

SECTION 15781 - PACKAGED HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of packaged heating and cooling units work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of packaged heating and cooling units specified in this section include the following:
 - 1. Indoor packaged units, 15-tons and smaller.
 - 2. Indoor packaged units, 20-tons and larger.
 - 3. Variable air volume units.
 - 4. Through the wall package units.
- C. Refer to other Division 15 sections for automatic temperature controls not factory-installed, and required for conjunction with packaged heating and cooling units; not work of this section.
- D. Electrical Work: Refer to Division 15 section "Electrical Provisions of Mechanical Work" for requirements.

1.2 REFRIGERANTS:

- A. All refrigerants used for each condensing unit shall be on the latest EPA list of approved refrigerants & environmentally friendly.
- B. No CFC based refrigerants shall be used.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged heating and cooling units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Provide capacity ratings for packaged heating and cooling units in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
 - 2. ASHRAE Compliance: Construct refrigerating system of packaged heating and cooling units in accordance with ASHRAE Standard 15 "Safety Code for Mechanical Refrigeration".
 - 3. UL Compliance: Provide packaged heating and cooling units which are UL-listed and labeled.

1.4 SUBMITTALS:

- A. Each manufacturer shall describe in writing, how their company is addressing the CFC legislation issue. Provide equipment capable of accepting a substitute refrigerant. The equipment provided shall provide the scheduled capacity when the substitute refrigerant proposed, the nominal equipment capacity reduction effects (if any), performance in KW/TON, the refrigerant change out procedure and long term maintenance effects the new refrigerant has on the equipment.

- B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions.
 - C. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
 - D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to packaged heating and cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of packaged heating and cooling units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field- installed.
 - E. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 15.
 - F. Maintenance Data: Submit maintenance data and parts list for each packaged heating and cooling unit, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual; in accordance with requirements of Division 15.
- 1.5 DELIVERY, STORAGE, AND HANDLING:
- A. Handle packaged heating and cooling units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged packaged heating and cooling units or components; replace with new.
 - B. Store packaged heating and cooling units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
 - C. Comply with manufacturer's rigging and installation instructions for unloading packaged heating and cooling units, and moving units to final location for installation.
 - D. Units shall be broken down and shipped in components as field conditions require. A factory authorized representative shall inspect the final installation to certify that the unit has been reassembled per factory recommendations and specifications.
- 1.6 SPECIAL PROJECT WARRANTY:
- A. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
 - 1. Extended Warranty Period: 5 years from Date of Substantial Completion.

<p>This extended warranty is only applicable when the Owner has requested it and the associated costs have been determined and it has been documented in writing. This is not applicable to residential and smaller tonnage units.</p>
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PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Indoor Packaged Units:

- a. York; Division of York International
- b. Borg-Warner Air Conditioning, Inc.
- c. McQuay Air Conditioning; Snyder General Corp.
- d. Trane (The) Co.
- e. Mammoth

2. Variable Air Volume Units:

- a. York Division
- b. Borg-Warner Air Conditioning, Inc.
- c. McQuay Air Conditioning; Snyder General Corp.
- d. Trane (The) Co.
- e. Mammoth

3. Through the Wall Package Units:

- a. Trane (The) Co.

4. Outdoor Through the Wall Package Cooling and Heating Units:

- a. Climate-Tel
- b. Bard Manufacturing Co.

2.2 INDOOR PACKAGED UNITS, 15 TONS AND SMALLER:

A. General: Provide factory-assembled and tested packaged units as indicated, consisting of casing, compressor, evaporator, fans, filters, and unit controls. Provide capacities and electrical characteristics as scheduled.

B. Casing: Provide manufacturer's standard casing construction, corrosion protection coating, and exterior finish. Provide removable panels and/or access doors for inspection and access to internal parts. Insulate casing with 1/2" thick minimum thermal insulation, and compressor compartment with acoustical insulation. Provide knockouts for electrical and piping connections.

1. Provide decorative return air grille in return air opening.

2. Provide free discharge plenum over supply air opening, equipped with double deflection adjustable grilles.

C. Refrigeration Circuit: Provide refrigerant thermal expansion valve for refrigerant control. Provide access valves in suction and liquid lines. Provide dual refrigeration circuits for dual compressor units.

