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USACE / NAVFAC / AFCEC / NASA | **UFGS-05 50 13 (May 2017)**
Change 1 - 08/18

Preparing Activity: NAVFAC | **Superseding**
UFGS-05 50 13 (May 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2022
****

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

05/17, CHG 1: 08/18

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALIFICATION OF WELDERS
1.4 DELIVERY, STORAGE, AND PROTECTION
1.5 MISCELLANEOUS REQUIREMENTS
1.5.1 Fabrication Drawings
1.5.2 Installation Drawings

PART 2 PRODUCTS

2.1 RECYCLED CONTENT
2.2 MATERIALS
2.2.1 Structural Carbon Steel
2.2.2 Structural Tubing
2.2.3 Steel Pipe
2.2.4 Fittings for Steel Pipe
2.2.5 Gratings
2.2.6 Floor Plates, Patterned
2.2.7 Anchor Bolts
2.2.7.1 [Expansion Anchors] [Sleeve Anchors] [Adhesive Anchors]
2.2.7.2 Lag Screws and Bolts
2.2.7.3 Toggle Bolts
2.2.7.4 Bolts, Nuts, Studs and Rivets
2.2.7.5 Powder Actuated Fasteners
2.2.7.6 Screws
2.2.7.7 Washers
2.2.7.8 Welded Headed Shear Studs
2.2.8 Aluminum Alloy Products
2.3 FABRICATION FINISHES
2.3.1 Galvanizing
2.3.2 Galvanize
2.3.3 Repair of Zinc-Coated Surfaces

2.3.4 Shop Cleaning and Painting
2.3.4.1 Surface Preparation
2.3.4.2 Pretreatment, Priming and Painting
2.3.5 Nonferrous Metal Surfaces
2.3.6 Aluminum Surfaces
2.3.6.1 Surface Condition
2.3.6.2 Aluminum Finishes
2.4 CORNER GUARDS
2.5 COVER PLATES AND FRAMES
2.6 EXPANSION JOINT COVERS
2.7 FLOOR GRATINGS AND ROOF WALKWAYS
2.8 BOLLARDS/PIPE GUARDS
2.9 DOWNSPOUT TERMINATIONS
2.10 MISCELLANEOUS PLATES AND SHAPES
2.11 SAFETY CHAINS
2.12 SECURITY GRILLES
2.13 STEEL PLATE WAINSCOTS FOR CONCRETE OR MASONRY COLUMNS
2.14 STRUCTURAL STEEL DOOR FRAMES
2.15 WHEEL GUARDS
2.16 ROOF HATCHES (SCUTTLES)
2.17 WINDOW[AND DOOR] GUARDS, DIAMOND-MESH TYPE
2.18 WINDOW[AND DOOR] GUARDS
2.19 CHIMNEYS, VENTS, AND SMOKESTACKS
2.20 CLEANOUT DOORS
2.21 COAL HOPPER DOORS
2.22 GUY CABLES
2.23 WINDOW SUB-SILL
2.24 WINDOW WELLS

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS
3.2 WORKMANSHIP
3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS
3.4 BUILT-IN WORK
3.5 WELDING
3.6 DISSIMILAR METALS
3.7 PREPARATION
3.7.1 Material Coatings and Surfaces
3.7.2 Environmental Conditions
3.8 EXPANSION JOINT COVERS
3.9 COVER PLATES AND FRAMES
3.10 WHEEL GUARDS
3.11 ROOF HATCH (SCUTTLES)
3.12 INSTALLATION OF CHIMNEYS, VENTS, AND SMOKESTACKS
3.13 DOOR GUARD FRAME
3.14 INSTALLATION OF BOLLARDS/PIPE GUARDS
3.15 INSTALLATION OF DOWNSPOUT TERMINATIONS
3.16 MOUNTING OF SAFETY CHAINS
3.17 STRUCTURAL STEEL DOOR FRAMES
3.18 INSTALLATION OF WHEEL GUARDS
3.19 BAR-GRILLE WINDOW GUARDS
3.20 DIAMOND MESH WINDOW [AND DOOR]GUARDS
3.21 INSTALLATION OF WINDOW WELLS
3.22 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA	**UFGS-05 50 13 (May 2017)**
	Change 1 - 08/18

Preparing Activity: NAVFAC	**Superseding**
	UFGS-05 50 13 (May 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2022
****

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS
05/17, CHG 1: 08/18

****
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 item(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: This section includes metal items which require specific fabrication to meet the desired project requirements.

