

GUIDE SPECIFICATIONS - 50TCQ*07-14

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Rooftop Packaged Heat Pump

HVAC Guide Specifications

Size Range: 6 to 12.5 Nominal Tons



<u>Section</u>	<u>Description</u>
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23 06 80	Schedules for Decentralized HVAC Equipment
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23 06 80.13	Decentralized Unitary HVAC Equipment Schedule
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23 06 80.13.A.	Rooftop unit schedule
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1. Schedule is per the project specification requirements.

23 07 16	HVAC Equipment Insulation
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23 07 16.13	Decentralized, Rooftop Units:
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23 07 16.13.A.	Evaporator fan compartment:
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1. Interior cabinet surfaces shall be insulated with a minimum 1/2-in. thick, minimum 1 1/2 lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
3. Unit internal insulation linings are manufactured to meet industry requirements for microbial resistance as required as part of UL-181 and ASTM C1071-12, having been evaluated in accordance with the "Mold Growth and Humidity" test in UL 181, and tests for fungi resistance in ASTM C1338 and ASTM G21. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.

23 07 16.13.B.	Electric heat compartment:
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1. Aluminum foil-faced fiberglass insulation shall be used.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

23 09 13	Instrumentation and Control Devices for HVAC
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23 09 13.23	Sensors and Transmitters
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23 09 13.23.A.	Thermostats
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1. Thermostat must:
 - a. have capability to energize 2 different stages of cooling, and 2 different stages of heating.
 - b. include capability for occupancy scheduling.

23 09 23	Direct-digital Control system for HVAC
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23 09 23.13	Decentralized, Rooftop Units:
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23 09 23.13.A.	PremierLink™ controller
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1. Shall be ASHRAE 62 compliant.
2. Shall accept 18-32VAC input power.
3. Shall have an operating temperature range from -40°F (-40°C) to 158°F (70°C), 10% - 95% RH (non-condensing).
4. Shall include an integrated economizer controller to support an economizer with 4 to 20 mA actuator input and no microprocessor controller.
5. Controller shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock-out, fire shutdown, enthalpy, fan status, remote time clock/door switch.
6. Shall accept a CO₂ sensor in the conditioned space, and be demand controlled ventilation (DCV) ready.
7. Shall provide the following outputs: Economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve/ dehumidify/ occupied.
8. Unit shall provide surge protection for the controller through a circuit breaker.
9. Shall be Internet capable, and communicate at a Baud rate of 38.4K or faster.
10. Shall have an LED display independently showing the status of activity on the communication bus, and processor operation.

11. Shall include an EIA-485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an EIA-485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks* plug-in communications card.
12. Shall have built-in Carrier Comfort Network[®] (CCN) protocol, and be compatible with other CCN devices, including ComfortLink and ComfortVIEW™ controllers.
13. Shall have built-in support for Carrier technician tool.
14. Software upgrades will be accomplished by local download. Software upgrades through chip replacements are not allowed.
15. Shall be shock resistant in all planes to 5G peak, 11ms during operation, and 100G peak, 11ms during storage.
16. Shall be vibration resistant in all planes to 1.5G @ 20-300 Hz.
17. Shall support a bus length of 4000 ft max (1219 m), 60 devices per 1000 ft (305 m) section, and 1 RS-485 repeater per 1000 ft sections.

23 09 23.13.B. RTU Open Multi-protocol, direct digital controller:

1. Shall be ASHRAE 62 compliant.
2. Shall accept 18-30VAC, 50-60Hz, and consumer 15VA or less power.
3. Shall have an operating temperature range from -40°F (-40°C) to 130°F (54°C), 10% - 90% RH (non-condensing).
4. Shall include built-in protocol for BACnet[†] (MS/TP and PTP modes), Modbus** (RTU and ASCII), Johnson N2 and LonWorks. LonWorks Echelon processor required for all Lon applications shall be contained in separate communication board.
5. Shall allow access of up to 62 network variables (SNVT). Shall be compatible with all open controllers.
6. Baud rate Controller shall be selectable using a dipswitch.
7. Shall have an LED display independently showing the status of serial communication, running, errors, power, all digital outputs, and all analog inputs.
8. Shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, compressor lock-out, fire shutdown, enthalpy switch, and fan status/filter status/humidity/ remote occupancy.
9. Shall provide the following outputs: economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve.
10. Shall have built-in surge protection circuitry through solid state polyswitches. Polyswitches shall be used on incoming power and network connections. Polyswitches will return to normal when the “trip” condition clears.
11. Shall have a battery back-up capable of a minimum of 10,000 hours of data and time clock retention during power outages.
12. Shall have built-in support for Carrier technician tool.
13. Shall include an EIA-485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an EIA-485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks communications card.
14. Software upgrades will be accomplished by either local or remote download. No software upgrades through chip replacements are allowed.

23 09 33 Electric and Electronic Control System for HVAC

23 09 33.13 Decentralized, Rooftop Units:

23 09 33.13.A. General:

1. Shall be complete with self-contained low voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformer shall have 75VA capability.
2. Shall utilize color-coded wiring.
3. 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 switch, high pressure switches.
4. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.
5. Shall include integrated defrost system to prevent excessive frost accumulation during heating duty, and shall be controlled as follows:
 - a. Defrost shall be initiated on the basis of time and coil temperature.
 - b. A 30, 60, 90, 120 minute timer shall activate the defrost cycle only if the coil temperature is low enough to indicate a heavy frost condition.

* LonWorks is a registered trademark of Echelon Corporation.

† BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers).

** Modbus is a registered trademark of Schneider Electric.

- c. Defrost cycle shall terminate when defrost thermostat is satisfied and shall have a positive termination time of 10 minutes.
- 6. Defrost system shall also include:
 - a. Defrost Cycle Indicator LED.
 - b. Dip switch selectable defrost time between 30, 60, 90 and 120 minutes. Factory set at 30 minutes.
 - c. Molded plug connection to insure proper connection.

23 09 33.23.B. Safeties:

- 1. Compressor overtemperature, overcurrent.
- 2. Loss of charge switch.
 - a. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
 - b. Loss of charge switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- 3. High-pressure switch.
 - a. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
 - b. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service technician to correctly wire and/or troubleshoot the rooftop unit.
- 4. Freeze protection thermostat, evaporator coil.
- 5. Automatic reset, motor thermal overload protector.

23 09 93 Sequence of Operations for HVAC Controls

23 09 93.13 Decentralized, Rooftop Units:

23 09 93.13.A INSERT SEQUENCE OF OPERATION

23 40 13 Panel Air Filters

23 40 13.13 Decentralized, Rooftop Units:

23 40 13.13.A. Standard filter section

- 1. Shall consist of factory-installed, low velocity, throwaway 2-in. thick fiberglass filters of commercially available sizes.
- 2. Unit shall use only one filter size. Multiple sizes are not acceptable.
- 3. Filters shall be accessible through an access panel with “no-tool” removal as described in the unit cabinet section of this specification (23 81 19.13.G).

23 81 19 Self-Contained Air Conditioners

23 81 19.13 Small-Capacity Self-Contained Air Conditioners (50TCQ*07-14)

23 81 19.13.A. General

- 1. 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.
- 2. 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.
- 3. Unit shall use Puron[®] refrigerant.
- 4. Unit shall be installed in accordance with the manufacturer’s instructions.
- 5. Unit must be selected and installed in compliance with local, state, and federal codes.

23 81 19.13.B. Quality Assurance

- 1. Unit meets ASHRAE 90.1-2016 and IECC-2015 minimum efficiency requirements.
- 2. Unit shall be rated in accordance with AHRI Standards 340/360.
- 3. Unit shall be designed to conform to ASHRAE 15.
- 4. Unit shall be ETL-tested and certified in accordance with ANSI Z21.47 Standards and ETL-listed and certified under Canadian standards as a total package for safety requirements.
- 5. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- 6. Unit internal insulation linings shall be resistant to mold growth in accordance with “mold growth and humidity” test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the “Erosion Test” in UL 181, as part of ASTM C1071.
- 7. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
- 8. Roof curb shall be designed to conform to NRCA Standards.

