
USACE / NAVFAC / AFCEA UFGS-05502A (September 2003)

Preparing Activity: USACE (CW) Superseding
UFGS-05502A (May 1992)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05502A

METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS

09/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 LUMP SUM PRICE
 - 1.2.1 Metalwork Fabrication, Machine Work, Miscellaneous Provisions
 - 1.2.1.1 Payment
 - 1.2.1.2 Unit of Measure
- 1.3 SUBMITTALS
- 1.4 FABRICATION AND WORKMANSHIP REQUIREMENTS

PART 2 PRODUCTS

- 2.1 MISCELLANEOUS METALS AND STANDARD METAL ARTICLES
 - 2.1.1 Structural Steel
 - 2.1.2 Steel Plates
 - 2.1.2.1 Structural
 - 2.1.2.2 Pressure Vessel
 - 2.1.3 Steel Tubing
 - 2.1.3.1 Structural
 - 2.1.3.2 Mechanical
 - 2.1.4 Steel Pipes and Pipe Fittings
 - 2.1.4.1 Pipes
 - 2.1.4.2 Pipe Fittings
 - 2.1.5 Stainless Steel
 - 2.1.5.1 Plate, Sheet, and Strip
 - 2.1.5.2 Clad Plate
 - 2.1.5.3 Bars and Shapes
 - 2.1.5.4 Plates, Bars & Shapes for Roller & Track Systems
 - 2.1.5.5 Pipe
 - 2.1.6 Steel Forgings
 - 2.1.6.1 General Industrial Use
 - 2.1.6.2 Railway Use
 - 2.1.7 Steel Castings
 - 2.1.8 Steel Strips
 - 2.1.9 Aluminum
 - 2.1.9.1 Sheets and Plates

- 2.1.9.2 Bars, Rods and Wire
- 2.1.9.3 Structural Shapes
- 2.1.9.4 Castings
- 2.1.9.5 Pipes and Tubes
- 2.1.10 Bronze
 - 2.1.10.1 Copper Alloy Castings
 - 2.1.10.2 Aluminum Bronze Castings
 - 2.1.10.3 Aluminum Bronze Rods, Bars, and Shapes
 - 2.1.10.4 Manganese Bronze Castings
 - 2.1.10.5 Rolled Manganese Bronze and Manganese Bronze Forgings
 - 2.1.10.6 Manganese Bronze Rods, Bars, and Shapes
- 2.1.11 Brass
 - 2.1.11.1 Sheet, Plates, and Bars
 - 2.1.11.2 Castings
 - 2.1.11.3 Naval Brass
- 2.1.12 Copper Flat Products
- 2.1.13 Lead Sheet
- 2.1.14 Zinc
- 2.1.15 Babbitt Metal
- 2.1.16 Bolts, Nuts, and Washers
 - 2.1.16.1 High-Strength Bolts, Nuts, and Washers
 - 2.1.16.2 Bolts, Nuts, and Washers (Other Than High-Strength)
- 2.1.17 Screws
 - 2.1.17.1 Cap Screws
 - 2.1.17.2 Machine Screws
 - 2.1.17.3 Wood Screws
 - 2.1.17.4 Set Screws
- 2.1.18 Expansion Anchors
- 2.1.19 Toggle Bolts
- 2.1.20 Rivets
- 2.1.21 Safety Treads
- 2.1.22 Wire Rope
- 2.1.23 Chains and Attachments
- 2.1.24 Steel Rails
- 2.1.25 Cast Iron Frames and Covers
- 2.1.26 Steel Wheels
- 2.1.27 Floor Gratings
- 2.1.28 Steel Floor Plate
- 2.2 SHOP FABRICATED METAL ITEMS
 - 2.2.1 Railings
 - 2.2.1.1 Materials
 - 2.2.1.2 Fabrication
 - 2.2.1.3 Installation
 - 2.2.2 Gratings and Cover Plates
 - 2.2.2.1 Grating
 - 2.2.2.2 Cover Plates
 - 2.2.3 Steel Stairs
 - 2.2.4 Recess Frames
 - 2.2.5 Ladders
 - 2.2.6 [Ladder Rungs] [Grab Bars] [Pulling Irons] [Mooring Rings]
 - 2.2.7 Lock Wall Armor
 - 2.2.8 Lock Wall Line Hooks and Check Posts

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA UFGS-05502A (September 2003)

Preparing Activity: USACE (CW) Superseding
UFGS-05502A (May 1992)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION 05502A

METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS
09/03

NOTE: This guide specification covers the requirements for providing all equipment, materials, and labor for fabricating, furnishing, and installing miscellaneous metal materials, standard metal articles, and shop fabricated items.

