

**0SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL**1.1 DESCRIPTION:**

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.
- D. Steel Decking: Section 05 31 00, STEEL DECKING.
- F. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

1.3 QUALITY ASSURANCE:

- A. Fabricator and erector shall maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Work shall be fabricated in an AISC certified Category Conventional Steel Structures fabrication plant.
- B. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the COR.

1.4 TOLERANCES:

Fabrication tolerances for structural steel shall be held 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 LRFD Manual, Second Edition, Page 1-183), except as follows:

- A. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
- B. 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).
- C. 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 DESIGN:

- A. Connections: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with the details shown on the Drawings, supplementing where necessary.

The details shown on the Drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the COR of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the COR. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

- B. Cooling Tower Supports: Unless otherwise shown on the Contract Documents, the design, location, and dimensions of cooling tower supports are based upon a typical installation. Contractor shall furnish and install at no additional cost to the Government, adequate structural supports for equipment furnished for this installation. Design shall be based on loads supplied by the Cooling Tower Manufacturer and must include an allowance for wind and other lateral loads. Submit detailed drawings and design calculations, prepared by a registered Professional Engineer, for approval before members are fabricated.

1.6 REGULATORY REQUIREMENTS:

- A. AISC: Specification for Structural Steel Buildings - Allowable Stress Design.
- B. AISC: Code of Standard Practice for Steel Buildings and Bridges.

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.
 2. Cooling Tower Supports: If not designed on the Structural Drawings.
- 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 basic designation only.

B. American Institute of Steel Construction (AISC):

- 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Second Edition, 2005)
- 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1995)
- 3. Code of Standard Practice for Steel Buildings and Bridges (2010).

C. American National Standards Institute (ANSI):

- B18.22.1-65(R2008).....Plain Washers
- B18.22M-81(R2000).....Metric Plain Washers

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

- A6/A6M-09.....Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
- A36/A36M-08.....Standard Specification for Carbon Structural Steel
- A53/A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- A123/A123M-09.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A242/A242M-04(R2009)....Standard Specification for High-Strength Low-Alloy Structural Steel
- A283/A283M-03(R2007)....Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A307-10.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A490-10.....Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength
- A500/A500M-10.....Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07.....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

A572/A572M-07.....Standard Specification for High-Strength
 Low-Alloy Columbium-Vanadium Structural Steel
 A992/A992M-06.....Standard Specification for 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
- G. Military Specifications (Mil. Spec.):
 MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing,
 Repair
- H. Occupational Safety and Health Administration (OSHA):
 29 CFR Part 1926-2001...Safety Standards for Steel Erection

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Structural Steel: ASTM A36, , and W shapes: Grade 50 A992.
- B. Structural Tubing: ASTM A500, Grade B.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
 1. High-strength bolts, including nuts and washers: ASTM A325 or A490.
 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. Welds shall be made only
 by welders and welding operators who have been previously qualified by
 tests as prescribed in AWS D1.1 to perform type of work required.
- 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. Tightening done with properly calibrated
 wrenches, by turn-of-nut method or by use of direct tension indicators
 (bolts or washers). Tighten bolts in connections identified as slip-
 critical using Direct Tension Indicators or the turn-of-the-nut method.
 Twist-off torque bolts are not an acceptable alternate fastener for slip
 critical connections.

3.2 FABRICATION:

Fabrication in accordance with Chapter M, Specification for Steel Buildings - Load and Resistance Factor Design.

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 50 mm (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 (Hot Dip Galvanized) per ASTM A123 (after fabrication):
Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.4 ERECTION:

- A. General: Erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: 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:

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 COR for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall 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:**

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: 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: Showing 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. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.
- B. 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.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-08.....Standard Specification for Carbon Structural Steel
 - A611-97.....Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
 - A653/A653M-08.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
 - C423-08.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (ninth Edition, 1989)
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)
- D. American Iron and Steel Institute (AISI):
 - 1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members
- E. American Welding Society (AWS):
 - D1.3-08.....Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
 - 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement
 - 2. Factory Mutual Research Approval Guide (2002)
- G. Military Specifications (Mil. Spec.)
 - MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS**2.1 MATERIALS:**

- A. Steel Decking: ASTM A653, Grade 33.
- 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 shall be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E70XX 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: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - 4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (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 1 mm (20 gauge) metal with a minimum 125 mm (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: Fabricated from single piece of minimum 1.9 mm (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 75 mm (3 inches) wide. Recess pans not less than 38 mm (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.
8. Acoustic Sound Barrier Closures: Manufacturer's standard mineral fiber closures.

