SECTION 238113 - PACKAGED TERMINAL AIR-CONDITIONERS

This Section includes packaged terminal air conditioning and heat pump units with electric, hot water, steam, or gas heating; accessories; and controls.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term Architect/Engineer. "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Packaged terminal air conditioning units.

Packaged terminal heat pump units.

* + - * 1. Related Sections:

Section 230900 - Instrumentation and Control for HVAC: Execution requirements for connecting units to controls remote from unit specified in this section.

Section 231123 - Facility Natural-Gas Piping: Execution requirements for natural gas piping connections to units specified in this section.

Section 231126 - Facility Liquefied-Petroleum Gas Piping: Execution requirements for LP gas piping connections to units specified in this section.

Section 232113 - Hydronic Piping: Execution requirements for water and drain piping connections to units specified in this section.

Section 232213 - Steam and Condensate Heating Piping: Execution requirements for steam supply and condensate return piping connections to units specified in this section.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. Air-Conditioning and Refrigeration Institute:

ARI 310/380 - Packaged Terminal Air-Conditioners and Heat Pumps.

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

* + - * 1. National Fire Protection Association:

NFPA 54 - National Fuel Gas Code.

NFPA 58 - Liquefied Petroleum Gas Code.

* + - 1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the
         2. General Conditions.
         3. Manufacturer’s installation instructions shall be provided along with product data.
         4. Submittals shall be provided in the order in which they are specified and tabbed (for
         5. combined submittals).

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Section 013300 - Submittal Procedures: Submittal procedures.
        2. Product Data: Submit data indicating capacity, dimensions, rough-in connections, and electrical characteristics and connection requirements.
        3. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
        4. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
      1. CLOSEOUT SUBMITTALS
         1. Section 017716 – Contract Closeout
         2. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.
      2. QUALITY ASSURANCE
         1. Test and rate packaged terminal **[air conditioners] [heat pumps]** in accordance with ARI 310/380 “Packaged Terminal Air-Conditioners and Heat Pumps”.
         2. Performance Requirements: Conform to minimum cooling mode efficiency prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” when tested in accordance with ARI 310/380 “Packaged Terminal Air-Conditioners and Heat Pumps”.
         3. Performance Requirements: Conform to minimum heating mode efficiency prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” when tested in accordance with ARI 310/380 “Packaged Terminal Air-Conditioners and Heat Pumps”.

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain **[one copy] [<\_\_\_\_\_\_\_\_> copies]** of **[each]** document on site.
      1. QUALIFICATIONS
         1. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum **[three] <\_\_\_\_\_\_\_\_>** years' **[documented]** experience.
         2. Installer: Company specializing in performing work of this section with minimum **[three] <\_\_\_\_\_\_\_\_>** years' **[documented]** experience **[and approved by manufacturer]**.
      2. PRE-INSTALLATION MEETINGS
         1. Section 013000 - Administrative Requirements: Pre-installation meeting.
         2. Convene minimum **[one] <\_\_\_\_\_\_\_\_>** week prior to commencing work of this section.
      3. DELIVERY, STORAGE, AND HANDLING
         1. Section 016500 – Materials and Equipment
         2. Accept units on site in factory packaging. Inspect for damage.
         3. Protect units from damage by providing temporary covers until construction is complete.
         4. Protect items shipped loose with units in original packaging and store in secured area.
      4. FIELD MEASUREMENTS
         1. Verify by field measurements size and configuration are compatible with wall construction and layout.
      5. COORDINATION
         1. Section 013000 - Administrative Requirements: Requirements for coordination.
         2. Coordinate **[wall openings,] [wall sleeve installation,] [sealing of louvers,] [piping rough-in locations,] [and] [electrical rough-in locations]** to accommodate Work of this Section.
      6. WARRANTY
         1. Section 017716 – Contract Closeout
         2. Furnish **[five] <\_\_\_\_\_\_\_\_>**-year manufacturer's warranty for compressors.

Include the following only for gas-fired units.

