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SECTION 05 05 23**WELDING****PART 1 – GENERAL****1.01 REFERENCES**

- A. The following is a list of standards which may be referenced in this section:
1. American Society of Mechanical Engineers (ASME):
 - a. *BPVC SEC V*, Nondestructive Examination.
 - b. *BPVC SEC IX*, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
 2. American Society of Nondestructive Testing (ASNT): *SNT -TC-1A*, Personnel Qualification and Certification in Nondestructive Testing.
 3. ASTM International (ASTM): *A370*, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
 4. American Welding Society (AWS):
 - a. *A2.4*, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - b. *A3.0*, Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermalspraying.
 - c. *D1.1/D1.1M*, Structural Welding Code -Steel.
 - d. *D1.2/D1.2M*, Structural Welding Code -Aluminum.
 - e. *D1.3*, Structural Welding Code -Sheet Steel. *D1.4/D1.4M*, Structural Welding Code -Reinforcing Steel.
 - f. *D1.6/D1.6M*, Structural Welding Code -Stainless Steel.
 - g. *QCI*, Standard for AWS Certification of Welding Inspectors.

1.02 ABBREVIATIONS

- A. CJP: Complete Joint Penetration.
- B. CWI: Certified Welding Inspector.
- C. MT: Magnetic Particle Testing.
- D. NDE: Nondestructive Examination.

- E. NDT: Nondestructive Testing.
- F. PJP: Partial Joint Penetration.
- G. PQR: Procedure Qualification Record.
- H. PT: Liquid Penetrant Testing.
- I. RT: Radiographic Testing.
- J. UT: Ultrasonic Testing.
- K. VT: Visual Testing.
- L. WPQ: Welder/Welding Operator Performance Qualification.
- M. WPS: Welding Procedure Specification.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Shop and field WPSs and PQRs.
 - 2. NDT procedure specifications prepared in accordance with ASME BPVC SEC V.
 - 3. Welding Data (Shop and Field):
 - a. Show on Shop Drawings or a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tails of combined welding and NDE symbols as indicated in AWS A2.4.
 - b. Distinguish between shop and field welds.
 - c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
 - d. For pipe fittings, provide a joint weld beveling diagram. Refer to AWS D1.1, Annex G Local Dihedral Angle that can be used to calculate bevels for weld joint details of intersecting pipes.
 - e. Welding and NDE symbols shall be in accordance with AWS A2.4.
 - f. Welding terms and definitions shall be in accordance with AWS A3.0.

- g. Submit welding data together with shop drawings as a complete package.
- B. Informational Submittals:
 - 1. WPQs.
 - 2. CWI credentials.
 - 3. Testing agency personnel credentials.
 - 4. CWI reports.
 - 5. Welding Documentation: Submit on appropriate forms in referenced welding codes.

1.04 QUALIFICATIONS

- A. WPSs: In accordance with AWS D1.1 (Annex E Forms).
- B. WPQs: In accordance with AWS D1.1 (Annex E Forms).
- C. CWI: Certified in accordance with AWS QC 1, and having prior experience with the welding codes specified. Alternate welding inspector qualifications require approval by the Engineer.
- D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.05 SEQUENCING AND SCHEDULING

- A. Unless otherwise specified, all Submittals required in this section shall be submitted and approved prior to commencement of welding operations.

PART 2 – PRODUCTS

2.01 SOURCE QUALITY CONTROL

- A. The CWI shall be present whenever shop welding is performed. The CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1 or referenced welding code and as follows:
 - 1. Verifying conformance of specified job material and proper storage.
 - 2. Monitoring conformance with approved WPS.
 - 3. Monitoring conformance of WPQ.
 - 4. Inspecting weld joint fit-up and in-process inspection.

5. Providing 100 percent visual inspection of welds.
6. Supervising nondestructive testing personnel and evaluating test results.
7. Maintaining records and preparing report confirming results of inspection and testing comply with the work.

PART 3 – EXECUTION

3.01 GENERAL

- A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.
- B. Welding procedure specifications for all pressure piping shall be qualified for notch toughness by limiting heat input; charpy testing of weld metal and heat affected zone shall be done as a part of the welding procedure qualification. Full-size specimens shall be charpy tested in accordance with ASTM A370 at a test temperature of 30 degrees F. The minimum average energy of the test coupons shall not be less than 25 foot-pounds.

3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

- A. Weld Inspection Criteria:
 1. Selection of welds to be tested unless 100 percent NDT is specified herein, shall be as agreed upon between Contractor and Subcontractor.
 2. Unless otherwise specified, perform NDT of welds at a frequency as shown below or in the attached table in accordance with the referenced welding codes as follows. In case there is a conflict the higher frequency level of NDT shall apply:
 - a. Fillet Welds and PJP Groove Welds: 10 percent random MT or PT.
 - b. All Welds: 100 percent VT.
 3. Weld Acceptance:
 - a. VT:
 - 1) Structural Pipe and Tubing: AWS D1.1, Paragraph 6.9, Visual Inspection, Tubular Connections.
 - 2) All Other Structural Steel: AWS D1.1, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
 - 3) Stud Connections: AWS D1.1, Paragraph 7.8.1.
 - b. PT or MT:

- 1) Perform on fillet and PJP groove welds in accordance with AWS D1.1, Paragraph 6.10.
- 2) Acceptance shall be in accordance with VT standards specified above.

3.03 FIELD QUALITY CONTROL

- A. The CWI shall be present whenever field welding is performed. The CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1 or referenced welding code and as follows:
1. Verifying conformance of specified job material and proper storage.
 2. Monitoring conformance with approved PS.
 3. Monitoring conformance of WPQ.
 4. Inspecting weld joint fit-up and in-process inspection.
 5. Providing 100 percent visual inspection of all welds.
 6. Supervising nondestructive testing personnel and evaluating test results.
 7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

3.04 WELD DEFECT REPAIR

- A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

3.05 SUPPLEMENTS

- A. The supplement listed below, following "End of Section," is a part of this Specification.
1. Welding and Nondestructive Testing table.

END OF SECTION

Welding and Nondestructive Testing						
Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
05 12 00 Structural Steel Framing	AWS D1.1, Structural Welding Code – Steel	Yes	Yes	Yes	Yes	100% UT or RT of all CJP groove-and-butt joint welds; 10% MT of all fillet welds; see Section 05 12 00
05 31 00 Steel Decking	AWS D1.1, Structural Welding Code – Steel or AWS D1.3, Structural Welding Code – Sheet Steel	No	No	Yes	No	100% VT; see Section 05 31 00
05 41 00 Structural Metal Stud Framing	AWS D1.1, Structural Welding Code – Steel or AWS D1.3, Structural Welding Code – Sheet Steel	Yes	Yes	Yes	Yes	100% VT; see Section 05 41 00
05 50 00 Metal Fabrications	AWS D1.1, Structural Welding Code – Steel or AWS D1.2, , Structural Welding Code – Aluminum or AWS D1.6, Structural Welding Code – Stainless Steel	Yes	Yes	Yes	Yes	100% VT; see Section 05 50 00
05 51 00 Metal Stairs	AWS D1.1, Structural Welding Code – Steel or AWS D1.3, Structural Welding Code – Sheet Steel	Yes	Yes	Yes	Yes	100% VT; see Section 05 51 00
05 52 00 Metal Railings	AWS D1.1, Structural Welding Code – Steel or AWS D1.2, , Structural Welding Code – Aluminum	No	No	No	No	100% VT; see Section 05 52 00
05 53 00 Metal Gratings	AWS D1.1, Structural Welding Code – Steel or AWS D1.2, , Structural Welding Code – Aluminum	No	No	No	No	100% VT; see Section 05 53 00

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SECTION 05 12 00**STRUCTURAL STEEL FRAMING****PART 1 - GENERAL****1.01 REFERENCES**

- A. Provide the structural steel system, including shop primer or galvanizing, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 325 except as modified in this contract.

