
USACE / NAVFAC / AFCEC / NASA UFGS-05 50 13 (May 2010)

Preparing Activity: NAVFAC Superseding
UFGS-05 50 00 (August 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2015

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MISCELLANEOUS METAL FABRICATIONS 05/10

NOTE: This guide specification covers requirements
for miscellaneous metalwork.

Adhere to UFC 1-300-02 Unified Facilities Guide
Specifications (UFGS) Format Standard when editing
this guide specification or preparing new project
specification sections. Edit this guide
specification for project specific requirements by
adding, deleting, or revising text. For bracketed
items, choose applicable items(s) or insert
appropriate information.

Remove information and requirements not required in
respective project, whether or not brackets are
present.

Comments, suggestions and recommended changes for
this guide specification are welcome and should be
submitted as a Criteria Change Request (CCR).

NOTE: Units of work normally included in this
section should be metal items which require specific
fabrication to meet the desired project requirements.

The Key Word Index of the CSI "Masterformat" should
be consulted for the proper location of most items.
Loose items fabricated from structural shapes and
not directly attached to major structural steel
items may be included in this section, especially
when a structural steel section is not included.

NOTE: Show the following information on the
drawings:

1. Location and configuration of all metalwork.
2. All sizes and dimensions.

3. Special fastenings, attachments or anchoring.
4. Location and size of expansion anchors larger than 10 mm 3/8 inch in diameter.
5. Location of products to be galvanized.
6. Location and special details of expansion joint covers.
7. Connection details, other than manufacturer's standard, of grating.
8. Location and details of all structural steel door frames.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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

ALUMINUM ASSOCIATION (AA)

| | |
|----------|--|
| AA DAF45 | (2003; Reaffirmed 2009) Designation System for Aluminum Finishes |
|----------|--|

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

| | |
|----------|--|
| AISC 303 | (2010) Code of Standard Practice for Steel Buildings and Bridges |
|----------|--|

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum
Design Loads for Buildings and Other
Structures

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3 (2013) Operations - Safety Requirements
for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.2.2 (2010) Nuts for General Applications:
Machine Screw Nuts, Hex, Square, Hex
Flange, and Coupling Nuts (Inch Series)

ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth
Lock, and Plain Washers (Inch Series)

ASME B18.21.2M (1999; R 2014) Lock Washers (Metric Series)

ASME B18.22M (1981; R 2010) Metric Plain Washers

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws,
Square Head Set Screws, and Slotted
Headless Set Screws: Inch Series

ASME B18.6.3 (2013) Machine Screws, Tapping Screws, and
Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A283/A283M (2013) Standard Specification for Low and
Intermediate Tensile Strength Carbon Steel
Plates

ASTM A307 (2014) Standard Specification for Carbon
Steel Bolts and Studs, 60 000 PSI Tensile
Strength

ASTM A36/A36M (2014) Standard Specification for Carbon
Structural Steel

| | |
|-----------------|---|
| ASTM A467/A467M | (2007; R 2012) Standard Specification for Machine Coil Chain |
| ASTM A47/A47M | (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings |
| ASTM A475 | (2003; R 2014) Standard Specification for Zinc-Coated Steel Wire Strand |
| ASTM A48/A48M | (2003; R 2012) Standard Specification for Gray Iron Castings |
| ASTM A500/A500M | (2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A53/A53M | (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A653/A653M | (2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A780/A780M | (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM A786/A786M | (2005; R 2009) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates |
| ASTM A924/A924M | (2014) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process |
| ASTM B108/B108M | (2015) Standard Specification for Aluminum-Alloy Permanent Mold Castings |
| ASTM B209 | (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B209M | (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) |
| ASTM B221 | (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| ASTM B221M | (2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) |
| ASTM B26/B26M | (2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings |

| | |
|-------------------|--|
| ASTM C1513 | (2013) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections |
| ASTM D1187/D1187M | (1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal |
| ASTM D2047 | (2011) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine |
| ASTM E488/E488M | (2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements |
| ASTM F1267 | (2012) Metal, Expanded, Steel |