2.2 REQUIREMENTS:

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Form Deck - Type 1: Single pan fluted units utilized as a permanent form for reinforced concrete slabs. Comply with the depth and gauge requirements as shown on the Contract Documents.
 1. Finish: Galvanized G-60.
- C. 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.
 3. Finish: Galvanized.
- D. 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. Intermediate Rib (Type F) deck.
 3. Narrow Rib (Type A) deck.
 4. Deep Rib (Type N) deck.
 5. Finish: Galvanized G-60.
 7. Finish: Prime painted. Apply finished coat of paint to underside of deck after installation. Color as selected by Architect.
- E. Acoustic Metal Roof Deck Units: Single-pan fluted units with perforated vertical webs, metal thickness, depth and width as indicated. Provide mineral fiber acoustical insulation strips of profile to fit void space between vertical ribs, with a system Noise Reduction Coefficient of

0.90. Submit test results per ASTM C423 certifying acoustical performance.

- F. 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.
- G. 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 50 kg/m² (10 psf).
 - 3. System shall provide for a minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm (24 inches) on centers transversely.
 - 4. Maximum load suspended from any hanger is 23 kg (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 laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- F. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal

- strength, spaced not more than 305 mm (12 inches) 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 915 mm (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 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
 4. Fasten roof deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) 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 1524 mm (5 feet) between supports, at intervals not exceeding 915 mm (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 2.1 kPa (45 psf) at eave overhang and 1.4 kPa (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 380 mm (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 760 mm (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 COR. Provide any additional reinforcing or framing required for the opening at no cost to the Government. 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:

Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR:

1. Areas scarred during erection.
2. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint. Touch-up paint for shop painted units of same type used for shop painting.

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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: (12, 14A, 14C)
 - 2. Frames: (24E)
 - 3. Guards
 - 4. Covers and Frames for Pits and Trenches.
 - 5. Gratings
 - 6. Loose Lintels
 - 7. Shelf Angles
 - 8. Gas Racks
 - 9. Plate Door Sill
 - 10. Safety Nosings
 - 11. Ladders
 - 12. Railings: (10)
 - 13. Catwalks and Platforms
 - 14. Trap Doors with Ceiling Hatch

1.2 RELATED WORK

- A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- B. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.
- D. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
Trap door	Wheel guards
Ceiling hatch	Sidewalk Access door
Manhole Covers	Safety nosing

- C. Shop Drawings:

- 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
- 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
- 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
 - 1. Anodized finish as specified.
 - 2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 - B18.6.1-97.....Wood Screws
 - B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
 - A36/A36M-08.....Structural Steel
 - A47-99(R2009).....Malleable Iron Castings
 - A48-03(R2008).....Gray Iron Castings
 - A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
 - A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products

- A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- A269-10.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- A312/A312M-09.....Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- A391/A391M-07.....Grade 80 Alloy Steel Chain
- A653/A653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- A786/A786M-09.....Rolled Steel Floor Plate
- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- B632-08.....Aluminum-Alloy Rolled Tread Plate
- C1107-08.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- F436-10.....Hardened Steel Washers
- F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1667-11.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
 - D1.1-10.....Structural Welding Code Steel
 - D1.2-08.....Structural Welding Code Aluminum
 - D1.3-08.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 - AMP 521-01.....Pipe Railing Manual
 - AMP 500-06.....Metal Finishes Manual
 - MBG 531-09.....Metal Bar Grating Manual
 - MBG 532-09.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
 - SP 1-04.....No. 1, Solvent Cleaning
 - SP 2-04.....No. 2, Hand Tool Cleaning
 - SP 3-04.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):

RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

SPEC WRITER NOTE:

- 1. Update materials requirements to agree with applicable requirements (types, grades, classes,) specified in the referenced Applicable Publications.
- 2. Coordinate with structural design criteria and specify live loads where fork lift and other vehicles will subject plates, gratings and trap doors in floors or pavements to concentrated loads.

2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.
- D. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m² (100 pounds per square foot). Use _____ kg (pounds) for concentrated loads. Use ____ kg/m² (pounds per square foot) for vehicle loads in the following areas : _____.
- E. Manhole Covers: 1200 kg/m² (250 pounds per square foot).