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: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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.

ASME INTERNATIONAL (ASME)

ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws, Inch Series
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts
ASME B18.21.1	(1999) Lock Washers (Inch Series)
ASME B18.22.1	(1965; R 1998) Plain Washers
ASME B18.22M	(1981; R 2000) Metric Plain Washers
ASME B18.3	(1998) Socket Cap Shoulder and Set Screws Hex and Spline Keys
ASME B18.6.1	(1981; R 1997) Wood Screws (Inch Series)
ASME B18.6.2	(1998) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series (B18.6.2)
ASME B18.6.3	(1999) Machine Screws and Machine Screw Nuts
ASME B27.7	(1977; R 1999) General Purpose Tapered and Reduced Cross Section Retaining Rings, Metric

ASTM INTERNATIONAL (ASTM)

ASTM A 1	(2000) Carbon Steel Tee Rails
ASTM A 109/A 109M	(2003) Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 148/A 148M	(2003) Steel Castings, High Strength, for Structural Purposes
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2003a) Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both

ASTM A 20/A 20M	(2002) General Requirements for Steel Plates for Pressure Vessels
ASTM A 240/A 240M	(2003c) Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels for General Applications
ASTM A 263	(2003) Stainless Chromium Steel-Clad Plate
ASTM A 264	(2003) Stainless Chromium-Nickel Steel-Clad Plate, Sheet, and Strip
ASTM A 27/A 27M	(2003) Steel Castings, Carbon, for General Application
ASTM A 276	(2003) Stainless Steel Bars and Shapes
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 312/A 312M	(2002) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 320/A 320M	(2003) Alloy/Steel Bolting Materials for Low-Temperature Service
ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(2003) Structural Bolts, Steel, Heat Treated, 830 Mpa Minimum Tensile Strength (Metric)
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 484/A 484M	(2003a) General Requirements for Stainless Steel Bars, Billets, and Forgings
ASTM A 490	(2002) Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A 490M	(2003) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 500	(2003) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(2001) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 504	(1993; R 1999) Wrought Carbon Steel Wheels
ASTM A 514/A 514M	(2000a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for

Welding

ASTM A 516/A 516M	(2003) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 519	(1996; R 2001) Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 564/A 564M	(2002a) Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A 572/A 572M	(2003a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(2003) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 618	(2001) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 668/A 668M	(2003) Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A 730	(1993; R 1999) Forgings, Carbon and Alloy Steel, for Railway Use
ASTM A 786/A 786M	(2000b) Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM B 121/B 121M	(2001) Lead Brass Plate, Sheet, Strip, and Rolled Bar
ASTM B 124/B 124M	(2000) Copper and Copper Alloy Forging Rod, Bar, and Shapes
ASTM B 138/B 138M	(2001) Manganese Bronze Rod, Bar and Shapes
ASTM B 148	(1997; R 2003) Aluminum-Bronze Sand Castings
ASTM B 150/B 150M	(2003) Aluminum Bronze Rod, Bar, and Shapes
ASTM B 152/B 152M	(2000) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 176	(1995) Copper-Alloy Die Castings
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B 21/B 21M	(2001e1) Naval Brass Rod, Bar, and Shapes
ASTM B 211	(2002) Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B 211M	(2002) Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric)
ASTM B 23	(2000) White Metal Bearing Alloys (known Commercially as "Babbitt Metal")
ASTM B 241/B 241M	(2002) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM B 271	(1996; R 2003) Copper-Base Alloy Centrifugal Castings
ASTM B 308/B 308M	(2002) Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B 36/B 36M	(2001) Brass Plate, Sheet, Strip, and Rolled Bar
ASTM B 505/B 505M	(2002) Copper-Base Alloy Continuous Castings
ASTM B 584	(2000) Copper Alloy Sand Castings for General Applications
ASTM B 6	(2000) Zinc
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 749	(2003) Lead and Lead Alloy Strip, Sheet, and Plate Products
ASTM B 763	(1998) Copper Alloy Sand Castings for Valve Application
ASTM B 806	(2002) Copper Alloy Permanent Mold Castings for General Applications
ASTM B 824	(2002) General Requirements for Copper Alloy Castings
ASTM F 436	(2003) Hardened Steel Washers
ASTM F 436M	(2003) Hardened Steel Washers (Metric)
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM MBG 531	(2000) Metal Bar Grating Manual
NAAMM MBG 531S	(1989) Guide Specification for Stainless Steel Grating

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2003) Safety -- Safety and Health
Requirements

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1922 (Rev A; Notice 1) Shield, Expansion
(Caulking Anchors, Single Lead)

CID A-A-1923 (Rev A; Notice 1) Shield, Expansion (Lag,
Machine and Externally Threaded Wedge Bolt
Anchors)

CID A-A-1924 (Rev A; Notice 1) Shield, Expansion (Self
Drilling Tubular Expansion Shell Bolt
Anchors)

CID A-A-1925 (Rev A; Notice 1) Shield Expansion (Nail
Anchors)

CID A-A-55614 (Basic; Notice 1) Shield, Expansion
(Non-Drilling Expansion Anchors)

CID A-A-55615 (Basic; Notice 1) Shield, Expansion (Wood
Screw and Lag Bolt Self-Threading Anchors)

CID A-A-60005 (Basic; Notice 1) Frames, Covers,
Gratings, Steps, Sump and Catch Basin,
Manhole

FS RR-C-271 (Rev D; Am 1) Chains and Attachments,
Welded and Weldless

FS RR-W-410 (Rev E) Wire Rope and Strand

1.2 LUMP SUM PRICE

NOTE: If Section 01270A MEASUREMENT AND PAYMENT is
included in the project specifications, this
paragraph title (LUMP SUM PRICE) should be deleted
from this section and the remaining appropriately
edited subparagraphs below should be inserted into
Section 01270A.

1.2.1 Metalwork Fabrication, Machine Work, Miscellaneous Provisions

1.2.1.1 Payment

Payment shall constitute full compensation for furnishing all plant, labor,
materials and equipment and performing all operations necessary for the
metalwork fabrication, machine work, miscellaneous provisions as specified.

1.2.1.2 Unit of Measure

Unit of measure: lump sum.

1.3 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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 projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy 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.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Fabricated Metal Items[; G][; G, [_____]]

Detail drawings shall be submitted for approval as specified and in Section 05055A METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-03 Product Data

Miscellaneous Metals and Standard Metal Articles[; G][; G, [_____]]
Shop Fabricated Metal Items[; G][; G, [_____]]

Lists of materials, and records which identify the disposition

of approved material and fabricated items in the work, shall be submitted for approval as specified and in Section 05055A METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-04 Samples

Miscellaneous Metals and Standard Metal Articles[; G][; G, [____]]
Shop Fabricated Metal Items[; G][; G, [____]]

Samples shall be submitted for approval as specified and in Section 05055A METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS. Samples of standard or fabricated items shall be full size and complete as required for installation in the work, and may be installed in the work, provided each sample is clearly identified and its location recorded.

SD-06 Test Reports

Miscellaneous Metals and Standard Metal Articles[; G][; G, [____]]
Shop Fabricated Metal Items[; G][; G, [____]]

Certified test reports for materials tests and analyses shall be submitted for approval as specified and in Section 05055A METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

1.4 FABRICATION AND WORKMANSHIP REQUIREMENTS

Fabrication requirements and workmanship provisions for items specified in this section shall conform with the requirements of Section 05055A METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

PART 2 PRODUCTS

2.1 MISCELLANEOUS METALS AND STANDARD METAL ARTICLES

Miscellaneous metal materials and standard metal articles shall conform to the respective specifications and other designated requirements. Sizes shall be as specified or shown. Where material requirements are not specified, materials furnished shall be suitable for the intended use and shall be subject to approval.

2.1.1 Structural Steel

[ASTM A 36/A 36M] [ASTM A 572/A 572M] Grade [____], Type [____]] [ASTM A 588/A 588M, Grade [____]].

2.1.2 Steel Plates

2.1.2.1 Structural

ASTM A 514/A 514M, Grade [____].

2.1.2.2 Pressure Vessel

ASTM A 516/A 516M, Grade [____], and shall meet the requirements of the Charpy V-notch impact tests and the drop-weight tests as specified in ASTM A 20/A 20M.

2.1.3 Steel Tubing

2.1.3.1 Structural

ASTM A 500, Grade [____], [[ASTM A 501] [ASTM A 618], Grade [____]],
[seamless] [welded], [outside diameter] [outside dimensions] and nominal
wall thickness as shown.

2.1.3.2 Mechanical

ASTM A 519 [seamless carbon] [alloy steel mechanical tubing], [hot
finished] [cold finished], Conditions [____] and [____], Grade dimensions
as shown.