MASTER PAINTERS INSTITUTE (MPI)

| | |
|--------|--|
| MPI 79 | (Oct 2009) Alkyd Anti-Corrosive Metal Primer |
|--------|--|

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

| | |
|---------------|--|
| NAAMM MBG 531 | (2009) Metal Bar Grating Manual |
| NAAMM MBG 532 | (2009) Heavy Duty Metal Bar Grating Manual |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|--|
| NFPA 211 | (2013) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances |
|----------|--|

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

| | |
|---------------------|------------------------------------|
| SSPC SP 3 | (1982; E 2004) Power Tool Cleaning |
| SSPC SP 6/NACE No.3 | (2007) Commercial Blast Cleaning |

1.2 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G"

designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for information only.][for Contractor Quality Control approval.] When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication drawings of structural steel door frames; G[, [_____]]

Access doors and panels, installation drawings; G[, [_____]]

Cover plates and frames, installation drawings; G[, [_____]]

Expansion joint covers, installation drawings; G[, [_____]]

Floor gratings and roof walkways, installation drawings; G[, [_____]]

Wheel guards, installation drawings; G[, [_____]]

Window[and door] guards, installation drawings; G[, [_____]]

Embedded angles and plates, installation drawings; G[, [_____]]

Roof hatch; G[, [_____]]

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Access doors and panels
Cover plates and frames
Control-joint covers
Expansion joint covers
Floor gratings and roof walkways
Structural steel door frames
Wheel guards
Window[and door] guards
Roof hatch

SD-04 Samples

Expansion joint covers
Control-joint covers

Provide full size samples , taken from manufacturer's stock, and be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 QUALIFICATION OF WELDERS

NOTE: For jobs in Iceland, in lieu of AWS welders and inspectors, use "Technological Institute of Iceland" certified welders and inspectors.

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

NOTE: Product selections should be based on esthetic values, reliability and cost. Delete alternate requirements where they occur.

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.5 Gratings

- a. Gray cast iron ASTM A48/A48M, Class 40.
- b. Metal plank grating, non-slip requirement, aluminum ASTM B209M ASTM B209, 6061-T6; steel ASTM A653/A653M, Z275 G90.
- c. Metal bar type grating NAAMM MBG 531[NAAMM MBG 532].

**NOTE: Use NAAM MBG 531 for gratings for pedestrian
grates and use NAAM MBG 532 for vehicular grates not
specified elsewhere.**

2.1.6 Floor Plates, Patterned

Floor plate ASTM A786/A786M. Steel plate shall not be less than 1.9 mm 14 gage.

2.1.7 Anchor Bolts

ASTM A307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.7.1 [Expansion Anchors] [Sleeve Anchors] [Adhesive Anchors]

Provide [_____]mm [_____]in. diameter [expansion anchors][sleeve anchors][adhesive anchors]. Minimum [concrete][masonry] embedment shall be [_____]mm [_____]in. Design values listed shall be as tested according to ASTM E488/E488M.

- a. Minimum [ultimate][allowable] pullout value shall be [_____]kN [_____]lb.
- b. Minimum [ultimate][allowable] shear value shall be [_____]kN [_____]lb.

2.1.7.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

2.1.7.3 Toggle Bolts

ASME B18.2.1.

2.1.7.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 or ASTM A307.

2.1.7.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

2.1.7.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.1.7.7 Washers

Provide plain washers to conform to ASME B18.22M ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.2M ASME B18.21.1.

2.1.8 Aluminum Alloy Products

Conform to ASTM B209M ASTM B209 for sheet plate, ASTM B221M ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 3 mm 1/8 inch thick and aluminum plate or sheet at least 1.3 mm 0.050 inch thick.

2.2 FABRICATION FINISHES

NOTE: The Material Safety Data Sheets (MSDS) for coating materials shall show exclusion or replacement of the following materials as intended ingredients: asbestos, benzene, chromium compounds, coal tar, 2-ethoxyethanol and 2-methoxyethanol and their acetates, halogenated hydrocarbons, and lead compounds. The content of volatile organic compounds (VOC), and marking, shall be in compliance with air quality regulations for the type of application and jurisdiction where used.

2.2.1 Galvanizing

NOTE: Specify galvanizing for items installed in exterior exposures subject to salt spray or corrosive fumes and interior areas subject to continual wetting or high humidity.

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

NOTE: Delete this paragraph when no galvanized items are specified.

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

NOTE: Shop painting herein is for structural steel protected from the weather and not subjected to corrosive environments. For steel which will be exposed to the weather or corrosive environments, modify the shop painting accordingly.

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

NOTE: Use manufacturers standard treatment when painting and finishing is required.

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. [On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.03 mm 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.]

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with a [standard mill finish.] [hand sanded or machine finish to a 240 grit.] [anodized finish.] Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45. Provide a polished satin finish on items to be anodized.

2.3 ACCESS DOORS AND PANELS

NOTE: Access doors and panels in fire-rated walls and ceilings must be of equivalent fire ratings. Coordinate the location of access doors and panels with the mechanical drawings and specifications. Prime coat should be specified if it is desirable to have a field painted finish.

Provide flush type access doors and panels unless otherwise indicated. Fabricate frames for access doors of steel not lighter than 1.9 mm 14 gage with welded joints and anchorage for securing into construction. Provide access doors with a minimum of 350 by 500 mm 14 by 20 inches and of not lighter than 1.9 mm 14 gage steel, with stiffened edges and welded attachments. Provide access doors hinged to frame and with a flush-face, turn-screw-operated latch. [Provide exposed metal surface with a baked enamel finish.] [Provide exposed metal surfaces with a shop applied prime coat.]

NOTE: For BEQ projects which have terminal air blenders, add the bracketed item.

[Provide ceiling access panels for terminal air blenders as indicated. Provide pin-tumbler cylinder locks with appropriate cams in lieu of screwdriver-operated latches.]

2.4 CONTROL-JOINT COVERS

NOTE: Use control-joint covers only when necessary to meet specific job requirements such as elimination of cracks which would be difficult to clean.

Provide control-joint covers to be located on wall surfaces of concrete, masonry and tile work. Provide protective coating on the surface in contact with concrete, masonry or tile.

2.5 CORNER GUARDS AND SHIELDS

For jambs and sills of openings and edges of platforms provide steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with glazed or ceramic tile finish on walls with 1.6 mm 0.0625 inch thick corrosion-resisting steel with polished or satin finish, extend 1.5 m 5 feet above the top of cove base or to the top of the wainscot, whichever is less, and securely anchor to the supporting wall. Corner guards on exterior shall be [galvanized] [_____].

2.6 COVER PLATES AND FRAMES

NOTE: Insert required live load value in the blank space. Select requirements for floor plate removal method. Specific pattern should not be indicated unless required for matching purposes or to meet design requirements.

Fabricate cover plates of [6] [_____] mm [1/4] [_____] inch thick rolled steel weighing not more than 45 kg 100 pounds per plate with a [selected raised pattern nonslip top surface] [slip-resistant, carbon steel conforming to ASTM A283/A283M having a minimum static coefficient of friction of 0.50 when tested in accordance with ASTM D2047. On wearing surfaces provide aluminum oxide or silicon carbide.]. Plate shall be [galvanized] [shop painted]. Reinforce to sustain a live load of [_____] MPa [_____] pounds per square foot. Frames shall be structural steel shapes and plates, [with bent steel bars or headed anchors welded to frame for anchoring to concrete] [securely fastened to the structure as indicated]. Miter and weld all corners. Butt joint straight runs. Allow for expansion on straight runs over 4500 mm 15 feet. [Provide holes for lifting tools.] [Provide flush drop handles for removal formed from 6 mm 1/4 inch round stock where indicated.] [Provide holes and openings with 13 mm 1/2 inch clearance for pipes and equipment.] Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld all connections and grind top surface smooth. Weld bar stops every six inches. Provide 3 mm 1/8 inch clearance at edges and between cover plates.

2.7 EXPANSION JOINT COVERS

NOTE: Design floor expansion joint covers to support the required loads in the area and permit the calculated movement. Design floor expansion joint covers so that top of cover plate is flush with adjoining finished floor surfaces. Use plain-surface floor plate on interior finished floors and abrasive-surface floor plate on exposed concrete interior floors and exterior applications. Covers may be of steel if deemed adequate for serviceability, and the paragraph modified accordingly. Detail expansion joints on the drawings. The expansion joint must have the same

fire rating as the floor.

Provide expansion joint covers constructed of extruded aluminum with anodized satin aluminum finish for walls and ceilings and with standard mill finish for floor covers and exterior covers. Furnish plates, backup angles, expansion filler strip and anchors as indicated. [Provide a [____]-hour fire rating expansion joint system.]

2.8 EXTRUDED FLOOR MAT FRAMES

Provide recess frames for roll-up floor mats of extruded 6063-T5 aluminum, in sizes shown. Miter corners to ensure accurate fitting. Determine depth of recess by the mat thickness. Anchor frames in concrete with anchor pins or bolts. Provide roll-up mats of aluminum construction with [carpet] [vinyl] [serrated aluminum] [abrasive] surface. Provide roll-up mats for use in [level surface area.] [recessed area. Show construction details of recessed areas on the drawings.]

2.9 FLOOR GRATINGS AND ROOF WALKWAYS

NOTE: Insert required live load value in the blank space.

NOTE: Gratings for treads and landings should be considered for maintenance walkways, anti-skid platforms, maintenance and inspection walkways, mezzanine flooring, rooftop walkways, storage areas, catwalks and staging platforms. Grating tread type has openings thru the surface; consider footwear worn by personnel using these facilities. Select frame anchorage for the applicable installation. Where banding is required to be load bearing, drawings must detail the welding of banding to bearing bars. Walkways must be designed to allow roof movements and to resist wind forces and creep. At building expansion joints a bridge piece should be installed. Supports must be sized to distribute the walkway loads to the roof material. Where not specified elsewhere use NAAMM MBG 532 when grating supports vehicular traffic.

Design [steel] [aluminum] grating in accordance with NAAMM MBG 531[NAAMM MBG 532] for bar type grating or manufacturer's charts for plank grating. [Galvanize steel floor gratings.]

- a. Design floor gratings to support a stress live load of [____] MPa [____] pounds per square foot for the spans indicated, with maximum deflection of L/240.
- b. [NAAMM MBG 531[NAAMM MBG 532], band edges of grating with bars of the same size as the bearing bars. Weld banding in accordance with the manufacturer's standard for trim [unless otherwise indicated]. Design tops of bearing bars, cross or intermediate bars to be in the same plane and match grating finish.]

--or--

[NAAMM MBG 531[NAAMM MBG 532], band ends of gratings with bars of the same or greater thickness than the metal used for grating. Weld banding bars to the bearing bars or channels at least every fourth bar or channel and in every corner. Tack weld intervening bars or channels. Band diagonal or round cuts by welding bars of the same or greater thickness metal used for grating in accordance with the manufacturer's standard for trim [unless otherwise indicated].]

- c. [Attach gratings to structural members with welded-on anchors.] [Anchor gratings to structural members with bolts, toggle bolts, or expansion shields and bolts.] [Attach grating as per manufacturer's roof attachment system.]

NOTE: Use coefficient of friction minimum of 0.6
where used along an accessible route.

- d. Slip resistance requirements must exceed both wet and dry a static coefficient of friction of 0.5[0.6].

