SECTION 05 50 00 – MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements including but not limited to:

1. Steel framing and supports for:
    a. Countertops, factory primed and concealed from view. Paint where exposed to view in the finished work.
    b. Paneled metal ceilings, factory primed and concealed from view. Paint where exposed to view in the finished work.
    c. Linear metal ceilings, factory primed and concealed from view. Paint where exposed to view in the finished work.
    d. Mechanical, electrical, and plumbing equipment and component hangers and supports, factory primed and concealed from view. Paint where exposed to view in the finished work.
    e. Applications where framing and supports not specified elsewhere, factory primed and concealed from view. Paint where exposed to view in the finished work.
    f. Miscellaneous metal framing and supports, factory primed and concealed from view. Paint where exposed to view in the finished work.
    g. Ceiling hung artwork, factory primed and concealed from view. Paint where exposed to view in the finished work.
    h. Suspended interior wayfinding signage. Paint where exposed to view in the finished work.
2. Steel tube reinforcement for low partitions.
3. Slotted channel support grid.
4. Anchor bolts, steel pipe sleeves, slotted channel inserts, and wedge type inserts indicated to be cast into concrete or built into unit masonry.
5. Steel weld plates and angles for casting into concrete for applications.
6. Alternative hanger system for supporting suspended ceilings from metal deck flutes.
7. Steel VDGS pole, painted.
8. High mast lighting, hot dip galvanized.
9. Overhead door supports, finish as indicated on drawings. Paint where exposed to view in the finished work.
10. Baggage handling systems support and anchoring systems, material and finish as indicated on drawings.
11. Elevator guiderails and hoist beams, material and finish as indicated on drawings.
12. Metal ladders.
13. Metal ships' ladders.
14. Metal Grating Stairs.
15. Steel landing platforms.
16. Gratings.
17. Roof mounted equipment connections and curbs, material, and finish as indicated on drawings.

B. Related Work:
1. Division 05 Section “Decorative Formed Metal”.
2. Division 07 Section “Roof Accessories”.
3. Division 08 Section “Overhead Coiling Doors”.
4. Division 08 Section “Overhead Rapid Coiling Doors”.
5. Division 09 Section “Gypsum Board Assemblies”.
6. Division 09 Section “Painting” for field painting of metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: Submit technical data for each miscellaneous metal fabrications, paint, coatings, and grout accessories indicated.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
b. Bio-based Materials: For bio-based products and materials other than wood, submit documentation of product data and testing results in compliance with LEED requirements.
c. Wood Products: Submit documentation of FSC or equivalent certification.
d. Materials Reuse: For products that are salvaged, refurbished, or reused, include a statement indicating costs for each product.

e. Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

1) Include statement indicating costs for each product having recycled content.

f. Regional Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010 or v1.2 2017, using the applicable exposure scenario.

a. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 1113-2011.

3. Adhesives and Sealants: For wet applied on-site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of January 7, 2005.

C. Shop Drawings: Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.
2. Steel framing and supports for ceiling hung toilet compartments.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Metal ladders.
8. Metal ships' ladders.
9. Metal Grating Stairs, Pipe Supports, and Platforms.

D. Fabrication Engineering and Design Data Submittal: Submit for products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Slotted Channel Support Grid: Provide support grid capable of withstanding imposed gravity loads and resisting seismic loads.
2. Metal Ships Ladder.
3. Metal stairs, pipe supports, and platforms.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates and Reports:

1. Welding certificates.
2. Mill certificates.
3. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
4. Research/Evaluation Reports: ICC-ES reports for post installed anchors.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000pm) with at least one of the following:
   1) Submit published manufacturer inventory of ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   2) Submit documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
   3) Submit Declare product label indicating that all ingredients have been disclosed down to 1000 ppm or designated as Red List Free or Declared
   4) Living Product Challenge
   5) Product Lens Certification
   6) USGBC approved program.

1.4 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: A firm having minimum 5 years documented experience in producing metal fabrications similar to those indicated.

B. Professional Engineer Qualifications: A professional engineer legally qualified to practice in jurisdiction is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated in material, design, and extent.

C. Gratings Manufacturer: A manufacturer specializing in the fabrication of the type of units required who has tested the units for load-bearing strength and deflection, and has currently published load tables based on recognized test procedures.

