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USACE / NAVFAC / AFCEC / NASA	**UFGS-23 74 33.00 40 (May 2017)**

Preparing Activity: NASA	**Superseding**
	UFGS-23 74 33.00 40 (February 2011)
	UFGS-23 74 33 (November 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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SECTION TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 74 33.00 40

PACKAGED, OUTDOOR, HEATING AND COOLING MAKEUP AIR-CONDITIONERS

05/17

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALITY CONTROL
1.4 WARRANTY

PART 2 PRODUCTS

2.1 FABRICATION
2.1.1 Coil Coating
2.2 EQUIPMENT
2.2.1 Window, Packaged, Self-Contained (WAC)
2.2.2 Console, Packaged, Self-Contained (CAC)
2.2.3 Remote-Split, Packaged, Self-Contained (RSAC)
2.2.3.1 Compressor
2.2.3.2 Cooling Coil
2.2.3.3 Fans
2.2.3.4 Casing
2.2.3.5 Controls
2.2.3.6 Filters
2.2.3.7 Air-Cooled Condenser
2.2.3.8 Water-Cooled Condenser
2.3 COMPONENTS
2.3.1 Vibration Isolators

PART 3 EXECUTION

3.1 INSTALLATION
3.2 FIELD QUALITY CONTROL
3.2.1 Quality Control
3.3 CLOSEOUT ACTIVITIES

-- End of Section Table of Contents --

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SECTION 23 74 33.00 40

PACKAGED, OUTDOOR, HEATING AND COOLING MAKEUP AIR-CONDITIONERS
05/17

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NOTE: This guide specification covers the requirements for packaged air-conditioning units.

Show cooling and dehumidification requirements, capacity, mounting details, power connections, etc. on drawings or schedule.

Heating provisions are not included.

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).

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PART 1 GENERAL

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NOTE: If Section 23 30 00 HVAC AIR DISTRIBUTION is not included in the project specification, insert applicable requirements and delete the following paragraph. If Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT is not included in the project specification, insert applicable requirements and delete the second paragraph.

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[Section 23 30 00 HVAC AIR DISTRIBUTIONapplies to work specified in this section.

][Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT 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 are automatically 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)

AHRI 340/360 I-P	(2015) Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
AHRI 450	(2007) Water-Cooled Refrigerant Condensers, Remote Type
ANSI/AHRI 210/240	(2008; Add 1 2011; Add 2 2012) Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(2015) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings

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

ASHRAE 52.2	(2012) Method of Testing General Ventilation Air-Cleaning Devices for

	Removal Efficiency by Particle Size
ASHRAE 90.1 - IP	(2013) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI	(2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

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, 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.

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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-02 Shop Drawings

Packaged Unit; G[, [____]]

Compressor; G[, [____]]

Cooling Coil; G[, [____]]

Controls; G[, [____]]

Casing; G[, [____]]

Condenser; G[, [____]]

Installation Drawings; G[, [____]]

SD-03 Product Data

Equipment and Performance Data; G[, [____]]

Air-Conditioning Systems; G[, [____]]

Compressor; G[, [____]]

Cooling Coil; G[, [____]]

Fans; G[, [____]]

Controls; G[, [____]]

Casing; G[, [____]]

Filters; G[, [____]]

Condenser; G[, [____]]

Vibration Isolation; G[, [____]]

SD-07 Certificates

List of Product Installations

Manufacturer's Warranty; G[, [____]]

Coil Coating Warranty; G[, [____]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

1.3 QUALITY CONTROL

Submit a list of product installations of packaged air-conditioning units showing a minimum of five installed units, similar to those proposed for

use, that have been in successful service for a minimum period of 5 years. Provide a list that includes the purchaser, address of installation, service organization, and date of installation.

1.4 WARRANTY

Submit the manufacturer's warranty for the unit.

[Submit the coil coating warranty.

]PART 2 PRODUCTS

Submit equipment and performance data for packaged air-conditioning units, consisting of use life, power ratings, capacity ranges, face area classifications, and rotational velocities.

****
NOTE: In harsh environments, a coating can be added to the coils to reduce corrosion of the coils.
****

[2.1 FABRICATION

2.1.1 Coil Coating

Apply a [polyurethane][epoxy][silane][_____] coating to the coils for corrosion protection. Ensure that the coating thickness is [0.025][0.050][_____] mm [1][2][_____] mils. Ensure that the coating protects against ultraviolet radiation.

Ensure that the coating meets the requirements of ASTM B117.

]2.2 EQUIPMENT

2.2.1 Window, Packaged, Self-Contained (WAC)

****
NOTE: Unit sizes to 23,000 British thermal units (Btu) 6740 watts per hour.
****

Provide packaged unit, self-contained window unit that includes a hermetic compressor, fan(s), motor drives, coils and controls for fully automatic operation, intercomponent piping and wiring, a totally enclosed weatherproof casing, and a frame mounting ready for power connection.

