
USACE / NAVFAC / AFCEA / NASA UFGS-05 50 00.00 40 (October 2006)

Preparing Activity: NASA Superseding
UFGS-05 50 00.00 40 (June 2006)
NASA-05500S (December 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 9 October 2006

Latest change indicated by CHG tags

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05 50 00.00 40

METAL FABRICATIONS

10/06

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 METALWORK REQUIREMENTS
- 1.4 QUALIFICATIONS FOR WELDING WORK
- 1.5 DRAINAGE HOLES

PART 2 PRODUCTS

- 2.1 STRUCTURAL STEEL PLATES, SHAPES, AND BARS
- 2.2 STRUCTURAL STEEL TUBING
- 2.3 HOT-ROLLED CARBON STEEL BARS AND BAR SIZE SHAPES
- 2.4 HOT-ROLLED CARBON STEEL SHEETS AND STRIPS
- 2.5 COLD-ROLLED CARBON STEEL SHEETS
- 2.6 GALVANIZED CARBON STEEL SHEETS
- 2.7 GRAY IRON CASTINGS
- 2.8 MALLEABLE IRON CASTINGS
- 2.9 RAISED PATTERN STEEL FLOOR PLATES
- 2.10 STEEL BAR GRATING
- 2.11 ANCHORAGE MATERIALS
- 2.12 FASTENING MATERIALS
- 2.13 PAINT MATERIALS
- 2.14 GENERAL FABRICATION
 - 2.14.1 Workmanship
 - 2.14.2 Holes for Other Work
 - 2.14.3 Galvanizing
 - 2.14.4 Shop Painting
- 2.15 MISCELLANEOUS METAL ITEMS
 - 2.15.1 Access Panels and Frames for Masonry Walls
 - 2.15.2 Cast Abrasive Thresholds
 - 2.15.3 Curb Edge Bars
 - 2.15.4 Floor Gratings and Frames

- 2.15.5 Floor Plate Covers and Frames
- 2.15.6 Ladders
- 2.15.7 Ladder Safety Cages
- 2.15.8 Loose Steel Lintels
- 2.15.9 Metal Safety Nosing for Concrete Treads
- 2.15.10 Miscellaneous Steel Framing and Supports
- 2.15.11 Roof Scuttles
- 2.15.12 Safety Chains
- 2.15.13 Shelf Angles
- 2.15.14 Steel Pipe Railings
- 2.15.15 Steel Stairs
 - 2.15.15.1 Stair Framing
 - 2.15.15.2 Metal Pan Risers, Subtreads, and Subplatforms
 - 2.15.15.3 Steel Floor Plate Treads
 - 2.15.15.4 Floor Grating Treads and Platforms
 - 2.15.15.5 Stair Railings and Handrails
 - 2.15.15.6 Soffit Clips
 - 2.15.15.7 Exterior Stairs
 - 2.15.15.8 Workmanship
- 2.16 STEEL DOOR FRAMES
- 2.17 WHEEL GUARDS
- 2.18 WIRE MESH PARTITIONS
 - 2.18.1 Vertical Reinforcement
 - 2.18.2 Top Capping
 - 2.18.3 Corner Posts
 - 2.18.4 Swing Doors
 - 2.18.5 Sliding Doors
 - 2.18.6 Door Hardware
 - 2.18.7 Service Windows
- 2.19 WIRE MESH WINDOW GUARDS

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 ANCHORAGE DEVICES EMBEDDED IN OTHER CONSTRUCTION
- 3.3 FASTENING TO CONSTRUCTION-IN-PLACE
- 3.4 CUTTING AND FITTING
- 3.5 SETTING MASONRY ANCHORAGE DEVICES
- 3.6 FIELD WELDING
- 3.7 THREADED CONNECTIONS
- 3.8 STEEL PIPE RAILINGS
- 3.9 STRUCTURAL STEEL DOOR FRAMES
- 3.10 WHEEL GUARDS
- 3.11 WIRE MESH WINDOW GUARDS
- 3.12 COUNTER SHUTTER
- 3.13 TOUCHUP PAINTING
- 3.14 RAISED PATTERN FLOOR PLATES
- 3.15 STEEL BAR GRATING

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-05 50 00.00 40 (October 2006)

Preparing Activity: NASA Superseding
 UFGS-05 50 00.00 40 (June 2006)
 NASA-05500S (December 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 9 October 2006

Latest change indicated by CHG tags

SECTION 05 50 00.00 40

METAL FABRICATIONS
10/06

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers utilitarian metal products, customarily manufactured to meet specific requirements in building construction and fabricated steel not a part of the structural steel framework.

Drawings must include a complete design indicating the character of the work to be performed and giving the following:

Location and details of each fabricated metal item showing all dimensions, shapes, and sizes of members, connections, holes for other work, and the relation of fabricated metal items to other building components

Anchorage devices embedded in other construction

Location of galvanized fabricated metal items in interior locations when the same item is not required to be galvanized in all interior locations

Metal connection materials and anchorage devices required for precast concrete wall panels, precast concrete structural members, and precast concrete roof decking are specified in Division 3, "Concrete."

Metal anchors, anchor slots, and ties for brick and block masonry, structural glazed tile, and precast stone work are specified in Division 4, "Masonry."

Structural steel framework, including steel bar grating, steel floor plates, and structural steel door frames that are a part of the structural steel

framework, are specified in Section 05 12 00
STRUCTURAL STEEL.

Loose bearing plates and anchorage devices for steel joists are specified in Section 05 21 00.00 40 STEEL JOIST FRAMING.

Miscellaneous metal products used in building construction for functional, architectural, and decorative effects, such as aluminum railings, aluminum joint cover assemblies, extruded aluminum louvers, building letters, and stamped metal decorative grills, are specified in the Section 05 70 00.00 40 DECORATIVE METALS.

Carpenters iron for carpentry, wood roof decks, wood fiber roof deck, and metal studs; and anchorage devices for gypsum wall board are specified in Division 6, "Wood and Plastics."

Sheet metal work, (including metal flashing, metal louvers, metal gutters and downspouts, and cast iron downspout boots), metal roofing and siding, gravity roof ventilators, and anchorage devices are specified in Division 7, "Thermal and Moisture Protection."

Hollow metal frames, UL-labeled steel door frames, metal doors (including louvers), metal windows (including window stools), metal curtain wall systems, finish hardware (including extruded aluminum thresholds), and anchorage devices are specified in Division 8, "Doors and Windows."

Metal ceiling suspension systems, metal furring systems, and metal access panels for plaster and acoustical work; metal studs for plastered partitions; metal divider strips for terrazzo work; metal trim for resilient flooring and vinyl wall coverings; and anchorage devices are specified in Division 9, "Finishes."

Finish painting is specified in Section 09 97 13.00 40 STEEL COATINGS and Section 09 90 00.00 40 PAINTING AND COATING.

Metal partitions, metal lockers, metal toilet accessories, and anchorage devices are specified in Division 10, "Specialties."

Metal tracks and anchorage devices for venetian blinds are specified in Division 12, "Furnishings."

Elevator guide rails, brackets, and all structural steel required for elevators except hoistways structural steel, elevator machine beam supports, and steel lintels over hoistway door openings and thresholds for elevator hoistway entrances are specified in Division 14, "Conveying Systems."

Metal supports, sleeves, construction castings (including manhole covers, frames, and steps), wire mesh machinery guards, and anchorage devices required for mechanical equipment, piping, ducts, and other mechanical systems are specified in Division 15, "Mechanical."

Metal supports, sleeves, construction castings (including manholes, covers, frames and steps) and anchorage devices required for electrical equipment, conduit, and other electrical systems are specified in Division 16, "Electrical."

