 2.5 CLEANING AND SHOP PRIMING

- A. Cleaning:
  - 1. Standard Cleaning: For members to receive standard primer clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
  - 2. Special Cleaning: For members to receive special primer coordinate cleaning requirements with the associated painting specification section. When not specifically noted the minimum cleaning shall be power tool cleaning, SSPC-SP6.
- B. Priming:
  - 1. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

2. Standard Priming:
  - a. All joist and joist accessories to be located interior and in concealed from view shall be primed with once coat of Standard Shop Primer to provide a continuous dry paint film not less than 1 mil thick.
  - b. Typical all joist unless specifically noted otherwise.
3. Special Priming:
  - a. All joist located in interior spaces but to remain exposed shall be shop primed per Division 09 painting sections

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- 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. Do not rigidly connect bottom chord extensions to columns or supports unless specifically indicated.
- C. Field weld joists to supporting steel bearing plates and framework. 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. Unless noted otherwise weld joist as follows:
  1. K-series and KCS type K-series joist: 1/8" fillet weld, 2" each side of bearing seat
- D. Bolt joists to supporting steel framework using carbon-steel bolts as required for erection stability.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

### 3.3 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

#### 3.4 REPAIRS AND PROTECTION

- A. Touchup Painting: At all exterior and exposed interior conditions promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
  - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
  - 2. Apply a primer of same type as shop primer used on adjacent surfaces. Coordinate with Part 2 priming requirements
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

## SECTION 053100 - STEEL DECKING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.
3. Noncomposite form deck.

- B. Related Sections include the following:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
3. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
4. Division 05 Section "Structural Steel Framing" for framing deck openings with miscellaneous steel shapes.
5. Division 09 painting Sections for field painting of primed and galvanized deck.

#### 1.3 PERFORMANCE REQUIREMENTS:

- A. Deck Fastening Systems: The basis of design for the deck fastening systems is outlined in this specification and the contract documents. Product substitutions must result in diaphragm shear strength, and uplift resistance capacities equal or greater than values calculated for each specific condition. The baseline strength shall be calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code. See requirements for substitution submittals.

#### 1.4 DEFINITIONS

- A. Protected Zone: Structural steel members or portions of structural steel members indicated as "Protected Zone" on Drawings. Penetrating fastener connections to structural steel members in protected zones is not permitted.

#### 1.5 SUBMITTALS

- A. Product Data:

1. Electrodes
2. Galvanizing Repair Paint
3. Sidelap fasteners

4. Mechanical fasteners
  5. Powder Actuated Fasteners
  6. Primer
  7. Protected Zone Marking Paint
  8. Fastener Type Marking Paint
- B. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"
- C. Quality Control Plan: Job specific Quality Control Plan for the Steel Deck Erector
- D. Shop Drawings: Submit detailed layout showing placement extent of each type of deck including the following:
1. Coordinate layout with approved Engineered cold-formed metal trusses and Steel joist shop drawings
  2. Anchorage pattern for each type of deck and each anchorage condition
  3. Details for flat sump pans and associate anchorage
  4. Details of hip, ridge and valley plates and associated anchorage
  5. Details of cover plates and associated anchorage and changes in deck direction.
  6. Details of end jointed conditions
  7. Details of side lap conditions.
  8. Details of girder fills
  9. Details of finish/filler strips
  10. Details of pour stops
- E. Product Certificates: For each type of steel deck, signed by product manufacturer.
- F. Welding certificates.
1. Submit welding certificates for all individuals expected to be performing field welding
- G. Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code -Steel" and AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
  2. Electrode manufacturer and trade name, for demand critical welds.
  3. Supplement standard WPS with parameter for time per weld for each size of weld.
- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- I. Research/Evaluation Reports:
1. For steel decking in fire resistance assemblies submit reports per the assembly specification.
  2. Submit ICC reports for the following:
    - a. Side lap Fasteners
    - b. Mechanical fasteners
    - c. Power actuated fasteners
- J. Qualification Data: Submit Powder Actuated Fastener installer qualification data as stated in Quality Assurance section. Qualifications shall be submitted in a letter format for each type of anchor to be installed, and shall include the following:



1. The specific product to be used
2. Complete description of installation procedure
3. Personnel to be trained on fastener installation
4. Date of Manufacturer training
5. Manufacturer's training certificates or letter from manufacturer certifying training was complete with a list of individuals that were trained.

K. Substitution for Deck Fastening Systems:

1. Substitutions to a welded fastening system in lieu of powder actuated fastening system will not be permitted except as specifically noted.
2. Substitution requests may only be made using products with ICC-ESR reports for the product indicating approval for use of the product in the specific condition existing on this project.
3. Substitution requests shall include signed and sealed calculations demonstrating that the product is capable of providing equivalent performance of the basis of design product for each specific location and condition when calculated using the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code.
4. An increase in material or labor cost resulting from the substitution shall be the responsibility of the contractor.