Consult the Key Word Index of the CSI "Masterformat" 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 Reference Identifier (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 CONCRETE INSTITUTE (ACI)

ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete

(ACI 318-14) and Commentary (ACI 318R-14)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2016) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

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

ASME B18.2.2 (2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.6.2 (2020) Square Head Set Screws and Slotted Headless Set Screws (Inch Series)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) 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 2017) Metric Plain Washers

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.3 (2020) Safety Requirements for Powder-Actuated Fastening Systems American National Standard for Construction and Demolition Operations

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A29/A29M (2020) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard

	Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) 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	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A467/A467M	(2020) Standard Specification for Machine Coil Chain
ASTM A475	(2022) Standard Specification for Metallic-Coated Steel Wire Strand
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786/A786M	(2015; R 2021) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B26/B26M	(2018; E 2018) Standard Specification for

	Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) 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	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C1513	(2018) 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 E488/E488M	(2022) Standard Test Methods for Strength of Anchors in Concrete Elements
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
MASTER PAINTERS INSTITUTE (MPI)	
MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM MBG 531	(2017) Metal Bar Grating Manual
NAAMM MBG 532	(2019) Heavy Duty Metal Bar Grating Manual
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2014) Safety -- Safety and Health

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Steel Door Frames, Fabrication Drawings; G[, [_____]]

Cover Plates and Frames, Installation Drawings; G[, [_____]]

Expansion Joint Covers, Installation Drawings; G[, [_____]]

Floor Gratings, Installation Drawings; G[, [_____]]

Roof Walkways, Installation Drawings; G[, [_____]]

Bollards/Pipe Guards; G[, [_____]]

Wheel Guards, Installation Drawings; G[, [_____]]

Window[and Door] Guards, Installation Drawings; G[, [_____]]

Embedded Angles and Plates, Installation Drawings; G[, [_____]]

Roof Hatches, Installation Drawings; G[, [_____]]

SD-03 Product Data

Corner Guards

Cover Plates and Frames; G[, [_____]]

Expansion Joint Covers; G[, [_____]]

Floor Gratings; G[, [_____]]

Roof Walkways; G[, [_____]]

Structural Steel Door Frames; G[, [_____]]

Wheel Guards

Window[and Door] Guards; G[, [_____]]

Roof Hatches; G[, [_____]]

Each Downspout Terminations Type; G[, [_____]]

Recycled Content; S

SD-04 Samples

Expansion Joint Covers

SD-07 Certificates

[Certificates of Compliance; G[, [_____]]

][Certified Mill Test Reports for Chemistry and Mechanical Properties; G[, [_____]]

]

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.

1.5 MISCELLANEOUS REQUIREMENTS

1.5.1 Fabrication Drawings

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

1.5.2 Installation Drawings

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

PART 2 PRODUCTS

****

NOTE: Base product selections on aesthetic values, reliability, sustainability and cost. Delete alternate requirements where they occur.

Include bracketed sentence for Army projects only.

****

2.1 RECYCLED CONTENT

Provide products with recycled content.[Provide certificates of compliance for recycled content.]

2.2 MATERIALS

****

NOTE: Choose the bracketed item for projects that do not include Section 05 12 00 STRUCTURAL STEEL.

****

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied.[Submit the manufacturer's certified mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied materials.]

2.2.1 Structural Carbon Steel

Provide in accordance with ASTM A36/A36M.

2.2.2 Structural Tubing

Provide in accordance with ASTM A500/A500M.

2.2.3 Steel Pipe

Provide in accordance with ASTM A53/A53M, Type E or S, Grade B.

2.2.4 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with ASTM A47/A47M.

2.2.5 Gratings

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

a. Provide gray cast iron in accordance with ASTM A48/A48M, Class 40.

b. Provide metal plank grating, non-slip requirement, [aluminum in accordance with ASTM B209M ASTM B209, 6061-T6][steel in accordance with ASTM A653/A653M, Z275 G90].

c. Provide metal bar type grating in accordance with[NAAMM MBG 531][and][NAAMM MBG 532].

2.2.6 Floor Plates, Patterned

Provide floor plate in accordance with ASTM A786/A786M. Provide steel plate not less than 1.9 mm 14 gage.

2.2.7 Anchor Bolts

Provide in accordance with ASTM F1554. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.2.7.1 [Expansion Anchors] [Sleeve Anchors] [Adhesive Anchors]

Provide [_____]mm [_____]in. diameter [expansion anchors][sleeve anchors][adhesive anchors]. Minimum [concrete][masonry] embedment of [_____]mm [_____]in. Design values listed are as tested in accordance with ASTM E488/E488M.

a. Provide minimum [ultimate][allowable] pullout value of [_____]kN [_____]lb. Calculate pullout capacity according to ACI 318.

b. Provide minimum [ultimate][allowable] shear value of [_____]kN [_____]lb. Calculate shear capacity according to ACI 318.