2.1.4 Steel Pipes and Pipe Fittings

2.1.4.1 Pipes

ASTM A 53/A 53M, Type [E] [S], Grade [A] [B], [seamless] [electric-resistance
welded], [black] [galvanized], nominal size and weight class or outside
diameter and nominal wall thickness as shown, [plain] [threaded] [threaded
and coupled] ends.

2.1.4.2 Pipe Fittings

- a. Flanged - ASME B16.5, Class [____], faced and drilled.
- b. Screwed - ASME B16.3, Type [____].
- c. Butt-welding - ASME B16.9.

2.1.5 Stainless Steel

NOTE: UNS S30400, S40500, and S41000 are low
strength alloys suitable for use in welded
assemblies. UNS S21800 is an intermediate strength
alloy with excellent anti-galling characteristics.
UNS S17400 and S45000 are high strength alloys.
Welding of UNS S21800, S17400, and S45000 should be
avoided.

2.1.5.1 Plate, Sheet, and Strip

ASTM A 240/A 240M, UNS [S30400,] [S40500] or [S41008]. Plate finish shall
be hot-rolled and annealed or heat treated, and blast cleaned or pickled.
Sheet and strip finish shall be No. 1.

2.1.5.2 Clad Plate

NOTE: Thickness of cladding may have to be changed
for some applications.

ASTM A 263, with cladding conforming to ASTM A 240/A 240M, UNS S40500 or
S41008; or ASTM A 264, with cladding conforming to ASTM A 240/A 240M, UNS
S30400. Cladding shall be bonded on one side of base metal. Nominal

thickness of the cladding shall be 10 percent of the nominal total plate thickness or 2 mm 1/16 inch, whichever is greater. The thickness of the cladding shall not vary under the thickness specified by more than 2 percent of the nominal thickness of the clad plate. Plate finish shall be sandblasted, pickled, or, blast-cleaned and pickled. Stainless steel plate specified above in paragraph PLATE, SHEET, AND STRIP may be used in lieu of clad plate at the option of the Contractor.

2.1.5.3 Bars and Shapes

Stainless steel bars and shapes shall conform to the following as specified or shown:

- a. ASTM A 276, UNS [S30400, S40500, or S41000 with a maximum carbon content of 0.08 percent] [S21800], Condition A, hot-finished or cold-finished, Class C.
- b. ASTM A 564/A 564M, UNS S17400 or S45000, age-hardened heat treatment condition, hot-finished or cold-finished, Class C.

2.1.5.4 Plates, Bars & Shapes for Roller & Track Systems

NOTE: Rollers and track plates on gates and in gate slots which are subjected to hydraulic loads from water during operation of gates should be hardened by heat treatment as specified below in subparagraph GATE ROLLERS AND BOLTED TRACK PLATES. Hardened track plates are not suitable for welding and should be bolted in place. Track plates which are lightly loaded, such as gate upstream track plates, should conform to subparagraph WELDED SEAL PLATES AND BARS; WELDED ROLLER GUIDE BARS; AND WELDED TRACK PLATES below and be welded in place.

- a. Gate Rollers and Bolted Track Plates - ASTM A 564/A 564M, UNS S17400 or S45000, age-hardened heat treated to obtain a Brinell hardness range of 331 minimum to 401 maximum, hot-finished or cold-finished, Class C. Heat treatment of rollers and plates shall not commence until the heat treatment procedure and the test reports for other required material tests are approved. After heat treating and final machining, each roller and track plate shall be free of scale and cracks, as determined by magnetic particle, florescent, or dye penetrant inspection tests.

(1) Hardness Check Tests - Suitable 13 mm 1/2 inch thick samples of the material from each heat shall be tested to determine the hardness in both the solution-annealed and age-hardened conditions. Where the oven-batch heat-treating process is used, hardness check tests shall be performed on material of each heat in each oven batch. Where a continuous heat-treating process is used, three check tests shall be performed on material of each heat: one on the first material through the process, one at the middle of the run, and one on the last material through the process.

- b. Fasteners for Bolted Track Plates and Guide Bars - Bolting materials shall conform to ASTM A 193/A 193M or ASTM A 320/A 320M,

Class 2, Grade B8 Nuts shall conform to ASTM A 194/A 194M, Grade 8A.

c. Gate Roller Links and Pins

(1) Links - ASTM A 276, UNS S30400 or S41000, Condition A, hot-finished or cold-finished, Class A.