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Floor Plate:
 - 1. Steel ASTM A786.
 - 2. Aluminum: ASTM B632.
- E. Steel Pipe: ASTM A53.
 - 1. Galvanized for exterior locations.
 - 2. Type S, Grade A unless specified otherwise.
 - 3. NPS (inside diameter) as shown.
- F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- G. Malleable Iron Castings: A47.
- H. Primer Paint: As specified in Section 09 91 00, PAINTING.
- I. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- J. Modular Channel Units:
 - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.

2. Form channel 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 A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:

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

B. Fasteners:

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

2.4 FABRICATION GENERAL

A. Material

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

B. Size:

1. Size and thickness of members as shown.

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

C. Connections

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

D. Fasteners and Anchors

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

E. Workmanship

1. General:
 - a. Fabricate items to design shown.

- b. Furnish members in longest lengths commercially available within the limits shown and specified.
 - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
 - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
 - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
 - f. Prepare members for the installation and fitting of hardware.
 - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
 - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
- a. Weld in accordance with AWS.
 - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
 - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
 - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
 - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
 - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
 - b. Fit removable members to be easily removed.

- c. Design and construct field connections in the most practical place for appearance and ease of installation.
 - d. Fit pieces together as required.
 - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
 - f. Joints firm when assembled.
 - g. Conceal joining, fitting and welding on exposed work as far as practical.
 - h. Do not show rivets and screws prominently on the exposed face.
 - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.
- F. Finish:
1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
 2. Aluminum: NAAMM AMP 501.
 - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
 - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
 - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
 - d. Painted: AA-C22R10.
 3. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - c. Shop Prime Painting:
 - 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.

e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

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

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.

2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.

2. Use clip angles or make provisions for welding hangers and braces to overhead construction.

3. Field connections may be welded or bolted.

B. For 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.

6. Provide supports for ceiling hung pilasters at dressing booths and entrance screen to toilet room similar to support for toilet stall pilasters.

C. For Wall Mounted Items:

1. For items supported by metal stud partitions.

2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.

3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.

4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.

5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
 6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.
- D. For Trapeze Bars:
1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (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.
- E. For Intravenous Track and Cubical Curtain Track:
1. Fabricate assembly of steel angle as shown.
 2. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.
 3. Provide pipe sleeve welded to angle.
- F. Supports at Ceiling for Radiographic (x-ray) Equipment:
1. Fabricate hangers braces, and track of modular channel units assembly as shown.
 2. Fabricate steel plates for anchor to structure above.
 3. Drill bent plates for bolting at mid height at concrete beams.
- G. For Operating Room Light:
1. Fabricate as shown to suit equipment furnished.
 2. Drill leveling plate for light fixture bolts.
- H. Supports in Orthopedic Brace Shop:
1. Fabricate from 25 mm (one inch) steel pipe, fasten to steel angles above and extend to a point 150 mm (6 inches) below finished ceiling.
 2. Lower end of the pipe shall have a standard pipe thread.
 3. Provide an escutcheon plate at ceiling.

- I. Supports for Accordion Partition Tracks, Exercise Equipment, and Items at Various Conditions at Suspended Ceilings:
 - 1. Fabricate of structural steel shapes as shown.
 - 2. Drill for anchor bolts of suspended item.
- J. Supports for Communion Rail Posts in Chapel:
 - 1. Fabricate one steel plate support for each post as shown.
 - 2. Drill for fasteners.