1.02 REFERENCES

- A. The following is a list of standards (LATEST REVISION) which may be referenced in this section:

AISC 303	Code of Standard Practice for Steel Buildings and Bridges
AISC 316	ASD Manual of Steel Construction
AISC 317	ASD Manual of Steel Construction, Vol II: Connections
AISC 325	LRFD Manual of Steel Construction
AISC 326	Detailing for Steel Construction
AISC 348	Structural Joints Using ASTM A325 or A490 Bolts
AISC 350	Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings
AISC M018L	LRFD Manual of Steel Construction, Metric Conversion Volume I
AISC M019L	LRFD Manual of Steel Construction, Metric Conversion Volume II

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 36	Carbon Structural Steel
ASTM A 490	Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 563	Carbon and Alloy Steel Nuts
ASTM A 572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 6	General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 780	Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 992	Structural Steel Shapes
ASTM F 436	Hardened Steel Washers
ASTM F 959	Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

1.03 MODIFICATIONS TO REFERENCES

- A. AISC 325, AISC 350, AISC 303, AISC 348, and AISC S340, except as modified in this section, shall be considered a part of AISC M018L and AISC M019L and is referred to in this section as AISC 325.

1.04 SUBMITTALS

- A. Action Submittals:

1. Provide Shop Drawing details showing:
 - a. Complete details and schedules for fabrication and shop assembly of members and details of cuts, connections, camber, holes and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
 - b. Provide setting or erection Drawings for the installation of anchor bolts and other anchorages or embedded items to be installed by others.
 - c. Schedules for fabrication procedures.
 - d. Primer and other coatings.

The Contractor shall check and stamp all submittals for conformance with these Specifications and with the Drawings before submission to the Engineer. In review of Shop Drawing, Engineer shall not be deemed to have conducted structural analyses or detailed review of standard details prepared under fabricator's design responsibility

2. Name and address of manufacturer(s).
3. Product specifications.
4. Manufacturers' testing procedures and standards.
5. Preparation and installation or application instructions, as appropriate.

B. Informational Submittals:

1. Mill Certificates of tests made in accordance with ASTM A6.
2. High-Strength Bolts (Plain Noncoated and Hot-Dip Galvanized):
 - a. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
 - b. Manufacturer's inspection test report results for production lot(s) furnished, to include:
 - 1) Tensile strength.
 - 2) Yield strength.
 - 3) Reduction of area.
 - 4) Elongation and hardness.
 - c. Certified Mill Test Reports for Bolts and Nuts:
 - 1) Name and address of manufacturer.
 - 2) Bolts correctly marked.
 - 3) Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.
3. Direct Tension Indicators (DTIs): Furnish manufacturer's test report meeting requirements of ASTM F959.
4. Tension Control (TC) Bolts: Furnish manufacturer's test report meeting requirements of ASTM A325 and ASTM F1852.
5. Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.
6. Welding Materials Procedures, Qualifications, and inspection Report: As specified in Section 05 05 23, Welding.
7. Non-shrink Grout
8. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer with description of material processed and ASTM standard used for coating.
9. AISC Quality Certification: AISC certificate showing name and address of certified firm, effective date, and category of certification; or, for erectors, documentation of similar project experience to include project name, location, date of completion, and name and phone number of owner's contact person.

1.05 QUALITY ASSURANCE

- A. Drawing Requirements:
1. Fabricate structural steel members in accordance with AISC Code of Standard Practice.
 2. Design connections not detailed on Drawings under direct supervision of a registered Professional Structural Engineer experienced in design of this Work and licensed in Georgia.
 3. Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326, AISC 316 and AISC 317. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols.
- B. Mill identification marks in accordance with ASTM A6.
- C. AISC Quality Certification for Fabricator: Conventional Steel Structures (Sbd).
- D. AISC Quality Certification as Certified Steel Erector (CSE), or documented experience in erection of at least five similar structural steel facilities over the past 10 years in lieu of AISC certification.
- E. Welding Qualifications: As specified in Section 050523, Welding.
- F. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.
- B. Storage:
1. Protect structural steel members and packaged materials from corrosion and deterioration.
 2. Store in dry area and not in direct contact with ground.
 3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.

- C. Handle materials to avoid distortion or damage to members or supporting structures.
- D. Shop fabrication shall be sequenced/scheduled so that delivery will expedite erection, will minimize field handling of materials, and will ensure uninterrupted progress of the work

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Channels, Angles and Plates: ASTM A36, unless indicated otherwise.
- B. W-Shapes:
 - 1. ASTM A992, Grade 50 unless indicated otherwise on Drawings.
- C. Steel Pipe: ASTM A53, Type E or S, Grade B.
- D. Round Hollow Structural Sections (HSS): ASTM A500, Grade B (Fy equals 42 ksi).
- E. Square and Rectangular Hollow Structural Sections (HSS): ASTM A500, Grade B (Fy equals 46 ksi).
- F. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5 inches thick for A36 and A572 steels), limit the maximum silicon content to 0.21 percent and the phosphorous content to 0.03 percent.

2.02 FASTENERS

- A. Anchor Bolts: As specified in Section 05 50 0, Metal Fabrications.
- B. High-Strength Bolts: ASTM A325, bolt type I plain uncoated. Bolt length and thread length shall be as required for the connection type shown, with hardened washers as required.
- C. Direct Tension Indicators (DTIs) or Load Indicator Washers:
 - 1. ASTM F959, coating type to match bolt finish.
 - 2. Type A325 or A490, to match bolt type.
 - 3. Manufacturers and Products:
 - a. TurnaSure LLC, Langhorne, P A; TI's.
 - b. Applied Bolting Technology Products, Ludlow, VT; DTI's, regular or Squirter type.

- D. Tension Control (TC) Bolts:
 - 1. High-strength, ASTM A325 and ASTM F1852.
 - 2. Manufacturers:
 - a. Lejeune Bolt Company, Burnsville, MN.
 - b. Nucor Fastener, Saint Joe, IN.
 - c. T.S. Bolts and Tools, Bristol Machine Co., Walnut, CA.
 - d. Haydon Bolts, Philadelphia, P A.
 - e. Vermont Fasteners Manufacturing, Swanton, VT.
- E. Nuts: ASTM A563, type to match bolt type and finish.
- F. Hardened Steel Flat and Beveled Washers: AS M F436, type to match bolt finish.
- G. Welded Shear Studs: As specified in Section 05 00 00, Metal Fabrications.

2.03 ANCILLARY MATERIALS

- A. Surface Preparation and Primer: As specified in Section 09 90 00, Painting and Coating.
- B. Grout: As specified in Section 03 30 00 Cast-In-Place Concrete.

2.04 FABRICATION

- A. General:
 - 1. Fabricate as shown and in accordance with AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges.
 - 2. Columns shall be full length members without splices, unless shown otherwise or approved by Engineer.
 - 3. Mark and match materials for field assembly.
 - 4. Complete assembly, including bolting and welding of units, before start of finishing operations.
 - 5. Fabricate to agree with field measurements.
- B. Connections:
 - 1. Shop Connections: Weld or bolt, as shown.

2. Meet requirements of AISC Manual of Steel Construction tables for bolted double-angle shear connections, unless indicated otherwise.
 3. Meet OSHA requirements for one independent bolt at beams framing in to column web connections.
 4. Provide oversized holes for anchor bolts in column base plates in accordance with AISC Manual of Steel Construction, unless indicated otherwise.
- C. Welded Construction:
1. As specified in Section 05 05 23, Welding.
 2. Groove and Butt Joint Welds: as indicated. Where no size is provided, Engineer intends for minimum size for the prequalified weld to be used from AISC Manual of Steel Construction.
- D. Interface with Other Work:
1. Holes:
 - a. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.
 - b. No flame-cut holes will be permitted without prior approval of Engineer.
 2. Weld threaded nuts to framing, and other specialty items as shown to receive other Work.
- E. Shop Paint Primer:
1. Surface Preparation and painting as specified in Section 09 90 00, Painting and Coating.
 2. Do not shop prime the following surface, unless indicated otherwise:
 - a. Faying surfaces of slip critical bolt d connections.
 - b. Within 2 inches of field-welded connections.
 - c. Steel members to be completely encased in reinforced concrete or coated with cementitious fireproofing.
 3. Apply shop primer to top flange surfaces of composite steel beams unless indicated otherwise.
- F. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143, ASTM A384, and ASTM A385. Avoid fabrication techniques that could cause distortion or embrittlement of steel.
 2. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
 3. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
 4. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A 23.
 5. Hot-dip galvanize ASTM A325 bolts, nuts, washers, and hardware components in accordance with ASTM 153. Oversize holes to allow for zinc alloy growth. Shop assemble bolts, nuts, and washers with special lubricant and test in accordance with ASTM A325 and ASTM A563.
 6. Tension-control (TC) bolts, nuts, and washers shall be mechanically zinc coated in accordance with ASTM F1852 and ASTM B695, Class 50.
 7. Galvanize components of bolted assemblies separately before assembly.
- G. Slip Critical Bolted Connections:
1. Mask faying surfaces of slip critical (SC) bolted connections to be shop painted as specified in Section 09 90 00, Painting and Coating.
 2. Roughen galvanized faying surfaces with hand wire brushing.