D. Compressors: Provide welded shell, hermetic compressors, 3,600 rpm; or serviceable hermetic compressors, 1750 rpm. Provide crankcase heaters.

1. Compressor shall be isolated within unit to prevent vibration.
- E. Evaporator Coil: Construct of copper tubing and aluminum fins, pressure and leak tested at 1.5 times working pressure.
- F. Fans: Provide double-inlet, forward curved, centrifugal fans with adjustable belt drive. Provide permanently lubricated fan and motor bearings, and thermal overloads in motor.
- G. Filters: Provide 2" thick throwaway filters.
- H. Water-Cooled Condensers: Provide shell-and-tube or tube-in-tube design with removable heads and cleanable tubes. Design for refrigerant side and water side pressures of 1.5 times working pressure, in accordance with ASME Pressure Vessel Code. Provide pressure relief valve, liquid line valve, and provisions for subcooling. Provide separate condenser for each refrigerant circuit.
- I. Integral Air-Cooled Condensers: Provide condenser coil constructed of copper tubes and aluminum fins. Factory leak-test at 1.5 times working pressure, dehydrate and provide full charge of refrigerant. Provide subcooler and accumulator.
1. Condenser Fan: Provide double-width, double-inlet, forward-curved centrifugal fan with adjustable belt drive.
 2. Low Ambient Control: Provide head pressure control, designed to operate at temperatures down to -20°F (-18 deg. C).
- J. Remote Air-Cooled Condensers: Provide condenser coil constructed of copper tubes and aluminum fins. Factory leak-test at 1.5 times working pressure, dehydrate and provide full charge of refrigerant. Provide subcooler and accumulator. Provide propeller-type fan with adjustable belt drive.
1. Low Ambient Control: Provide head pressure control, designed to operate at temperatures down to 0 deg. F (- 18 deg. C).
- K. Controls: Provide factory-installed and wired controls, with terminal strip. Provide connections for remote thermostat.
1. Provide each motor with individual overload protection.
 2. Provide high and low refrigerant cutouts.
 3. Provide fan-auto and heat-off-cool switches.
 4. Dampers to accept 0-10 m/a signal
 5. Low voltage controls
- L. Heating Coil: Provide hot water heating coil, constructed of copper tubes and aluminum fins, designed to fit within casing with no duct modifications necessary.
- 2.3 INDOOR PACKAGED UNITS, 20 TONS AND LARGER:
- A. General: Provide factory-assembled and tested packaged units as indicated, consisting of casing, compressors, evaporator, fans, filters, and unit controls. Provide capacities and electrical characteristics as scheduled.
- B. Casings: Construct casings of 18-ga minimum mill galvanized steel, designed to withstand specific operating pressures. Provide casing panels and/or access doors that are easily and quickly removable for inspection and access to internal parts.

1. Provide single zone/variable air volume units consisting of fan section, coil section, adjustable fan motor mounting, and drain pan.
2. Provide multizone units consisting of single zone components, diffuser section, damper section, zoning dampers, and balancing plate when required to equalize resistances through cooling and heating passes.
3. Provide reinforced points of support for either setting or hanging units.
4. Provide drain pan, stainless steel located under cooling coil section and humidifier section, extensive enough to catch condensate leaving coil at highest catalogued face velocity. Provide at least one drain connection at low point in drain pan.
5. Cover casing and frame with protective finish on both sides.
6. Provide lights in accessible sections with wire guards, factory wired to switch mounted on casing exterior. In spray coil or humidifier sections provide marine lights of glass and wire sealed design.
7. Units shall be provided with double wall construction in fan section only/throughout. The interior section shall be constructed of 20 gauge, perforated sheet metal. The walls shall be 2"/4". The panels shall be fully insulated.

The above paragraph is for Temtrol, Pace, Mammoth or other custom type units only. It is not applicable to Trane, York and McQuay.