- [e. Rooftop walkway: Minimum 600 mm 2 feet wide, 1.8 mm 14 gage, ASTM A653/A653M, Z275 G-90, steel with slip resistant surface. Furnish all brackets, connectors and other accessories. Support at minimum 1500 mm 5 foot intervals on hard rubber pads in accordance with manufacturers instructions.]

2.10 GAS-TIGHT MANHOLE COVER AND FRAME

Provide a heavy duty type made of ductile cast-iron with bolted lid, machined bearing surfaces and gasket grooves, continuous neoprene gasket, counter sunk bronze hex head cap screws, and concealed watertight pickholes. Provide frame with a 760 mm 30 inch diameter clear opening. Maximum weight of frame and cover together to be 240 kg 530 pounds.

2.11 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide [_____] mm [_____] inch [galvanized] [prime coated] [standard] [extra strong] weight steel pipe as specified in ASTM A53/A53M. Anchor posts in concrete [as indicated] and fill solidly with concrete with minimum compressive strength of 17 MPa 2500 psi.

2.12 MISCELLANEOUS PLATES AND SHAPES

NOTE: Indicate construction details on the drawings
for clarification of the type and the arrangement of
miscellaneous metal.

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, [support framing for ceiling-mounted toilet partitions,] miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions [as indicated and] as required to support wall loads over openings. Provide with connections and [fasteners] [welds].

Construct to have at least 200 mm 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A36/A36M, for embedment as indicated.
Galvanize embedded items exposed to the elements according to
ASTM A123/A123M.

2.13 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, 5 mm 3/16 inch diameter, with at least twelve links per 300 mm foot, and with snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide snap hooks of boat type. Provide galvanized 10 mm 3/8 inch bolt with 20 mm 3/4 inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 100 mm 4 inches longer than the anchorage spacing, for each guarded area. Locate safety chain where indicated. Mount the top chain 1050 mm feet 6 inches[_____] above the [floor] [ground] and mount the lower chain 600 mm 2 feet [_____] above the [floor] [ground].

2.14 SECURITY GRILLES

Fabricate of channel frames with not less than two masonry anchors at each jamb and 12 mm 1/2 inch hardened steel bars spaced not over 100 mm 4 inches both ways and welded to frame. Provide 18 by 16 mesh screen and two layers of 6 mm 1/4 inch hardware cloth clamped to frame.

2.15 STEEL PLATE WAINSCOTS FOR CONCRETE OR MASONRY COLUMNS

Shop bend to radius for round columns and at right angles for square and rectangular columns with slight 6 mm 1/4 inch radius on corners, with no horizontal joints and not more than 2 vertical joints single strapped and butt welded with a thickness of [_____].

2.16 STRUCTURAL STEEL DOOR FRAMES

NOTE: Choose one of the two options below.

NOTE: Select the applicable paragraph(s) from the following:

- [a. Provide frames as indicated. If not otherwise shown, construct frames of structural shapes, or shape and plate composite, to form a full depth channel shape with at least 40 mm 1 1/2 inch outstanding legs. For single swing doors, provide continuous 16 by 40 mm 5/8 by 1 1/2 inch bar stock stops at head and jambs. For freight elevator hoistway entrance, include a non-skid metal sill [as indicated].]
- b. Where track, guides, hoods, hangers, operators, and other such accessories are required, provide support as indicated.
- c. Provide jamb anchors near top, bottom, and at not more than 600 mm 24 inch intervals. Provide the bottom of each jamb member with a clip angle welded in place with two 12 mm 1/2 inch diameter floor bolts for adjustment.

[d. Provide spreaders between bottoms of floor jamb members. When floor construction permits, they may be left in place, concealed in the floor.]

