

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Buildings and Bridges.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Steel Decking: Section 05 31 00, STEEL DECKING.
- D. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.

1.3 QUALITY ASSURANCE

- A. Fabricator and erector must maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Fabricate work in an AISC certified Category Conventional Steel Structures fabrication plant.
- B. The controlling contractor must ensure that the steel erector is provided written notification required by 29 CFR 1926.752, before authorizing the commencement of steel erection; provide copy of this notification to the COTR.
- C. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.4 TOLERANCES

- A. Hold fabrication tolerances for structural steel within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC ASD Manual, Ninth Edition, Page 1-145), except as follows:
 - 1. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).

2. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
3. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

1.5 REGULATORY REQUIREMENTS

- A. AISC: Specification for Structural Steel Buildings - Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD).
- B. AISC: Code of Standard Practice for Steel Buildings and Bridges.

1.6 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIRMENTS, for project local/regional materials, recycled content, requirements.

1.7 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete.
- C. Certificates:
 1. Structural steel.
 2. Steel for all connections.
 3. Welding materials.
 4. Shop coat primer paint.
- D. Test Reports:
 1. Welders' qualifying tests.
- E. Design Calculations and Drawings:
 1. Connection calculations, if required.
- F. Record Surveys.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Institute of Steel Construction (AISC):
AISC 303-10 Steel Buildings and Bridges

- AISC 360-10 Structural Steel Buildings
- C. American National Standards Institute (ANSI):
- B18.22.1-03 Plain Washers
- B18.22M-05 Metric Plain Washers
- D. American Society for Testing and Materials (ASTM):
- A6/A6M-13 General Requirements for Rolled Structural Steel Bars,
Plates, Shapes, and Sheet Piling
- A36/A36M-12 Carbon Structural Steel
- A53/A53M-12 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded
and Seamless
- A123/A123M-12 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel
Products
- A242/A242M-04(2009) High-Strength Low-Alloy Structural Steel
- A283/A283M-12a Low and Intermediate Tensile Strength Carbon Steel
Plates
- A307-12 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- A325-10 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum
Tensile Strength
- A490/A490M-12 Heat-Treated Steel Structural Bolts 150 ksi Minimum
Tensile Strength
- A500/A500M-10a Cold Formed Welded and Seamless Carbon Steel
Structural Tubing in Rounds and Shapes
- A501-07 Hot-Formed Welded and Seamless Carbon Steel
Structural Tubing
- A572/A572M-12a High-Strength Low-Alloy Columbium-Vanadium Structural
Steel
- A992/A992M-11 Structural Steel Shapes
- E. American Welding Society (AWS):
- D1.1/D1.1M-10 Structural Welding Code-Steel
- F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
Specification for Structural Joints Using ASTM A325 or A490 Bolts (2000)
- G. Military Specifications (Mil. Spec.):
- MIL-P-21035 Paint, High Zinc Dust Content, Galvanizing, Repair (2003)
- H. Occupational Safety and Health Administration (OSHA):

29 CFR Part 1926

Safety Standards for Construction

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel: ASTM Grade 50.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
 - 1. High-strength bolts, including nuts and washers: ASTM A325.
 - 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:
ANSI Standard B18.22.1.
- F. Zinc Coating: ASTM A123.
- G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD)

- A. Welding: Welding in accordance with AWS D1.1. Make welds 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.
- B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than proof load given in Specification for Structural Joints Using ASTM A325 or A490 Bolts. Perform tightening 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 or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION

- A. Execute fabrication in accordance with Chapter M, Specification for Steel Buildings - Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD).

3.3 SHOP PAINTING

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.

- C. Do not apply paint to following:
 - 1. Surfaces within 2 inches of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.
- D. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting.
- E. Zinc Coated Finish (Hot Dip Galvanized): Provide per ASTM A123 (after fabrication).
- F. 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.

3.4 ERECTION

- A. General: Erect structural steel framing in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Provide temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

3.5 FIELD PAINTING

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

3.6 SURVEY

- A. Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to COTR for approval. Prepare reports by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS; specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

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SECTION 05 31 00 STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies material and services required for installation of steel decking as shown and specified.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Finish Painting: Section 09 91 00, PAINTING.