8. The access doors shall be of double wall construction. Three lever type handles shall be provided on each access door. The doors shall be fully gasketed with neoprene material.
 9. Provide decorative return air grille in return air opening.
 10. Provide free discharge plenum over supply air opening, equipped with double deflection adjustable grilles.
- C. Compressor: Reciprocating hermetic-type compressor, 1,750 RPM, designed for air-cooled condensing, complete with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports. Capacity shall be controlled through cylinder unloading. Additional features include:
1. Crankcase heater in well within crankcase;
 2. Capacity steps as scheduled, or greater number;
 3. Compressor of same manufacturer as condensing unit.
- D. Screw Compressors:

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- E. Air-Cooled Condenser: Design unit for use with remote air-cooled condenser. Refer to Section 15743 for specification requirements.
- F. Water-Cooled Condenser: Provide shell-and-tube or tube-in-tube design with removable heads and cleanable tubes. Design for refrigerant side and water side pressures of 1.5 times working pressure, in accordance with ASME Pressure Vessel Code. Provide pressure relief valve, liquid line valve, and provisions for subcooling.
- G. Cooling Coils: Construct of copper tubes mechanically expanded into aluminum fins. Test coils at 300 psig under water. Provide galvanized drain pan under coils. Provide for each coil, expansion valve, solenoid valve and distributor.
- H. Heating Coils: Construct of copper tubes mechanically expanded into aluminum fins, with 18 ga. minimum galvanized steel casing. Test coils at 1.5 times working pressure.
- I. Fan Sections: Provide forward curved/air foil/plug fans/backward inclined, fans specifically designed and suitable for class of service indicated. Provide adjustable motor base, adjusted with mounting bolts, to provide variation in center distance. Provide locking nuts, or similar devices, to secure base in proper position. Provide belt-driven fans with adjustable pitch pulley permitting fan speed to be varied. Select pulley for mid-point of adjustable range. Design fan shafts so as not to pass through first critical speed when unit comes up to rated RPM. Provide grease-lubricated fan bearings with externally accessible fittings for lubrication. Statically and dynamically balance fan assemblies in fan housing after final assembly.
 - 1. Provide inlet vanes for stable capacity modulation where required for variable air volume applications. Discharge dampers shall not be an acceptable means to control fan capacity for variable air volume applications.
 - 2. Fans shall be internally isolated on spring isolators. Flexible connectors shall be provide at all fan connections.
 - 3. Where plug fans are provided, interlock access door with fan to turn fan off when door is opened.
 - 4. Fan bearings shall be rated for a minimum of 200,000 hours.
- J. Zoning Damper Sections: Provide zoning damper sections for multi-zone units, furnished with series of equal-sized discharge openings, each with set of dampers to regulate air flow from heating pass and cooling pass. Permanently secure damper blades in correct position on single shaft, rotating in sintered bronze or nylon bearings, and extend either upward or downward for connection to damper motor. Provide blade seals and edge seals on damper blades. Connect damper shafts together with one continuous linkage bar which may be cut in field to separate dampered openings into groupings as required. Provide damper section capable of either horizontal or vertical air discharge, factory-installed for orientation indicated.
- K. Controls: Operating and safety controls shall include high and low pressure cutouts, oil pressure cutout, compressor winding thermostat cutout, 3-leg compressor overload protection, and condenser fan motors with thermal and overload cutouts. Control transformer if required shall be 115-volts. Provide magnetic contactors for compressor and condenser fan motors. Additional features include:
 - 1. Reset relay circuit for manual resetting of cutouts from remote thermostat location;
 - 2. Automatic nonrecycling pumpdown, and timing device to prevent excessive compressor cycling;

3. Unfused disconnect switch, factory-mounted and wired, for single external electrical power connection.
4. Compressor shall be located in a section separated from condenser fans and coils.
5. Compressor shall be mounted on spring isolators.
6. Compressor shall be provided with hot gas bypass

When HGBP is specified, make sure piping is shown on drawings. This is required when system capacity is anticipated; can be anticipated to drop to 30% or less. When in doubt, it should be provided.