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121 (2004) Standard Definitions for Use in the Design of Steel Structures

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.22.1 (1975; R 2003) Plain Washers

ANSI B18.22M (1981; R 2000) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M (2004) Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2004) Structural Welding Code-Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (1996; R 2005) Square and Hex Bolts and Screws, (Inch Series)

ASME B18.2.3.8M (1981; R 2005) Metric Hex Lag Screws

ASME B18.21.1 (1999; R 2005) Lock Washers (Inch Series)

ASME B18.21.2M (1999; R 2005) Lock Washers (Metric Series)

ASME B18.6.3 (2003) Machine Screws and Machine Screw Nuts

ASME B18.6.7M (1999; R 2005) Metric Machine Screws

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M (2005a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened

ASTM A 1011/A 1011M (2005) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 27/A 27M (2005) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A 283/A 283M	(2003) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 307	(2004) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 467/A 467M	(2001) Standard Specification for Machine Coil and Chain
ASTM A 47/A 47M	(2004) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 48/A 48M	(2003) Standard Specification for Gray Iron Castings
ASTM A 500	(2003a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(2001) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 513	(2000) Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM A 526/A 526M	(1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A 53/A 53M	(2004a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 563	(2004) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A 563M	(2004) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A 575	(2002) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 653/A 653M	(2004a) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 786/A 786M	(2000b) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High

Strength Low-Alloy, and Alloy Steel Floor
Plates

ASTM A 924/A 924M (2004) Standard Specification for General
Requirements for Steel Sheet,
Metallic-Coated by the Hot-Dip Process

ASTM B 26/B 26M (2005) Standard Specification for
Aluminum-Alloy Sand Castings

ASTM C 387 (2004) Standard Specification for
Packaged, Dry, Combined Materials for
Mortar and Concrete

ASTM C 514 (2004) Standard Specification for Nails
for the Application of Gypsum Board

ASTM E 648 (2004) Critical Radiant Flux of
Floor-Covering Systems Using a Radiant
Heat Energy Source

ASTM F 568M (2004) Standard Specification for Carbon
and Alloy Steel Externally Threaded Metric
Fasteners

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (2000) Metal Bar Grating Manual

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20 (2000) Zinc-Rich Coating Type I Inorganic
and Type II Organic

SSPC Paint 25 (1997; 2004e1) Zinc Oxide, Alkyd, Linseed
Oil Primer for Use Over Hand Cleaned Steel
Type I and Type II

SSPC SP 10 (2000) Joint Surface Preparation, Standard
Near-White Metal Blast Cleaning (NACE No.
2)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588 (Rev D) Bolt, Toggle; and Expansion
Sleeve, Screw

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail,
Expansion; and Nail, Drive Screw (Devices,
Anchoring, Masonry)

FS RR-T-650 (1988d) Treads, Metallic and Non-Metallic,
Skid Resistant

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 (2001) Occupational Safety and Health
Standards

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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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.

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 Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation 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

Fabrication drawings for the following items shall be in accordance with the paragraph entitled, "General Fabrication," of this section.

Structural Steel
Joints
Castings

Installation drawings for Miscellaneous Metal Items shall include location, dimensions, size, and weight or thickness as applicable to the members, type and location of welded connections, location and details of anchorage devices that are to be embedded in cast-in-place concrete and masonry construction, and any other pertinent construction and erection details.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Structural Steel Plates, Shapes, and Bars
- Structural Steel Tubing
- Hot-Rolled Carbon Steel Bars and Bar Size Shapes
- Hot-Rolled Carbon Steel Sheets and Strips
- Cold-Rolled Carbon Steel Sheets
- Galvanized Carbon Steel Sheets
- Gray Iron Castings
- Malleable Iron Castings
- Raised Pattern Steel Floor Plates
- Steel Bar Grating
- Access Panels and Frames
- Roof Scuttles
- Steel Pipe Railing
- Wheel Guards
- Wire Mesh Partitions
- Wire Mesh Window Guards
- Anchorage Materials
- Paint Materials
- Fastening Materials
- Miscellaneous Metal Items

SD-04 Samples

Contractor shall submit one full-size sample, each type, for the following. After approval, full-size samples may be used in the construction, provided each sample is clearly identified and its location recorded.

- Cast Abrasive Thresholds
- Metal Safety Nosing for Concrete Treads
- Anchorage Materials
- Fastening Materials
- Lock Cylinder

SD-07 Certificates

Welding Procedures shall be in accordance with AWS D1.1/D1.1M.

Certificates for Welder Qualifications shall be in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

Certificates shall be provided for Miscellaneous Metal Items showing conformance with the referenced standards contained in this section.

SD-08 Manufacturer's Instructions

Manufacturers instructions covering installation of Miscellaneous Metal Items shall be submitted.

1.3 METALWORK REQUIREMENTS

For items not specifically described in these specifications, materials and workmanship shall conform to the accepted standard practices of the trades. Supplementary parts necessary to complete each item shall be furnished and installed. Anchors, sockets, or fastenings required for securing metal work to other structures shall be furnished to the appropriate trades promptly. Details and specifications of items for which standard products are available are representative guides of minimum requirements for such items. Standard products, generally meeting such requirements, will be accepted subject to approval. Welding shall be continuous along entire area of contact except where tack welding is noted. Tack welding will not be permitted on exposed surfaces. Items specified to be galvanized shall be hot-dip galvanized after fabrication. Weight of coating shall be not less than 0.38 kilogram per square meter 1.25 ounces per square foot of surface.

Templates and patterns for proper fitting of hardware and other accessories shall be used wherever practical.

Substitutions of materials or modification of details, or both, shall be made only when warranted and approved.

1.4 QUALIFICATIONS FOR WELDING WORK

[Section 05 05 23.00 14 WELDING, STRUCTURAL applies to work specified in this section.]

[Welding Procedures shall be in accordance with AWS D1.1/D1.1M. Test specimens shall be made in the presence of Contracting Officer and shall be tested by an approved testing laboratory at the Contractor's expense.

Certification of Welder Qualifications by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test shall be submitted. In addition, tests shall be performed on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, an immediate retest of two test welds shall be made and each test weld shall pass. Failure in the immediate retest will require that the welder be retested after further practice or training and a complete set of test welds shall be made.]

1.5 DRAINAGE HOLES

Drainage holes shall be drilled to eliminate water traps. Hole locations and diameter of holes shall be 13 millimeter 1/2 inch and shown on detail drawings for Contracting Officer's approval. Hole size and locations shall not affect structural integrity.

PART 2 PRODUCTS

NOTE: Delete the following metals that are not required for the items specified in paragraph "Miscellaneous Metal Items." The specified metals are only those which are common to several miscellaneous metal items. Metals which are required only for a specific fabricated metal item are specified in the paragraph for the item.

2.1 STRUCTURAL STEEL PLATES, SHAPES, AND BARS

Plates, shapes, and bars shall conform to ASTM A 36/A 36M.

Plates to be bent or cold formed shall conform to ASTM A 283/A 283M, Grade C.

2.2 STRUCTURAL STEEL TUBING

Square or rectangular tubing shall be hot formed, welded or seamless, conforming to ASTM A 501.

2.3 HOT-ROLLED CARBON STEEL BARS AND BAR SIZE SHAPES

Bars and bar sizes shall conform to ASTM A 575, Grade M1020.

2.4 HOT-ROLLED CARBON STEEL SHEETS AND STRIPS

Sheets and strip shall be uncoated and shall conform to ASTM A 1011/A 1011M.

2.5 COLD-ROLLED CARBON STEEL SHEETS

Sheets shall be uncoated and shall conform to ASTM A 1008/A 1008M.

2.6 GALVANIZED CARBON STEEL SHEETS

Sheets shall conform to ASTM A 526/A 526M; galvanizing shall conform to ASTM A 653/A 653M and ASTM A 924/A 924M.

2.7 GRAY IRON CASTINGS

Castings shall conform to ASTM A 48/A 48M, Class 30.