Provide units that are shipped with a refrigerant holding-charge.

Provide window units that mount through the wall.

Provide units that are listed by Underwriters Laboratories (UL).

Provide the rating for the unit's maximum operating speed.

Locate controls [on the front face of unit] [with remote thermostat with on/off/fan selector] [at a remote panel]. Provide a [two] [three]-speed [gradually adjustable] [solid-state] conditioned-air circulating fan control.

Provide a unit admits controlled amounts of outside air as makeup and for exhausting internal air.

Provide units with efficiencies at the levels specified in ASHRAE 90.1 - SI ASHRAE 90.1 - IP.

Provide centrifugal evaporator fan with [_____] blades.

Provide a [centrifugal] [propeller] condenser fan.

Provide evaporator and condenser fans that are driven by [a common motor with a double shaft] [individual motors].

Provide an evaporator coil of nonferrous construction with [_____] [aluminum-plated] [copperplated] fins per millimeter inch, mechanically bonded to staggered [aluminum] [copper] tubing [_____] millimeter [_____] inch in diameter.

Provide a condenser coil of nonferrous construction with [_____] [aluminum-plated] [copper-plated] fins per millimeter, inch, mechanically bonded to staggered [aluminum] [copper] tubing [_____] millimeter [_____] inch in diameter.

Provide a unit with an internally mounted [reusable] [throwaway] filter, that is at least [_____] inches thick and has a face area of [_____] square millimeter at least [_____] square [inches] [feet].

Provide outlet grilles that are constructed to permit adjustable horizontal and vertical flow.

2.2.2 Console, Packaged, Self-Contained (CAC)

****

NOTE: Referenced standard permits the actual capacity of the furnished unit to be 95 percent of the nameplate capacity and the power input to be 105 percent of the rated input.

Unit sizes 5861 to 35168 watts 20,000 to 120,000 Btu per hour.

****

Provide packaged, self-contained console unit for floor mounting that includes compressors, fans, motor(s), drives, coils, a water-cooled condenser, air filters, controls for fully automatic operation, intercomponent piping and wiring, and a single casing suitable for exposed-to-view office locations ready for field terminal connections.

Provide units that are shipped with a refrigerant holding-charge.

Provide [an AHRI Classification RCU-W-CB evaporator/blower unit and a remote air-cooled condensing unit with capacities ranging from 5860 to 35170 watts 20,000 to 120,000 British thermal units] [an evaporator/blower unit with plenum, modified to be self-contained, conforming to ANSI/AHRI 210/240].

[Provide a unit that meets the 70 percent room-sensible cooling-effect requirements of ANSI/AHRI 210/240.

] Provide the rating for the unit's maximum operating speed.

Provide centrifugal conditioned-air circulating fans with [_____] blades.

Provide an evaporator coil of nonferrous construction with [_____] [aluminum-plated] [copper-plated] fins per millimeter inch mechanically bonded to [aluminum] [copper] tubing [_____] millimeter [_____] inch in diameter.

Provide a water-cooled condenser within the enclosure.

Provide outlet grilles that permit adjustable horizontal and vertical flow.

[Provide a unit that is fitted with automatic cooling-water control valves.

]2.2.3 Remote-Split, Packaged, Self-Contained (RSAC)

****

NOTE: Heating provisions are not included. Air- and water-cooled condensers are included.

Referenced standard permits the actual capacity of the furnished unit to be 95 percent of the identification plate capacity and the power input to be 105 percent of the rated input.

Type I unit range 5860 to 35170 watts 20,000 to 120,000 Btu/hr; Type II unit range 10260 to 52755 watt/hr 35,000 to 180,000 Btu/hr; Type III unit range 9085 to 70340 watt/hr 31,000 to 240,000 Btu/hr. Style A units are console type with plenum; Style B units have duct connections.

****

Provide an air-conditioner that consists of matched assemblies. Provide a packaged unit complete with a frame and enclosure, interconnecting piping and wiring, necessary controls and safety devices, and an operating charge of oil. Ensure that the unit is ready for full-capacity operation after removal of the shipping protection, connection to the remote compressor/condenser or condenser, charging, and connection to utilities. Completely charge the system in the field. Have units shipped with a refrigerant holding-charge.

[Provide an AHRI Classification RCU-A-CB, ANSI/AHRI 210/240 evaporator/blower unit and a remote air-cooled condenser and compressor, with capacities ranging from 5860 to 35170 watt 20,000 to 120,000 Btu per hour.

][Provide an AHRI Classification RCU-W-CB, ANSI/AHRI 210/240 AHRI 340/360 I-P evaporator/blower unit and a remote water-cooled condenser and compressor, with capacities ranging from 10260 to 52755 watt 35,000 to 180,000 Btu per hour.

][Provide an AHRI Classification RC-A, AHRI 340/360 I-P evaporator/blower, a compressor unit, and a remote air-cooled condenser unit, with capacities ranging from 9085 to 70340 watt 31,000 to 240,000 Btu per hour.

][Provide a floor-mounted console evaporator/blower unit with plenum.

][Provide a floor-mounted evaporator/blower unit with connections for ductwork.

]2.2.3.1 Compressor

Provide one,750-revolution-per-minute (rpm) [semihermetic] [hermetic] compressor with an internal crankcase sight glass and a protected motor. A 3,500 rpm compressor is acceptable in units of 70340 watt 20 tons and less. Provide a unit that is capable of continuous operation under AHRI "Maximum Operating Conditions" and "Load Temperature Operations."

Provide a compressor with capacity reduction devices to automatically reduce capacity by at least 66 percent in two equal steps. Ensure that the compressors start with the capacity reduction devices in the unloaded position.

If standard with the manufacturer, provide two equal-sized compressors that operate in independent refrigerant circuits. Actuate the compressors by capacity control relays interlocked with a time sequence switch that starts unloaded or with gas pressures equalized across the compressor.

[Provide compressors with a high/low pressure safety cutoff. Equip each compressor with a reversible oil pump for lubrication, an oil-pressure-failure switch and gage, crankcase heaters, suction and discharge flanged valves, head pressure, and suction pressure gages with shutoff valves. Select a system that limits the compressor power input to 1.2 kilowatts per ton of refrigeration at standard AHRI conditions. Mount the compressor on spring vibration isolators.

]2.2.3.2 Cooling Coil

[Provide separate cooling-coil circuits for each compressor in the unit.] [Furnish pilot expansion valves.] For compressors with capacity reduction, provide the associated coil with a separate circuit, a liquid solenoid valve, and an expansion device for each two stages of capacity reduction. For each compressor of a dual-compressor unit, provide the associated coil with a protected, insulated drain pan. Provide seamless copper tubes, with [copper] [aluminum] fins mechanically bonded to the tubes at maximum intervals of 12 fins per 25 millimeter inch. Provide [vertical] [angled] coils equipped with liquid-feed distributors to ensure equal feed to each refrigerant circuit. Ensure that coils are tested at 2760 kilopascal 400 pounds per square inch (psi) at the factory and are completely dehydrated. Limit air flow to 2.54 meter per second 500 feet per minute (fpm). Provide a design that precludes carryover of water.

2.2.3.3 Fans

Provide centrifugal fans with [_____] blades in each fan section. Provide fans that are mounted [on a common shaft] [on two shafts if each shaft is driven by double belts and a single double-end motor]. Provide antifriction bearings, manufactured from vacuum-processed alloys. Provide bearings that have an [ABMA 9] [ABMA 11], L-10 life expectancy rating of 40,000 hours under service load conditions. Statically and dynamically balance fans. Provide fans that are V-belt-driven by a constant-speed motor powerful enough that the brake power rating does not exceed the nominal motor rating. Ensure that an adjustable sheave provides fan speed adjustment of at least 20 percent. Size the sheave to ensure that the fan speed at the approximate midpoint of the sheave adjustment produces the specified air quantity.

2.2.3.4 Casing

Construct the outer casing of insulated 1.3 millimeter 18-gage metal panels adequately reinforced with [angles] [a formed metal frame] and provided with easily removable panels located for access to all parts of the equipment. Round the corners to provide a neat appearance. Provide metal surfaces that are Bonderite-treated, are phosphatized, and have a baked enamel finish. Integrate the return air inlet grilles located on the front face of the unit as part of the unit casing. Ensure that the casing and insulation are designed to limit noise and vibration within acceptable levels.

Ensure that outlet grilles permit adjustable directional flow in both horizontal and vertical planes.

2.2.3.5 Controls

Mount a switch with fan/off/cool positions, [in the unit] [with the remote thermostat]. Remotely mount the thermostat where shown on the drawing. Mount other controls, including motor starter or contactors and safety controls, inside the enclosure. Provide magnetic across-the-line motor starters. Provide general-purpose enclosures for motor starters. Where two or more compressors are used, provide time-delay relays for sequence starting.

2.2.3.6 Filters

Locate filters in the filter return air fixture [in the rear of the casing] [on the inside of the front casing]. Select filters that limit air velocities to 2.54 meter per second 500 fpm. Ensure that filters have an average efficiency of at least 20 percent based on ASHRAE 52.2.

[Provide a [_____] millimeter [_____] inch thick panel, with permanent, cleanable, impingement, all-metal construction filters. Provide a galvanized steel frame not less than 1.0 millimeter 20-gage with mitered, reinforced corners. Provide a galvanized, corrugated-metal. filter medium. Use aluminum filters if the medium is the herringbone type. Do not use expanded aluminum metal.

] [Provide a [_____] millimeter [_____] inch thick panel, with glass-fiber filters, housed in a fiberboard casing between metal grids. Provide a stiffener bar for additional support. Provide a filtering medium that is formed of continuous interlaced glass filaments. Provide a fiber coated with a nonflammable fluid gel that forms an adhesive film to hold collected dust. Provide a fluid gel that does not drip at temperatures below66 degrees C 150 degrees F.]

2.2.3.7 Air-Cooled Condenser

Provide a condenser enclosure constructed of [sheet steel not less than 1.3 millimeter 18-gage] [aluminum adequately reinforced and braced], with access panels and with a rust-inhibitive baked enamel or galvanized finish.

Provide an air-cooled condenser with vertical discharge, in a weather-protected casing, that is suitable for installation remote from the air-conditioning unit. Provide air inlet and discharge grilles with galvanized wire-mesh birdscreens.

Provide an extended-surface condenser coil, constructed with [copper] [aluminum] tubes with [_____] [copper] [aluminum] fins per 25.4 millimeter inch, mechanically bonded to the coil. Ensure that the entire refrigerant circuit is dehydrated and sealed at the factory. Provide a coil that is designed for the refrigerant used in the air conditioner. Ensure that the condensers are designed for the working pressure of the system.

Provide [centrifugal] [propeller] fans that are [belt-driven] [directly connected to low-speed (1,200 rpm maximum) electric motors]. For belt-driven fans, provide a guard and adjustable sheaves that permit the fan speed to be adjusted at least 20 percent. Select sheaves that provide the capacity indicated at the approximate midpoint of the adjustment.

Provide an electric motor that is totally enclosed. Provide a magnetic across-the-line-type motor starter within a weather-resistant housing.

[Control the condensing pressure by an electronic solid-state control system that modulates the speed of the condenser's fan motor from 0 to 100 percent by fan cycling.

][Control the condensing pressure by an electric thermostat that cycles the condenser's fan motor.

][Control the condensing pressure by a head pressure switch that cycles the condenser's fan motor.

][Control the condensing pressure by [fan cycling] [modulation of dampers located in the airstream].

][Control the condensing pressure by [a condenser-coil flooding system] [modulation of dampers located in the airstream].

]2.2.3.8 Water-Cooled Condenser

****
NOTE: The following covers remote condensers for process or comfort air-conditioning systems.
****

Provide water-cooled condensers that include all necessary openings, water and refrigerant connections, purge valves, relief devices, refrigerant valves, a liquid-level indicating device, and support provisions.

Ensure that the condenser conforms to AHRI 450, ASME BPVC SEC VIII D1 [and is so stamped].

[When a condenser is being used as a combination receiver, provide a pump-down capacity equal to 80 percent of the available condenser volume.

][Select a unit for water velocities not in excess of 2.1 meter 7 feet per second and a fouling factor of 0.0010.

][Provide a [copper][brass] condensing surface between the halogen refrigerant and the cooling water.

][Provide a copper condensing surface between the halogen refrigerant and the cooling water; provide nonferrous tube sheets.

][Provide condensers that are [shell and coil] [shell and U-tube] [shell and

tube] construction, with a refrigeration capacity of 35 kilowatt 10 tons and under. Provide [brazed] [silver] soldered coil joints.

][Provide a condenser that is [shell and coil] [shell and U-tube] [shell and tube] construction.

][Provide condensers that are shell and tube, cleanable construction, with tubes that are [rolled] [brazed] into tube sheet, with a refrigeration capacity of at least 35 kilowatt 10 tons.

][Provide condensers that are shell and tube, cleanable construction, and with tubes that are [rolled] [brazed] into tube sheet.

] Provide intermediate tube supports so that the distance between the straight-tube supports does not exceed [900] [3] [_____] millimeter [_____] feet for copper tubes and [1200] [4] [_____] millimeter [_____] feet for brass tubes. Fit supports to the tubes in a manner that precludes corrosion, vibration, and abrasion.

2.3 COMPONENTS

2.3.1 Vibration Isolators

Ensure that vibration isolation provisions conform to the requirements in Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment in accordance with the manufacturer's recommendations.

Submit installation drawings for packaged air-conditioning units in accordance with referenced standards in this section.

3.2 FIELD QUALITY CONTROL

3.2.1 Quality Control

Test and rate components of the air-conditioning systems as a system in accordance with ANSI/AHRI 210/240.

3.3 CLOSEOUT ACTIVITIES

Submit [6] [_____] copies of the operation and maintenance manuals at least 30 calendar days before testing the packaged air-conditioning units. Update and resubmit data for final approval at least 30 calendar days before contract completion.

-- End of Section --