1.3 DESIGN REQUIREMENTS

- A. Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Prepare shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. 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: Indicate steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".
- E. 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. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-12 Carbon Structural Steel
 - A653/A653M-11 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
 - A1008/A1008M-12a Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- C. American Institute of Steel Construction (AISC):
 - AISC 360-10 Specification for Structural Steel Buildings – Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD)
- D. American Iron and Steel Institute (AISI):
 - AISI S100-07 North American Specification for the Design of Cold-Formed Steel Structural Members, Specification and Commentary for the Design of Cold-Formed Steel Structural Members
- E. American Welding Society (AWS):
 - D1.3D1.3M-08 Structural Welding Code - Sheet Steel

- F. Factory Mutual (FM Global):
 - 1. Loss Prevention Data Sheet 1-28: Design Wind Loads (2012)
 - 2. Factory Mutual Research Approval Guide (2005)
- F. Military Specifications (Mil. Spec.):
 - MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair (2003)

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Decking: ASTM A653, Structural Quality.
- B. Galvanizing: ASTM A653, G60.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. 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 must be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, 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: Provide 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 18 gauge sheet steel.
 - 2. Continuous Sheet Metal Edging: Provide at openings, concrete slab edges and roof deck edges; same quality as deck units but not less than 18 gauge steel. Manufacture to design side and end closures supporting concrete and their attachment to supporting steel, to safely support the wet weight of concrete and construction loads. Limit deflection of cantilever closures to 1/8 inch maximum.
 - 3. Metal Closure Strips: Provide for openings between decking and other construction, of not less than 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. Ridge and Valley Plates: Provide 18 gauge, 4 inch wide ridge and valley plates where roof slope exceeds 1/2 inch per foot.

5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 20 gauge metal with a minimum 5 inch face width.
6. Seat Angles for Deck: Provide where a beam does not frame into a column.
7. Sump Pans for Roof Drains: Fabricate from single piece of minimum 14 gauge galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Recess pans not less than 1 1/2 inches below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

2.2 REQUIREMENTS

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Form Deck – Type 2: Corrugated deck units used as a permanent form for reinforced concrete slabs. Comply with the depth and minimum gauge requirements as shown on the Contract Documents.
 1. Finish: Galvanized.
- C. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.
 1. Wide Rib (Type B) deck
 2. Finish: Galvanized G-60.
- D. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.
- E. Steel decking units used for interstitial levels shall include an integral system.
 1. System to provide a simple point of attachment for light duty hanger devices.
 2. System to allow for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 10 psf.
 3. System shall provide for a minimum spacing pattern of 12 inches on centers longitudinally and 24 inches on centers transversely.
 4. Maximum load suspended from any hanger is 50 pounds.
 5. System consisting of fold-down type hanger tabs or lip hanger is acceptable.

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. Remove any 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. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End lap sheets of roof deck a minimum of 2 inches and over supports.
- F. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members by not less than 5/8 inch diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches o.c. 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 3 feet o.c. 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 5 feet. Fasten at midspan or 3 feet o.c., whichever is smaller.
 - 4. Fasten roof deck units to steel supporting members by not less than 5/8 inch diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.

5. Mechanically fasten side laps of adjacent roof deck units with spans greater than 5 feet between supports, at intervals not exceeding 3 feet o.c., or midspan, whichever is closer, using self-tapping No. 8 or larger machine screws.
 6. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
 7. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 psf at eave overhang and 30 psf for other roof areas.
 8. Weld end laps of corrugated form deck units in valley of side lap and at middle of sheet (maximum spacing of welds is 15 inches).
 9. Weld corrugated deck to intermediate supports in an X pattern. Weld in valley of side laps on every other support and in the valley of the center corrugation on the remaining supports (maximum spacing of welds is 30 inches).
- G. Cutting and Fitting:
1. Cut all metal deck units to proper length in the shop 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 by the trade requiring the opening.
 4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
 5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the RE/COTR. Provide any additional reinforcing or framing required for the opening at no cost to the NCA. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
 6. 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 WELDING

- A. Make welds only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR

- A. Areas scarred during erection.
- B. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units must be zinc rich galvanizing repair paint.

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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 shear connector studs and miscellaneous closures required to prepare deck for concrete placement as shown and specified.

1.2 RELATED WORK

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

1.3 DESIGN REQUIREMENTS

- A. Design steel decking in accordance with American Iron And Steel Institute publication "Specifications for the Design of Cold Formed Steel Structural Members", except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, for project local/regional materials, recycled content, requirements.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Prepare 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. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. 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: Indicate steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:

1. Shape of decking section to be used.
 2. Cleaning of steel decking prior to concrete placement.
- E. Test Report: Verify structural characteristics of composite concrete and steel decking system.
- F. Test Report: Verify stud base qualification.
- G. Submit welding power setting recommendation by shear stud manufacturer.
- H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.

1.6 QUALITY ASSURANCE

- A. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Iron and Steel Institute (AISI):
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition)
- C. American Society of Testing and Materials (ASTM):
- | | |
|---------------|---|
| A36/A36M-12 | Carbon Structural Steel |
| A108-07 | Steel Bars, Carbon, Cold Finished, Standard Quality |
| A653/A653M-11 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process |
| A780/A780M-09 | Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings |
- D. American Institute of Steel Construction (AISC):

Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design
(Latest Edition)

Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest
Edition)

E. American Welding Society (AWS):

D1.1 Structural Welding Code - Steel

D1.3 Structural Welding Code - Sheet Steel

F. Military Specifications (Mil. Spec.):

MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Decking and all Flashings: ASTM A653.

B. Galvanizing: ASTM A653, G60, Grade 33.

C. Shear connector studs: ASTM A108, Grades 1015-1020.

1. Yield: Minimum 350 Mpa (50,000 psi).

2. Tensile strength: Minimum 400 Mpa (60,000 psi)

3. Reduction of area: 50 percent minimum

4. Studs of uniform diameter; heads concentric and normal to shaft; stud after welding free from any substance or defect which would interfere with its function as a shear connector.

5. Do not paint or galvanize studs.

6. Provide stud size(s) as shown on drawings.

7. Studs must be manufactured by a company normally engaged in the manufacturer of shear studs and installation equipment.

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

E. Miscellaneous Steel Shapes: ASTM A36.

F. Welding Electrode: E60XX minimum.

G. Sheet Metal Accessories: ASTM A653, 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: Provide 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: Provide at openings; same quality as deck units but not less than 1.3 mm (18 gauge) steel.
3. Metal Closure Strips: Provide 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: Provide where a beam does not frame into a column.

2.2 REQUIREMENTS

- A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Steel decking units to include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning and electrical items.

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. Remove any 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. Erect steel deck in accordance with manufacturer's printed instructions.
- D. Ship steel deck units to project in standard widths and cut to proper length.
- E. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- F. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. 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. Maximum space

between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to NCA.

- G. Ceiling hanger loops, if used, must be flattened or removed to obtain bearing of units on structural steel.

H. Fastening Deck Units:

1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds.
2. Tack weld or use self-tapping No. 8 or larger machine screws located as indicated for fastening end closures. Only use welds to attach longitudinal end closures.
3. Weld side laps and perimeter edge as indicated.

I. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.

J. Areas Scarred during Erection – Galvanizing Repairs: Comply with ASTM A780.

K. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop 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 by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the COTR. Provide any additional reinforcing or framing required for the opening at no cost to the NCA. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

L. Installation of shear connector studs through previously installed metal deck to conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:

1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
2. Steel deck sheets must be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded must be clean and dry.
3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
5. Ferrules specially developed for the weld-through technique must be used; provide ferrules appropriate for size of studs used; remove ferrules after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

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 delegated design services required for installation of cold-formed steel, including tracks and required accessories as shown and specified.

This Section includes the following:

1. Pre-fabricated metal roof trusses.
2. Interior load-bearing steel stud walls.
3. Exterior envelope non-load-bearing steel stud wall framing.
4. Steel joists.

1.2 RELATED WORK

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- C. 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. Prefabricated Metal Roof Trusses: Vertical deflection of 1/360 of the span.
 - b. Interior Load-Bearing Walls: Lateral deflection 1/360 of the wall height.
 - c. Exterior Envelope Non-Load-Bearing Wall Framing: Lateral deflection of 1/600 of the wall height.
 - d. Steel Joists: Vertical deflection of 1/360 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 envelope non-load-bearing wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
 6. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as in accordance with code.
 7. Engineering Responsibility: Engage a qualified professional engineer who assumes undivided responsibility for engineering cold-formed metal framing, prepares design calculations, shop drawings, and other structural data.
- D. Welding in accordance with AWS D1.3.
- E. Furnish members and accessories by one manufacturer only.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 1. Shop and erection drawings showing layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication, fastening and anchorage details, including mechanical fasteners. Include information necessary to complete installation as shown and specified.
 2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 3. Include seal of the qualified professional engineer responsible for their preparation.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. Delegated-Design Submittal: For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For professional engineer demonstrating license to practice in location of their practice.

1.5 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Iron and Steel Institute (AISI):
Design of Cold-Formed Steel Structural Members (2010)
- C. American Society of Testing and Materials (ASTM):
- | | |
|------------------|---|
| A36/A36M-12 | Carbon Structural Steel |
| A123/A123M-12 | Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| A153/A153M-09 | Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| A307-12 | Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength |
| A653/A653M-11 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| A780/A780M-09 | Repair of Damaged and Uncoated Areas of Hot Dipped Galvanized Coatings |
| A1003/A1003M-13a | Steel Sheet, Carbon, Metallic- and Non-metallic coated for Cold Form Metal Framing Members |
| C955-11c | 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-13 | Packaged Dry, Hydraulic-Cement Grout (Non-shrink) |
| C1513-12 | Steel Tapping Screws for Cold-Formed Steel Framing Connections |
| E119-12 | Test Methods for Fire Tests of Building Construction and Materials |

