SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural steel shapes, plates, and bars.
2. Structural pipe.
3. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

A. Materials Testing And Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Steel Decking: Section 05 31 00, STEEL DECKING.

C. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.

D. Steel Framing: Section 08 56 53, BLAST RESISTANT FAÇADE SYSTEMS; Section 08 51 13 Aluminum Windows, Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS ;

E. Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Institute of Steel Construction (AISC):
1. AISC Manual - Steel Construction Manual, 14th Ed.
2. 303-10 - Code of Structural Steel Buildings and Bridges.
3. 360-10: Specification for Structural Steel Buildings.

C. The American Society of Mechanical Engineers (ASME):
1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.

D. American Welding Society (AWS):
1. D1.1/D1.1M-15 - Structural Welding Code - Steel.

E. ASTM International (ASTM):
1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
2. A36/A36M-14 - Carbon Structural Steel.
3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
11. A992/A992M-15 - Structural Shapes.
12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.

13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.

H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.

I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

D. Test Reports: Certify products comply with specifications.
1. Welders' qualifying tests.

E. Certificates: Certify each product complies with specifications.
1. Structural steel.
2. Steel connections.
3. Welding materials.
4. Shop coat primer paint.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Fabricator with project experience list.
2. Installer with project experience list.
3. Welders and welding procedures.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible Engineer registered in the state in which the project is located.
1. Connection calculations.

H. The connection engineer shall also submit a letter documenting they have reviewed the steel shop drawings and their connection designs have been properly incorporated into the steel shop drawings..Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
1. Regularly fabricates specified products.
2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.

B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations for minimum five years.

C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.

D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.

B. Design structural steel framing connections complying with specified performance:
1. Load Capacity:Resist loads indicated on drawings Account for connection and member loads and eccentricities.
   a. Request additional design criteria when necessary to complete connection design.
2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the Contracting Officer Representative of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Contracting Officer's Representative. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

2.2 MATERIALS

A. W-Shapes:
1. ASTM A992/A992M.

B. Channel and Angles:
1. ASTM A36/A36M.

C. Plates and Bars:
1. ASTM A36/A36M.

D. Hollow Structural Sections:
1. ASTM A500/A500M Grade B

E. Structural Pipe: ASTM A53/A53M, Grade B.

F. Bolts, Nuts and Washers: Galvanized for galvanized framing and plain finish for other framing .
1. High-strength bolts, including nuts and washers: ASTM F3125.
2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.

G. Welding Materials: AWS D1.1, type to suit application.

2.3 PRODUCTS - GENERAL

A. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.
   2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
      a. Paints and coatings.

2.4 FABRICATION

A. Fabricate structural steel according to Chapter M, AISC 360.

B. Shop and Field Connections:
   1. Weld connections according to AWS D1.1/D1.1M. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
   2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

2.5 FINISHES

A. Shop Priming:
   1. Prime paint structural steel according to AISC 303, Section 6.
      a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.

B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.

C. Do not paint:
   1. Surfaces within 50 mm (2 inches) of field welded joints.
   2. Surfaces indicated to be encased in concrete.
   3. Surfaces receiving sprayed on fireproofing.
   4. Beam top flanges receiving shear connector studs applied.
   5. Area around bolts that are slip critical connections.

D. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.
   1. Galvanize structural steel framing installed at exterior locations.

E. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

A. General: Shop paint steel according to AISC 303, Section 6.

B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.

C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel according to AISC 303 and AISC 360.

B. Set structural steel accurately at locations and elevations indicated on drawings.

C. Maintain erection tolerances of structural steel within AISC 303 requirements.
   1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.

D. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

A. After welding, clean and prime weld areas to match adjacent finish.

B. Touch-up primer damaged by construction operations.

C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.

D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.3 FIELD QUALITY CONTROL

A. Record Survey:
1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.
2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
3. Identify deviations from allowable tolerances specified in AISC Manual.

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SECTION 05 12 13

ARCHITECTURAL STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Architectural Structural Steel, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Section covers fabrication and erection requirements in addition to those specified in Section 05 12 00 for structural steel, indicated to be Architecturally Exposed Structural Steel (AESS).

B. Quality standards, qualifications, source quality control and testing and inspection, specified in Section 05 12 00, shall apply to Architecturally Exposed Structural Steel.
   1. Fabricator and erector shall have successfully completed AESS work similar to work indicated for this project.

C. Tolerances: AISC, Code of Standard Practice for Steel Buildings and Bridges, Section 10, or as noted.

D. Final design of connections not defined on Contract Documents as specified in Section 05 12 00.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Provide erection drawings indicating AESS members.
   2. Details indicating compliance with fabrication and erection requirements, including connections consistent with concepts indicated in drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, showing size, length and type of each weld, and identifying grinding, finish and profile of each weld.
   4. Indicate bolts by type, size, finish and length, distinguishing between shop and field bolts, identifying high-strength bolted, direct-tensioned shear/bearing connections, and showing which direction bolt heads are to be oriented.
   5. Indicate surfaces and edges exposed and class of surface preparation used.
   6. Indicate tolerances and erection requirements as defined in drawings or specified in this section.

B. Product Data:
   1. Source and certification of quality for high-strength bolts, nuts and washers.
   2. Technical data on base plate grout.
   3. Project Information:
   4. Fabricator and Erector Qualifications:
      a. List completed project names and addresses, and names and addresses of their Architects and Owners.
      b. Fabricator’s AISC certification or name of independent testing agency for use by non-certified fabricator.
      c. Proof fabricator has ten (10) years experience in fabrication of structural steel for buildings.
      d. Steel erector’s AISC Certification or proof that steel erector has ten (10) years experience in erection of structural steel.

5. Inspection reports and certification of shop fabrication by independent testing laboratory for non-certified fabricator.
6. Connection design calculations.
7. Welding Procedure Specification (WPS) for shop and field welds.

C. Contract Closeout Information:
1. Certificate by fabricator that steel was fabricated in accordance with approved construction documents.
2. Certificate by erector that steel was erected in accordance with approved erection plans and specifications.

PART 2 - MATERIALS

2.1 ARCHITECTURAL STRUCTURAL STEEL

A. Steel specified in Section 05 12 00.

B. Epoxy filler:
1. Solvent resistant, two component metal and epoxy compound compatible with required protective coating systems.
2. Acceptable product:
a. Tnemec, 215 Surfacing Epoxy.

C. Primer:
1. Sherwin-Williams Pro Industrial Pro-Cryl Universal Acrylic Primer.

2.2 FABRICATION

A. Fabricate and assemble in shop to greatest extent possible.
1. Locate field joints at concealed locations unless otherwise indicated.
2. Detail assemblies to minimize field handling and expedite erection.

B. Fabricate with exposed surfaces smooth, square and with consistent surface quality.

C. Fabrication Tolerance:
1. Fabricate steel to one-half of normal tolerances specified in AISC Code of Standard Practice for Steel Buildings and Bridges, Section 10.

D. Welds:
1. Grind welds smooth.
2. Grove welds: Make flush to surfaces each side to within + 1/16 IN to – 0 IN of plate thickness.
3. Contouring and Blending of Welds: Oversize fillet welds for grinding to smooth transitions.
4. Continuous welds: Uniform size and profile.
5. Minimize weld show-through at locations where welding on far side of exposed connection.

E. Coping, Blocking, and Joint Gap Tolerance: Uniform gap of 1/8 IN +/- 1/32 IN.

F. Fabricate each piece such that piece mark is fully hidden in the final structure or made with such media to permit full removal after erection.

G. Steel shall be delivered with no mill marks in exposed locations.
1. Omit mill marks by cutting of mill material to appropriate lengths where possible.
2. Where not possible, fill and grind mark area to a surface consistent with surrounding surface.
3. Filler caulk, or body putty type materials, other than filler metal deposited by welding process, is not acceptable for remedial work.

4. Epoxy filler may be applied to pockets, voids, pitting, or other blemishes on exposed surfaces of interior steel to be painted, including welds.

H. Grind smooth edges of sheared, punched or flame-cut steel.

I. Roll members to final curved shape in shop and tied during shipping to prevent stress relieving.
1. Distortion of web or stem and of outstanding flanges or legs of angles will be visibly acceptable only if not perceived from a distance of 20 FT under any lighting condition.
2. Tolerances for vertical and horizontal walls of regular HHS members after rolling shall be specified dimension +/- 1/2 IN.