## 1.6 QUALITY ASSURANCE

A. Quality Control Plan: Each deckErector shall provide a job specific Quality Control plan.

1. The plan shall specifically identify all QC and QA inspections erector will be completing, the frequency of those inspections and the erector's personnel and/or erector's testing agency that will be completing the specific inspections.
2. The plan shall comply with the latest edition of the SDI "Standard for Quality Control and Quality Assurance for Installation of Steel Deck".

B. Manufacturer Qualifications: A manufacturer certified by SDI to manufacture steel deck complying with applicable standard specifications and load tables of SDI "Specifications".

1. The Manufacturer for steel deck bearing on structural steel shall be act as a direct subcontractor of the structural steel fabricator.
2. Manufacturer's responsibilities include providing professional engineering services for designing deck to comply with performance requirements.

C. Erector Qualifications: The erector shall be experienced in installing steel deck equal in material, design and scope to the steel deck required for this project.

D. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

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

F. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

- G. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- H. SDI Specifications:
  - 1. Form Deck shall comply with ANSI/SDI NC-2010, "Standard for Non-Composite Floor Deck", or latest adopted edition of the standard.
  - 2. Roof Deck shall comply with ANSI/SDI RD-2010, "Standard for Steel Roof Deck", or latest adopted edition of the standard.
  - 3. Composite Steel Deck shall comply with ANSI/SDI-C1.O-2006, "Standard for Composite Steel Floor Deck", or latest adopted edition of the standard.
- I. Professional Engineering Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of the kind indicated.
- J. Powder Actuated Fastener Installer Training: Conduct a thorough training session with the manufacturer's representative. Each individual responsible for the installation of fasteners shall attend the training session. Training shall consist of a review of the complete process for the installation of the fasteners and the use of proper equipment for the installation.
- K. Preinstallation Conference: Conduct conference at Project site in conjunction with preinstallation conference for the supporting substrate (i.e. structural steel, steel joists, etc.)
  - 1. Review special inspection and testing and inspecting agency procedures for field quality control.
  - 2. Review items requiring special inspection and testing that must be tested and inspected prior to installation of decking
  - 3. Review welding requirements
  - 4. Review electrode storage requirements
  - 5. Review requirements for protected zones

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
  - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.
- C. Store steel decking on supports off the ground
- D. Keep steel decking free of dirt and foreign matter.

#### 1.8 COORDINATION

- A. Coordinate layout of steel decking in areas of engineered cold-formed truss/rafter framing with approved truss/rafter shop drawings. Do not submit decking for these areas for approval until engineered cold-formed truss framing shop drawings have been approved. Prior to fabrication perform a final coordination with field use engineered cold formed metal truss framing shop drawings.

- B. Coordinate layout of steel decking in areas of steel joist framing with approved joist shop drawings. Do not submit decking for these areas for approval until steel joist shop drawings have been approved. Prior to fabrication perform a final coordination with field use engineered steel joist shop drawings.

## PART 2 - PRODUCTS

### 2.1 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves as follows:

1. Type "RD1" (galvanized) and "RD1P" (galvanized and primed)
  - a. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G90 zinc coating.
  - b. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G90 zinc coating; cleaned, pretreated, and bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - 1) Color: Coordinate with finish paint color
  - c. Deck Profile: Type WR, wide rib.
  - d. Profile Depth: 1-1/2 inches.
  - e. Properties as follows:
    - 1) Design Uncoated-Steel Thicknesses: 0.0358 inch
    - 2) Moment of Inertia (Ip): 0.198 in<sup>4</sup>/ft
    - 3) Moment of Inertia (In): 0.218 in<sup>4</sup>/ft
    - 4) Section Modulus (Sp): 0.226 in<sup>3</sup>/ft
    - 5) Section Modulus (Sn): 0.237 in<sup>3</sup>/ft
    - 6) Yield Strength (Fy): 33 ksi
  - f. Span Condition: Double span unless noted otherwise.
  - g. Side Laps: Nested
  - h. End Joints: Lapped
2. Type "RD2"(galvanized) and "RD2P" (galvanized and primed)
  - a. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G90 zinc coating.
  - b. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G90 zinc coating; cleaned, pretreated, and bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - 1) Color: Coordinate with finish paint color
  - c. Deck Profile: Type IR, intermediate rib.
  - d. Profile Depth: 3 inches.
  - e. Properties as follows:
    - 1) Design Uncoated-Steel Thicknesses: 0.0358 inch
    - 2) Moment of Inertia (Ip): 0.714 in<sup>4</sup>/ft
    - 3) Moment of Inertia (In): 0.874 in<sup>4</sup>/ft
    - 4) Section Modulus (Sp): 0.400 in<sup>3</sup>/ft
    - 5) Section Modulus (Sn): 0.449 in<sup>3</sup>/ft
    - 6) Yield Strength (Fy): 33 ksi