7. Extended 5 year compressor warranty: 5 years from date of substantial completion.
- L. Temperature Controls: Provide remote thermostat for heat, fan, and cool control.
- M. Temperature Control: Provide sensor unit, factory-mounted in supply plenum to actuate compressor cylinder unloaders through slow-acting step controller.
1. Economizer Control: Provide factory-installed and wired enthalpy control of outside and return air dampers, interlocked with plenum sensor unit.
 2. Timeclock: Provide programmable 7-day timeclock to index system between occupied and unoccupied cycles, and to actuate morning warm-up cycle when conditions require.
- N. Multi-Zone Controls: Control compressor loading and unloading from leaving cooling coil temperature. Provide hot-gas bypass control on last step.
- O. Filters: Provide filter box with integral filter rack and hinged access door on both sides.
- Filter Type: 2"/4" thick throwaway.
 Filter Type: 2"/4" thick permanent.
 Filter Type: 1"/2"/4" thick, UL Class 2, pleated media @ 20%/30% efficiency when tested in accordance with ASHRAE 52-7 standard.
- P. Mixing Boxes: Provide mixing boxes of physical size to match basic unit, and include equal-sized flanged openings capable of handling full air flow. Arrange openings as indicated. Provide dual action parallel dampers with blade seals and edge seals, arranged to operate automatically with one set of linkage. Provide dampers of balanced construction, rotating in sintered bronze or nylon bearings.
1. Provide dampers with leakage limited to 10 cfm/sq. ft. at 4" w.g.
 2. Dampers shall be aluminum, air foil type dampers.

Air foil dampers are not available on Trane, York, McQuay. Edit as required.

2.4 VARIABLE AIR VOLUME UNITS:

- A. General: Provide factory-assembled and tested packaged variable air volume units as indicated, consisting of casing, compressors evaporator, fans, filters, and unit controls. Provide capacities and electrical characteristics as scheduled.
- B. Casings: Construct casings of 18-ga minimum mill galvanized steel, designed to withstand specific operating pressures. Provide casing panels and/or access doors that are easily and quickly removable for inspection and access to internal parts.
1. Provide single zone/variable air volume units consisting of fan section, coil section, adjustable fan motor mounting, and drain pan.
 2. Provide multizone units consisting of single zone components, diffuser section, damper section, zoning dampers, and balancing plate when required to equalize resistances through cooling and heating passes.
 3. Provide reinforced points of support for either setting or hanging units.
 4. Provide drain pan, stainless steel located under cooling coil section and humidifier section, extensive enough to catch condensate leaving coil at highest catalogued face velocity. Provide at least one drain connection at low point in drain pan.
 5. Cover casing and frame with protective finish on both sides.
 6. Provide lights in accessible sections with wire guards, factory wired to switch mounted on casing exterior. In spray coil or humidifier sections provide marine lights of glass and wire sealed design.
 7. Units shall be provided with double wall construction in fan section only/throughout. The interior section shall be constructed of 20 gauge, perforated sheet metal. The walls shall be 2"/4". The panels shall be fully insulated.

<p>The above paragraph is for Temtrol, Pace, Mammoth or other custom type units only. It is not applicable to Trane, York and McQuay.</p>

8. The access doors shall be of double wall construction. Three lever type handles shall be provided on each access door. The doors shall be fully gasketed with neoprene material.
 9. Provide decorative return air grille in return air opening.
 10. Provide free discharge plenum over supply air opening, equipped with double deflection adjustable grilles.
- C. Compressor: Reciprocating hermetic-type compressor, 1,750 RPM, designed for air-cooled condensing, complete with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports. Capacity shall be controlled through cylinder unloading. Additional features include:
1. Crankcase heater in well within crankcase;
 2. Capacity steps as scheduled, or greater number;