J. Seal weld ends of round and rectangular hollow structural sections with 3/8 IN thick closure plates, and provide continuous sealed welds at angle to gusset plate connections and similar locations where exposed to weather.

K. Shop Connections:
1. Comply with Section 05 12 00.
2. Bolt Connections:
a. Provide bolt type and finish and align bolt heads as indicated on approved shop erection drawings.
3. Weld Connections:
a. Comply with AWS-D1.1.
1) Assemble and weld build-up sections by methods maintaining alignment of members without warp exceeding tolerance specified.

2.3 SHOP PRIMING

A. Shop prime steel surfaces except surfaces embedded in concrete or mortar, and surfaces to be field welded.
1. Extend priming of partially embedded members to a depth of 2 IN.

B. Do not prime surfaces to be high-strength bolted with slip-critical connections if primer does not meet specified AISC slip coefficient.

C. Surface Preparation:
1. Clean surfaces to be painted by removing loose rust, loose mill scale, and spatter, slag or flux deposits.
2. Prepare surfaces concealed by other work minimally according to SSPC-P3 Power Tool Cleaning.
3. Prepare exterior surfaces minimally according to SSPC-P6 Commercial Blast Cleaning.
4. Coordinate required blast profile with approved paint submittal prior to beginning surface preparation.

D. Priming:
1. Apply primer immediately after surface preparation, in accordance with manufacturer's instructions.
2. Provide a dry film thickness of not less than 2.5 mils and with full coverage of joints, corners, edges and other exposed surfaces.
3. Stripe paint lap joints, plate edges, corners, crevices, bolts, welds and sharp edges.
4. Apply two (2) coats of shop primer to surfaces inaccessible after assembly or erection.

2.4 GALVANIZING

A. Zinc Coating:
1. Hot dip process in accordance with ASTM A123.
2. Fabricate galvanized assemblies for field connections made by bolted connections.
3. Provide galvanized finish in consistent color and surface texture throughout.

2.5 FINISH PAINTING

A. Refinish abraded areas with compatible primer.

B. Apply finish paint upon completion of steel erection.

C. Exterior Paint Systems:
   1. See Section 09 91 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify members are free of twist, kinks, gouges or other imperfections which may result in rejection of the appearance of the member.

B. Replace defective members or correct defects.

3.2 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where indicated on approved shop drawings.

B. Temporary connections not shown on shop drawings shall be made at locations not exposed to view in the final structure.

C. Handle, lift, and align pieces using padded slings and other protection required to maintain appearance of through process of erection.

D. Handle to prevent twisting or warping of members.

3.3 ERECTION

A. Set accurately in locations and to elevations indicated and according to AISC specifications, as specified in Section 05 12 00 and per following:
   1. Erection Tolerances:
      a. AISC Code of Standard Practice for Steel Buildings and Bridges Section 7, except Section 10, where AESS is located within 20 FT of personnel.
   2. Provide field welds complying with the same requirements required for welds during fabrication, including grinding for flush finish conditions.
      a. Assemble and weld build-up sections by methods maintaining true alignment of axes without warp.
      b. Verify weld sizes, fabrication sequence and equipment used will limit distortion to acceptable tolerances.
   3. Bolting:
      a. Comply with same requirements for bolting during fabrication, including orientation of bolt heads to same side.
   4. Remove run-out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up or field welding,
      a. Make remaining surfaces made smooth to match adjacent surfaces.
      b. Holes for erection bolts shall be plug welded and ground smooth.
      c. Holes cut to permit field welding shall be filled by procedures to minimize restraint and thermal stress.
   5. Ream holes to permit bolts.
      a. Burning and use of drift pins are not allowed.
   6. Replace misaligned connection plates where holes cannot be aligned for acceptable final appearance.
   7. Remove and replace welded material deemed inferior to quality of mock-up.
   8. Repair only when proposed procedures are approved.

3.4 ADJUSTING AND CLEANING

A. Clean and touch up painting of field welds, bolted connections and abraded areas.
   1. Touch-up priming, painting, or both:

2. Stripe paint lap joints, plate edges, corners, crevices, bolts, welds and sharp edges as required.
3. Blend with adjacent surfaces and comply with paint manufacturer's instructions.

B. Galvanized Surfaces:
1. Clean field welds, bolted connections and abraded areas, and repair galvanizing in compliance with ASTM A780.

END OF SECTION

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SECTION 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Single pan fluted metal form deck supporting concrete fill as roof substrate.
2. Corrugated metal form deck supporting concrete fill as roof substrate.
3. Single pan fluted metal roof deck as roof substrate.
4. Acoustic metal roof deck as roof substrate.

1.2 RELATED REQUIREMENTS

A. Structural Steel Shapes: Section 05 12 00, STRUCTURAL STEEL FRAMING.

B. Finish Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. AISI - American Iron and Steel Institute.
1. S100-12 - Specification for the Design of Cold-formed Steel Structural Members.

C. American Welding Society (AWS):
1. D1.1/D1.1M-15 - Structural Welding Code - Steel.
2. D1.3/D1.3M-08 - Structural Welding Code - Sheet Steel.

D. ASTM International (ASTM):
1. A36/A36M-14 - Carbon Structural Steel.
2. A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.
4. C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. E119-15 - Fire Tests of Building Construction and Materials.

E. FM Global (FM):
1. 1-28-15 - Wind Design.
2. Factory Mutual Research Approval Guide.

F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):
1. MIL-P-21035B - Paint, High Zinc Dust Content, Galvanizing Repair.

H. Steel Deck Institute (SDI):
1. No. 31-07 - Design Manual for Composite Deck, Form Decks, and Roof Decks.

I. UL LLC (UL):
1. Listed - Online Certifications Directory.
2. 580-13 - Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show layout, connections to supporting members, anchorage, sump pans, accessories, deck openings and reinforcements.
2. Show similar information necessary for completing installation as shown and specified, including supplementary framing, ridge and valley plates, cant strips, cut openings, special jointing or other accessories.
3. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
4. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Show steel decking section properties and structural characteristics.

D. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Certificates: Certify each product complies with specifications.
1. Fire Resistance Product Listing: For each metal deck type and thickness supporting concrete slab or fill.
2. Show steel decking is UL Listed for specified application.
3. Show noise reduction coefficient test results.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Welders and welding procedures.

G. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 QUALITY ASSURANCE

A. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in “Factory Mutual Research Approval Guide” for “Class 1” fire rated construction.

B. Welders and Welding Procedures Qualifications: AWS D1.3/D1.3M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design steel decking and accessories according to AISI S100.
1. Wind Uplift Resistance and Corner Conditions:
   a. Eave Overhang: 2.1 kPa (45 psf), minimum. Refer to project drawings for additional requirements.
   b. Other Roof Areas: 1.4 kPa (30 psf), minimum. Refer to project drawings for additional requirements.
   c.
2. Wind Uplift Resistance and Corner Conditions: Refer to the project drawings.
3.

4. Fire Resistance: ASTM E119; as component of 1 hour rated roof assembly.
5. Noise Reduction Coefficient (NRC): Minimum 0.90 when tested according to ASTM C423.
6. Design side and end closures and attachment to supporting steel to safely support wet weight of concrete and construction loads.
   a. Cantilever Closure Deflection: 3 mm (1/8 inch), maximum.

2.2 MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M; G60 coating.

B. Painted Steel Sheet: ASTM A1008/A1008M, Grade C or D, shop primed.

C. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.

D. Steel Shapes: ASTM A36/A36M.

E. Acoustic Deck: Cellular deck profile, SDI Publication No. 31.

F. Acoustic Insulation: Manufacturer’s standard mineral fiber type, profile matching deck flute profile.

2.3 PRODUCTS - GENERAL

A. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.

2.4 METAL ROOF DECK

A. Metal Roof Deck: FM Global approvedas metal roof deck panels.
   1. Steel decking of the type, depth, thickness, and section properties as shown.

B. Metal Form Deck - Type 1: Single pan fluted units as permanent form for reinforced concrete slabs.
   1. Depth and Thickness: As indicated on drawings.
   2. Material: Galvanized sheet steel.