- f. Span Condition: Double span unless noted otherwise.
- g. Side Laps: Nested
- h. End Joints: Lapped

## 2.2 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Type "CFD1" (galvanized) and "CFD1P" (galvanized and primed)
  - a. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating.
  - b. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - 1) Color: Coordinate with finish paint color
  - c. Profile Depth: 3 inches
  - d. Properties as follows:
    - 1) Design Uncoated-Steel Thicknesses: 0.0358 inch
    - 2) Area (As): 0.610 in<sup>2</sup>/ft
    - 3) Moment of Inertia (I): 0.967 in<sup>4</sup>/ft
    - 4) Section Modulus (Sp): 0.562 in<sup>3</sup>/ft
    - 5) Section Modulus (Sn): 0.606 in<sup>3</sup>/ft
    - 6) Yield Strength (Fy): 40 ksi
  - e. Span Condition: Double span unless noted otherwise.
  - f. Side Laps: Interlocking
  - g. End Joints: Butted
2. Type "CFD2" (Galvanized) and "CFD2P" (Galvanized and primed)
  - a. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
  - b. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - 1) Color: Coordinate with finish paint color
  - c. Profile Depth: 2 inches
  - d. Properties as follows:
    - 1) Design Uncoated-Steel Thicknesses: 0.0358 inch
    - 2) Area (As): 0.540 in<sup>2</sup>/ft
    - 3) Moment of Inertia (I): 0.419 in<sup>4</sup>/ft
    - 4) Section Modulus (Sp): 0.346 in<sup>3</sup>/ft
    - 5) Section Modulus (Sn): 0.378 in<sup>3</sup>/ft
    - 6) Yield Strength (Fy): 40 ksi
  - e. Span Condition: Double span unless noted otherwise.

- f. Side Laps: Interlocking
  - g. End Joints: Butted
3. Type "CFD3" (Galvanized) and CFD3P (Galvanized and primed)
- a. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating.
  - b. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - 1) Color: Coordinate with finish paint color
  - c. Profile Depth: 3 inches
  - d. Properties as follows:
    - 1) Design Uncoated-Steel Thicknesses: 0.0474 inch
    - 2) Area ( $A_s$ ): 0.810 in<sup>2</sup>/ft
    - 3) Moment of Inertia (I): 0.1311 in<sup>4</sup>/ft
    - 4) Section Modulus ( $S_p$ ): 0.799 in<sup>3</sup>/ft
    - 5) Section Modulus ( $S_n$ ): 0.826 in<sup>3</sup>/ft
    - 6) Yield Strength ( $F_y$ ): 40 ksi
  - e. Span Condition: Double span unless noted otherwise.
  - f. Side Laps: Interlocking
  - g. End Joints: Butted

### 2.3 NONCOMPOSITE FORM DECK

- A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
- 1. Type "NCFD1"
    - a. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating.
    - b. Profile Depth: 9/16 inch.
    - c. Properties as follows:
      - 1) Moment of Inertia (I): 0.019 in<sup>4</sup>/ft
      - 2) Section Modulus ( $S_p$ ): 0.057 in<sup>3</sup>/ft
      - 3) Section Modulus ( $S_n$ ): 0.057 in<sup>3</sup>/ft
      - 4) Yield Strength ( $F_y$ ): 60 ksi
    - d. Span Condition: Double span unless noted otherwise.
    - e. Side Laps: Nested.
    - f. Span Condition: Double span unless noted otherwise.
    - g. Side Laps: Nested.
    - h. End Joints: Lapped

## 2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber. Profile to match underside of associated deck profile
- C. Powder Actuated Fasteners: Basis of design product as indicated on drawings. See requirements for substitution submittals. Where not specifically indicate the basis of design fasteners shall be Hilti fasteners in accordance with ICC ESR-2197.
- D. Mechanical Fasteners: Unless noted otherwise, ASTM C1513, corrosion-resistant coated, self-drilling, self-tapping steel drill screws. No. 10 minimum diameter unless noted otherwise.
- E. Side-Lap Fasteners: Unless noted otherwise, ASTM C1513, corrosion-resistant coated, self-drilling, self-tapping steel drill screws. No. 10 minimum diameter unless noted otherwise.
- F. Welding Electrodes: Comply with AWS standards.
- G. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, grade, thickness, and finish to match associated deck. Profile as required for application.
- H. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated. Where not specifically indicated provide as recommended by SDI Publication No. 30 for overhang and slab depth.
  - 1. Provide a stiffened return lip on the vertical lip of all pour stops.
- I. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- J. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, coordinate drain assembly opening requirements plus 6" all sides (minimum 24"x24") of same material and finish as deck. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A 780.
- L. Repair Primer: Manufacturer's standard rust-inhibitive primer of same type and color as shop primer.
- M. Protection Zone Marking Paint: Easily identifiable canister spray paint.
- N. Fastener Type Marking Paint: Easily identifiable canister spray paint

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### 3.2 INSTALLATION, GENERAL

- A. Immediately upon placing and adjusting deck panels to final position mark top surface of deck in areas of deck bearing on the protect zones with protected zone marking paint and identify as protected zone.
- B. Do not install powder actuated fasteners or other penetrating type fasteners in protected zones.
- C. In cases where varying type powder actuated fasteners are required each beam/joist support shall be marked with color coded “fastener type marking paint” to identify which fastener type is to be used at specific beam/joists.
- D. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- E. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- F. Locate deck bundles to prevent overloading of supporting members.
- G. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- H. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- I. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- J. Provide flat sump plates at all roof drains
- K. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- L. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- M. Mechanical Fasteners: Locate mechanical fasteners and install according to drawings, and the following requirements:
  - 1) Minimum edge distance and center to center spacing of fasteners shall be three fastener diameters unless noted otherwise.
  - 2) Minimum screw penetration shall leave at least 3 exposed threads on the backside of connection unless noted otherwise.

### 3.3 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members as indicated.
  - 1. Do not install power actuated or other penetrating type fasteners in areas of protected zones.
  - 2. Where the typical fastening system consists of powder actuated or other penetrating type fasteners replace each fastener with one 5/8” diameter puddle weld unless noted otherwise for the extent of protected zones.
- B. Fasten roof deck side laps and perimeter edges as indicated.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. Lapped unless noted as butted.
- D. Roof Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
- E. Miscellaneous Roof-Deck Accessories: Install hip, ridge and valley plates, cover plates, finish/filler strips, end closures, and reinforcing channels according to deck manufacturer's written instructions.
  - 1. Provide cover plates at changes in deck direction unless noted otherwise
  - 2. Provide hip, ridge, and valley plates at all changes in roof planes.
  - 3. Provide reinforcing channels at all deck edges including framed penetrations to ensure the deck edge is properly supported
- F. Flexible Closure Strips: Install flexible closure strips over walls below. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor deck panels to steel supporting members as indicated.
  - 1. Do not install power actuated or other penetrating type fasteners in areas of protected zones.
  - 2. Where the typical fastening system consists of powder actuated or other penetrating type fasteners replace each fastener with one 5/8" diameter puddle weld unless noted otherwise for the extent of protected zones.
- B. Fasten floor deck side laps and perimeter edges as indicated.
- C. 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 unless noted as lapped.
- D. Pour Stops and Girder Fillers: Fasten steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Fasten steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Flexible Closure Strips: Install flexible closure strips over walls below. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.5 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.



- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas of prime-painted deck immediately after installation, and apply repair primer.
  - 1. Apply repair primer, of same type and color as adjacent shop-primed deck.
- C. Protected Zone repairs: Where penetrating type fasteners are errantly installed in a protected zone the repair shall be completed by the structural steel erector. The deficiency shall be reported to the EOR and the EOR will provide direction on the removal of the fastener, the substrate repair, and an alternate fastener installed as directed by the EOR.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

## SECTION 054100 - ENGINEERED COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This specification section addresses structural cold-formed elements which are not specifically designed and detailed in the contract documents, with the exception of engineered fabricated cold formed metal trusses. These elements require professional design services to be completed via the shop drawing process.
- B. This Section includes the following:
  - 1. Roof Framing.
  - 2. Exterior Non-Load Bearing Wall Framing
  - 3. Exterior Ceiling and Soffit Framing
- C. Related Sections include the following:
  - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2. Division 05 Section "Steel Decking" for decking of cold formed framing
  - 3. Division 06 Section "Sheathing" for sheathing of cold formed walls

#### 1.3 DEFINITIONS

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
  - 1. Design Loads: As follows:
    - a. Dead Loads: Weights of attached and supported sheathing and Cladding
    - b. Live Loads: As indicated
    - c. Snow Loads: Compute using structural design criteria given.
    - d. Wind Loads:
      - 1) Calculate components and cladding pressures based on structural design criteria given.
      - 2) Components and cladding pressures may be calculated using a 10 year wind speed when checking deflection
    - e. Seismic Loads: Compute Seismic load factors to determine horizontal and vertical seismic forces using structural design criteria given.
  - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater

than the following:

- a. Exterior Non-Load-Bearing Framing
    - 1) Horizontal deflection of 1/600 of the wall height when acting as backup for masonry:
    - 2) Horizontal deflection of 1/360 of the wall height when acting as backup for other than masonry
  - b. Roof Framing:
    - 1) Live load vertical deflection of 1/360 of the span not to exceed 3/4"
    - 2) Total load vertical deflection of 1/240 of the span not to exceed 1"
  - c. Ceiling Joist Framing:
    - 1) Live load vertical deflection of 1/360 of the span not to exceed 3/4"
    - 2) Total load vertical deflection of 1/240 of the span not to exceed 1"
  3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
  4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 3/4" inch.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
  2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

## 1.5 SUBMITTALS

- A. Product Data:
1. Galvanizing Repair Paint
  2. Bracing
  3. Bridging
  4. Studs
  5. Joists
  6. Tracks
  7. Miscellaneous structural clips and accessories
  8. Post installed structural anchors: See specification section 050520
- B. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"
- C. Shop Drawings:
1. Provide shop drawings for all items included in this spec section
  2. Show layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

3. Indicate specific post installed structural anchors, mechanical fasteners, and powder actuated fastener products to be used during installation.

D. Professional Design Services Submittal:

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Indicate specific post installed structural anchors, mechanical fasteners and powder actuated fasteners used in calculations and to be used during installation.

E. Research/Evaluation Reports:

1. Submit ICC reports for the following:
  - a. Mechanical fasteners
  - b. Powder actuated fasteners
  - c. Post installed structural anchors: See specification section 050520.

F. Qualification Data:

1. Post Installed Structural Anchor Installer per specification section 050520
2. Powder Actuated Fastener Installer: Submit installer qualification data as stated in Quality Assurance section. Qualifications shall be submitted in a letter format for each type of anchor to be installed, and shall include the following.
  - a. The specific product to be used
  - b. Complete description of installation procedure
  - c. Manufacturer's training certificates

## 1.6 QUALITY ASSURANCE

- A. Post Installed Structural Anchor Installer: See specification section 050520 for requirements
- B. Powder Actuated Fastener Installer: All installers shall be experienced in installing anchors equal to type and into the substrate material required for the project. All installers shall have a manufacturer's training certificate.
- C. Installer Qualifications: The installer shall be experienced in installing cold formed steel equal in material, design and scope to that required for this project.
- D. Professional Design Services Engineer:
  1. Responsibility: Preparation of Shop Drawings, design calculations, and other structural data for elements requiring design to meet specified performance criteria.
  2. Qualifications: A professional engineer who is legally qualified 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 installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- E. AISI Specifications and Standards:
  1. Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Review Powder Actuated Fastener Installer requirements
  2. Review Post Installed anchor installer requirements

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.
- C. Store cold-formed metal framing on supports off the ground
- D. Keep cold-formed metal framing free of dirt and foreign matter.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  1. Grade: As required by structural performance.
  2. Coating: G60
- B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating
  1. Grade: As required by structural performance.
  2. Coating: G60.

#### 2.2 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: As required for structural performance, but not less than 1-5/8 inches.
  3. Section Properties: As required for structural performance.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with un-stiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: As required for structural performance, but not less than 1-1/2 inches.
  3. Section Properties: As required for structural performance.
- C. Steel Box Headers: Manufacturer's standard C-shapes used to form header beams in a boxed configuration, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: As required for structural performance, but not less than 1-5/8 inches
  3. Section Properties: As required for structural performance.
- D. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as required by detailing conditions, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: 1 inch plus twice the design gap.
  3. Flanges: Provide flanges with slotted holes at regular intervals to allow for positive attachment of studs while allowing for vertical movement up to the design gap dimension.
  4. Webs: Provide webs with slotted holes at regular intervals to allow for positive attachment of track to structure while allowing for horizontal movement where required based on interstory drift criteria.
- F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
    - b. Flange Width: plus twice the design gap.
  2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils
    - b. Flange Width: Insert dimension equal to sum of outer deflection track flange width plus 1 inch
- G. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure as required by interstory drift criteria.

## 2.3 ROOF FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: As required for structural performance, but not less than 1-5/8 inches.
  3. Section Properties: As required for structural performance.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.

2. Flange Width: As required for structural performance, but not less than 1-5/8 inches.
3. Section Properties: As required for structural performance.

#### 2.4 EXTERIOR CEILING AND SOFFIT FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: As required for structural performance, but not less than 1-5/8 inches.
  3. Section Properties: As required for structural performance.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: As required for structural performance, but not less than 43 mils.
  2. Flange Width: As required for structural performance, but not less than 1-5/8 inches.
  3. Section Properties: As required for structural performance.