- | | |
|---------------|---|
| E488/E488M-10 | Test Methods for Strength of Anchors in Concrete Elements |
| E1190-11 | Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members |
| F1941-10 | Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR)) |
- D. American Welding Society (AWS):
D1.3/D1.3M:2008 Structural Welding Code-Sheet Steel
- E. Military Specifications (Mil. Spec.):
MIL-P-21035B
(Reinst. Notice 2) Paint, High Zinc Dust Content, Galvanizing Repair
- F. Society for Protective Coatings (SSPC):
SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Steel for joists, studs and other structural elements 16 gage and heavier: ASTM A1003, structural grade, zinc coated Z180 (G60), with a yield of 50 ksi minimum.
- B. Sheet Steel for joists, studs, and accessories 18 gage and lighter: ASTM A653 or ASTM A1003, zinc coated G90, with a yield of 33 ksi minimum.
- C. Galvanizing Repair Paint: MIL-P-21035B or SSPC - Paint 20.

2.2 WALL FRAMING

- A. Framing components must comply with ASTM C955 and the following.
- B. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
 - 1. Design Uncoated-Steel Thickness:
16 gage
 - 2. Flange Width:
1-5/8 inches
 - 3. Web: Punched.
- C. 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. Design Uncoated-Steel Thickness: 16 gage (min).
 2. Flange Width: 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 Uncoated-Steel Thickness: Matching steel joists.
 2. Flange Width: 2 inches.

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 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 CONNECTIONS

- A. Provide screws for steel-to-steel connections as self-drilling or tapping screws in compliance with ASTM C1513 of the type, size and location shown on the shop drawings.
- B. Electroplated screws to have a minimum 5 micron zinc coating in accordance with ASTM F1941.
- C. Screws, bolts, and anchors to be hot-dipped galvanized in accordance with ASTM A123 or ASTM A153 as appropriate.
- D. Screws, bolts, and anchors to be hot dipped galvanized in accordance with ASTM A123 or ASTM A153 as appropriate.

2.6 PLASTIC GROMMETS

- A. Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires.
- B. Prevent metal to metal contact for plumbing pipes.

2.7 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: Provide products 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: Provide 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.
- F. Welding Electrodes: Comply with AWS Standards.

2.8 REQUIREMENTS:

- A. Welding in accordance with AWS D1.3.
- B. Furnish members and accessories by one manufacturer only.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Framing components may be preassembled into panels; fabricate panels 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 INSTALLATION

- A. General:
1. Install cold-formed framing in accordance with ASTM C1107 and AISI S200.
 2. Install cold-formed steel framing according to AISI S202 and to manufacturer's written instructions unless more stringent requirements are indicated.
- B. Handle and lift prefabricated panels in a manner as to not distort any member.
- C. Securely anchor tracks to supports as shown.
- D. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- E. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- F. Align all axially loaded members vertically to allow for full transfer of the loads down to the foundation; maintain vertical alignment at floor/wall intersections.
- G. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger.
- H. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- I. Install headers in all openings that are larger than the stud spacing in that wall.
- J. Building Envelope Construction:
1. Provide for vertical movement where studs connect to the structural frame.
 2. Provide horizontal bracing in accordance with the design calculations and AISI SG03-3, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles.
3. Minimum Bracing:

LOAD	HEIGHT	BRACING
Wind load only	Up to 10 feet	One row at mid-height
	Over 10 feet	Rows 5'-0" o.c. maximum
Axial load	Up to 10 feet	Two rows at 1/3 points
	Over 10 feet	Rows 3'-4" o.c. maximum

- K. Attach bridging for studs in a manner to prevent stud rotation.
- L. Provide studs in one piece for their entire length; splices will not be permitted.
- M. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- N. Provide joist bridging and web stiffeners at reaction points where shown.
- O. Provide end blocking where joist ends are not restrained from rotation.
- P. 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.
- Q. Provide temporary bracing and leave in place until framing is permanently stabilized.
- R. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- S. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.3 TOLERANCES

- A. Vertical Alignment (plumbness) of Studs: Within 1/960th of the span.
- B. Horizontal Alignment (levelness) of Walls: Within 1/960th of their respective lengths.
- C. Spacing of Studs: Not be more than 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 not be more than 1/8 inch +/- out of square within the length of that panel.

3.4 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - 1. Test and inspect field and shop welds.
 - 2. Perform inspections in order to assure strict conformance to the shop drawings at all phases of construction.
 - 3. Check members for proper alignment, bearing, completeness of attachments, proper alignment, reinforcement, etc.
- B. Testing agency must report test results promptly and in writing.
- C. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.5 FIELD REPAIR

- A. Touch-up damaged galvanizing with galvanizing repair paint complying with ASTM A780.

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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.
 - 2. Loose Lintels.
 - 3. Shelf Angles.
 - 4. Railings.
 - 5. Ladders.
 - 6. Access Platforms.
 - 7. Frames.
 - 8. Guards.
 - 9. Covers and Frames for Pits and Trenches.
 - 10. Gratings.
 - 11. Plate Door Sill.
 - 12. Safety Nosings.
 - 13. Sidewalk Access Doors.