2.05 SOURCE QUALITY CONTROL

- A. Welding:
1. Visually inspect fabrication welds in accordance with AWS D 1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
 2. Repair and retest defective welds as specified in Section 05 05 23, Welding.
- B. Hot-Dip Galvanizing:
1. An independent testing agency will be retained by Owner, if necessary.
 2. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three test samples from each lot in accordance with ASTM A123 and ASTM A153.
 3. Reject and retest nonconforming articles in accordance with ASTM A123 and ASTM A153.

PART 3 – EXECUTION

3.01 ERECTION

- A. Meet requirements of AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges, with exceptions as specified.
- B. Install Contractor–designed temporary construction bracing to provide necessary support until components are in place and construction is complete.
- C. High–Strength Bolted Connections:
 - 1. Tighten in accordance with AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.
 - 2. Hardened Washers:
 - a. Provide at locations required by Washer Requirements section of AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts, to include slip critical connections using slotted or oversized holes or ASTM A490 bolts.
 - b. Use beveled style and extra thickness where required by AISC Specification.
 - c. Use square or rectangular beveled washers at inner flange surfaces of American Standard beams and channels.
 - d. Do not substitute DTIs for hardened flat washers required at slotted and oversize holes.
 - 3. For bearing–type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.
- D. Fully Tensioned Bolted Connections:
 - 1. Use DTIs or TC bolts at slip critical (SC) and fully tensioned (FT) bearing–type connections.
 - 2. DTIs:
 - a. Position within bolted assembly in accordance with ASTM F959.
 - b. Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until plies are in firm contact and fasteners are uniformly snug tight.
 - 3. Final tighten bolts, beginning at most rigid part of bolted connection and progressing toward free edges, until final twist–off of TC bolts or until DTIs

have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

- E. Welded Connections:
 - 1. As specified previously herein.

3.02 ANCHOR BOLTS

- A. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in-place work.
- B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.
- C. Projection of anchor bolts beyond face of concrete and threaded length shall be adequate to allow for full engagement of all threads of hold-down nuts, adjustment of leveling nuts, washer thicknesses, and construction tolerances, unless indicated otherwise.
- D. Placement Tolerances:
 - 1. As required by AISC Code of Standard Practice for Steel Buildings and Bridges, unless indicated otherwise.
 - 2. Embedded anchor bolts shall not vary from the dimensions as shown on Drawings by more than the following:
 - a. Center to center of any two bolts within an anchor group: 1/8 inch
 - b. Center to center of adjacent anchor bolt groups: 1/4 inch.
 - c. Variation from perpendicular to theoretical bearing surface: 1:50.

3.03 SETTING BASES AND BEARING PLATES

- A. Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces.
- B. Clean bottom surface of base and bearing plates.
- C. Set loose and attached base plates and bearing plates for structural members on wedges, shims, leveling nuts, or other adjustable devices. Use leveling plates where indicated.
- D. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to placing grout. Weld plate washers to base plates where indicated.

- E. Grout Under Baseplates, prior to placing loads on structure.
 - 1. Center to center of any two bolts within an anchor group: 1/8 inch.
 - 2. Center to center of adjacent anchor bolt groups: 1/4 inch.
 - 3. Variation from perpendicular to theoretical bearing surface: 1:50.

3.04 FIELD ASSEMBLY

- A. Set structural frames accurately to lines and elevations shown.
- B. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.
- C. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.
- D. Level and plumb individual members of structure within tolerances shown in AISC Code of Standard Practice for Steel Buildings and Bridges.
- E. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.
- F. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.
- G. Provide additional field connection material as required by AISC Code of Standard Practice for Steel Buildings and Bridges.
- H. Splice members only where indicated and accepted on shop drawings.

3.05 MISFITS AT BOLTED CONNECTIONS

- A. Where misfits in erection bolting are encountered, immediately notify Engineer for approval of one of the following: methods of correction:
 - 1. Ream holes that must be enlarged to admit bolts and use oversized bolts.
 - 2. Plug weld misaligned holes and redrill holes to admit standard size bolts.
 - 3. Drill additional holes in connection, conforming to AISC Standards for bolt spacing and end and edge distances, and add additional bolts.
 - 4. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.
- B. Do not enlarge incorrectly sized or misaligned holes in members by burning or by use of drift pins.

3.06 MISFITS AT ANCHOR BOLTS

- A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.
- B. Do not flame cut to enlarge holes without prior approval of Engineer.

3.07 GAS CUTTING

- A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.
- B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by Engineer.
- C. Finish flame-cut sections equivalent to sheared and punched appearance.

3.08 REPAIR AND CLEANING

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.
- B. Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.
- C. Remove weld back-up bars and grind smooth where indicated on Drawings.
- D. Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application and as specified in Section 09 90 00, Painting and Coating.

3.09 REPAIR OF DAMAGED HOT-DIP GALVANIZED COATING

- A. Conform to ASTM A 780.
- B. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
- C. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
- D. Use magnetic gauge to determine that thickness is equal to or greater than base galvanized coating.

3.10 FIELD QUALITY CONTROL

- A. High-Strength Bolted Connections:
 - 1. An independent testing agency will be retained by Owner to perform the following inspection and testing in accordance with the AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts:

- a. Marking identification and conformance to ASTM standards.
 - b. Alignment of bolt holes.
 - c. Placement, type, and thickness of hardened washers.
 - d. Tightening of bolts.
2. Bearing-Type Connections Not Fully Tensioned (N, X): Snug tight condition with plies of joint in firm contact.
 3. Fully Tensioned (FT) Bearing and Slip Critical (SC) Connections:
 - a. Conduct preinstallation test.
 - b. Monitor installation and tightening of DTIs or TC bolts.
 - c. Monitor condition of faying surfaces for slip critical connections.
 4. Preinstallation Test:
 - a. Conduct jobsite test prior to start of work using a bolt tension measuring device.
 - b. Select representative sample of not less than three bolts of each diameter, length, and grade.
 - c. Include DTIs and flat hardened washers as required to match actual connection assembly.
 - d. Conduct test in accordance with Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.
 5. Nondestructive Testing (NDT) Report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.
 6. Defective Connections: Correct and reinspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.
- B. Welded Connections:
1. Visually inspect field welds in accordance with AWS D 1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
 2. Repair and retest defective welds as specified in Section 05 05 23, Welding.

END OF SECTION

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SECTION 05 31 00**STEEL DECKING****PART 1 – GENERAL****1.01 REFERENCES**

- A. The following is a list of standards which may be referenced in this section:
1. American Iron and Steel Institute (AISI): Specifications for the Design of Cold Formed Steel Structural Members.
 2. American Welding Society (AWS): D1.3, Structural Welding Code Sheet Steel.
 3. ASTM International (ASTM):
 - a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - b. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - c. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 4. Steel Deck Institute (SDI):
 - a. Design Manual for Composite Decks, Form Decks, and Roof Decks.
 - b. Diaphragm Design Manual.
 5. Factory Mutual (FM):
 - a. Factory Mutual Approval Guide.
 - b. FM Research Corporation (FMRC): Approval Requirements for Steel Roof Deck Construction.
 6. Underwriters Laboratories, Inc. (UL): Fire Resistance Directory.

1.02 SUBMITTALS

- A. Action Submittals:
1. Plan view layout of decking showing type and section properties of deck panels, reinforcing channels, pans, special jointing, and accessories.
 2. Location of openings, deck laps, and deck attachment details.

- B. Informational Submittals:
 - 1. Decking manufacturer's installation requirements.
 - 2. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding.
 - 3. Operation manuals for mechanical fastener installation tools.
 - 4. Manufacturer's Certificate of Compliance to state product conformance with design requirements.

1.03 QUALITY ASSURANCE

- A. General: For metal decking section properties, meet requirements of AISI Specifications for Design of Cold-Formed Steel Structural Members.
- B. FM Requirements:
 - 1. Steel Roof Deck: Listed in Factory Mutual "Approval Guide" for Class 1 fire rating and Class 1-120 wind uplift rating.
 - 2. Mechanical Fasteners: Packing containers shall show name of manufacturer and product and FMRC approval mark.
- C. Qualifications for Field Welding: As specified in Section 05 05 23, Welding.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store deck bundles on platforms or pallets, with one end elevated to provide drainage.
- C. Protect bundles against condensation with a ventilated waterproof covering.
- D. Stack bundles so there is no danger of tipping, sliding, rolling, shifting, or material damage.

PART 2 – PRODUCTS

2.01 METAL DECKING

- A. Materials and Finishes:
 - 1. Galvanized Deck:

- a. Sheet steel for galvanized deck and accessories shall conform to ASTM A653 Structural Quality Grade 33 or higher.
 - b. Galvanizing shall conform to ASTM A924 with coating class of G90 as defined in ASTM A653.
- B. Manufacturers:
1. Vulcraft Division of Nucor Co. Model 2VLI, 20 Gage.
 2. Approved equal.
- C. Welding Materials: AWS D1.1

2.02 ACCESSORIES

- A. Provide pour stops, column closures, end closures, cover plates, girder fillers, ridge and valley plates, finish strips, reinforcing channels, and other accessories as required for complete installation.
- B. Accessories shall be minimum 22-gauge, except edge forms shall be sized as required by the deck manufacturer, unless shown otherwise on the Drawings.

2.03 MECHANICAL FASTENERS

- A. Self-Drilling Screws:
1. Galvanized, hardened, self-drilling, self-tapping screws with hexagonal washer head.
 2. Manufacturers and Products:
 - a. ITW Buildex, Itasca, IL;
 - b. Hilti, Inc., Tulsa, OK;

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.02 INSTALLATION

- A. Install deck panels and accessories according to Steel Deck Institute specifications and recommendations, SDI Manual of Construction with Steel Deck, and in accordance with the placement plans and requirements of this Section.

- B. Locate deck bundles to prevent overloading of support framing members.
- C. Install at right angles to supporting members in a three-span minimum lay-up, unless shown otherwise, and in accordance with Specification and manufacturer's installation recommendation.
- D. Bearing: 1-1/2 inches, minimum.
- E. Endlaps: Minimum of 2 inches and located over supports.
- F. Do not stretch sidelaps.
- G. Cut and neatly fit deck and accessories at skew conditions, around openings, and at other work projecting through or adjacent to the decking
- H. Closure Plates:
 - 1. Install closure and cover plate accessories as recommended by the metal deck manufacturer, unless shown otherwise on the Drawings.
 - 2. Floor Deck and Form Deck Closures:
 - a. Fasten column closures, cell closures, and zee closures to deck to provide tight fitting closures at open ends of ribs and sides of decking.
 - b. Fasten cell closures at changes of direction of deck units unless otherwise indicated.
- I. Holes and Openings
 - 1. Do not cut unscheduled openings through the deck without the approval of the Engineer. Reinforce openings as directed.
 - 2. Cut and fit around roof openings and other work projecting through or adjacent to decking.
 - 3. Locate holes and openings to clear structural framing and bracing members.
 - 4. Reinforcement around openings:
 - a. Roof Deck: For hole sizes of at least 6 inches across, but not more than 12 inches across in roof deck, reinforce with 0.0474-inch design thickness steel plate, painted, or galvanized to match deck coating. Extend plate at least 12 inches beyond opening in all directions and attach to top of roof deck with No. 10 self-drilling screws at 6-inch spacing and at all corners. For openings larger than 12 inches across, reinforce roof deck with framing as shown on Drawings.

- J. Protect deck areas from heavy concentrated loads or wheel traffic with planking or other approved means. Do not impose construction loads that exceed the load capacity of the deck.
- K. Install temporary shoring, if required, to meet strength and deflection limitations, before placing any concrete topping on deck panels.
- L. Completed Deck: Free from buckles and irregularities, and in accordance with FM and UL requirements.

3.03 DECK ATTACHMENT

- A. Fasten panels as shown in the following schedule:

Steel Deck Attachment Schedule							
		At Perpendicular Supports		At Parallel Supports		At Sidelaps	
Type	Depth (in)	Type	Spacing	Type	Spacing (in)	Type	Spacing
Floor Deck	2 + 4	5/8" dia. puddle welds	12" o.c.	5/8" dia. puddle welds	24" max	Weld per Mfr	24" max

- B. Welded Connections: Weld deck sidelaps, attachment to framing, and accessories in accordance with AWS D1.3 and as specified in Section 05 05 23, Welding.
- C. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating with two coats of cold galvanizing compound which imparts cathodic action against corrosion. Surface preparation and application shall be in accordance with the manufacturer's instructions.
- D. Mechanical Fasteners:
 - 1. Self-Drilling Screws:
 - a. Install screws in accordance with manufacturer's written instructions and with special installation tool. Do not over-torque.
 - b. Remove and re-drive screws at sidelaps where upper sheet is not drawn tightly against lower sheet.

3.04 TOUCHUP PAINTING

- A. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating with two coats of cold galvanizing compound which imparts cathodic action against corrosion. Surface preparation and application shall be in accordance with the manufacturer's instructions.

- B. Immediately following erection, remove unused deck edge trimmings, screws, fasteners, welding washers, butt ends of welding rods, and debris from completed installation.
- C. Clean field welds, bolted connections, rust spots, and abraded areas.
- D. Repair any damaged galvanized surfaces with zinc-rich spray paint in accordance with ASTM A 780; color to match galvanized deck.
- E. Use magnetic gauge to determine that thickness of repair is equal to or greater than base painted or galvanized coating.

3.05 FIELD QUALITY CONTROL

- A. An independent testing agency will be retained by Owner to perform following inspections.
 - 1. Welded Connections: Visually inspect in accordance with AWS D1.3, Section 7, and as specified in Section 05 05 23, Welding.
 - 2. Mechanical Fasteners: Visually inspect, in accordance with manufacturer's instructions, for each type of fastener.
- B. Repair or replace defective welds and fasteners.

END OF SECTION

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SECTION 05 41 00**COLD-FORMED STEEL FRAMING****PART 1 – GENERAL****1.01 SUMMARY**

1. This section applies to cold-formed metal trusses.
2. Relevant specification sections include 09 22 16, Non-Structural Metal Framing, applicable to interior non-loadbearing metal stud wall framing.

1.02 SUBMITTALS

- A. Product Data: Truss Component Manufacturer's material certifications and descriptive literature for each item of cold-formed metal framing and each accessory specified in this section.
- B. Shop Drawings: Truss fabricator's drawings and details that indicate the following:
 1. special components and installations not fully detailed in product data
 2. the number, types, location, and spacings of trusses and other framing members
 3. details of truss loading, reactions, uplifts, support locations, material sizes and gauges, permanent truss web bracing, and splices as required for a complete installation
- C. Truss Component Manufacturer's Instructions: Printed installation instructions for each item of cold-formed metal framing and each accessory specified in this section.
- D. Design Data: Results of design analysis, bearing the seal and signature of a professional engineer registered in the State in which project is located.
- E. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding.

1.03 QUALITY ASSURANCE

- A. General: For member section properties, meet requirements of AISI, Specification for the Design of Cold-Formed Steel Structural Members and Design Guide for Cold-Formed Steel Trusses.
- B. Qualifications for Welding: As specified in Section 05 05 23, Welding.
- C. Pre-installation Meeting: to be held on site prior to commencement of construction activities of this section to include installer(s) of products in this section, general contractor, engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Handle and lift shop assembled units in accordance with Truss Component Manufacturer's recommendations to prevent damage or distortion.
- B. Deliver to Site in bundles marked with name of manufacturer, section type, thickness, grade of material, and length.
- C. Store bundles on wood blocking, flat and off ground, to keep clean and to prevent any damage or permanent distortion. Adhere to other recommendations from Truss Component Manufacturer to prevent damage, distortion and moisture buildup.

1.05 DESIGN REQUIREMENTS

- A. Design loads shall be as indicated on the drawings.
- B. Design framing systems to withstand design loads without vertical deflections greater than 1/240 of the span.
- C. 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 degrees F.
- D. Design framing systems to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

PART 2 – PRODUCTS**2.01 GENERAL**

- A. Truss system, with framing components and accessories, shall provide a complete horizontal framing system, ready for deck installation, meeting specified Design Requirements.
- B. Dimensions and Properties: Calculate section properties in accordance with AISI Cold-Formed Steel Design Manual.

2.02 MANUFACTURERS

- A. Choose from the following:
 - 1. Aegis Metal Framing (MiTek USA Inc.).
 - 2. Advanced Exterior Systems.
 - 3. TrusSteel (ITW Building Components Group).
 - 4. Nuconsteel (A Nucor Company)

5. Raney Truss
6. East Coast Truss, Inc.
7. Other approved suppliers may be considered upon request, prior to submittal of bids and contract award.

2.03 MATERIALS

- A. Truss chord and web components shall have rolled or closed edges.
- B. Load Bearing Members: Mechanical properties of components shall be determined by testing conforming to ASTM A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products. Members shall be cold-formed to indicated sizes, profiles, and thickness of steel conforming to ASTM A 653, minimum G60 coating, and ASTM A500 as follows:
 1. Chord materials - Minimum yield strength 55,000 KSI
 2. Web materials - Minimum yield strength 45,000 KSI.
 3. Shapes: Indicated on shop drawings.
 4. Size: Indicated on shop drawings.
 5. Gauge: Indicated on shop drawings.
- C. Fasteners Used in Fabricating Trusses: All web to chord connections shall be made with the appropriate screw fastener as recommended by the Truss Component Manufacturer. Each screw shall bear the stamp of the Truss Component Manufacturer for ready identification. Alternative fastening methods, such as welding, are not acceptable.
- D. Accessories shall be from same manufacturer as trusses.

2.04 MECHANICAL FASTENERS

- A. Self-Drilling Screws:
 1. Self-drilling, self-tapping screws with hexagonal washer head and corrosion-resistant finish.
 2. Manufacturers and Products:
 - a. ITW Buildex, Itasca, IL; ICH Traxx Self-Drilling Fasteners with Climaseal Coating and Autotraxx Standup Installation Tool.
 - b. Hilti, Inc., Tulsa, OK; Kwik-Pro RWH Self-Drilling Screws with Kwik-Cote Treatment and Kwik-Tapper Screwdriver.
- B. Powder-Driven Fasteners:
 1. Knurled shank, minimum 1/2-inch diameter steel washer, corrosion-resistant coating.

2. Pin diameter and length to suit deck type and flange thickness of steel support member.
3. Manufacturers and Products:
 - a. ITW Buildex, Itasca, IL; Buildex BX14 pins with yellow dichromate galvanizing and BX900 Installation Tool.
 - b. Hilti, Inc., Tulsa, OK; ENP-series fasteners with electroplated zinc coating and DX-750 Installation Tool.

2.05 FABRICATION

- A. Shop fabricate from cold formed steel components in accordance with shop drawings, using jiggling systems to ensure consistent component placement and alignment of components, and to maintain specified tolerances as shown herein.
- B. Field fabrication of trusses is strictly prohibited unless performed by authorized fabricator using the fabricator's shop assemblers and proper jiggling systems. Request for this must be sent to Engineer with fabricator documentation.
- C. Shop fabrication of other cold formed steel framing components into assemblies prior to erection is permitted; fabricate assemblies in accordance with shop drawings.

2.06 TOLERANCES

- A. Material Tolerances: Steel for cold-formed chord components:
 1. Nominal 22 ga. members: Minimum bare metal thickness: 0.0284 inch, Maximum design thickness: 0.0299 inch.
 2. Nominal 20 ga. members: Minimum bare metal thickness: 0.0329 inch, Maximum design thickness: 0.0346 inch.
 3. Nominal 18 ga. members: Minimum bare metal thickness: 0.0428 inch, Maximum design thickness: 0.0451 inch.
 4. Nominal 16 ga. members: Minimum bare metal thickness: 0.0538 inch, Maximum design thickness: 0.0566 inch.
- B. Material Tolerances: Steel for cold-formed web components
 1. Nominal 20 ga. members: Minimum bare metal thickness: 0.033 inch, Maximum design thickness: 0.035 inch.
 2. Nominal 18 ga. members: Minimum bare metal thickness: 0.047 inch, Maximum design thickness: 0.049 inch.
 3. Nominal 16 ga. members: Minimum bare metal thickness: 0.063 inch, Maximum design thickness: 0.065 inch.

- C. Materials Tolerances: Truss Assemblies: Fabricate to tolerances of maximum variation from plumb, level, or true to line as indicated below:
1. Trusses up to 30 ft long = max 1/2 in. variation from design length.
 2. Trusses over 30 ft. long = max 3/4 in. variation from design length.
 3. Trusses up to 5 ft. high = max 1/4 in. variation from design height.
 4. Trusses over 5 ft. high = max 1/2 in. variation from design height.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Inspect all fabricated assemblies and repair any damage.
- B. Examine bearing support surfaces for compliance with requirements for installation tolerances and other conditions affecting performance of metal framing systems.
- C. Provide smooth level bearing surfaces.
- D. Clean all member and bearing surfaces that will be in contact after assembly.

3.02 INSTALLATION

- A. General:
1. Install framing systems as indicated on Drawings, complete and in accordance with manufacturer's recommendations.
 2. Provide temporary bracing for support of all construction loads until framing system is installed complete with sheathing or decking.
 3. Install framing in true line, plumb, level, and in proper alignment.
 4. Cut ends of framing members with saw or shear to bear uniformly against abutting members. Flame cutting is not permitted.
 5. All structural framing members shall be full-length without splices, unless indicated otherwise.
 6. Fasten members together in accordance with AISI, Cold-Formed Steel Design Manual, Part N, Connections. Wire tying is not permitted.
- B. Metal Trusses:
1. Install metal trusses in accordance with Truss Component Manufacturer's instructions and the Truss Fabricator's shop drawing submittal. Place components at spacings indicated on the Truss Fabricator's shop drawings. Install truss installation (erection) bracing. Truss installation (erection) bracing shall hold trusses straight and plumb and in safe

condition until decking and permanent truss bracing has been fastened, forming a structurally sound framing system. All sub-contractors shall employ proper construction procedures to insure adequate distribution of temporary construction loads so that the carrying capacity of any single truss or group of trusses is not exceeded.

2. Install required roof and system permanent bracing and bridging as indicated by the drawings and notes of the Architect or Engineer. See the Truss Fabricator's shop drawings for any additional bracing requirements. All truss installation (erection) bracing and permanent bracing and bridging shall be installed before the application of any loads.
3. The field removal, cutting or alteration of any truss chord, web or bracing members is not allowed without prior written approval of the Engineer and the Truss Designer.
4. Damaged chords, webs and complete trusses shall be repaired or replaced as directed and approved in writing by the Engineer and the Truss Designer prior to installation or application of the repair or replacement.
5. Install field fasteners as identified on drawings and in accordance with Manufacturer's recommendations.
6. Tolerances:
 - a. Variation from Level or Specified Plane: Maximum 1/8 inch in 10 feet.
 - b. Variation from Specified Position: Maximum 1/4 inch.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will be retained by Owner to inspect field connections and welds.
 1. Mechanical Fasteners: Visually inspect in accordance with manufacturer's instructions, for each type of fastener.
 2. Welded connections performed during fabrication shall be visually inspected.
- B. Repair or replace defective welds and/or fasteners.

END OF SECTION

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SECTION 05 50 00**METAL FABRICATIONS****PART 1- GENERAL****1.01 CLASSIFICATION OF ENVIRONMENTS**

- A. See Paragraph 1.03 of Section 01 00 01, General Requirements for additional information.

1.02 SUBMITTALS

- A. Action Submittals:

1. Shop Drawings:

- a. Metal fabrications, including welding and fastener information.
- b. Specific instructions for concrete anchor installation, including drilled hole size, preparation, placement, procedures, and instructions for safe handling of anchoring systems.