9. 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.
 10. Unit shall be designed in accordance with UL Standard 1995, ETL listed including tested to withstand rain.
 11. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
 12. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
 13. High Efficiency Motors listed shall meet section 313 of the Energy Independence and Security Act of 2007 (EISA 2007).
- 23 81 19.13.C. Delivery, Storage, and Handling
1. Unit shall be stored and handled per manufacturer's recommendations.
 2. Lifted by crane requires either shipping top panel or spreader bars.
 3. Unit shall only be stored or positioned in the upright position.
- 23 81 19.13.D. Project Conditions
1. As specified in the contract.
- 23 81 19.13.E. Operating Characteristics
1. 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 ± 10% voltage.
 2. Compressor with standard controls shall be capable of operation from 25°F (-4°C), ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures below 25°F (-4°C).
 3. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.
 4. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
 5. Unit shall be factory configured for vertical supply and return configurations.
 6. Unit shall be field convertible from vertical to horizontal configuration.
 7. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.
- 23 81 19.13.F. Electrical Requirements
1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.
- 23 81 19.13.G. Unit Cabinet
1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
 2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F / 16°C): 60, Hardness: H-2H Pencil hardness.
 3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
 4. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
 5. Base of unit shall have a minimum of three locations for thru-the-base electrical connections (factory-installed or field-installed), standard.
 6. Base Rail
 - a. Unit shall have base rails on a minimum of 2 sides.
 - b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
 - c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
 - d. Base rail shall be a minimum of 16 gauge thickness.
 7. Condensate pan and connections:
 - a. Shall be a sloped condensate drain pan made of a non-corrosive material.
 - b. Shall comply with ASHRAE Standard 62.
 - c. Shall use a 3/4-in. -14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.
 8. Top panel:
 - a. Shall be a single piece top panel on 07 thru 09 sizes, two pieces on 12 and 14 sizes.

9. Electrical Connections

- a. All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.
- b. Thru-the-base capability.
 - (1.) Standard unit shall have a thru-the-base electrical location (s) using a raised, embossed portion of the unit basepan.
 - (2.) Optional, factory-approved, water-tight connection method must be used for thru-the-base electrical connections.
 - (3.) No basepan penetration, other than those authorized by the manufacturer, is permitted.

10. Component access panels (standard)

- a. Cabinet panels shall be easily removable for servicing.
- b. Unit shall have one factory-installed, tool-less, removable, filter access panel.
- c. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
- d. Handles shall be UV modified, composite, permanently attached, and recessed into the panel.
- e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.
- f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

23 81 19.13.H. Coils

1. Standard Aluminum/Copper Coils:

- a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
- b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
- c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

2. Optional Pre-coated aluminum fin condenser coils:

- a. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
- b. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.
- c. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.
- d. Corrosion durability of fin stock shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.
- e. Corrosion durability of fin stock shall be confirmed through testing to have no visible corrosion after 48 hour immersion in a room temperature solution of 5% salt, 1% acetic acid.
- f. Fin stock coating shall pass 2000 hours of the following: one week exposure in the prohesion chamber followed by one week of accelerated ultraviolet light testing. Prohesion chamber: the solution shall contain 3.5% sodium chloride and 0.35% ammonium sulfate. The exposure cycle is one hour of salt fog application at ambient followed by one hour drying at 95°F (35°C).

3. Optional Copper-fin evaporator and condenser coils on all models:

- a. Shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets.
- b. Galvanized steel tube sheets shall not be acceptable.
- c. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.