#### 2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight as follows:
  1. Grade: As required by structural performance.
  2. Coating: G60
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  1. Supplementary framing.
  2. Bracing, bridging, and solid blocking.
  3. Web stiffeners.
  4. Anchor clips.
  5. End clips.
  6. Hole reinforcing plates.
  7. Backer plates.

#### 2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Post installed structural anchors: See specification section 050520.
- C. Powder-Actuated Fasteners: Fastener system specifically indicated on approved shop drawings and calculations of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure the required loads as determined by testing per ASTM E 1190 and ICC AC70 conducted by a qualified independent testing agency, and documented in an ICC ESR report applicable for the specific substrate being anchored into.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

## 2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.

2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding, screw fastening; clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION



- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
- E. Cut framing members by sawing or shearing; do not torch cut.
- F. Post installed structural anchors: See specification section 050520.
- G. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
  - 1. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - 2. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- H. Do not install penetrating fasteners in protected zones.
- I. Install framing members in one-piece lengths unless splice connections are indicated for track or tension

members.

- J. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- K. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- L. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- M. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

#### 3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten flanges of studs as indicated on shop drawings.
- C. Space studs as follows:
  - 1. Stud Spacing: As indicated, but not more than 16 inches.
- D. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- E. Isolate non-load-bearing steel framing from building structure per shop drawings to prevent transfer of vertical loads while providing lateral support.
- F. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

#### 3.5 EXTERIOR CEILING AND SOFFIT FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
  - 1. Install joists over supporting frame with a minimum end bearing as indicated on shop drawings, but not less than 1-1/2 inches.
  - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip

angles, or steel-stud sections as indicated on Shop Drawings.

- C. Locate joists against abutting walls, and as follows:
  - 1. Joist Spacing: As indicated, but not more than 16 inches
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
  - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings but not more than 48 inches apart. Fasten bridging at each joist intersection.
- G. Secure joists to interior supports to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### 3.6 ROOF FRAMING

- A. Install rafters bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce.
  - 1. Install joists over supporting frame with a minimum end bearing as indicated on shop drawings, but not less than 1-1/2 inches.
  - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- B. Locate joists against abutting walls, and as follows:
  - 1. Joist Spacing: As indicated, but not more than 16 inches
- C. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- D. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
  - 1. Install web stiffeners to transfer axial loads of walls above.
- E. Install bridging at intervals indicated on Shop Drawings but not more than 48 inches apart. Fasten bridging at each joist intersection.
- F. Secure joists to interior supports to prevent lateral movement of bottom flange.
- G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### 3.7 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Protected Zone repairs: Where penetrating type fasteners are errantly installed in a protected zone the repair shall be completed by the structural steel erector. The deficiency shall be reported to the EOR and the EOR will provide direction on the removal of the fastener, the substrate repair, and an alternate fastener installed as directed by the EOR.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054100

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Miscellaneous steel framing and supports.
  - 2. Metal ships' ladders.
  - 3. Abrasive metal nosings.
- B. Related Requirements:
  - 1. Section 064023 "Interior Architectural Woodwork" for woodwork and cabinets requiring metal support framing. Contractor must review interior casework drawings for additional steel supports required.
  - 2. Section 077200 "Roof Accessories" for roof hatch accessed by ship's ladder.
  - 3. Section 101400 "Signage" for exterior signage panels.
  - 4. **General: Construction Documents Drawing Package includes metal fabrications / miscellaneous steel items that are not documented on Structural Drawings. Contractor shall review entire Drawing Package to ensure that all metal fabrications / miscellaneous steel items are included in the Bid.**

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Professional Design Services by Contractor: Engage a qualified professional engineer, licensed in SC, as defined in Section 014000 "Quality Requirements," to design signage trusses and support towers at NE Plaza and ship's ladders.
- B. Thermal Movements: Provide exterior metal fabrications 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.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
  - 3. Metal nosings.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  2. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Professional Design Submittal by Contractor: For signage trusses and support towers at NE Plaza and for ship's ladders.
- D. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. 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 handrails and railings that are similar to those indicated for this Project in material, design, and extent.
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
  2. AWS D1.3, "Structural Welding Code--Sheet Steel."

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.7 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

#### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

#### 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
- C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

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

## 2.3 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

## 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Bolts: ASME B18.2.1.
- H. Plain Washers: Round, ASME B18.22.1.
- I. Lock Washers: Helical, spring type, ASME B18.21.1.
- J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M 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.
- K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer for Interior Metal Fabrications: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. Epoxy-Compatible Shop Primer for Exterior Metal Fabrications: Provide the following shop primer for exterior exposed steel members to receive field-applied high performance coating:
  1. Sherwin-Williams; Kem Kromik Universal Metal Primer, B50AZ6.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. 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.

