

GUIDE SPECIFICATIONS — RHPDYB – 090-120

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ELECTRIC HEAT PUMP PACKAGED ROOFTOP

HVAC Guide Specifications

Size Range: 7.5 to 10 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 340/360.
- 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.
- J. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.

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. Unit 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. Unit cabinet shall be constructed of galvanized steel.
- B. Unit cabinet 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 or 360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1.6 lbs density, flexible fiberglass insulation, foil faced on the air side. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment.
- E. Shall utilize uniform screw sizing.
- F. Base of unit shall have a location for thru-the-base gas and electrical connections standard.
- G. 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 for fork truck.
 - iv. Base rail shall be a minimum of 14 gauge thickness.
- H. 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.

- I. Standard factory-installed condensate overflow sensor.
- J. Top panel
 - i. Shall be a single piece top panel over indoor section.
- K. Electrical Connections:
 - i. All unit power wiring shall enter unit cabinet via a single, factory-prepared, continuous raised flange opening in the
 - 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.
- L. Component access panels (standard):
 - i. Cabinet panels shall be easily opened for servicing.
 - ii. Stainless steel metal hinges are standard on all doors
 - iii. Panels covering control box, indoor fan, indoor fan motor, and electric or gas heater components (where applicable), shall have 1/4 turn latches.

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 340/360 at $\pm 10\%$ voltage.
- B. Compressor with standard controls shall be capable of operation down to 40°F (4°C), ambient outdoor temperatures. Low ambient accessory kit is necessary if mechanically cooling at ambient temperatures to 40°F (4°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.
- F. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.

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 LB 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. Thermostat must:
 - i. Energize both "W" and "G" when calling for heat.
 - ii. Have capability to energize 1 stage of cooling, and at least 1 stage of heating.
 - iii. 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 (090-150 units have a resettable circuit breaker).
- 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, DDC control options, loss of charge, freeze sensor, high-pressure switches.
- D. Unit shall include a minimum of one 10-pin screw terminal connection board for connection of control wiring.
- E. Unit control board shall be provided with 7 segment readout via LCD display 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
 - a. 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.
 - iii. 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.
 - ii. Induced draft motor pressure switch.

1.11 Standard Filter Section:

- A. Filters 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 fully hermetic, 2-stage scroll compressor for each independent refrigeration circuit.
 - 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-ampereage 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.
 - iii. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
- B. Direct Drive Evaporator Fan:
 - i. Belt drive shall include an adjustable-pitch motor pulley.
 - ii. Shall use sealed, permanently lubricated ball-bearing type.
 - iii. Blower fan shall be double-inlet type with forward-curved blades.
 - iv. 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 Motors:
 - 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 Fans:
 - 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 158°F (70°C), 10%–95% RH (non-condensing).
- D. Controller shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air enthalpy, fire shutdown, return air enthalpy, fan status, remote time clock/door switch.
- 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, heat stage 1, heat stage 2, exhaust, occupied.
- G. Unit shall provide surge protection for the controller through a circuit breaker.
- H. Shall have a field-installed communication card allowing the unit to be able to communicate at a Baud rate of 19.2K or faster.
- I. Shall have an LED display independently showing the status of activity on the communication bus, and processor operation.
- J. Optional field-installed BACnet plug-in communication card which includes an EIA-485 protocol communication port, or an optional field-installed LonWorks plug-in communications card.
- K. Software upgrades will be accomplished by local download. Software upgrades through chip replacements are not allowed.
- L. Shall be shock resistant in all planes to 5G peak, 11ms during operation, and 100G peak, 11ms during storage.
- M. Shall be vibration resistant in all planes to 1.5G @ 20-300 Hz.
- N. Shall support a bus length of 4000 ft max, 60 devices per 1000 ft section, and 1 RS-485 repeater per 1000 ft sections.