2.8 MALLEABLE IRON CASTINGS

Castings shall conform to ASTM A 47/A 47M, Grade 32510 or Grade 35018.

2.9 RAISED PATTERN STEEL FLOOR PLATES

NOTE: Drawings must indicate the thickness of floor
plate.

Plates shall be structural-quality steel having a raised figure pattern at regular intervals on the surface, and shall be flatback style carbon steel conforming to ASTM A 786/A 786M, except that the steel shall conform to ASTM A 36/A 36M and pattern shall be No. [1] [2] [3] [4] [5].

2.10 STEEL BAR GRATING

NOTE: Drawings must indicate bearing bar size.

Grating shall conform to NAAMM MBG 531 steel shall conform to ASTM A 36/A 36M and finish shall be shop-applied paint instead of galvanized. End-banding bars, anchors, and other components shall be

provided as required to suit conditions indicated. Steel grating exposed to the weather shall be galvanized after fabrication.

2.11 ANCHORAGE MATERIALS

NOTE: Concrete inserts shall be used for the fastening of fabricated metal items to cast-in-place concrete construction when the anchorage device will be subjected to direct pull-out loadings. Such fabricated metal items include shelf angles and equipment supports attached to, or suspended from, concrete slab ceilings.

Threaded-type concrete inserts shall be galvanized ferrous castings having an enlarged base with not less than two nailing lugs, length not more than thickness of concrete section less 19 millimeter 3/4 inch, and internally threaded to receive diameter M20 3/4-inch machine bolt. Ferrous castings shall be ferritic malleable iron conforming to ASTM A 47/A 47M, Grade 32510 or Grade 35018, or may be medium-strength cast steel conforming to ASTM A 27/A 27M, Grade U-60-30. Inserts shall be galvanized after fabrication in accordance with ASTM A 153/A 153M.

Threaded inserts shall not be removable when embedded in 20 Megapascal 3,000 pounds per square inch (psi) concrete and subjected to a 44.5 kilonewton 10,000 pound tension load test in an axial direction.

Carbon steel bolts having special wedge-shape heads, nuts, washers, and shims shall be provided. Such hardware items shall be galvanized in accordance with ASTM A 153/A 153M.

Slotted-type concrete inserts shall be galvanized, pressed steel plate, welded construction, box type with slot designed to receive diameter M20 3/4-inch square head bolt and to provide lateral adjustment of the bolt. Length of insert body less anchorage lugs shall be not less than 115 millimeter 4-1/2 inches. Inserts shall be provided with knockout cover. Steel plate shall be not less than 3 millimeter 1/8 inch thick and shall conform to ASTM A 283/A 283M, Grade C. Inserts shall be galvanized after fabrication in accordance with ASTM A 153/A 153M.

Slotted inserts shall not be removable when embedded in 20 Megapascal 3,000 psi concrete and subjected to a 27 kilonewton 6,000 pound tension load test in an axial direction.

NOTE: Masonry anchorage devices must be used only for the fastening of fabricated metal items to solid masonry and concrete-in-place construction when the anchorage device will not be subjected to direct pull-out loadings nor to vibration. Masonry anchorage devices are used only for nonvibratory shear loads.

Masonry anchorage devices shall be expansion shields conforming to FS FF-S-325 and ASTM C 514, Group, Type, and Class as follows:

[Lead expansion shields for machine screws and bolts M6 1/4 inch and

smaller shall be head-out embedded-nut type, single-unit class, conforming to Group I, Type 1, Class 1.]

[Lead expansion shields for machine screws and bolts greater than M6 1/4 inch shall be head-out embedded-nut type, multiple-unit class, conforming to Group I, Type 1, Class 2.]

[Bolt anchor expansion shields for lag bolts shall be zinc-alloy long-shield anchors class, conforming to Group II, Type 1, Class 1.]

[Bolt anchor expansion shields for bolts shall be closed-end bottom bearing class, conforming to Group II, Type 2, Class 1.]

NOTE: Toggle bolts must be used for the fastening
of fabricated metal items to hollow masonry and stud
partitions.

Toggle bolts shall be tumble-wing type of the class and style best suited for the work, and shall conform to FS FF-B-588, Type II.

2.12 FASTENING MATERIALS

Standard bolts shall be regular hexagon head type, low-carbon steel, coarse thread series, conforming to ASTM F 568M ASTM A 307.

Nuts shall be plain hexagon, regular style, carbon steel, conforming to ASTM A 563M ASTM A 563, Grade A.

Lag bolts shall be square head, gimlet point or cone point, carbon steel, conforming to ASME B18.2.3.8M ASME B18.2.1.

Machine screws shall be carbon steel, cross-recess drive, [flat-head] [countersunk head], conforming to ASME B18.6.7M ASME B18.6.3.

Wood screws shall be carbon steel, single thread, flat countersunk head, cross-recess drive, conforming to ASME B18.2.3.8M ASME B18.2.1.

Plain washers shall be round, general-assembly-grade, carbon steel class, conforming to ANSI B18.22M ANSI B18.22.1.

Lockwashers shall be helical spring, carbon steel class, of the style best suited for the work, conforming to ASME B18.21.2M ASME B18.21.1.

Electrodes for manual shielded metal arc welding shall meet the requirements of AWS D1.1/D1.1M, and shall be mild steel electrodes conforming to AWS A5.1/A5.1M, E60 series.

2.13 PAINT MATERIALS

Paint for carbon steel shall [conform to SSPC Paint 20.] [be as specified in Section 09 97 13.00 40 STEEL COATINGS.]

Primer for carbon steel shall [conform to SSPC Paint 25.] [be as specified in Section 09 97 13.00 40 STEEL COATINGS.]

2.14 GENERAL FABRICATION

2.14.1 Workmanship

Fabricated **Structural Steel** shall be in accordance with **ASTM E 648** and **AISC/AISI 121**.

Joints shall be milled to a close fit. Corner joints shall be coped or mitered, well-formed, and in true alignment. Joints exposed to the weather shall be formed and fabricated to exclude water.

Castings shall be sound and free from warp or defects that impair strength and appearance. Exposed surfaces shall have a smooth finish and sharp, well-defined lines and arrises. Joints shall be milled to a close fit.

2.14.2 Holes for Other Work

Holes shall be provided as indicated for securing items to metal work.

2.14.3 Galvanizing

NOTE: Exterior and interior fabricated metal items of ferrous metals exposed to dampness or excessive moisture must be galvanized. When a specific fabricated metal item is required to be galvanized when installed in some interior locations but not in other interior locations, the items to be galvanized must be indicated.

Fabricated metal items specified to be galvanized shall be covered with a zinc coating applied by the hot-dip process after fabrication.

Galvanizing of iron and steel hardware shall be in accordance with **ASTM A 153/A 153M**.

Galvanizing of rolled, pressed, and forged steel shapes, plates, bars, and strip, **6 millimeter 1/8-inch** thick and heavier, shall be in accordance with **ASTM A 123/A 123M**.

Galvanizing of assembled steel products shall be in accordance with **ASTM A 123/A 123M**.

2.14.4 Shop Painting

Fabricated metal work, except metal surfaces embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces shall be primed in accordance with [**SSPC Paint 25**] [Section 09 97 13.00 40 STEEL COATINGS.]

2.15 MISCELLANEOUS METAL ITEMS

2.15.1 Access Panels and Frames for Masonry Walls

NOTE: Access panels and frames for plastered stud partitions and acoustical ceilings are specified in Division 9, "Finishes."

Panels and frames shall be provided at each pipe space and plumbing chase in masonry walls and at other locations as indicated.

Panels and frames shall be flush panel type for masonry construction, with door size not less than 400 by 500 millimeter 16 inches by 20 inches.

Frames shall be fabricated from 1.6 millimeter 16 gage, cold-rolled carbon steel sheets with exposed flange not less than 22 millimeter 7/8 inch wide, with welded joints and with anchorage for securing to building construction. Panels shall be fabricated from 2.0 millimeter 14-gage, cold-rolled carbon steel sheets, with stiffened edges and with welded attachments. Panels shall be completely assembled with two hinges and one lock per door. Hinges shall be concealed spring type; locks shall be flush-face, turn-screw-operated latch type. Finish shall be prime coat of baked enamel.

2.15.2 Cast Abrasive Thresholds

NOTE: Thresholds for aluminum entrances are specified in Section 08 11 16 ALUMINUM DOORS AND FRAMES. Thresholds for sound retardant doors are specified in Section 08 34 73.00 40 SOUND CONTROL DOOR ASSEMBLIES. Extruded aluminum thresholds for doorways except aluminum entrance and sound-retardant doors are specified in Section 08 71 00 DOOR HARDWARE. Thresholds for elevator hoistway entrances are specified in Section 14 21 00.00 40 ELECTRIC TRACTION ELEVATORS.

Drawings must indicate location, type, pattern, and width of thresholds.

Thresholds shall be gray iron castings with fluted tread and abrasive grit embedded uniformly into the walking surface at the time of casting. Gray iron castings shall be ASTM Class 20. Abrasive grit shall be No. 20 grain aluminum oxide or silicon carbide or a combination of both. Screws for securing cast-iron thresholds shall be zinc- or cadmium-coated.

Thresholds shall be aluminum-alloy sand castings with fluted tread and abrasive grit embedded uniformly into the walking surface at the time of casting. Aluminum castings shall conform to ASTM B 26/B 26M, Alloy 514.0 or B443.0, Temper F. Abrasive grit shall be 20-grain aluminum oxide. Screws for securing cast aluminum thresholds shall be made of Type 300 series corrosion-resisting, chromium-nickel steel.

Thresholds shall be of the patterns and widths indicated. Lengths shall be as required to accurately fit each opening. Metal thickness shall be not less than 10 millimeter 3/8 inch. Thresholds shall be drilled and countersunk to receive flathead screws spaced not more than 75 millimeter 3 inches from each threshold end and not more than 380 millimeter 15 inches on center; a single row of screw holes for thresholds 130 millimeter 5 inches or less in width shall be provided; and a double row of screw holes for thresholds greater than 130 millimeter 5 inches in width, with two screw holes at ends and with staggered intermediate screw holes also shall be provided. Threshold ends shall be cut to fit door frame jambs.

Thresholds for double doors shall be provided with cutouts to receive bottom bolts.

Thresholds to concrete floor slab shall be secured with lead expansion shields and M6 1/4-inch flathead machine screws.

2.15.3 Curb Edge Bars

Bars shall be structural steel shapes of sizes indicated, all welded construction, with mitered corners and continuously welded joints. Anchors welded to curbs shall be provided for embedding in concrete or masonry construction; they shall be spaced not more than 150 millimeter 6 inches from each curb end and corners and not more than 600 millimeter 24 inches on center. Anchors shall be structural steel bars 19 millimeter 3/4-inch wide by 10 millimeter 3/8-inch thick with length as required for a minimum embedment of 150 millimeter 6 inches in the concrete.

Exterior curb edge bars shall be galvanized. Interior curb edge bars shall be galvanized, where indicated.

2.15.4 Floor Gratings and Frames

NOTE: Steel grating treads and platforms for steel
stairs are specified in paragraph "Steel Stairs."

Gratings shall be carbon steel with parallel bearing bars either right angle or diagonal cross members, conforming to NAAMM MBG 531. Grating panel sizes and bearing bar sizes shall be as indicated. Each panel shall be provided with end-banding bars, four saddle clip anchors designed to fit over two bearing bars, and four stud bolts, each with a plain washer and nut.

Frames shall be structural steel angles, all-welded construction, and fabricated so that the tops of frames and floor grating finish flush with the finished floor elevation. Anchors welded to the frame shall be provided, spaced not more than 150 millimeter 6 inches from ends of frame sections, not more than 150 millimeter 6 inches from corners, and not more than 600 millimeter 24 inches on center between end and corner anchors. Anchors shall be structural steel bars, 75 millimeter 3/4-inch wide by 10 millimeter 3/8-inch thick with length as required for a minimum embedment of 6 inches 150 millimeter in the concrete.

Grating panels shall be removable. Stud bolts to receive saddle clip anchors shall be field welded to the frame. Notching of bearing bars at supports will not be permitted. Openings in the grating shall be provided as indicated.

NOTE: Select one when galvanizing is required, as
applicable to the project. Galvanizing is required
for exterior gratings.

Exterior gratings and frames, including fasteners and clips, shall be galvanized. Interior grating and frames, including fasteners and clips, shall be galvanized where indicated.

2.15.5 Floor Plate Covers and Frames

NOTE: Steel floor plates connected to structural steel work are specified in Section 05 12 00 STRUCTURAL STEEL. Steel floor plate treads and platforms for steel stairs are specified in paragraph, "Steel Stairs."

Covers shall be carbon steel plates having a raised figure pattern at regular intervals on the surface, conforming to ASTM A 786/A 786M and pattern shall be No. [1] [2] [3] [4] [5].

Cover sections shall be the width and thickness indicated. Length shall be limited by total weight not to exceed 45 kilogram 100 pounds. Each floor plate cover section shall be provided with two flush lifting rings, (one located at each end of the section). Covers shall be free of sharp edges and burrs. Covers shall be provided with holes to receive flathead machine screws.

Frames shall be structural steel angles and steel bar stops, all-welded construction, and fabricated so that the tops of frames and floor plate covers finish flush with the finished floor elevation. Anchors welded to the frame shall be provided, and shall be spaced not more than 150 millimeter 6 inches from ends of frame sections and corners and not more than 600 millimeter 24 inches on center. Anchors shall be structural steel bars 75 millimeter 3/4-inch wide by 10 millimeter 3/8-inch thick with the length as required for a minimum embedment of 150 millimeter 6 inches in the concrete. Frames shall be drilled and tapped to receive machine screws.

Plate covers shall be removable and shall be secured to frame with 10 millimeter 3/8-inch machine screws spaced not more than 75 millimeter 3 inches from each cover end and not more than 300 millimeter 12 inches on center. Machine screws shall be zinc-or cadmium-coated. Openings in plate covers shall be provided as indicated.

Exterior plates and frames shall be galvanized. Interior plates and frames shall be galvanized where indicated.

2.15.6 Ladders

NOTE: Minimum design requirements for ladders are specified in 29 CFR 1910, Section 27.

Ladders shall be fixed-rail type, located and detailed as indicated and specified. Rungs shall be 75 millimeter, 3/4-inch, solid-section structural steel rods, spaced 300 millimeter 12 inches on center. Side rails shall be structural steel flat bars with rounded edges 64 by 13 millimeter spaced 16 inches 400 millimeter 2-1/2 inches by 1/2 inch apart, and conforming to 29 CFR 1910, Section 27. Rungs shall be fitted into punched holes in the side rails, welded, and ground smooth. Splices and connections shall have a smooth transition with original members without projections that are sharp or more extensive than required for joint strength. Ladders shall be provided with structural steel brackets, drilled to receive anchor bolts, and welded to side rails. Bracket spacing shall not exceed 3.1 meter 10 feet on center.

Exterior and interior ladders, including brackets and fasteners, shall be galvanized where indicated.

2.15.7 Ladder Safety Cages

NOTE: Minimum design requirements for ladder safety cages are specified in 29 CFR 1910, Section 27.