3. Compressor of same manufacturer as condensing unit.

D. Screw Compressors:

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- E. Air-Cooled Condenser: Design unit for use with remote air-cooled condenser; not work of this section. Refer to Section 15743 for specification requirements.
- F. Water-Cooled Condenser: Multipass shell-and-tube type condenser having replaceable seamless integral finned copper tubes, positive liquid subcooling circuit, pressure relief device, liquid level test cock, purge connection, liquid line shutoff valve, and 1/4" flare angle valve for connection of water regulating valve.
1. Unit shall bear ASME stamp for refrigerant side working pressure of 385 psig; and water side working pressure of 250 psig.
- G. Cooling Coils: Provide nonferrous construction with aluminum fins mechanically bonded to copper tubing. Provide capacity control of refrigerant flow to coils, capable of modulating to 10% of nominal capacity.
- H. Heating Coils: Provide nonferrous construction with aluminum fins mechanically bonded to copper tubing. Provide 18 ga. minimum galvanized steel casing.
- I. Fan Sections: Provide forward curved/air foil/plug fans/backward inclined, fans specifically designed and suitable for class of service indicated. Provide adjustable motor base, adjusted with mounting bolts, to provide variation in center distance. Provide locking nuts, or similar devices, to secure base in proper position. Provide belt-driven fans with adjustable pitch pulley permitting fan speed to be varied. Select pulley for mid-point of adjustable range. Design fan shafts so as not to pass through first critical speed when unit comes up to rated RPM. Provide grease-lubricated fan bearings with externally accessible fittings for lubrication. Statically and dynamically balance fan assemblies in fan housing after final assembly.
1. Provide inlet vanes for stable capacity modulation where required for variable air volume applications. Discharge dampers shall not be an acceptable means to control fan capacity for variable air volume applications.
2. Fans shall be internally isolated on spring isolators. Flexible connectors shall be provide at all fan connections.
3. Where plug fans are provided, interlock access door with fan to turn fan off when door is opened.
4. Fan bearings shall be rated for a minimum of 200,000 hours.
- J. Filters: Provide filter box with integral filter rack and hinged access door on both sides.
- Filter Type: 2"/4" thick throwaway.
 Filter Type: 2"/4" thick permanent.
 Filter Type: 1"/2"/4" Pleated media @ 20%/30% ASHRAE atmospheric dust spot efficiency.
- K. Controls: Operating and safety controls shall include high and low pressure cutouts, oil pressure cutout, compressor winding thermostat cutout, 3-leg compressor overload protection, and condenser fan motors with thermal and overload cutouts. Control transformer if required

shall be 115-volts. Provide magnetic contactors for compressor and condenser fan motors. Additional features include:

1. Reset relay circuit for manual resetting of cutouts from remote thermostat location;
 2. Automatic nonrecycling pumpdown, and timing device to prevent excessive compressor cycling;
 3. Unfused disconnect switch, factory-mounted and wired, for single external electrical power connection.
- L. Temperature Control: Provide sensor unit, factory-mounted in supply plenum to actuate compressor cylinder unloaders through slow-acting step controller.
1. Economizer Control: Provide factory-installed and wired enthalpy control of outside and return air dampers, interlocked with plenum sensor unit.
 2. Timeclock: Provide programmable 7-day timeclock to index system between occupied and unoccupied cycles, and to actuate morning warm-up cycle when conditions require.
 3. Provide hot gas bypass.
- M. Mixing Boxes: Provide mixing boxes of physical size to match basic unit, and include equal-sized flanged openings capable of handling full air flow. Arrange openings as indicated. Provide dual action parallel dampers with blade seals and edge seals, arranged to operate automatically with one set of linkage. Provide dampers of balanced construction, rotating in sintered bronze or nylon bearings.
1. Provide dampers with leakage limited to 10 cfm/sq. ft. at 4" w.g.
 2. Dampers shall be aluminum, air foil type dampers.

Air foil dampers are not available on Trane, York, McQuay. Edit as required.
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2.5 THROUGH THE WALL PACKAGED HEATING AND COOLING UNITS:

- A. General: Provide packaged heating and cooling units as indicated, consisting of cabinet compressor, evaporator fan condenser fan, filters, wall sleeve, louver, subbase, coils and controls. Provide capacities and electrical characteristics as scheduled.
- B. Cabinet: Wall sleeve and unit chassis shall be 18-gauge, phosphatized, galvanized steel. Exterior parts shall be hot dipped, zinc-coated. Bulkhead shall be insulated. The entire chassis shall be primed and painted, electrically bonded to the metal and baked on. Wall sleeve and room cabinet shall be baked-on acrylic enamel. The front panel of the unit chassis shall be removable. Provide subbase.
- C. Louver: The exterior louver shall be extruded aluminum.
- D. Grille: Grille shall be adjustable discharge at an angle of 15 or 40 degrees from vertical position.
- E. Fans: Evaporator fan shall be twin, forward curved, centrifugal type, direct connected to a two speed motor. Condenser fan shall be propeller type.

