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USACE / NAVFAC / AFCEA / NASA UFGS-23 00 00.00 40 (April 2007)  
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Preparing Activity: NASA Superseding  
UFGS-23 00 00.00 40 (October 2006)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 19 March 2007

Latest change indicated by CHG tags

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

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HEATING, VENTILATING, AND AIR-CONDITIONING

04/07

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### SECTION 23 00 00.00 40

#### HEATING, VENTILATING, AND AIR-CONDITIONING 04/07

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NOTE: This specification covers the requirements for requirements common to all mechanical sections and should be included in all project specifications which contain any sections of Division 15, "Mechanical." Accordingly, this section should be tailored carefully to suit project conditions and to meet project requirements and should be coordinated with Division 1 to avoid conflicts or repetition.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

Comments 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).

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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 A13.1 (1996; R 2002) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

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

ASTM B 766 (2003) Standard Specification for Electrodeposited Coatings of Cadmium

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1650 (1998) Seismic Restraint Manual: Guidelines for Mechanical Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101B (1970) Color Code For Pipelines and For Compressed Gas Cylinders

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

40 CFR 82 (1996) Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 6 (2004e13) Standard for Electrical Rigid Metal Conduit-Steel

UL Bld Mat Dir (2005) Building Materials Directory

1.2 SUBMITTALS

Not Used

### 1.3 COORDINATION

Contractor shall coordinate the work of the different trades so that interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work properly shall be furnished complete in place at no additional cost to the Government.

### 1.4 MECHANICAL SYSTEMS IDENTIFICATION

#### 1.4.1 Diagrams

Chart listing of equipment shall be by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics. This requirement shall not apply for accessories or minor equipment items, such as vents, but is required for such equipment as pumps, water heaters, air-handling system equipment, refrigeration compressors, heat exchangers, and boilers.

Diagrams shall be neat mechanical drawings provided with extruded aluminum frames and 3 millimeter 1/8-inch acrylic plastic protection. Location shall be as directed by the Contracting Officer. The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart per space is required, these shall be mounted in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

#### 1.4.2 Identification Tags

Identification tags made of brass or aluminum indicating function of a control or similar component shall be installed on such system devices. Tags shall be 50 millimeter 2 inches in diameter and marking shall be stamped.

Equipment shall be provided with metal identification tags displaying an equipment designation number matching drawing or control diagram designation.

Tags shall be wired to valve or equipment items with No. 12 AWG 2 millimeter 0.0808-inch diameter corrosion-resistant steel wire.

#### 1.4.3 Service Labeling

All piping, including that concealed in accessible spaces; exposed, bare and painted; and insulated, shall be labeled to designate service. Each label shall include an arrow or arrows to indicate flow direction. Labels and valve tag schedule shall be in accordance with the typical examples below:

<u>SERVICE</u>	<u>LABEL AND TAG DESIGNATION</u>
Cold potable water	COLD POT. WATER
Hot potable water supply	HOT POT. WATER SUPPLY
Hot potable water return	HOT POT. WATER RETURN
Rain water leader	RAIN WATER

<u>SERVICE</u>	<u>LABEL AND TAG DESIGNATION</u>
Sanitary sewer	SAN. SEWER
Sanitary waste	SAN. WASTE
Sanitary drain	SAN. DRAIN
Sanitary vent	SAN. VENT
Storm drain	STORM DRAIN
Corrosion resistant sewer	COR. RES. SEWER
Storm sewer	STORM SEWER
Corrosion resistant waste	COR. RES. WASTE
Corrosion resistant drain	COR. RES. DRAIN
Corrosion resistant vent	COR. RES. VENT
Air handling unit No. [_____]	AIR HAND. UNIT NO. [_____]
Automatic temperature control	AUTO. TEMP. CONTROL
Chilled water-supply	CHILLED WATER-SUPPLY
Chilled water-return	CHILLED WATER-RETURN
Control and instrument air	CONTROL AND INSTR.
Cooling tower water-supply	C TWR WATER-SUPPLY
Cooling tower water-return	C TWR WATER-RETURN
Dual temperature water-supply	DUAL TEMP. WATER-SUPPLY
Dual temperature water-return	DUAL TEMP. WATER-RETURN
Refrigerant-suction	REFRIG-SUCTION
Refrigerant-discharge	REFRIG-DISCH
Refrigerant-liquid	REFRIG-LIQUID
Steam	STEAM (___ kPa) (___ PSI)
Steam condensate return	STEAM CONDEN RETURN
High-temperature hot water supply (primary)	HTHW SUPPLY PRI
High-temperature hot water return (primary)	HTHW RETURN PRI
Medium-temperature hot water supply (secondary)	MTHW SUPPLY SEC

<u>SERVICE</u>	<u>LABEL AND TAG DESIGNATION</u>
Medium-temperature hot water return (secondary)	MTHW RETURN SEC
Low-temperature hot water supply (secondary)	LTHW SUPPLY SEC
Low-temperature hot water return (secondary)	LTHW RETURN SEC
Fuel oil supply	FUEL OIL SUPPLY
Fuel oil return	FUEL OIL RET
Fuel oil vent	FUEL OIL VENT
High-pressure steam supply (primary)	HP STEAM SUPPLY PRI [ ] kPa [ ] PSI
High-pressure steam return (primary)	HP STEAM RET PRI [ ] PSI [ ] kPa
Medium-pressure steam supply (secondary)	MP STEAM SUPPLY SEC [ ] PSI [ ] kPa
Medium-pressure steam return (secondary)	MP STEAM RET SEC [ ] PSI [ ]
kPa	
Low-pressure steam supply (secondary)	LP STEAM SUPPLY SEC [ ] PSI [ ] kPa
Low-pressure steam return (secondary)	LP STEAM RET SEC [ ] PSI [ ]
kPa	
Makeup water	MAKEUP WATER
Brine supply	BRINE SUPPLY
Brine return	BRINE RET
Condenser water supply	COND. WATER SUPPLY
Condenser water return	COND. WATER RET
Condensate drain	COND. DRAIN
Compressed air supply	[ ] PSI [ ] kPa SUPPLY AIR

Similar services with different temperatures or pressures shall be identified. Where pressures may exceed 860 kilopascal 125 pounds per square inch, gage, the maximum system pressure shall be included in the label.

Piping shall be labeled and arrowed in accordance with the following:

Each point of entry and exit of pipe passing through walls

Each change in direction, i.e., elbows, tees

In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.

In long straight runs, labels shall be located at distances within eyesight of each other but in no case shall the distance between labels exceed 22 meter 75 feet. All labels shall be visible and legible from the primary service and operating area.

For Bare or Insulated Pipes  
for Outside Diameters of

Lettering

13 thru [ ] millimeter  
40 thru [ ] millimeter  
65 millimeter and larger

13 millimeter  
[ ] millimeter  
[ ] millimeter

1/2 thru 1-3/8 inch  
1-1/2 thru 2-3/8 inch  
2-1/2 inch and larger

1/2 inch  
3/4 inch  
1-1/4 inch

Labels shall be made of self-sticking, plastic film designed for permanent installation.

#### 1.5 COLOR CODING

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NOTE: The MIL-STD-101B system is for ground based  
piping systems and compressed gas cylinders. The  
color coding is not compatible with ASME A13.1 which  
is commonly used for facilities work  
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Color coding of all piping systems shall be in accordance with [ASME A13.1]  
[MIL-STD-101B].

#### 1.6 APPROVAL REQUIREMENTS

Except as otherwise specified, approval of materials and equipment will be based on manufacturer's published data.

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 will be acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, the Contractor may submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Methods of testing used by the specified agencies shall be outlined.

Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item will be acceptable as proof of compliance.

Conformance to such agency requirements does not relieve the item from

compliance with other requirements of these specifications.

#### 1.7 PREVENTION OF CORROSION

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NOTE: For all outdoor applications and all indoor applications in a harsh environment refer to Section 09 96 00 HIGH-PERFORMANCE COATINGS. High performance coatings are specified for all outdoor applications because ultraviolet radiation will break down most standard coatings, causing a phenomena known as chalking, which is the first stage of the corrosion process. For additional information, contact The Coatings Industry Alliance, specific suppliers such as Keeler and Long and PPG, and NACE International (NACE).  
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Metallic materials shall be protected against corrosion. Equipment enclosures shall be given rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with earth, and where connected to dissimilar metal, shall be protected by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123/A 123M for exterior locations and cadmium-plated in conformance with ASTM B 766 for interior locations.

#### 1.8 OZONE DEPLETING SUBSTANCES USED AS REFRIGERANTS

Releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's will be minimized by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F. Any person conducting repair, maintenance, servicing or disposal of appliances owned by NASA comply with the following:

No Class I or Class II substances used as a refrigerant may be knowingly vented or otherwise released into the environment.

No appliances may be opened without meeting the requirements of 40 CFR 82 Part 82.156 Subpart F, regarding required practices regarding evacuation and collection of refrigerant, and 40 CFR 82 Part 82.158 Subpart F, regarding standards of recycling and recovery equipment.

No work may be conducted on appliances containing refrigerant except by persons who comply with 40 CFR 82 Part 82.161 Subpart F, regarding technician certification.

In addition, copies of all applicable certifications must be provided to the Contracting Officer at least 14 calendar days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:

Proof of Technician Certification

Proof of Equipment Certification, if recovery or recycling equipment is to be provided by the Contractor



Proof of availability of certified recovery or recycling equipment, if equipment is to be provided by the Contractor

#### 1.9 USE OF OZONE DEPLETING SUBSTANCES, OTHER THAN REFRIGERANTS

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon

Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays

Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial

Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

A waiver may be requested should a programmatic or facility requirement dictate that a prohibited material is necessary to achieve project goals. A waiver request must be submitted in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

### PART 2 PRODUCTS

#### 2.1 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, engraved laminated phenolic identification plates shall be provided for each piece of mechanical equipment. Identification plates shall designate the function of the equipment. Designation shall be submitted with the shop drawings.

Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 40 millimeter 1-1/2-inches high and smaller shall be 1.6 millimeter 1/16-inch thick, with engraved lettering 3 millimeter 1/8-inch high; identification plates larger than 40 millimeter 1-1/2-inches high shall be 3 millimeter 1/8-inch thick, with engraved lettering of suitable height. Identification plates 40 millimeter 1-1/2-inches high and larger shall have beveled edges. Identification plates shall be installed using a compatible adhesive.

#### 2.2 ANCHOR BOLTS

Anchor bolts shall be provided for equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the equipment manufacturer and shall be located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

## 2.3 SEISMIC ANCHORAGE

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NOTE: Retain this paragraph only when equipment is  
to be installed in areas of seismic activity.  
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Equipment shall be anchored in accordance with applicable seismic criteria for the area and as defined in **SMACNA 1650**

## 2.4 PAINTING

\*\*\*\*\*  
NOTE: For all outdoor applications and all indoor applications in a harsh environment refer to Section **09 96 00 HIGH-PERFORMANCE COATINGS**. High performance coatings are specified for all outdoor applications because ultraviolet radiation will break down most standard coatings, causing a phenomena known as chalking, which is the first stage of the corrosion process. For additional information, contact The Coatings Industry Alliance, specific suppliers such as Keeler and Long and PPG, and NACE International (NACE).  
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Equipment units shall be painted in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouching shall be accomplished only if approved; otherwise equipment shall be returned to the factory for refinishing.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Materials and equipment shall be installed in accordance with the requirements of the contract drawings and approved recommendations of the manufacturers. Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

No installation shall be permitted which blocks or otherwise impedes access to any existing machine or system. All hinged doors shall swing open a minimum of 120 degrees. The area in front of all access doors shall be clear a minimum of [3][ ]feet. The area in front of all access doors to electrical circuits shall be clear the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333(Electrical-Safety Related work practices)and an additional [3][ ] feet.

Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations. All indicators, to include gauges, meters, and alarms shall be mounted in order to be easily visible by people in the area.

### 3.2 EQUIPMENT PADS

Equipment pads shall be provided and shall be of dimensions shown or, if not shown, they shall conform to the shape of each piece of equipment

served with a minimum 75 millimeter 3-inch margin around the equipment and supports. Equipment bases and foundations, when constructed of concrete or grout, shall cure a minimum of [28] [14] [\_\_\_\_\_] calendar days before being loaded.

### 3.3 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching of the building structure.

Holes in exposed locations, in or through existing floors, shall be drilled and smoothed by sanding. Use of a jackhammer will be permitted only where specifically approved.

Holes through masonry walls to accommodate sleeves shall be made with an iron pipe masonry core saw.

### 3.4 CLEANING

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NOTE: General cleaning and rubbish removal  
requirements should be covered in Division 1.  
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Exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared for final finish painting or are enclosed within the building structure.

Before final acceptance, mechanical equipment, including piping, ducting, and fixtures, shall be clean and free from dirt, grease, and finger marks.

When the work area is in an occupied space such as office, laboratory or warehouse [\_\_\_\_\_] all furniture and equipment shall be protected from dirt and debris. Field construction work shall incorporate housekeeping which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.

-- End of Section --