2.2.7.2 Lag Screws and Bolts

Provide in accordance with ASME B18.2.1, type and grade best suited for the purpose.

2.2.7.3 Toggle Bolts

Provide in accordance with ASME B18.2.1.

2.2.7.4 Bolts, Nuts, Studs and Rivets

Provide in accordance with ASME B18.2.2 or ASTM A307.

2.2.7.5 Powder Actuated Fasteners

Follow safety provisions in accordance with ASSP A10.3.

2.2.7.6 Screws

Provide in accordance with ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.2.7.7 Washers

Provide plain washers in accordance with 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 in accordance with ASME B18.21.2M, ASME B18.21.1.

2.2.7.8 Welded Headed Shear Studs

Provide in accordance with[ASTM A108][or][ASTM A29/A29M-12].

2.2.8 Aluminum Alloy Products

Provide in accordance with ASTM B209M, ASTM B209 for sheet plate, ASTM B221M, ASTM B221M, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings. 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.

2.3 FABRICATION FINISHES

****
NOTE: The Safety Data Sheets (SDS) for coating materials must 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, must be in compliance with air quality regulations for the type of application and jurisdiction where used.
****

2.3.1 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. Provide galvanizing in accordance with ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90.

2.3.2 Galvanize

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

[2.3.3 Repair of Zinc-Coated Surfaces

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

Repair damaged surfaces with galvanizing repair method and paint in accordance with 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, with a torch, surfaces to which stick or paste material will be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

]2.3.4 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.
****

2.3.4.1 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 must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

2.3.4.2 Pretreatment, Priming and Painting

****
NOTE: Use manufacturer's standard treatment when painting and finishing is required.
****

Apply pre-treatment, 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.]

2.3.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.3.6 Aluminum Surfaces

2.3.6.1 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.

2.3.6.2 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. Provide in accordance with AA DAF45. Provide a polished satin finish on items to be anodized.

2.4 CORNER GUARDS

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. Provide [galvanized][_____] corner guards on exterior.[Provide interior corner guards as indicated in Section 10 26 00 WALL AND DOOR PROTECTION.]

2.5 COVER PLATES AND FRAMES

****
NOTE: Insert required live load value in the blank space. Select requirements for floor plate removal method. Do not indicate specific pattern 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 in accordance with ASTM A283/A283M. Provide aluminum oxide or silicon carbide on wearing surfaces]. Provide [galvanized][shop painted] plate. Reinforce to sustain a live load of [_____] MPa [_____] pounds per square foot. Provide structural steel shapes and plates for frames, [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 where indicated; form from 6 mm 1/4

inch round stock.][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.

2.6 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 standard mill finish for floor covers and exterior covers. Furnish plates, backup angles, expansion filler strips and anchors as indicated.[Provide a [_____]-hour fire-rating for expansion joints.]

2.7 FLOOR GRATINGS AND ROOF WALKWAYS

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

****
NOTE: Consider gratings for treads and landings 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. Specify building expansion joints. Size supports to distribute 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[and NAAMM MBG 532] for bar type gratings, or in accordance with 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. In accordance with 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 to match grating finish.

][b. 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 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 as the grating and 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 in accordance with manufacturer's roof attachment system.]
]

****

NOTE: US Access Board standards require ground and floor surfaces to be slip resistant, however, they no longer specify a minimum level of slip resistance or coefficient of friction because there is no consensus regarding test procedures. Therefore coefficient of friction requirements have been removed. Designer must verify slip resistance characteristics of products submitted for approval.

****

d. Provide slip resistant surface finishes.

[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 manufacturer's instructions.

]2.8 BOLLARDS/PIPE GUARDS

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

2.9 DOWNSPOUT TERMINATIONS

Provide [102 x 102 mm] [4x4 inch], [102 x 152 mm] [4x6 inch][and][or] [152 x 152 mm] [6x6 inch] [_____] aluminum downspout tile adapter with [mill][manufacturer's standard powder coated] finish. Units shall have all seams welded.

Provide [nickel bronze] [polished bronze] [chrome plated] cast downspout nozzle and flange.