--or--

[Provide frames of rolled shapes as indicated. Miter and weld heads to jambs, or have riveted clip angle connections concealed in the finished work. Provide frames for swinging doors with 16 by 40 mm 5/8 by 1 1/2 inch solid bar stops secured to the frame by welding or by 6 mm 1/4 inch diameter countersunk machine screws spaced not more than 300 mm 12 inches on centers. Stiffen head openings greater than 900 mm 3 feet sufficient to limit deflection to not more than 2 mm 1/16 inch. Secure frames to masonry with zinc-coated metal anchors spaced not more than 750 mm 30 inches on centers. Where necessary to engage the threads of machine screws for fastening hardware, back frames on inside faces with steel plates of suitable thickness; tap frames and reinforcing plates as necessary for the installation of hardware and other work. Countersink rivets and screw heads where exposed in the finished work. Grind welds smooth.]

2.17 WHEEL GUARDS

Provide wheel guards of hollow, heavy-duty type cast iron conforming to ASTM A48/A48M, with shaped, [rounded][half round][three quarters round]top, at least 450 mm 18 inches high, and designed to provide a minimum of 150 mm 6 inches of protection.

2.18 WINDOW[AND DOOR] GUARDS, DIAMOND-MESH TYPE

NOTE: Select mesh size for woven wire. Include expanded metal option when 40 mm 1 1/2 inch mesh is specified. Delete remaining parenthetical portions. Specify proper portion for interior or exterior installation. Select the type of window guard which best suits job requirements.

Provide diamond-mesh window[and door] guards constructed of woven steel wire [or expanded metal]framed with hot-rolled or cold-formed structural steel shapes. Provide woven wire panels of 3.3 mm 10 gage, 40 mm 1 1/2 inch mesh secured through weaving bar to 25 by 12 by 3 mm one by 1/2 by 1/8 inch thick channel frame. Miter and weld corners of frames. [Provide expanded metal panels conforming to ASTM F1267.] 38 mm 1-1/2 inches, [Mount window[and door] guards on interior of window[and door] frame with not less than two tamperproof hinged butts mounted on wood jambs with 6 mm 1/4 inch lag bolts, to masonry jamb with toggle bolts, or welded to metal jambs.] [Mount window[and door] guards on exterior of window frame with not less than two tamperproof hinged butts mounted on 25 by 12 by 3 mm one by 1/2 by 1/8 inch jamb channel attached as indicated to 50 by 6 mm 2 by 1/4 inch plate anchored to wood jamb with 6 mm 1/4 inch lag bolts; to masonry jamb with toggle bolts, or to concrete jambs and solid masonry jambs with expansion shields and bolts.] Provide one additional butt for each 900 mm 3 foot internal length of guard over 1500 mm 5 feet. Provide one tamperproof hasp and padlock, with access from the interior, for each butt used and installed on the jamb opposite to that hinged. [Provide galvanized guards and accessories.]

2.19 WINDOW[AND DOOR] GUARDS, WOVEN WIRE

Provide woven wire window[and door] guards of size necessary to completely fill opening. Construct guards with 10 mm 3/8 inch round rod frame and 40 mm 1 1/2 inch diamond-mesh of No. 10 U.S. Gage (3.4 mm) (0.135 diameter) wire; all material zinc-coated. Provide at least three hinge side clips on one side and two lock ring hasps on opposite side.

2.20 CHIMNEYS, VENTS, AND SMOKESTACKS

Design and construct chimneys and vents in accordance with NFPA 211. Form chimney connectors of not lighter than 1.01 mm 20 gauge galvanized steel. Design and construct stacks to withstand a wind velocity of [_____] km/h mile/h in accordance with ASCE 7. Construct unlined stacks of black-steel plates not less than 5 mm 3/16 inch thick conforming to ASTM A36/A36M. Weld seams and joints, except provide an angle flange for connection to the boiler, other equipment, and stack support.

2.21 CLEANOUT DOORS

Provide [galvanized] [cast iron] cleanout doors with frames, and unless otherwise indicated sized to match flues. Provide a continuous flange and anchors for securing frames into masonry. The doors shall be smokeproof, hinged, and have fastening devices to hold the door closed.