## 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. 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.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.



- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from 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. Furnish inserts if units are installed after concrete is placed.
- C. Prime miscellaneous framing and supports with epoxy primer as specified in Section 099100.

## 2.8 METAL SHIPS' LADDERS

- A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
  - 1. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
  - 2. Fabricate ships' ladders, including railings from aluminum.
  - 3. Fabricate treads from rolled-steel floor plate or rolled-aluminum-alloy tread plate.
  - 4. Comply with applicable railing requirements in Section 055100 "Metal Stairs."

## 2.9 ABRASIVE METAL NOSINGS

- A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide **Model R-315LP by Balco, Inc.** or Architect approved comparable product by one of the following:
    - a. American Safety Tread Co., Inc.
    - b. Wooster Products, Inc.
  - 2. Provide ribbed units, with abrasive filler strips projecting 1/4 inch above aluminum extrusion.
  - 3. Nosings: Square-back units, 3 inches wide, for casting into concrete steps.

- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
  - 1. Provide two rows of holes for units more than 5 inches wide, with two holes aligned at ends and intermediate holes staggered.
- D. Apply bituminous paint to concealed surfaces of cast-metal units.
- E. Apply clear lacquer to concealed surfaces of extruded units.

#### 2.10 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

#### 2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123/A 123M, 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."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: 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: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

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

### 3.2 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.

### 3.3 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

### 3.4 SIGNAGE TRUSS AND SUPPORT TOWER INSTALLATION

- A. Install steel trusses and support towers according to manufacturer's written instructions unless more stringent requirements are indicated.
  - 1. Anchor trusses securely at all bearing points.
  - 2. Install bridging and bracing as indicated on Shop Drawings.
- B. Install steel trusses, towers and accessories true to line and location, and with connections securely fastened.

1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
2. Erect trusses without damaging truss members or connections.
3. Fasten steel trusses by welding or mechanical fasteners.

### 3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded 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 055000

## SECTION 055100 - METAL STAIRS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preassembled steel stairs and metal railings.
- B. Related Sections:
  - 1. Section 055000 "Metal Fabrications" for metal nosings for exterior stairs.
  - 2. Section 133416 "Grandstands and Bleachers" for sole-source provision of exterior stairs and railings associated with bleachers.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Professional Design Services by Contractor: Engage a qualified professional engineer, licensed in SC, as defined in Section 014000 "Quality Requirements," to design metal stairs.
- B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sq. ft.
  - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members for pre-assembled stairs to  $L/360$  or  $1/4$  inch, whichever is less.
  - 6. Limit deflection of treads, platforms, and framing members for monumental stairs to  $L/720$ .
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.

- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to applicable code requirement, as determined by Structural Engineer.
  - 1. Stairs shall be designed and detailed to accommodate interstory drift values indicated while remaining structurally stable and maintaining structural integrity

#### 1.4 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Provide templates for anchors and bolts specified for installation under other Sections.
  - 2. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Professional Design Submittal by Contractor: For metal stairs.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

#### 1.5 QUALITY ASSURANCE

- A. 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 handrails and railings that are similar to those indicated for this Project in material, design, and extent.
- B. Installer Qualifications: Fabricator of products.
- C. 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. Exit Stairs: Commercial class.
- D. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

#### 1.6 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 anchorages, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

### PART 2 - PRODUCTS

## 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.

## 2.3 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. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip, zinc-coated anchor bolts for exterior stairs.
- D. Machine Screws: ASME B18.6.3.
- E. Plain Washers: Round, ASME B18.22.1.
- F. Lock Washers: Helical, spring type, ASME B18.21.1.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Epoxy Primer for Exterior Stairs: Provide primers that comply with Section 099100 "Painting."
- C. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

## 2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, 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.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- 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. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

## 2.6 STEEL-FRAMED STAIRS

- A. Stair Framing:
1. Fabricate stringers of steel channels or tubes, unless otherwise indicated.
  2. Construct platforms as indicated, with framing members as needed to comply with performance requirements.
  3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers, as indicated. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
  4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- B. Metal-Pan Stairs: Form risers, subread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.
1. Steel Sheet: Uncoated cold-rolled steel sheet.
  2. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
  3. Attach abrasive safety nosings to risers of exterior stairs.
  4. Shape metal pans to include nosing integral with riser of interior stairs.
  5. Provide stair assemblies with metal-pan subreads filled with reinforced concrete during fabrication.
  6. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.



## 2.7 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate 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.
  - 1. Rails and Posts: Diameter as indicated.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Form changes in direction of railings by radius bends of radius indicated.
- 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 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 components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
  - 1. Connect posts to stair framing by direct welding unless otherwise indicated.
  - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

## 2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- D. Painted Finish for Stairs: Comply with Division 09 painting Sections.

## PART 3 - EXECUTION

### 3.1 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 of 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. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

### 3.2 INSTALLING STEEL RAILINGS

- A. Adjust 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 rail 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.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

### 3.3 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 055100

## SECTION 055213 - PIPE AND TUBE RAILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Aluminum tube railings.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Professional Design Services by Contractor: Engage a qualified professional engineer, licensed in SC, as defined in Section 014000 "Quality Requirements," to design stanchions for post mounting at ramps.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- C. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
- D. 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.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 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.
- C. Professional Design Submittal by Contractor: For stanchions for post mounting at ramps.

#### 1.5 QUALITY ASSURANCE

- A. 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 handrails and railings that are similar to those indicated for this Project in material, design, and extent.

#### 1.6 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.

#### 1.7 COORDINATION AND 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. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Series 200x by Hansen Architectural Systems** or Architect approved comparable product by one of the following:
  - 1. SC Railing Company.
  - 2. Superior Aluminum Products, Inc.

#### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

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

## 2.3 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- C. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

## 2.4 FASTENERS

- A. General: Provide the following:
  - 1. Aluminum Railings: Type 316 stainless-steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
- D. Anchors: Provide cast-in-place chemical or torque-controlled expansion 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.

## 2.5 MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- B. 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.
- C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.
  - 1. Profile and Finish: As indicated.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with nonwelded connections unless otherwise indicated.
- H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- I. Form changes in direction as follows:
  - 1. By bending or by inserting prefabricated elbow fittings.
- J. 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.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. 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.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

## 2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Mechanical Finish: AA-M3x (Mechanical Finish: as specified); sand top rails, handrails, and intermediate rails in 1 direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

### 3.3 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
- 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 expansion shields and hanger or lag bolts.
  - 2. For hollow masonry anchorage, use toggle bolts.

### 3.4 ANCHORING POSTS

- A. Anchor posts by one of the following methods, as indicated on Drawings.
  - 1. Flat aluminum plate bolted to concrete.
  - 2. 90° L-shaped aluminum plate bolted to concrete.
  - 3. Custom stanchion set into concrete at ramps. Install posts over vertical portion of stanchion and grout in place.

### 3.5 ADJUSTING AND CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

### 3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at 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 055213



## SECTION 057000 - DECORATIVE METAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Decorative architectural mesh.
- B. Related Work:
  - 1. Section 064023 "Interior Architectural Woodwork" for decorative metallic laminate (DM-1).

#### 1.3 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. 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.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide decorative mesh systems, including anchorage, capable of withstanding, without failure, the effects of the following:
  - 1. Structural loads.
  - 2. Thermal movements.
  - 3. Movements of supporting structure indicated on Drawings.
  - 4. Dimensional tolerances of building frame and other adjacent construction.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative metal.

1. Include plans, elevations, component details, and attachment details.
2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples for Verification: For each type of exposed finish.

#### 1.7 QUALITY ASSURANCE

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

B. Installer Qualifications: Fabricator of products.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup consisting of one panel of decorative mesh screen, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

#### 1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

### PART 2 - PRODUCTS

#### 2.1 METALS, GENERAL

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

#### 2.2 STAINLESS STEEL

A. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.

B. Decorative Mesh: ASTM A 666, Type 304; flexible mesh of pattern indicated.

## 2.3 BRASS

- A. Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS C26000 (cartridge brass, 70 percent copper).

## 2.4 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Stainless-Steel Items: Type 316 stainless-steel fasteners.
  - 2. Dissimilar Metals: Type 316 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.
  - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
  - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.5 MISCELLANEOUS MATERIALS

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

## 2.6 FABRICATION, GENERAL

- A. Assemble items 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.
- B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- D. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- F. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- G. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- H. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
- I. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
  - 1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint.

## 2.7 DECORATIVE MESH SCREENS (DM-2)

- A. Basis-of-Design Product: .Subject to compliance with requirements, provide **Circuit by Cambridge Architectural Mesh** or Architect approved comparable product.
- B. Fabricate decorative mesh screens from stainless-steel and brass link fabric of thickness, size, and pattern indicated.
  - 1. Open Area: 0%.
  - 2. Thickness: 0.0196 inch.
- C. Fabricate panel or U-binding frames of profiles and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates welded to back of frames.
  - 1. Secure mesh panels in frames in accordance with manufacturer's written instructions.

## 2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## 2.9 STAINLESS-STEEL FINISHES

- A. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run grain of directional finishes with long dimension of each piece.
- B. Directional Satin Finish: No. 4.

## 2.10 COPPER-ALLOY FINISHES

- A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
- B. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

### 3.3 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- C. 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 057000