1.2 RELATED WORK

- A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- B. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PRODUCT DATA.
- B. Manufacturer's Literature and Data:
 - Grating, each type.
- C. Shop Drawings:
 - 1. Indicate 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. Submit Design Calculations for specified live loads including dead loads prepared by professional engineer licensed in the location of their practice.
- 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 must meet or exceed the requirements specified, and be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type to 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. Publications listed below form a part of this specification to extent referenced.
Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society of Mechanical Engineers (ASME):
B18.6.1-81(R2008) Wood Screws
B18.2.2-10 Nuts for General Applications
- C. American Society for Testing and Materials (ASTM):
A36/A36M-12 Carbon Structural Steel
A47-14 Ferritic Malleable Iron Castings
A48-12 Gray Iron Castings
A53-12 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded
and Seamless

A123/A123M-12	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A269-14	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A307-12	Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
A312/A312M-15	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A391/A391M-12	Grade 80 Alloy Steel Chain
A500/A500M-10a	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A653/A653M-11	Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
A786/A786M-09	Hot-Rolled Carbon, Low-Alloy, High-Strength, Low-Alloy, and Alloy Steel Floor Plates
B221-14	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B456-11	Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
B632/B632M-08	Aluminum-Alloy Rolled Tread Plate
C1107/C1107M-13	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
E488-10	Strength of Anchors in Concrete Elements
F436-11	Hardened Steel Washers
F468-13	Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use
F593-13a	Stainless Steel Bolts, Hex Cap Screws, and Studs
F1667-13	Driven Fasteners: Nails, Spikes, and Staples
D. American Welding Society (AWS):	
D1.1/D1.1M:2010	Structural Welding Code Steel
D1.2/D1.2M:2008	Structural Welding Code Aluminum
D1.3/D1.3M:2008	Structural Welding Code Sheet Steel
E. National Association of Architectural Metal Manufacturers (NAAMM):	
AMP 500-06-2006	Metal Finishes Manual
AMP 521-01-12	Pipe Railing Manual

MBG531-09 Metal Bar Grating Manual

MBG532-09 Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC):

SSPC-SP 1 Solvent Cleaning

SSPC-SP 2 Hand Tool Cleaning

SSPC-SP 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: 250 pounds at any point.
- C. Railings and Handrails: 200 pounds in any direction at any point.
- D. Manhole Covers: 250 pounds per square foot.

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Structural Tubing: ASTM A500.
- C. Stainless Steel: ASTM A167, Type 302 or 304.
- D. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- E. Floor Plate:
 - 1. Steel ASTM A768.
 - 2. Aluminum: ASTM B632.
- F. Steel Pipe: ASTM A53.
 - 1. Galvanized for exterior locations.
 - 2. Type S, Grade A unless specified otherwise.
 - 3. NPS (inside diameter) as shown.
- G. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- H. Malleable Iron Casting: A47.
- I. Primer Paint: As specified in Section 09 91 00, PAINTING.
- J. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- K. 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 with in-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 A653, 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 0.0125 inch thick stainless steel.

L. Grout: ASTM C1107, pourable type.

M. 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 is used.

B. Bolts with nuts: same material, color, and finish as the metal to which applied when exposed.

1. ASME B18.2.2.
2. ASTM A307 for 60,000 psi tensile strength bolts.
3. ASTM F468 for nonferrous bolts.
4. ASTM F593 for stainless steel.

C. Expansion and Adhesive Anchors: Design values listed must be as tested according to ASTM E488.

D. Lag Screws and Bolts: ASME B18.2.1, type and grade best suited for the purpose.

E. Toggle Bolts: ASME B18.2.1.

F. Bolts, Nuts, Studs and Rivets: ASME B18.2.2 or ASTM A307.

G. Washers: ASTM F436, type to suit material and anchorage.

H. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION

A. General:

1. Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames.
2. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as required to support wall loads over openings. Provide with connections.
3. Construct to have at least 8 inches bearing on masonry at each end.
4. Provide angles and plates, ASTM A36, for embedment as indicated.
5. Galvanize embedded items exposed to the elements according to ASTM A123.

B. 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.

C. 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.

D. 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 punch or drill; 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 member's machine screws or bolts.