- F. Controls: Provide unit mounted push-button controls with the following functions:
1. OFF - Turns unit off.
 2. FAN ONLY - Indoor fan operates at medium speed.
 3. HI-COOL - Provides cooling with medium-speed indoor fan.
 4. LO-COOL - Provides cooling with low-speed indoor fan.
 5. HI-HEAT - Provides heating with medium-speed indoor fan.
 6. LO-HEAT - Provides heating with low-speed fan.
 7. LOW AMBIENT LOCKOUT - Prevents compressor from running below 40°F outdoor ambient.

Provide unit with a factory-mounted terminal strip to be tied into a remote wall-mounted 24-volt thermostat.

- G. Outside Air Damper: Provide adjustable manual outside air damper for zero outside air (closed) to fully open (60%).
- H. Fan Cycle Switch: Provide fan switch to allow either continuous or cycled fan control.
- I. Refrigeration System: Compressor shall be fully hermetic, internally isolated with a steel shell and externally isolated. Tubing connections to compressor shall be looped.
- J. Capillary Tube Expansion Device: Provide capillary tube expansion device for uniform refrigerant flow throughout the system operating range to maintain operating efficiency.
- K. Coils: Coils shall be seamless copper tubing mechanically expanded into configured aluminum plate fins and tested at 600 psi.

Heat Pump Type Unit: Heat pump type units shall be provided with a reversing valve which locks in the reverse cycle position, as long as controls are in the "heat" position, to prevent noisy feedback when the unit shuts off. A coil thermostat senses outdoor coil temperature during heating operation and switches unit from reverse cycle operation to electric heat when outdoor air temperature can lead to frost formation on the outdoor coil.

- L. Electric Heating Coils: Nichrome coiled elements protected by a fusible link and an overheat limit control. Coils 4.0 kw or greater have two-stage operation.
- M. Motors: Provide separate evaporator and condenser fan motors. Motors shall be high efficiency, permanent split capacitor (psc) type.
- N. Electrical: Provide units with factory-installed cord or detach cord for permanent wiring connection to the unit.

For use with hard-wire junction box. Provide mechanical disconnect at the junction box.

- O. Leveling Legs: Provide adjustable leveling legs for adjustment from 2-5/8" to 5-1/4".

Provide factory-supplied, field installed, package for central system hot water heat/steam capability at the unit. Optional package includes hydronic coil box, auxiliary control escutcheon, transition piece and control valve wiring harness. Coil is of seamless copper tubing, mechanically expanded into configured aluminum plate fins, one-row coil, 3/8" tube, 13 fins per inch and air bleed port. Left-handed or right-handed female connections and tested at 300 psi.

- P. Thermostats: For use with remote thermostat controlled unit, provide the following:

1. Single-speed fan operation in heating and cooling mode.
2. Two-speed fan operation in heating and cooling mode.
3. Provide lock to control panel access to prevent unauthorized operation.
4. Provide set back thermostat with manual override.