4. Optional E-coated aluminum-fin evaporator and condenser coils on all models:

- a. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.
- b. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.
- c. Color shall be high gloss black with gloss per ASTM D523-89.
- d. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges.
- e. Superior hardness characteristics of 2H per ASTM D3363-92A and cross-hatch adhesion of 4B-5B per ASTM D3359-93.
- f. Impact resistance shall be up to 160 in.-lb (ASTM D2794-93).
- g. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92).
- h. Corrosion durability shall be confirmed through testing to be no less than 6000 hours salt spray per ASTM B117-90.

23 81 19.13.I. Refrigerant Components

1. Refrigerant circuit shall include the following control, safety, and maintenance features:
 - a. Fixed orifice metering system shall prevent mal-distribution of two-phase refrigerant by including multiple fixed orifice devices in each refrigeration circuit. Each orifice is to be optimized to the coil circuit it serves.
 - b. Refrigerant filter drier.
 - c. Service gauge connections on suction and discharge lines.
 - d. Pressure gauge access through a specially designed access port in the top panel of the unit.
 - e. Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching.
2. There shall be gauge line access port in the top of the rooftop, covered by a black, removable plug.
 - a. The plug shall be easy to remove and replace.
 - b. When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.
 - c. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
 - d. The plug shall be made of a leak proof, UV-resistant, composite material.
3. Compressors
 - a. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
 - b. Models shall be available with single compressor designs on 07 models, plus additional 2 compressor (stage) models from 08-14 sizes.
 - c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
 - d. Compressors shall be internally protected from high discharge temperature conditions.
 - e. Compressors shall be protected from an overtemperature and over-amperage conditions by an internal, motor overload device.
 - f. Compressor shall be factory mounted on rubber grommets.
 - g. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
 - h. Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.

23 81 19.13.J. Filter Section

1. Filters access is specified in the unit cabinet section of this specification.
2. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
3. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
4. Filters shall be standard, commercially available sizes.
5. Only one size filter per unit is allowed.

23 81 19.13.K. Evaporator Fan and Motor

1. Evaporator fan motor:
 - a. Shall have permanently lubricated bearings.
 - b. Shall have inherent automatic-reset thermal overload protection or circuit breaker.
 - c. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
2. Belt-driven Evaporator Fan:
 - a. Belt drive shall include an adjustable pitch motor pulley.
 - b. Shall use sealed, permanently lubricated ball-bearing type.
 - c. Blower fan shall be double inlet type with forward-curved blades.
 - d. Shall be constructed from steel with a finish that aids with corrosion resistance and dynamically balanced.

23 81 19.13.L. Condenser Fans and Motors

1. Condenser fan motors:
 - a. Shall be a totally enclosed motor.
 - b. Shall use permanently lubricated bearings.
 - c. Shall have inherent thermal overload protection with an automatic reset feature.
 - d. Shall use a shaft down design on all models.
2. Condenser Fans:
 - a. Shall be a direct driven propeller type fan.

- b. Shall have aluminum blades riveted to steel spiders that have corrosion resistant properties and shall be dynamically balanced.

23 81 19.13.M. Special Features, Options and Accessories

1. Staged Air Volume System (SAVt) for all models.
 - a. Evaporator fan motor:
 - (1.) Shall have permanently lubricated bearings.
 - (2.) Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating.
 - (3.) Shall be Variable Frequency duty and 2-speed control.
 - (4.) Shall contain motor shaft grounding ring to prevent electrical bearing fluting damage by safely diverting harmful shaft voltages and bearing currents to ground.
2. Variable Frequency Drive (VFD). Only available on 2-speed indoor fan motor option (SAV):
 - a. Factory-supplied VFDs qualify, through ABB, for a 12-month warranty from date of commissioning or 18 months from date of sale, whichever occurs first.
 - b. Shall be installed inside the unit cabinet, mounted, wired and tested.
 - c. Shall contain Electromagnetic Interference (EMI) frequency protection.
 - d. Insulated Gate Bi-Polar Transistors (IGBT) used to produce the output pulse width modulated (PWM) waveform, allowing for quiet motor operation.
 - e. Self diagnostics with fault and power code LED indicator. Field accessory Display Kit available for further diagnostics and special setup applications.
 - f. RS485 capability standard.
 - g. Electronic thermal overload protection.
 - h. 5% swinging chokes for harmonic reduction and improved power factor.
 - i. All printed circuit boards shall be conformal coated.
3. Integrated EconoMiSer[®] IV, EconoMiSer2, and EconoMiSer X standard leak rate models, factory or field-installed.
 - a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
 - b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
 - c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
 - d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
 - e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
 - f. Standard leak rate models shall be equipped with dampers not to exceed 2% leakage at 1 in. wg pressure differential.
 - g. Economizer controller on EconoMiSer IV models shall be Honeywell W7212 that provides:
 - (1.) Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.
 - (2.) Functions with solid state analog enthalpy or dry bulb changeover control sensing.
 - (3.) Contain LED indicates for: when free cooling is available, when module is in DCV mode, when exhaust fan contact is closed.
 - h. Economizer controller on EconoMiSer X models shall be the Honeywell W7220 that provides:
 - (1.) 2-line LCD interface screen for setup, configuration and troubleshooting.
 - (2.) On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24.
 - (3.) Sensor failure loss of communication identification.
 - (4.) Automatic sensor detection.
 - (5.) Capabilities for use with multiple-speed indoor fan systems.
 - (6.) Utilize digital sensors: Dry bulb and Enthalpy.
 - i. Economizer controller on EconoMiSer 2 models with PremierLink[™] controller shall be 4-20mA design and controlled by the PremierLink controller. The PremierLink controller does not comply with California Title 24 Fault Detection and Diagnostic (FDD) requirements.
 - j. Economizer controller on EconoMiSer 2 models with RTU Open controller shall be a 4-20mA design controlled directly by the RTU Open controller. RTU Open controller meets California Title 24 Fault Detection and Diagnostic (FDD) requirements.

- k. Shall be capable of introducing up to 100% outdoor air.
 - l. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.
 - m. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
 - n. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available for factory-installed economizers only. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F (4 to 38°C). Additional sensor options shall be available as accessories.
 - o. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.
 - p. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.
 - q. Dampers shall be completely closed when the unit is in the unoccupied mode.
 - r. Economizer controller shall accept a 2-10 Vdc 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.
 - s. Compressor lockout temperature on W7220 is adjustable from -45°F to 80°F, set at a factory default of 32°F. Others shall open at 35°F (2°C) and close at 50°F (10°C).
 - t. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
 - u. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
4. Integrated EconoMiSer[®]2, and EconoMiSer X Ultra Low Leak rate models, factory or field-installed.
- a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
 - b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
 - c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
 - d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
 - e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
 - f. Ultra Low Leak design meets California Title 24 section 140.4 and ASHRAE 90.1-2016 and IECC-2015 requirements for 4 cfm per sq. ft. on the outside air dampers and 10 cfm per sq. ft. on the return dampers.
 - g. Economizer controller on EconoMiSer X models shall be the Honeywell W7220 that provides:
 - (1.) 2-line LCD interface screen for setup, configuration and troubleshooting.
 - (2.) On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24.
 - (3.) Sensor failure loss of communication identification.
 - (4.) Automatic sensor detection.
 - (5.) Capabilities for use with multiple-speed indoor fan systems.
 - (6.) Utilize digital sensors: Dry bulb and Enthalpy.
 - h. Economizer controller on EconoMiSer 2 models with RTU Open controller shall be a 4-20mA design controlled directly by the RTU Open controller. RTU Open controller meets California Title 24 Fault Detection and Diagnostic (FDD) requirements.
 - i. Shall be capable of introducing up to 100% outdoor air.
 - j. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.
 - k. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
 - l. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available for factory-installed economizers only. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F (4 to 38°C). Additional sensor options shall be available as accessories.
 - m. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.
 - n. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.
 - o. Dampers shall be completely closed when the unit is in the unoccupied mode.

- p. Economizer controller shall accept a 2-10 Vdc 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.
 - q. Compressor lockout temperature on W7220 is adjustable from -45° F to 80° F, set at a factory default of 32° F. Others shall open at 35°F (2°C) and closes at 50°F (10°C).
 - r. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
 - s. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
5. Two-Position Damper (factory-installed)
- a. Damper shall be a Two-Position Damper. Damper travel shall be from the full closed position to the field adjustable %-open setpoint.
 - b. Damper shall include adjustable damper travel from 25% to 100% (full open).
 - c. Damper shall include single or dual blade, gear driven dampers and actuator motor.
 - d. Actuator shall be direct coupled to damper gear. No linkage arms or control rods shall be acceptable.
 - e. Damper will admit up to 100% outdoor air for applicable rooftop units.
 - f. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
 - g. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
 - h. Outside air hood shall include aluminum water entrainment filter
 - i. Not available with Staged Air Volume (SAV™) models.
6. Head Pressure Control Package (Motormaster®)
- a. Controller shall control coil head pressure by condenser fan speed modulation or condenser fan cycling and wind baffles.
 - b. Shall consist of solid state control and condenser coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to -20°F (-29°C).
7. Condenser Coil Hail Guard Assembly
- a. Shall protect against damage from hail.
 - b. Shall be louvered design.
8. Unit-Mounted, Non-Fused Disconnect Switch:
- a. Switch shall be factory-installed, internally mounted.
 - b. National Electric Code (NEC) and UL approved non-fused switch shall provide unit power shutoff.
 - c. Shall be accessible from outside the unit.
 - d. Shall provide local shutdown and lockout capability.
 - e. Sized only for the unit as ordered from the factory. Does not accommodate field-installed devices.
9. Convenience Outlet:
- a. Powered convenience outlet.
 - (1.) Outlet shall be powered from main line power to the rooftop unit.
 - (2.) Outlet shall be powered from line side or load side of disconnect by installing contractor, as required by code. If outlet is powered from load side of disconnect, unit electrical ratings shall be ETL certified and rated for additional outlet amperage.
 - (3.) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
 - (4.) Outlet shall include 15 amp GFI receptacles with independent fuse protection.
 - (5.) Voltage required to operate convenience outlet shall be provided by a factory-installed step down transformer.
 - (6.) Outlet shall be accessible from outside the unit.
 - (7.) Outlet shall include a field-installed "Wet in Use" cover.
 - b. Factory-Installed Non-Powered convenience outlet.
 - (1.) Outlet shall be powered from a separate 115-120v power source.
 - (2.) A transformer shall not be included.
 - (3.) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
 - (4.) Outlet shall include 15 amp GFI receptacles. (5.)
Outlet shall be accessible from outside the unit.
 - (6.) Outlet shall include a field-installed "Wet in Use" cover.
 - c. Field-Installed Non-Powered convenience outlet.
 - (1.) Outlet shall be powered from a separate 115-120v power source.