1.17 Open Protocol, Direct Digital Controller:

- A. Shall be ASHRAE 62-2001 compliant.
- B. Shall accept 18-30VAC, 50-60Hz, and consumer 15VA or less power.
- C. Shall have an operating temperature range from -40°F (-40°C) to 130°F (54°C), 10% - 90% RH (non-condensing).
- D. Shall have either a field-installed BACnet plug-in communication card which includes an EIA-485 protocol communication port, or a field-installed LonWorks plug-in communications card.
- E. The BACnet plug-in communication card shall include built-in protocol for BACnet (MS/TP and PTP modes).
- F. The LonWorks plug-in communication card shall include the Echelon processor required for all Lon applications.
- G. Shall allow access of up to 62 network variables (SNVT). Shall be compatible with all open controllers.
- H. Baud rate Controller shall be selectable through the EIA-485 protocol communication port.
- I. Shall have an LED display independently showing the status of serial communication, running, errors, power, all digital outputs, and all analog inputs.
- J. 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.
- K. Shall provide the following outputs: economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, exhaust.
- L. Software upgrades will be accomplished by either local or remote download. No software upgrades through chip replacements are allowed.
- M. Shall be natively equipped with Modbus® communication protocol.

1.18 Adjustable Frequency Drive:

- A. Unit shall be supplied with an electronic variable frequency drive for the supply air fan.
- B. Drive shall be factory-installed in an enclosed cabinet.
- C. Drive shall meet UL Standard 60335-2-40 4th Edition.
- D. The completed unit assembly shall be UL listed.
- E. Drives are to be accessible through a tooled access hinged door assembly.
- F. The unit manufacturer shall install all power and control wiring.
- G. The supply air fan drive output shall be controlled by the factory-installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.
- H. Drive shall be programmed and factory run tested in the unit.

1.19 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 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 70%, 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 2-10Vdc CO2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor-air damper to provide ventilation based on the sensor input.
- xv. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
- xvi. Economizer wire harness will have provision for smoke detector available in supply and return options.
- xvii. Shall provide fault detection and diagnostics (FDD) system in accordance with local code. Faults shall be communicated out on an alarm signal.

B. Two-Position Motorized Damper:

- i. Damper shall be a Two-Position Motorized Damper. Damper travel shall be from the full closed position to the field adjustable %-open setpoint.
- ii. Damper shall include adjustable damper travel from 25% to 100% (full open).
- iii. Damper shall include single or dual blade, gear driven dampers and actuator motor.
- iv. Actuator shall be direct coupled to damper gear. No linkage arms or control rods shall be acceptable.
- v. Damper will admit up to 100% outdoor air for applicable rooftop units.
- vi. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
- vii. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
- viii. Outside air hood shall include aluminum water entrainment filter

C. 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.

D. Condenser Coil Hail Guard Assembly:

- i. Shall protect against damage from hail.
- ii. Shall be louvered style.

E. 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.

F. 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 115-v female receptacle.
- v. Outlet shall include 15 amp GFI receptacle with independent fuse protection.
- vi. Outlet shall be accessible from outside the unit.

- G. 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 are open.
 - v. Capable of adjustable but constant volume.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. Barometric Relief:
 - i. Shall include damper, seals, hardware, and hoods to relieve excess building pressure.
 - ii. Damper shall gravity-close upon shutdown.
- M. 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.
- N. Standard Factory-Installed Overflow Switch
 - i. Switch shall monitor the condensate level in drain pan and stops compression operation when overflow conditions occur.
- O. Access Panels:
 - i. Hinges with $\frac{1}{4}$ turn fasteners shall be permanently attached.
 - ii. Hinges shall be powder coated and made from stainless steel.
- P. Head Pressure Control Package
 - i. Controller shall control coil head pressure by condenser-fan cycling.
- Q. Fan/Filter Status Switch:
 - i. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).
 - ii. Status shall be displayed either over communication bus (when used with direct digital controls) or through the controller LCD display inside the unit control box.
- R. 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.