E. 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.

F. 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 standards as listed in article Applicable Publications.

- 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. Provide as indicated.
 - b. Where metal fabrications are shown to be preset in concrete, weld 1-1/4 by 1/8 inch steel strap anchors, 6 inches long with one inch hooked end, to back of member at 2 feet on center, unless otherwise shown.
 - c. Where metal fabrications are shown to be built into masonry use 1-1/4 by 1/8 inch steel strap anchors, 10 inches long with 2 inch hooked end, welded to back of member at 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. 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. Fabricate fit of components and the alignment of holes to 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.
- G. Finish:
- 1. Finish exposed surfaces in accordance with NAAMM 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 PAINTING.
 - 2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

H. 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 Ceiling Hung Toilet Stall:
1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
 2. Make provision for installation of stud bolts in lower flange of channel.
 3. Provide a continuous steel angle at wall and channel braces spaced as shown.
 4. Use threaded rod hangers.
 5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
- C. For Wall Mounted Items:
1. For items supported by metal stud partitions.
 2. Steel strip or hat channel minimum of 0.0598 inch thick.
 3. Steel strip minimum of 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 4 inches on center between ends.
- D. For Trapeze Bars:
1. Construct assembly above ceilings as shown and design to support not less than a 750 pound working load at any point.
 2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
 3. Fabricate concealed components of structural steel shapes unless shown otherwise.
 4. Stainless steel ceiling plate drilled for eye bolt.
 5. Continuously weld connections where welds shown.
 6. Use modular channel where shown with manufacturers bolts and fittings.
 - a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.

- b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

2.6 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 6 inch bearing at each end for nonbearing masonry walls, and 8 inch bearing at each end for bearing walls.
- C. Provide one angle lintel for each 4 inches of masonry thickness as follows except as otherwise specified or shown.
 1. Openings 2-1/2 feet to 6 feet - 4 x 3-1/2 x 5/16 inch.
 2. Openings 6 feet to 10 feet - 6 x 3-1/2 x 3/8 inch.
- D. For 6 inch thick masonry openings 2-1/2 feet to 10 feet use one angle 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 3/4 inch bolts spaced at 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.
- I. Elevator Entrance:
 1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 4 inch bearing each end.
 2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.7 SHELF ANGLES

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 3/4 inch bolts spaced at not over 3 feet on centers and within 12 inches of ends.
- C. Provide adjustable malleable iron inserts for embedded in concrete framing.

2.8 RAILINGS

- A. Design Criteria: 200 pounds in any direction at any point.
- 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.
 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. Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. 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 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 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 5/16 inch diameter, eight links per 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 3/8 inch diameter.
 - c. Fabricate anchor at walls, for engagement of snap hook of either a 3/8 inch diameter eye bolt or punched angle.
 - d. Galvanize chain and bolts after fabrication.

2.9 LADDERS

A. Steel Ladders:

- 1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
- 2. Fabricate angle brackets of 2 inch wide by 1/2 inch thick steel; brackets spaced maximum of 4 feet apart and of length to hold ladder 7 inches from wall to center of rungs. Provide turned ends or clips for anchoring.
- 3. Provide holes for anchoring with expansion bolts through turned ends and brackets.

4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

SPEC WRITER NOTE: Verify details, show size
and dimensions of components, or specify.

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. Fabricate from one inch diameter steel bars.
2. Fabricate so that rungs will extend at least 4 inches into wall with ends turned 2 inches, project out from wall 7 inches, be 16 inches wide and be designed so that foot cannot slide off end.
3. Galvanized after fabrication, ASTM A123, G-90 rungs for exterior use and for access to pits.

2.10 ACCESS PLATFORMS

- A. Fabricate 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 ladders as specified under paragraph LADDERS unless shown otherwise.
- D. Fabricate steel pipe railings as specified under paragraph RAILINGS.
- E. Platforms floor surfaces as shown.
 1. Steel gratings as specified under paragraph gratings, either bar or plank type.
 2. Steel floor plate.
 3. Aluminum floor plate.
- F. Prime paint platform system.

2.11 FRAMES

- A. Channel Door Frames:
 1. Fabricate of structural steel channels of size shown.
 2. Miter and weld frames at corners.

3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 3/16 inch thick by 1-3/4 inch wide steel strap anchors with ends turned 2 inches, and of sufficient length to extend at least 12 inches into wall. Space anchors 24 inches above bottom of frame and 24 inches o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 24 inches above bottom of frame and 24 inches o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 3/4 x 3/4 x 1/8 inch thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section, BUILDER'S HARDWARE.
 - a. Cut a slot in the lock jamb to receive the lock bolt.
 - b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 18 inches on center.

2.12 GUARDS

- A. Wall Corner Guards:
 1. Fabricate from steel angles and furnish with anchors as shown.
 2. Continuously weld anchor to angle.
- B. Guard Angles for Overhead Doors:
 1. Cut away top portion of outstanding leg of angle and extend remaining portion of angle up wall.
 2. Weld filler piece across head of opening to jamb angles.
 3. Make provisions for fasteners and anchorage.
- C. Channel Guard at Loading Platform:
 1. Fabricate from steel channel of size shown.
 2. Weld anchors to channels as shown.
 3. Drill channel for bumper anchor bolts.
- D. Edge Guard Angles for Openings in slabs.
 1. Fabricate from steel angles of sizes and with anchorage shown.

