

Guide Specifications RHPCYC-036— 060

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ELECTRIC HEAT PACKAGED ROOFTOP

HVAC Guide Specifications

Size Range: 3 to 5 Nominal Tons

1.00 General:

- A. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a(n) hermetic scroll compressor(s) for cooling duty and heat pump for heating duty.
- B. Factory assembled, single-piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
- C. Unit shall use environmentally safe, R-454B refrigerant.
- D. Unit shall be installed in accordance with the manufacturer's instructions.
- E. Unit must be selected and installed in compliance with local, state, and federal codes.
- F. Model and serial data shall be printed inside the control box.

1.01 Quality Assurance:

- A. Unit meets ASHRAE 90.1 2022 minimum efficiency requirements.
- B. Unit shall be rated in accordance with AHRI Standards 210/240 or 340/360 and 10 CFR appendix M1 to subpart B or part 430.
- C. Unit shall be designed to conform to ASHRAE 15.
- D. Unit shall be UL-tested and certified in accordance with Standards and UL-listed and certified under Canadian standards as a total package for safety requirements.
- E. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- F. Unit casing shall be capable of withstanding 1000-hour salt spray exposure per ASTM B117 (scribed specimen).
- G. Roof curb shall be designed to conform to NRCA Standards.
- H. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory and must be available upon request.
- I. Unit shall be designed in accordance with UL Standard 60335-2-40 4th Edition. including tested to withstand rain.

1.02 Manufacturer Qualifications

- A. Unit shall be designed in accordance with ISO 9001:2015 and shall be manufactured in a facility registered by ISO 9001:2015.

1.03 Installer Qualifications

- A. The installer shall be trained to install and service equipment with A2L refrigerants.

1.04 Delivery, Storage, and Handling:

- A. Unit shall be stored and handled per manufacturer's recommendations.
- B. Lifted by crane requires either shipping top panel or spreader bars.
- C. Unit shall only be stored or positioned in the upright position.

1.05 Unit Cabinet:

- A. Shall be constructed of galvanized steel.
- B. Exterior paint shall be: pre-painted steel.
- C. The sheet-metal cabinet shall be constructed of 18-gauge material for structural components with an underlying coat of G90.
- D. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1.6 lb density, flexible fiberglass insulation, foil faced on the air side.
- E. Base of unit shall have a location for thru-the-base gas and electrical connections standard.
- F. Base Rail:
 - i. Unit shall have base rails on a minimum of 4 sides.
 - ii. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
 - iii. Holes shall be provided in the base rail for moving the rooftop unit with a fork truck.
 - iv. Base rail shall be a minimum of 14 gauge thickness.

- G. Condensate pan and connections:
 - i. Shall be a sloped condensate drain pan made of a non-corrosive material and be removable for cleaning.
 - ii. Shall comply with ASHRAE Standard 62.
 - iii. Shall use a 3/4" NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations.
 - iv. Shall be able to be easily removed.
 - v. Shall be separate from the coil.
- H. Standard factory-installed condensate overflow sensor.
- I. Top panel
 - i. Shall be a single piece top panel over indoor section.
- J. Electrical Connections:
 - i. All unit power wiring may enter unit cabinet through a single, factory-prepared, continuous raised flange opening in the basepan. Unit power wiring may also enter unit cabinet through a dedicated entry point on the condenser side of the unit.
 - ii. Thru-the-base capability:
 - a. Standard unit shall have a thru-the-base electrical location(s) using a raised, continuous raised flange opening in the basepan.
 - b. No basepan penetration, other than those authorized by the manufacturer, is permitted.
- K. Component access panels (standard):
 - i. Cabinet panels shall be easily opened for servicing.
 - ii. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and filters shall have hinges with 1/4 turn fasteners on units with factory-installed hinged option.
 - iii. 1/4 fasteners shall be permanently attached.

