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USACE / NAVFAC / AFCEC / NASA **UFGS-42 23 13.00 40 (August 2017)**

Preparing Activity: NASA **Superseding**
UFGS-42 23 13.00 40 (August 2014)
UFGS-42 23 13 (May 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

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PROCESS CONDENSERS

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SECTION 42 23 13.00 40

PROCESS CONDENSERS
08/17

NOTE: This guide specification covers the requirements for remote air-cooled condensers for processes.

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 item(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).

PART 1 GENERAL

NOTE: If Section 23 30 00 HVAC AIR DISTRIBUTION is not included in the project specification, insert applicable requirements therefrom and delete the following paragraph.

Section 23 30 00 HVAC AIR DISTRIBUTION applies to work specified in this section.

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide

specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

ANSI/AHRI 460	(2005) Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ANSI/ASHRAE 15 & 34	(2013) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
ASHRAE 23	(2022) Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units
ASHRAE EQUIP IP HDBK	(2012) Handbook, HVAC Systems and Equipment (IP Edition)
ASHRAE EQUIP SI HDBK	(2012) Handbook, HVAC Systems and Equipment (SI Edition)

ASTM INTERNATIONAL (ASTM)

ASTM A90/A90M	(2021) Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 21940-11	(2016) Mechanical vibration -- Rotor balancing -- Part 11: Procedures and Tolerances for Rotors with Rigid Behavior

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J636	(2019) V-Belts and Pulleys

UNDERWRITERS LABORATORIES (UL)

UL 207	(2022) UL Standard for Safety Refrigerant-Containing Components and Accessories, Nonelectrical
UL 1995	(2015; Reprint Aug 2022) UL Standard for Safety Heating and Cooling Equipment

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals

required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Survey of Existing Conditions; G[, [____]]

SD-02 Shop Drawings

Motors; G[, [____]]

Control Panel; G[, [____]]

Air-Cooled Condenser; G[, [____]]

Refrigerant-Containing Components; G[, [____]]

Control Diagrams; G[, [____]]

Installation Drawings; G[, [____]]

SD-03 Product Data

Equipment Foundation Data; G[, [____]]

Manufacturer's Catalog Data; G[, [____]]

Sample Warranty; G[, [____]]

SD-04 Samples

Manufacturer's Standard Color Chart; G[, [____]]

SD-05 Design Data

Design Analysis and Calculations; G[, [____]]

SD-07 Certificates

List of Product Installation

Certificates of Compliance

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings; G[, [____]]

Warranty; G[, [____]]

1.3 QUALITY CONTROL

Conduct a survey of existing conditions. Ensure that the results of survey the include features of existing structures and facilities within and adjacent to the jobsite. Commencement of work constitutes acceptance of existing conditions.

Submit a list of product installation for air-cooled condenser units, showing at least 5 installed units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Identify the purchaser, address of installation, service organization, and date of installation.

Submit certificates of compliance for following the items, showing conformance with the standards cited in this section:

a. Motors

b. Control panel

c. Air-cooled condenser

d. Refrigerant-containing components

e. Fans and drives

f. Condensing pressure control

g. Casing

h. Vibration isolation

1.4 WARRANTY

****

NOTE: The Systems Engineer/Condition Monitoring Office/Predictive Testing Group needs to know the warranty expiration date, in order to perform the inspections within the prescribed time frame.

****

Final acceptance is dependent upon providing the warranty, based on approved sample warranty, to the Contracting Officer, along with final test reports. Ensure that the warranty is valid for a minimum of [2] [5] [_____] years from the date of project closeout and shows the [Government] [_____] as the warranty recipient.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

****
NOTE: Ensure that fan and motor balancing conform to ISO Std.1940-1 unless otherwise noted. For motor vibration levels, conform to NEMA Specification MG-1, unless otherwise noted.
****

2.1.1 Air-Cooled Condenser Package

Provide a packaged, self-contained air-cooled condenser assembly that includes fans, motors, drives, refrigerant condensing coils, controls, intercomponent piping and wiring, totally enclosed weatherproof casing, and frame mounting and that is ready for terminal field connections with fully automatic operation.

