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## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2015

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 74 33.00 40

PACKAGED, OUTDOOR, HEATING AND COOLING MAKEUP AIR-CONDITIONERS

02/11

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

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

- |         |                                                                              |
|---------|------------------------------------------------------------------------------|
| ABMA 11 | (2014) Load Ratings and Fatigue Life for<br>Roller Bearings                  |
| ABMA 9  | (1990; ERTA 2012; S 2013) Load Ratings and<br>Fatigue Life for Ball Bearings |

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

- |                  |                                                                                                                                             |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| ASHRAE 52.2      | (2012; Errata 2013; INT 1 2014) Method of<br>Testing General Ventilation Air-Cleaning<br>Devices for Removal Efficiency by Particle<br>Size |
| ASHRAE 90.1 - IP | (2010; ERTA 2011-2013) Energy Standard for<br>Buildings Except Low-Rise Residential<br>Buildings                                            |
| ASHRAE 90.1 - SI | (2010; ERTA 2011-2013) Energy Standard for<br>Buildings Except Low-Rise Residential<br>Buildings                                            |

ASME INTERNATIONAL (ASME)

- |                       |                                                                                   |
|-----------------------|-----------------------------------------------------------------------------------|
| ASME BPVC SEC VIII D1 | (2010) BPVC Section VIII-Rules for<br>Construction of Pressure Vessels Division 1 |
|-----------------------|-----------------------------------------------------------------------------------|

U.S. DEPARTMENT OF ENERGY (DOE)

DOE CE-3	(2001) How to Buy an Energy-Efficient Commercial Unitary Air Conditioner
DOE RA-1	(2000) How to Buy an Energy-Efficient Room Air Conditioner

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.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Submit Fabrication drawings for the following items consisting of fabrication and assembly details to be performed in the factory.

Packaged Unit[; G[, [\_\_\_\_]]]

Compressor[; G[, [\_\_\_\_]]]

Cooling Coil[; G[, [\_\_\_\_]]]

Controls[; G[, [\_\_\_\_]]]

Casing[; G[, [\_\_\_\_]]]

Condenser[; G[, [\_\_\_\_]]]

Submit Installation Drawings[; G[, [\_\_\_\_]]] for packaged air-conditioning units in accordance with paragraph entitled, "Installation," of this section.

#### SD-03 Product Data

Submit Equipment and Performance Data[; G[, [\_\_\_\_]]] for packaged air-conditioning units in accordance with paragraph entitled, "General Requirements," of this section.

Submit Manufacturer's catalog data for the following items:

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

Submit Listing of Product Installations[; G[, [\_\_\_\_]]] for packaged air-conditioning units in accordance with paragraph entitled, "Installation," of this section.

#### SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals[; G[, [\_\_\_\_]]] in accordance with paragraph entitled, "Operation and Maintenance," of this section.

### 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. 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 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION AND EXHAUST SYSTEMS applies 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.

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

## PART 2 PRODUCTS

### 2.1 MANUFACTURED UNITS

#### 2.1.1 Window-Type, Packaged, Self-Contained (WAC)

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NOTE: Unit sizes to 23,000 British thermal units (Btu) 6740 watt per hour.  
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Provide packaged unit that is a window-type, self-contained assemblage that includes hermetic compressor, fan(s), motor drives, coils and controls for fully automatic operation, intercomponent piping and wiring, totally enclosed weatherproof casing, and frame mounting ready for power connection.

Provide units that use a non-chlorofluorocarbon (CFC) refrigerant and are shipped with a refrigerant holding charge.

Provide units that are window type through wall.

Provide units that are Underwriters Laboratories (UL) listed.

Provide rating at unit maximum speed.

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

Provide unit that has provisions for admitting controlled amounts of outside air as makeup and for exhausting internal air.

Provide units that have efficiencies in accordance with the recommended levels specified in DOE RA-1 and ASHRAE 90.1 - IP ASHRAE 90.1 - SI.

Provide centrifugal type evaporator fan with [\_\_\_\_\_] type blades.

Provide [centrifugal] [propeller] type condenser fan.

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

Provide evaporator coil that is nonferrous construction with [\_\_\_\_\_] [aluminum] [copper] plate fins per millimeter inch, mechanically bonded to staggered [aluminum] [copper] tubing [\_\_\_\_\_] millimeter [\_\_\_\_\_] inch in diameter.

Provide condenser coil that is nonferrous construction with [\_\_\_\_\_] [aluminum] [copper] plate fins per millimeter, inch, mechanically bonded to staggered [aluminum] [copper] tubing [\_\_\_\_\_] millimeter [\_\_\_\_\_] inch in diameter.

Provide unit that has an internally mounted [reusable] [throwaway] filter, minimum [\_\_\_\_\_] millimeter [\_\_\_\_\_] inch(es) thick with minimum face area of [\_\_\_\_\_] square millimeter [\_\_\_\_\_] square [inches] [feet].

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

#### 2.1.2 Console-Type, Packaged, Self-Contained (CAC)

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

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

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Provide packaged unit that is self-contained, floor-mounted assemblage that includes compressors, fans, motor(s), drives, coils, 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 use a non-cfc refrigerant and are shipped with a refrigerant holding-charge.

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

Provide units that have efficiencies in accordance with the recommended levels specified in DOE CE-3.

[Provide 70 percent room sensible cooling effect requirements of ANSI/AHRI 210/240.]

Provide rating at unit maximum speed.

Provide centrifugal type conditioned-air circulating fans with [\_\_\_\_\_] type blades.

Provide evaporator coil that is nonferrous construction with [\_\_\_\_\_] [aluminum] [copper] plate fins per millimeter inch mechanically bonded to [aluminum] [copper] tubing [\_\_\_\_\_] millimeter [\_\_\_\_\_] inch in diameter.

Provide condenser that is water-cooled type and that is contained within the enclosure.

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

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

#### ]2.1.1.3 Remote-Split-Type, Packaged, Self-Contained (RSAC)

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

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

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Provide air-conditioner that consists of matched assemblies. Provide packaged unit complete with frame and enclosure, interconnecting piping and wiring, necessary controls and safety devices, and operating charge of oil. Provide unit that is ready for full-capacity operation after removal of shipping protection, connection to remote compressor/condenser or condenser, charging, and connection to utilities. Completely charge system in the field. Provide refrigerant that is R-22. Have units shipped with a refrigerant holding-charge.

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

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

] Provide air-cooled units that have efficiencies in accordance with the recommended levels specified in DOE CE-3.

[ Provide water-cooled units that have efficiencies in accordance with the recommended levels specified in DOE CE-3.



] [Provide units that are RC-A, ANSI/AHRI 340/360, evaporator/blower, compressor unit and remote air-cooled condenser unit, with capacities ranging from 9085 to 70340 watt 31,000 to 240,000 Btu per hour.

] [Provide floor-mounted console type evaporator/blower units with plenum.]

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

#### ]2.1.3.1 Compressor

Provide 1,750-revolution per minute (rpm) [semihermetic] [hermetic] type compressor with internal crankcase sight glass and protected motor. A 3,500-rpm compressor is acceptable in units of 70340 watt 20 tons and less. Provide unit that is capable of continuous operation under ARI, "Maximum Operating Conditions" and "Load Temperature Operations".

Provide compressor with capacity reduction devices to produce automatic-capacity reduction of at least 66 percent in two equal steps. Ensure compressors start with capacity reduction devices in the unloaded position. If standard with the manufacturer, provide two equal-sized compressors in lieu of a single compressor, and operate in completely independent refrigerant circuits, actuated by capacity control relays interlocked with a time sequence switch, that start unloaded or with gas pressures across the compressor equalized.

[ Provide compressors with high/low pressure safety cutoff. Equip compressor with 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 system that limits the compressor power input to 1.2 kilowatts per ton of refrigeration at standard ARI conditions. Mount compressor on spring-type vibration isolators.

#### ]2.1.3.2 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, 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, [copper] [aluminum] fins, mechanically bonded to the tube at 12 fins per 25 millimeter inch, maximum. Provide [vertical] [set at an angle] coils equipped with liquid-feed distributors to ensure equal feed to each refrigerant circuit. Test coils at 2760 kilopascal 400 pounds per square inch (psi) at the factory and completely dehydrated. Limit air flow to 2.54 meter per second 500 feet per minute (fpm). Provide design that precludes carryover of water.

#### 2.1.3.3 Fans

Provide centrifugal-type fans with [\_\_\_\_\_] type 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 type bearings, manufactured from vacuum processed alloys. Provide bearings that have a [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 constant-speed motor of sufficient size that the brake power rating does not exceed the nominal motor rating. Ensure adjustable sheave provides not less than 20 percent fan-speed adjustment. Select sheave size so that fan speed at the approximate midpoint of the sheave adjustment produces the specified air quantity.

#### 2.1.3.4 Casing

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

Provide outlet grilles that are constructed to permit adjustable directional flow in both horizontal and vertical planes.

#### 2.1.3.5 Controls

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

#### 2.1.3.6 Filters

Locate filters in the filter return air fixture [in the rear of the casing] [on the inside of the front casing]. Provide filters that limit air velocities to 2.54 meter per second 500 fpm. Provide filters with an average efficiency of not less than 20 percent based on ASHRAE 52.2.

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

] [Provide [\_\_\_\_\_] millimeter [\_\_\_\_\_] inch thick panel, glass-fiber type filters, housed in a fiberboard casing between metal grids. Provide stiffener bar for additional support. Provide filtering medium that is formed of continuous interlaced glass filaments. Provide fiber that is coated with a nonflammable fluid jell that forms an adhesive film to hold collected dust. Provide fluid jell that does not drip at temperatures below 66 degrees C 150 degrees F.]

#### 2.1.3.7 Air-Cooled Condenser

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

Provide an extended surface fin-and-tube type condenser coil, constructed with [copper] [aluminum] tubes with [\_\_\_\_\_] [copper] [aluminum] fins per 25.4 millimeter 1 inch mechanically bonded to coil. Dehydrate and seal entire refrigerant circuit at the factory. Provide coil that is designed for the refrigerant used in the air conditioner. Provide R-22 condensers that are designed for working pressure of not less than 2070 kilopascal 300 psi and that are factory tested at not less than [2760] [400] [\_\_\_\_\_] kilopascal [\_\_\_\_\_] psi.

Provide [centrifugal] [propeller] type fans. Provide fans that are [belt-driven] [directly connected to low-speed (1,200 rpm maximum) electric motors]. Provide belt drive with guard and adjustable sheaves to provide not less than 20 percent fan speed adjustment. Select sheaves to provide the capacity indicated at the approximate midpoint of the adjustment.

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

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

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

][Accomplish condensing pressure control by an electric thermostat that cycles the condenser fan motor.

][Acomplish condensing pressure control by a head pressure switch that cycles the condenser fan motor.

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

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

#### ]2.1.3.8 Water-Cooled Condenser

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**NOTE: The following covers remote condensers for  
process or comfort air-conditioning systems.**  
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Provide water-cooled condensers that include all necessary openings, water and refrigerant connections, purge valves, relief devices, refrigerant valves, liquid-level indicating device, and support provisions.

Provide condenser that conforms to AHRI 450, ASME BPVC SEC VIII D1 [and 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 unit for water velocities not in excess of 2.1 meter 7 feet per second and a fouling factor of 0.0010.

- ][Provide [copper][brass] condensing surface between halogen refrigerant and cooling water.
- ][Provide copper condensing surface between halogen refrigerant and cooling water; provide nonferrous metal tube sheets.
- ][Provide condensers with a refrigeration capacity of 35 kilowatt 10 tons and under that are [shell and coil] [shell and U-tube] [shell and tube] construction. Provide [brazed] [silver] soldered coil joints.
- ][Provide condenser that is [shell and coil] [shell and U-tube] [shell and tube] construction.
- ][Provide condensers with a refrigeration capacity of 35 kilowatt 10 tons or more of shell and tube cleanable type construction, and tubes that are [rolled] [brazed] into tube sheet.
- ][Provide condenser made of shell and tube cleanable type construction, and tubes that are [rolled] [brazed] into tube sheet.
- ] Provide intermediate tube supports so that distance between 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 to preclude corrosion, vibration, and abrasion.

## 2.2 COMPONENTS

### 2.2.1 Vibration Isolators

Provide vibration isolation provisions that conform to requirements specified 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 manufacturer's recommendations.

Submit listing of product installations for packaged air-conditioning units showing a minimum of 5 installed units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Provide list that includes purchaser, address of installation, service organization, and date of installation.

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

### 3.2 TESTING

#### 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 OPERATION AND MAINTENANCE

Submit [6] [\_\_\_\_\_] copies of the operation and maintenance manuals 30 calendar days prior to testing the packaged air-conditioning units. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

-- End of Section --