2.6 FRAMES

- A. Elevator Entrance Wall Opening.
 - 1. Fabricate of channel shapes, plates, and angles as shown.
 - 2. Weld or bolt head to jamb as shown.
 - 3. Weld clip angles to bottom of frame and top of jamb members extended to structure above for framed construction.
 - a. Provide holes for anchors.
 - b. Weld head to jamb members.
- B. 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, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (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 600 mm (24 inches) above bottom of frame and 600 mm (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 19 x 19 x 3 mm (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 08 71 00, DOOR 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 450 mm (18 inches) on center.
- C. Frames for Breech Opening:
1. Fabricate from steel channels, or combination of steel plates and angles to size and contour shown.
 2. Weld strap anchors on back of frame at not over 600 mm (2 feet) on centers for concrete or masonry openings.
- D. Frames for Lead Lined Doors:
1. Obtain accurate dimensions and templates from suppliers of lead lined doors, finish hardware, and hollow steel door frames.
 2. Fabricate as shown for use in connection with lead lined doors.
 3. Deliver assembled frames with removable shipping spreaders at top and bottom.
 4. Extend angles at jambs from floor to structural slab above. At floors of interstitial spaces, terminate jamb sections and provide anchors as shown.
 5. Continuously weld plates and reinforcements to frame members and head members of angle frames between jambs.
 6. Weld strap anchors, not over 600 mm (24 inches) on centers, to the back of angles for embedment in masonry or concrete unless shown otherwise.
7. Type 15 Door Frames:
- a. Structural steel angle frames with plate or bar full height to heads. Extend reinforcing at hinge cutouts two inches beyond cutout.
 - b. Fabricate top anchorage to beam side at mid height.
 - c. Weld clip angles to both legs of angle at top and bottom.
 - d. Drill clips and plates, at top and bottom for anchoring jamb angles with two 9 mm (3/8 inch) expansion bolts at each location.
 - e. Cut rabbet for pivot hinges and lock strike.

2.7 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 50 x 50 x 6 mm (2 x 2 x 1/4 inch) steel angle with 32 x 5 mm (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 16 mm (5/8 inch) thick cast iron.
 2. Provide corner type, with flanges for bolting to walls.

2.8 COVERS AND FRAMES FOR PITS AND TRENCHES

- A. Fabricate covers to support live loads specified.
- B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.
- C. Steel Covers:
1. Use 6 mm (1/4 inch) thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
 2. Provide clearance at all sides to permit easy removal of covers.
 3. Make cutouts within 6 mm (1/4 inch) of penetration for passage of pipes and ducts.
 4. Drill covers for flat head countersunk screws.
 5. Make cover sections not to exceed 2.3 m² (25 square feet) in area and 90 kg (200 pounds) in weight.
 6. Fabricate trench cover sections not be over 900 mm (3 feet) long and if width of trench is more than 900 mm (3 feet) or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
 7. Use two, 13 mm (1/2 inch) diameter steel bar flush drop handles for each cover section.
- D. Cast Iron Covers
1. Fabricate covers to support live loads specified.

2. Fabricate from ASTM A48, cast-iron, 13 mm (1/2 inch) minimum metal thickness, cast with stiffeners as required.
3. Fabricate as flush type with frame, reasonably watertight and be equipped with flush type lifting rings. Provide seals where watertight covers noted.
4. Make covers in sections not over 90 kg (200 pounds) except round covers.

E. Steel Frames:

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

F. Cast Iron Frames:

1. Fabricate from ASTM A48 cast iron to shape shown.
2. Provide anchors for embedding in concrete, spaced near ends and not over 600 mm (24 inches) apart.

2.9 GRATINGS

- A. Fabricate gratings to support live loads specified and a concentrated load as specified.
- B. Provide clearance at all sides to permit easy removal of grating.
- C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
- D. Fabricate in sections not to exceed 2.3 m² (25 square feet) in area and 90 kg (200 pounds) in weight.
- E. Fabricate sections of grating with end-banding bars.
- F. Fabricate angle frames and supports, including anchorage as shown.
 1. Fabricate intermediate supporting members from "T's" or angles.
 2. Locate intermediate supports to support grating section edges.
 3. Fabricate frame to finish flush with top of grating.
 4. Locate anchors at ends and not over 600 mm (24 inches) o.c.

5. Butt or miter, and weld angle frame at corners.

G. Steel Bar Gratings:

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

H. Aluminum Bar Gratings:

1. Fabricate grating and frame assembly from aluminum as shown in accordance with Metal Bar Grating Manual.
2. Use 25 x 5 mm (1 x 3/16 inch) minimum size bearing bars.
3. Mill finish unless specified otherwise.

I. Plank Gratings:

1. Conform to Fed. Spec. RR-G-1602.
2. Manufacturers standard widths, lengths and side channels to meet live load requirements.
3. Galvanize exterior steel gratings ASTM A123, G-90 after fabrication.
4. Fabricate interior steel gratings from galvanized steel sheet, ASTM A525, where bearing on concrete or masonry.
5. Fabricate other interior grating from steel sheet and finish with shop prime paint. Prime painted galvanized sheet may be used.

J. Cast Iron Gratings:

1. Fabricate gratings to support a live load of 23940 Pa (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 1200 mm (4 feet) or over 90 kg (200 pounds) and fit so as to be readily removable.

2.10 LOOSE LINTELS

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.

1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
 2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (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.

2.11 SHELF ANGLES

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.
- C. Provide adjustable malleable iron inserts for embedded in concrete framing.

2.12 PLATE DOOR SILL

- A. Fabricate of checkered plate as detailed.
1. Aluminum Plate: ASTM B632, 3 mm (0.125 inch) thick.
 2. Steel Plate: ASTM A786, 3 mm (0.125 inch thick), galvanized G90.
- B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 300 mm (12 inches), o.c.

2.13 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 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.
- D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.
- E. Fabricate nosings to extend within 100 mm (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.

2.14 LADDERS

A. Steel Ladders:

- 1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
- 2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
- 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.

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 25 mm (one inch) diameter steel bars.
- 2. Fabricate so that rungs will extend at least 100 mm (4 inches) into wall with ends turned 50 mm (2 inches), project out from wall 175 mm (7 inches), be 400 mm (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.

2.15 RAILINGS

- A. In addition to the dead load design railing assembly to support live load specified.
- 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 1800 mm (6 feet) on centers between end posts.
 4. Form handrail brackets from malleable iron.
 5. Fabricate removable sections with posts at end of section.

6. Removable Rails:

- a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
- b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
- c. Continuously weld brackets to post.
- d. Provide slotted bolt holes in rail bracket.
- e. Weld bolt heads flush with top of rail.
- f. Weld flanged fitting to post where posts are installed in sleeves.

7. Opening Guard Rails:

- a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
- b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
- c. Fabricate rails for floor openings for anchorage in sleeves.

8. Gates:

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

9. Chains:

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

E. Aluminum Railings:

1. Fabricate from extruded aluminum.
2. Use tubular posts not less than 3 mm (0.125 inch) wall thickness for exterior railings.

3. Punch intermediate rails and bottom of top rails for passage of posts and machine to a close fit.
4. Where shown use extruded channel sections for top rail with 13 mm (1/2 inch) thick top cover plates and closed ends.
5. Fabricate brackets of extruded or wrought aluminum as shown.
6. Fabricate stainless pipe sleeves with closed bottom at least six inches deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of posts where set in concrete.

F. Stainless Steel Railings:

1. Fabricate from 38 mm (1-1/2 inches) outside diameter stainless steel tubing, ASTM A269, having a wall thickness of 1.6 mm (0.065 inch).
2. Join sections by an internal connector to form hairline joints where field assembled.
3. Fabricate with continuous welded connections.
4. Fabricate brackets of stainless steel to design shown.
5. Fabricate stainless steel sleeves at least 150 mm (6 inches) deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of post.

2.16 CATWALKS

- A. Fabricate catwalks including platforms, railings, ladders, supports and hangers, and arrangement of members as shown on drawings.
- B. Fabricate stairs as specified in Section 05 51 00, METAL STAIRS.
- C. Fabricate steel ladders as specified under paragraph LADDERS unless shown otherwise.
- D. Fabricate steel pipe railings as specified under paragraph RAILINGS.
- E. Catwalk and 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 catwalk system.

2.17 TRAP DOOR AND FRAMES WITH CEILING HATCH

- A. Design to support a live load as specified.
- B. Frames:
 1. Fabricate steel angle frame to set in concrete slabs and design to set flush with finished concrete slab or curb. If not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles.
 2. Miter steel angles at corners and weld together.
 3. Weld steel bar stops to vertical leg of frame, to support doors flush with the top of the frame.

4. Weld steel strap anchors on each side not over 600 mm (24 inches) on center to the backs of the frames. If not shown use 6 x 50 x 200 mm (1/4 x 2 x 8 inch) long straps with 50 mm (2 inch bent) ends.
5. Form frames from steel angles with welded corners for reinforcing and bracing of well lining and support of ceiling hatch.

C. Covers:

1. Use 6 mm (1/4 inch) thick steel floor plate.
2. Where double leaf covers are shown, reinforce at meeting edges.
3. Use wrought steel hinges with fixed brass pins.
 - a. Weld to cover.
 - b. Secure to frame with machine screws.
4. Where ladders occur, install hinges on the side opposite the ladder.
5. Provide two bar type drop handles, flush with cover when closed for each leaf.

D. Well Lining:

1. Fabricate well linings, for access through concrete floor slabs and suspended ceilings, from hatch to ceiling hatch or ceiling openings.
2. Use steel sheet and shapes of size and thickness as shown. If not shown use 1.5 mm (0.0598 inch) thick steel sheet.
3. If not shown use 50 x 50 x 6 mm (2 x 2 x 1/4 inch) angle braces from ceiling level on each side angled at 45 degrees to structure above.
4. Use 25 x 25 x 3 mm (1 x 1 x 1/8 inch) angle bottom flange trim welded to well lining where no ceiling hatch occurs.

E. Ceiling Hatch:

1. Construct hatch with "T" or angle frame designed to support edge of ceiling and hatch, weld to well lining.
2. Form hatch panels of 3 mm (1/8 inch) steel, 5 mm (3/16 inch) aluminum or 1 mm (0.0359 inch) thick steel of pan type construction with 25 mm (one inch) of mineral fiber insulation between.
3. Use counter balance device, hinges, latch, hangers and other accessories required for installation and operation of hatch with not over 90 N (20 pounds) of force.
4. Fabricate panels flush and reinforced to remain flat.
5. Locate hatch panel flush with frame.

F. Finish with baked on prime coat.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 - 1. Provide temporary bracing for such items until concrete or masonry is set.
 - 2. Place in accordance with setting drawings and instructions.
 - 3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
 - 1. Design and finish as specified for shop welding.
 - 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

- A. Anchorage to structure.
 - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
 - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
 - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
 - 4. Secure steel plate or hat channels to studs as detailed.
- B. 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. Support at Ceiling for X-ray Tube Stand and Radiographic Equipment:
1. Bolt modular steel channel frames to hangers as shown, anchored to structure above.
 2. Fasten frames with modular channel manufacturers fittings, bolts, and nuts. Space modular channel supports and hangers as shown and as required to suit equipment furnished.
 3. Install closure plates in channels at ceiling where channel opening is visible. Coordinate and cut plates to fit tight against equipment anchors after equipment anchors are installed.
- E. Ceiling Support for Operating Light:
1. Anchor support to structure above as shown.
 2. Set leveling plate as shown level with ceiling.
 3. Secure operating light to leveling plate in accordance with light manufacturer's requirements.
- F. Supports for intravenous (IV) Track and Cubicle Curtain Track:
1. Install assembly where shown after ceiling suspension grid is installed.
 2. Drill angle for bolt and weld nut to angle prior to installation of tile.
- G. Support for cantilever grab bars:
1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
 2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.

3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

H. 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.

I. Support for Communion Rail Posts:

1. Anchor steel plate supports for posts as shown.
2. Use four bolts per plate, locate two at top and two at bottom.
3. Use lag bolts.

3.3 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.

3.4 FRAMES FOR LEAD LINED DOORS

- A. Secure jamb angle clips and plates, at top and bottom with two, 9 mm (3/8 inch) expansion bolts to concrete.
- B. Secure 150 x 90 x 13 mm (6 x 3-1/2 x 1/2 inch) angle to steel framing for anchorage when expansion bolts to concrete is not possible.
- C. Secure clips by welding to steel.
- D. At interstitial spaces, anchor jamb angles as shown.

3.5 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.

3.6 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.

- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

3.7 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 16 mm (5/8 inch) diameter by 75 mm (3 inch) long expansion bolts 450 mm (18 inches) on center.
 - 5. Install Guard Angles at Edges of Trench, Stairwell, 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 50 mm (2 inches) into pavement.
 - 2. Anchor to walls as shown, expansion bolt if not shown.

3.8 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.

3.9 STEEL LINTELS

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.10 SHELF ANGLES

- A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.
- B. Provide expansion space at end of members.

3.11 PLATE DOOR SILL

- A. Install after roofing base flashing and counter flashing work is completed.
- B. Set in sealant and bolt to curb.

3.12 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 100 mm (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.

3.13 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 150 mm (6 inches) from wall.
 - 3. Space rungs approximately 300 mm (12 inches) on centers.
 - 4. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

3.14 RAILINGS

- A. Steel Posts:
 - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.