Cages shall be basket guard hoop type, located and detailed as indicated and specified. Cages shall be fabricated from structural steel flat bars and assembled by bolting or welding. Top and bottom hoops and intermediate hoops at intervals of not more than 6.1 meter 20 feet between top and bottom hoops, shall be 100 by 8 millimeter 4 inches by 5/16 inch. Hoops between 100 millimeter 4-inch wide hoops shall be 50 by 8 millimeter 2 inches by 5/16 inch and spaced not more than 1.2 meter 4 feet on center. Vertical bars shall be 50 by 8 millimeter 2 inches by 5/16 inch and spaced not more than 230 millimeter 9 inches or 40 degrees on center. Hoops shall be fastened to the steel ladder side rails with M15 1/2-inch steel bolts or be shop welded.

[Exterior] [and] [interior] ladder safety cages, including fasteners, shall be galvanized.

2.15.8 Loose Steel Lintels

NOTE: Delete paragraph heading and following paragraphs when reinforced masonry or concrete lintels only are required. Lintel types required must be indicated.

Lintels shall be provided for openings and recesses in masonry walls and partitions as indicated.

Lintels shall be structural steel shapes as indicated. Lintels consisting of more than one member shall be welded together to form one unit. Bearing at each side of openings shall be not less than 150 millimeter 6 inches.

Lintels installed in exterior walls shall be galvanized.

2.15.9 Metal Safety Nosing for Concrete Treads

Nosings shall be provided for interior concrete stair treads and concrete platforms and landings, as indicated.

Nosings shall be nonskid type, [cast iron class, with 6 millimeter 1/4-inch radius nose lip, conforming to FS RR-T-650, Composition D, Type 5.] [cast aluminum-alloy class, with 6 millimeter 1/4-inch radius nose lip, conforming to FS RR-T-650 (where abrasive material in top surface is embedded not less than 1.5 millimeter).]

Nosings shall be 100 millimeter wide by 200 millimeter 4-inches wide by 8-inches shorter in length than the width of concrete tread, platform or landing. Each nosing shall be equipped with integrally cast anchors for embedding in fresh concrete. Anchors shall be spaced not more than 100

millimeter 4 inches from each nosing end and not more than 380 millimeter 15 inches on centers.

2.15.10 Miscellaneous Steel Framing and Supports

Miscellaneous steel framing and supports that do not form a part of the structural steel framework shall be provided to complete the work.

Miscellaneous steel framing and supports shall be fabricated of structural steel plates, shapes, bars, and tubing, of sizes and arrangement indicated.

Exterior [and interior] fabricated steel framing and supports shall be galvanized as indicated.

2.15.11 Roof Scuttles

Roof scuttles shall be single-leaf type, sized to provide a minimum clear opening of [760 by 900] [30 by 36] [_____ by _____] millimeter inches.

Steel sheets shall be prime painted, electro-deposited galvanized, hot-rolled carbon steel sheets; covers and curbs shall be 2.0 millimeter, and 0.85 millimeter 14 gage, and 22 gage for cover liner.

Steel sheets shall be hot-dip-galvanized carbon steel sheets. Sheet equivalent thickness shall be 2.0 millimeter 0.0785 inch (14 galvanized sheet gage) for covers and curbs and 0.85 millimeter 0.0336 inch (22 galvanized sheet gage) for cover liner.

Cover shall be formed from one piece of the specified steel sheet with 75 millimeter 3-inch hemmed edge and corners full welded and ground smooth. Cover shall be insulated with either glass fiber or rigid fiberboard insulation 25 millimeter 1 inch thick. Insulation shall be covered and protected by the specified steel sheet cover liner.

Curbs shall be made of the specified steel sheet 300 millimeter 12 inches in height, formed with 90 millimeter 3-1/2-inch mounting flange having holes for securing to the roof deck. Curb shall be equipped with an integral metal cap flashing made of the same metal and gage as the curb, having corners full welded and ground smooth. Curb shall be insulated on the exterior face with rigid fiberboard insulation 25 millimeter 1 inch thick.

Scuttles shall be completely assembled with heavy pintle hinges, either compression-spring operators enclosed in telescopic tubes or enclosed torsion-spring operators; they shall have an automatic locking hold-open arm provided with hand-grip handle, positive snap latch with an operating handle both inside and outside, provisions for padlocking on the inside, and chloroprene elastomer weatherseal. Hardware shall be zinc- or cadmium-coated.

2.15.12 Safety Chains

Chains, complete with snap fasteners on each end and eye bolts for attachment of chains, shall be provided for each guarded opening where indicated.

Chains shall be galvanized, welded type, proof coil steel chain, 5 millimeter 3/16-inch nominal size, with at least 33 links per meter 10 links per foot, proof loading not less than 4,500 newton 1,000 pounds,

zinc-coated, conforming to ASTM A 467/A 467M.

Snap fasteners shall be boat type with strength equivalent to the chain proof loading. Eye bolts for attachment of chains shall be M10 3/8-inch bolt with 19 millimeter 3/4-inch eye diameter and shall have strength equal to the chain proof loading. Safety fasteners and eye bolts shall be galvanized.

Two chains 150 millimeter 6 inches longer than the anchorage spacing shall be provided for each guarded opening. Top chain shall be mounted not less than 1 meter 3 feet 6 inches above the floor and the second chain shall be mounted 0.6 meter 2 feet above the floor.

2.15.13 Shelf Angles

NOTE: Shelf angles connected to structural steel work are specified in Section 05 12 00 STRUCTURAL STEEL.

Angles attached to concrete framing shall be structural steel angles of the sizes indicated. Angles shall be provided with slotted holes to receive M20 3/4-inch bolts, spaced not more than 150 millimeter 6 inches from each shelf angle end and not more than 600 millimeter 24 inches on center.

Angles to be installed in exterior walls shall be galvanized.

Wedge-type concrete inserts, complete with fasteners, shall be provided for the attachment of shelf angles to cast-in-place concrete.

2.15.14 Steel Pipe Railings

NOTE: Nonferrous pipe railings and ornamental railings are specified in Section 05 70 00.00 40 DECORATIVE METALS. Design requirements for railings are specified in 29 CFR 1910, Section 23.

Steel pipe railings shall include guarding at open-sided areas consisting of top rail, intermediate rail and posts, and handrails at walls, as indicated.

Minimum railings shall be 38 millimeter 1-1/2-inch nominal size and standard weight, conforming to ASTM A 500, Grade B, ASTM A 501; or may be 38 millimeter 1-1/2-inch nominal size, 4.1 kilogram per meter 2.72 pounds weight per foot round structural-steel tubing.

Joining of post, rails, and corners shall be made by one of the following methods:

Flush-type steel railing fittings, welded and ground smooth, with railing splice locks secured with M10 3/8-inch hexagonal recessed-head setscrews.

Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a

tight-fitting interior sleeve not less than 150 millimeter 6 inches long.

Railings may be bent at corners instead of joining, provided the bends are made in suitable jigs and that the cylindrical cross section of the pipe is maintained throughout the entire bend.

Removable railing sections shall be provided as indicated.

Kickplates shall be provided between railing posts where indicated. Kickplates shall be steel flat bars 6 millimeter 1/4-inch thick by not less than 150 millimeter 6 inches high. Kickplates shall be secured as indicated.

Exterior and interior railings, including pipe, fittings, brackets, fasteners and other ferrous metal components where indicated shall be galvanized; interior railings not indicated galvanized shall be black.

2.15.15 Steel Stairs

NOTE: When Section 05 51 00.00 40 METAL STAIRS is used edit out 2.15.15 through 2.15.15.8. Steel stairs shall be of the type, arrangement, and design to conform to Class A, "Interior Stairs and Smokeproof Towers," Sections 5.2.2 And 5.2.3, National Fire Protection Association "Code for Safety to Life from Fire in Buildings and Structures," NFPA 101. Where applicable 29 CFR 1910, Section 24 shall also be followed.