Ensure that the condenser and spare parts conform to the applicable requirements of UL 1995, UL 207, ANSI/ASHRAE 15 & 34, ASHRAE 23, ANSI/AHRI 460.

****
NOTE: Revise the following paragraphs as required to suit project conditions. A condenser suitable for a lower ambient temperature will require a more expensive low-ambient control.
****

Provide a unit suitable for startup and operation in ambient temperatures as low as 7 [_____]degrees C 45 [_____]degrees F.

2.1.2 Equipment and Performance Data

****
Include in drawings or schedule total heat rejection capacity, capacity conditions, coil circuits, and control diagrams.
****

Submit manufacturer's catalog data for the following items, including the manufacturer's standard color selections and finishes for condensers within manufacturer's standard color chart:

a. Air-cooled condenser: Indicate use life, system functional flows, safety features, and other features, such as electrical system protective device ratings.

b. Motors

c. Control panel

d. Refrigerant-containing components

e. Fans and drives

f. Condensing pressure control

g. Casing

h. Vibration isolation

i. Spare parts

Submit control diagrams for air-cooled condenser units, showing the physical and functional relationship of equipment. Show size, type, and capacity of the system on electrical diagrams.

Submit design analysis and calculations for air-cooled condensers, indicating the manufacturer's recommended wattage horsepower ratings, rotational speeds, and piston speeds.

Submit equipment foundation data, including equipment weight and operation loads; location and projection of anchor bolts; and horizontal and vertical clearances for installation, operation, and maintenance for the following:

a. Air-cooled condenser

b. Fans and drives

c. Motors

d. Vibration isolation: Ensure that vibration isolation provisions conform to requirements specified under Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

Include dimensions of foundations and relative elevations, and installation requirements such as noise abatement, vibration isolation, and utility services.

Submit shop drawings, including the general physical layout of all controls, and internal tubing and wiring details. Submit connection diagrams indicating the relations and connections of the following items:

a. Motors

b. Control panel

c. Air-cooled condenser

d. Refrigerant-containing components

2.2 COMPONENTS

2.2.1 Fans and Drives

****

NOTE: Select the first paragraph for on-the-roof and other applications where noise is not a factor. Select the second paragraph for on-grade locations adjacent to offices, situations requiring ducting, and generally for low-noise-level areas.

Where noise is a factor, show on drawings limiting speeds, outlet velocities, or noise criteria to suit project conditions.

****

[Provide corrosion-resistant propeller fans, statically and dynamically balanced to ISO 21940-11, [G6.3] [G2.5] [_____] with a vertical discharge and a maximum fan-tip speed of 51 meter per second 10,000 feet per minute.

][Provide a double-width, double-inlet, centrifugal-scroll fan with forward curved or airfoil-section-bladed wheels of corrosion-resistant construction that are statically and dynamically balanced to ISO 21940-11, [G6.3] [G2.5] [_____]. Ensure that the fan shaft first-critical speed is at 20 percent above the fan operating speed.
]

****

NOTE: Select the first paragraph only for propeller fan units with ratings less than 3730 watt smaller than 5 horsepower. If the second paragraph is selected, specify with not less than two belts for critical operations.

****

[Provide direct drive.

][Provide a V-belt with a corrosion-protected shaft and antifriction bearing drive conforming to ASHRAE EQUIP SI HDBK ASHRAE EQUIP IP HDBK, rated at not less than 1.5 times the identification plate motor wattage horsepower, SAE J636. Provide bearings [sealed against moisture and dirt, prelubricated, and suitable for not less than 10,000 operating hours without need for relubrication] [of a lubricable type with grease supply and relief fittings, together with an extension tubing for accessibility where necessary][permanently lubricated and sealed]. Completely pack the bearing cavity with a grease suitable for the service.
]

****

NOTE: Modify or delete the following two paragraphs as required.

****

[Equip the fan drive with an adjustable sheave sized for installation at its midpoint setting and able to provide 20-percent speed adjustment.

][Mount the motors on an adjustable base; mount motors with ratings larger than 7460 watt larger than 10 horsepower on a pivoted motor base.

] Provide a weather-protected drive. Guard the drive and fan discharge and inlet in accordance with the recommendations of the Occupational Safety and Health Act (OSHA). Provide a fan guard that is hot-dip galvanized after fabrication and suitable for salt-air atmosphere; electrogalvanizing is not acceptable.

2.2.2 Motors

Provide totally enclosed motors conforming to NEMA MG 1.

****

NOTE: Retain the following paragraph for direct-drive units.

****

[Provide resilient mount motors.

][2.2.3 Refrigerant-Containing Components

****
NOTE: Modify the following paragraphs as required to suit the project. Check the subcooling requirements for the project.
****

Design and size the condensing coils specifically for air-cooled condenser service. Construct with seamless copper tubing, with copper extended surface integrated with or mechanically attached to the tube. Provide a coil frame not less than 2.8 millimeter 12-gage galvanized steel. [Factory-test the coils, pneumatically under water at not less than 2758 kilopascal 400 pounds per square inch gage.]Provide a purging vent at the highest point of the entering refrigerant header of each coil circuit. Provide coil subcooling when a differential not greater than 7 degrees C below zero degrees C 20 degrees F exists between condensing and ambient temperatures.

Provide a condenser coil and receiver with an excess capacity of not less than 20 percent for storage of pumped-down refrigerant.

Clean and factory-charge the condensing coil and the remainder of the refrigerant circuit with dry nitrogen or refrigerant.

Protect the coil from physical damage.

]2.2.4 Condensing Pressure Control

****
NOTE: Retain the following paragraph only for single-phase powered units.
****

[Accomplish condensing pressure control by an electronic solid-state control system that modulates the motor speed and conforms to requirements specified herein from 0 to 100 percent by fan cycling or by a combination of these methods.
]

****
NOTE: Retain one of the following two paragraphs for single- or three-phase powered units.
****

[Accomplish condensing pressure control by [condenser-coil flooding system] [modulation of dampers located in the discharge airstream].

][Accomplish condensing pressure control by [fan cycling] [modulation of dampers located in the discharge airstream] [combination of fan cycling and discharge damper modulation].

] Where the condenser is being used as a combination receiver, provide a pump-down capacity of at least 80 percent of the available refrigerant volume.

2.2.5 Casing

Provide a casing of minimum 1.3 millimeter 18-gage mill-galvanized steel

that has been phosphatized, primed, and finished with the manufacturer's standard enamel.[Specially treat casing for use in a coastal environment.]

****
NOTE: Specify 71 gram 2.5 ounces of zinc for heavy-duty steel.
****

Ensure that mill-galvanized steel conforms to ASTM A653/A653M and is coated with not less than 380 gram 1.25 ounces of zinc per square meter foot of two-sided surface when tested in accordance with ASTM A90/A90M.

Provide a casing frame of mill-galvanized steel or hot-dip galvanized steel after fabrication to equal or exceed mill-galvanizing requirements.

Include access doors and a coil end enclosure. Locate the control panel inside or outside the casing.

2.2.6 Control Panel

****
NOTE: Modify the following paragraphs for remote location.
****

Provide condenser-mounted control panel and intercomponent piping and wiring. For control panels exposed to the weather, provide NEMA 250, Type 3 enclosures and NEMA 250, Type 1 enclosures if protected by casing. Conform to NFPA 70 requirements for electrical work and incorporate UL-listed components.

****
NOTE: Modify the following paragraph to suit project requirements.
****

Provide a control panel with the following factory-mounted controls: 115-volt control power transformer, fan contactors, fan controls for low ambient operation, and a compressor interlock.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

Submit installation drawings for air-cooled condenser units. Indicate on the drawings: overall physical features, dimensions, ratings, service requirements, weights of equipment, and details of equipment room layout and arrangement.

3.2 CLOSEOUT ACTIVITIES

3.2.1 Operation and Maintenance

Submit [six] [_____] copies of the operation and maintenance manuals 30 calendar days before testing the air-cooled condenser units. Update and resubmit data for final approval no later than 30 calendar days before

contract completion.

3.2.2 Record Drawings

Submit record drawings for air-cooled condenser units and provide information, including deviations from, and amendments to the drawings and concealed and visible changes in the work.

3.2.3 Acceptance

With the warranty and final test reports, provide a cover letter/sheet clearly marked with the system name, date, and the words "Equipment Warranty" - "Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --