SECTION 238113.13 - PACKAGED TERMINAL AIR-CONDITIONERS, OUTDOOR, WALL-MOUNTED UNITS

This Section includes requirements for sustainable design systems. However, equipment specified in this Section may not meet requirements of those systems. Verify, with manufacturers, that the requirements can be met. To comply, HVAC system design alternatives that do not include packaged, terminal air conditioners may be required.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes packaged, terminal, outdoor, wall-mounted air conditioners.
			2. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
				5. Shop Drawings: For packaged, terminal air conditioners.

Include plans, elevations, sections, details for wall penetrations,**[ seismic bracing,]** and attachments to other work.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

* + - * 1. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.
				2. Product Test Reports: For packaged, terminal air conditioners, for tests performed by manufacturer and witnessed by a commissioning agency.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For special warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.
			2. WARRANTY

When warranties are required, verify with Director’s Representative 's that warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components.

Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than **[five] <Insert number>** years from date of Substantial Completion, including components and labor.

Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than **[five] <Insert number>** years from date of Substantial Completion, including only components and excluding labor.

Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than **[five] <Insert number>** years from date of Substantial Completion.

Warranty Period for Energy Recovery Ventilator: : Manufacturer's standard, but not less than **[five] <Insert number>** years from date of Substantial Completion.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or AVITRU. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. MANUFACTURERS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Bard Manufacturing Company.

Compu-Aire, Inc.

Liebert; Vertiv Holdings Co.

Approved equivalent.

* + - 1. MANUFACTURED UNITS

Retain first option in "Description" paragraph below for heating and cooling units and for heat pumps with supplemental heat.

* + - * 1. Description: Factory-assembled and -tested, self-contained, packaged, terminal air conditioner with room cabinet, electric refrigeration system,**[ heating,]** and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis and circuit breaker.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Sustainable design systems require compliance with requirements in ASHRAE 62.1. In addition to establishing minimum ventilation rates, ASHRAE 62.1 includes requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, humidification and dehumidification, drain pan construction and connection, finned-tube coil selection and cleaning, and equipment access. See "Sustainable Design Considerations" Article in the Evaluations. Verify, with manufacturers, availability of units with components and features that comply with these requirements.

* + - * 1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

Sustainable design systems require minimum efficiency equal to requirements in ASHRAE/IES 90.1. See "Sustainable Design Considerations" Article in the Evaluations for discussion on this prerequisite.

* + - * 1. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
				2. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.
				3. ASHRAE ERV Testing: Applicable requirements in ASHRAE 84.
				4. AHRI Rating: Applicable requirements in AHRI 1060.
				5. UL listed and ETL performance certified.
			1. CHASSIS
				1. Cabinet: Sloped top, **[0.052-inch-] <Insert dimension> thick [steel] [aluminum]** with removable front panel with concealed latches.

Retain "Mounting," "Discharge Grille," and "Return Grille" subparagraphs below if units are not scheduled on Drawings.

Mounting: On exterior wall.

Discharge Grille: **[Extruded-aluminum discharge grille] [Supply-air acoustical plenum]**.

Return Grille: **[Extruded-aluminum grille] [Return-air acoustical plenum]**.

Louvers: **[Extruded aluminum with enamel finish] [Stamped aluminum with clear-anodized finish]; [medium bronze] [dark bronze]** color.

Finish: **[Epoxy coating] [Baked enamel]**.

Access Door: Hinged door in top of cabinet for access to controls.

Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.

Insulation: Cooling and heating sections fully insulated with 1-inch-thick fiberglass insulation.

Retain "Finish of Interior Surfaces" subparagraph below to comply with sustainable design systems or if required by Project requirements or authorities having jurisdiction. See "Sustainable Design Considerations" Article in the Evaluations.

Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Retain "Wall Sleeves" subparagraph below for floor-mounted units.

Wall Sleeves: **[Galvanized steel with polyester finish] [Molded polymer] [Molded fiberglass-reinforced polyester]**.

* + - * 1. Refrigeration System: Direct-expansion indoor coil with capillary restrictor and hermetically sealed[, soft-start] scroll compressor with **[crankcase heater,] liquid line filter dryer, externally equalized expansion valve, high-pressure switch, [low-pressure switch,] [low-pressure bypass timer,] [fan cycle, control, common alarm,] [fan cycle, variable speed control, common alarm,] [fan cycle, control, lockout relay, common alarm,] [fan cycle, variable speed control, lockout relay, common alarm,]** vibration isolation, and overload protection.

Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins**[ with capillary tube distributor on indoor coil]**.

Retain first three subparagraphs below for heat-pump units.

Accumulator.

Constant-pressure expansion valve.

Reversing valve.

Charge: **[R-407C] [R-410A]**.

* + - * 1. Indoor Fan: Forward curved, centrifugal; with **[single] [twin] [constant-] [variable-]speed motor(s) and positive-pressure ventilation damper with [concealed manual] [electric]** operator.

Filters in "Filters" paragraph below are optional feature. Washable filters may not comply with requirements in ASHRAE 62.1 for a minimum MERV 6, which is required by sustainable design systems. Verify filter efficiency with manufacturers.

* + - * 1. Filters: [Washable polyurethane in molded plastic frame] [2-inch, pleated, disposable MERV 6], serviceable from front of the unit.
				2. Condensate Drain: Coated galvanized-steel drain pan [**to direct condensate to outdoor coil for re-evaporation**] [**and piping to direct condensate to building waste and vent piping**].

In subparagraph below, verify drain pan construction and connection requirements with manufacturers for sustainable design systems or if required by Project requirements or authorities having jurisdiction. ASHRAE 62.1 has specific requirements for drain pan construction and connections.

Comply with ASHRAE 62.1 for drain pan construction and connections.

* + - * 1. Outdoor Fan: [**High-ambient**] [**Forward curved, centrifugal**] [**Propeller**] [**Forward curved, centrifugal, or propeller**] type [**with separate**] [**driven by indoor fan**] motor.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Fan Motors: Permanently lubricated split capacitor.

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

* + - * 1. Energy Recovery Wheel:

Casing: Steel with standard factory-painted finish.

Casing seals on periphery of rotor and on duct divider.

Support vertical rotors on grease-lubricated ball bearings having extended grease fittings[**or permanently lubricated bearings**]. Support horizontal rotors on tapered roller bearing.

Rotor: Polymer segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.

Drive: Fractional horsepower motor, gear reducer, and self-adjusting multilink belt around outside of rotor.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment.

Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Controls: Starting relay, factory mounted and wired, and manual motor starter for field wiring.

* + - 1. HEATING

Retain "Electric-Resistance Heating Coil" or "Gas Heat" paragraph below for heating and cooling units or for heat pumps with supplemental heat.

* + - * 1. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.
				2. Gas Heat:

General Requirements for Gas-Fired, Noncondensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.86/CSA 2.32, "Vented Gas-Fired Space Heating Appliances," and with NFPA 54.

Type of Gas: **[Natural] [Propane]**.

Heat Exchanger: **[Stainless]** steel.

Burner:

In first subparagraph below, two-stage and modulating gas valves are optional features.

Gas Valve: 100 percent safety, **[two-stage] [modulating]** main gas valve; main shutoff valve; pressure regulator; safety pilot with electronic flame sensor; limit control; transformer; and combination ignition/fan timer control board.

Ignition: Electric pilot ignition with hot-surface igniter or electric spark ignition.

Field conversion kit for high altitude.

Gas-Burner Safety Controls:

Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.

Flame Rollout Switch: Installed on burner box; prevents burner operation.

Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

Combustion-Air Inducer: Centrifugal fan prepurges heat exchanger and vents combustion products; thermally protected motor includes sleeve bearings; pressure switch prevents operation if combustion-air inlet or flue outlet is blocked.

Furnace Controls: Solid-state board for integrating ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; and terminals for connection to accessories.

* + - 1. CONTROLS

Sustainable design systems require compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment," for ventilation system controls.

* + - * 1. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:

Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F outdoor air temperature.

Retain "Heat-Pump Ambient Control" subparagraph below for heat-pump units.

Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F and to supplemental heating below plus 25 deg F.

Retain option in "Temperature-Limit Control" subparagraph below for heating and cooling units and for heat pumps.

Temperature-Limit Control: Prevents occupant from exceeding preset**[ setback or]** setup temperature.

Building Automation System Interface: Allows remote on-off control with setback temperature control.

Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on **[indoor] [outdoor]** coil and reverses unit to melt frost.

* + - * 1. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage, adjustable thermostat with heat anticipator; **[heat-off-cool-auto] [heat-off-cool]** switch; and**[ on-auto]** fan switch.

Retain one of two "Outdoor Air" paragraphs below. Retain first paragraph to comply with sustainable design systems, which require compliance with ASHRAE 62.1, or if required by Project requirements or authorities having jurisdiction. See "Sustainable Design Considerations" Article in the Evaluations.

* + - * 1. Outdoor Air: Motorized intake damper. Open intake when unit indoor-air fan runs.
				2. Outdoor Air: Manual intake damper.
				3. Economizer Operation: Motorized intake-air damper controlled by an enthalpy sensor and a mixed-air sensor to provide natural cooling when the outdoor air temperature is favorable.
				4. Dual Unit Control (DUC): Hinged cover with two-stage heat/cool thermostat with individual heat/cool setpoints, adjustable interstage differentials and bimetallic elements. The control shall feature a solid-state timer with 1-2-4-8 day sequence, unit lead selector, Unit 1 and 2 power-on LEDs, Unit 1 or 2 lead unit LEDs, 48-hour program save on loss of power, industry standard connections, and 24-volt power from each unit. The DUC shall provide auto sequencing and displays on status and operating status parameters.
				5. Three-Phase Power Rotation Monitor: Three-phase monitoring to protect compressor from reverse rotation and to protect the unit from phase failure. Monitor manually reset.
				6. Ventilation:

Extra Ventilation: Section internally mounted, allowing up to 50% outside air and exhaust air through the action of adjustable dampers.

Energy Recovery Ventilator: **[One] [Two]** rotary washable desiccant wheel(s), insulated cassette frame with seals, three-speed drive motor and belt, and intake and exhaust blowers.

* + - * 1. Dehumidification Circuit: Supply-air stream, independent heat exchanger using a separate humidistat, hot gas three-way valve, separate desuperheating condenser circuit, and back drain orifice inserted between the reheat coil and suction line.
			1. CAPACITIES AND CHARACTERISTICS

If Project has more than one type or configuration of packaged, terminal air conditioners, delete this article and schedule packaged, terminal air conditioners on Drawings.

* + - * 1. Airflow: **<Insert cfm>**.

Sustainable design systems require minimum ventilation rates according to ASHRAE 62.1. See "Sustainable Design Considerations" Article in the Evaluations.

* + - * 1. Outdoor-Air Intake Rate: **<Insert cfm>**.
				2. Cooling Capacity:

Total: **<Insert Btu/h>**.

Sensible: **<Insert Btu/h>**.

Sustainable design systems require minimum efficiency equal to requirements in ASHRAE/IES 90.1. See "Sustainable Design Considerations" Article in the Evaluations.

Energy-Efficiency Ratio: **<Insert number>**.

Indoor Coil Entering-Air Dry Bulb Temperature: **<Insert deg F>**.

Indoor Coil Entering-Air Wet Bulb Temperature: **<Insert deg F>**.

Indoor Coil Leaving-Air Dry Bulb Temperature: **<Insert deg F>**.

Indoor Coil Leaving-Air Wet Bulb Temperature: **<Insert deg F>**.

Outdoor Coil Entering-Air Temperature: **<Insert deg F>**.

* + - * 1. Heat-Pump Capacity:

Total: **<Insert Btu/h>**.

Outdoor Temperature: **<Insert deg F>**.

* + - * 1. Electric Heat Capacity: **<Insert Btu/h>**.
				2. Hydronic Heat Capacity:

Total: **<Insert Btu/h>**.

Entering-Air Temperature: **<Insert deg F>**.

Leaving-Air Temperature: **<Insert deg F>**.

Water Flow: **<Insert gpm>**.

Entering-Water Temperature: **<Insert deg F>**.

Leaving-Water Temperature: **<Insert deg F>**.

* + - * 1. Gas Heat Capacity:

Input: **<Insert Btu/h>**.

Output: **<Insert Btu/h>**.

Sustainable design systems require minimum efficiency equal to requirements in ASHRAE/IES 90.1. See "Sustainable Design Considerations" Article in the Evaluations.

AFUE: **[80] <Insert number>** percent.

* + - * 1. Exhaust Air:

Airflow: **<Insert cfm>**.

Face Velocity: **<Insert fpm>**.

Summer:

Entering-Air Temperature, Dry Bulb: **<Insert deg F>**.

Entering-Air Temperature, Wet Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Dry Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Wet Bulb: **<Insert deg F>**.

Winter:

Entering-Air Temperature, Dry Bulb: **<Insert deg F>**.

Entering-Air Temperature, Wet Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Dry Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Wet Bulb: **<Insert deg F>**.

Air-Pressure Drop: **<Insert inches wg>**.

* + - * 1. Supply Air:

Airflow: **<Insert cfm>**.

Face Velocity: **<Insert fpm>**.

Summer:

Entering-Air Temperature, Dry Bulb: **<Insert deg F>**.

Entering-Air Temperature, Wet Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Dry Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Wet Bulb: **<Insert deg F>**.

Winter:

Entering-Air Temperature, Dry Bulb: **<Insert deg F>**.

Entering-Air Temperature, Wet Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Dry Bulb: **<Insert deg F>**.

Leaving-Air Temperature, Wet Bulb: **<Insert deg F>**.

Air-Pressure Drop: **<Insert inches wg>**.

* + - * 1. Wheel Drive:

Motor Size: **<Insert horsepower>**.

Motor Electrical Characteristics:

Volts: **[120] [208] [230] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

* + - * 1. Effectiveness: **<Insert percent>**.
				2. Sound:

Indoor: **<Insert bels>**.

Outdoor: **<Insert bels>**.

* + - * 1. Electrical Characteristics:

Volts: **<Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. SOURCE QUALITY CONTROL
				1. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
				2. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."
1. EXECUTION
	* + 1. INSTALLATION
				1. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
				2. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

Retain paragraph below in seismic areas. Equipment protection may be required for some types of buildings. Verify requirements with model building codes and ASCE/SEI 7.

* + - * 1. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.
			1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

Retain first paragraph below for units with hot-water supplemental heating.

* + - * 1. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

Retain first paragraph below for units with gas-fired supplemental heating.

* + - * 1. Comply with requirements for piping specified in Section 231123 "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Install piping adjacent to machine to allow service and maintenance.
			1. FIELD QUALITY CONTROL

Retain "Manufacturer's Field Service" and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections**[ with the assistance of a Company Field Advisor per OGS Spec Section 014216]**:

Inspect for and remove shipping bolts, blocks, and tie-down straps.

After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.

Unit is level on base and is flashed in exterior wall.

Unit casing has no visible damage.

Compressor, air-cooled condenser coil, and fans have no visible damage.

Labels are clearly visible.

Controls are connected and operable.

Shipping bolts, blocks, and tie-down straps are removed.

Filters are installed and clean.

Drain pan and drain line are installed correctly.

Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical Sections.

Installation: Perform startup checks according to manufacturer's written instructions, including the following:

Lubricate bearings on fan.

Check fan-wheel rotation for correct direction without vibration and binding.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. After performance test, change filters.
				2. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.
				3. Prepare test and inspection reports.
			1. ADJUSTING
				1. Adjust initial temperature set points.
				2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
			2. DEMONSTRATION
				1. **[Engage a Company Field Advisor per OGS Spec Section 014216 to train] [Train]** Facility’s maintenance personnel to adjust, operate, and maintain packaged, terminal air conditioners.

END OF SECTION 238113.13