Steel stairs shall be constructed to conform to the sizes and arrangements indicated. Steel framing, hangers, columns, struts, clips, brackets, bearing plates, and other components shall be provided as required for the support of stairs and platforms.

2.15.15.1 Stair Framing

Stringers shall be structural steel channels or structural steel plates or a combination thereof, as indicated. Exposed ends of stringers shall be closed.

Platform of structural steel channel headers and miscellaneous framing members shall be constructed as indicated. Headers shall be bolted to stringers and newels. Framing members shall be bolted to stringers and headers.

2.15.15.2 Metal Pan Risers, Subtreads, and Subplatforms

Metal pans shall be formed from 2.8 millimeter 12-gage structural steel sheets and shall be made to receive cement fill. Structural steel sheets shall be uncoated, hot-rolled, carbon steel of structural quality having a minimum yield point of 275.8 Megapascal 40,000 psi and shall conform to ASTM A 1011/A 1011M, Grade 40.

Metal pans shall be formed from 2.8 millimeter 12-gage structural steel sheets, galvanized, and shall be made to receive cement fill. Galvanized structural steel sheets shall be hot-dip galvanized, carbon steel

structural quality having a minimum yield point of 227.5 Megapascal 33,000 psi and shall conform to ASTM A 653/A 653M, Grade A, with zinc coating conforming to ASTM A 653/A 653M and ASTM A 924/A 924M.

Riser and subtread metal pans shall be formed with nosing and sanitary cove as indicated. Tread and riser supporting brackets shall be structural steel angles, of size indicated, welded to stringers. Metal pans shall be secured to brackets with rivets or with welds.

Subplatform metal pans shall be secured to platform framing members with welds.

Metal safety nosings shall be nonskid type, cast aluminum-alloy class with 9 millimeter 3/8-inch radius nose lip, conforming to FS RR-T-650. Nosings shall be 100 millimeter 4-inches wide by length of tread and landing as applicable. Each nosing shall be equipped with integrally cast anchors for embedding in fresh cement fill. Anchors shall be spaced not more than 100 millimeter from each nosing end and not more than 15 inches 380 millimeter on center.

2.15.15.3 Steel Floor Plate Treads

Steel floor plate shall be carbon steel plate having raised figure at regular intervals on the surface conforming to ASTM A 786/A 786M, and pattern shall be No. [1] [2] [3] [4] [5].

Treads shall be formed of 6 millimeter 1/4-inch thick steel floor plate with nosing and back resistance welded carbon steel mechanical tubing conforming to ASTM A 513, of size indicated, welded to stringers. Treads shall be secured to brackets with welds.

Platforms shall be steel floor plate of the thickness indicated. Nosing matching that on steel floor plate treads shall be provided at landings.

2.15.15.4 Floor Grating Treads and Platforms

Floor grating shall be carbon steel, all-welded, parallel bearing bars with right-angle cross members, conforming to NAAMM MBG 531.

Grating treads shall be open riser type, fabricated from floor grating having the bearing bar size indicated, with steel floor plate nosing on front edge and with steel angle or steel plate carrier at each end for string connections. Treads shall be secured to stringers with bolts.

Platforms shall be fabricated from floor grating having the bearing bar size indicated. Nosing matching that on grating treads shall be provided at all landings. Open-sided edges of floor grating platforms shall be provided with toe plates, and all other edges shall be provided with end-banding bars. Grating shall be secured to platform framing members as indicated.

2.15.15.5 Stair Railings and Handrails

[Newels shall be fabricated from steel tubing of wall thickness and shape indicated, with gray iron casting caps. Steel tubing shall be electric-resistance-welded carbon steel mechanical tubing conforming to ASTM A 513, or it may be cold-formed welded or seamless structural steel tubing conforming to ASTM A 500, Grade A, B, or C; or ASTM A 53/A 53M, Type E or S, Grade B. Remainder of stair railings and handrails at walls shall

be steel pipe railings as specified.]

[Stair railings and handrails at walls shall be steel pipe railings as specified.]

2.15.15.6 Soffit Clips

Stair treads and platforms shall be provided with soffit clips having holes for attaching metal furring for plastered soffits. Clips shall be spaced not more than 300 millimeter 12 inches on center.

2.15.15.7 Exterior Stairs

Exterior stairs, including platforms, railings, and other ferrous metal components shall be galvanized.

2.15.15.8 Workmanship

Welding shall be used for joining pieces together. Bolts or similar fastenings shall not appear on finish surfaces. Joints shall be true and tight and connections between parts lightproof tight. Welds shall be continuous and ground smooth.

Stair work shall be erected to line, plumb, square, true, and level. Runs shall register level with floor and platform levels.

2.16 STEEL DOOR FRAMES

NOTE: Structural steel door frames connected to structural steel work are specified in Section 05 12 00 STRUCTURAL STEEL. Structural steel frames for UL-labeled openings are specified with the fire door in Division 8, "Doors and Windows." Pressed steel door frames are specified in Section 08 11 13 STEEL DOORS AND FRAMES.

Steel door frames shall be made of steel shapes of the sizes and weights indicated. Frames shall be fabricated by welding and shall be uniform, square and true. Built-up members shall be plug welded; exposed joints shall be continuously welded, with welds ground smooth. Steel bar stops shall be 38 by 16 millimeter 1-1/2 inches by 5/8 inch and shall be plug welded to frames except where stops are indicated to be removable. Removable stops shall be secured to frame with machine screws, uniformly spaced not more than 250 millimeter 10 inches on center. Any necessary reinforcement shall be made and the frames shall be drilled and tapped as required for finish hardware.

Anchors shall be provided for securing door frames into adjoining concrete or masonry. Anchors shall be structural steel bars 3 by 50 millimeter 1/8 inch by 2 inches by length as required for a minimum embedment of 100 millimeter 4 inches in the concrete or masonry. Anchors shall be welded to frames. Anchors shall be located on jambs not more than 300 millimeter 12 inches from both the bottom and head of frame and at uniformly spaced intermediate intervals not exceeding 750 millimeter 30 inches on center between anchors.

Exterior [and interior] steel door frames shall be galvanized where

indicated.

2.17 WHEEL GUARDS

Guards shall be gray iron castings, hollow-core type, of the shape indicated, with wall thickness not less than 19 millimeter, 3/4 inch, with holes for M24 7/8-inch diameter countersunk anchor bolts, and with grout holes.

2.18 WIRE MESH PARTITIONS

NOTE: If Section 10 22 00.00 40 PARTITIONS is used,
edit out all of 2.18 through 2.19. Wire mesh
partition height, type and size of doors, and size
of service windows, if required, must be indicated
on the drawings.

Partition panels shall be 1.5 meter 5-feet wide by the height indicated, fabricated of steel wire mesh securely clinched into the panel frames. Frames shall be fabricated of steel channels with corners mortised and tenoned and with vertical members having 6 millimeter 1/4-inch diameter holes spaced not more than 300 millimeter 12 inches on center for bolting to adjacent panels. Horizontal reinforcement shall be one steel channel with the wire mesh woven through the reinforcement channel, or it may be two steel channels, one on each side of the wire mesh and riveted together. Horizontal reinforcement shall be tenoned to the panel frame vertical members and shall be located approximately 1050 millimeter 42 inches above the bottom of the panel. Size of partition panel components shall be as follows:

Wire mesh shall be [3.5 millimeter 10-gage (0.135-inch) steel wire woven into 38 millimeter 1-1/2-inch diamond mesh.] [4.9 millimeter 6-gage (0.192-inch) steel wire woven into 50 millimeter 2-inch diamond mesh.]

Frame horizontal members shall be [25 by 13] [38 by 19] by 3.2 millimeter [1- by 1/2-] [1-1/2- by 3/4-] by 1/8-inch hot-rolled carbon steel channels.