2. Where size of angle is not shown, provide 2 x 2 x 1/4 inch steel angle with 1-1/4 x 3/16 inch strap anchors, welded to back.
3. Miter or butt angles at corners and weld.
4. Use one anchor near end and three feet on centers between end anchors.

E. Wheel Guards:

1. Construct wheel guards of not less than 5/8 inch thick cast iron.
2. Provide corner type, with flanges for bolting to walls.

2.13 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 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 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 25 square feet in area and 200 pounds in weight.
6. Fabricate trench cover sections not be over 3 feet long and if width of trench is more than 3 feet or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
7. Use two, 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 2-1/2 x 2-1/2 x 1/4 inch angles for frame openings over 4 feet long and 2 x 2 x 1/4 inch for frame openings less than 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 24 inches o.c., not shown otherwise between end anchors. Use 1/4 x 1 x 8 inches with 2 inch bent ends strap anchors unless shown otherwise.

5. Drill and tap frames for screw anchors where plate covers occur.

2.14 GRATINGS

- A. Cast Iron Gratings:
 1. Fabricate gratings to support a live load of 500 pounds per square foot.
 2. Fabricate gratings and frames for gutter type drains from cast-iron conforming to ASTM A48.
 3. Fabricate gratings in section not longer than 4 feet or over 200 pounds and fit so as to be readily removable.

2.15 PLATE DOOR SILL

- A. Fabricate of checkered plate as detailed.
 1. Aluminum Plate: ASTM B632, 0.125 inch thick.
 2. Steel Plate: ASTM A786, 0.125 inch thick, galvanized G90.
- B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 12 inches, o.c.

2.16 SAFETY NOSINGS

- A. Fed. Spec. RR-T-650, Type C.
 1. Aluminum: Class 2, Style 2.
 2. Cast iron: Class 4.
- B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.
- C. Fabricate nosings approximately 4 inches wide with not more than 3/8 inch nose.
- D. Provide nosings with integral type anchors spaced not more than 4 inches from each end and intermediate anchors spaced approximately 15 inches on center.
- E. Fabricate nosings to extend within 4 inches of ends of concrete stair treads except where shown to extend full width.
- F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.
- G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

2.17 SIDEWALK ACCESS DOOR

- A. Use flush, watertight, gutter type design.
- B. Cover fabricate of 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.
- F. Provide gutters at all joints for drainage of water.

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.
 - 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 on shop drawings.

B. Ceiling Hung Toilet Stalls:

1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
2. Bolt continuous steel angle at wall to masonry or weld to face of each metal stud.
3. Secure brace for steel channels over toilet stall pilasters to wall angle supports with bolts at each end spaced as shown.
4. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
5. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.
6. Install support for ceiling hung pilasters at entrance screen to toilet room similar to toilet stall pilasters.

C. 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.

D. Supports for Trapeze Bars:

1. Secure plates to overhead construction with fasteners as shown.
2. Secure angle brace assembly to overhead construction with fasteners as shown and bolt plate to braces.
3. Fit modular channel unit flush with finish ceiling, and secure to plate with modular channel unit manufacturer's standard fittings through steel shims or spreaders as shown.
 - a. Install closure plates in channel between eye bolts.
 - b. Install eyebolts in channel.

3.3 STEEL LINTELS

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 6 inch masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 6 inch bearing at each end for nonbearing walls, and 8 inch bearing at each end for bearing walls.

3.4 SHELF ANGLES

- A. Anchor shelf angles with 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. 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.
- C. 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.
- D. Gates:
 - 1. Hang gate to swing as shown.
 - 2. Bolt gate hinges to jamb post with clamp on or through bolts.
- E. 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.
- F. Handrails:
1. Anchor brackets for metal handrails as detailed.
 2. Install brackets within 12 inches of return of walls, and at evenly spaced intermediate points not exceeding 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 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- B. In elevator pits, set ladders to clear all elevator equipment where shown on the drawings.
1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
 2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.
- C. Ladder Rungs:
1. Set ladder rungs into formwork before concrete is placed. Build ladder rungs into masonry as the work progresses.
 2. Set step portion of rung 6 inches from wall.
 3. Space rungs approximately 12 inches on centers.
 4. Where only one rung is required, locate it 16 inches above the floor.