C. Metal Form Deck - Type 2: Corrugated deck units as permanent form for reinforced concrete slabs.
   1. Depth and Thickness: As indicated on drawings.
   2. Material: Galvanized sheet steel.

D. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces as permanent support for superimposed loads.
   1. Deck Style:
      a. Wide Rib (Type B) deck.
      b. Intermediate Rib (Type F) deck.
      c. Narrow Rib (Type A) deck.
      d. Deep Rib (Type N) deck.
   2. Depth and Thickness: As indicated on drawings.
   3. Material: Painted sheet steel.

E. Do not use steel deck for hanging supports of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

F. Include integral system for steel decking units used for interstitial levels.
   1. Provide system suitable for simple point of attachment for light duty hanger devices.
   2. Provide system suitable to allow for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 50 kg/m2 (10 psf).

3. Provide a minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm (24 inches) on centers transversely.
4. Maximum allowable load suspended from any hanger: 23 kg (50 pounds).
5. System consisting of fold-down type hanger tabs or lip hanger is acceptable.

2.5 FABRICATION

A. Fabricate steel decking in sufficient lengths to extend over 3 or more supports, except for interstitial levels.
   1. Cut metal deck units to proper length in shop.

B. Fabricate accessories required to complete installation of steel decking.
   1. Exposed to View: Fabricate from sheet steel matching metal decking.
   2. Concealed from View: Fabricate from galvanized sheet steel.

C. Sheet Metal Accessories:
   1. Metal Cover Plates: For end-abutting decking, to close gaps at changes in deck direction, columns, walls and openings.
      a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
   2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges.
      a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
   3. Metal Closure Strips: For openings between decking and other construction. Form to configurations required to provide tight-fitting closures at open ends of flutes and sides of decking.
      a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
   4. Ridge and Valley Plates: Minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 1/24 (1/2 inch per foot).
      a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
   5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the drawings. Fabricate cant strips with minimum 125 mm (5 inch) face width.
      a. Sheet Steel: Minimum 0.8 mm (0.03 inch) thick.
   6. Seat Angles for Deck: Provide where beam does not frame into column.
   7. Sump Pans for Roof Drains: Fabricated from single piece galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges minimum 75 mm (3 inches) wide. Recess pans minimum 38 mm (1-1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Drain holes will be field cut.
      a. Sheet Steel: Minimum 1.7 mm (0.06 inch) thick.

2.6 FINISHES

A. Shop prime painted sheet steel with two coats of primer.

2.7 ACCESSORIES

A. Primer: Manufacturer's standard primer compatible with finish painting specified in Section 09 91 00, PAINTING.

B. Welding Materials: AWS D1.1, type to suit application.

C. Galvanizing Repair Paint: MPI No. 18.

D. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove contaminates from structural steel surfaces where steel decking will be welded.

D. Verify structural steel framing installation is completed, plumbed, and aligned with temporary bracing installed where required.

E. Coordinate with structural steel erector to prevent overloading of structural members when placing steel decking for installation.

3.2 ERECTION

A. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace deck units that become damaged after erection and before casting concrete at no cost additional to the Government.

B. Place steel decking at right angles to supporting members with ends located over supports.

C. Lap end joints 50 mm (2 inches), minimum.

D. Fluted Form Deck Fastening:
   1. Fasten form deck to steel supporting members by welding.
      a. Welds: 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength.
      b. Weld Spacing: Maximum 300 mm (12 inches) on center with minimum two welds per unit at each support.
      c. Where two units abut, fasten each unit individually to supporting steel framework.
   2. End Closure Fastening: Tack weld or self-tapping No. 8 or larger machine screws at 900 mm (3 feet) on center.
      a. Longitudinal End Closure Fastening: Tack weld only.
   3. Weld side laps of adjacent decking units.
      a. Fastener Locations: Mid-span and maximum 900 mm (3 feet) on center.

E. Corrugated Form Deck Fastening:
   1. Weld end laps of corrugated form deck units in valley of side lap and at middle of sheet.
      a. Weld Spacing: Maximum 380 mm (15 inches) on center.
   2. Weld corrugated deck to intermediate supports in X-pattern. Weld in valley of side laps on every other support and in valley of center corrugation on remaining support.
      a. Weld Spacing: Maximum 760 mm (30 inches) on center.

F. Roof Deck Fastening:
   1. Fasten decking to steel supporting members by screw fasteners indicated by the project drawings.
      a. Screws: Minimum #12 sheet metal screws to supports.
      b. Screw Spacing: Maximum 300 mm (12 inches) on center at every support. Use closer spacing where required for lateral force resistance by diaphragm action. Refer to the project drawings for details.
   2. Fasten split or partial decking panels to structure in every valley.
   3. Fasten decking to each supporting member at ribs where side laps occur.
   4. Mechanically fasten decking side laps with self-tapping No. 10 or larger machine screws.
      a. Fastener Locations: Mid-span and maximum 900 mm (3 feet) on center.
   5. Provide additional fastening necessary to comply with FM Approval for specified performance.

G. Cutting and Fitting:
   1. Field cut steel decking to accommodate columns and other penetrating items.
   2. Cut openings located and dimensioned on Structural Drawings.
   3. Coordinate openings for other penetrations shown on approved submittal drawings but not shown on Structural Drawings.
      a. Cut and reinforce required opening.
   4. Make cuts neat and trim using metal saw, drill or punch-out device. Cutting with torches is prohibited.

5. Do not make cuts in the metal deck that are not shown on the approved metal decking submittal drawings.
   a. When additional openings are required, submit scaled drawing, locating required opening and other openings and supports in immediate area.
   b. Do not cut the opening until drawing is approved by Contracting Officer's Representative.
   c. Provide additional reinforcing and framing required for opening.
   d. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected steel decking.
6. Opening Reinforcement: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work.

H. Touch up damaged factory finishes.
   1. Apply galvanizing repair paint to damaged galvanized surfaces.
   2. Apply touch up paint to damaged shop painted surfaces.

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SECTION 05 36 00

COMPOSITE METAL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies material and services required for installation of composite steel decking including miscellaneous closures required to prepare deck for concrete placement as shown and specified.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.3 DESIGN REQUIREMENTS:

A. Design steel decking in accordance with AISI S-100, except as otherwise shown or specified.

B. Design steel decking to comply with Steel Deck Institute (SDI) specification and IBC 2018 building codes.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Combined recycled content as specified in PART 2 - PRODUCTS.

C. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories.
   1. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
   2. Show openings required for work of other trades, including openings not shown on structural drawings.
   3. Indicate where temporary shoring is required to satisfy design criteria.

D. Manufacturer's Literature and Data: Showing steel decking section properties and specifying required structural characteristics.

E. Manufacturer's written recommendations for:
   1. Shape of decking section.
   2. Cleaning of steel decking prior to concrete placement.

F. Test Report - Establishing structural characteristics of composite concrete and steel decking system.

G. Certification: For each type and gauge of metal deck supporting concrete slab or fill, submit certification of specified fire ratings. Certify that units supplied are UL listed as a “Steel Floor and Form Unit”.

H. Manufacturers Certificates for deck units attesting compliance with specified requirements.

I. Submit manufacturer’s catalog data for Welding Equipment and Welding Rods and Accessories intended use.

J. Power Actuated Tool Operator Certificates.

K. Welders qualifications.

1.5 QUALITY ASSURANCE:

A. Fire Safety
1. Underwriters' Label: Provide composite metal floor deck units listed in Underwriters' Laboratories "Building Materials Directory", with each deck unit bearing the UL label and marking for specific system detailed.
2. FM Listing: Provide composite metal roof deck units which have been evaluated by Factory Mutual Global and are listed in "Factory Mutual Research Approval Guide" for "Class 1" fire rated construction.
3. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

B. Deck Units: Provide deck units and accessory products from a manufacturer engaged in the manufacture of steel decking for more than three (3) years. Submit manufacturer's certificates attesting that the decking material complies with the specified requirements.

C. Certification of Powder-Actuated Tool Operator: Manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.

D. Qualifications for Welding Work: Submit qualified welder qualifications in accordance with AWS D1.1/D1.1M or under an approved qualification test.