2.22 COAL-HOPPER DOORS

Construct coal-hopper doors of [galvanized] [_____] steel plates and shapes and complete with frame, stops, wall box, hinges, and hasp or locktype latch. Weld joints and attachments.

2.23 DOWNSPOUT BOOTS

Provide cast iron downspout boots with receiving bells sized to fit downspouts.

2.24 FOUNDATION VENTS

Provide foundation vents of the same size as the masonry units or sized as indicated, and made of extruded aluminum with integral water stop and sliding interior closer or damper operable from the outside. Provide an insect screen at the back of the vent. Provide Louvered openings with top and bottom drip lips, and the net ventilating area with closer or damper open at least 35 percent of the gross wall opening. The frames shall have a structural strength adequate to permit use in masonry walls without a lintel.

2.25 GUY CABLES

Guy cables shall be prestretched, galvanized wire rope of the sizes indicated. Wire rope shall conform to ASTM A475, high strength grade with Class A coating. Guys shall have a factory attached clevis top-end fitting; a factory attached open-bridge strand socket bottom-end fitting; and be complete with oval eye, threaded anchor rods. Fittings and accessories shall be hot-dip galvanized.

2.26 WINDOW SUB-SILL

Provide window sub-sill of extruded aluminum alloy with size and design

indicated. Provide not less than two anchors per window section for securing into mortar joints of masonry sill course. Provide sills for banks of windows with standard mill finish with a protective coating, prior to shipment, of two coats of a clear, colorless, methacrylate lacquer applied to all surfaces of the sills.

2.27 WINDOW WELLS

Window wells shall be not lighter than 1.5 mm, 16 gauge, corrugated sheet steel, hot-dip galvanized after fabrication with top edge of walls having a 19 mm 3/4 inch bead or rolled top. Window wells shall be semicircular or semielliptical in form and shall overlap the window by at least 75 mm 3 inches on each side. Removable cover, hot-dip galvanized after fabrication, consisting of steel bar grate with bars spaced at not more than 50 mm 2 inch centers and welded to 25 by 6 mm 1 by 1/4 inch frame shall be designed to fit into and rest on top edge of window well.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.6 FINISHES

3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

3.6.2 Field Preparation

**NOTE: Delete these paragraphs when Section 09 90
00, PAINTS AND COATINGS is included in the project
specifications.**

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.6.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 15 degrees C 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.7 ACCESS PANELS

Install a removable access panel not less than 300 by 300 mm 12 by 12 inches directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.8 CONTROL-JOINT COVERS

Provide covers over control-joints and fasten on one side only with fasteners spaced to give positive contact with wall surfaces on both sides of joint throughout the entire length of cover.

3.9 COVER PLATES AND FRAMES

Install the tops of cover plates and frames flush with floor.

3.10 WHEEL GUARDS

Anchor guards to concrete or masonry in accordance with manufacturer's instructions. Fill hollow cores solid with concrete with minimum compressive strength of 17 MPa 2500 psi.

3.11 [ROOF HATCH (SCUTTLES)

Provide [aluminum] [zinc-coated steel sheets not less than 1.9 mm 14 gage,] with 75 mm 3 inch beaded flange, welded and ground at corner. Provide a minimum clear opening of 760 by 900 mm 30 by 36 inches. Construction and accessories as follows:

- a. Insulate cover and curb with 25 mm one inch thick rigid fiberboard insulation covered and protected by [aluminum sheet] [zinc-coated steel liner not less than 0.45 mm 26 gage] with 300 mm 12 inches high curb, formed with 75 mm 3 inch mounting flange with holes provided for securing to the roof deck. Equip the curb with an integral metal cap flashing of the same gage and metal as the curb, full welded and ground at corners for weather tightness.
- b. Provide hatch completely assembled with pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles on inside and outside, and neoprene draft seal. Provide fasteners for padlocking on the inside. Equip the cover with an automatic hold-open arm complete with grip handle to permit one-hand release. Cover action shall be smooth through its entire range with an operating pressure of approximately 130 N 30 pounds.

]

3.12 INSTALLATION OF CHIMNEYS, VENTS, AND SMOKESTACKS

Install chimneys and vents in accordance with NFPA 211. Provide a cleanout opening with a tight-fitting, hinged, cast-iron door and frame at the base of each smokestack. Provide a top band on stacks for attachment of painter's rigging. Provide roof housing, rain cap, downdraft diverter, fire damper, and other accessories required for a complete installation. Join sections of prefabricated lined stacks with acid-resisting high-temperature cement and steel draw bands. Provide means to prevent accumulation of water in the smokestack.

3.13 DOOR GUARD FRAME

Mount door guard frame over the glazed opening using 6 mm 1/4 inch lag bolts on the interior of wood doors or tamperproof through bolts on the interior of metal doors.

3.14 INSTALLATION OF GUARD POSTS (BOLLARDS/PIPE GUARDS)

**NOTE: Details of pipe guard installation will be
shown on the drawings.**

Set pipe guards vertically in concrete piers. Construct piers of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 21 MPa 3000 psi.

3.15 INSTALLATION OF DOWNSPOUT BOOTS

Secure downspouts to building through integral lips with appropriate fasteners.

3.16 RECESSED FLOOR FRAMES & MATS

Verify field measurements prior to releasing materials for fabrication by the manufacturer. Use a mat frame to ensure recess accuracy in size, shape and depth. Form drain pit by blocking out concrete when frames are installed, dampproof after concrete has set. Assemble frames onsite and install so that upper edge will be level with finished floor surface. Screeded the concrete base inside the mat recess frame area using the edge provided by the frame as a guide and anchor into the cement with anchor pins a minimum of 610 mm 24 inches on centers.

3.17 MOUNTING OF SAFETY CHAINS

Mount safety chains 1070 mm 3 feet 6 inches and 610 mm 2 feet above the floor.

3.18 STRUCTURAL STEEL DOOR FRAMES

Secure door frames to the floor slab by means of angle clips and expansion bolts. Weld continuous door stops to the frame or tap screwed with countersunk screws at no more than 450 mm 18 inchcenters, assuring in either case full contact with the frame. Make any necessary reinforcements and drill and tap the frames as required for hardware.

3.19 INSTALLATION OF WHEEL GUARDS

Fill wheel guards with concrete and anchor to the floor or the building according to the manufacturer's recommendations.

3.20 BAR-GRILLE WINDOW GUARDS

Securely anchor bar-grille window guards to masonry with 13 mm 1/2 inch diameter prison-type screws or bolts and expansion shields, or other type of fastenings if the ends of such fastenings are welded to the adjoining metal grilles or otherwise made tamperproof in a satisfactory manner. Spanner-head screws or bolts are not considered prison-type fasteners.

3.21 DIAMOND MESH WINDOW [AND DOOR]GUARDS

Mount diamond mesh window guards on [interior window frame with not less than two tamperproof hinged butts mounted on wood jambs.] [exterior of window frame with not less than two tamperproof hinged butts mounted on 25 by 300 by 3 mm 1 by 12 by 1/8 inch jamb channel attached as indicated to 50 by 6 mm 2 by 1/4 inch plate anchored to wood jamb with 6 mm 1/4 inch lag bolt, to masonry jamb with toggle bolts, or to concrete jambs and solid masonry jambs with expansion shields and bolts.] Provide one additional butt for each 900 mm 3 foot internal length of guard over 1500 mm 5 feet. Install hasp and padlock on the jamb opposite to that hinged.

3.22 INSTALLATION OF WINDOW WELLS

Place window wells as shown with the walls securely anchored to foundation surface. Excavate the area within the well to the bottom of the well and covered with a 100 mm 4 inch thick layer of coarse gravel or crushed rock.

-- End of Section --