2. Install sleeves in concrete formwork.
 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
 4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
 5. Secure sliding flanged fittings to posts at base with set screws.
 6. Secure fixed flanged fittings to concrete with expansion bolts.
 7. Secure posts to steel with welds.
- B. Aluminum Railing, Stainless Steel Railing, and Ornamental Railing Posts:
1. Install pipe sleeves in concrete formwork.
 2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
 3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.
- C. Anchor to Walls:
1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
 - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
 - b. Anchor steel plate to hollow masonry with toggle bolts.
 2. Anchor flanged fitting with toggle bolt to steel support in frame walls.
- D. Removable Rails:
1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
 2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.
- E. Gates:
1. Hang gate to swing as shown.
 2. Bolt gate hinges to jamb post with clamp on or through bolts.
- F. Chains:
1. Eye bolt chains to pipe posts.
 2. Eye bolt anchoring at walls.
 - a. Expansion bolt to concrete or solid masonry.

- b. Toggle bolt to hollow masonry of frame wall installed support.
- G. Handrails:
 - 1. Anchor brackets for metal handrails as detailed.
 - 2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
 - 3. Expansion bolt to concrete or solid masonry.
 - 4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.15 CATWALK AND PLATFORMS

- A. Expansion bolt members to concrete unless shown otherwise.
- B. Bolt or weld structural components together including ladders and stairs to support system.
- C. Weld railings to structural framing.
- D. Bolt or weld walk surface to structural framing.
- E. Smooth field welds and spot prime damaged prime paint surface.
- F. Fasten removable members with stainless steel fasteners.

.3.16 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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**SECTION 05 51 00
METAL STAIRS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies steel stairs with railings.
- B. Types:
 - 1. Closed riser stairs with concrete filled treads and platforms.
 - 2. Industrial stairs: Closed and open riser stairs.

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 APPLICATION PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-08.....Structural Steel
 - A47-99 (R2009).....Ferritic Malleable Iron Castings
 - A48-03(R2008).....Gray Iron Castings
 - A53-10.....Pipe, Steel, Black and Hot-Dipped Zinc-Coated
Welded and Seamless
 - A307-10.....Carbon Steel Bolts and Studs, 60000 psi Tensile
Strength
 - A653/653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc
Alloy Coated (Galvannealed) by the Hot-Dip
Process
 - A563-07.....Carbon and Alloy Steel Nuts
 - A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural,
High-Strength, Low-Alloy
 - A786/A786M-09.....Rolled Steel Floor Plates

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

Metal Bar Gratings (ANSI/NAAMM MBG 531-09)

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

E. American Iron and Steel Institute (AISI):

2001.....Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. Design stairs to support a live load of 500 kg/m² (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 Grating treads in accordance with NAAMM Metal Bar Grating Manual.
- D. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

- A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.
- B. Steel Grating: Metal bar type grating NAAMM BG.
- C. Sheet Steel: ASTM A1008.
- D. Structural Steel: ASTM A36.
- E. Steel Floor Plate: ASTM 786.
- F. Steel Decking: Form from zinc coated steel conforming to ASTM A446, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.
- G. Steel Plate: ASTM A1011.
- H. Iron Castings: ASTM A48, Class 30.
- I. 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 RISER STAIRS

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

B. Fabricate pans for treads and platforms, and risers from sheet steel // Fabricate pans for platforms from steel decking where shown //.

C. Form risers with sanitary cove.

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

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

2.6 INDUSTRIAL STAIRS

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

B. Treads and platforms of checkered steel floor plate:

1. Turn floor plate down to form nosing on treads and edge of platform at head of stairs.
 2. Support tread and platforms with angles welded to plate.
 3. Do not leave exposed fasteners on top of treads or platform surfaces.
 4. Provide flat sheet steel risers for stairs with steel plate treads where shown.
- C. Treads and platforms of steel grating:
1. Fabricate steel grating treads and platforms in accordance with requirements of NAAMM Metal Bar Grating Manuals.
 2. Provide end banding bars, except where carrier angle are used at tread ends.
 3. Support treads by use of carrier plates or carrier angle. Use carrier plate end banding bars on exterior stairs.
 4. Provide abrasive nosing on treads and edge of platforms at head of stairs.
 5. Provide toe plates on platforms where shown.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

- A. Provide hangers and struts required to support the loads imposed.
- B. Perform job site welding and bolting as specified for shop fabrication.
- C. Set stairs and other members in position and secure to structure as shown.
- D. Install stairs plumb, level and true to line.
- E. Provide steel closure plate to fill 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 3 mm in 3650 mm (1/8-inch in 12 feet).
- D. Set posts plumb and aligned to within 3 mm in 3650 mm (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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