1.6 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Refer to the latest edition of referenced Standards and codes.

B. American Iron and Steel Institute (AISI):
S-100-12.....North American Specification for the Design of Cold-Formed Steel Structural Members

C. ASTM International (ASTM):
A36/A36M-14 .....Carbon Structural Steel

A108-13.....Steel Bars, Carbon, Cold Finished, Standard Quality

A653/A653M-13 .....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process

D. American Institute of Steel Construction (AISC):
1. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design (Latest Edition)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)

E. American Welding Society (AWS):
D1.1/D1.1M-11.....Structural Welding Code - Steel

D1.3/D1.3M-05(R2008).....Structural Welding Code - Sheet Steel

F. FM Global (FM):
APP Guide.....Approval Guide

DS 1-28-2012.....Design Wind Loads

G. Military Specifications (Mil. Spec.):
MIL-P-21035B .....Paint, High Zinc Dust Content, Galvanizing Repair

H. Underwriters Laboratories (UL):
Bld Mat Dir(Annually) .....Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel Decking and Flashings: ASTM A653/A653M,

B. Recycled Content of Steel Products: Combined recycled content not less than 75percent.

C. Galvanizing: ASTM A653/A653M, G60 . Thickness not less than indicated on drawings .

D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.

E. Miscellaneous Steel Shapes: ASTM A36/A36M.

F. Welding Electrode: E60XX minimum.

G. Sheet Metal Accessories: ASTM A653/A653M, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
2. Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel to be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures to be limited to a total of 3 mm (1/8 inch) maximum.
3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
4. Seat angles for deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS:

A. Steel decking depth, gage, and section properties to be as shown on contract documents. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.

B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. Deck units combined with concrete slab to be capable of supporting total design loads.

C. C. Provide integral system with single point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning electrical and similar items.
1. Provide a minimum spacing pattern of 305 mm (12 inches) on centers longitudinally and 610 mm or 914 mm (24 or 36 inches) on centers transversely.
2. Provide suspension system capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at one hanger attachment point.
3. System may consist of fold-down type hanger tabs or a lip hanger.

PART 3 - EXECUTION

3.1 ERECTION:

A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed, and until temporary shoring, where required, has been installed.
   1. Remove oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.

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

C. Do not use floor deck units for storage or working platforms until permanently secured.
   1. Do not overload deck units once placed.
   2. Replace deck units that become damaged after erection and prior to casting concrete at no additional cost to the Government.

D. Erect steel deck in accordance with manufacturer's printed instructions.

E. Ship steel deck units in standard widths and fabricated to proper length.

F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.

G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastened.
   1. Bring each unit to proper bearing on supporting beams.
   2. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit.
   3. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates.

H. Ceiling hanger loops, if provided, must be flattened or removed to obtain bearing of units on structural steel.

I. Fastening Deck Units:
   1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) on center with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
   2. Tack weld or use self-tapping No. 8 or larger machine screws at 914 mm (3 feet) on center for fastening end closures. Only use welds to attach longitudinal end closures.
   3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 914 mm (3 feet) on center, whichever is smaller.

J. Weld in conformance to AWS D1.3/D1.3M and done by qualified experienced welding mechanics.

K. Clean and touch-up area and welds scarred during erection, and repair with zinc rich galvanizing repair paint.
   1. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.

L. Provide metal concrete stops at edges of deck.

M. Cutting and Fitting:
   1. Fabricate metal deck units to proper length prior to shipping.
   2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.

3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced.
4. Make cuts and penetrations neat and trim using a metal saw, drill or punchout device; cutting with torches is prohibited.
5. Do not make cuts in the metal deck that are not shown on the approved metal deck drawings.
6. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Contracting Officer Representative (COR). Provide additional reinforcing or framing required for the opening at no additional cost to the Government.
7. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

3.2 CLEANING:

A. Clean deck in accordance with manufacturer's recommendation before concrete placement.

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:
   1. Exterior load-bearing steel stud walls.
   2. Interior load-bearing steel stud walls.
   3. Exterior non-load-bearing steel stud curtain wall.
   4. Steel joists.
   5. Steel trusses.

1.2 RELATED WORK:

A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
   1.

B. Blast resistant load bearing and non-load bearing metal stud wall framings: Section 08 56 53, BLAST RESISTANT FAÇADE SYSTEMS.

C. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

D. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

1.3 DESIGN REQUIREMENTS:

A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.

B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.

C. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
   1. Design Loads: As indicated.
   2. Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Load-Bearing Walls: Lateral deflection of 1/600 of the wall height.
      b. Interior Load-Bearing Walls: Lateral deflection of 1/360 of the wall height.
      c. Exterior Non-load-Bearing Curtain wall: Lateral deflection of 1/600 of the wall height.
      d. Floor Joists: Vertical deflection of for Total Load 1/240 of the span and for live l load 1/360 of the span.
      e. Roof Trusses: Vertical deflection of 1/240 for total load of the span and 1/360 for live load of the span.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).
   4. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
   5. Design exterior non-load-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.

6. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

D. Blast Requirements: Engineer, fabricate, and erect cold-formed metal framing to withstand the blast loads within limits and under conditions required.
1. Dynamic blast loads and performance limits for cold-formed metal stud wall framing (load bearing and non-load bearing wall systems), metal sheathing and corrugated decking: refer to Section 08 56 53 Blast Resistant Façade Systems for blast design requirements.
2. Dynamic ramp-up and ramp-down blast loads for the cold-formed roof truss systems or open web steel joists are as follows. All elements shall meet both loading scenarios.
a.

b. Level	c. Ramp-Up/Ramp-Down Dynamic Blast Loading Scenario 1	d. Ramp-Up/Ramp-Down Dynamic Blast Loading Scenario 2
e. High Roof	f. Pressure = 3.24 psi, Impulse =16.99 psi-msec, g. Rise Time = 5.24 msec, h. Total Duration = 10.49 mse	i. Pressure = 0.98 psi, j. Impulse = 20.56 psi-msec, k. Rise Time = 20.98 msec, l. Total Duration = 41.9

	c	6 msec
m. Low Roof	n. Pressure = 7.81 psi, o. Impulse = 27.94psi-msec, p. Rise Time = 3.58 msec, q. Total Duration = 7.15 msec	r. Pressure = 2.07 psi, s. Impulse = 33.75 psi-msec, t. Rise Time = 16.30 msec, u. Total Duration = 32.61 msec

1)

3. Design cold-formed roof truss systems or open web steel joists to withstand the dynamic loads as indicated in 1.3.D.2 with the response limits corresponding to a moderate damage for the primary elements, in accordance with ASCE 59-11 Blast Protection of Buildings, as follows:
   a. Rotation limit of 3 degree for downward loading (flexure response), assuming tension yielding of bottom chord with adequate bracing of top chord to prevent lateral buckling.
   b. Ductility limit of 1.5 for upward loading (flexure response), assuming adequate anchorage to prevent pull-out failure and adequate bracing of bottom chord to prevent lateral buckling.
   c. Ductility limit of 0.8 for shear response, assuming member capacity is controlled by web members, web connections, or support connections. Shear response ductility ratio is equal to peak shear force divided by the shear capacity.
      1)
4. Design of the cold-formed roof truss systems or open web steel joists shall also meet the following requirements:
   a. Bottom chord bracing shall be provided at ¼ points minimum.
   b. The bottom and top chords shall be designed to yield prior to buckling of the web members, considering a uniform loading scenario.
   c. The connections between web members and chords shall be designed to develop the full capacity of the web members.
   d.

1.4 SUBMITTALS:

A. Studs and Joists
1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified. Shop drawings shall be detailed and be sealed by a Professional Engineer licensed in the state in which the project is located.
3. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
4. For cold-formed metal framing indicated to comply with certain design loadings noted in this specification, include structural analysis data/calculations sealed and signed by the qualified professional engineer who was responsible for its preparation and registered in the state which the project is located.

