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USACE / NAVFAC / AFCEA / NASA                      UFGS-23 22 13.13 40 (April 2006)  
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Preparing Activity:    NASA                      Superseding  
   NASA-15106S (December 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are NOT in agreement with UMRL dated 01 April 2006

Revised throughout - changes not indicated by CHG tags

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### SECTION 23 22 13.13 40

#### FERROUS PIPE AND FITTINGS 04/06

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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 steam and condensate systems (150 and 350 pounds per square inch (psi)) (1034 and 2413 kilopascal) and high-pressure compressed air systems (2,000 and 6,000 psi) (15 and 41 megapascal). For other types of steel pipe and valves, see Section 23 05 00.00 40 BASIC MECHANICAL MATERIALS AND METHODS and Section 23 09 13.33 40 VALVES.

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.

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## PART 1    GENERAL

### 1.1    REFERENCES

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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.

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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 B16.11     | (2005) Forged Steel Fittings, Socket-Welding and Threaded             |
| ASME B16.3      | (1998) Malleable Iron Threaded Fittings Classes 150 and 300           |
| ASME B16.39     | (1998) Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300 |
| ASME B16.5      | (2003) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24      |
| ASME B16.9      | (2003) Factory-Made Wrought Steel Buttwelding Fittings                |
| ASME B18.2.2    | (1987; R 2005) Square and Hex Nuts                                    |
| ASME B18.2.4.6M | (1979; R 2003) Metric Heavy Hex Nuts                                  |
| ASME B36.10M    | (2004) Welded and Seamless Wrought Steel Pipe                         |

ASTM INTERNATIONAL (ASTM)

|                   |  |
|-------------------|--|
| ASTM A 105/A 105M | (2005) Standard Specification for Carbon Steel Forgings for Piping Applications                                  |
| ASTM A 106/A 106M | (2004) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service                        |
| ASTM A 181/A 181M | (2001) Standard Specification for Carbon Steel Forgings, for General-Purpose Piping                              |
| ASTM A 193/A 193M | (2005) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service |

|                   |   |
|-------------------|---|
| ASTM A 194/A 194M | (2005) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both      |
| ASTM A 197/A 197M | (2000) Standard Specification for Cupola Malleable Iron   |
| ASTM A 234/A 234M | (2005) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| ASTM A 325        | (2004b) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength                      |
| ASTM A 325M       | (2004b) Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength (Metric)            |
| ASTM A 53/A 53M   | (2004a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless                              |
| ASTM F 104        | (2003) Standard Classification System for Nonmetallic Gasket Materials  |

## 1.2 SUBMITTALS

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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.

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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

Installation Drawings for steel piping shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Piping for Steam and Condensate  
Piping for High-Pressure Compressed-Air Systems  
Fittings  
Unions  
Flanges  
Gaskets  
Bolting

### 1.3 GENERAL REQUIREMENTS

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NOTE: If Section 23 00 00.00 40 GENERAL MECHANICAL PROVISIONS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

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Section 23 00 00.00 40 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Installation Drawings for steel piping shall be in accordance with the manufacturer's recommendations and in accordance with Section 23 05 00.00 40 BASIC MECHANICAL MATERIALS AND METHODS.

### PART 2 PRODUCTS

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NOTE: For accessories and supporting elements see Section 23 05 00.00 40 BASIC MECHANICAL MATERIALS AND METHODS.

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## 2.1 PIPING FOR STEAM AND CONDENSATE

Steam and condensate piping for 1034-, 2413-, 13790-, 41369- kilopascal 150-, 350-, 2,000-, and 6,000-pound per square inch (psi) service shall be black carbon steel (BCS).

### 2.1.1 Type BCS-150 (1034 kilopascal 150-psi Service)

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NOTE: Avoid screwed-end connections in condensate piping wherever possible. Bend pipe for change in direction where practicable.  
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Pipe or tube (DN6 through DN25): (1/8 inch through 10 inches): Schedule 40 for steam, Schedule 80 for condensate, seamless black carbon steel, conforming to ASTM A 106/A 106M, Grade B and ASME B36.10M

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NOTE: Select 150- or 300-psi 1034 or 2068 kilopascal malleable-iron or forged-steel fittings; delete fittings not applicable if option is not given.  
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Fittings (DN6 through DN50): 2068 kilopascal (1/8 inch through 2 inches): 300-psi working steam pressure (wsp) banded malleable iron, screwed end, conforming to ASTM A 197/A 197M and ASME B16.3

Fittings (DN6 through DN50): 15- or 20- megapascal (1/8 inch through 2 inches): 2,000-or 3,000-psi water, oil, or gas (wog) forged carbon steel, socket weld or screwed end, conforming to ASTM A 105/A 105M and ASME B16.11

Fittings (DN65 through DN250): (2-1/2 through 10 inches): Wall thickness to match pipe, long radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

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NOTE: Select 250-psi 1724 kilopascal malleable iron or forged steel unions.  
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Unions (DN6 through DN50): 1724 kilopascal (1/8 inch through 2 inches): 250-psi wsp, malleable iron, screwed end, ground joint, with brass or bronze seat insert, conforming to ASME B16.39

Unions (DN6 through DN50): 15- or 20- megapascal (1/8 inch through 2 inches): 2,000 or 3,000-psi wog, forged carbon steel; socket weld through 50 millimeter 2-inch, screwed end through 25 millimeter 1-inch, conforming to ASTM A 105/A 105M and ASME B16.11, with ground joint and stainless-steel seat insert

Flanges (DN65 through DN250): 1034-kilopascal (2-1/2 through 10 inches): 150-pound, forged carbon steel, welding neck, with raised face or flat face and concentric finish, conforming to ASTM A 105/A 105M and ASME B16.5

Flange Gaskets: Compressed non-asbestos sheet conforming to ASTM F 104, Type 1, P1161A, coated on both sides with graphite or similar lubricant, containing not less than 75-percent non-asbestos fiber materials

**Bolting:** Bolting and flange bolting shall be hexhead and shall conform to ASTM A 325M ASTM A 325. Heavy hex-nuts shall conform to ASME B18.2.4.6M ASME B18.2.2.. Square-head bolts and nuts are not acceptable.

#### 2.1.2 Type BCS-350 (2413 kilopascal 350-psi Service)

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NOTE: Avoid screwed-end connections in condensate piping wherever possible. Bend pipe for change in direction, where practicable.  
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Pipe or tube(DN6 through DN25): (1/8 inch through 10 inches): Schedule 40 for steam, Schedule 80 for condensate; seamless black carbon steel, conforming to ASTM A 106/A 106M, Grade B and ASME B36.10M

Fittings(DN6 through DN50): 15- or 20- megapascal (1/8 inch through 2 inches): 2,000-or 3,000-psi wog to match pipe wall, forged carbon steel, socket weld or screwed end, conforming to ASTM A 105/A 105M and ASME B16.11

Fittings(DN6 through DN25): (1/8 inch through 10 inches): Schedule 40, long-radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

Unions(DN6 through DN50): 15- or 20- megapascal (1/8 inch through 2 inches): 2,000-or 3,000-psi wog to match pipe wall, forged carbon steel, socket weld through 50 millimeter 2-inch, screwed end through 25 millimeter 1-inch, conforming to ASTM A 105/A 105M and ASME B16.11, with ground joint and stainless-steel seat insert

Flanges (DN65 through DN250): 2068 kilopascal (2-1/2 through 10 inches): 300-pound, forged carbon steel, weld neck, with raised face and concentric serrated finish, conforming to ASTM A 181/A 181M, Class 70, and ASME B16.5

Gaskets: Spiral-wound, non-asbestos-fiber-filled, carbon steel, with centering provisions, conforming to ASME B16.5, Group 1

**Bolting:** Heavy hex-head, carbon-steel bolts or bolt studs and semifinished heavy hexnuts, conforming to ASTM A 325M ASTM A 325.

Square-head bolts are not acceptable.

#### 2.2 PIPING FOR HIGH-PRESSURE COMPRESSED-AIR SYSTEMS

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NOTE: ASME B31.1 Does not cover industrial compressed air piping outside of power houses. ANSI B31.2 covers only fuel gas portion of obsolete industrial gas and air piping systems. ANSI committee recommends interim use of ASME B31.3 for compressed-air piping.

The following system pressures are based on ASME B31.3, zero corrosion factor, welded joints, and a stress value of 20,000 psi 138 megapascal systems with pipe size larger than 3 inches 80 millimeter.

The following material specifications do not take into account material temperatures lower than minus

20 degrees F minus 7 degrees C.

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#### 2.2.1 Type BCS-2,000 (15 megapascal 2,000-psi Service)

Pipe or tube (DN6 through DN80): (1/8 inch through 3 inches): Schedule 40, seamless black carbon steel, conforming to ASTM A 106/A 106M, Grade B, or ASTM A 53/A 53M, Grade B, Type S, and ASME B36.10M

Fittings (DN6 through DN40): 15 megapascal (1/8 inch through 1-1/2 inches): 2,000-psi wog, forged carbon steel, socket weld, conforming to ASTM A 105/A 105M and ASME B16.11

Fittings (DN50 through DN80): (2 through 3 inches): Schedule 40, long radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

Flanges (DN25 through DN80): 6200 kilopascal (1 inch through 3 inches): 900-pound, forged carbon steel, welding neck, with raised face and concentric serrated finish, conforming to ASTM A 105/A 105M or ASTM A 181/A 181M, Class 60, and ASME B16.5

Gaskets: Spiral wound, non-asbestos-fiber-filled, carbon steel, with centering provisions, conforming to ASME B16.5, Group 1

Bolting: Alloy-steel bolt studs conforming to ASTM A 193/A 193M, Grade B7, and semifinished heavy hex-nuts, conforming to ASTM A 194/A 194M, Grade 2H

#### 2.2.2 Type BCS-6,000 (41368-kilopascal 6,000-psi Service)

Pipe or tube (DN15 through DN80): (1/2 inch through 3 inches): XXS, seamless, black carbon steel, conforming to ASTM A 106/A 106M, Grade B, or ASTM A 53/A 53M, Grade B, Type S and ASME B36.10M

Fittings (DN15 through DN40): 41.3 megapascal (1/2 inch through 1-1/2 inches): 6,000-psi wog, forged carbon steel, socket weld, conforming to ASTM A 105/A 105M and ASME B16.11

Fittings (DN50 through DN80): (2 through 3 inches): XXS, long-radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, ASME B16.9, and ASME B36.10M

Flanges (DN50 through DN80): 17.2 megapascal (2 through 3 inches): 2,500-pound, forged carbon steel, welding neck with raised face and concentric serrated finish, conforming to ASTM A 105/A 105M and ASME B16.5

Gaskets: Spiral-wound, non-asbestos-filled, carbon steel, with centering provisions, conforming to ASME B16.5, Group 1

Bolting: Alloy steel bolt studs conforming to ASTM A 193/A 193M, Grade B7, and semifinished heavy hex-nuts, conforming to ASTM A 194/A 194M, Grade 2H

### PART 3 EXECUTION

#### 3.1 GENERAL

Pipe shall be installed in accordance with manufacturer's recommendations and in accordance with Section 23 05 00.00 40 BASIC MECHANICAL MATERIALS AND METHODS.



-- End of Section --