* + - * 1. Furnish **[five] <\_\_\_\_\_\_\_\_>**-year manufacturer's warranty for heat exchanger.
      1. EXTRA MATERIALS
         1. Section 017716 – Contract Closeout
         2. Furnish **[one set] <\_\_\_\_\_\_\_\_>** of **[filters] <\_\_\_\_\_\_\_\_>** for each unit.
         3. Furnish **<\_\_\_\_\_\_\_\_>** sets of filters for project.
         4. Furnish **[one] <\_\_\_\_\_\_\_\_>** extra packaged terminal air conditioning of each capacity size on Project.
         5. Furnish extra **[casing] [wall sleeve]** for physical size unit on Project.

1. PRODUCTS
   * + 1. PACKAGED TERMINAL **[AIR CONDITIONING] [HEAT PUMP]** UNITS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=11095) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Amana; a division of Whirlpool Corporation](http://www.specagent.com/Lookup?uid=123457049235).

[Comfort-Aire; a division of Heat Controller, Inc](http://www.specagent.com/Lookup?uid=123457049236).

[Friedrich Air Conditioning Company](http://www.specagent.com/Lookup?uid=123457049231).

[GE Appliances; Haier Group](http://www.specagent.com/Lookup?uid=123457216282).

[LG Electronics USA, Inc.; LG Electronics Inc](http://www.specagent.com/Lookup?uid=123457049237).

[Suburban Manufacturing Company; a division of AIRXCEL, Inc](http://www.specagent.com/Lookup?uid=123457049234).

Approved equivalent.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers' products specified above.

* + - * 1. Product Description: Packaged, terminal **[air conditioning] [heat pump]** units, with **[wall sleeve,]** room cabinet, electric refrigeration system, **[electric] [hot water] [steam] [gas-fired]** heating, **[outside air louvers,] [and] [built-in] [remote]** temperature controls.
        2. Cabinet:

Select appropriate mounting arrangement.

Cabinet: **[Wall mounted] [Floor mounted] [Sub-base mounted]**; **[18 gauge]** galvanized steel with **[epoxy coated] [baked enamel]** finish, removable front panel or access doors with concealed latches, **<\_\_\_\_\_\_\_\_>** color **[as selected]**. **[Furnish with lockable access doors.] [Furnish compressor and condenser section coated with corrosion resistant finish.]**

Touch up paint: Furnish to match factory applied finish.

Insulation: Furnish **[casing and compressor compartment] [front panel]** insulated with 1/2 inch thick glass fiber insulation.

Discharge Grille and Access Door: **[Removable] [Integral] [punched louver] [extruded aluminum] discharge grilles [,] [with air deflector] [allowing 4-way discharge air pattern,]** with hinged door in top of cabinet for access to controls.

Cabinet Extension: Match cabinet construction and finish, allow diversion of **[40] <\_\_\_\_\_\_\_\_>** percent of unit air flow to adjoining room, with grille.

Subbase: Closure piece for unit front and sides to fit between unit chassis and floor. Furnish with adjustable legs **[and] [electrical knockouts] [plug-in receptacle]**.

* + - * 1. Wall Sleeves and Louvers:

Insert requirements. Use this paragraph for one or identical units. When specifying units of differing sizes, use schedules.

Wall Sleeves: **<\_\_\_\_\_\_\_\_>** inches deep, **[16 gauge]** galvanized steel with **[protective mastic coating] [polyester finish]**. **[Furnish sleeve insulation kit.]**

Louvers: **[Flush] [Companion flanged]** of **[stamped] [extruded]** aluminum construction factory **[anodized] [enamel finish]**, **<\_\_\_\_\_\_\_\_>** color **[as selected]**.

* + - * 1. Chassis:

Select appropriate components. Accumulator, expansion valve, and reversing valve are generally only required in heat pump units.

Refrigeration System:

Direct expansion **[cooling] [indoor]** coil. Constructed of copper tubing with aluminum fins mechanically bonded to tubes.

Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.

Fully charged with refrigerant and filled with oil.

Accumulator.

**[Condenser] [Outdoor]** coil and fan. Construct of copper tubing and aluminum fins.

Capillary restrictor **[and constant pressure expansion valve]**.

Reversing valve.

Air System: Centrifugal forward curved **[tangential] [evaporator] [indoor]** fans with **[two speed]** permanent split capacitor motor, positive pressure ventilation damper with concealed **[manual] [electrically powered]** operator.

Filters: **[Throwaway type.] [Permanent washable type.]**

Electric Heating Coil: Nichrome coiled elements each protected by fusible link and overheat limit control.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

**[Hot Water] [Steam]** Heating Coil: Constructed of copper tubing with aluminum fins mechanically bonded to tubes. Supply and return connections on same side of coil. Furnish **[normally open] [normally closed] [two-way] [three-way]** electrically operated control valve.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Gas-fired Heating:

Fuel: **[Natural gas] [Propane]**.

Factory installed heat exchanger with electronic controlled non-spark ignition.

Located in indoor air stream.

Condensate Drain: Drain pan to direct condensate to **[condenser] [outdoor]** coil for re-evaporation. **[Furnish external condensate drain kit.]**

One of most important features between quality of packaged terminal air conditioners is single motor driving compressor and condenser or when they are driven by separate motors.

**[Condenser] [Outdoor]** Fan: **[Centrifugal, forward curved] [Propeller]** type **[with separate permanent split capacitor motor.] [driven by [evaporator] [indoor] fan motor.]**

Electrical Connection: Furnish with **[cord and plug kit] [hard wire junction box] [power disconnect switch]**.

* + - * 1. Controls:

Select applicable control options.

Thermostat: **[Unit] [Remote]** mounted adjustable thermostat with heat anticipator, **[heat-off-cool] [off-heat-auto-cool]** switch, **[high-low]** fan switch.

Low Ambient Lockout Control: Below **[35] <\_\_\_\_\_\_\_\_>** degrees F, outdoor thermostat **[prevents compressor operation] [and switches to heat mode]**.

Energy Management Kit: To allow units to be controlled from remote **[location] [signal]**.

Refer to Section 230900 for remotely mounted thermostats.

* + - * 1. Capacity:

Insert capacity information applicable to project. Use the following for one or more identical units. When specifying units of different sizes, use schedule at end of this section.

Supply Air:

Air flow: **<\_\_\_\_\_\_\_\_>** cfm.

Outside air flow: **<\_\_\_\_\_\_\_\_>** cfm.

Cooling Capacity:

Rated cooling output: **<\_\_\_\_\_\_\_\_>** Btuh.

Entering air temperature: **<\_\_\_\_\_\_\_\_>** degrees F dry bulb, **<\_\_\_\_\_\_\_\_>** degrees F wet bulb.

Condenser ambient air temperature: **<\_\_\_\_\_\_\_\_>** degrees F.

Energy efficiency ratio: Minimum **<\_\_\_\_\_\_\_\_>**.

Heating:

Heating capacity: **<\_\_\_\_\_\_\_\_>** Btuh.

Water flow: **<\_\_\_\_\_\_\_\_>** gpm.

Entering water temperature: **<\_\_\_\_\_\_\_\_>** degrees F.

Coil pressure drop: **<\_\_\_\_\_\_\_\_>** feet.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Heating:

Heating capacity: **<\_\_\_\_\_\_\_\_>** Btuh.

Steam flow: **<\_\_\_\_\_\_\_\_>** lb/hr.

Steam pressure: **<\_\_\_\_\_\_\_\_>** psig.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Heating:

Electric resistance heating capacity: **<\_\_\_\_\_\_\_\_>** Btuh.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Gas Heating:

Input: **<\_\_\_\_\_\_\_\_>** Btuh.

Output: **<\_\_\_\_\_\_\_\_>** Btuh.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Heat Pump Heating:

Rated heating output: **<\_\_\_\_\_\_\_\_>** Btuh.

Rated outdoor air temperature: **[47 degrees F DB and 43 degrees F] [17 degrees F DB and 15 degrees F]**.

Rated air temperature entering indoor coil: 70 degrees F.

Reverse cycle COP: **<\_\_\_\_\_\_\_\_>**.

* + - 1. ELECTRICAL CHARACTERISTICS AND COMPONENTS

Select one or more of the following subparagraphs appropriate to equipment requirements.