- (2.) A transformer shall not be included.
 - (3.) Outlet shall be field-installed and internally mounted with easily accessible 115-v female receptacle. (4.) Outlet shall include 20 amp GFI receptacles. This kit provides a flexible installation method which allows code compliance for height requirements of the GFCI outlet from the finished roof surface as well as the capability to relocate the outlet to a more convenient location.
 - (5.) Outlet shall be accessible from outside the unit.
 - (6.) Outlet shall include a field-installed "Wet in Use" cover.
10. Thru-the-Base Connectors:
 - a. Kits shall provide connectors to permit electrical connections to be brought to the unit through the unit basepan.
 - b. Minimum of three connection locations per unit.
 11. Propeller Power Exhaust:
 - a. Power exhaust shall be used in conjunction with an integrated economizer.
 - b. Independent modules for vertical or horizontal return configurations shall be available.
 - c. Horizontal power exhaust shall be mounted in return ductwork.
 - d. 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.
 12. Roof Curbs (Vertical):
 - a. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
 - b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
 - c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
 13. High Static Indoor Fan Motor(s) and Drive(s):
 - a. High static motor(s) and drive(s) shall be factory-installed to provide additional performance range.
 14. Thru-the-Bottom Utility Connectors:
 - a. Kit shall provide connectors to permit gas and electrical connections to be brought to the unit through the basepan.
 15. Outdoor Air Enthalpy Sensor:
 - a. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.
 16. Return Air Enthalpy Sensor:
 - a. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.
 17. Indoor Air Quality (CO₂) Sensor:
 - a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.
 - b. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The set-point shall have adjustment capability.
 18. Smoke detectors (Factory-Installed Only):
 - a. Shall be a Four-Wire Controller and Detector.
 - b. Shall be environmental compensated with differential sensing for reliable, stable, and drift-free sensitivity.
 - c. Shall use magnet activated test/reset sensor switches.
 - d. Shall have tool-less connection terminal access.
 - e. Shall have a recessed momentary switch for testing and resetting the detector.
 - f. Controller shall include:
 - (1.) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
 - (2.) Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.
 - (3.) One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
 - (4.) Capable of direct connection to two individual detector modules.
 - (5.) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.
 19. Horn/Strobe Annunciator
 - a. Provides an audible/visual signaling device for use with factory-installed option or field-installed accessory smoke detectors.

- (1.) Requires installation of a field-supplied 24-v transformer suitable for 4.2 VA (AC) or 3.0 VA (DC) per horn/strobe accessory.
 - (2.) Requires field-supplied electrical box, North American 1-gang box, 2-in (51 mm) x 4-in (102 mm).
 - (3.) Shall have a clear colored lens.
20. Winter Start kit
- a. Shall contain a bypass device around the low-pressure switch.
 - b. Shall be required when mechanical cooling is required down to 25°F (-4°C).
 - c. Shall not be required to operate on an economizer when below an outdoor ambient of 40°F (4°C).
21. Time Guard
- a. Shall prevent compressor short cycling by providing a 5-minute delay (± 2 minutes) before restarting a compressor after shutdown for any reason.
 - b. One device shall be required per compressor.
22. Electric Heat:
- a. Heating Section
 - (1.) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
 - (2.) Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermo limit controls, magnetic heater contactors (24V coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
23. Hinged Access Panels
- a. Shall provide easy access through integrated quarter turn latches.
 - b. Shall be on major panels of: filters, control box, fan motor and compressor.
24. Display Kit for Variable Frequency Drive
- a. Kit allows the ability to access the VFD controller programs to provide special setup capabilities and diagnostics.
 - b. Kit contains display module and communication cable.
 - c. Display Kit can be permanently installed in the unit or used on any SAV™ system VFD controller as needed.
25. Condensate Overflow Switch
- a. This sensor and related controller monitors the condensate level in the drain pan and shuts down compression operation when overflow conditions occur. It includes:
 - (1.) Indicator light - solid red (more than 10 seconds on water contact - compressors disabled), blinking red (sensor disconnected).
 - (2.) 10 second delay to break - eliminates nuisance trips from splashing or waves in pan (sensor needs 10 seconds of constant water contact before tripping).
 - (3.) Disables the compressor(s) operation when condensate plug is detected, but still allows fans to run for Economizer.
26. Manual Damper
- a. Manual Damper package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 25 or 50% outdoor air for year-round ventilation. Not available with Staged Air Volume (SAV™) models.
27. Supply Duct Cover: (14 size only.)
- a. Required when field converting the factory standard vertical duct supply to horizontal duct supply configuration. One required per unit.
28. Disconnect Switch Bracket (14 size only)
- a. Provides a pre-engineered and sized mounting bracket for applications requiring a unit mounted fused and non-fused disconnect of greater than 100 amps. Bracket assures that no damage will occur to coils when mounting with screws and other fasteners.