Horizontal reinforcement shall be [one 25 by 13] [two 25 by 19] [38 by 19] by 3.2 millimeter [one 1- by 1/2-] [two 1- by 3/4-] [1-1/2- by 3/4-] by 1/8-inch hot-rolled carbon steel channels.

Frame vertical members shall be the same as horizontal members or may be 32 by 16 millimeter 1-1/4- by 5/8-inch cold-formed C-channels fabricated from 3.1 millimeter 11-gage (0.120-inch) cold-rolled carbon steel sheets.

Measurements shall be made at the building for final location of pipes, ducts, electrical conduit, and other items that will pass through wire mesh partitions. At such locations, openings shall be framed using the same size steel channels as those specified for the partition panels.

Bolts, hardware, accessories, field bracing, and other components shall be provided as required for a complete installation.

2.18.1 Vertical Reinforcement

NOTE: Vertical reinforcement is required for
standard partitions 3 meter 10 feet or more in
height and for all heavy duty partitions.

Vertical reinforcement shall be provided between partition panels.
Vertical reinforcement shall be hot-rolled carbon steel flat bars. Bars
shall be provided with bolt holes to match those in partition panels and
shall be of the following sizes:

NOTE: Delete following paragraphs when standard
partitions (38 millimeter 1-1/2-inch diamond mesh)
having vertical reinforcement are not required.

[8 by 45 millimeter 5/16-inch by 1-3/4-inches for partitions not
exceeding 4.3 meter 14 feet in height]

[8 by 64 millimeter 5/16-inch by 2-1/2-inches for partitions over 4.3
meter 14 feet not exceeding 5.2 meter 17 feet in height]

[8 by 45 millimeter 5/16-inch by 3-inches for partitions over 5.2 meter
17 feet not exceeding 6.1 meter 20 feet in height]

NOTE: Delete following paragraphs when heavy duty
partitions (50 millimeter 2-inch diamond mesh) are
not required.

[8 by 64 millimeter 5/16-inch by 2-1/2-inches for partitions over 2.1
meter 7 feet not exceeding 3.7 meter 12 feet in height]

[8 by 75 millimeter 5/16-inch by 3-inches for partitions over 3.7 meter
12 feet not exceeding 4.9 meter 16 feet in height]

[8 by 89 millimeter 5/16-inch by 3-1/2 inches for partitions over 4.9
meter 16 feet not exceeding 6.1 meter 20 feet in height]

2.18.2 Top Capping

NOTE: Top capping bar is required for partitions 6
meter 20 feet or more in length.

Top capping bar shall be provided for wire mesh partitions. Top capping
shall be provided with 6 millimeter 1/4-inch diameter holes spaced not more
than 600 millimeter 24 inches on center for U-bolting to the partition
panels, and shall be [57 by 25 by 3 millimeter 2-1/4- by 1- by 1/8-inch
hot-rolled carbon steel channel for use with 38 millimeter 1-1/2-inch
diamond mesh.] [75 millimeter 3-inch structural steel channel weighing 6.1
kilogram per meter 4.1 pounds per foot for use with 50 millimeter 2 inch
diamond mesh.]

2.18.3 Corner Posts

NOTE: Corner posts may be steel pipe or structural
steel tubing or structural steel I-beams instead of
steel angles

Corner posts shall be provided at wire mesh partition corners. Posts shall be provided with bolt holes to match those in partition panels and shall be [32 by 32 by 3 millimeter 1-1/4- by 1-1/4- by 1/8-inch hot-rolled carbon steel angles for 38 millimeter 1-1/2-inch diamond mesh.] [45 by 45 by 3 millimeter 1-3/4- by 1-3/4- by 1/8-inch hot-rolled carbon steel angles for 50 millimeter 2-inch diamond mesh.]

2.18.4 Swing Doors

Door construction shall match that of partition panels. Door frames shall be covered on four sides with hot-rolled carbon steel flat bar the same width as the frame and 3 millimeter 1/8-inch thick. Each swing door shall be provided with one and one-half pairs of butts riveted to both the door frame and jamb.

2.18.5 Sliding Doors

Sliding doors shall be the size indicated. Door construction shall be the same as that specified for partition panels. Door frames shall be covered on four sides with hot-rolled carbon steel flat bar the same width as the frame and 3 millimeter 1/8-inch thick. Each sliding door shall be provided with two [two] [four] -wheel roller bearing hangers traveling in an enclosed track, with a bottom guide rail.

2.18.6 Door Hardware

Bronze mortise lock capable of receiving the Lock Cylinder without modification. Lock shall be key-operated on the outside and recessed turn-knob-operated on the inside.

2.18.7 Service Windows

Service windows shall be provided where indicated. Windows shall be slide-up type with shelf. Window openings shall be 600 millimeter 24 inches nominal width by 380 millimeter 15-inches nominal height. Window frame and wire mesh shall be the same as that specified for the partition panels. Shelf shall be 600 millimeter 24 inches nominal width by 300 millimeter 12 inches in depth and shall be formed from 12-gage, 2.8 millimeter hot-rolled carbon steel sheet. Windows shall be provided with spring catches that lock window in the open or closed position.

2.19 WIRE MESH WINDOW GUARDS

Guards shall be fabricated from 3.5 millimeter 10-gage (0.135-inch) steel wire woven into 38 millimeter 1-1/2-inch diamond mesh clinched into the frame. Frame shall be fabricated from 25 by 13 by 3 millimeter 1- by 1/2- by 1/8-inch hot-rolled carbon steel channels with corners mitered and welded. Window guards 1.5 meter 5 feet and over in height shall be provided with center horizontal reinforcement consisting of two 25 by 10 by 3 millimeter 1-by 3/8-by 1/8-inch hot-rolled carbon steel channels, one on each side of the wire mesh riveted together. Horizontal reinforcement

shall be welded to the frame vertical members.

Subframes shall be 32 by 32 by 3 millimeter 1-1/4- by 1-1/4- by 1/8-inch hot-rolled carbon steel angles with 6 millimeter 1/4-inch diameter holes spaced not more than 300 millimeter 12 inches on center for bolting to the building construction.

Each window guard shall be provided with one pair of tamperproof hinges for window guards 1.5 meter 5 feet and less in height and one additional hinge for each 0.9 meter 3-foot increase, or fraction thereof, in height over 1.5 meter 5 feet. One tamperproof padlock hasp shall be provided with each hinge used.

Window guards, subframes, hardware, and fasteners shall be galvanized.

PART 3 EXECUTION

3.1 GENERAL

Fabricated metal work shall be installed in accordance with the approved detail drawings and descriptive data for each item of fabricated metal, and as specified.

Fabricated metal items shall be securely fastened plumb and true to lines and levels.

3.2 ANCHORAGE DEVICES EMBEDDED IN OTHER CONSTRUCTION

Anchorage devices, such as concrete inserts, anchor bolts, and fabricated metal items having integral anchors, which are to be embedded in cast-in-place concrete and masonry construction, shall be delivered in time to be installed before the start of cast-in-place concrete operations and masonry work.

Setting drawings, templates, instructions, and directions shall be provided for the installation of the anchorage devices.

3.3 FASTENING TO CONSTRUCTION-IN-PLACE

Anchorage devices and fasteners shall be provided where necessary for fastening fabricated metal items to construction-in-place. Fastening shall include threaded fasteners for concrete inserts embedded in cast-in-place concrete; masonry anchorage devices and threaded fasteners for solid masonry and concrete-in-place; toggle bolts for hollow masonry and stud partitions; through bolting for masonry and wood construction; lag bolts and wood screws for wood construction; and connections for structural steel. Fastening shall be provided as indicated and as specified. Fastening to wood plugs in masonry or concrete-in-place will not be permitted.

3.4 CUTTING AND FITTING

Cutting, drilling, and fitting required shall be performed for the installation of fabricated metal work. Cutting, drilling, and fitting shall be executed carefully; when required, work shall be fitted in place before fastening.