B. Trusses
1. Product Data: Submit Truss Component Manufacturer’s descriptive literature for each item of cold-formed metal framing and each accessory specified in this section.
2. Shop Drawings: Submit detailed shop drawings sealed by a Professional Engineer licensed in the state in which the project is located. Shop Drawings should indicate:
   a. Special components and installations not fully detailed in product data.
   b. The number, types, location, and spacing of trusses and other framing members.
   c. Details of truss loading, reactions, uplifts, support locations, material sizes and gauges, permanent truss web bracing, and splices as required for a complete installation.
3. Design Data: Submit results of design analysis sealed by a Professional Engineer licensed in the state in which the project is located.
4. Installation Instructions: Submit Truss Component Manufacturer’s printed instructions for handling, storage, and installation of each item of cold-formed metal framing and each accessory specified in this section.
5.

1.5 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Iron and Steel Institute (AISI):

C. Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)

D. American Society of Testing and Materials (ASTM):

A36/A36M-08 ..... Standard Specifications for Carbon Structural Steel

A123/A123M-09 ..... Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-09 ..... Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307-10..... Standard Specifications for Carbon Steel Bolts and Studs

A653/A653M-10 ..... Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

C955..... Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

C1107/C1107M-08 ..... Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

E488-96(R2003) ..... Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

E1190-95(R2007) ..... Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

E. American Welding Society (AWS):
D1.3/D1.3M-08 ..... Structural Welding Code-Sheet Steel

F. Military Specifications (Mil. Spec.):
MIL-P-21035B ..... Paint, High Zinc Dust Content, Galvanizing Repair

G. American Iron and Steel Institute (AISI)/Committee on Framing Standards (COFS)/Truss 2000
1. Standard for Cold-Formed Steel Framing-Truss Design

H. Light Gauge Steel Engineers Association (LGSEA), latest version:
1. Field Installation Guide for Cold-Formed Steel Trusses
2. Design guide for Construction Bracing of Cold-Formed Steel Trusses
3. Design Guide for Permanent Bracing of Cold-Formed Steel Trusses

I. Physical Security & Resiliency Design Manual (PSRDM) October 1, 2020, for Veterans Affairs Life Safety Protected Facilities

J. American Society of Civil Engineers (ASCE), ASCE 59-11, Blast Protection of Buildings
a.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM A653, structural steel, zinc coated G90 , with a yield of 340 MPa (50 ksi) minimum.

B. Sheet Steel for joists, studs and accessories 18 gage and lighter: ASTM A653, structural steel, zinc coated G90, with a yield of 230 MPa (33 ksi) minimum.

C. Galvanizing Repair Paint: MIL-P-21035B.

D. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

2.2 WALL FRAMING:

A. Steel Studs: Complying with ASTM C 955. Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
1. Minimum Base-Steel Thickness(uncoated):
a. 0.84 mm (0.0329 inch)
b. 1.09 mm (0.0428 inch) supporting brick veneer
2. Min. Flange Width:
a. (1-5/8 inches)
3. Web: Punched

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched,of web depths indicated, with straight flanges, and complying with the following:
1. Design Uncoated-Steel Thickness: Matching steel studs.
2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

2.3 JOIST FRAMING:

A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:
   1. Minimum Base-Steel Thickness: 0.84 mm (0.0329 inch.
   2. Design Thickness: 0.88 mm (0.0346 inch).
   3. Flange Width: 41 mm (1 5/8 inches) minimum.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
   1. Design Thickness: Matching steel joists.
   2. Flange Width: 41 mm (1 5/8-inches) minimum.

2.4 FRAMING ACCESSORIES:

A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa (33 ksi).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Gusset plates.
   5. Deflection track and vertical slide clips.
   6. Stud kickers and girts.
   7. Joist hangers and end closures.
   8. Reinforcement plates.

2.5 ANCHORS, CLIPS, AND FASTENERS:

A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.

B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 REQUIREMENTS:

A. Welding in accordance with AWS D1.3

B. Furnish members and accessories by one manufacturer only.

2.7 TRUSS COMPONENTS

1. Pre-engineered Cold-Formed Steel Trusses: Provide a complete horizontal framing system, ready for deck installation, and meeting specified requirements.
   a. Truss Type, Span, and Height: As indicated on drawings.
   b. Comply with requirements of the 2018 International Building Code (IBC).
   c. Deflection Under Live Loads: 1/360th of span, maximum.

d. Shop fabricate trusses in accordance with shop drawings, using jigging systems to ensure consistent component placement and alignment of components, and to maintain specified tolerances; field fabrication is strictly prohibited unless approved by ENGINEER.
e. Shop fabrication of other cold-formed steel framing components into assemblies prior to erection is permitted; fabricate assemblies in accordance with shop drawings.
f. Fasten connections within truss assemblies with Truss Component Manufacturer's screws only and as shown on the shop drawings; welding and other fasteners are prohibited.
g. Fabricate straight, level, and true, without rack, and to following tolerances:
    1) Trusses up to 30 feet long: Maximum 1/2"variation from design length.
    2) Trusses over 30 feet long: Maximum 3/4" inch variation from design length.
    3) Trusses up to 5 feet high: Maximum 1/4" inch variation from design height.
    4) Trusses over 5 feet high: Maximum 1/2" inch variation from design height.

2. Truss Chord and Web Components: Provide components with rolled or closed edges to minimize the danger of cutting during handling; chord and web components without rolled edges are prohibited.
    a. Shapes, Sizes, and Thickness: As required to suit design and as indicated in shop drawings.
    b. Chords: Cold-formed from ASTM A653 galvanized steel sheet, minimum G60 coating; minimum yield strength of 55 ksi.
    c. Nominal 22 gauge members:
        1) Minimum bare metal thickness: 0.0284 inch.
        2) Maximum design thickness: 0.0299 inch.
    d. Nominal 20 gauge members:
        1) Minimum bare metal thickness: 0.0329 inch.
        2) Maximum design thickness: 0.0346 inch.
    e. Nominal 18 gauge members:
        1) Minimum bare metal thickness: 0.0428 inch.
        2) Maximum design thickness: 0.0451 inch.
    f. Nominal 16 gauge members:
        1) Minimum bare metal thickness: 0.0538 inch.
        2) Maximum design thickness: 0.0566 inch.
3. Webs: Cold-Formed ASTM A500 Steel Structural Tubing; minimum yield strength of 45 ksi.
    a. Nominal 20 gauge members:
        1) Minimum bare metal thickness: 0.033 inch.
        2) Maximum design thickness: 0.035 inch.
    b. Nominal 18 gauge members:
        1) Minimum bare metal thickness: 0.047 inch.
        2) Maximum design thickness: 0.049 inch.
    c. Nominal 16 gauge members:
        1) Minimum bare metal thickness: 0.063 inch.
        2) Maximum design thickness: 0.065 inch.
4. Fasteners used in Fabricating Trusses: Screw fasteners recommended by Truss Component Manufacturer, bearing stamp of Truss Component Manufacturer for ready identification.
5. Design Loads: Pre-Engineered Cold-Formed Trusses shall be designed for the following loads:
    a. All wind loads and snow loads, including balance, unbalanced, drift and sliding snow, determined using the 2018 International Building Code (IBC).
    b. Minimum Top chord live load = 30 psf
    c. Minimum Top chord dead load = 15 psf
    d. Minimum Bottom chord dead load = 10 psf

PART 3 - EXECUTION

3.1 FABRICATION:

A. Framing components may be preassembled into panels. Panels shall be square with components attached.

B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.

C. Hold members in place until fastened.

D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
   1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

3.2 DELIVERY, STORAGE AND HANDLING OF STEEL TRUSSES

A. Pack, ship, handle, unload, and lift shop products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage or distortion.

B. Store and protect products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage, distortion and moisture buildup.

3.3 EXAMINATION OF STEEL TRUSSES

A. Verify that bearing surfaces and substrates are ready to receive steel trusses.

B. Verify that truss bearing surfaces are within the following tolerances:

C. Variation from level or Specified Plan: Maximum 1/8" in 10 feet.

D. Variation from Specified Position: Maximum 1/4".

E. Verify that rough-in utilities and chases that will penetrate plane of trusses are in correct locations and do not interfere with truss, bracing, or bridging placement.

F. Inspect conditions under which installation is to be performed and submit written notification if such conditions are unacceptable to installer.
   1. Notify ENGINEER within 24 hours of inspection.
   2. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
   3. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.4 ERECTION:

A. Joists and Studs
   1. Handle and lift prefabricated panels in a manner as to not distort any member.
   2. Securely anchor tracks to supports as shown.
   3. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
   4. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.

5. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
6. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
7. Install headers in all openings that are larger than the stud spacing in that wall.
8. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.
9. Studs in one piece for their entire length, splices will not be permitted.
10. Provide a load distribution member at top track where joist is not located directly over bearing stud.
11. Provide joist bridging and web stiffeners at reaction points where shown.
12. Provide end blocking where joist ends are not restrained from rotation.
13. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.
14. Provide temporary bracing and leave in place until framing is permanently stabilized.
15. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
16. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

B. Trusses
1. Install trusses in accordance with Truss Component Manufacturer's instructions and Truss Fabricator's shop drawings. Use correct fasteners.
2. Place components at spacings indicated on the shop drawings.
3. Install all erection (temporary installation) bracing and permanent bracing and bridging before application of any loads; follow recommendations of LGSEA Field Installation Guide for Cold-Formed Steel Roof Trusses.
4. Install Erection Bracing:
   a. Provide bracing that hold trusses straight and plumb and in safe condition until decking and permanent truss bracing has been fastened to form a structurally sound framing system.
   b. All subcontractors 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.
5. Install permanent bracing and bridging as shown in the Truss Fabricator's shop drawings.
6. Removal, cutting, or alteration of any truss chord, web, or bracing member in the field is prohibited, unless approved in advance in writing by the ENGINEER and the Truss Designer.
7. Repair or replace damaged chords, webs, and complete trusses as directed and approved in writing in advance by the ENGINEER and the Truss Component Manufacturer.

3.5 TOLERANCES:

A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.

B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.

C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.

D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

3.6 FIELD REPAIR:

A. Touch-up damaged galvanizing with galvanizing repair paint.

PART 4 - QUALITY ASSURANCE

4.1 MANUFACTURER QUALIFICATIONS

A. Company specializing in the manufacturing of products specified in this section with minimum of 5 years documented experience.

4.2 ERECTOR QUALIFICATIONS

A. Company specializing in performing the work of this section with minimum of 5 years documented experience, and shall be approved by the manufacturer.

4.3 TRUSSES DESIGNS

A. Provide design of trusses by Truss Component Manufacturer, using design methodologies recommended in AISI and LGSEA references.
   1. Determine mechanical properties of load-bearing components by testing in accordance with ASTM A370.
   2. Provide design by professional engineer registered in the State in which project is located.
   3. Provide Truss Fabricator's shop drawings.

4.4 PRE-INSTALLATION MEETING

A. Attendees:
   1. Truss Fabricator, if requested by installer.
   2. Installer of this section.
   3. Installer of truss support framing.
   4. Installer of mechanical systems.
   5. Installer of electrical systems.

B. Review potential interface conflicts; coordinate layout and support provisions.

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.
1. Support for Wall and Ceiling Mounted Items: (SD055000-01, SD055000-02, SD102113-01, SD102600-01, SD123100-01 & SD123100-02)
2. Frames
3. GuardsCovers and Frames for Pits and Trenches.
4. Gratings
5. Loose Lintels
6. Shelf Angles
7. Gas Racks
8. Ladders
9. Railings:
10. Catwalks and Platforms
11. Floor Access Doors
12. Steel Pipe Bollards

1.2 RELATED WORK

A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.

B. Section 09 22 16 NON-STRUCTURAL METAL FRAMING, Shower Seat Support.

C. Colors, finishes, and textures: See Construction documents.

D. Prime and finish painting: Section 09 91 00, PAINTING.

E. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

F. Section 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES: Swing Up Grab Bars..

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

C. Shop Drawings:
1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.

3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:
1. Anodized finish as specified.
2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):
B18.6.1-97.....Wood Screws

B18.2.2-87(R2010).....Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):
A36/A36M-14 .....Structural Steel

A47-99(R2014).....Malleable Iron Castings

A48-03(R2012).....Gray Iron Castings

A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A240/A240M-15 .....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A269-15.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A391/A391M-07(R2015) .....Grade 80 Alloy Steel Chain

A786/A786M-15 .....Rolled Steel Floor Plate

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-11.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

B632-08.....Aluminum-Alloy Rolled Tread Plate

C1107-13.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

D3656-13.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

F436-16.....Hardened Steel Washers

F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13.....Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-15.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):
D1.1-15.....Structural Welding Code Steel

D1.2-14.....Structural Welding Code Aluminum

D1.3-18.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)
AMP 521-01(R2012) .....Pipe Railing Manual

AMP 500-06 .....Metal Finishes Manual

MBG 531-09(R2017).....Metal Bar Grating Manual

MBG 532-09 .....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
SP 1-15 .....No. 1, Solvent Cleaning

SP 2-04 .....No. 2, Hand Tool Cleaning

SP 3-04 .....No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):
RR-T-650E .....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

B. Ladders and Rungs: 120 kg (250 pounds) at any point.

C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

D. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m^2 (100 pounds per square foot).

E. Manhole Covers: 1200 kg/m^2 (250 pounds per square foot).

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Stainless Steel: ASTM A240, Type 302 or 304.

C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.

D. Floor Plate:
1. Steel ASTM A786.

2. Aluminum: ASTM B632.

E. Steel Pipe (Bollard): ASTM A53.
1. Galvanized for exterior locations.
2. Type S, Grade A unless specified otherwise.
3. NPS (inside diameter) as shown.

F. Cast-Iron: ASTM A48, Class 30, commercial pattern.

G. Malleable Iron Castings: A47.

H. Primer Paint: As specified in Section 09 91 00, PAINTING.

I. Stainless Steel Tubing: ASTM A269, type 302 or 304.

J. Modular Channel Units:
1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel within turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:
1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:
1. Bolts with Nuts:
a. ASME B18.2.2.
b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
c. ASTM F468 for nonferrous bolts.
d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material
1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:
1. Size and thickness of members as shown.

2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections
1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship
1. General:
    a. Fabricate items to design shown.
    b. Furnish members in longest lengths commercially available within the limits shown and specified.
    c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
    d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
    e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
    f. Prepare members for the installation and fitting of hardware.
    g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
    h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
    a. Weld in accordance with AWS.
    b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
    c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
    d. Finish welded joints to match finish of adjacent surface.

3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.
   e. Fabricate connections for ease of assembly and disassembly without use of special tools.
   f. f. Joints firm when assembled.
   g. Conceal joining, fitting and welding on exposed work as far as practical.
   h. Do not show rivets and screws prominently on the exposed face.
   i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:
1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.
         c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
         d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
         e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
      2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:
1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:
1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Wall Mounted Items:
1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.
7. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.

C. Supports at Ceiling for Equipment:
1. Fabricate hangers braces, and track of modular channel units assembly as shown.
2. Fabricate steel plates for anchor to structure above.

D. Supports for Exercise Equipment, and Items at Various Conditions at Suspended Ceilings:
1. Fabricate of structural steel shapes as shown.
2. Drill for anchor bolts of suspended item.

E. Support for Swing-up grab bars:
1. Per detail SD102800-02 as found on VA TIL.
2. Fabricate of structural steel shapes as shown.
3. Fabricate steel plates for anchor to structure.
a.

2.6 GUARDS

A. Wall Corner Guards:
1. Fabricate from steel angles and furnish with anchors as shown.
2. Continuously weld anchor to angle.

B. Wheel Guards:
1. Construct wheel guards of not less than 16 mm (5/8 inch) thick cast iron.
2. Provide corner type, with flanges for bolting to walls.

2.7 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Fabricate covers to support live loads specified.

B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.

C. Steel Covers:

1. Use 6 mm (1/4 inch) thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
2. Provide clearance at all sides to permit easy removal of covers.
3. Make cutouts within 6 mm (1/4 inch) of penetration for passage of pipes and ducts.
4. Drill covers for flat head countersunk screws.
5. Make cover sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.
6. Fabricate trench cover sections not be over 900 mm (3 feet) long and if width of trench is more than 900 mm (3 feet)or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
7. Use two, 13 mm (1/2 inch) diameter steel bar flush drop handles for each cover section.

D. Steel Frames:
1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.
4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
5. Drill and tap frames for screw anchors where plate covers occur.

2.8 GRATINGS

A. Fabricate gratings to support live loads specified and a concentrated load as specified.

B. Provide clearance at all sides to permit easy removal of grating.

C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.

D. Fabricate in sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.

E. Fabricate sections of grating with end-banding bars.

F. Fabricate angle frames and supports, including anchorage as shown.
1. Fabricate intermediate supporting members from "T's" or angles.
2. Locate intermediate supports to support grating section edges.
3. Fabricate frame to finish flush with top of grating.
4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
5. Butt or miter, and weld angle frame at corners.

G. Steel Bar Gratings:
1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.
3. Interior gratings: Prime paint unless specified galvanized.
4. Use serrated bars for exterior gratings

H. Plank Gratings:
1. Conform to Fed. Spec. RR-G-1602.
2. Manufacturers standard widths, lengths and side channels to meet live load requirements.
3. Galvanize exterior steel gratings ASTM A123, G-90 after fabrication.

4. Fabricate interior steel gratings from galvanized steel sheet, ASTM A525, where bearing on concrete or masonry.
5. Fabricate other interior grating from steel sheet and finish with shop prime paint. Prime painted galvanized sheet may be used.

2.9 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

2.10 SHELF ANGLES

A. Fabricate from steel angles of size shown.

B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.

C. Provide adjustable malleable iron inserts for embedded in concrete framing.

2.11 LADDERS

A. Steel Ladders:
1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
2. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long,
3. formed from tubular steel extrusions. Squared or ‘D’ extrusions and deeply serrated on all sides.
   a. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure
4. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
5. Provide holes for anchoring with expansion bolts through turned ends and brackets.
6. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
7. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

B. Aluminum Ladders:
1. Fixed-rail type, constructed of structural aluminum, with mill finish.
2. Fabricate side rails and rungs of size and design shown, with the rungs shouldered and headed into and welded to the rails.
3. Where shown fabrication side rails curved, twisted and formed into gooseneck.

4. Fabricate angle brackets at top and bottom and intermediate brackets where shown. Drill for bolting.

C. Ladder Rungs:
1. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long,
2. formed from tubular aluminum extrusions. Squared or 'D' extrusions and deeply serrated on all sides.
   a. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

2.12 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.

B. B. Fabrication General:
1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form handrail brackets to size and design shown.
5. Exterior Post Anchors.
   a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
   b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
   c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts. Base plates are not required on pipe sleeves where ornamental railings occur.
6. Interior Post Anchors:
   a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
   b. Weld or thread flanged fitting to posts at base.
   c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
   d. Provide sliding flange base plate on posts secured with set screws.
   e. Weld flange base plate to removable posts set in sleeves.

C. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
   a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
   b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
   c. Continuously weld brackets to post.
   d. Provide slotted bolt holes in rail bracket.
   e. Weld bolt heads flush with top of rail.
   f. Weld flanged fitting to post where posts are installed in sleeves.
7. Opening Guard Rails:
   a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
   b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
   c. Fabricate rails for floor openings for anchorage in sleeves.
8. Gates:
   a. Fabricate from steel pipe as specified for railings.

b. Fabricate gate fittings from either malleable iron or wrought steel.
c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
d. Provide suitable stops, so that gate will swing as shown.
e. Provide padlock eyes where shown.

9. Chains:
   a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 8 mm (5/16 inch) diameter, eight links per 25 mm (foot) and with boat type snap hook on one end, and through type eye bolt on other end.
   b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 9 mm (3/8 inch) diameter.
   c. Fabricate anchor at walls, for engagement of snap hook of either a 9 mm (3/8 inch) diameter eye bolt or punched angle.
   d. Galvanize chain and bolts after fabrication.

2.13 CATWALKS

A. Fabricate catwalks including platforms, railings, ladders, supports and hangers, and arrangement of members as shown on drawings.

B. Fabricate stairs as specified in Section 05 51 00, METAL STAIRS.

C. Fabricate steel pipe railings as specified under paragraph RAILINGS.

D. Catwalk and platforms floor surfaces as shown.
   1. Steel gratings as specified under paragraph gratings, either bar or plank type.

2.14 FLOOR ACCESS DOOR

A. Use flush, type design.

B. Cover fabricate of 6 mm (1/4 inch) thick, diamond pattern floor plate.

C. Use automatic lock hold open feature and be hung on two flush type heavy bronze hinges capable of 90 degree swing on each door leaf.

D. Equip with locking and latching device and lifting devices; operable and accessible from both sides of doors.

E. Doors removable without disturbing frame.

2.15 STEEL PIPE BOLLARD

A. Provide bollard in accordance with ASTM A53 with dimensions as shown in

B. standard detail SD320523-04. Anchor posts in concrete and fill solidly

C. with concrete with a minimum compressive strength of 17 MPa 2500psi.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.
   1. Provide temporary bracing for such items until concrete or masonry is set.
   2. Place in accordance with setting drawings and instructions.
   3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.
   1. Design and finish as specified for shop welding.
   2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

A. Anchorage to structure.
   1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
   2. Secure supports to concrete inserts by bolting or continuous welding as shown.
   3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
   4. Secure steel plate or hat channels to studs as detailed.

B. Supports for Wall Mounted items:
   1. Locate center of support at anchorage point of supported item.
   2. Locate support at top and bottom of wall hung cabinets.
   3. Locate support at top of floor cabinets and shelving installed against walls.
   4. Locate supports where required for items shown.

C. Support at Ceiling for c Equipment:
   1. Bolt modular steel channel frames to hangers as shown, anchored to structure above.
   2. Fasten frames with modular channel manufacturers fittings, bolts, and nuts. Space modular channel supports and hangers as shown and as required to suit equipment furnished.
   3. Install closure plates in channels at ceiling where channel opening is visible. Coordinate and cut plates to fit tight against equipment anchors after equipment anchors are installed.

D. Supports for intravenous (IV) Track and Cubicle Curtain Track:
   1. Install assembly where shown after ceiling suspension grid is installed.
   2. Drill angle for bolt and weld nut to angle prior to installation of tile.

E. Support for cantilever grab bars:
   1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
   2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
   3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
   4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

3.3 STEEL LINTELS

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.4 SHELF ANGLES

A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.

B. Provide expansion space at end of members.

3.5 RAILINGS

A. Steel Posts:
1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
2. Install sleeves in concrete formwork.
3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS-on exterior posts.
4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
5. Secure sliding flanged fittings to posts at base with set screws.
6. Secure fixed flanged fittings to concrete with expansion bolts.
7. Secure posts to steel with welds.

B. Aluminum Railing, Stainless Steel Railing, and Ornamental Railing Posts:
1. Install pipe sleeves in concrete formwork.
2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.

C. Anchor to Walls:
1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
   a. Anchor steel plate to concrete or solid masonry with expansion bolts.
   b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. Removable Rails:
1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.

E. Gates:
1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

F. Chains:
1. Eye bolt chains to pipe posts.
2. Eye bolt anchoring at walls.
   a. Expansion bolt to concrete or solid masonry.
   b. Toggle bolt to hollow masonry of frame wall installed support.

G. Handrails:
1. Anchor brackets for metal handrails as detailed.

2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.6 CATWALK AND PLATFORMS

A. Expansion bolt members to concrete unless shown otherwise.

B. Bolt or weld structural components together including ladders and stairs to support system.

C. Weld railings to structural framing.

D. Bolt or weld walk surface to structural framing.

E. Smooth field welds and spot prime damaged prime paint surface.

F. Fasten removable members with stainless steel fasteners.

3.7 FLOOR ACCESS DOORS, AND FRAMES

A. Set frame flush with finished concrete slab.

B. Secure well linings to structure with expansion bolts unless shown otherwise.

C. Bolt floor hatch to well lining angle brace and to angle iron frames near corners and 300 mm (12 inches) on centers with not less than 9 mm (3/8 inch) roundhead machine screws.

3.8 STEEL COMPONENTS FOR MILLWORK ITEMS

A. Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.9 INSTALLATION OF STEEL PIPE BOLLARD

A. Set bollards vertically in concrete piers. Compressive strength of

B. concrete piers shall be 21MPa 3000psi. For dimensions of concrete piers

C. See standard detail SD320523-04.

3.10 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies steel stairs with railings.

