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Preparing Activity:    NASA                              Superseding  
    UFGS-23 82 16 (August 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2012

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02/11

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### SECTION 23 82 16.00 40

#### AIR COILS

02/11

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NOTE: This guide specification covers the requirements for coils for cold water, hot water, steam, and refrigerant.

Include in drawings or schedules all capacity conditions, media superheat if any, maximum airside pressure drops, number of passes, fins per millimeter linear inch, rows deep, face area, coil circuits, inlet and outlet connections, etc.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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#### PART 1    GENERAL

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NOTE: Include in drawings or schedules all capacity conditions, media superheat if any, maximum airside pressure drops, number of passes, fins per millimeter, linear inch, rows deep, face area, coil circuits, inlet and outlet connections, etc.

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#### 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 are automatically 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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 410 (2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

## 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.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags 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 reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Record of Existing Conditions[; G][; G, [\_\_\_\_]]

Fabrication Drawings[; G][; G, [\_\_\_\_]]

Connection Diagrams[; G][; G, [\_\_\_\_]]

Layout of All Controls[; G][; G, [\_\_\_\_]]

Internal Tubing and Wiring[; G][; G, [\_\_\_\_]]

Installation Drawings[; G][; G, [\_\_\_\_]]

Record Drawings[; G][; G, [\_\_\_\_]]

#### SD-03 Product Data

Steam Heating[; G][; G, [\_\_\_\_]]

Hot-Water Heating[; G][; G, [\_\_\_\_]]

Chilled-Water Cooling[; G][; G, [\_\_\_\_]]

Volatile Refrigerant Cooling[; G][; G, [\_\_\_\_]]

#### SD-05 Design Data

Design Analysis and Calculations[; G][; G, [\_\_\_\_]]

#### SD-06 Test Reports

Pressure Tests[; G][; G, [\_\_\_\_]]

Vacuum Tests[; G][; G, [\_\_\_\_]]

#### SD-07 Certificates

Certificates of Conformance[; G][; G, [\_\_\_\_]]

## SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G][; G, [\_\_\_\_]]

### 1.3 GENERAL REQUIREMENTS

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NOTE: If Section 23 00 00 AIR SUPPLY, DISTRIBUTION,  
VENTILATION, AND EXHAUST SYSTEMS is not included in  
the project specification, insert applicable  
requirements and delete the following paragraph.  
\*\*\*\*\*

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS  
applies to work specified in this section.

Submit manufacturer's catalog data for the following coil types indicating,  
when applicable, coil pressure and temperature ratings, coil casings,  
headers, tubing, circuiting, and drainable coils.

- a. Steam heating
- b. Hot-water heating
- c. Chilled-water cooling
- d. Volatile refrigerant cooling

Submit fabrication drawings for coil units consisting of fabrication and  
assembly details to be performed in the factory. Include connection  
diagrams indicating the relations and connections of the following items:

- a. Coil
- b. Coil casings
- c. Coil headers
- d. Coil tubing
- e. Coil circuiting

Indicate the general physical layout of all controls, and internal tubing  
and wiring details on the drawings. Submit design analysis and calculations  
for coils.

Submit record drawings for coil systems providing current factual  
information including deviations from, and amendments to, the drawings and  
concealed and visible changes in the work.

Submit record of existing conditions consisting of the results of  
Contractor's survey of work area conditions and features of existing  
structures and facilities within and adjacent to the jobsite. Commencement  
of work constitutes acceptance of existing conditions.

### 1.4 QUALITY ASSURANCE

Provide coils that bear the ARI certification seal indicating compliance

with AHRI 410. Submit certificates of conformance for following items showing conformance with the referenced standards contained in this section:

- a. Coil
- b. Coil casings
- c. Coil headers
- d. Coil tubing
- e. Coil circuiting

## PART 2 PRODUCTS

### 2.1 GENERAL

#### 2.1.1 Coil Pressure and Temperature Ratings

\*\*\*\*\*  
NOTE: Delete ratings not applicable to project.  
\*\*\*\*\*

Provide coils that are designed for the following fluid operating pressures and temperatures.

<u>Service</u>	<u>Pressure (kPa)</u>	<u>Temperature (Degrees C)</u>
Steam - low pressure	175	131
Steam - high pressure	1050	186
Steam - superheated	2400	260
Hot water	1400	121
Chilled water	1400	7
Volatile refrigerant	1400	149

<u>Service</u>	<u>Pressure (psi)</u>	<u>Temperature (Degrees F)</u>
Steam - low pressure	25	267
Steam - high pressure	150	366
Steam - superheated	350	500
Hot water	200	250
Chilled water	200	45
Volatile refrigerant	200	300

Air-pressure test coils under water at the following minimum pressures:

<u>Service</u>	<u>Pressure (kPa)</u>
Steam	1750
Hot water	1750
Chilled water	1750
Volatile refrigerant	2800

<u>Service</u>	<u>Pressure (psi)</u>
Steam	250
Hot water	250
Chilled water	250
Volatile refrigerant	400

#### 2.1.1.2 Coil Casings

Provide coil casing that is mill-galvanized 1.6 millimeter 16-gage, minimum, sheet metal with not less than 380 gram per square meter 1.25 ounces of zinc per square foot of two-sided metal surface conforming to ASTM A653/A653M. Provide casing that is flanged on four sides for bolted assembly, except as otherwise specified.

Where coils are stacked, provide casing that is of double-bend construction.

Provide duct-mounted reheat coil casings not over 900 millimeter 36 inches in length that are fabricated from a minimum 1.0 millimeter 20-gage galvanized steel conforming to above specified requirements; provide casings that are flanged or suitable for drive-slip assembly.

\*\*\*\*\*  
**NOTE: Coordinate clearance with drawings.**  
 \*\*\*\*\*

Provide coil mounting within housing that is either fixed or slide-out type, except as otherwise specified. Provide slide-out type coils for ceiling-suspended package units, and for other package units whose capacity exceeds 7 cubic meter per second 15,000 cubic feet per minute.

#### 2.1.1.3 Coil Headers

\*\*\*\*\*  
**NOTE: Where corrosive-condensate conditions exist, only copper headers are suitable.**  
 \*\*\*\*\*

Provide coil headers of cast iron, brass, copper, or aluminum casting.

Provide direct expansion, volatile refrigerant coils that have copper or brass headers with necessary control connections.

Fit steam and water coil headers with DN8 1/4-inch iron pipe size spring-loaded plug drains and vent petcocks. Provide automatic vents where indicated.

#### 2.1.1.4 Coil Tubing

Provide coils that are constructed of copper tubing with aluminum or copper fins. Provide helical coil fins that are wound tight to the tubes and solder-coated. Provide plate fins that have spacer collars in metallic contact with the adjacent fin, and fins that are mechanically bonded to the tube. Ensure bare tube surface is not visible within the finned portion of the coil.

Provide solder-coated cooling coils of helical wound copper design.

Provide coil tubes in water and volatile refrigerant service that are parallel and that have sufficient intermediate full coil depth supports to prevent sagging of unsupported span due to working fluid pressures and temperatures and summer and winter coil-ambient conditions. Sagging is unacceptable if tube centerline is displaced by more than 5 millimeter 3/16 inch from centerline of tube connection at outlet header when coils are more than two rows deep and when installed in accordance with the manufacturer's instructions. Provide adequate provisions for expansion and contraction to preclude sagging and distortion under thermal loads applied in indicated or specified service. Slope tubes to be free draining.

Provide maximum heating-coil face tube spacing of 75 millimeter 3 inches on center for DN25 1-inch outside-diameter (od) tubes, 50 millimeter 2 inches for DN20 3/4-inch od tubes, and 38 millimeter for DN18 1-1/2 inches for 5/8-inch od tubes.

Provide coil face tube spacing for cooling coils and for helically wound heating coils immediately followed by water-cooling coils that do not exceed 38 millimeter 1-1/2 inches on center.

Provide tubes that are straight, with turns made through headers or return U-bends, and connections and joints brazed, except as otherwise specified.

\*\*\*\*\*  
NOTE: Select the following paragraph for standard  
hot and chilled water and saturated steam conditions.  
\*\*\*\*\*

Ensure coil tube material is seamless deoxidized copper.

Provide coil tube material for superheated-steam service to 2500 kilopascal 350 pounds per square inch (psi) at 260 degrees C 500 degrees F or where indicated that is seamless 90-10 copper-nickel with 0.89 millimeter 0.035-inch wall thickness.

\*\*\*\*\*  
NOTE: Select the following paragraph for low cost  
installation for steam, hot and chilled water, and  
dx coils, with the expectation of a long coil life.  
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Provide raw coil tube stock wall with a minimum thickness of 0.64 millimeter 0.025 inch.



\*\*\*\*\*  
NOTE: Select the following paragraph for general construction for steam, hot and chilled water and dx coils. Standard copper heavy duty coils with 1.24 millimeter 0.049-inch walls are available.  
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Provide raw coil tube stock wall with a minimum thickness of 0.89 millimeter 0.035 inch.

Where mechanical insert devices are used to increase liquid turbulence within tubes, increase the wall thickness of these tubes by 0.25 millimeter 0.010 inch over the minimum raw coil tube stock specified for the service.

Provide minimum tube DN15 od of 1/2 inch.

#### 2.1.5 Coil Circuiting

Provide standard or full-circuited water coils that have as many full-length tubes in each circuit as the number of tubes in the depth of the coil face; provide double-circuit water coils that have twice as many as standard coils; and provide half-circuit water coils that have half as many as standard coils and to the next larger whole number where odd numbers are involved.

Provide counterflow type coils when more than two rows deep, except that in the case of double- or half-circuit coils, reasonable deviation from counterflow arrangement is permitted, provided the pressure drop and capacity requirements are met.

#### 2.1.6 Drainable Coils

Provide drainable coils that are capable of being purged free of water with compressed air.

Provide self-draining coils with a drain point at the end of every tube and pitch to that point. Provide drain provisions that include: drained headers; U-bends with integral plugs; or nonferrous plugs in cast-iron headers. Provide tubes that drain substantially dry by gravity alone when drains and vents are open.

Where necessary, fill the coil with water to the end of the manufacturer's header connections and check drainage volume against the manufacturer's data.

### 2.2 COIL TYPES

#### 2.2.1 Steam Heating

[ For Type SA, provide steam distributing, tube-in-tube with multiple-orifice distributors. Provide a tube with a minimum outside-diameter of DN25 1-inch wherever coil is exposed to airstream at freezing temperatures. For all other applications, provide a minimum outside-diameter of DN18 5/8 inch. Provide tubes that are pitched 3.1 millimeter in 300 millimeter 1/8 inch per foot, and coil casing that is level. Provide coil with inlet and outlet connections on the same side.

] [For Type SB, provide tube-in-tube type, for reheat service, with modulating control. When located in ductwork over 1800 millimeter 6 feet in total

width, provide either two separate coils or one coil with supply to both ends and a single return. Provide coil with inlet and outlet connections on the same end and on opposite sides of the two-coil assembly.

- ] [For Type SC, provide single row, single circuit, for reheat service with two-position control.
- ] [For Type SD, provide integral damper face and bypass type. Provide coil that includes finned elements with headers, and with return bends pitched within the casing, and bypasses with interlocked dampers controlled by a damper motor and airstream thermostats.
- ] Provide 10 per 25 millimeter linear inch maximum fin spacing. Provide tubes that are connected to supply and return headers by mechanical joints and are secured against vibration by a channel that permits expansion and contraction. Provide 1.6 millimeter 16-gage cold-rolled steel damper blades. Provide graphite-impregnated nylon damper rod bearings. Provide oil-impregnated bronze linkage bearings. Proportion air such that the average temperature at any point in a plane parallel to the coil face, 900 millimeter 3 feet downstream of the leaving side, does not vary more than 3 degrees C 5 degrees F from the thermostat setting. Vary pressure-drop of air passing through the coil no more than plus or minus 5 percent, regardless of the position of the internal dampers.

#### 2.2.2 Hot-Water Heating

- [ For Type HA, provide continuous circuit type, limited to two rows depth.
- ] [For Type HB, provide drainable counterflow type, with more than two rows.

#### ] 2.2.3 Chilled-Water Cooling

- [ For Type CA, provide continuous circuit, drainable type, limited to two rows depth.
- ] [For Type CB, provide self-draining, counterflow type.
- ] [For Type CC, provide self-draining, cleanable, counterflow type. Provide straight-through type tubes, rolled or brazed into steel tube sheets. Enclose headers with gasketed and bolted removable cover plates to provide access to tube internals from either one end or both ends of coil.

#### ] 2.2.4 Volatile Refrigerant Cooling

- [ For Type DX, provide counterflow type, designed for use with refrigerant specified, with equal length circuiting arrangement. Provide number of distributors that suit indicated refrigerant and that eliminate trapping of refrigerant and oil. Obtain coil capacity with expansion valve set for not less than 5 degrees C 8 degrees F of superheat. Provide a refrigerant distributor that is furnished and installed by the coil manufacturer. Provide tube od that is either DN18 5/8 inch or DN20 3/4 inch.
- ] [Provide refrigerant distributor that is suitable for the thermostatic expansion valve recommended by the manufacturer for the service and capacity specified or indicated. Provide arrangement capable of stable operation down to 40 percent or less of design capacity.
- ] [Provide refrigerant distributor suitable for use with a balanced, double-ported thermostatic expansion valve or with a pilot-operated valve

where indicated. Make arrangement capable of stable operation down to 15 percent of design capacity.

## ] PART 3 EXECUTION

### 3.1 INSTALLATION

Install coils in accordance with the manufacturer's recommendations.

Submit [installation drawings](#) for coil systems. Indicate overall physical features, dimensions, ratings, service requirements, equipment weights and layout and arrangement details of equipment room on drawings.

### 3.2 TESTS

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NOTE: Conduct inspection of the installation by the  
Systems Engineer/Condition Monitoring  
Office/Predictive Testing Group during acceptance  
testing using advanced monitoring technologies such  
as Infrared Imaging or Ultrasonic Listening. These  
technologies can identify plugged or restricted  
tubing and system/pressure/vacuum leaks.  
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For drainable types:

Field check coil pitch and leveling for drainability in the presence of the Contracting Officer.

Perform [pressure tests](#) and dehydrate coils. Perform [vacuum tests](#), purge with inert gas, and seal coils.

Provide final test reports to the Contracting Officer. Provide reports with a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

### 3.3 OPERATION AND MAINTENANCE

Submit [6] [\_\_\_\_\_] copies of the [operation and maintenance manuals](#) 30 calendar days prior to testing the coil systems. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

-- End of Section --