(2) Pins - ASTM A 276, UNS S21800, Condition A, cold-finished or hot-rolled and machine-finished to the tolerances specified in ASTM A 484/A 484M for cold-finished round bars, Class C.

NOTE: It is contemplated that the pin diameter and tolerances shown will be the minimum size and tolerances as given in ASTM A 484/A 484M for cold finished round bars. Machined pins should have a surface roughness of not exceeding 1.6 micrometers (63 microinches). Minimum diameter of holes in bars shall be the maximum pin size plus an allowance of 0.2 mm (0.008 inch) for a free fit. Minimum diameter of holes in rollers should be the nominal diameter of the pin plus 1 mm (1/32 inch). The length of the pin between retainer ring grooves should be based on the maximum width of the roller, the maximum thickness of the hot-finished bars rolled to the tolerances given in ASTM A 484/A 484M plus a clearance of approximately 1 mm (0.040 inch) to avoid binding between bars, or binding between bars and rollers.

d. Retaining rings for gate roller links shall be corrosion resistant steel conforming to ASME B27.7, BASIC external series type with nominal ring size of [_____] mm inches.

e. Seal Plates, Bars, and Retainers; Roller Guide Bars; and Track Plates.

(1) Welded Seal Plates and Bars; Welded Roller Guide Bars; and Welded Track Plates - ASTM A 240/A 240M, UNS [S40500] [S41008] [S30400], Hot-Rolled and Annealed or Heat Treated, and Blast Cleaned or Pickled Finish; or ASTM A 276, UNS S30400, S40500, or S41000 with a maximum carbon content of 0.08 percent, Condition A, Hot-Finished or Cold-Finished, Class C.

(2) Bolted Seal Plates, Bars, and Retainers; and Bolted Roller Guide Bars - ASTM A 240/A 240M, UNS [S40500] or [S41008] [S30400], Hot-Rolled and Annealed or Heat Treated, and Blast Cleaned or Pickled finish; or ASTM A 276, UNS S30400, S40500, or S41000, Condition A, hot-finished or cold-finished, Class C.

2.1.5.5 Pipe

ASTM A 312/A 312M, [seamless] [welded], UNS S30400, NPS and schedule number or outside diameter and nominal wall thickness as shown, [plain] [threaded] [threaded and coupled] ends.

2.1.6 Steel Forgings

2.1.6.1 General Industrial Use

ASTM A 668/A 668M, Class [____], carbon content not exceeding 0.35 percent, and an overall chemical composition which results in satisfactory weldability.

2.1.6.2 Railway Use

ASTM A 730, Grade [____], carbon content not exceeding 0.35 percent and an overall chemical composition which results in satisfactory weldability.

2.1.7 Steel Castings

ASTM A 27/A 27M, Grade [____], Class [____], or ASTM A 148/A 148M, Grade [____].

2.1.8 Steel Strips

ASTM A 109/A 109M, [oiled] [not oiled], Temper [____] Edge [____], Finish [____].

2.1.9 Aluminum

2.1.9.1 Sheets and Plates

ASTM B 209M ASTM B 209, Alloy [____], Temper [____].

2.1.9.2 Bars, Rods and Wire

ASTM B 211M ASTM B 211, Alloy [____], Temper [____].

2.1.9.3 Structural Shapes

ASTM B 308/B 308M, Alloy [____], Temper [____].

2.1.9.4 Castings

ASTM B 26/B 26M, Alloy [____], Temper [____].

2.1.9.5 Pipes and Tubes

ASTM B 241/B 241M, Alloy 6063, Temper [____], size and schedule number or outside diameter and wall thickness as shown.

2.1.10 Bronze

2.1.10.1 Copper Alloy Castings

NOTE: After the specific ASTM casting specification and Alloy UNS Number has been selected, the general requirements of ASTM B 824 should be specified as needed based upon the application and importance of the component. ASTM B 828 establishes a group of general requirements common to the ASTM Copper Alloy Casting specifications. These requirements include pressure

tests, certification, witness inspection, etc. Additionally, some of the specific copper alloy casting specifications have optional requirements which should be added if they are determined necessary. These optional requirements can include, but are not limited to, soundness, mechanical properties, and chemical analysis of residual elements.

[ASTM B 148] [ASTM B 62] [ASTM B 176] [ASTM B 271] [ASTM B 505/B 505M] [ASTM B 584] [ASTM B 763] [ASTM B 806], Copper Alloy UNS No. [____].

a. General requirements of ASTM B 824:

- (1) Pressure tests
- (2) Certification
- (3) Witness tests
- (4) [____]

b. Optional requirements of [ASTM B 148] [ASTM B 62] [ASTM B 176] [ASTM B 271] [ASTM B 505/B 505M] [ASTM B 584] [ASTM B 763] [ASTM B 806] [ASTM B 824].

- (1) Soundness
- (2) Mechanical properties
- (3) Chemical analysis of residual elements
- (4) [____]

2.1.10.2 Aluminum Bronze Castings

[ASTM B 148] [ASTM B 271] [ASTM B 505/B 505M] [ASTM B 763] [ASTM B 806], Copper Alloy UNS No. [____].

2.1.10.3 Aluminum Bronze Rods, Bars, and Shapes

ASTM B 150/B 150M, Copper Alloy UNS No. [____], Temper [____].

2.1.10.4 Manganese Bronze Castings

[ASTM B 176] [ASTM B 271] [ASTM B 505/B 505M] [ASTM B 584] [ASTM B 763], Copper Alloy UNS No. [____].

2.1.10.5 Rolled Manganese Bronze and Manganese Bronze Forgings

ASTM B 138/B 138M ASTM B 138/B 138M, Class [____], Temper [____].

2.1.10.6 Manganese Bronze Rods, Bars, and Shapes

ASTM B 138/B 138M ASTM B 138/B 138M, Copper Alloy UNS No. [____], Temper [____].

2.1.11 Brass

2.1.11.1 Sheet, Plates, and Bars

[ASTM B 36/B 36M] [ASTM B 121/B 121M], Composition [____], Temper [____].

2.1.11.2 Castings

[ASTM B 62] [ASTM B 176] [ASTM B 271] [ASTM B 505/B 505M] [ASTM B 584] [ASTM B 763] [ASTM B 806], Copper Alloy UNS No. [____].

2.1.11.3 Naval Brass

[ASTM B 21/B 21M,] [ASTM B 124/B 124M,] Composition [____], Temper [____].

2.1.12 Copper Flat Products

ASTM B 152/B 152M, Temper [____].

2.1.13 Lead Sheet

ASTM B 749, Alloy UNS No. [____], Type [L____].

2.1.14 Zinc

ASTM B 6, [Special High Grade] [High Grade] [Prime Western].

2.1.15 Babbitt Metal

ASTM B 23, Alloy UNS No. [____].

2.1.16 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall be of the material, grade, type, class, style and finish indicated or best suited for intended use.

2.1.16.1 High-Strength Bolts, Nuts, and Washers

ASTM A 325M ASTM A 325, Type [____], [hot-dip galvanized] or ASTM A 490M ASTM A 490, Type [____].

2.1.16.2 Bolts, Nuts, and Washers (Other Than High-Strength)

a. Bolts and Nuts - ASTM A 307, Grade A, [hot-dip galvanized] or ASTM A 320/A 320M, [Ferritic Steel, Grade [____]] [Austenitic Steel, Class [____]].

b. Bolts - ASME B18.2.1.

c. Nuts - ASME B18.2.2.

d. Washers

(1) Plain Washers - ASME B18.22M ASME B18.22.1, Type B.

(2) Lock Washer - ASME B18.21.1.

(3) Beveled Washers - ASTM F 436M ASTM F 436, Type [____], Beveled.

2.1.17 Screws

Screws shall be of the material, grade, type, style, and finish indicated or best suited for use intended.

2.1.17.1 Cap Screws

ASME B18.2.1, ASME B18.3, or ASME B18.6.2 as required.

2.1.17.2 Machine Screws

ASME B18.6.3.

2.1.17.3 Wood Screws

ASME B18.6.1.

2.1.17.4 Set Screws

ASME B18.6.2.

2.1.18 Expansion Anchors

NOTE: The designer should replace FS FF-S-325 Groups with the following: CID A-A-1922 replaces Group I; CID A-A-1923 replaces Group II; CID A-A-1924 replaces Group III; CID A-A-55615 with Group IV; CID A-A-1925 replaces Group V; and CID A-A-55614 replaces Group VIII.

[CID A-A-1922] [CID A-A-1923] [CID A-A-1924] [CID A-A-1925] [CID A-A-55614] [CID A-A-55615], type as required, except that nail driven types will not be acceptable, galvanized unless otherwise indicated.

2.1.19 Toggle Bolts

Toggle bolts shall have spring action snap open wings and require a predrilled hole. Screws and sheet metal wings shall be made of zinc-plated steel.

2.1.20 Rivets

Rivets shall conform to [____], Grade [____].

2.1.21 Safety Treads

Treads shall slip-on skid resistant and made from [rubber] [vinyl] [aluminum alloy] [cast iron] as best suited for the intended location.

2.1.22 Wire Rope

NOTE: Identify the requirements for wire rope by inserting number of wires, material, type of core, lay, coating, and whether preformed or not.

FS RR-W-410, Type [____], Class [____], Construction [____], [wire sizes] [strand seizing] as shown.

2.1.23 Chains and Attachments

FS RR-C-271, Type [____], Grade [____], Class [____], Style [____], Size [____], Finish [____].

2.1.24 Steel Rails

ASTM A 1, [No. 1] [No. 2].

2.1.25 Cast Iron Frames and Covers

CID A-A-60005, Type [____], Style [____] frame, type [____] cover.

2.1.26 Steel Wheels

ASTM A 504, Class [____], design and rough bore size as shown.

2.1.27 Floor Gratings

NOTE: When choosing grating size, welded cross members should not be less than 2.52 square mm (1/16-square inch) in cross-sectional area. Galvanizing adds approximately 5% to the weight of the average grating.

NAAMM MBG 531 and NAAMM MBG 531S.

a. Description of grating: [____].

b. Anchorage: [____].

c. Finish: [steel] [steel zinc-coated in accordance with ASTM A 123/A 123M after fabrication, and steel hardware and fasteners completely zinc-coated in accordance with ASTM A 153/A 153M] [stainless steel] [aluminum].

2.1.28 Steel Floor Plate

ASTM A 786/A 786M, Pattern No. [1] [2] [3] [4] [5].

2.2 SHOP FABRICATED METAL ITEMS

Shop fabricated metal items shall conform to the requirements and details as specified or shown and to the workmanship provisions and other applicable fabrication requirements as specified in Section 05055A METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.2.1 Railings

Railings shall be of the type specified and shown and shall be furnished and installed complete with all fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation.

2.2.1.1 Materials

Aluminum railings shall be of pipe or tube as specified in paragraph PIPES AND TUBES. Steel railings shall be of steel as specified in paragraph PIPE. Sleeves and other appurtenances shall be of the same material as the rails and posts or approved compatible materials.

2.2.1.2 Fabrication

NOTE: Flush-finished joints should be specified for railings when a good appearance is desired.

NOTE: 90 kg (200 lb) is the recommended minimum design working load for welded assembly railings fabricated of 38 mm (1-1/2 inch) nominal size, standard weight pipe with posts spaced 2.5 m (8 feet) on centers. Other loads may be specified for railings when they are designed to resist greater loads.

Rigid joints in railings shall be of welded, threaded, or slip-on fittings assembly [and shall be flush-finished]. Welded joints shall be reinforced with tight-fitting interior sleeves and shall be assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Assembled threaded joints shall have no exposed threads. Slip-on fittings shall be tight-fitting. Fasteners for slip-on fittings shall be the self-locking, concealed type. Fasteners for aluminum fittings shall be of aluminum or stainless steel. Fasteners for steel fittings shall be of stainless steel. Expansion joints in railings shall be an [inner-sleeved] [outer-sleeved] [outer-sleeved or inner-sleeved] slip-joint, with one end of the sleeve secured to one rail and the ends of the adjoining rails separated a minimum of 25 mm 1 inch in the installed position. Expansion joints shall be located in rails near the intersection of rails and posts. Bends in railings shall be made in a manner that railings are not crushed and shall maintain their original cross-sectional shape. Welds shall be ground smooth. Railings shall be free of burrs, sharp corners, and sharp edges. For railings of other than welded assembly, manufacturer design calculations, showing that the installed railings are capable of withstanding a design working load of [90] [_____] kg [200] [_____] pounds applied in any direction at any point on the top rail without permanent deformation, must be submitted and approved prior to installation.

2.2.1.3 Installation

Railings shall be installed as specified and shown. Railing posts anchored to concrete surfaces perpendicular to the posts shall be [set in sleeve inserts anchored in the concrete, and the space between posts and sleeves shall be filled with molten lead, sulphur, or a quick-setting hydraulic cement and covered with standard collar fittings secured to the posts. A 6 mm 1/4 inch drain hole shall be drilled near the bottom of each post.] [rigidly secured to flange fittings anchored to concrete with expansion anchors.] Railing posts anchored to concrete surfaces parallel to the posts shall [have the sides of posts continuously welded to base plates] [be rigidly secured to flange fittings] anchored to concrete with expansion anchors. Railing posts anchored to structural metal shall be [welded to

base plates] [rigidly secured to flange fittings] [bolted] [welded] to structural metal. Ends of rails anchored to concrete or masonry shall be rigidly secured to flange fittings anchored to concrete or masonry with expansion anchors

2.2.2 Gratings and Cover Plates

Grating and cover plates shall be of the material and size shown, and shall be fabricated in sectional panels of the width and length shown, or as appropriate, to accurately fit within the supporting recess frames. Openings through panels shall be provided as shown or as required. [Hinged panels shall be provided with hinges of the type shown or suitable for the application.] [Steel gratings and cover plates shall be galvanized after fabrication.]

2.2.2.1 Grating

Gratings shall be as specified in paragraph FLOOR GRATINGS. Edges of gratings and openings through gratings which require the cutting of more than one bearing bar shall be banded. Fasteners shall be of the type recommended by the manufacturer and approved. [Stair tread gratings shall have nonslip nosings.]

2.2.2.2 Cover Plates

Cover plates shall be as specified in paragraph STEEL FLOOR PLATE. Cover plate panels shall be provided with [holes for insertion of removal tool] [mm 1/4 inch bar, flush, drop handles for removal] as shown or as required. Sharp edges and burrs shall be removed from plates.

2.2.3 Steel Stairs

Steel stairs shall be fabricated and installed as shown. All materials shall be galvanized after fabrication. Stringers, [columns] and other structural framing members shall be of structural steel shown. Stringers shall have exposed ends closed [and shall be continued around landings which they support]. Stair treads [and landings] shall be fabricated of steel gratings of the type specified in paragraph GRATING. Bolts, nuts and other fastenings shall be provided as shown and as required for proper installation. Lock washers shall be used under all nuts. [Railings of the type specified above in paragraph RAILINGS shall be anchored to stairs as shown.]

2.2.4 Recess Frames

Recess frames shall be fabricated of structural shapes of the type shown. Welded joints in frames shall be ground smooth. [Steel frames shall be galvanized after fabrication.] Frames shall be anchored to supports in the manner shown and shall not be continuous across contraction or expansion joints.

2.2.5 Ladders

Ladders shall be fixed-rail metal ladders conforming to the requirements of EM 385-1-1 and to details shown. Ladders shall be fabricated of [structural steel as shown and shall be galvanized after fabrication] [aluminum as shown]. Fabrication of ladders shall consist of solid-section rod rungs fitted into holes in bar side rails and welded. Splices in side rails shall be made using full penetration welds and shall provide a flush

and smooth transition between connecting ends. All welds shall be ground smooth. Ladder rails shall be welded to bent-bar supporting brackets anchored to supporting structure as shown.

2.2.6 [Ladder Rungs] [Grab Bars] [Pulling Irons] [Mooring Rings]

[Ladder rungs], [grab bars], [pulling irons], [mooring rings] shall be fabricated from steel rods in accordance with the details and shall be galvanized after fabrication.

2.2.7 Lock Wall Armor

Lock wall armor tees and preformed corner protection plates shall be fabricated from steel conforming to ASTM A 36/A 36M, except that minimum yield strength shall be 230 MPa 33,000 psi, maximum tensile strength shall be waived, and the maximum allowable manganese content shall be 1.40 percent. Tees may be commercially rolled sections or may be fabricated from steel plates provided they have a nominal weight of not less than 42.0 kg/m 28.2 pounds per foot and conform essentially to details shown. Installation shall conform to details shown. Tees and preformed plates shall be erected true to line and grade. The continuous edges of exposed faces shall not have a vertical or horizontal distortion from a straight line greater than 2 mm/meter 0.025 inch per foot of length. Distortion for any single section shall not exceed 36 mm 1.4 inches. Where there is a warp in the installed tees or preformed plates greater than 2 mm 1/16 inch, an extra anchor shall be installed at the proper location to draw the section into position. Bolt heads on exposed faces shall be counter sunk and fitted so that they are flush with the finished surfaces. Joints between abutting sections shall be square and the butting ends shall be sawed or otherwise made smooth and regular.

2.2.8 Lock Wall Line Hooks and Check Posts

Lock wall line hooks and check posts shall be fabricated of alloy steel mechanical tubing as specified in paragraph MECHANICAL. Dimensions, including outside diameter and wall thickness, and anchor bars shall be as shown.

PART 3 EXECUTION (Not Applicable)

-- End of Section --