1.06 Operating Characteristics:

- A. Unit shall be capable of starting and running at 115°F (46°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at $\pm 10\%$ voltage.
- B. Compressor with standard controls shall be capable of operation down to 50°F (10°C), ambient outdoor temperatures. Low ambient accessory kit is necessary if mechanically cooling at ambient temperatures to 30°F (-1.1°C).
- C. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
- D. Unit shall be factory configured for vertical supply & return configurations.
- E. Unit shall be field convertible from vertical to horizontal configuration.

1.07 Electrical Requirements

- A. Main power supply voltage, phase, and frequency must match those required by the manufacturer.

1.08 Evaporator Fan Compartment:

- A. Interior cabinet surfaces shall be insulated with a minimum 1/2-in. thick, minimum 1.6 lbs. density, flexible fiberglass insulation bonded with foil face on the air side.
- B. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- C. Insulation shall also be mechanically fastened with welded pin and retainer washer.

1.09 Thermostats:

- A. Energize both "W" and "G" when calling for heat.
- B. Have capability to energize 1 stage of cooling, and at least 1 stage of heating.
- C. All units shall have the capability to energize to 2 stages.
- D. Include capability for occupancy scheduling.

1.10 Electronic Control System for HVAC:

- A. Shall be complete with self-contained low-voltage control circuit protected by a fuse on the 24-V transformer side.
- B. Shall utilize color-coded wiring.
- C. Shall include a central control terminal board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, building management systems, loss of charge, freeze sensor, high-pressure switches.
- D. Unit shall include a minimum of one 11-position terminal block for control wiring.
- E. Unit control board incorporates a 22 character LCD display to easily navigate through the Human Machine Interface (HMI) and with easy-to-understand fault codes for status and diagnostics.

1.10.01 Safeties:

- A. Compressor over-temperature, over current.
- B. Standard Low-pressure switch:
 - i. Units shall have low pressure, loss of charge automatic reset device that will shut off compressor when tripped.
 - ii. Low pressure control:
Provides active protection in both heating and cooling modes at all outdoor ambient temperatures.
The low pressure control is an automatic reset type and opens at approximately 15 PSIG and closes at approximately 40 PSIG. Operation is slightly different between cooling and heating modes.
- C. Standard High-pressure switch:
 - i. Unit shall be equipped with high pressure switch device that will shut off compressor when tripped.
 - ii. High pressure control:
The high pressure control is an automatic reset type and opens at approximately 610 PSIG and closes at approximately 420 PSIG. The compressor and fan motor will stop when the high pressure control opens and will start again if the high side pressure drops to approximately 420 PSIG where the automatic reset high pressure control resets. If the high pressure control opens 3 times within a particular call for heating or cooling operation, the defrost control will lock out compressor and outdoor fan operation.
- D. Automatic reset, motor thermal overload protector.
- E. The unit must be permanently grounded.
- F. Components are not compatible between different refrigerants. Do not use R-410A service equipment or components on R-454B equipment. System or part failure could occur.
- G. Heating section shall be provided with the following minimum protections
 - i. High-temperature limit switches.

1.11 Standard Filter Section:

- A. Shall consist of factory-installed, low velocity, throwaway 2-in. thick fiberglass filters of commercially available sizes.
- B. Unit will accept both 2-in. and 4-in. filters.
- C. Filter face velocity shall not exceed 365 fpm at nominal airflows.
- D. Filters shall be accessible through an access panel with "no-tool" removal as described in the unit cabinet section of the specification.
- E. Filters access is specified in the unit cabinet section of this specification.
- F. Filters shall be held in place by metal rods, facilitating easy removal and installation.

1.12 Coils

- A. Standard Aluminum/MicroChannel Coils:
 - i. Standard evaporator and condenser coils shall be aluminum.
 - ii. Evaporator and condenser coils shall be leak tested to 150 PSIG, pressure tested to 400 PSIG, and qualified to burst test at 2,200 psi.

