

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

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes packaged, terminal, outdoor, wall-mounted air conditioners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. LEED Submittals:
 - 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
 - 2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: For packaged, terminal air conditioners.
 - 1. Include plans, elevations, sections, details for wall penetrations,[**seismic bracing**,] and attachments to other work.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- D. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For packaged, terminal air conditioners, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. 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.
 - 2. 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.
 - 3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than [five] <Insert number> years from date of Substantial Completion.
 - 4. Warranty Period for Energy Recovery Ventilator: : Manufacturer's standard, but not less than [five] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.2 MANUFACTURED UNITS

- A. 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.
- B. 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.

- C. 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."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- E. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.
- F. ASHRAE ERV Testing: Applicable requirements in ASHRAE 84.
- G. AHRI Rating: Applicable requirements in AHRI 1060.
- H. UL listed and ETL performance certified.

2.3 CHASSIS

- A. Cabinet: Sloped top, [**0.052-inch- (1.32-mm-)**] <Insert dimension> thick [**steel**] [**aluminum**] with removable front panel with concealed latches.
 - 1. Mounting: On exterior wall.
 - 2. Discharge Grille: [**Extruded-aluminum discharge grille**] [**Supply-air acoustical plenum**].
 - 3. Return Grille: [**Extruded-aluminum grille**] [**Return-air acoustical plenum**].
 - 4. Louvers: [**Extruded aluminum with enamel finish**] [**Stamped aluminum with clear-anodized finish**]; [**medium bronze**] [**dark bronze**] color.
 - 5. Finish: [**Epoxy coating**] [**Baked enamel**].
 - 6. Access Door: Hinged door in top of cabinet for access to controls.
 - 7. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
 - 8. Insulation: Cooling and heating sections fully insulated with **1-inch (25-mm)**-thick fiberglass insulation.
 - 9. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - 10. Wall Sleeves: [**Galvanized steel with polyester finish**] [**Molded polymer**] [**Molded fiberglass-reinforced polyester**].
- B. 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.
 - 1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins[**with capillary tube distributor on indoor coil**].
 - 2. Accumulator.
 - 3. Constant-pressure expansion valve.
 - 4. Reversing valve.
 - 5. Charge: [**R-407C**] [**R-410A**].

- C. Indoor Fan: Forward curved, centrifugal; with **[single]** **[twin]** **[constant-]** **[variable-]** speed motor(s) and positive-pressure ventilation damper with **[concealed manual]** **[electric]** operator.
 - D. Filters: **[Washable polyurethane in molded plastic frame]** **[2-inch (25-mm), pleated, disposable MERV 6]**, serviceable from front of the unit.
 - E. 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]**.
 - 1. Comply with ASHRAE 62.1 for drain pan construction and connections.
 - F. Outdoor Fan: **[High-ambient]** **[Forward curved, centrifugal]** **[Propeller]** **[Forward curved, centrifugal, or propeller]** type **[with separate]** **[driven by indoor fan]** motor.
 - 1. 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."
 - a. Fan Motors: Permanently lubricated split capacitor.
 - b. 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.
 - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - G. Energy Recovery Wheel:
 - 1. Casing: Steel with standard factory-painted finish.
 - 2. Casing seals on periphery of rotor and on duct divider.
 - 3. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings **[or permanently lubricated bearings]**. Support horizontal rotors on tapered roller bearing.
 - 4. Rotor: Polymer segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.
 - 5. Drive: Fractional horsepower motor, gear reducer, and self-adjusting multilink belt around outside of rotor.
 - a. 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."
 - b. 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.
 - 6. Controls: Starting relay, factory mounted and wired, and manual motor starter for field wiring.
- 2.4 HEATING
- A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

B. Gas Heat:

1. 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.
2. Type of Gas: **[Natural]** **[Propane]**.
3. Heat Exchanger: **[Stainless]** steel.
4. Burner:
 - a. 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.
 - b. Ignition: Electric pilot ignition with hot-surface igniter or electric spark ignition.
 - c. Field conversion kit for high altitude.
5. Gas-Burner Safety Controls:
 - a. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 - b. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 - c. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
6. 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.
7. 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.

2.5 CONTROLS

- A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
1. Low-Ambient Lockout Control: Prevents cooling-cycle operation below **40 deg F (5 deg C)** outdoor air temperature.
 2. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above **40 deg F (5 deg C)** and to supplemental heating below **plus 25 deg F (minus 4 deg C)**.
 3. Temperature-Limit Control: Prevents occupant from exceeding preset **[setback or]** setup temperature.
 4. Building Automation System Interface: Allows remote on-off control with setback temperature control.
 5. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on **[indoor]** **[outdoor]** coil and reverses unit to melt frost.
- B. 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.

- C. Outdoor Air: Motorized intake damper. Open intake when unit indoor-air fan runs.
- D. Outdoor Air: Manual intake damper.
- E. 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.
- F. 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.
- G. 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.
- H. Ventilation:
 - 1. Extra Ventilation: Section internally mounted, allowing up to 50% outside air and exhaust air through the action of adjustable dampers.
 - 2. 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.
- I. 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.

2.6 CAPACITIES AND CHARACTERISTICS

- A. Airflow: **<Insert cfm (L/s)>**.
- B. Outdoor-Air Intake Rate: **<Insert cfm (L/s)>**.
- C. Cooling Capacity:
 - 1. Total: **<Insert Btu/h (kW)>**.
 - 2. Sensible: **<Insert Btu/h (kW)>**.
 - 3. Energy-Efficiency Ratio: **<Insert number>**.
 - 4. Indoor Coil Entering-Air Dry Bulb Temperature: **<Insert deg F (deg C)>**.
 - 5. Indoor Coil Entering-Air Wet Bulb Temperature: **<Insert deg F (deg C)>**.
 - 6. Indoor Coil Leaving-Air Dry Bulb Temperature: **<Insert deg F (deg C)>**.
 - 7. Indoor Coil Leaving-Air Wet Bulb Temperature: **<Insert deg F (deg C)>**.
 - 8. Outdoor Coil Entering-Air Temperature: **<Insert deg F (deg C)>**.
- D. Heat-Pump Capacity:
 - 1. Total: **<Insert Btu/h (kW)>**.
 - 2. Outdoor Temperature: **<Insert deg F (deg C)>**.

- E. Electric Heat Capacity: <Insert **Btu/h (kW)**>.
- F. Hydronic Heat Capacity:
1. Total: <Insert **Btu/h (kW)**>.
 2. Entering-Air Temperature: <Insert **deg F (deg C)**>.
 3. Leaving-Air Temperature: <Insert **deg F (deg C)**>.
 4. Water Flow: <Insert **gpm (L/s)**>.
 5. Entering-Water Temperature: <Insert **deg F (deg C)**>.
 6. Leaving-Water Temperature: <Insert **deg F (deg C)**>.
- G. Gas Heat Capacity:
1. Input: <Insert **Btu/h (kW)**>.
 2. Output: <Insert **Btu/h (kW)**>.
 3. AFUE: [80] <Insert number> percent.
- H. Exhaust Air:
1. Airflow: <Insert **cfm (L/s)**>.
 2. Face Velocity: <Insert **fpm (m/s)**>.
 3. Summer:
 - a. Entering-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - b. Entering-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 - c. Leaving-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - d. Leaving-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 4. Winter:
 - a. Entering-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - b. Entering-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 - c. Leaving-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - d. Leaving-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 5. Air-Pressure Drop: <Insert **inches wg (Pa)**>.
- I. Supply Air:
1. Airflow: <Insert **cfm (L/s)**>.
 2. Face Velocity: <Insert **fpm (m/s)**>.
 3. Summer:
 - a. Entering-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - b. Entering-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 - c. Leaving-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - d. Leaving-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 4. Winter:
 - a. Entering-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.

- b. Entering-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 - c. Leaving-Air Temperature, Dry Bulb: <Insert **deg F (deg C)**>.
 - d. Leaving-Air Temperature, Wet Bulb: <Insert **deg F (deg C)**>.
 - 5. Air-Pressure Drop: <Insert **inches wg (Pa)**>.
 - J. Wheel Drive:
 - 1. Motor Size: <Insert **horsepower**>.
 - 2. Motor Electrical Characteristics:
 - a. Volts: [**120**] [**208**] [**230**] <Insert **value**>.
 - b. Phase: [**Single**] [**Three**].
 - c. Hertz: 60.
 - K. Effectiveness: <Insert **percent**>.
 - L. Sound:
 - 1. Indoor: <Insert **bels**>.
 - 2. Outdoor: <Insert **bels**>.
 - M. Electrical Characteristics:
 - 1. Volts: <Insert **value**>.
 - 2. Phase: [**Single**] [**Three**].
 - 3. Hertz: 60.
 - 4. Full-Load Amperes: <Insert **value**>.
 - 5. Minimum Circuit Ampacity: <Insert **value**>.
 - 6. Maximum Overcurrent Protection: <Insert **amperage**>.
- 2.7 SOURCE QUALITY CONTROL
- A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
 - B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
- B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

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

3.2 CONNECTIONS

- A. 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.
- B. Comply with requirements for piping specified in Section 231123 "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- C. Install piping adjacent to machine to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage]** **[Engage]** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Unit is level on base and is flashed in exterior wall.
 - 4. Unit casing has no visible damage.
 - 5. Compressor, air-cooled condenser coil, and fans have no visible damage.
 - 6. Labels are clearly visible.
 - 7. Controls are connected and operable.
 - 8. Shipping bolts, blocks, and tie-down straps are removed.
 - 9. Filters are installed and clean.
 - 10. Drain pan and drain line are installed correctly.
 - 11. Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical Sections.
 - 12. Installation: Perform startup checks according to manufacturer's written instructions, including the following:
 - a. Lubricate bearings on fan.
 - b. Check fan-wheel rotation for correct direction without vibration and binding.
 - 13. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 14. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- D. After performance test, change filters.
- E. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain packaged, terminal air conditioners.

END OF SECTION 238113.13