B. Types:
   1. Closed riser stairs with concrete filled treads and platforms.
   2. Industrial stairs: Closed riser stairs.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

D. Fabrication qualifications.

E. Installer qualifications.

F. Calculations.

G. Welding qualifications.

1.4 QUALITY ASSURANCE:

A. Fabricator: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit fabricator qualifications.

B. Installer: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit installer qualifications.

C. Calculations: Provide professionally prepared calculations and certification of performance of this work, signed and sealed by a Professional Engineer registered in the state where the work is located. Perform structural design of the stair including supports for the metal stair frame. Indicate how Design Criteria as specified have been incorporated into the design.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M and AWS D1.3/D1.3M.

1.5 APPLICATION PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.

B. American Society of Mechanical Engineers (ASME):

B18.2.1-12 ..... Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

B18.2.3.8M-81(R2005) ..... Metric Heavy Lag Screws

B18.6.1-81(R2008) ..... Wood Screws (Inch Series)

B18.6.3-13 ..... Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)

B18.6.5M-10 ..... Metric Thread Forming and Thread Cutting Tapping Screws

B18.6.7M-10 ..... Metric Machine Screws

B18.22M-81(R2010) ..... Metric Plain Washers

B18.21.1-09 ..... Washers: Helical Spring-Lock, Tooth Lock, and Plain Washer (Inch Series)

C. ASTM International (ASTM):

A36/A36M-14 ..... Structural Steel

A47/A47M-99 (R2014) ..... Ferritic Malleable Iron Castings

A48/A48M-03(R2012) ..... Gray Iron Castings

A53/A53M-12 ..... Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless

A123/A123M-13 ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-09 ..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307-14 ..... Carbon Steel Bolts, Studs and Threaded Rod 60,000 PSI Tensile Strength

A653/A653M-13 ..... Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process

A786/A786M-05(R2009) ..... Rolled Steel Floor Plates

A1008/A1008M-13 ..... Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy

A1011/A1011M-14 ..... Steel, Sheet and Strip, Strip, Hot-Rolled Carbon, Structural, High-Strength, Low-Alloy

D. American Welding Society (AWS):

D1.1/D1.1M-10 ..... Structural Welding Code-Steel

D1.3/D1.3M-08 ..... Structural Welding Code-Sheet Steel

E. The National Association of Architectural Metal Manufactures (NAAMM) Manuals:

MBG 531-09 ..... Metal Bar Gratings

AMP521-01 ..... Pipe Railing Manual, Including Round Tube

F. American Iron and Steel Institute (AISI):

S100-12 ..... Design of Cold-Formed Steel Structural Members

G. National Fire Protection Association (NFPA):

101-18 ..... Life Safety Code

H. Society for Protective Coatings (SSPC):

Paint 25(1997; E 2004) ..... Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA:

A. Design stairs to support live load of 4.79 kN/sq. m (100 lbf/ sq. ft.) and a concentrated load of 1.33 kN (300 lbf) applied on an area of 2580 sq. mm (4 sq. in.).
   1. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Provide stair framing capable of withstanding stresses resulting from railing loads in addition to the loads specified above. Limit deflection of treads, platforms, and framing members to L/360 or 6.4 mm (1/4 inch), whichever is less.

B. Provide structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design Grating treads in accordance with NAAMM Metal Bar Grating Manual.

D. Design handrails and top rails of guards to support uniform load of not 0.73 kN/m (50 lbf/ft.) applied in any direction and a concentrated load of 0.89 kN (200 lbf) applied in any direction. Uniform and concentrated loads need not be assumed to act concurrently.

E. Infill of guards to support concentrated load of 0.22 kN (50 lbf) applied horizontally on an area of 0.093 sq. m (1 sq. ft.).

F. Design fire stairs to conform to NFPA 101.

2.2 MATERIALS:

A. Steel Pipe: ASTM A53/A53M, Standard Weight, zinc coated.

B. Steel Grating: Metal bar type grating NAAMM BG.

C. Sheet Steel: ASTM A1008/A1008M.

D. Structural Steel: ASTM A36/A36M.

E. Steel Floor Plate: ASTM A786/A786M.

F. Steel Decking: Form from zinc coated steel conforming to ASTM A653/A653M, with properties conforming to AISI S100 Specification for the Design of Cold-Formed Steel Structural Members.

G. Steel Plate: ASTM A1011/A1011M.

H. Iron Castings: ASTM A48/A48M, Class 30.

I. Malleable Iron Castings: ASTM A47/A47M.

J. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

2.3 FABRICATION GENERAL:

A. Fasteners:
   1. Conceal bolts and screws wherever possible.
   2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.
   3. Galvanized zinc-coated fasteners in accordance with ASTM A153/A153M and used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.
   4. Standard/regular hexagon-head bolts and nuts be conforming to ASTM A307, Grade A.
   5. Square-head lag bolts conforming to ASME B18.2.3.8M, ASME B18.2.1.
   6. Machine screws cadmium-plated steel conforming to ASME B18.6.7M, ASME B18.6.3.
   7. Wood screws, flat-head carbon steel conforming to ASME B18.6.5M, ASME B18.6.1.
   8. Plain washers, round, general-assembly-grade, carbon steel conforming to ASME B18.22M, ASME B18.21.1.

9. Lockwashers helical spring, carbon steel conforming to ASME B18.2.1, ASME B18.2.3.8M.

B. Welding:
1. Structural steel, AWS D1.1/D1.1M, and sheet steel, AWS D1.3/D1.3M.
2. Where possible, locate welds on unexposed side.
3. Grind exposed welds smooth and true to contour of welded member.
4. Remove welding splatter.

C. Remove sharp edges and burrs.

D. Fit stringers to head channel and close ends with steel plates welded in place where shown.

E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.

F. Shop Prime Painting: Shop prime steelwork with red oxide primer in accordance with SSPC Paint 25.
1. Hot dip galvanize steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

G. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 0.8 mm (1/32 inch), and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

H. Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind smooth exposed welds and flush to match and blend with adjoining surfaces.

I. Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

J. Provide and coordinate anchorage of the type indicated with the supporting structure. Fabricate anchoring devices, space as indicated and required to provide adequate support for the intended use of the work.

K. Use hot-rolled steel bars for work fabricated for bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

2.4 RAILINGS:

A. Fabricate railings, including handrails, from steel pipe.
1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.

B. Return ends of handrail to wall and close free end.

C. Provide standard terminal castings where fastened to newel.

D. Space intermediate posts not over 1828 mm (6 feet) on center between end post or newel post.

E. Fabricate handrail brackets from cast malleable iron.

F. Provide standard terminal fittings at ends of post and rails.

2.5 CLOSED RISER STAIRS:

A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.

B. Fabricate pans for treads and platforms, and risers from sheet steel.

C. Form risers with sanitary cove.

D. Fabricate stringers, headers, and other supporting members from structural steel.

E. Construct newel posts of steel tubing having wall thickness not less than 5 mm (3/16-inch), with forged steel caps and drops.

2.6 INDUSTRIAL STAIRS:

A. Provide treads, platforms, railings, stringers and other supporting members as shown.

B. Treads and platforms of checkered steel floor plate:
1. Turn floor plate down to form nosing on treads and edge of platform at head of stairs.
2. Support tread and platforms with angles welded to plate.
3. Do not leave exposed fasteners on top of treads or platform surfaces.
4. Provide flat sheet steel risers for stairs with steel plate treads where shown.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION:

A. Provide hangers and struts required to support the loads imposed.

B. Perform job site welding and bolting as specified for shop fabrication.

C. Set stairs and other members in position and secure to structure as shown.

D. Install stairs plumb, level and true to line.

E. Provide steel closure plate to fill gap between the stringer and surrounding wall. Weld and apply primer, ready to accept paint finish.

3.2 RAILING INSTALLATION:

A. Install standard terminal fittings at ends of posts and rails.

B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.

C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3658 mm (1/8-inch in 12 feet).

D. Set posts plumb and aligned to within 3 mm in 3658 mm (1/8-inch in 12 feet).

3.3 FIELD PRIME PAINTING:

A. Touch-up abraded areas with same primer paint used for shop priming.

B. Touch up abraded galvanized areas.

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