1.13 Refrigerant Components:

- A. Refrigerant circuit shall include the following control, safety, and maintenance features:
 - i. TXV metering system shall prevent mal-distribution of two-phase refrigerant.
 - ii. Refrigerant filter drier.
 - iii. Service gauge connections on suction and discharge lines.
 - iv. External pressure gauge ports access shall be located in front exterior of cabinet.
 - v. External gauge ports shall be lockable.
- B. Compressors:
 - i. Unit shall use one two-stage scroll compressor with internal line break overload and high pressure protection.
 - ii. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
 - iii. Compressors shall be internally protected from high discharge temperature conditions.
 - iv. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
 - v. Compressor shall be factory mounted on rubber grommets.
 - vi. Compressor motors shall have internal line break thermal and current overload protection.
 - vii. Crankcase heaters shall not be required for normal operating range.
 - viii. Compressor shall have molded electrical plug.

1.14 Evaporator Fan and Motor:

- A. Evaporator Fan Motor:
 - i. Shall have permanently lubricated bearings.
 - ii. Shall have inherent automatic-reset thermal overload protection.
- B. Direct Drive Evaporator Fan:
 - i. Direct drive ECM technology with multiple speed of 0-10Vdc(%) input from the controller.
 - ii. Blower fan shall be double-inlet type with forward-curved blades.
 - iii. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
- C. Blower Assembly:
 - i. Entire assembly shall be able to slide out completely.
 - ii. Shall be able to slide-out without the removal of the roof and condenser fan motors.

1.15 Condenser Fans and Motors:

- A. Condenser Fan Motor:
 - i. Shall be a totally enclosed motor.
 - ii. Shall use permanently lubricated bearings.
 - iii. Shall have inherent thermal overload protection with an automatic reset feature.
 - iv. Shall use a shaft-down design. Shaft-up designs including those with "rain-slinger devices" shall not be allowed.
- B. Condenser Fan:
 - i. Shall be a direct-driven propeller type fan.
 - ii. Shall have blades riveted to corrosion-resistant steel spiders and shall be dynamically balanced.

1.16 RTU-C Controller:

- A. Shall be ASHRAE 62-2001 compliant.
- B. Shall accept 18-32VAC input power.
- C. Shall have an operating temperature range from -40°F (-40°C) to 140°F (60°C), 10%– 95% RH (non-condensing).
- D. Shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air enthalpy, compressor lock-out, fire shutdown, enthalpy switch and fan status/filter status/humidity/remote occupancy.
- E. Shall accept a CO₂ sensor in the conditioned space and be Demand Control Ventilation (DCV) ready.
- F. Shall provide the following outputs: Economizer, fan, cooling stage 1, cooling stage 2, electric heat stage 1, electric heat stage 2, heat pump heating stage 1, heat pump heating stage 2, exhaust, occupied.
- G. Unit shall provide surge protection for the controller through a circuit breaker.
- H. Shall have a built-in BACnet IP or MS/TP allowing the unit to be able to communicate at a an adjustable Baud rate.
- I. Shall have an LCD display independently showing the status of activity on the communication bus, and processor operation.
- J. Software upgrades will be accomplished by local download. Software upgrades through chip replacements are not allowed.
- K. Shall be shock resistant in all planes to 5G peak, 11ms during operation, and 100G peak, 11ms during storage.
- L. Shall be vibration resistant in all planes to 1.5G @ 20-300 Hz.
- M. Shall support a bus length of 4000 ft max, 60 devices per 1000 ft section, and 1 RS-485 repeater per 1000 ft sections.
- N. Shall allow access of up to 62 network variables (SNVT). Shall be compatible with all open controllers.
- O. Shall have an LED display independently showing the status of serial communication, running, errors, power, all digital outputs and all analog inputs.
- P. Shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air enthalpy, compressor lock-out, fire shutdown, enthalpy switch and fan status/filter status/humidity/remote occupancy.
- Q. Shall be natively equipped with Modbus® communication protocol.

1.17 Special Features:

- A. Integrated Economizers:
 - i. Integrated, parallel modulating blade design type capable of simultaneous economizer and compressor operation.
 - ii. Independent modules for vertical or horizontal return configurations shall be available. Vertical return modules shall be available as a factory-installed option.
 - iii. Damper blades shall be galvanized steel. Plastic or composite blades on intake or return shall not be acceptable.
 - iv. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.

- v. Shall be equipped with driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
 - vi. Shall be equipped with low-leakage dampers, not to exceed 2% leakage at 1-in. wg pressure differential.
 - vii. Shall be capable of introducing up to 100% outdoor air.
 - viii. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air.
 - ix. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
 - x. Enthalpy sensor shall be provided as standard. Outdoor air sensor set point shall be adjustable and shall range from 40 to 100°F / 4 to 38°C. Additional sensor options shall be available as accessories.
 - xi. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 60%, with a range of 0% to 100%.
 - xii. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy. A remote potentiometer may be used to override the damper set point.
 - xiii. Dampers shall be completely closed when the unit is in the unoccupied mode.
 - xiv. Economizer controller shall accept a 0-10VDC, 0-5VDC, 2-10VDC, or 4-20ma CO₂ sensor input for IAQ/DCV control.
 - xv. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
 - xvi. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
 - xvii. Economizer wire harness will have provision for smoke detector available in supply and return options.
 - xviii. Shall provide fault detection and diagnostics (FDD) system in accordance with local code.
Faults shall be communicated out on an alarm signal.
- B. Manual Damper
- i. Manual damper package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 50% outdoor air for year-round ventilation.
- C. Condenser Coil Hail Guard Assembly:
- i. Shall protect against damage from hail.
 - ii. Shall be louvered style.
- D. Unit-Mounted, Non-Fused Disconnect Switch:
- i. Switch shall be factory-installed, internally mounted.
 - ii. National Electric Code (NEC) and UL approved non-fused switch shall provide unit power shutoff.
 - iii. Shall be accessible from outside the unit.
 - iv. Shall provide local shutdown and lockout capability.
- E. Convenience Outlet:
- i. Non-Powered convenience outlet.
 - ii. Outlet shall be powered from a separate 115-120V power source.
 - iii. A transformer shall not be included.
 - iv. Outlet shall be field-installed and internally mounted with easily accessible 115V female receptacle.
 - v. Outlet shall include 15 amp GFI receptacle with independent fuse protection.
 - vi. Outlet shall be accessible from outside the unit.
- F. Propeller Power Exhaust:
- i. Power exhaust shall be used in conjunction with an integrated economizer.
 - ii. Independent modules for vertical or horizontal return configurations shall be available.
 - iii. Horizontal power exhaust shall be mounted in return ductwork.
 - iv. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0-100% adjustable setpoint on the economizer control.
 - v. Capable of adjustable but constant volume.
- G. Roof Curbs (Vertical):
- i. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
 - ii. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
- H. Return Air Enthalpy Sensor
- i. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.

- I. Indoor Air Quality (CO₂) Sensor:
 - i. Shall be able to provide demand ventilation indoor air quality (IAQ) control.
 - ii. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display.
The set point shall have adjustment capability.
- J. Smoke Detectors:
 - i. Shall be a Four-Wire Controller and Detector.
 - ii. Shall be environmental compensated with differential sensing for reliable, stable, and drift-free sensitivity.
 - iii. Shall use magnet-activated test/reset sensor switches.
 - iv. Shall have tool-less connection terminal access.
 - v. Shall have a recessed momentary switch for testing and resetting the detector.
 - vi. Controller shall include:
 - a. One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
 - b. Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.
 - c. One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
 - d. Capable of direct connection to two individual detector modules.
 - e. Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.
- K. Barometric Relief:
 - i. Shall include damper, seals, hardware and hoods to relieve excess building pressure.
 - ii. Damper shall gravity-close upon shutdown.
- L. Time Guard:
 - i. Shall prevent compressor short cycling by providing a 5-minute delay (± 2 minutes) before restarting a compressor after shutdown for any reason.
 - ii. One device shall be required per compressor.
- M. Standard Factory-Installed Overflow Switch
 - i. Switch shall monitor the condensate level in drain pan and stops compression operation when overflow conditions occur.
- M. Refrigerant Leak Detection System:
 - i. Shall be standard and factory-installed in every unit.
 - ii. Shall trigger a fault code to the unit controller and initiate mitigation procedures.