3.7 ACCESS 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.

3.8 DOOR FRAMES

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

- B. Level and plumb frame; brace in position required.
- C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
- D. Set frames in formwork for frames cast into concrete.
- E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.9 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 18 inches on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

3.10 GUARDS

- A. Steel Angle Corner Guards:
 - 1. Build into masonry as the work progress.
 - 2. Set into formwork before concrete is placed.
 - 3. Set angles flush with edge of opening and finish floor or wall or as shown.
 - 4. At existing construction fasten angle and filler piece to adjoining construction with 5/8 inch diameter by 3 inch long expansion bolts 18 inches on center.
 - 5. Install Guard Angles at Edges of Trench, Openings in Slab and Overhead Doors where shown.
- B. Channel Guard at Top Edge of Concrete Platforms:
 - 1. Install in formwork before concrete is placed.
 - 2. Set channel flush with top of the platform.
- C. Wheel Guards:
 - 1. Set flanges of wheel guard at least 2 inches into pavement.
 - 2. Anchor to walls as shown, expansion bolt if not shown.

3.11 COVERS AND FRAMES FOR PITS AND TRENCHES

- A. Set frame and cover flush with finish floor.
- B. Secure plates to frame with flat head countersunk screws.
- C. Set gratings loose in drainage trenches or over pits unless shown anchored.

3.12 GRATINGS

- A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
- B. Set frame in formwork before concrete is placed.

- C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

3.13 PLATE DOOR SILL

- A. Install after roofing base flashing and counter flashing work is completed.
- B. Set in sealant and bolt to curb.
- C. Install nosing to within 4 inches of ends of concrete stair treads, except where shown to extend full width.
- D. Extend nosings full width of door openings.
- E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.14 SAFETY NOSINGS

- A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
 - 1. Exterior concrete steps.
 - 2. Door sills of areaway entrances curbs.
 - 3. Exposed edges of curbs of door sills at transformer and service rooms.
 - 4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.
- B. Install flush with horizontal and vertical surfaces.
- C. Install nosing to within 4 inches of ends of concrete stair treads, except where shown to extend full width.
- D. Extend nosings full width of door openings.
- E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.15 SIDEWALK ACCESS DOOR

- A. Set frame flush with finished concrete slab or curb.
- B. Secure well linings to structure with expansion bolts unless shown otherwise.
- C. Bolt ceiling hatch to well lining angle brace and to angle iron frames near corners and 12 inches on centers with not less than 3/8 inch roundhead machine screws.
- D. Coordinate sidewalk door drain connections with plumbing work.

3.16 STEEL COMPONENTS FOR MILLWORK ITEMS

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

3.17 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 aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

**SECTION 05 51 00
METAL STAIRS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies steel stairs with railings.
- B. Closed riser stairs with concrete filled treads and platforms.

1.2 RELATED WORK

- A. Concrete fill for treads and platforms: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.
- C. Requirements for shop painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

1.4 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 basic designation.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-08 Structural Steel
 - A47-99(2009) Ferritic Malleable Iron Castings
 - A48-08 Gray Iron Castings
 - A53-12 Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
 - A307-14 Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
 - A563-14 Carbon and Alloy Steel Nuts
 - A653/A653-11 Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process
 - A786/A786M-09 Hot-Rolled Carbons, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
 - A1008-10 Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy

- A1011-10 Steel, Sheet and Strip, Strip, Hot-Rolled Carbon,
Structural, High-Strength, Low-Alloy
- C. American Welding Society (AWS):
- D1.1-10 Structural Welding Code-Steel
- D1.3-08 Structural Welding Code-Sheet Steel
- D. American Iron and Steel Institute (AISI):
- 2008 Design of Cold-Formed Steel Structural Members
- E. The National Association of Architectural Metal Manufacturers (NAAMM) Manuals:
- MBG 531-09 Metal Bar Grating Manual
- AMP 521-01-12 Pipe Railing Manual

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. Design stairs to support a live load of 100 pounds per square foot.
- B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.
- C. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 200 pounds in any direction at any point.

2.2 MATERIALS

- A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.
- B. Sheet Steel: ASTM A1008.
- C. Structural Steel: ASTM A36.
- D. Steel Floor Plate: ASTM 786.
- E. Steel Decking: Form from zinc coated steel conforming to ASTM A653, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.
- F. Steel Plate: ASTM A1011.
- G. Iron Castings: ASTM A48, Class 30.
- H. Malleable Iron Castings: ASTM A47.

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.

- B. Welding:
 - 1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
 - 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: Prepare surface and apply primer as specified for ferrous metals in Section 09 91 00, PAINTING.

2.4 RAILINGS

- A. Fabricate railings, including handrails, from steel pipe with flush.
 - 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 six 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 STAIR RISERS

- 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 3/16-inch, with forged steel caps and drops.

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 any gap between the stringer and surrounding shaft wall. Weld and finish with prime and paint finish of adjoining steel.

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 1/8-inch in 12 feet.
- D. Set posts plumb and aligned to within 1/8-inch in 12 feet.

3.3 FIELD PRIME PAINTING

- A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.
- B. Touch-up abraded areas with same primer paint used for shop priming.
- C. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

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