Provide [100 x 76 mm] [4x3 inch], [125 x 100 mm] [5x4 inch][and][or] [100 mm diameter] [4 inch diameter] [_____] [cast iron] [galvanized cast iron] downspout boot with cleanout access and manufacturer's standard cast iron strap.

2.10 MISCELLANEOUS PLATES AND SHAPES

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

Provide 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 [[_____] mm] [200 mm] [[_____] in][8 in] bearing on masonry at each end.

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

2.11 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, minimum 5 mm 3/16 inch diameter, with a minimum of twelve links per 300 mm one foot, and snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide boat type snap hooks. 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.

2.12 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.

2.13 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 [_____].

2.14 STRUCTURAL STEEL DOOR FRAMES

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

[a. Provide frames as indicated. Unless otherwise indicated, 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. Provide extruded metal frames as required by the elevator manufacturer.

] b. Provide support where track, guides, hoods, hangers, operators, and other accessories are required.

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, spreaders may be left in place and concealed in the floor.
]

****
NOTE: Or select the following paragraph.
****

[Provide frames of rolled shapes as indicated. Miter and weld heads to jambs, or provide 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 as necessary 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 they will be exposed in the finished work. Grind welds smooth.

]2.15 WHEEL GUARDS

Provide wheel guards of hollow, heavy-duty type cast iron in accordance with 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.

[2.16 ROOF HATCHES (SCUTTLES)

Provide [aluminum][zinc-coated steel] sheets not less than 1.9 mm 14 gauge with 75 mm 3 inch beaded flange, welded and ground at corners. Provide a minimum clear opening of 760 by 900 mm 30 by 36 inches. Insulate cover and curb with 25 mm one inch thick rigid fiberboard insulation, covered and protected by [aluminum sheet][zinc-coated steel liner] of not less than 0.45 mm 26 gage. Provide with 300 mm 12 inches high curb, formed with 75 mm 3 inch mounting flanges with holes for securing to the roof deck.

]2.17 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 bracketed portions. Edit choices for interior or exterior installations.
****

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.[Provide expanded metal panels in accordance with ASTM F1267.] Miter and weld corners of frames.[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 inchjamb channel attached as indicated to 50 by 6 mm 2 by 1/4 inchplate 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.]

2.18 WINDOW[AND DOOR] GUARDS

Provide woven wire window[and door] guards of size as 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. Provide all materials with zinc coating. Provide a minimum of three hinge side clips on one side and two lock ring hasps on the opposite side.

2.19 CHIMNEYS, VENTS, AND SMOKESTACKS

Provide chimneys and vents in accordance with NFPA 211. Form chimney connectors of minimum 1.01 mm 20 gauge galvanized steel. Design and construct stacks to withstand a wind velocity of [_____] km/h [_____] mph in accordance with ASCE 7-16. Construct unlined stacks of black-steel plates not less than 5 mm 3/16 inch thick in accordance with ASTM A36/A36M. Weld seams and joints. Provide angle flanges for connections to boilers, other equipment, and stack supports.

2.20 CLEANOUT DOORS

Provide [galvanized][cast iron]cleanout doors with frames, sized to match flues unless otherwise indicated. Provide continuous flange and anchors for securing frames to masonry. Provide smokeproof, hinged doors with[lockable] fastening devices to hold doors closed[and secured].

2.21 COAL HOPPER DOORS

Provide coal hopper doors of [galvanized][_____] steel plates and shapes. Provide complete assemblies including frames, stops, wall boxes, hinges, and hasp or lock-type latches. Weld joints and attachments.

2.22 GUY CABLES

Provide guy cables as pre-stretched, galvanized wire rope of sizes indicated. Provide wire rope in accordance with ASTM A475, high strength grade with Class A coating. Guys must have a factory attached clevis top-end fitting, a factory attached open-bridge strand socket bottom-end fitting, and must be complete with oval eye, threaded anchor rods. Provide hot-dip galvanized fittings and accessories.

2.23 WINDOW SUB-SILL

Provide window sub-sill of extruded aluminum alloy, standard mill finish, of size(s) and design(s) indicated. Provide a minimum of two anchors per window section for securing to mortar joints of masonry sill course. Provide sills with protective coating for shipment, of two coats of a clear, colorless, methacrylate lacquer applied to all surfaces of the sills.

