

SECTION 15670 CONDENSING UNITS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Section includes:

1. Residential air-cooled condensing units.
2. Air-cooled condensing units.
3. Water-cooled condensing units.

B. Manufacturers shall be responsible to provide any information to the contractor prior to bidding which may impact the installed cost for the contractor including but not limited to:

1. Power wiring sizing, quantity and type of conductors and terminations requirements.
2. Control Power.
3. Auxiliary piping connections.

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 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.

B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of condensing units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

C. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 15.

D. Maintenance Data: Submit maintenance data and parts list for each condensing 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.

E. Operation and Maintenance Data: Submit maintenance data and parts list for each condensing unit, control, and accessory; including "trouble shooting" maintenance guide; plus servicing, and preventative maintenance procedures and schedule. Include this data and product data in maintenance manual; in accordance with requirements of Division 15.

1.4 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of condensing 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. Capacity ratings for condensing units shall be in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment" and all other ARI standards applicable to the specific equipment as applicable.
 2. Refrigeration system of condensing units shall be constructed in accordance with ASHRAE Standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".
 3. Condensing units shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design".
 4. Construction and testing of water cooled condensing units shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII.
 5. Condensing units shall be listed by UL and have UL label affixed.
 6. Unit construction shall comply with ANSI safety codes.
 7. Unit construction shall comply with the National Electrical Code.
- 1.5 DELIVERY, STORAGE, AND HANDLING:
- A. Handle condensing units and components carefully to prevent damage. Follow manufacturer's written instructions for rigging. Replace damaged condensing units or components.
 - B. Store condensing units and components in clean dry place off the ground. Protect from weather, water, and physical damage.
- 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 or 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.

The extended warranty is only applicable when the Owner has requested and the associated costs have been determined, and it has been documented in writing. This is not applicable to residential and smaller tonnage units.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS:
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Residential Air-Cooled Condensing Units:

- a. Air Conditioning; Div Corp.
 - b. Lennox Industries, Inc.
 - c. Trane (The) Co; Div American Standard Inc.
 - d. York; Div York International.
2. Air-Cooled Condensing Units:
- a. McQuay Air Conditioning Group; McQuay Inc.
 - b. Trane (The) Co; Div American Standard Inc.
 - c. York; Div of York International.
3. Water-Cooled Condensing Units:
- a. McQuay Air Conditioning Group; McQuay Inc.
 - b. Trane (The) Co; Div American Standard Inc.
 - c. York; Div of York International.
- 2.2 RESIDENTIAL AIR-COOLED CONDENSING UNITS (1-1/2 TON TO 5 TONS):
- A. General: Factory-assembled and tested air-cooled condensing units, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir, and operating controls.
 - B. Casing: Galvanized steel finished with baked enamel, complete with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Unit shall be complete with brass service valves, fittings, and gauge ports on exterior of casing.
 - C. Compressor: Hermetically sealed, with built-in overloads and vibration isolation. Compressor motor, shall have thermal and current sensitive overload devices, internal high-pressure protection, high and low pressure cutout switches, start capacitor and relay, 2-pole contactor, crankcase heater, and temperature actuated switch and timer to prevent compressor rapid cycle.
 - D. Condenser: Coil shall have copper tubes and aluminum fins, or aluminum tubes and aluminum fins; complete with liquid accumulator and liquid subcooler. Aluminum propeller fan shall be direct driven, with permanently lubricated fan motor having thermal overload protection.
 - 1. Fan motor shall be 2-speed and shall automatically switch speeds.
 - E. The unit shall contain sufficient refrigerant charge for complete system.
 - F. Accessories:
 - 1. Low-voltage thermostat and subbase to control condensing unit and evaporator fan.
 - a. Low voltage control transformer.
 - b. Start capacitor and relays.
 - c. Indoor fan relays.
 - 2. Precharged and insulated suction and liquid tubing of length indicated.
 - a. Liquid line filter drier.
 - 3. Heat reclaim device providing preheating of domestic hot water with hot gas from condensing unit.

4. Low-voltage control transformer.
5. Water-to-refrigerant heat exchanger.
6. Low ambient head pressure control.
7. Device to prevent compressor from short cycling.

2.3 AIR-COOLED CONDENSING UNITS:

Design Note: Provide electrical engineer condensing unit manufacturers starter wiring information.

- A. General: Factory-assembled and tested air-cooled condensing units, consisting of casing, compressors, condensers, coils, condensing coil guard, condenser fans and motors, and unit controls.
- B. Unit Casings: Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include:
 1. Steel, galvanized or zinc-coated, for exposed casing surfaces, treated and finished with manufacturer's standard paint coating;
 2. Lifting lugs to facilitate rigging of units;
 3. Factory-installed metal grilles, for protection of condenser coil during shipping, installation, and operation;
 4. Hinged and gasketed control panel door.
- 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.

Design Note: Specify reduced voltage starters for larger loads.

- D. 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.
- E. Condensing Section: Condenser coil shall be seamless copper tubing mechanically bonded to heavy-duty, configured aluminum fins, with separate and independent refrigeration circuit for each compressor. Units shall include liquid accumulator and subcooling circuit, and backseating liquid line service access valve. Condenser coils shall be factory-tested at 450 psig, vacuum dehydrate, and filled with a holding charge of nitrogen.
- F. Condenser fans and drives: propeller-type condenser fans for vertical air discharge; either direct drive or belt drive. Additional features include:
1. Permanent lubricated ball bearing condenser fan motors;
 2. Separate motor for each condenser fan;
 3. Constant speed condenser fan motors;
 4. Each fan assembly shall be dynamically and statically balanced.
- G. Low ambient head pressure control: Factory-installed low ambient damper assembly, fan speed control, or fan cycling control for operation down to -20 degrees F.

Design Note: Provide electrical engineer condensing unit manufacturers starter wiring information

2.4 WATER-COOLED CONDENSING UNITS:

- A. General: Factory-assembled and tested water-cooled condensing units, consisting of reciprocating compressor, water-cooled condenser, base, and unit control panel.
- B. 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 inch 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.
- C. Compressor: Reciprocating serviceable hermetic type compressor with reversible oil pump, operating oil charge, and suction and discharge shutoff valves. Compressor shall be factory-mounted to base using spring isolators.

1. Compressor motor shall be using suction gas around motor windings. Thermally protect compressor motor.
2. Compressor shall be equipped with insert type crankcase heater of size required to control oil dilution during shutdown.
3. Capacity control shall be obtained through cylinder unloading, by suction pressure controlled and discharge pressure operated. Design so compressor will start with controlled cylinders unloaded.
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
7. Extended 5 year compressor warranty: 5 years from date of substantial completion.
8. Compressor speed shall not exceed 1750 rpm.

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| Design Note: Specify reduced voltage starter for larger loads sizes. |
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D. Controls: factory-mounted and wired control panel containing the following:

1. Positive acting timer to prevent short cycling;
2. High and low pressure controls;
3. Power and control circuit terminal blocks;
4. Compressor motor starter;
5. Control relays;
6. Control circuit off-on switch;
7. Control circuit fuse.

E. Accessories:

1. Discharge line muffler;
2. Gauge panel containing gauges for suction, discharge, and oil pressure;
3. Electric solenoid unloading in lieu of suction-pressure unloading;
4. Control circuit transformer; line to 130-volts AC;
5. Pumpdown relay package;
6. Crankcase coverplates with equalizer connections.
7. Combination sight glass and moisture indicator.
8. Refrigerant filter/dryer.
9. Charging valve.
10. Insulation on all suction lines.

F. Low ambient head pressure control: Factory installed low ambient damper assembly, fan speed control or fan cycling control for operation down to -20 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION:

- A. Verify roof structure, mounting supports, and membrane installations are completed to the proper point to allow installation of roof mounted units. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Install condensing units in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
 - 1. Provide flexible connections on all piping connections.
- B. Install ground-mounted units on 4inch thick reinforced concrete pad, 4inches larger on each side than condensing unit. Concrete is specified in Division 3. Coordinate installation of anchoring devices.
- C. Install roof-mounted units on equipment supports on roof curbs with water proof flashing. Anchor unit to supports with removable fasteners.
- D. Residential Units: Connect pre-charged refrigerant tubing to unit's quick-connect fittings. Run tubing so as not to interfere with access to unit.
 - 1. Install furnished accessories.
- E. Air-Cooled Condensing Units: Connect refrigerant piping to unit; maintain required access to unit.
 - 1. Install furnished field-mounted accessories.
- F. Water-Cooled Condensing Units: Connect refrigerant piping to unit, and condenser water piping. Maintain clear tube removal space.

3.3 FIELD QUALITY CONTROL:

- A. Testing: Test unit when field piping is completed through all phases of operation after pressure tests have been completed in compliance with Division 15 specification.
- B. Charge systems with full charge of refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.
 - 1. Install core in filter dryer after leak test, but before evacuation.
 - 2. Evacuate refrigerant system with vacuum pump until 35 degrees F is indicated on vacuum dehydration gauge.

3.4 DEMONSTRATION:

- A. Provide services of manufacturer's authorized service representative to provide factory 1start-up service and to instruct Owner's personnel in operation and maintenance of condensing units.
- B. Start-up condensing units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

- C. Train Owner's personnel on start-up and shut-down procedures, troubleshooting procedures, servicing, and preventative maintenance schedule and procedures. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Division One.

3.5 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.

END OF SECTION 15670