* + - * 1. Electrical Characteristics:

**[<\_\_\_\_\_\_\_\_> hp.] [<\_\_\_\_\_\_\_\_> rated load amperes.]**

**<\_\_\_\_\_\_\_\_>** volts, **[single] [three]** phase, 60 Hz.

**<\_\_\_\_\_\_\_\_>** amperes maximum **[fuse size] [circuit breaker size] [overcurrent protection]**.

**<\_\_\_\_\_\_\_\_>** minimum circuit ampacity.

**<\_\_\_\_\_\_\_\_>** percent minimum power factor at rated load.

1. EXECUTION
   * + 1. EXAMINATION
          1. Section 013000 - Administrative Requirements: Coordination and project conditions.
          2. Verify wall opening is ready for wall sleeve installation.
          3. Verify wall construction is ready for unit installation.
          4. Verify piping rough-in is at correct location.
          5. Verify electrical rough-in [is at correct location] [uses correct receptacle type].
       2. PREPARATION
          1. Coordinate to assure correct opening size for wall sleeve and louver.
          2. Furnish **[wall sleeve] [louver]** to installer at appropriate time in construction sequence.
       3. INSTALLATION
          1. Install units level.
          2. Install unit with wall sleeve, subbase, and outside air louver.
          3. Connect controls to remote locations.
          4. Install condensate drain piping to **[condensate drainage system.] <\_\_\_\_\_\_\_\_.>**

Choose between the following paragraphs based on heating coil type.

* + - * 1. Install the following piping accessories on hot water piping connections. Refer to Section 232113.

On supply:

Shutoff valve.

Strainer.

Control valve.

On return:

Shutoff valve.

**[Balancing valve.] [Flow control valve.]**

* + - * 1. Water coils: Install **[manual] [automatic]** air vents at high points complete with shutoff valve. Refer to Section 232113.
        2. Install the following piping accessories on steam piping connections. Refer to Section 232213.

On supply:

Shutoff valve.

Strainer.

Control valve.

Air vent.

On return:

Vacuum breaker.

Steam trap with outlet below coil return connection.

Shutoff valve.

Choose between the following paragraphs based on fuel.

* + - * 1. Connect natural gas piping in accordance with NFPA 54 “National Fuel Gas Code”.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Connect propane piping in accordance with NFPA 58 “Liquefied Petroleum Gas Code.”.

Choose between the following paragraphs based on fuel.

* + - * 1. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Connect propane piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

Edit the following based on Project conditions.

* + - * 1. Install the following piping accessories on natural gas piping connections. Refer to Section 231123.

Strainer.

Shutoff valve.

Pressure reducing valve.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install the following piping accessories on propane piping connections. Refer to Section 231126.

Strainer.

Shutoff valve.

Pressure reducing valve.

* + - 1. CLEANING
         1. Section 017716 – Contract Closeout
         2. After construction is completed, including painting, clean exposed surfaces of units.
         3. Vacuum clean coils and inside of cabinets.
         4. Touch up marred or scratched surfaces of factory finished cabinets, using finish materials furnished by manufacturer.
         5. Install new throwaway filters in units after Substantial Completion.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install temporary filters during construction period. Replace with permanent filters after Substantial Completion.
      1. DEMONSTRATION
         1. Section 017716 – Contract Closeout
         2. Demonstrate unit operation and maintenance.

For packaged terminal air conditioning units, may only want to consider this paragraph for projects with large quantities of units.

* + - * 1. Furnish services of manufacturer's technical representative for **[one] <\_\_\_\_\_\_\_\_> [8] <\_\_\_\_\_\_\_\_>** hour day to instruct Director’s Representative's personnel in operation and maintenance of units. Schedule training with Director’s Representative, provide at least 7 days notice to **[Director’s Representative] <\_\_\_\_\_\_\_\_>** of training date.
      1. PROTECTION OF FINISHED WORK
         1. Section 017716 – Contract Closeout
         2. Protect finished surfaces of cabinets with protective covers during remainder of construction.
      2. SCHEDULES

Include schedule when more than one size or type unit is required. Coordinate equipment tags and abbreviations with project specific requirements.

Consider the following examples when developing Project schedule.

* + - * 1. Packaged Terminal Air Conditioning Units Schedule:

Equipment Tag: **<PTAC-1>**:

**[Manufacturer: <\_\_\_\_\_\_\_\_>.]**

**[Model: <\_\_\_\_\_\_\_\_>.]**

Location: **<\_\_\_\_\_\_\_\_>**.

Supply Air:

Air Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Outside Air Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Cooling:

Rated Cooling Output: **<\_\_\_\_\_\_\_\_>**.

Entering Air Temperature - Dry Bulb: **<\_\_\_\_\_\_\_\_>**.

Entering Air Temperature - Wet Bulb: **<\_\_\_\_\_\_\_\_>**.

Condenser Ambient Air Temperature: **<\_\_\_\_\_\_\_\_>**.

Energy Efficiency Ratio: **<\_\_\_\_\_\_\_\_>**.

Hot Water Heating:

Heating Capacity: **<\_\_\_\_\_\_\_\_>**.

Water Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Entering Water Temperature: **<\_\_\_\_\_\_\_\_>**.

Coil Pressure Drop: **<\_\_\_\_\_\_\_\_>**.

Steam Heating:

Heating Capacity: **<\_\_\_\_\_\_\_\_>**.

Steam Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Steam Pressure: **<\_\_\_\_\_\_\_\_>**.

Electric Heating:

Electric Resistance Heating Capacity: **<\_\_\_\_\_\_\_\_>**.

Gas Heating:

Input: **<\_\_\_\_\_\_\_\_>**.

Output: **<\_\_\_\_\_\_\_\_>**.

Heat Pump Heating: **<\_\_\_\_\_\_\_\_>**.

Rated Heating Output: **<\_\_\_\_\_\_\_\_>**.

Rated Outdoor Air Temperature: **<\_\_\_\_\_\_\_\_>**.

Rated Air Temp Entering Indoor Coil: **<\_\_\_\_\_\_\_\_>**.

Reverse Cycle COP: **<\_\_\_\_\_\_\_\_>**.

Equipment Tag: **<PTAC-2>**:

**[Manufacturer: <\_\_\_\_\_\_\_\_>.]**

**[Model: <\_\_\_\_\_\_\_\_>.]**

Location: **<\_\_\_\_\_\_\_\_>.**

Supply Air:

Air Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Outside Air Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Cooling:

Rated Cooling Output: **<\_\_\_\_\_\_\_\_>**.

Entering Air Temperature - Dry Bulb: **<\_\_\_\_\_\_\_\_>**.

Entering Air Temperature - Wet Bulb: **<\_\_\_\_\_\_\_\_>**.

Condenser Ambient Air Temperature: **<\_\_\_\_\_\_\_\_>**.

Energy Efficiency Ratio: **<\_\_\_\_\_\_\_\_>**.

Hot Water Heating:

Heating Capacity: **<\_\_\_\_\_\_\_\_>**.

Water Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Entering Water Temperature: **<\_\_\_\_\_\_\_\_>**.

Coil Pressure Drop: **<\_\_\_\_\_\_\_\_>**.

Steam Heating:

Heating Capacity: **<\_\_\_\_\_\_\_\_>**.

Steam Flow Rate: **<\_\_\_\_\_\_\_\_>**.

Steam Pressure: **<\_\_\_\_\_\_\_\_>**.

Electric Heating:

Electric Resistance Heating Capacity: **<\_\_\_\_\_\_\_\_>**.

Gas Heating:

Input: **<\_\_\_\_\_\_\_\_>**.

Output: **<\_\_\_\_\_\_\_\_>**.

Heat Pump Heating: **<\_\_\_\_\_\_\_\_>**.

Rated Heating Output: **<\_\_\_\_\_\_\_\_>**.

Rated Outdoor Air Temperature: **<\_\_\_\_\_\_\_\_>**.

Rated Air Temp Entering Indoor Coil: **<\_\_\_\_\_\_\_\_>**.

Reverse Cycle COP: **<\_\_\_\_\_\_\_\_>**.

END OF SECTION 238113