2.6 OUTDOOR THROUGH-THE-WALL PACKAGED COOLING AND HEATING UNITS:

- A. General: Provide factory-assembled and tested packaged units as indicated, consisting of casing, compressor, evaporator, fans, filters, wall sleeves, grilles with knurled thumb screws, unit controls, coils, outside air intake hood with filter, energy conservation system and remote mounted thermostat. Provide capacities and electrical characteristics as scheduled.
- B. Casing: Provide manufacturer's standard casing construction, corrosion protection coating, and exterior finish. Provide removable panels and/or access doors for inspection and access to internal parts. Insulate casing with 1/2" thick minimum thermal insulation, and compressor compartment with acoustical insulation. Provide knockouts for electrical and piping connections.
 1. Provide double deflection supply air and single deflection return air grilles in extended wall sleeve openings.
- C. Refrigeration Circuit: Provide refrigerant thermal expansion valve for refrigerant control. Provide access valves in suction and liquid lines. Provide dual refrigeration circuits for dual compressor units.
- D. Compressors: Provide welded shell, hermetic compressors, 3,600 rpm; or serviceable hermetic compressors, 1750 rpm. Provide crankcase heaters.
- E. Evaporator Coil: Construct of copper tubing and aluminum fins, pressure and leak tested at 1.5 times working pressure.
- F. Fans: Provide double-inlet, forward curved, centrifugal fans with adjustable belt drive. Provide permanently lubricated fan and motor bearings, and thermal overloads in motor.
- G. Filters: Provide 2" thick, 30% efficiency throwaway filters.
- H. Integral Air-Cooled Condensers: Provide condenser coil constructed of copper tubes and aluminum fins. Factory leak-test at 1.5 times working pressure, dehydrate and provide full charge of refrigerant. Provide subcooler and accumulator.
 1. Condenser Fan: Provide double-width, double-inlet, forward-curved centrifugal fan with adjustable belt drive.
 2. Low Ambient Control: Provide head pressure control, designed to operate at temperatures down to 0°F (-18°C).
- I. Electric Resistance Coils: Open-wire type, 80 percent nickel, 20 percent chromium. Elements shall be uniformly distributed over cross-sectional area of unit with vertical support brackets to prevent coil element sag. Coil elements shall be insulated with ceramic bushings and supported in an aluminized or galvanized steel frame.

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Electric Resistance Coils: Finned-tubular construction with 80 percent nickel, 20 percent chromium. Elements shall be mounted in oxide powder. Tubes shall be spirally wound with copper-plated steel fins that are continuously brazed to tubes. Coils shall be mounted in an aluminized or galvanized steel frame.

- J. Controls: Provide factory-installed and wired controls, with terminal strip. Provide connections for remote thermostat.
 - 1. Provide each motor with individual overload protection.
 - 2. Provide high and low refrigerant cutouts.
 - 3. Provide on-off and off-cool switches.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. General: Examine areas and conditions under which packaged heating and cooling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PACKAGED HEATING AND COOLING UNITS:

- A. General: Install packaged heating and cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Install units on 4" high concrete pad, 4" larger on each side than equipment base. Cast anchor bolt inserts into pad.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
 - 2. Ductwork: Refer to Division-15 section "Ductwork". Connect supply and return ducts to unit with flexible duct connections. Provide transitions to exactly match unit duct connection size.
 - 3. Connect all duct connections to unit with flexible connection, provide manual damper, quadrant and lock.
- D. Water-Cooled Condenser Piping: Refer to Division-15 section "Condenser Water Piping System". Connect supply and return piping to unit as indicated, with unions and shutoff valves.
- E. Air-Cooled Condenser Piping: Refer to Division-15 section "Refrigeration Piping Systems". Connect liquid and hot gas piping to unit as indicated.
- F. Hot Water Heating Coil Piping: Refer to Division-15 section "Hot Water Piping Systems". Connect supply and return piping to hot water coil as indicated, with unions, flexible connections, balancing valves, thermometers (supply and return), P & T taps (supply and return), shutoff valves, and other accessories.

- G. Steam Heating Coil Piping: Refer to Division-15 section "Steam Piping Systems". Connect steam and condensate piping in steam coil as indicated, with unions and shutoff valves.
 - H. Drain Piping: Connect unit drain to nearest indirect waste connection. Provide trap at drain pan; construct at least 1" deeper than fan pressure in inches of water.
- 3.3 FIELD QUALITY CONTROL:
- A. General: Start-up packaged heating and cooling units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- 3.4 TRAINING:
- A. Schedule a minimum of 4 hours of training with Owner. The manufacturers representative, and the Division 15 contractor shall be present. The training shall be coordinated by the Division 15 contractor and the Owner in conjunction with the other mechanical equipment on the project.
 - B. Training:
 - 1. Train the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures. Review with the Owner's personnel, the contents of the Operating and Maintenance Data specified in Division 1 and Section 15010.
 - 2. Schedule training with Owner through the Architect/ Engineer with at least 7 days prior notice.
- 3.5 SPARE PARTS:
- A. General: Furnish to Owner, with receipt, the following spare parts for each packaged heating and cooling unit:
 - 1. One set of matched fan belts for each belt driven fan.
 - 2. One set filters for each unit.

END OF SECTION 15781