3.5 SETTING MASONRY ANCHORAGE DEVICES

Masonry anchorage devices shall be set in masonry or concrete-in-place construction in accordance with the anchorage device manufacturer's printed instructions. Holes shall be of the recommended depth and diameter and shall be drilled as recommended by the manufacturer of the particular anchorage device used. Drilled holes shall be left rough, not reamed, and free of drill dust.

3.6 FIELD WELDING

Procedures for manual shielded metal arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS D1.1/D1.1M, "Workmanship" and "Technique."

Welding shall be continuous along the entire area of contact except where tack welding is permitted. [Exposed connection of fabricated metal work in place shall not be permitted.] [Exposed connection of fabricated metal work in place shall not be tack welded.] Exposed welds shall be ground smooth.

3.7 THREADED CONNECTIONS

Where exposed to view, bolt and screw heads shall be flat and countersunk, unless otherwise specified. Threaded connections shall be made up tightly so that the threads will be entirely concealed by fitting.

3.8 STEEL PIPE RAILINGS

Railings shall be adjusted prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Posts shall be spaced not more than 1.8 meter 6 feet on center and shall be plumb in each direction. Posts and rail ends shall be secured to building construction as follows:

Concrete anchorage for posts shall be by means of pipe sleeves set and anchored into the concrete. Sleeves shall be galvanized, standard weight steel pipe not less than 150 millimeter 6 inches long and have an inside diameter not less than 13 millimeter 1/2 inch greater than the outside diameter of the inserted pipe post. Steel plate closure shall be provided, secured to the bottom of the sleeve, and shall be of width and length not less than 25 millimeter 1 inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, the annular space between post and sleeve shall be filled solid with molten lead, sulfur, or a quick-setting hydraulic cement. Anchorage joint shall be covered with a steel round flange welded to the post.

Steel anchorage for posts shall be made by means of steel oval flanges, angle or floor type required by conditions, welded to posts and bolted to the structural steel supporting members.

Concrete and masonry anchorage for rail ends shall be by means of steel round flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

Steel anchorage for rail ends shall be by means of steel oval or round flanges welded to rail ends and bolted to the structural steel members.

Handrails shall be secured to walls by means of wall brackets and wall return fitting at handrail ends. Brackets shall be malleable iron castings with not less than an 75 millimeter 3-inch projection from the finished wall surface to the center of the pipe handrail and with the wall plate portion of the bracket drilled to receive one M10 3/8-inch bolt. Brackets shall be located not more than 1525 millimeter 60 inches on center. Wall return fittings shall be cast-iron castings, flush-type, with the same projection as that specified for wall brackets. Wall brackets and wall return fittings shall be secured to building construction as follows:

Concrete and solid masonry anchorage shall be by means of bolt anchor expansion shields and lag bolts.

Hollow masonry and stud partition anchorage shall be by means of toggle bolts having square heads.

3.9 STRUCTURAL STEEL DOOR FRAMES

Bottom of frames shall extend below the finish floor elevation and shall be secured to the concrete slab by means of steel angle clips and expansion shields and bolts. Angle clips shall be welded to frames.

3.10 WHEEL GUARDS

Guard shall be anchored to concrete or masonry construction in accordance with the manufacturer's instructions.

Hollow cores shall be filled with air-entrained portland cement concrete having a 28-day compressive strength of not less than 20 Megapascal 3,000 psi, maximum coarse aggregate size of 19 millimeter 3/4 inch. Packaged concrete materials shall conform to ASTM C 387 for normal strength air-entrained concrete. Water shall be potable. Concrete mixing shall be done in a batch-type mechanical mixer equipped with a suitable charging hopper, water storage tank, and water-measuring device. Mixer shall be capable of mixing the concrete ingredients into a uniform mass within the specified mixing time and of discharging the mix without segregation. Each batch of 1.53 cubic meter 2 cubic yards or less shall be mixed for not less than 1-1/2 minutes; the mixing time shall be increased 15 seconds for each additional cubic .75 meter yard or fraction thereof. Concrete shall be handled from the mixer to the location of final deposits as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials. Concrete shall be deposited continuously.

3.11 WIRE MESH WINDOW GUARDS

NOTE: If Section 10 22 00.00 40 PARTITIONS is used,
edit out 3.11.

Guards shall be mounted on the exterior of the window frame. Subframes shall be anchored to concrete jambs and solid masonry jambs with lead expansion shields and bolts, to wood jambs with lag bolts. Hinges and padlock hasps shall be welded to the subframes and window guard frames. Padlock hasps shall be accessible from the interior and shall be installed on the jamb opposite the hinged jamb.

3.12 COUNTER SHUTTER

Rolling counter shutter with integral frame curtain shall consist of interlocking slats of 1.3 millimeter 0.050-inch thick anodized aluminum, with a tubular aluminum bottom bar with concealed slide bolts and vinyl astragal. Integral frame unit shall be extruded aluminum of 6063 alloy. Hood shall be aluminum not less than 1.0 millimeter 0.040-inch thick. Rolling counter door shall be manually operated with a helical torsion spring counterbalance having a 25 percent safety factor. A key lock shall be provided in sill.

3.13 TOUCHUP PAINTING

NOTE: When abrasive blasting with silica sand is performed, protective equipment required by NIOSH (National Institute for Occupational Safety and Health) must be used, to assure safety.

The only respirator suitable for use when using silica sand is Type CE, pressure-demand, abrasive blast supplied air respirator, with a protection factor of 2000.

When silica sand is not used as the blasting agent, and when a protection factor of 25 (loose fit hood/helmet) will provide adequate protection than Type CE, continuous flow, abrasive blast supplied air respirator shall be used.

After installation of fabricated metal work, the Contractor shall touch up field welds, field bolt heads and nuts, screw heads, damaged galvanized steel, and scarred surfaces on fabricated metal work and on adjacent ferrous metal surfaces. Touchup and repair shall be accomplished as soon as possible after the damage or installation has occurred. Surfaces shall be degreased, as required, prior to subsequent surface preparation. Degreasing shall be accomplished by steam cleaning or washing with a solution of trisodium phosphate in water followed by a fresh water rinse. Cuts, welds, and large damaged areas shall be sandblasted to near white SSPC SP 10. Blasting abrasive shall be sharp silica sand, size 16 to 35 mesh. When sandblasting is prohibited or impractical, mechanical cleaning by needle gun or abrasive disks or wheels shall be used. Minor abrasions and scars where extensive rusting has not occurred shall be rendered clean and dry and touched up without further surface preparation. Repair coating shall be applied within 6 hours after surface preparation or before rusting or re-contamination occurs. Touchup and repair material shall be the same inorganic zinc coating as applied in the shop. Application shall be by airless or conventional spray. Compressed air used for blasting and coating shall be free of moisture and oil. Manufacturer's recommended procedures shall be followed and the requirements of Section 09 97 13.00 40 STEEL COATINGS shall apply.

3.14 RAISED PATTERN FLOOR PLATES

NOTE: Raised pattern steel floor plates must not be used in wet or oily areas.

Floor plates, except floor plates indicated as removable, shall be welded to supporting members. Removable plates shall be fabricated to sizes indicated and secured with flush countersunk bolts. Joints in plates shall occur only over supports. Openings in flooring shall be provided as indicated.

3.15 STEEL BAR GRATING

Panels, except panels indicated as removable, shall be welded to supporting members. Removable panels shall be fabricated to sizes indicated and secured with stud bolt anchors welded to supporting member. Anchors shall be designed to fit over two bearing bars, and four anchors shall be provided for each removable panel. Joints in panels shall occur only over supports. Notching of bearing bars at supports to maintain elevations will not be permitted. Openings in flooring shall be provided as indicated.

-- End of Section --