2.24 WINDOW WELLS

Provide window wells in a minimum 1.5 mm, 16 gauge, corrugated sheet steel, hot-dip galvanized after fabrication, with top edge of window well walls with a 19 mm 3/4 inch bead or rolled top. Provide windows wells with radiused corners and of sizes that overlap each window by a minimum of 75 mm 3 inches on each side. Provide removable covers, hot-dipped 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 one by 1/4 inch frame. Frames must fit into, and rest on top edge of, window wells.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated in accordance with manufacturer's instructions. Verify all field dimensions prior to fabrication. Include materials and parts necessary to complete each assembly, whether indicated or not. Miss-alignment and miss-sizing of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Joints exposed to weather must be watertight.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersuck rivets where exposed. Provide coped and mitered corner joints aligned flush and without gaps.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

****

NOTE: Where Headed shear studs are used, edit this section to indicate installation requirements specific to the project or reference drawings or manufacturer's tested assemblies.

****

****

NOTE: Choose the bracketed item for projects that do not include Section 05 12 00 STRUCTURAL STEEL.

****

Provide anchorage as necessary, whether indicated or not, for fastening miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts (when approved for concrete), through bolts for masonry, headed shear studs, machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals), that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable. Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise.[Test a minimum of 2 bolt, nut, and washer assemblies from each certified mill batch in a tension measuring device at the job site prior to the beginning of bolting start-up.]

3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in 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. Provide welded headed shear studs in accordance with AWS D1.1/D1.1M, Clause 7, except as otherwise specified. Provide in accordance with the safety requirements of EM 385-1-1.

3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with 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 in accordance with ASTM D1187/D1187M, asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

3.7 PREPARATION

3.7.1 Material Coatings and Surfaces

****

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 metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.7.2 Environmental Conditions

Do not clean or paint surfaces 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. Metal surfaces to be painted must be dry for a minimum of 48 hours prior to the application of primer or paint.

3.8 EXPANSION JOINT COVERS

Provide in accordance with manufacturer's written instructions[and with seismic requirements indicated]. Verify installation allows specified movement prior to completion of work

3.9 COVER PLATES AND FRAMES

Provide tops of cover plates and frames flush with finished surface. Test for trip hazards and adjust for any encountered lippage.

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)

****

NOTE: When specifying roof hatches, coordinate guardrails around them by detail them on the drawings and by editing specification SECTION 05 52 00 METAL RAILINGS.

****

Construction and accessories as follows:

a. Provide insulated cover and curb with mounting flanges for securing to roof deck. Provide curbs with integral metal cap flashing of the same gage and metal as the curb, fully welded and ground at corners for weather tightness.

b. Provide hatches completely assembled, with pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latches with turn handles on inside and outside, and neoprene draft seals. Provide fasteners for padlocking from the inside. Provide covers with automatic hold-open arms complete with grip handle to permit one hand release. Cover action must be smooth through its entire range of motion 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 cleanout openings 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 in accordance with structural requirements. 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. Flash as necessary to prevent accumulation of water in the smokestack.

3.13 DOOR GUARD FRAME

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

3.14 INSTALLATION OF BOLLARDS/PIPE GUARDS

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

Set bollards/pipe guards vertically in concrete piers. Fill hollow cores with concrete having a compressive strength of 21 MPa 3000 psi.

3.15 INSTALLATION OF DOWNSPOUT TERMINATIONS

Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

3.16 MOUNTING OF SAFETY CHAINS

Provide safety chains where indicated. Mount the top chain 1050 mm 3 feet 6 inches[_____] above the [floor][ground] and mount the lower chain 600 mm 2 feet [_____] above the [floor][ground].

3.17 STRUCTURAL STEEL DOOR FRAMES

Secure door frames to the floor slab by means of angle clips and expansion bolts. Provide any necessary reinforcements and drill and tap frames as required for hardware. Clean metal shavings from finished surfaces at the end of each work day.

For freight elevator hoistway entrances, include a non-skid metal sill installed in accordance with the elevator manufacturer's written installation instructions.

3.18 INSTALLATION OF WHEEL GUARDS

Fill wheel guards with concrete and anchor to slab in accordance with manufacturer's recommendations.

3.19 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 manner as approved by the Contracting Officer. Spanner-head screws or bolts are not considered prison-type fasteners.

3.20 DIAMOND MESH WINDOW [AND DOOR]GUARDS

Provide diamond mesh window guards on [interior window frames with not

less than two tamperproof hinged butts mounted on wood jambs.][exterior of window frames with not less than two tamperproof hinged butts mounted on 25 by 300 by 3 mm one by 12 by 1/8 inch jamb channel attached to 50 by 6 mm 2 by 1/4 inch plate anchored][to wood jambs 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 jamb opposite the hinged side.

3.21 INSTALLATION OF WINDOW WELLS

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

3.22 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

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.

-- End of Section --