2. Samples: Color samples of abrasive stair nosings.

- B. Informational Submittals:

1. Concrete and Masonry Drilled Anchors:

2.

- a. Manufacturer's product description and installation procedures.
- b. Current test data or ICC Evaluation Report.
- c. Adhesive Anchor Installer Certification.

3. U-Channel Concrete Inserts:

4.

- a. Manufacturer's product description.
- b. Allowable load tables.

3. Ladders: Certification of load and fatigue tests.

4. Passivation method for stainless steel members.

5. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer, with description of material processed and ASTM standard used for coating.

1.03 QUALITY ASSURANCE

- A. Qualifications:

1. Adhesive Anchor Installers: Trained and certified by manufacturer.

2. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Insofar as practical, factory assemble items specified herein. Assemblies that due to necessity have to be shipped unassembled shall be packaged and tagged in manner that will protect materials from damage and will facilitate identification and field assembly.
- B. Package stainless steel items in a manner to provide protection from carbon impregnation.
- C. Protect painted coatings and hot-dip galvanized finishes from damage due to metal banding and rough handling. Use padded slings and straps.
- D. Store fabricated items in dry area, not in direct contact with ground.

1.05 GUARANTEE-OWNER AS BENEFICIARY

- A. Provide manufacturer's guarantee or warranty, with Owner named as beneficiary, in writing. Guarantee shall provide for correction of Work specified in this Section found defective during period of 2 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

1.06 EXTRA MATERIALS

- A. Furnish, tag, and box for shipment and storage the following extra materials:

<u>Item</u>	<u>Quantity</u>
Neoprene Gasket	Two for each location requiring neoprene gaskets.
Four-inch wide by 50-foot long neoprene gasket material	One roll for each location requiring neoprene gaskets.
Neoprene Gasket Adhesive each	One (manufacturer's recommended) for location requiring neoprene gaskets.

- B. Delivery: In accordance with Section 01 00 01, General Requirements.

PART 2 - PRODUCTS**2.01 GENERAL**

- A. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5 inches thick for A36 steel), limit the maximum silicon content to 0.21 percent and the phosphorous content to 0.03 percent.
- B. Unless otherwise indicated, meet the following requirements:

	<u>Item</u>	<u>ASTM Reference</u>
	Stainless Steel: Bars and Angles	A276, AISI Type 304 or 316 (304L or 316L for welded connections)
	Shapes	A276, AISI Type 304 or 316 (304L or 316L for welded connections)
	Steel Sheet, and Strip	A240/A240M, AISI Type 304 or 316 (304L or 316L for welded connections)
316, Anchor Condition CW	Bolts, Threaded Rods,	F593, AISI Type 304 or Anchor Bolts, and Studs
316,	Nuts	F594, AISI Type 304 or Condition CW
	Steel Bolts and Nuts: Carbon Steel High-Strength nuts	A307 bolts, with A563 nuts A325, Type 1 bolts, with A563
	Anchor Bolts and Rods	F1554, Grade 55, with weldability supplement S 1.
	Eyebolts	A489
	Threaded Rods	A36/A36M
	Flat Washers (Unhardened)	F844

Flat and Beveled Washers (Hardened)	F436
Thrust Ties for Steel Pipe: Threaded Rods	A193/A193M, Grade B7
Nuts	A194/A194M, Grade 2H
Plate	A283/A283M, Grade 2D
Welded Anchor Studs	A108, Grades C–1010 through C–1020
Aluminum Plates and Structural Shapes	B209 and B308/B308M, Alloy 6061–T6
Aluminum Bolts and Nuts	F468, Alloy 2024–T4
Cast Iron	A48, Class 35
C.	Bolts, Washers, and Nuts: Use stainless steel, hot–dip galvanized steel, zinc–plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

2.02 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

- A. Cast–In–Place Anchor Bolts:
1. Headed type, unless otherwise shown on Drawings.
 2. Material type and protective coating as shown in Fastener Schedule at end of this section.
- B. Anchor Bolt Sleeves:
1. Plastic:
 - a. Single unit construction with corrugated sleeve.
 - b. Top of sleeve shall be self–threading to provide adjustment of threaded anchor bolt projection.
 - c. Material: High density polyethylene.
 - d. Manufacturer: Sinco Products, Inc., Middletown, CT, (800) 243–6753.
 2. Fabricated Steel: ASTM A36/A36M.

2.03 CONCRETE AND MASONRY DRILLED ANCHORS

- A. General:
1. AISI Type 304 or 316 stainless, hot–dip galvanized, or zinc–plated steel, as shown in Fastener Schedule at end of this section.

2. Current evaluation and acceptance reports by ICC or other similar code organization.
- B. Wedge Anchors:
1. Manufacturers and Products:
 - a. ITW Ramset/Red Head, Addison, JL; Trubolt Wedge Anchor.
 - b. Hilti, Inc., Tulsa, OK; Kwik-Bolt-3 (KB-3) Anchor.
 - c. Powers Fasteners, New Rochelle, NY; Power-Stud Anchor.
 - d. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Wedge-All Anchor.
 - e. Wej-It Corp., Tulsa, OK; ANKR-fite Wedge Anchor.
 - f. Adhesives Technology, Pompano Beach, FL; Kingpin Wedge Anchor.
 - g. Unifex, Kansas City, MO; Pro-Poxy 300 and Pro-Poxy 300 Fast Epoxy Adhesive Anchors.
- C. Expansion Anchors:
1. Self-drilling anchors, snap-off or flush type, zinc-plated.
 2. Non-drilling Anchors: Flush type for use with zinc-plated or stainless steel bolt, or stud type with projecting threaded stud.
 3. Manufacturers and Products:
 - a. ITW Ramset/Red Head, Addison, JL; Multi-Set II Drop-In and Self Drill Anchor.
 - b. Hilti, Inc., Tulsa, OK; Hilti HDI Drop-In Anchor.
 - c. Powers Fasteners, New Rochelle, NY; Steel Drop-In Anchor.
 - d. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Drop-In Anchor.
- D. Undercut Anchors:
1. Manufacturers and Products:
 - a. USP Structural Connectors; DUC Undercut Anchor.
 - b. Hilti, Inc., Tulsa OK; HDA Undercut Anchor.
- E. Sleeve Anchors:
1. Manufacturers and Products:
 - a. ITW Ramset/Red Head, Addospm. II; Dyanbolt Hex Nut Sleeve Anchor.
 - b. Powers Fasteners, New Rochelle NY; Hex Head Power-Bolt Anchor.
 - c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Sleeve-All Hex Head Anchor.
 - d. Wej-It Corp., Tulsa, OK; Wej-It Sleeve Anchor.
 - e. Hilti, Inc., Tulsa, OK; HSL-3 Heavy Duty Sleeve Anchor.
- F. Adhesive Anchors:
1. Threaded Rod:

- a. ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.
- b. Length as required, to provide minimum depth of embedment.
- c. Clean and free of grease, oil, or other deleterious material.
- d. For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.

2. Adhesive:

- a. Two-component, designed to be used in adverse freeze/thaw environments, with gray color after mixing.
- b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
- c. Nonsag, with selected viscosity base on installation temperature and overhead application where applicable.
- d. Adhesive anchoring system shall be certified to meet AC308.

3. Packaging and Storage:

- a. Disposable, self-contained cartridge system capable of dispensing both components in the proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
- b. Store adhesive cartridges on pallets or shelving in covered storage area, in accordance with manufacturer's written instructions.
- c. Cartridge Markings: Include manufacturer's name, product name, material type, batch or serial number, and adhesive expiration date.
- d. Dispose of cartridges if shelf life has expired.

4. Manufacturers and Products:

- e. Hilti, Inc., Tulsa, OK; HIT RE 500, HIT HY 20 and HY 200.

G. Adhesive Threaded Inserts:

- 1. Stainless steel, internally threaded insert.
- 2. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-R Insert with HIT HY 200 adhesive.

2.04 WELDED ANCHOR STUDS

A. Headed anchor studs (HAS), threaded anchor studs (TAS), or deformed bar anchors (DBA), as indicated on Drawings.

- 1. Carbon Steel: ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semi-killed or killed aluminum or silicon dioxidation, unless indicated otherwise.

B. Manufacturers:

- 1. Nelson Stud Welding, FabriSteel Co., Elyria, OH.

2. Stud Welding Associates, Inc., Elyria, OH.

2.05 PIPE SLEEVES

A. As specified in Division 40 Specifications.

2.06 STEEL LINTELS AND SHELF ANGLES

A. In accordance with shapes and designations shown in Section 05 12 00 Structural Steel Framing.

2.07 ALUMINUM SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

- A. Aluminum support frames and connections to be installed in concrete shall be designed and provided by the fabricator.
- B. Protective coatings shall be applied to aluminum components as required by the fabricator.

2.08 FABRICATED UNITS

- A. Valve Operator Access Box: Cast iron, 8 inches by 4 inches, as manufactured by Zurn; No. ZN-1930-K.
- B. Wire Mesh Screen:
1. Fabricate frame of aluminum shapes and flat bar stock.
 2. Wire Mesh: Woven of 14-gauge aluminum wire, three openings per inch, stretched taut over frame before bolts are tightened down.

2.09 CASTINGS

- A. Meter Box Manhole: Nonslip surface and handle, as manufactured by Olympic Foundry Co.; 5823B.
- B. Floor Boxes:
1. Cast iron, except as otherwise shown.
 2. Depth: Equal to slab thickness where installed.
 3. Diameter: As shown.
 4. Manufacturers and Products:
 - a. Neenah Foundry, Neenah, WI; R 7506.
 - b. Mueller, Decatur, IL; No. A-27010.
 - c. Olympic Foundry Co., Seattle, W A; No. 5680.

2.10 ACCESSORIES

- A. Anti-seizing Lubricant for Stainless Steel Threaded Connections:
1. Suitable for potable water supply.

2. Resists washout.
3. Manufacturers and Products:
 - a. Bostik, Middleton, MA; Neverseez.
 - b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:

1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
2. Thickness: Minimum 1/4 inch.
3. Furnish without skin coat.
4. Manufacturer and Product: Rubatex Corporation, Bedford, V A; Rubatex No. RA11-N.

2.11 FABRICATION

A. General:

1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
3. Conceal fastenings where practical; where exposed, flush countersink.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 and 0.25 percent.
3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures – Allowable Stress Design.

C. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1, Section 5.
4. Aluminum: Meet requirements of AWS D 1.2.
5. Stainless Steel: Meet requirements of AWS D1.6.
6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D 1.1, Section 7, and manufacturer's instructions.
7. Complete welding before applying finish.

D. Painting:

1. Shop prime with rust-inhibitive primer as specified in Section 09 90 00, Painting and Coating, unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

E. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143, ASTM A384, and ASTM A385. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Watertight Seal: Where required or shown, furnish neoprene gasket of a type that is satisfactory for use in contact with sewage. Cover full bearing surfaces.

G. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

H. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.12 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct any deficiencies.

1. Steel: AWS D 1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
2. Aluminum: AWS D 1.2.
3. Stainless Steel: AWS D1.6.

B. Hot-Dip Galvanizing:

1. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three test samples from each lot in accordance with ASTM A123/A123M and ASTM A153/A153M.
2. Reject and retest nonconforming articles in accordance with ASTM A123/A123M and ASTM A153/A153M.

PART 3 - EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:

1. Install metal fabrications plumb or level, accurately fitted, free from distortion or defects.
2. Install rigid, substantial, and neat in appearance.
3. Install manufactured products in accordance with manufacturer's recommendations.
4. Obtain Contractor approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:

1. Do not remove mill markings from concealed surfaces.
2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

C. Pipe Sleeves:

1. Provide where pipes pass through concrete or masonry.
2. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls.
3. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
4. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

- D. Steel Lintels and Shelf Angles:** Provide as required for support of masonry and other construction not attached to structural steel framing, unless otherwise shown on Drawings.

3.02 CAST-IN-PLACE ANCHOR BOLTS

- A.** Accurately locate and hold anchor bolts in place with templates at the time concrete is placed.
- B.** Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.
- C.** Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise

shown.

3.03 CONCRETE AND MASONRY DRILLED ANCHORS

- A. Begin installation only after concrete or masonry to receive anchors has attained design strength.
- B. Install in accordance with manufacturer's instructions.
- C. Provide minimum embedment, edge distance, and spacing as indicated on the Drawings.
- D. Use only drill type and bit type and diameter recommended by anchor manufacturer. Clean hole of debris and dust with brush and compressed air.
- E. For undercut anchors, use special undercutting drill bit and rotary hammer drill and apply final torque as recommended by anchor manufacturer.
- F. When embedded steel or rebar is encountered in the drill path, slant drill to clear obstruction. If drill must be slanted more than 10 degrees to clear obstruction, notify Contractor for direction on how to proceed.
- G. Adhesive Anchors:
 - 1. Do not install adhesive anchors when temperature of concrete is below 40 degrees F or above 100 degrees F.
 - 2. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry where required by manufacturer's instructions.
 - 3. For hollow-unit masonry, install screen tube in accordance with manufacturer's instructions.
 - 4. Do not disturb anchor during recommended curing time.
 - 5. Do not exceed maximum torque as specified in manufacturer's instructions.

3.04 U-CHANNEL CONCRETE INSERTS

- A. Provide as indicated for pipe supports and where otherwise shown on Drawings.
- B. Except for interior dry areas, use plastic clips or similar dielectric material to isolate channel anchors from concrete reinforcing steel.

3.05 ELECTROLYTIC PROTECTION

- A. Aluminum and Galvanized Steel:
 - 1. Coat surfaces of aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified by fabricator/manufacturer.
 - 2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

3. Allow coating to dry before installation of the material.
 4. Protect coated surfaces during installation.
 5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.
- B. Titanium: Where titanium equipment is in contact with concrete or dissimilar metal, provide full-face neoprene insulation gasket, 3/32-inch minimum thickness and 70-durometer hardness.
- C. Stainless Steel:
1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
 2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
 3. Remove contamination in accordance with requirements of ASTM A380 and ASTM A967.
 4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
 5. After treatment, visually inspect surfaces for compliance.

3.06 PAINTING AND REPAIR OF GALVANIZED STEEL

- A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 00, Painting and Coating.
- B. Repair of Damaged Hot-Dip Galvanized Coating:
1. Conform to ASTM A 780.
 2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
 3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
 4. Use magnetic gauge to determine that thickness is equal to or greater than the base galvanized coating.

3.07 FIELD QUALITY CONTROL

- A. Welded Anchor Studs:
1. At start of each production period, Subcontractor shall perform the following test to determine proper generator, control unit, and stud welding gun settings, in accordance with AWS D 1.1, Chapter 7:
 - a. Weld two test studs and visually inspect for full 360-degree flash.
 - b. Bend test studs 30 degrees from vertical for headed anchor studs (HAS). Torque test threaded anchor studs (TAS) studs per AWS D1.1, Section 7.6.6.2.
 - c. Test studs will be acceptable if there is no failure of welds.
 - d. If weld fails, repeat test until two consecutive test studs test to be satisfactory.

2. During production, if visual inspection reveals that weld does not exhibit full 360-degree flash or that stud has been repaired by welding, Subcontractor shall perform the following test in accordance with AWS D1.1, Chapter 7:
 - a. HAS studs, bend stud approximately 15 degrees from vertical, away from missing portion of flash. For TAS studs, torque test per AWS D1.1, Section 7.6.6.2.
 - b. Studs meeting this test without exhibiting cracks in weld will be considered acceptable and left in bent position.
 - c. Replace studs failing test.

3.08 MANUFACTURER'S SERVICES

- A. Adhesive Anchors: Conduct site training of installation personnel for proper installation, handling, and storage of adhesive anchor system. Notify Contractor of time and place for sessions.

3.09 FASTENER SCHEDULE

- A. Unless indicated otherwise on the Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications, and Castings		
Interior Dry Areas	Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise.	
Exterior and Interior Wet Areas	Stainless steel headed anchor bolts.	See Section 09 90 00 – Painting and Coating
Submerged and Corrosive Areas	Stainless Steel headed anchor bolts	See Section 09 90 00 – Painting and Coating
2. Anchor Bolts Cast Into Concrete for Equipment Bases		
Interior Dry Areas	Stainless steel headed anchor bolts, unless otherwise specified with equipment	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor bolts, unless unspecified with equipment	See Section 09 90 00 – Painting and Coating

Service Use and Location	Product	Remarks
3. Drilled Anchors for Metal Components to Cast-In-Place Concrete (e.g., Ladders, Handrail Post, Electrical Panels, and Equipment).		
Interior Dry areas	Zinc – plated or stainless steel wedge or expansion	Use stainless steel undercut anchors or overhead and ceiling installations
Submerged, Exterior, Interior Wet, and Corrosive Areas Adhesive stainless steel anchors	Adhesive stainless steel anchors	Use stainless steel undercut anchors or overhead and ceiling installations.
4. Anchors in Grout – Filled Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Hot-Dip galvanized steel anchor bolts, zinc-plated or stainless steel sleeve anchors, or stainless steel adhesive anchors	
5. Anchors in Hollow Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Zinc-plated or stainless steel sleeve anchors or stainless steel adhesive anchors with screen tube.	
6. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members
7. Connections for Steel Fabrications and Wood Components		
Exterior and Interior Wet and Dry Areas	Stainless Steel bolted connections	

- B. Anti-seizing Lubricant: Use on all stainless steel threads.
- C. Do not use adhesive anchors to support fire-resistant construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION

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SECTION 05 51 00 – METAL STAIRS

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SECTION 05 51 00**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 with concrete-filled treads.
- B. Related Sections:
 - 1. Section 05 52 13 "Metal Railings" for pipe and tube railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Metal stairs shall withstand 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 to L/360 or 1/4 inch, whichever is less.

1.4 SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Paint products.
 - 2. Grout.

- B. 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. 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 and legally authorized to practice in South Carolina.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
- C. 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 anchors, 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. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

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 mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, ASME B18.21.1.
- H. 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.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. 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.
- D. 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, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding, unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. 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: Fabricate stringers of structural-steel channels, plates, or a combination of both, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
1. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- B. Metal-Pan Stairs: Form risers, subtreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.
1. Steel Sheet: Uncoated cold- or hot-rolled steel sheet.
 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 4. Shape metal pans to include nosing integral with riser.
 5. Attach abrasive nosings to risers.
 6. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.7 FINISHES

- A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize exterior items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Finish Painting: Finish painting of stairs is specified in Section 09 90 00 "Painting & Protective Coating."

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 from rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- 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.

3.2 ADJUSTING AND CLEANING

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

END OF SECTION

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SECTION 05 52 13

METAL 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. Exterior aluminum tube railings.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Stairs" for metal stair assembly to receive aluminum tube railings.

1.3 PERFORMANCE REQUIREMENTS

- A. 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.
- B. 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.
- C. 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 and anchoring cement.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."

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. Aluminum Pipe and Tube Railings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATR Technologies, Inc.
 - b. Blum, Julius & Co., Inc.
 - c. Superior Aluminum Products, Inc.
 - d. Tubular Specialties Manufacturing, Inc.
 - e. Wagner, R & B, 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. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.
- C. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- D. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 304 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. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. 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.

- D. 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.
- 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 either welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- I. 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.
- J. Form changes in direction as follows:
 - 1. By bending.
- K. 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.

- L. Close exposed ends of railing members with prefabricated end fittings.
- M. 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.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
- O. 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.
- P. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

2.7 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

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. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. 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. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- C. 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 RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges 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. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

- C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

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

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SECTION 05 53 00**METAL GRATINGS****PART 1 – GENERAL****1.01 REFERENCES**

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shape, and Tubes.
 2. National Association of Architectural Metal Manufacturers (NAAMM):
 - a. MBG 531, Metal Bar Grating Manual.
 - b. MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.02 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
 - a. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.
 - b. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
 - c. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
 - d. Catalog information and catalog cuts.
 - e. Manufacturer's specifications, to include coatings.
- B. Informational Submittals:
1. Special handling and storage requirements.
 2. Installation instructions.
 3. Factory test reports.
 4. Manufacturer's Certification of Compliance for specified products.
 5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.03 PREPARATION FOR SHIPMENT

- A. Insofar as is practical, factory assemble items provided.

- B. Package and clearly tag parts and assemblies that are of necessity shipped unassembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 – PRODUCTS

2.01 FOOT TRAFFIC GRATING

- A. Design Criteria:
 - 1. Uniform Service Load shall be as noted on the drawings.
- B. Description:
 - 1. Aluminum Pressure Locked Bar type grating.
 - 2. Maximum Deflection: 1/4 inch, unless otherwise shown.
 - 3. Space bearing bars as required for design loads, with a maximum of 1-inch center-to-center.
 - 4. Bearing bar depth shall be minimum required to meet loading requirements and design conditions.
 - 5. Bearing bar thickness shall be 3/16" to provide 3/4" between bars.
 - 6. Top surface of bars: Slip Resistant
 - 7. Cross Bar spacing: 2" or 4" on center, as required to meet loading requirements and design conditions.
 - 8. Banding: 3/16 inch minimum, same material as grating; NAAMM MBG 531 and NAAMM MBG532
- C. Manufacturers:
 - 1. Ohio Gratings Inc. Type 15-ADT-2 or 4 or
 - 2. Borden Gratings Inc., Type L or LF.
- D. Materials:
 - 1. Aluminum bearing bars and banding shall be 6063-T6 and Aluminum Cross Bars shall be 6063-T52; ASTM B221.
 - 2. Finish: Mill Finish.

2.02 ACCESSORIES

- A. Except where noted otherwise, hardware and removable fastener clips shall be stainless steel, as recommended by manufacturer, compatible with grating system, and capable of meeting the loading requirements with appropriate safety factors.
- B. Removable Fastener Clips shall be removable from above grating walkway surface.
- C. Partially Removable Anchor:

1. Bolt: Threaded stud, Type 304 or Type 316 stainless steel.
 - a. Manufacturer: Nelson Stud Welding Co., Lorain, OH.
2. Hat Bracket: Type 304 stainless steel.
 - a. Manufacturer: STRUCT-FAST, Wellesley Hills, MA.

2.03 FABRICATION

A. General:

1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld Connections: Not permitted on grating except at banding bars.

B. Design:

1. Field measure areas to receive grating, Verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
2. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
3. Minimum Bearing & Fabrication Tolerances shall be in accordance with NAAMM MBG 53I.
4. Crossbars: Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth.
6. Do not use weld type crossbars.
7. Furnish stainless steel Type 304 or Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, as manufactured by Nelson Studs Welding Co., Lorain, OH.

C. Supports:

1. Seat Angles and Beams:
 - a. To be designed and provided by grating manufacturer.
 - b. To be same material as rectangular bar grating.
 - c. Extruded aluminum frame with slot for recessed grating clips.
2. Coordinate dimensions and fabrication with grating to be supported.
3. Coordinate dimensions with increased depth due to serrations (if applicable).
4. Welded Frames with Anchors: Continuously welded.

- E. Aluminum:
 - 1. ASTM B221 extruded shapes.
 - 2. Fabricate as shown and in accordance with manufacturer's recommendations.
 - 3. Grind smooth sheared edges exposed in the finished work.
- F. Foot Traffic Grating: Any single grating section, individual plank, or plank assembly shall be not less than 1 foot 6 inches or greater than 3 feet 0 inch in width or weigh more than 160 pounds.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Electrolytic Protection:
 - 1. Aluminum in contact with dissimilar metals, other than stainless steel, and embedded or in contact with masonry, grout, and concrete, protect surfaces as specified in Section 09 90 00, Painting and Coating.
 - 2. Allow paint to dry before installation of the material.

3.02 INSTALLATION

- A. Installation shall be in accordance with manufacturer's recommendations.
- B. Install supports such that grating sections have a solid bearing on both ends, and that rock and wobble grating movement does not occur under designed traffic loading.
- C. Install plumb or level as applicable.
- D. Install welded frames with anchors to straight plane without offsets.
- E. Completed installation shall be rigid and neat in appearance.
- F. Protect painted surfaces during installation. Should coating become marred, prepare and touch up surface in accordance with paint manufacturer's instructions.

END OF SECTION