D. Regulatory Requirements:

1. Comply with requirements of regulatory agencies having jurisdiction and the local Building Code as they pertain to metal fabrications.
2. Welding: Qualify procedures and personnel according to the following:
    a. AWS D1.1/D1.1M Structural Welding Code - Steel.
    b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified, unless welders fail to perform acceptable welding, as determined by the Independent Special Inspection Agency (IIA). Certification and re-certification of welding personnel is subject to verification by the Testing Agency. Re-testing for re- certification will be the Contractor's responsibility

E. Reference Standards: Comply with requirements of the following referenced standards, except as modified by local codes:

1. National Association of Architectural Metal Manufacturers
    a. ANSI/NAAMM MBG 532 "Heavy Duty Metal Bar Grating Manual."
    b. ANSI/NAAMM-MBG-531 "Metal Bar Grating Manual".
    c. NAAMM "Pipe Railing Manual".
    d. NAAMM "Metal Stairs Manual".
2. Steel Structures Painting Council (SSPC): SSPC "Steel Structures Painting Manual, Volume 2, Systems and Specifications".
3. Industrial Fasteners Institute (IFC): "Fastener Standards Book".

1.5 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.6 FIELD CONDITIONS

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

1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 STORAGE, DELIVERY AND HANDLING

A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent type of damage to the fabricated work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design Data: Engage a qualified professional engineer, as defined in Section 01 33 16, “Fabrication Engineering Design Data,” to design Metal Fabrication Assemblies indicated in this section to comply with requirements.

B. Seismic Performance: Metal fabrication assemblies shall withstand the effects of earthquake motions at determined according to ASCE/SEI 7.

C. Fixed Steel Ladders, Ships Ladders and Grating Stairs: Design and construct to support at least two dead loads of 300 lbs. concentrated between any two consecutive attachments, plus anticipated loads caused by ice buildup, winds, rigging, and impact loads resulting from use of ladder safety devices.

1. Each step or rung shall be capable of supporting a single concentrated load of 300 lbs. applied in the middle of the step or sung, without deformation.
2. Provide steel landing platforms designed to support a live load of 100 psf. and a concentrated load of 300 lbf.
3. Where side rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall resist a single concentrated load of 100 lbs.
4. Limit deflection of stair treads, platforms, and framing members to L/360.
5. Out of plane deflection limit for ladder under service loads to be L/240 or 1/2" maximum of lateral movement.

D. Railings, Guardrails and Supports: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
    a. Uniform load of 50 plf applied in any direction at the top and to transfer load through supports to structure.
    b. Concentrated load of 200 lbf applied in any direction at any point and have supporting structure to transfer this loading to appropriate structural elements of the building.
    c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
    a. Intermediate rails, balusters and panel fillers shall withstand a horizontally applied load of load of 50 lbf on an area of 1 sq. ft., and a concentrated upward load of 50 pounds applied at the most critical location.
    b. Infill load and other loads need not be assumed to act concurrently.
3. When railings, balusters and components are subject to wind loads in excess of 50 lbs, design for anticipated wind load complying with ASCE 7-10 and Division 08 Section "Exterior Enclosure System Requirements".

E. Gratings:

1. Catwalks, Walkways, Elevated Platforms with Light Duty Gratings: Unless otherwise shown, design gratings for a uniform load of 60 psf and a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress. Limit deflection to L/360 or 1/4 in., whichever is less.

F. Structural Performance of Countertops and Vanities:

1. Countertops and Vanities: Provide countertop and vanity framing capable of withstanding the structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:

    a. All deadloads.
    b. 500-pound live load placed on the countertop and vanity.
    c. Deflection at Midspan: L/1000 times span or 1/8 inch whichever is less.

G. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

H. Slip Resistance for Walking Surfaces: top surface to provide minimum wet dynamic coefficient of Friction (DCOF) of 0.42 for interior, and 0.5 for exterior in accordance with ANSI A326.3.

I. ADA Compliant Grating Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

1. Per ADA section 302.1, walking surfaces shall have a slip-resistant surface with sufficient frictional counterforce to the forces exerted in walking to permit safe ambulation.

2.2 MATERIALS

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

B. Ferrous Metal:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Stainless Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
3. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.
4. Rolled Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
5. Rolled Stainless Steel Floor Plate: ASTM A 793.
6. Steel Tubing: ASTM A 500/A 500M, cold formed steel tubing.
7. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
8. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4.

    a. Size of Channels: 1-5/8 inches by 1-5/8 inches (41 mm by 41 mm), minimum.
    b. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230); 0.079 inch (2 mm)], minimum nominal thickness.
    c. Material: Cold rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230); 0.0677 inch (1.7 mm) minimum thickness.
    d. Cold Formed Metal Channels: Flange edges returned toward web and with 9/16-inch (14.3 mm) wide slotted holes in webs at 2 inches (51 mm) o.c.
    e. Width of Channels: 1-5/8 inches (41 mm).
    f. Depth of Channels: Indicated on Drawings.

g. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108 inch (2.8mm) nominal thickness.
h. Finish: Hot dip galvanized after fabrication.

9. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

C. Fasteners: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum.
2. Provide stainless steel fasteners for fastening stainless steel.
3. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
4. Stainless Steel Bolts and Nuts: Regular hexagon head annealed stainless steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy **Group 1 (A1)**.
5. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
   a. Hot dip galvanized or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
6. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
7. Cast in Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F 2329.
8. Post Installed Anchors: Torque controlled expansion anchors or chemical anchors.
   a. Material for Interior Locations: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
9. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4. Provide with temporary filler and tee head bolts, complete with washers and nuts, all zinc plated to comply with ASTM B 633, Class Fe/Zn 5, necessary for fastening to inserts
   a. Size of Channels: 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c.
   b. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; [0.108 inch (2.8 mm)] [0.079 inch (2 mm)] [0.064 inch (1.6 mm)] nominal thickness.
   c. Material: Cold rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230) minimum thickness; hot dip galvanized after fabrication.

D. Miscellaneous Materials:

1. Shop Primer for Ferrous Metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.

    a. Product: Provide Series 10-99 (red) or 10-09 (gray) by Tnemec Company.

2. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
3. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

    a. Product: Provide Series 90-97 Tneme-Zinc by Tnemec Company.

4. Bituminous Paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D 1187 ASTM D 1187/D 1187M.
5. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete Materials and Properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8-inch (3 mm) with at least 95 % passing a 3/8-inch (9 mm) sieve and not more than 10% passing a No. 8 sieve. Proportion fill to provide a minimum 28-day compressive strength of 3000 psi (20 MPa).

F. Low-Emitting Materials:

1. Architectural paints and coatings wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
2. All paints and coatings wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01, Section 01 81 13 "Sustainable Design Requirements - LEED v4 BD+C."
3. Adhesives and Sealants wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
4. All adhesives and sealants wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01, Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C."

2.3 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Form exposed work with accurate angles and surfaces and straight edges.
4. Weld corners and seams continuously to comply with the following:

    a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    b. Obtain fusion without undercut or overlap.
    c. Remove welding flux immediately.

d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
6. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
8. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
9. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with minimum 6-inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.4 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports necessary to complete the work and which are not a part of the structural framework, including but not limited to framing and supports for rooftop mechanical piping, elevator hoistway beams, elevator sills, overhead lobby door frames, countertop and vanities, ceiling hung toilet compartments, and tube framing for partial height walls, CMU partition head supports, mechanical and electrical equipment.

1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

a. Fabricate units from slotted channel framing where indicated.
b. Furnish inserts for units installed after concrete is placed.

B. Countertop and Vanity Framing: Custom fabricate countertop and vanity framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thickness, sizes and shapes shown, and necessary to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.

C. CMU Partition Head Supports: Fabricate supports from 4-inch x 4 inch x 1/4 inch x 36 inch (100 mm by 100 mm by 6 mm by 900 mm) long structural steel angles. Drill supports a maximum of 12 inches (300 mm) o.c. to receive expansion bolts.

1. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.

2.5 METAL ANGLES AND PLATES

A. Shelf Angles: Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.

2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
3. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

    a. Galvanize shelf angles located in exterior walls.
    b. Prime shelf angles located in exterior walls with zinc rich primer.
    c. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast in place concrete.

B. Loose Bearing and Leveling Plate: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

1. Finish: Galvanize plates.

C. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

1. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
2. Finish: Galvanize and prime loose steel lintels located in exterior walls.

D. Steel Weld Plates and Angles: Provide steel weld plates and angles not specified for items supported from concrete construction as necessary to complete the work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.6 METAL LADDERS

A. General:

1. Comply with local Building Code, ANSI A14.3 and OSHA 29 CFR 1910.28, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders: Standing off the building surface a minimum of 7 inches (perpendicular clearance).

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Harsco Industrial IKG, a division of Harsco Corporation; Mebac.
        2) ROSS TECHNOLOGY CORP.; Algrip Slip-Resistant Ladder Rungs - Carbon Steel.
        3) W.S. Molnar Company; SlipNOT Ladder Rungs.

7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.

8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanize and prime ladders, including brackets.
10. Prime ladders, including brackets and fasteners, with zinc-rich primer.
11. with welded or bolted aluminum brackets.
12. Provide minimum 72-inch- high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.7 METAL SHIPS' LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Treads: Not less than 5 inches exclusive of nosing or less than 8-1/2 inches. including the nosing. Riser height: Not more than 9-1/2 inches.
2. Fabricate ships' ladders, including railings from steel.
3. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch in least dimension.
4. Fabricate treads and platforms from rolled-steel floor or abrasive-surface floor plate.
5. Comply with applicable railing requirements in Division 05 Section "Pipe and Tube Railings."

2.8 GRATINGS

A. General: Provide galvanized steel gratings or aluminum gratings where indicated, including supplementary framing and supports. Verify depth of existing shelf supports at ADA compliant sidewalk gratings, and modify grating selection as required to fit depth of support, ADA compliant spacing, and loading criteria specified in "Performance Criteria" article.

B. Provide gratings of pressure lock type construction, rectangular pattern, with plain surface top bars in the same plane; accurately fabricated free from warps, twists or other defects affecting their serviceability or appearance.

C. Provide removable grating sections where shown, with end-banding bars for each panel and each opening, saddle clip anchors designed to fit over bearing-bars, and stud bolts with washers and nuts, unless otherwise shown.

D. Provide cutouts in grating sections for penetrations indicated. Edge band openings in grating that interrupt 4 or more bearing bars with bars of same size and material as bearing bars.

E. Catwalk and Other Light Duty Gratings (**MG02**); Provide the following welded steel gratings:

1. Grating Frame: Provide hot dipped galvanized steel frame in locations as shown, consisting of 2-inch x 2-inch x 1/4-inch-thick steel angle continuously welded to a 1 inch x 1/2 inch steel bar with anchors welded to backs of angles at 2 ft. centers with a minimum of eight (8) anchors per unit.
2. Grating: "11-W-4" (Ohio Gratings); 1 inch x 3/16-inch bars spaced 11/16 inch on center with 3/8-inch diameter cross bars spaced 4 inches on center for grilles, held down with recessed lock down anchors to grating frame embedded in concrete surround. Entire assembly shall withstand performance loads specified in Performance Criteria.

F. Catwalks and Adjacent Framing: Provide catwalks and adjacent framing, complete with gratings, toe guards, railings, steel framing, bracing and support members. Comply with requirements specified for railings in Division 05 Section "Steel and Pipe Railings".

2.9 METAL GRATING STAIRS

A. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

B. Provide metal grating stairs at mechanical areas, consisting of galvanized steel stringers, supporting brackets, toe guards, carrying angles, treads, platforms and railings. Comply with requirements specified hereinafter for railings in Division 05 Section "Steel and Pipe Railings". Provide bracing of steel framing as required to sustain torsional loads applied by hanging stairs from the framing.

C. Provide steel galvanized steel landing platforms complete with gratings, toe guards, guard rails, galvanized structural steel framing and support members. Comply with the requirements specified for railings

D. Steel treads: Light duty welded plain surfaced steel with a abrasive coated steel nosing. Provide one of the following:

1. "Welded Tread with Mebac Nosing" (IKG Industries).
2. "Light Duty Welded W Series" (Ohio Gratings Inc.)
3. "Standard Tread" (SeidelHuber Metal Products, Inc.).

2.10 MISCELLANEOUS STEEL TRIM

A. Steel Trim: Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

    a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c.

2. Cast in Pit Angles and Edge Angles: Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded on stud anchors spaced 24 inches (600 mm) on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.
3. Galvanize miscellaneous steel trim.

2.11 ALTERNATIVE HANGER SYSTEM FOR SUPPORTING SUSPENDED CEILINGS FROM METAL DECK FLUTES

A. Provide engineered suspension system to support suspended ceiling hangers from steel deck flutes which meets the following minimum requirements:

1. Strap Supports:

    a. Flat galvanized steel strap support 1/8-inch x 1 inch in size with pre-drilled to accommodate four (4) #10 Hex Head screws 5/16-inch ex Head x 1 inch length, two (2) screws for each side of strap.
    b. Bend match profile of steel decking flute for direct and intimate securement.
    c. Attach eye couplers, hex nuts, hex bolts, eye couplers, and washers.

2. Eye Couplers:

    a. Pre-galvanized carbon steel couplers, 2-1/4-inch-wide x 1-1/8 inch wide for holding 3/8-inch diameter hanger rods with a safety factor of 3.5.

b. FM labelled and third party engineered, tested, and listed for a 250 lb load.
c. Product: #0025837 5.6 Eye Couplers by Hilti.

3. Hex Head Bolts:

a. Carbon steel hex head bolts with 3/8 inch diameter x 1-1/4 inch long fabricated to ASME/ANSI B18.2 dimension standards.
b. Zinc electroplated to ASTM B633, with tread complying with SC-1 Type 1, with Class 2A fit, Class 2B thread ASME B1.1.
c. Product: #0411764 Hex Head Bolts by Hilti.

4. Hex Nuts:

a. Carbon steel hex nuts 11-16 inch width across flats, fabricated to ASME/ANSI B18.2 dimension standards.
b. Zinc electroplated to ASTM B633, with tread complying with SC-1 Type 1, with Class 2A fit, Class 2B thread ASME B1.1.
c. Product: #0411752 Hex Nut Heavy 3/8 inch by Hilti.

5. Washers:

a. Carbon steel washers with 0.438 inch inside diameter and 0.083 outside diamer, fabricated to meet ASME/ANSI B18.22.1 Type A dimensions.
b. Zinc electroplated to ASTM B633, with tread complying with SC-1 Type 1.
c. Product: #0411757 Washers 3/8 inch by Hilti.

6. Hex Head Screws:

a. Self-drilling galvanized carbon steel #10 hex head scres, 0.190 inch diameter, 1 inch long designed to drille their own hole in steel base materials up to ½ inch thick and fabricated to meet ASTM C1513, ASTM C954, and SAE J78 standards.
b. Product: #0411752 Hex Nut Heavy 3/8 inch by Hilti.

2.12 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).

D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).

E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.13 FINISH

A. Finish metal fabrications after assembly. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

B. Steel and Iron Finishes:

1. Galvanizing: Hot dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

2. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

3. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
4. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning:
    a. Exterior Items: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
    b. Items Indicated to Receive Zinc Rich Primer: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
    c. Items Indicated to receive primers specified for high performance Coatings: SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning.
    d. Other Items: SSPC-SP 3"Power Tool Cleaning.
5. Shop Priming: Apply shop primer to comply with SSPC-PA 1 Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel for shop painting.
6. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

3.3 PREPARATION

A. Substrate Acceptability: Commencement of installation shall constitute acceptance of substrate conditions by the Installer

3.4 INSTALLATION GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

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

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

G. Framing and Supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

1. Anchor supports for ceiling hung toilet partitions securely to, and rigidly brace from, building structure.

    a. CMU Partition Head Supports: Unless otherwise indicated place partition head supports on alternate faces of CMU partitions every 6 feet o.c. and expansion bolt to underside of structure. Do not bolt to CMU partitions.

2. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

    a. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified.

3. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified.

    a. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

H. Leveling Plate: Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.

1. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING LADDERS

A. Vertical Ladders, Industrial Type Ladders Provide vertical ladders, industrial type ladders at all locations requiring access to equipment, catwalks or gratings.

B. Securing Vertical Ladders: Secure vertical ladders to masonry or concrete with a minimum of two 1/2 in. diameter expansion bolts at each bracket, unless additional attachments are required to sustain imposed loads. At walls with cold formed metal panels, provide metal plate backup and anchor vertical ladders to metal plate reinforcement.

3.6 INSTALLING GRATINGS

A. Gratings: Install grating in accordance with requirements of ANSI/NAAMM MBG 531 "Metal Bar Grating Manual" including installation clearances and standard anchoring details. Weld gratings to supporting steel, except for sections which are hinged or required to be removable. Secure removable units to supporting members with type and size of clips and fasteners as recommended by grating manufacturer for type of installation conditions shown. Do not notch bearing bars at supports to maintain elevation. Secure toe plates to gratings by welding.

3.7 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel-stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.8 INSTALLATION OF NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation

3.9 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch (6mm).

C. Maximum Out of Position: 1/4 inch (6mm).

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections for welds of railings and stairs:

1. Inspection Agency: Engage a qualified independent inspection and testing agency to perform shop and on-site tests and inspections according to requirements of the Texas Building Code Special Inspection requirements in sections 1704.3.

2. Inspect the structural steel fabrication, welding, bolting and erection as Work progresses, in accordance with, but not limited to the Texas Building Code Special Inspection requirements in sections 1704.3. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Architect/Engineer for final acceptance.

    a. Field inspection of steel shall include connections, levelness, plumbness and alignment of the stair and railing systems in conformance with AWS welding methods, examination of surface before welding, examination and testing of completed welds.
    b. Where testing is required for less than 100% of locations, select test locations at random and throughout the project.

3. If testing finds welds are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
4. Welds will be considered defective if they do not pass tests and inspections.

    a. Remove and replace welds that does not pass tests and inspections, and retest.
    b. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

5. Prepare test and inspection reports

3.11 REPAIRS AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 “Painting”.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION