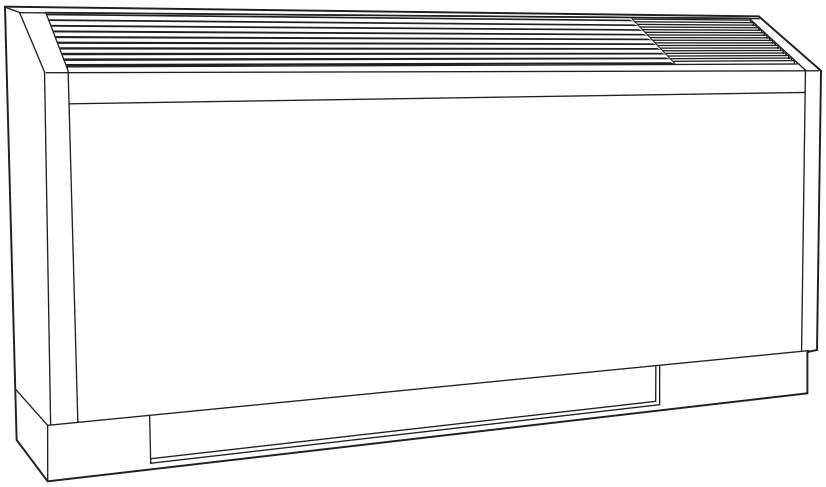
Carrier®

Product Data

AQUAZONE™ 50PEC09-18 Water Source Heat Pumps Console Unit with PURON® Refrigerant (R-410A)

3/4 to 1 1/2 Nominal Tons

AQUAZONE™



ASHRAE 90.1 COMPLIANT

Puron® the environmentally sound refrigerant

Single-package console water source heat pump with self-contained line voltage thermostats.

- Non-ozone depleting Puron refrigerant (R-410A)
- Suitable for either geothermal or boiler/tower applications with operating temperature range from 20 F to 110 F.
- Thermostatic expansion valve (TXV)
- Rubber grommet mounted compressors for quiet operation
- Sloped top cabinet
- Right or left hand piping connection
- Multiple unit-mounted and remote thermostat options
- Adaptable cabinet and subbase configurations
- Factory-mounted flow regulators and control valves for easy installation
- Flexible and reliable multiple protocol WSHP Open controller can use BACnet™, Modbus®, N2, and LON (with a separate card) protocols for integrating energy efficiency and precise unit control

Features/Benefits

Carrier's Aquazone console water source heat pumps are a flexible, attractive alternative for all finished interior space, under-window style installations.

Operating efficiency

Aquazone water source heat pump (WSHP) units are designed for quality and performance excellence over their lifetime. Units offer standard cooling EERs (energy efficiency ratios) up to 13.5 for boiler/tower systems and as high as 21.3 for geothermal applications. Heating COPs (coefficients of performance) are as high as 5.1, among the highest in the industry.

Features/Benefits (cont)

Quiet operation
The Carrier console WSHP provides exceptionally quiet operation for maximum comfort.

Design flexibility
Aquazone™ console WSHP units are offered in 4 capacity sizes to meet individual zone needs efficiently and effectively. Standard and extended operating range units are available to suit a variety of application requirements.

Safe, reliable operation
Standard safety features include: high and low pressure monitoring and field selectable water and air coil freeze protection sensing. All safety controls may be reset at the thermostat. Each unit is tested and run at the factory to ensure proper operation of all components and safety switches.

All components are carefully designed and selected for endurance, durability, and carefree day-to-day operation.

The water-to-refrigerant heat exchanger has copper inner and steel outer tubing which is painted on the outside to provide corrosion resistance protection. Cupronickel heat exchangers are available and should be used on all open loop applications.

Units are rated and certified in accordance with ARI (Air Conditioning and Refrigeration Institute)/ISO (International Organization for Standardization)/ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) 13256-1 performance standard, and are CSA (Canadian Standards Association)/NRTL (Nationally Recognized Testing Lab) listed.

Installation ease
The unit is packaged for simple, low cost handling, with minimal time required for installation. The console unit arrives at the jobsite fully assembled to minimize installation time and reduce installation cost. All units are pre-wired and factory charged with Puron® refrigerant (R-410A).

Water connections are available in a variety of configurations direct from the factory. The standard configuration is $^5/_8$ in. OD sweat connections for maximum flexibility in the field. Both FPT and MPT are available as factory-installed options to improve installation efficiency. Additionally, factory-installed motorized water shutoff valves are available for use on energy conserving systems employing a variable pumping technique.

The standard electrical connections are made quickly and directly to a power distribution terminal block. To further improve installation efficiency, a fused or unfused disconnect switch as well as a 20 amp plug and cord are available as factory-installed options.

A $^5/_8$ in. ID vinyl condensate connection is provided for connection to the field-installed condensate line.

Compact cabinet design dimensions are 12 in. deep, 48 in. wide and 24 in. tall. For flexibility, the controls can be mounted on the top right or left side. Additionally, the sloped top design discourages the use of the unit as a shelf or coffee holder, preventing air blockage and any spills from damaging the unit.

No-fuss maintenance and serviceability
Regular maintenance or service to the console WSHP units require little time. Large service access panels enable quick inspection for problem solving and the control box swings down for easy access to the controls.

Fan motor sleeve bearings are permanently lubricated for worry-free performance. If the unit requires service, an easily removable cabinet and slide-out fan section make access simple.

Refrigerant circuit protection is designed to result in fewer service calls. Units are equipped with easily accessible service access ports on both the suction and the discharge refrigerant lines for on-site testing and environmentally correct refrigerant recovery. Filter racks provide easy filter access for cleaning.

Maximum control flexibility
Aquazone water source heat pumps provide reliable control operation using a standard microprocessor board.

Flexible alternatives for many direct digital controls (DDC) applications include the Carrier Comfort Network® (CCN) controls and open protocol systems.

Carrier's Aquazone standard unit solid-state control system, the Complete C, provides control of the unit compressor, reversing valve, fan, safety features, and troubleshooting fault indication features. The Complete C is one of the most user friendly, low cost, and advanced control boards found in the WSHP industry. Many features are field selectable to provide the ultimate in field installation flexibility. The overall features of this standard control system include:

50-va transformer — Assists in accommodating accessory loads.

Anti-short cycle timer — Provides a minimum off time to prevent the unit from short cycling. The 5-minute timer energizes when the compressor is deenergized, resulting in a 5-minute delay before the unit can be restarted.

Random start relay — Ensures a random delay in energizing each different WSHP unit. This option minimizes peak electrical demand during start-up from different operating modes or after building power outages.

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High and low pressure refrigerant protection — Safeguards against unreliable unit operation and prevents refrigerant from leaking.

Condensate overflow sensor — Electronic sensor mounted to the drain pan. When condensate pan liquid reaches an unacceptable level, the unit is automatically deactivated and placed in a lockout condition. The sensor recognizes thirty continuous seconds of overflow as a fault condition.

High and low voltage protection — Safety protection for excessive or low voltage conditions.

Automatic intelligent reset — Unit shall automatically restart 5 minutes after shutdown if the fault has cleared. Should a fault occur 3 times sequentially, lockout will occur.

Accessory output — In applications such as variable speed pumping, a 24-v output cycles a motorized water valve or damper actuator with compressor.

Performance monitor (PM) — Unique feature monitors water temperatures to warn when the heat pump is operating inefficiently or beyond typical operating range. A field selectable switch initiates a warning code on the unit display.

Water coil freeze protection (selectable for water or anti-freeze) — Field selectable switch for water and water/glycol solution systems initiates a fault when temperatures exceed the selected limit for 30 continuous seconds.

Air coil freeze protection (check filter operation) — Field selectable switch for assessing excessive filter pressure drop initiates a fault when temperatures exceed the selected limit for 30 continuous seconds.

Alarm relay setting — Selectable 24-v or pilot duty dry contact provides remote alarm activation.

Electric heat option — Output provided on the controller for operating two stages of emergency electric heat.

Service Test mode with diagnostic LED (light-emitting diode) — Test mode allows service personnel to check the operation of the WSHP and control system efficiently. Upon entering Test mode, time delays speed up, and the Status LED flashes a code indicating the last fault. This mode provides easy fault diagnosis; based on the fault code the status LED flashes, Carrier provided troubleshooting tables provide easy reference to typical problems.

LED visual output — An LED panel indicates high pressure, low pressure, low voltage, high voltage, air/water freeze protection, condensate overflow, and control status.

WSHP Open multiple protocol controller — Carrier's state of the art water source heat pump multiple protocol controller is capable of communicating BACnet™, Modbus®*, N2, and LON (with a separate card) protocols. The controller is designed specifically for Carrier's WSHPs in order to bring more features and benefits to the units such as waterside economizer control, auxiliary heat, dehumidification, etc., in addition to independent compressor and fan operation. The WSHP Open controller can be used to actively monitor and control all modes of operation as well as monitor the following diagnostics and features: unit number, zone temperature, zone set point, zone humidity set point, discharge air temperatures, fan status, stages of heating, stages of cooling, outdoor-air temperature, leaving-air temperature, leaving water temperature, alarm status, and alarm lockout condition.

The controller also provides a proactive approach to maintenance and service enabling the unit to recognize and correct operating conditions outside of recommended operating conditions avoiding the need to manually restart equipment. From a system standpoint WSHP Open controller can accept both water and airside linkage.

Condenser water linkage provides optimized water loop operation using the UC (universal controller) Open XP loop controller. Loop pump operation is automatically controlled by WSHP equipment occupancy schedules, unoccupied demand and tenant override conditions. Positive pump status feedback prevents nuisance fault trips.

Airside linkage enables the WSHP equipment to be completely integrated with the Carrier's VVT® application as a system. The WSHP Open controller responds to individual zone demands rather than average temperature conditions to provide individual temperature control in each zone.

*Registered trademark of Schneider Electric.

This controller has a 38.4 kilobaud communications capability and is compatible with i-Vu® Open building automation system controls and CCN controls. The addition of the Carrier CO_2 sensor in the conditioned space provides ASHRAE 62-99 compliance and demand controlled ventilation (DCV). A DCV control strategy is especially beneficial for a water source heat pump system to minimize the energy utilized to condition ventilation air. In combination with energy efficient Aquazone units, DCV may be the most energy efficient approach ever developed for a water source heat pump system.

The WSHP Open multiple protocol controller is designed specifically for constant volume (CV) and variable volume and temperature (VVT®) applications. This comprehensive controls system allows water source heat pumps to be linked together to create a fully functional HVAC (heating, ventilation, and air conditioning) automation system.

PremierLink™ controller adds reliability, efficiency, and simplification

The PremierLink direct digital controller can be ordered as a factory-installed option. Designed and manufactured exclusively by Carrier, the controller can be used to actively monitor and control all modes of operation as well as monitor the following diagnostics and features: unit number, zone temperature, zone set point, zone humidity set point, discharge air temperatures, fan status, stages of heating, stages of cooling, outdoor-air temperature, leaving-air temperature, leaving water temperature, alarm status, and alarm lockout condition.

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Features/Benefits (cont)

The PremierLink™ peer-to-peer, Internet ready communicating control is designed specifically for constant volume (CV) and variable volume and temperature (VVT®) applications. This comprehensive controls system allows water source heat pumps to be linked together to create a fully functional HVAC (heating, ventilation, and air conditioning) automation system.

Puron® refrigerant (R-410A)

Puron refrigerant (R-410A) is a non-chlorine based refrigerant. Puron refrigerant characteristics, compared to R-22, have:

- Binary and near azeotropic mixture of 50% R-32 and 50% R-125.
- Higher efficiencies (50 to 60% higher operating pressures).
- Non-ozone depleting potential and low global warming potential.
- Virtually no glide. Unlike other alternative refrigerants, the two components in Puron refrigerant have virtually the same leak rates. Therefore, refrigerant can be added if necessary without recovering the charge.

E-coated (electro-coated) air coils

Carrier's 50PEC units are available with an optional e-coated air coil. This electro-coating process will provide years of protection against corrosion from airborne chemicals. Modern building materials, such as countertops, floor coverings, paints and other materials, can "outgas" chemicals into the indoor air. Some of these chemicals are suspected of contributing to corrosion in the air coils found in both traditional and geothermal heating and cooling equipment. Corrosion often results in refrigerant leaks and eventual failure of the air coil costing hundreds of dollars to replace. Studies have also shown that these air coil coatings improve moisture shedding and therefore improve a units moisture removal capability resulting in a more comfortable indoor environment. The 50PEC units assure both maximum air coil life and comfort.

Model number nomenclature

50PEC 12 S R C C 3 0 1 A R

50PEC – Aquazone™ Water Source Heat Pump Console Unit with Puron® Refrigerant (R-410A)

Size – Nominal Capacity (Tons)
09 – 3/4
12 – 1
15 – 1 1/4
18 – 1 1/2

Water Circuit Options

	Connection Type	Valve Option*
A –	Sweat	2-Way Water Control Valve
B –	Sweat	Autoflow Regulator, 2.25 Gpm/Ton
C –	Sweat	Autoflow Regulator, 3.0 Gpm/Ton
D –	Sweat	2-Way Water Control Valve with Autoflow Regulator, 2.25 Gpm/Ton
E –	Sweat	2-Way Water Control Valve with Autoflow Regulator, 3.0 Gpm/Ton
F –	FPT	None
G –	FPT	2-Way Water Control Valve
H –	FPT	Autoflow Regulator, 2.25 Gpm/Ton
J –	FPT	Autoflow Regulator, 3.0 Gpm/Ton
K –	FPT	2-Way Water Control Valve with Autoflow Regulator, 2.25 Gpm/Ton
L –	FPT	2-Way Water Control Valve with Autoflow Regulator, 3.0 Gpm/Ton
M –	MPT	None
N –	MPT	2-Way Water Control Valve
P –	MPT	Autoflow Regulator, 2.25 Gpm/Ton
Q –	MPT	Autoflow Regulator, 3.0 Gpm/Ton
R –	MPT	2-Way Water Control Valve with Autoflow Regulator, 2.25 Gpm/Ton
S –	Sweat	None
T –	MPT	2-Way Water Control Valve with Autoflow Regulator, 3.0 Gpm/Ton

Water Supply Orientation†
R – Right Hand
L – Left Hand

Control Options
A – Manual Changeover with Complete C
B – Manual Changeover with Deluxe D
C – Auto Changeover with Complete C
D – Auto Changeover with Deluxe D
L – LonWorks® Interface System with Complete C
M – LonWorks Interface System with Deluxe D
P – PremierLink™ DDC Control with Complete C
R – Remote Thermostat with Complete C
S – Remote Thermostat with Deluxe D
W – WSHP Open Multiple Protocol Communicating Control with Complete C
Y – WSHP Open Multiple Protocol Communicating Control with Deluxe D

Heat Exchanger and Operating Range
A – Copper Heat Exchanger with Coated Air Coil, Standard Range (60 to 95 F)
C – Copper Heat Exchanger, Standard Range (60 to 95 F)
E – Copper Heat Exchanger, Extended Range (20 to 110 F)
F – Cupronickel Heat Exchanger, Extended Range (20 to 110 F)
J – Cupronickel Heat Exchanger with Coated Air Coil, Standard Range (60 to 95 F)
M – Cupronickel Heat Exchanger with Coated Air Coil, Standard Range (20 to 110 F)
N – Cupronickel Heat Exchanger, Standard Range (60 to 95 F)
V – Copper Heat Exchanger with Coated Air Coil, Extended Range (20 to 110 F)

Cabinet, Subbase and Mute Package Options
C – Bottom Return and 5-in. Subbase with Motorized Damper
D – Bottom Return and No Subbase
G – Bottom Return, Locking Control Door, and 5-in. Subbase with Motorized Damper
H – Bottom Return, Locking Control Door, and No Subbase
J – Front Return and No Subbase
K – Front Return, Locking Control Door, and No Subbase
N – No Cabinet and 5-in. Subbase with Motorized Damper
O – Mute Package, Bottom Return, Locking Control Door, and 5-in. Subbase
P – No Cabinet and No Subbase
Q – No Cabinet and 5-in. Subbase
R – Bottom Return and 5-in. Subbase
S – Bottom Return, Locking Control Door, and 5-in. Subbase
V – Mute Package, Bottom Return, and 5-in. Subbase with Motorized Damper
W – Mute Package, Bottom Return, and No Subbase
1 – Mute Package, Bottom Return, Locking Control Door, and 5-in. Subbase with Motorized Damper
2 – Mute Package, Bottom Return, Locking Control Door, and No Subbase
3 – Mute Package, Front Return, and No Subbase
4 – Mute Package, Front Return, Locking Control Door, and No Subbase
7 – Mute Package, No Cabinet, and 5-in. Subbase with Motorized Damper
8 – Mute Package, No Cabinet, and No Subbase
9 – Mute Package, No Cabinet, and 5-in. Subbase
0 – Mute Package, Bottom Return, and 5-in. Subbase

Power Termination
A – Field-Connected, Hard Wired
B – 20A Plug and Cord
D – Disconnect Switch, 15A Fuse
F – Disconnect Switch, Non-Fused
H – 20A Plug, Cord, Receptacle, Disconnect Switch, 15A Fuse
K – 20A Plug, Cord, Disconnect Switch, No Fuse

Packaging
1 – Domestic

Revision Code
0 – Current Revision with Carrier Ltd. Korea Compressor
1 – Current Revision with LG Compressor

Power Supply
1 – 115-1-60**
3 – 208/230-1-60
4 – 265-1-60

AUTOFLOW REGULATOR SIZING (gpm)		
50PEC UNIT SIZE	**2.25 gpm/ton**	**3.0 gpm/ton**
09	2.0	2.5
12	2.5	3.0
15	3.0	3.5
18	3.5	4.0

LEGEND
DDC — Direct Digital Control

*See table for autoflow regulator sizing.
†Right and left hand orientation is determined by looking at front of unit.
**Sizes 09-12 only.

NOTES:
1. Standard 60 Hz unit controls are ETL listed.
2. Complete C controllers take 50-va transformers. Deluxe D controllers take 75-va transformers. All DDC controllers take 75-va transformers.
3. The 50PEC09-15 unit cabinets are 48 in. with ½ in. water connections. The 50PEC18 unit cabinet is 54 in. with ¾ in. water connections.

NRTL/C

As an ENERGY STAR® Partner, Carrier Corporation has determined that this product meets the ENERGY STAR guidelines for energy efficiency.

ARI/ISO capacity ratings

50PEC UNIT SIZE	WATER LOOP HEAT PUMP				GROUND WATER HEAT PUMP				GROUND LOOP HEAT PUMP			
	Cooling 86 F		Heating 68 F		Cooling 59 F		Heating 50 F		Cooling 77 F		Heating 32 F	
	Capacity (Btuh)	EER (Btuh/W)	Capacity (Btuh)	COP	Capacity (Btuh)	EER (Btuh/W)	Capacity (Btuh)	COP	Capacity (Btuh)	EER (Btuh/W)	Capacity (Btuh)	COP
09	8,600	13.3	11,400	4.6	9,200	18.6	9,500	4.0	8,800	14.9	7,300	3.3
12	11,300	13.3	14,900	4.9	12,500	18.7	12,100	4.1	11,800	15.1	9,300	3.7
15	14,100	13.5	18,200	5.1	16,600	21.3	14,800	4.3	15,100	15.8	11,400	3.5
18	16,200	13.0	20,100	4.5	17,600	19.5	16,500	4.0	16,500	15.0	13,200	3.4

LEGEND

COP — Coefficient of Performance
db — Dry Bulb Temperature
EER — Energy Efficiency Ratio
wb — Wet Bulb Temperature

NOTES:
1. Ratings are in accordance with and certified to ARI/ISO Standard 13256-1.
2. Cooling capacities based upon 80.6 F db, 66.2 F wb entering air temperature.
3. Heating capacities based upon 68 F db, 59 F wb entering air temperature.
4. All airflow is rated on high speed. Units factory-shipped on medium and low motor taps.
5. All ratings based upon operation at lower voltage of dual voltage rated models.

ARI PERFORMANCE CERTIFIED ™
ANSI/ARI/ASHRAE/ISO Standard 13256-1 60 Hz Water Source HP
www.aridirectory.org

Physical data

BASE UNIT 50PEC	09	12	15	18
NOMINAL COOLING CAPACITY (Btuh)	9,300	12,300	13,800	16,000
COMPRESSOR	Rotary			
BLOWER				
Motor Horsepower	1/20	1/12	1/8	1/8
Wheel Size D x W (in.) 2 each	5 1/4 x 6 1/4	5 1/4 x 6 1/4	5 1/4 x 6 1/4	5 1/4 x 6 1/4
FILTER SIZE (in.) Bottom Return (Qty)	10 x 30 x 1 (1)	10 x 30 x 1 (1)	10 x 30 x 1 (1)	10 x 36 x 1(1)
FILTER SIZE (in.) Front Return (Qty)	7 x 29 1/2 x 1/8 (1)	7 x 29 1/2 x 1/8 (1)	7 x 29 1/2 x 1/8 (1)	7 x 35 1/2 x 1/8 (1)
UNIT WEIGHT (lb)				
Shipping	185	190	200	232
Operating	175	180	190	220
REF. TO AIR HEAT EXCHANGER				
Face Area (sq ft)	1.4	1.4	1.8	1.8
No. of Rows Deep	2	3	3	3
Copper Tube Size OD (in.)	3/8	3/8	3/8	3/8
Fin Spacing (FPI)	13	13	13	12
REFRIG. CHARGE (R-410A)/CKT (oz)	28	29	37	39
No. of Circuits	1	1	1	1
UNIT CABINET WITH BOTTOM RETURN WITH STANDARD 5 in. SUBBASE Width x Height x Depth (in.)	48 x 26 x 12	48 x 26 x 12	48 x 26 x 12	54 x 26 x 12
UNIT CABINET WITH FRONT RETURN (NO SUBBASE) Width x Height x Depth (in.)	48 x 21 x 12	48 x 21 x 12	48 x 21 x 12	54 x 21 x 12
WATER IN/OUT SIZE OD SWEAT (in.)	1/2	1/2	1/2	3/4
CONDENSATE SIZE ID VINYL (in.)	5/8	5/8	5/8	5/8

LEGEND

FPI — Fins Per Inch

Options and accessories

DESCRIPTION	FACTORY-INSTALLED OPTIONS	FIELD-INSTALLED ACCESSORIES
Cupronickel Heat Exchangers	X	
Thermostat Options	X	
Extended Range	X	
Cabinet Options	X	
Motorized Fresh Air Damper	X	
Piping Connections	X	
Automatic Flow Regulators	X	
Two-Way Motorized Control Valve	X	
Mute Package	X	
Deluxe D Control System	X	
PremierLink™ Controller	X	
LONMark® Compliant Controller	X	
WSHP Open Multiple Protocol Controller	X	
Aquazone™ Thermostats		X
Aquazone System Control Panel		X
UC Open XP Loop Controller		X
Fire-Rated Hoses		X
Ball Valves		X
Y Strainers		X
Solenoid Valves		X
Hose Kit Assemblies		X
Remote Sensors (SPT, CO_2, Humidity Sensors)		X
PremierLink Accessories		X

Factory-installed options

Cupronickel heat exchangers are available for higher corrosion protection for applications such as open tower, geothermal, etc. Consult the water quality guidelines for proper application and selection of this option.

Thermostat options include a unit-mounted manual changeover (MCO) or auto changeover (ACO) thermostat. The temperature set point knob and pushbutton switches for fan speed and cool/heat mode (MCO) selection are conveniently located on the top. The thermostat senses the return-air temperature. The thermostat sends the appropriate signal to the controller for cooling or heating mode of operation.

Options R and S allow connection to a remote wall-mounted thermostat. The Complete C controller requires a heat pump thermostat. The Deluxe D controller can be configured for heat pump or heat/cool thermostat.

Extended range is provided to insulate the coaxial coil to prevent condensation, and therefore potential dripping problems, in applications where the entering water temperature is below the normal operating range (less than 60 F).

Cabinet options include a locking control panel for added security. Bottom or front return with left or right hand configurations are available for ease of installation. Available with 5 in. subbase (bottom return units only), with or without motorized damper.

Motorized fresh air damper with the unit-mounted thermostat. Opens when LOW or HIGH fan speed selections are made from the push button switches. When STOP or FAN ONLY selections are made the spring return on the damper motor closes the damper. With remote thermostat the motorized fresh air damper opens when the fan is running.

Piping connections can be provided on either the right or left hand side of the unit, for easy installation. Orientation is determined by facing the unit from the front side.

Automatic flow regulators include internally mounted 2.25 or 3.0 gpm per ton automatic flow regulating valves for easier installation.

Two-way motorized control valve can be provided with a copper or cupronickel heat exchanger for applications involving open type systems or variable speed pumping. This valve will slowly open and close in conjunction with the compressor operation to shut off or turn on water to the unit. Standard two-way valve performance includes coefficient of velocity (Cv) of 2.9 and maximum operating pressure differential (MOPD) of 125 psi.

Mute package includes high density noise suppression material on front, right, and left sides of compressor compartment and $^1/_2$-in. fiberglass insulation on all insulated surfaces, for extra-quiet operation in the most critical applications.

Deluxe D control system provides the same functions as the Complete C while incorporating additional flexibility and functions to include:

Thermostat input capabilities — Accommodate emergency shutdown mode and night setback with override (NSB) potential. Night setback from low temperature thermostat with 2-hour override is initiated by a momentary signal from the thermostat.

Compressor relay staging — Used with dual stage units (units with 2 compressors and 2 Deluxe D controls) or in master/slave applications.

Boilerless electric heat control system — Allows automatic changeover to electric heat at low loop water temperature.

Intelligent reversing valve operation — Minimizes reversing valve operation for extended life and quiet operation.

Thermostat type select (Y, O or Y, W) — Provides ability to work and select heat pump or heat/cool thermostats (Y, W).

Reversing valve signal select (O or B) — Provides selection for heat pump O/B thermostats.

Dehumidistat input — Provides operation of fan control for dehumidification operation.

Multiple units on one thermostat/wall sensor — Provides for communication for up to three heat pumps on one thermostat.

Boilerless changeover temperature — Provides selection of boilerless changeover temperature set point.

Accessory relays — Allow configuration for multiple applications including fan and compressor cycling, digital night setback (NSB), mechanical night setback, water valve operation, and outside air damper operation.

Night low limit — If the unit operation is turned OFF from either the push button switches, remote thermostat or the energy management system, it is possible that the space temperature could drop uncontrollably. The night low limit feature, with Deluxe D controller, helps maintain the space temperature at a level that is the best compromise between energy consumption and a safe space temperature. A thermostat located near the return air filter activates the blower and compressor operation when the space temperature

Options and accessories (cont)

falls below 50 F. When return-air temperature is raised above 55 F the compressor and blower stop.

Override function — An override function is available for units operating in occupied/unoccupied mode under the control of an external timeclock or an energy management system. A contact closure from the timeclock or energy management system shorts the NSB and C terminal on the Deluxe D controller signaling an unoccupied mode.

For units with the unit-mounted thermostat, pressing override switch (located under control access door) will override the unoccupied mode and allow the occupied mode of operation to continue for a period of two hours.

The units with the remote wall-mounted thermostat require a digital thermostat with the override function. In unoccupied mode, an accessory relay is energized on the Deluxe D controller. The NO/NC contacts of the relay can be used as appropriate input to the digital thermostat to signal occupied/unoccupied mode. The thermostat selects cooling/heating set points based on occupied/unoccupied mode.

PremierLink™ controller is compatible with the Carrier Comfort Network® (CCN) and other building automation systems (BAS). This control is designed to allow users the access and ability to change factory-defined settings thus expanding the function of the standard unit.

LONMark® compliant controller contains the factory-loaded Aquazone™ water source heat pump application for an interoperable control solution.

WSHP Open multiple protocol controller is a proactive controller capable of communicating BACnet™, Modbus®*, N2, and LON (with a separate card) protocols. The controller is designed to allow users the access and ability to change and configure multiple settings and features including indoor air quality (IAQ), waterside economizer controls, etc.

Field-installed accessories

Carrier's line of Aquazone thermostats (used with remote thermostat units) are both attractive and multifunctional, accommodating stand-alone water source heat pump installations.

Programmable 7-day thermostat offers 2-stage heat, 2-stage cool, auto changeover, 7-day programmable with copy command, 4 settings per day, fully electronic, 24 vac, backlit LCD, keypad lockout, no batteries required, 5-minute compressor protection, NEVERLOST™ memory, 3 security levels, temperature display in degrees F or C.

Programmable 7-day light-activated thermostat offers same features as the 7-day programmable thermostat and includes occupied comfort settings with lights on, unoccupied energy savings with lights off.

Programmable 7-day flush-mount thermostat offers the same features as the 7-day programmable thermostat and includes locking coverplate with tamper proof screws, flush to wall mount, holiday/vacation programming, set point limiting, dual point with adjustable deadband, O or B terminal, and optional wall or duct-mounted remote sensor.

Programmable 5-day thermostat offers 2-stage heat, 2-stage cool, auto changeover, 5-minute built-in compressor protection, locking cover included, temperature display in degrees F or C, keypad lockout, backlit display, 5-1-1 programming, O or B terminal, dual set point with adjustable deadband, configurable display, self-prompting program, 4 settings per day.

Non-programmable thermostat offers 2 heat stages, 2 cool stages, auto changeover, 5-minute built in compressor protection, locking cover included, temperature display in degrees F or C, keypad lockout, large display, back-lit display, O or B terminal, dual set point with adjustable deadband, backplate with terminals.

Aquazone system control panel includes a pre-programmed, easy to use, Carrier Comfort Controller set up for a WSHP system.

- Coordinates, monitors, and controls all WSHP units and ancillary equipment including cooling towers, boilers, and system pumps.
- 50RLP model nomenclature is used to customize the panel to control all WSHP system requirements.
- Panel can be ordered to include 2, 4, 6, or 8 stages of system heat rejection.
- Panel can be ordered to include 2, 4, 6, or 8 stages of system heat addition.
- Panel can be ordered with unique WSHP zone operation capabilities for stand alone systems (i.e., non-communicating) to control 10 or 18 zones of WSHP units.
- Panel can be ordered to control variable frequency cooling tower fan operation.
- System pumping operation can be configured for start/stop, lead/lag, or variable frequency pump operation.
- Direct digital controls (DDC) compatible using the Carrier Comfort Network (CCN) and WSHP units utilizing PremierLink CCN controllers.

UC Open XP loop controller with six stages (2 stages for heating and 4 stages for cooling) includes:

- Loop temperature alarms
- Two pump single loop flow monitoring with the ability to manually select the lead pump
- One common alarm signal and indicating light and one audible alarm
- Loop water temperature sensor test circuit
- Functional test simulation from operator keypad
- Real timeclock, industrial noise ratings
- Loop water temperature control switch
- Loop controller with six stages (2 stages for heating and 4 stages for cooling)

Fire-rated hoses are 2 ft long and have a fixed MPT on one end and a swivel with an adapter on the other end. Hose kits are provided with both a supply and return hose and can be either stainless steel or galvanized. Five sizes are available ($1/2$, $3/4$, 1, $1\,1/4$, $1\,1/2$ in.).

Ball valves (brass body) used for shutoff and balancing water flow. Available with memory, memory stop, and pressure temperature ports. UL-listed brass body, ball and stem type with Teflon† seats and seals. Five sizes are available ($1/2$, $3/4$, 1, $1\,1/4$, $1\,1/2$ in.).

Y strainers (bronze body) are "Y" type strainers with a brass cap. Maximum operating pressure rating of 450 psi. Strainer screen made of stainless steel. Available with blow down valves. Five sizes are available ($1/2$, $3/4$, 1, $1\,1/4$, $1\,1/2$ in.).

*Registered trademark of Schneider Electric.
†Teflon is a trademark of E. I. du Pont de Nemours and Company.

Solenoid valves (brass body) offer 3.5 watt coil, 24 volt, 50/60 Hz, 740 amps inrush, .312 amps holding. Slow operation for quiet system application. Five sizes are available ($1/2$, $3/4$, 1, $1\,1/4$, $1\,1/2$ in.).

Hose kit assemblies provide all the necessary components to hook up a water-side system. Supply hose includes a ported ball valve with pressure temperature (P/T) plug ports, flexible stainless steel hose with swivel and nipple. Return hose includes a ball valve, preset automatic balancing valve (gpm) with two P/T ports, flexible stainless steel hose with a swivel and nipple, balancing valve, and low-pressure drop water control valve.

Remote sensors are available for Aquazone flush-mount thermostats and for wall (wired and wireless) or duct mounted applications.

SPT Standard offers space temperature sensor with communication port.

SPT Plus offers space temperature sensor with set point adjust, local override with indicating light and communication port.

SPT Pro offers space temperature sensor with LCD display, set point adjust, local override, alarm icon, outside air, and unit status with heating and cooling set points.

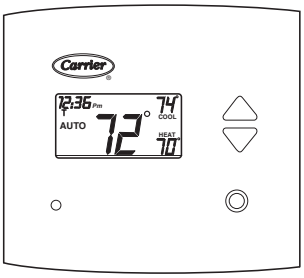
SPT Pro+ offers space temperature sensor with LCD display, set point adjust, local override, alarm icon, outside air, unit status with heating and cooling set points, and fan speed control.

LON wall sensors are available in 3 models: sensor only, sensor with status override indicator, and sensor with set point, status adjustment override, and digital LCD display.

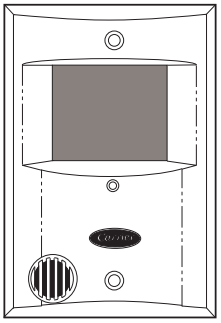
PremierLink™ accessories are available to provide a fully integrated WSHP DDC system. Accessories include supply air temperature sensors (with override and/or set point adjustment), communicating room sensors, CO_2 sensors (for use in demand control ventilation), and linkage thermostats (to control multiple units from one thermostat).

Options and accessories (cont)

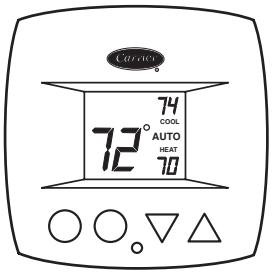
AQUAZONE™ THERMOSTATS



7-DAY PROGRAMMABLE/ LIGHT-ACTIVATED PROGRAMMABLE

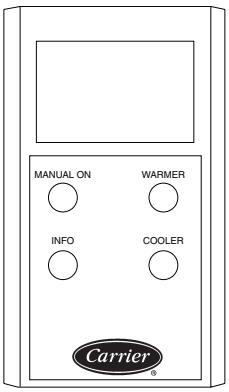


7-DAY PROGRAMMABLE FLUSH MOUNT

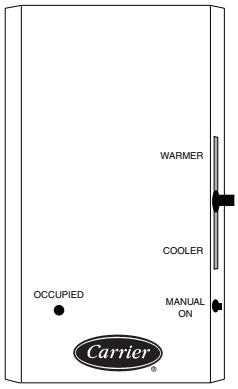


5-DAY PROGRAMMABLE/ NON-PROGRAMMABLE

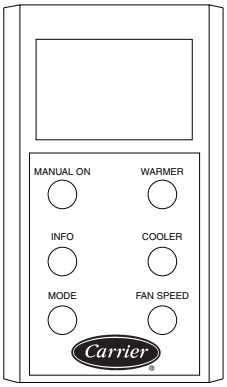
WSHP OPEN SENSORS



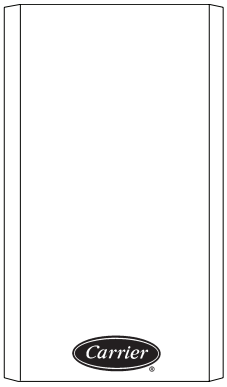
SPACE TEMPERATURE SENSOR WITH SET POINT ADJUSTMENT AND LOCAL OVERRIDE



SPACE TEMPERATURE SENSOR WITH SLIDE SET POINT ADJUSTMENT AND LOCAL OVERRIDE

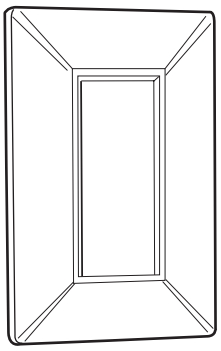


SPACE TEMPERATURE SENSOR WITH SET POINT ADJUSTMENT, FAN SPEED CONTROL, AND LOCAL OVERRIDE

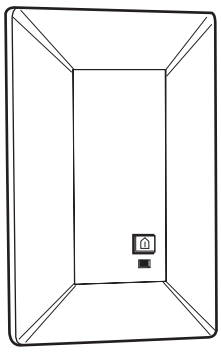


SPACE TEMPERATURE SENSOR ONLY

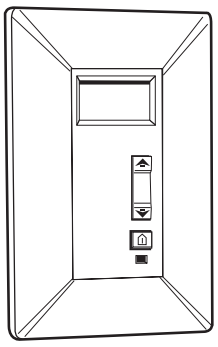
LON WALL SENSORS



SENSOR ONLY



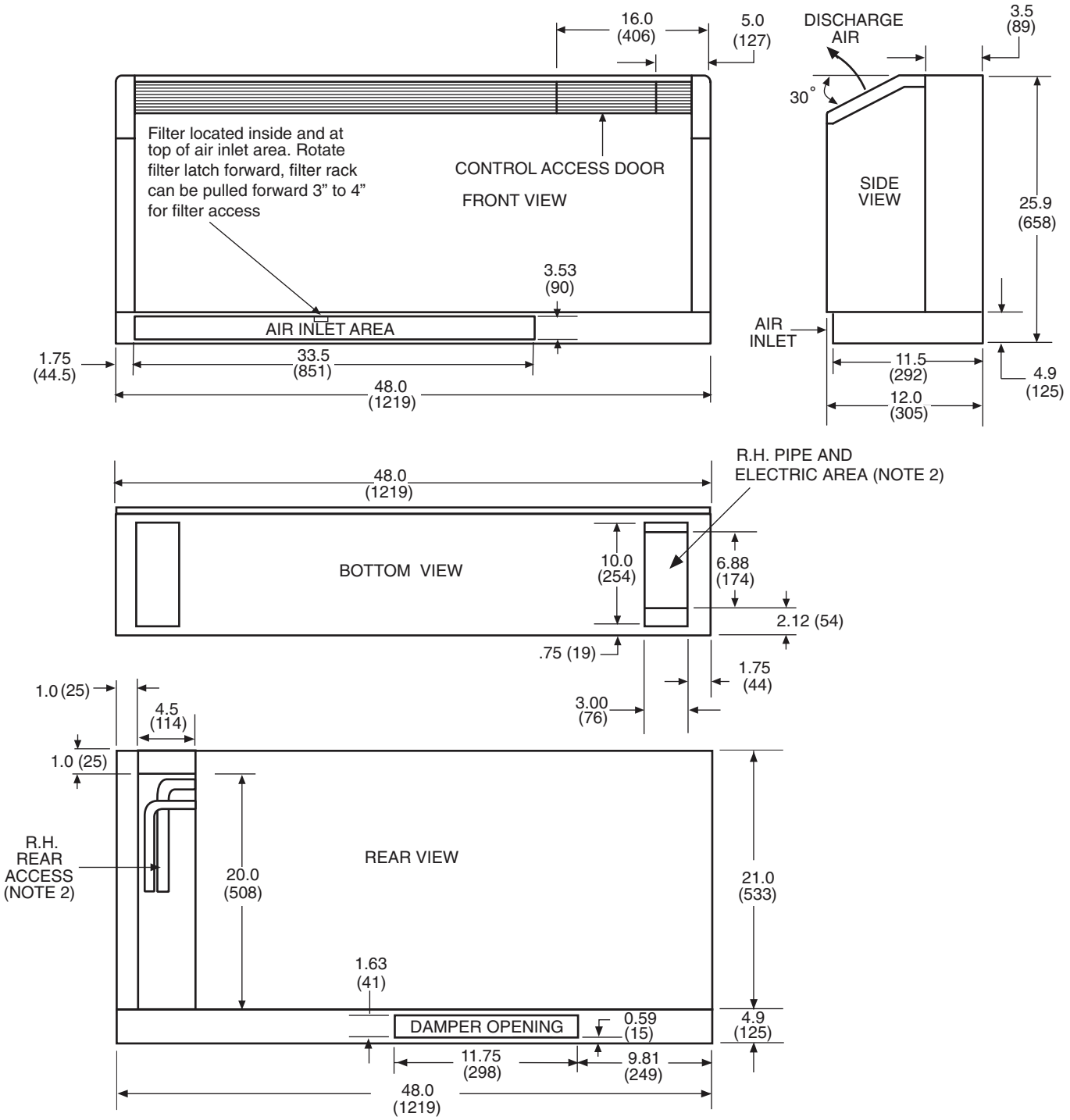
SENSOR WITH OVERRIDE



SENSOR WITH SET POINT ADJUSTMENT, OVERRIDE AND DIGITAL LCD

Dimensions

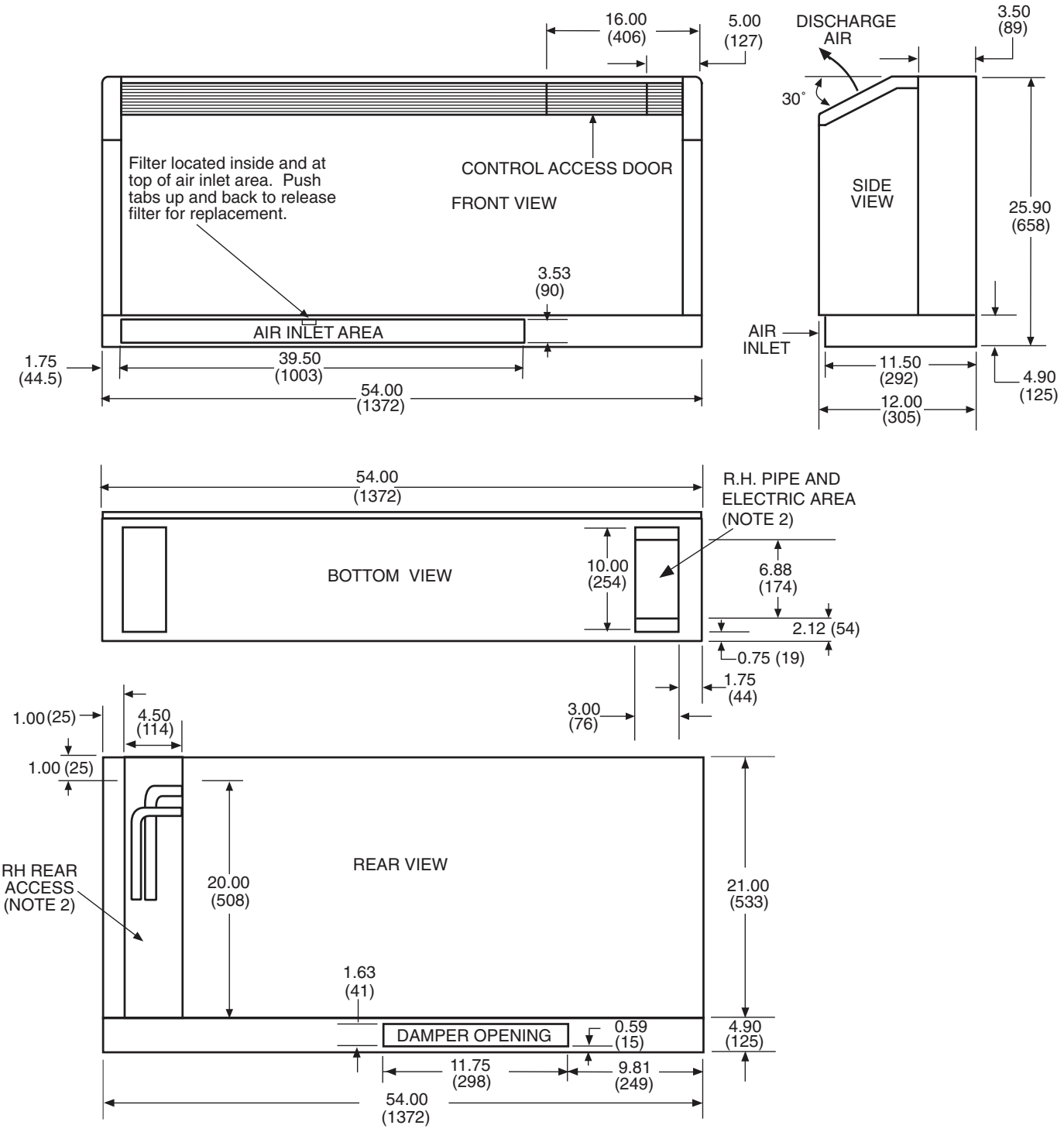
50PEC09-15 BOTTOM RETURN CABINET DIMENSIONS — RIGHT HAND PIPING



NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

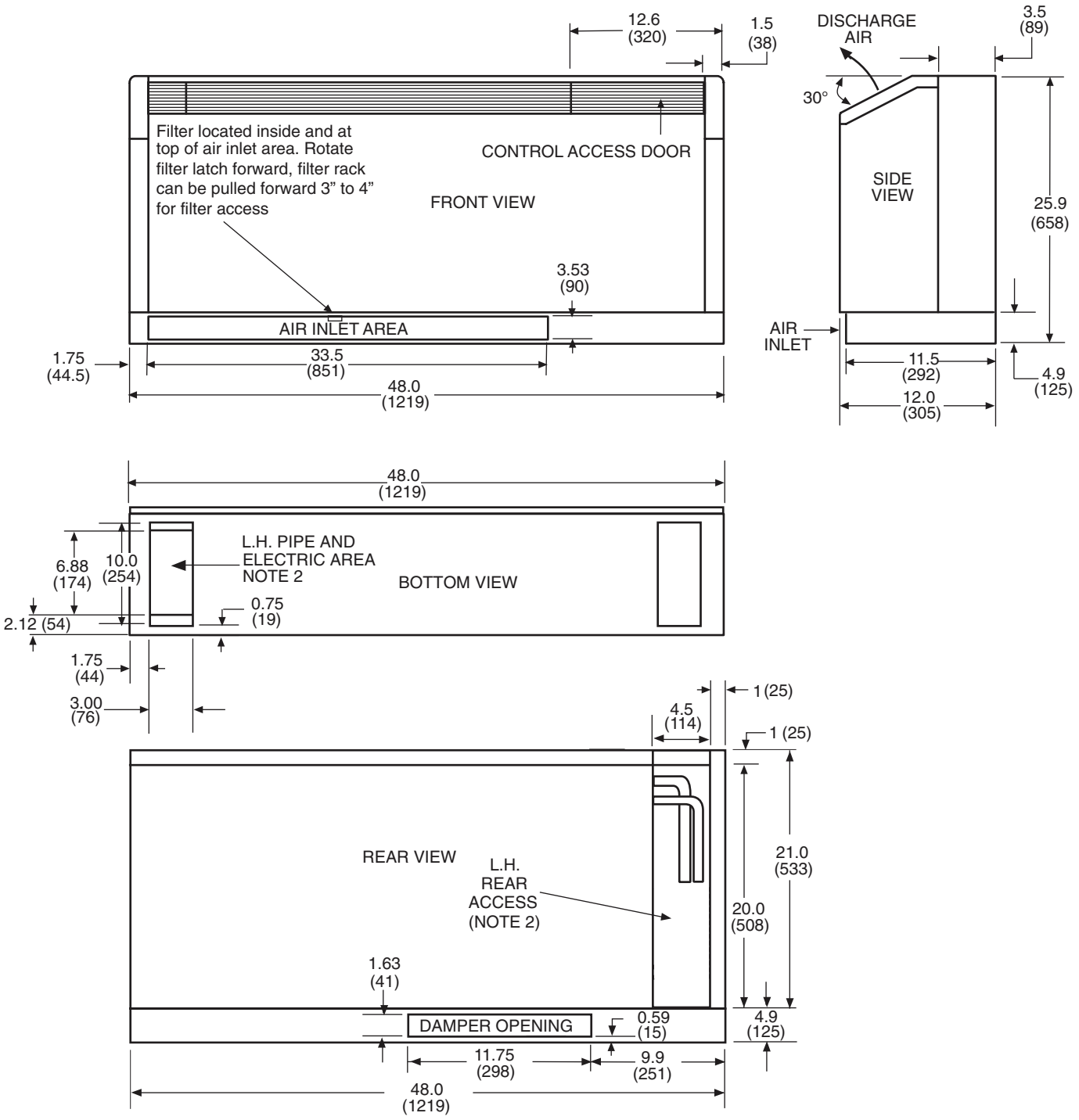
Dimensions (cont)

50PEC18 BOTTOM RETURN CABINET DIMENSIONS — RIGHT HAND PIPING



NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

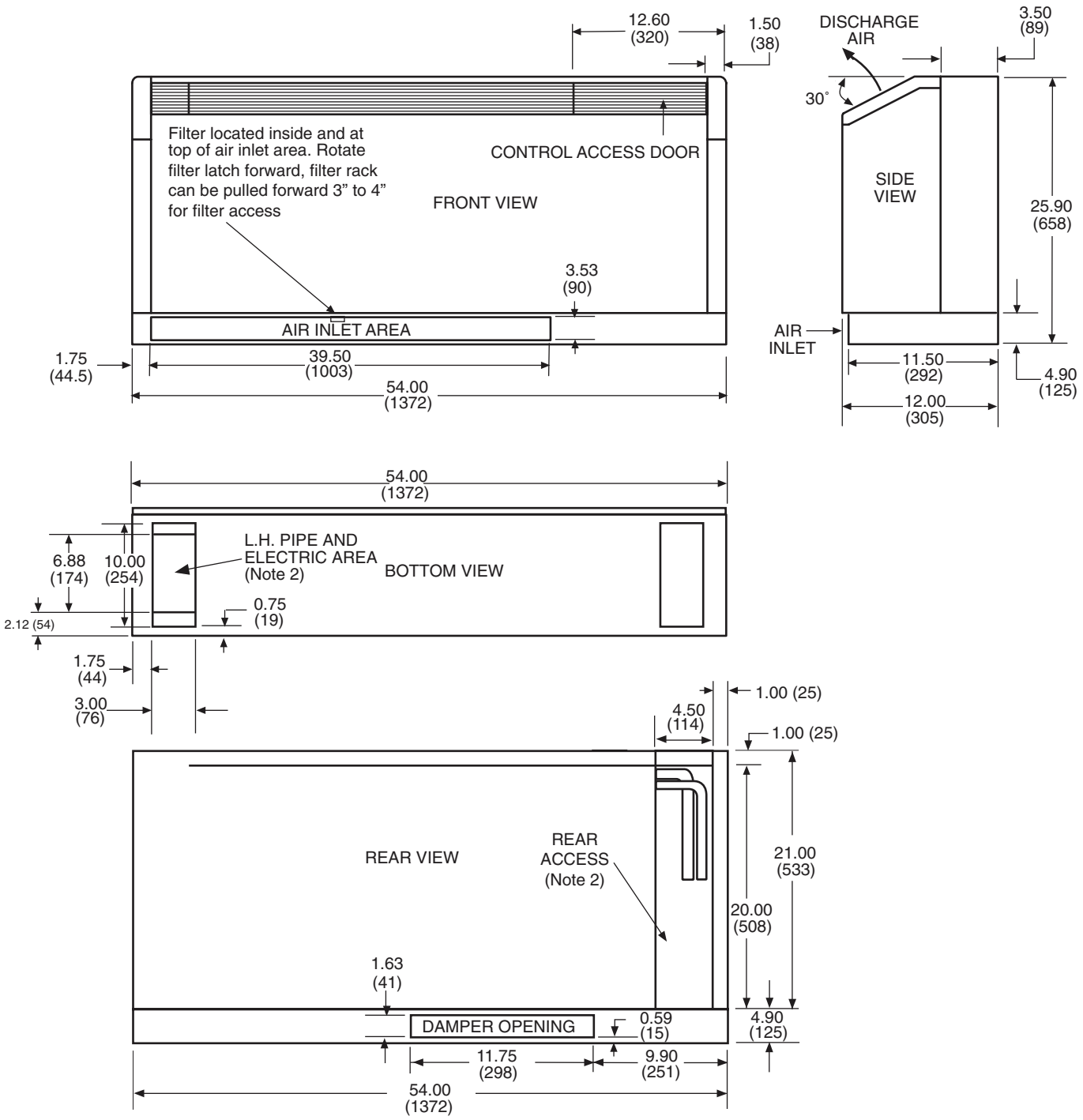
50PEC09-15 BOTTOM RETURN CABINET DIMENSIONS — LEFT HAND PIPING



NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

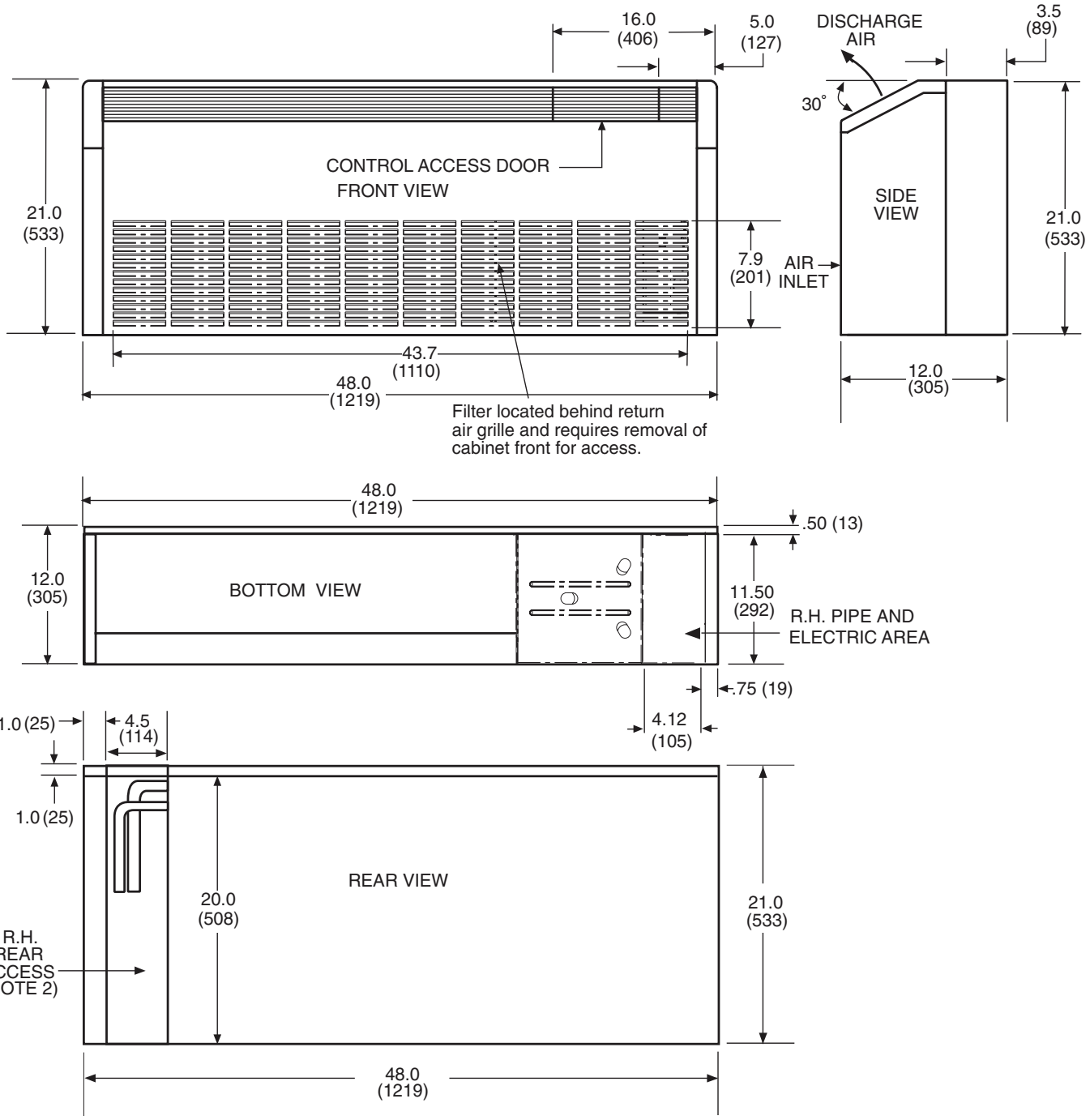
Dimensions (cont)

50PEC18 BOTTOM RETURN CABINET DIMENSIONS — LEFT HAND PIPING



NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

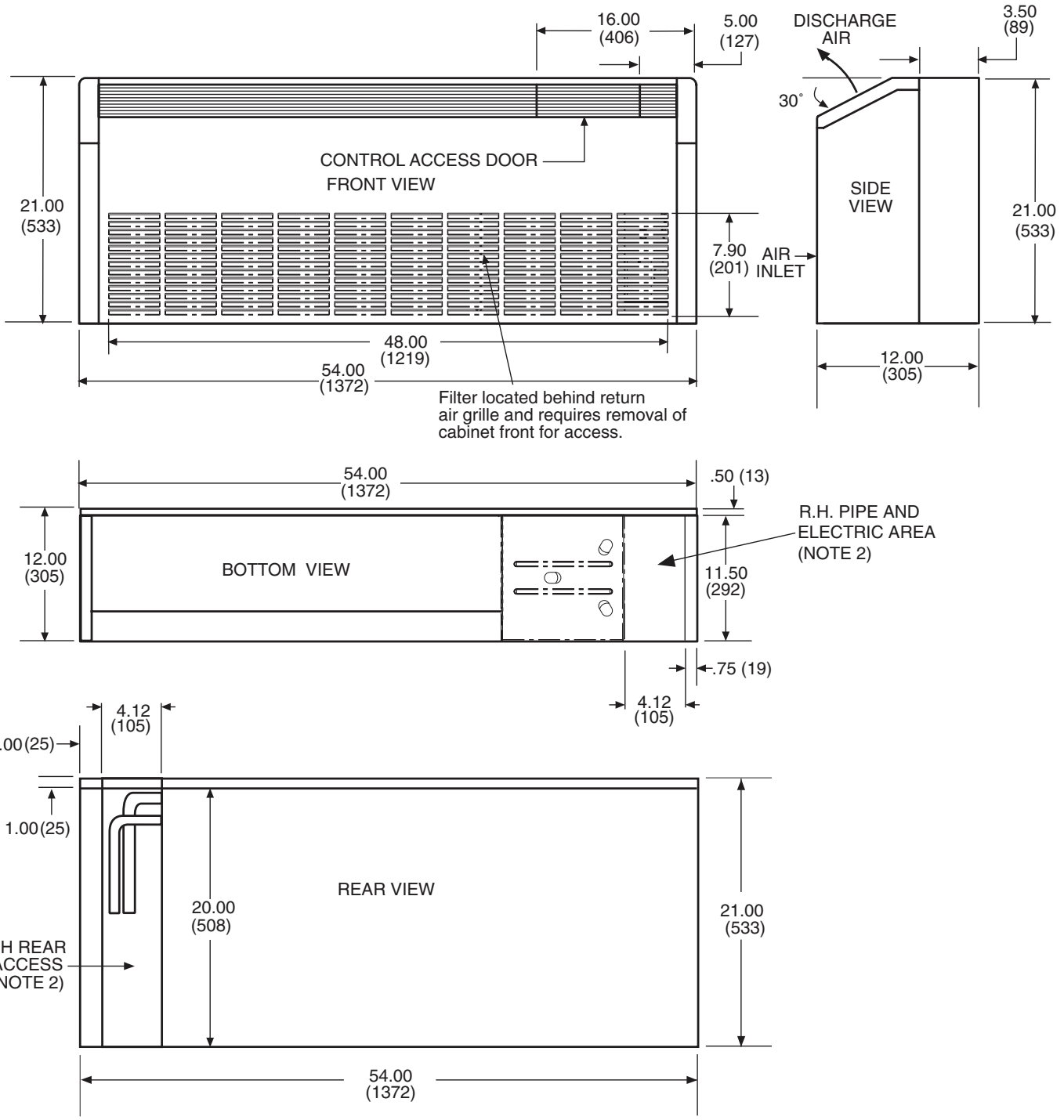
50PEC09-15 FRONT RETURN CABINET DIMENSIONS — RIGHT HAND PIPING



NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

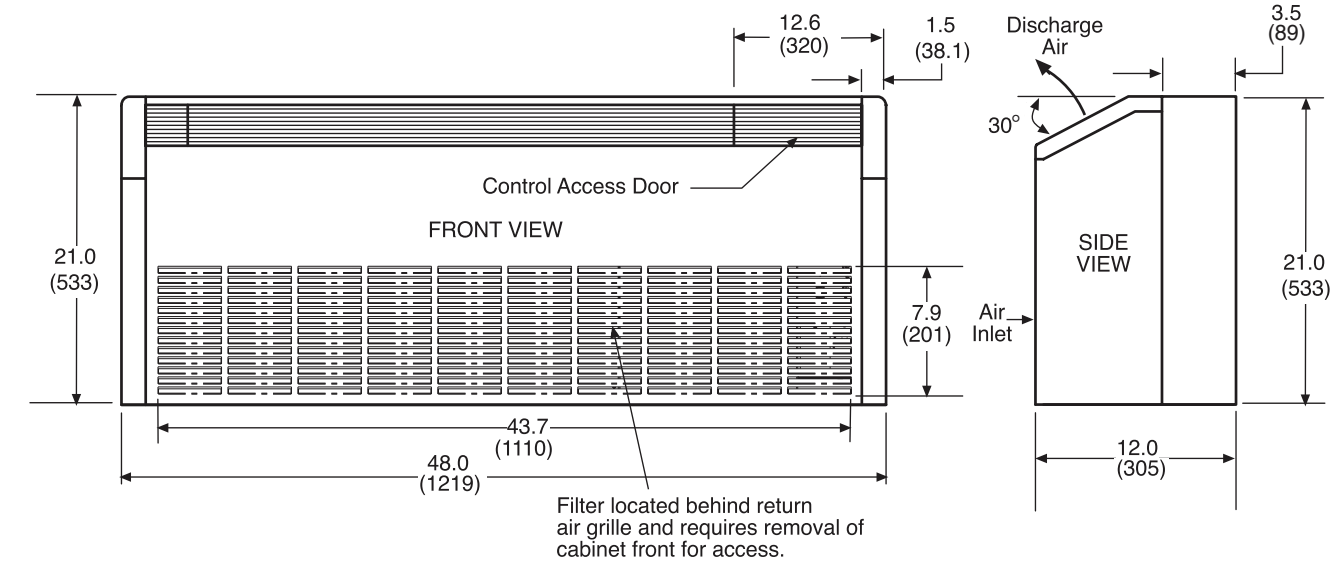
Dimensions (cont)

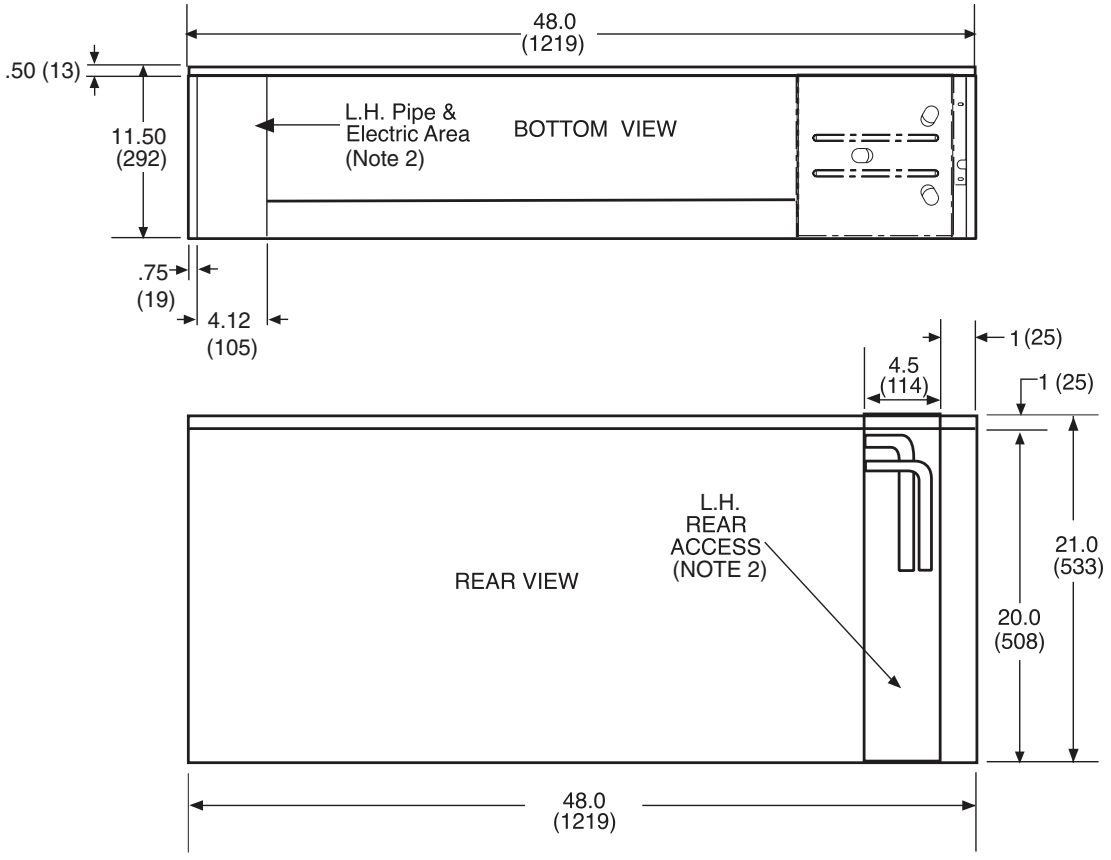
50PEC18 FRONT RETURN CABINET DIMENSIONS — RIGHT HAND PIPING



NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

50PEC09-15 FRONT RETURN CABINET DIMENSIONS — LEFT HAND PIPING

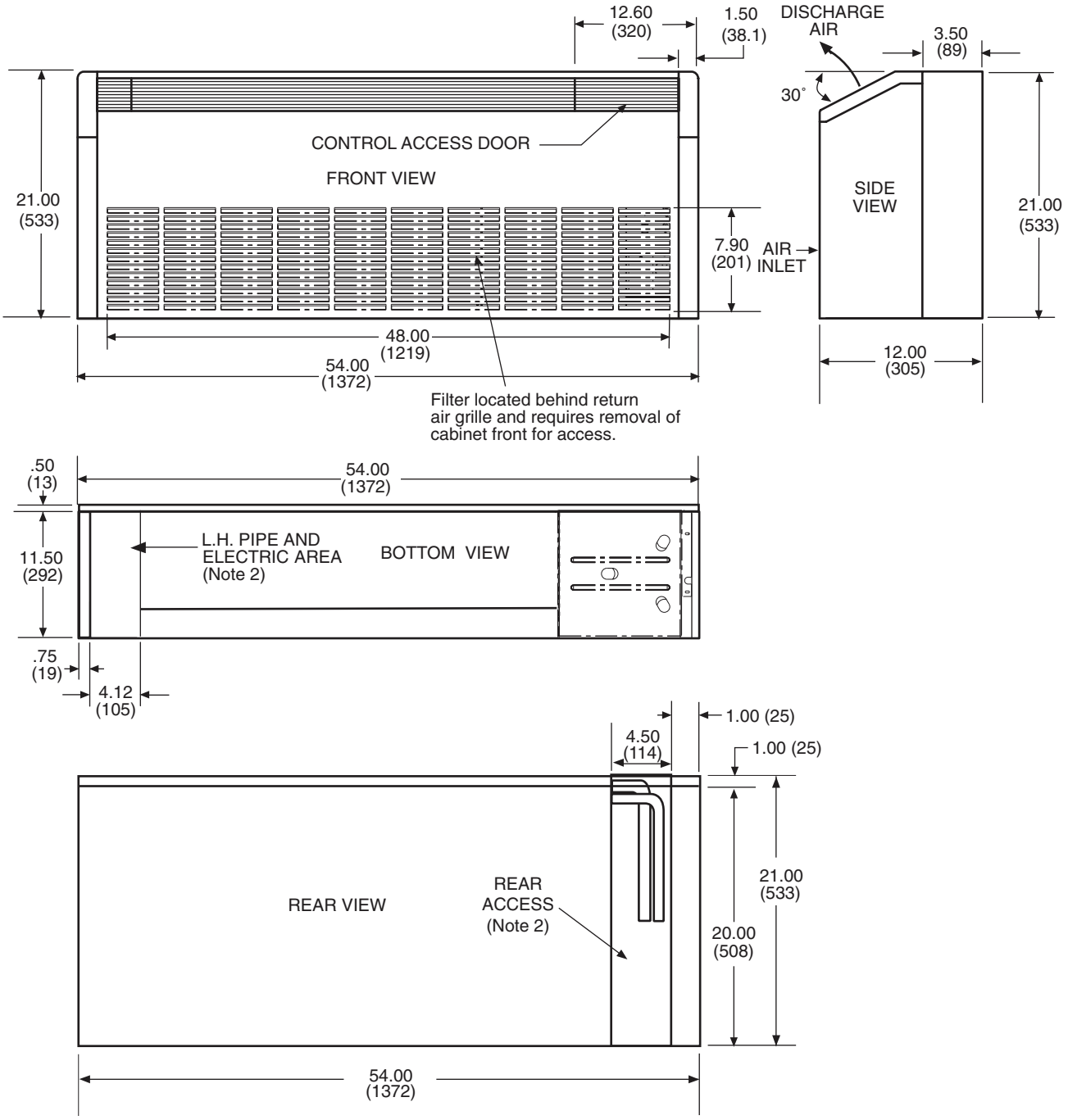




NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

Dimensions (cont)

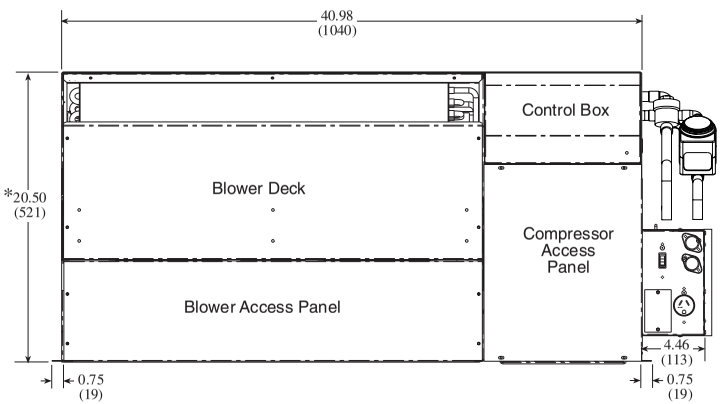
50PEC18 FRONT RETURN CABINET DIMENSIONS — LEFT HAND PIPING

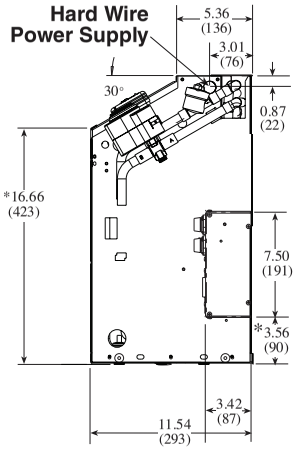


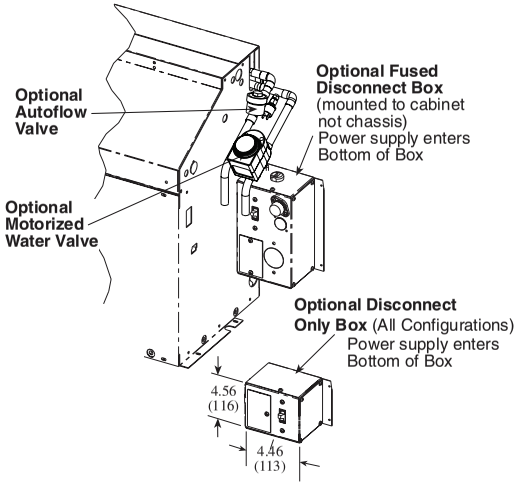
NOTES:
1. Dimensions are shown in inches. Dimensions in parentheses are in millimeters.
2. Access is reduced if optional disconnect box is selected.
3. Optional autoflow valve, motorized water valve and disconnect box are shown.

50PEC09-15 CHASSIS DIMENSIONS — BOTTOM RETURN

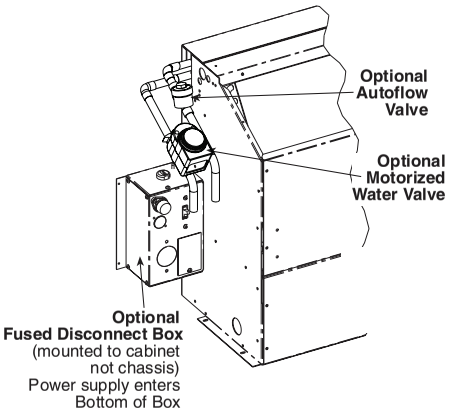
RIGHT HAND CONFIGURATION

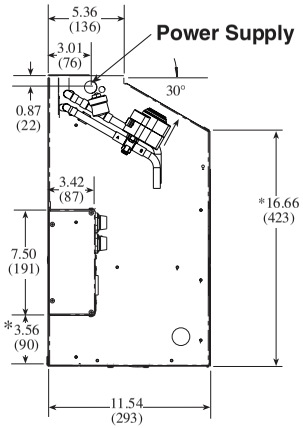


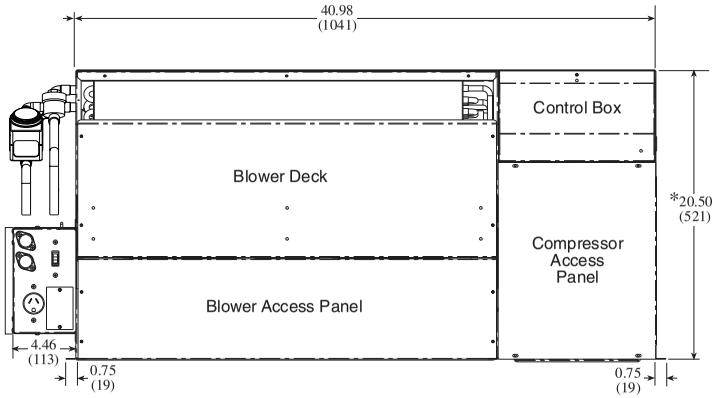




LEFT HAND CONFIGURATION







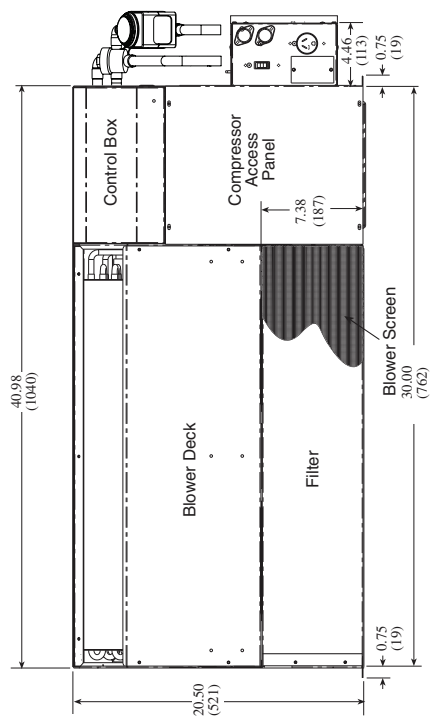
*If optional subbase is selected or if unit is installed raised above the floor, add 4.9 in. to dimension.

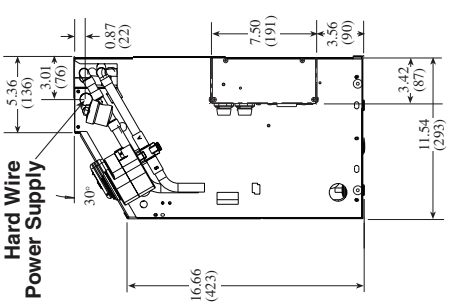
NOTES:
1. Dimensions shown are in inches. Dimensions in parentheses are in millimeters.
2. Optional autoflow valve, motorized water valve and disconnect box are shown.

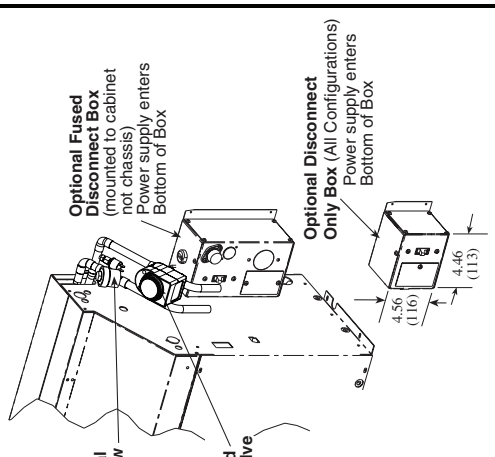
Dimensions (cont)

50PEC09-15 CHASSIS DIMENSIONS — FRONT RETURN

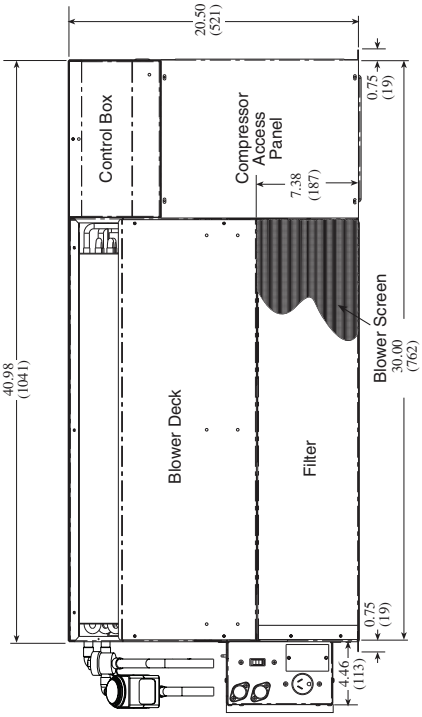
RIGHT HAND CONFIGURATION

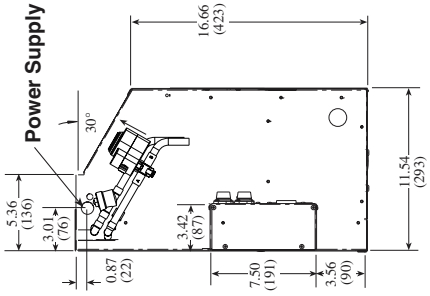


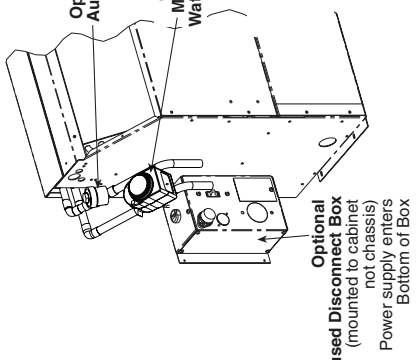




LEFT HAND CONFIGURATION



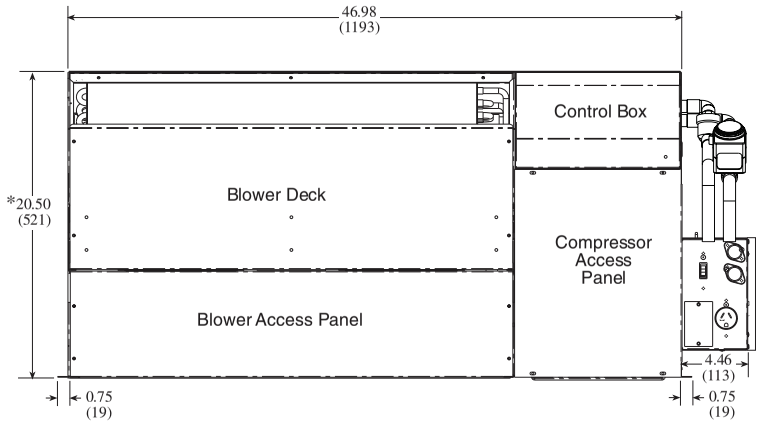


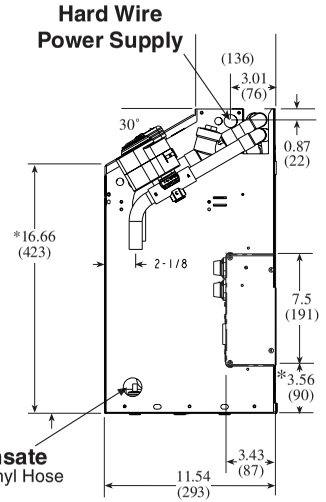


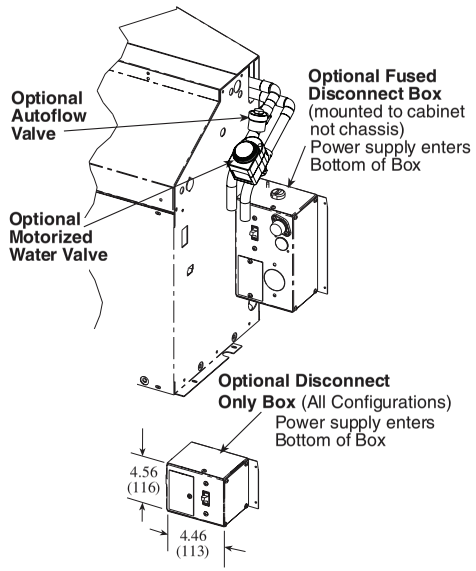
NOTES:
1. Dimensions shown are in inches. Dimensions in parentheses are in millimeters.
2. Optional autoflow valve, motorized water valve and disconnect box are shown.
3. Chassis can mount directly on floor.

50PEC18 CHASSIS DIMENSIONS — BOTTOM RETURN

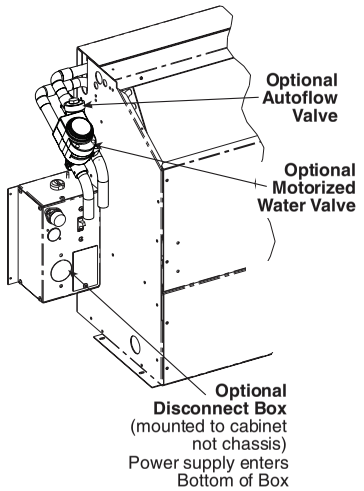
RIGHT HAND CONFIGURATION

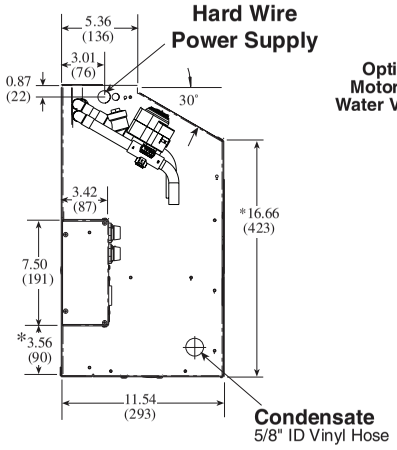


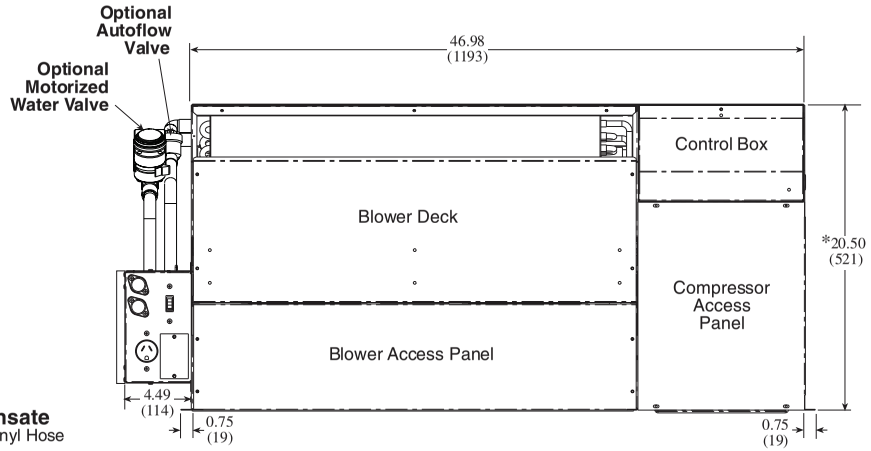




LEFT HAND CONFIGURATION





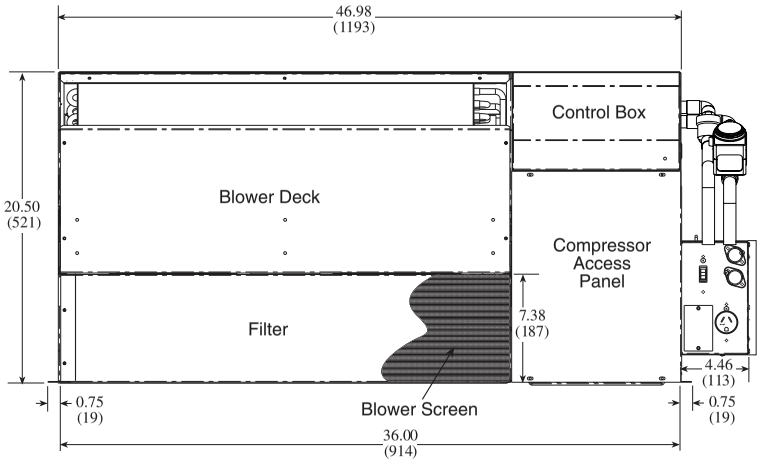


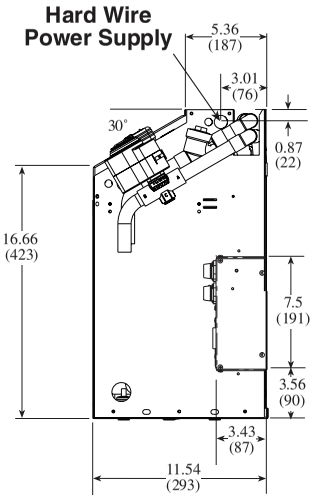
*If optional subbase is selected, add 4.9 in. to dimension.

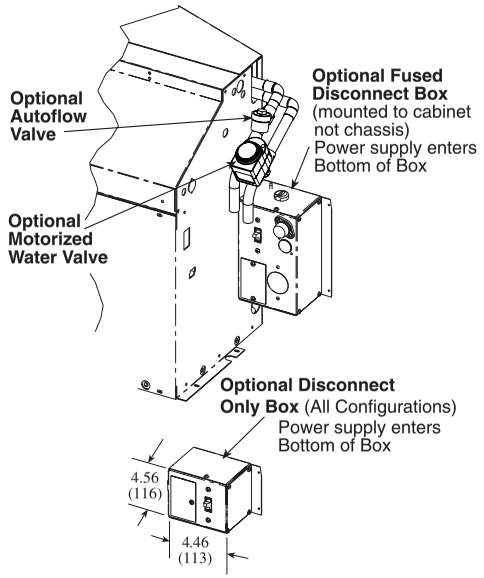
NOTES:
1. Dimensions shown are in inches. Dimensions in parentheses are in millimeters.
2. Optional autoflow valve, motorized water valve and disconnect box are shown.

50PEC18 CHASSIS DIMENSIONS — FRONT RETURN

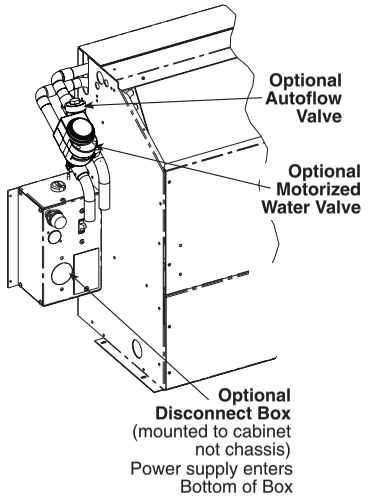
RIGHT HAND CONFIGURATION

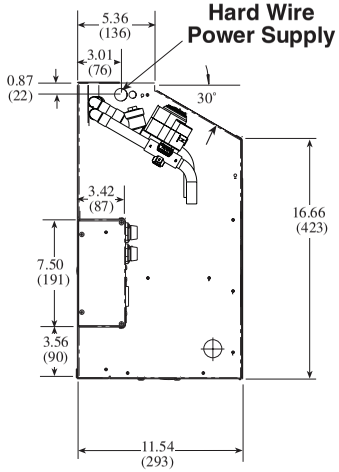


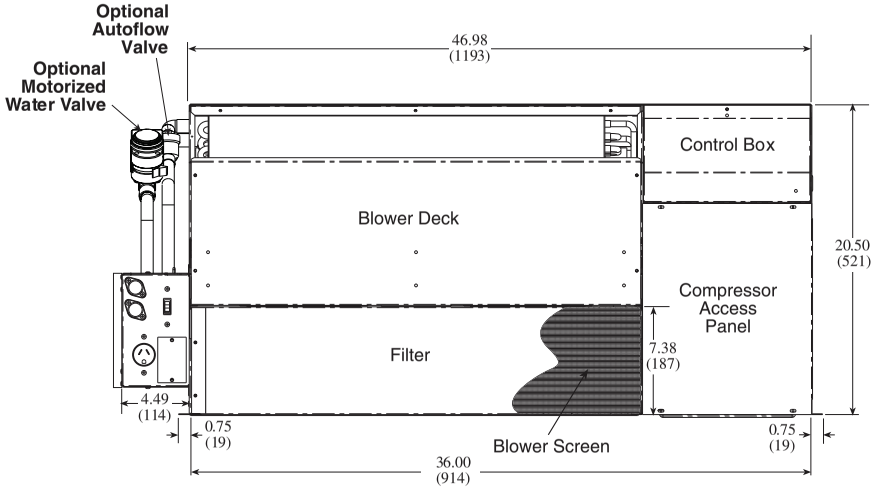




LEFT HAND CONFIGURATION







NOTES:
1. Dimensions shown are in inches. Dimensions in parentheses are in millimeters.
2. Optional autoflow valve, motorized water valve and disconnect box are shown.
3. Chassis can mount directly on floor.

Selection procedure (with 50PEC12 example)

I Determine the actual cooling and heating loads at the desired dry bulb and wet bulb conditions.

Given:

Total Cooling (TC) . . . . . .10,750 Btuh

Sensible Cooling (SC) . . . . . .8,650 Btuh

Entering-Air Temperature db . . . . . 80 F

Entering-Air Temperature wb . . . . . .66 F

II Determine the following design parameters.

Determine entering water temperature, water flow rate (gpm), airflow (cfm), water flow pressure drop and design wet and dry bulb temperatures. Airflow cfm should be between 300 and 450 cfm per ton. For applications using multiple units, the water pressure drop should be kept as close as possible across units to make water balancing easier. Enter the 50PEC12 Performance Data tables and find the proper indicated water flow and water temperature.

For example:

Entering Water Temp . . . . . 90 F

Water Flow (Based upon 10 F rise in temp) . . . . . .3.0 gpm

Airflow Cfm . . . . . .396 cfm

III Select a unit based on total cooling and total sensible cooling conditions.

Enter tables at the design water flow and water temperature. Read the total and sensible cooling capacities.

NOTE: Interpolation is permissible, extrapolation is not.

For example:

Enter the 50PEC12 Performance Table at design water flow and water temperature. Read Total Cooling, Sensible Cooling and Heat of Extraction capacities:

Total Cooling . . . . . .11,000 Btuh

Sensible Cooling . . . . . 9,200 Btuh

Heat of Extraction . . . . . .13,600 Btuh

NOTE: It is quite normal for water source heat pumps to be selected on cooling capacity only since the heating output is usually greater than the cooling capacity. Heating capacity is selected based on different entering water conditions than cooling capacity.

IV Determine the correction factors associated with the variable factors of dry bulb and wet bulb using the Corrections Factor tables found in this book.

Using the following formulas to determine the correction factors of dry bulb and wet bulb:

a) Corrected Total Cooling = tabulated total cooling x wet bulb correction x airflow correction.

b) Corrected Sensible Cooling = tabulated sensible cooling x wet/dry bulb correction x airflow correction

V Determine entering air and airflow correction using the Corrections Factor tables found in this book.

The nominal airflow for 50PEC12 is 450 cfm. The design parameter is 396 cfm.

396/450 = 88% of nominal airflow

Use the 89% row in the Correction Factors — Airflow table.

The Entering Air Temperature wb is 66 F. Use the 66.2 F row in the Entering Air Correction table.

Using the following formulas to determine the correction factors of entering air and airflow correction:

		Table		Ent Air		Airflow		Corrected
Corrected Total Cooling	=	11,000	x	0.990	x	0.974	=	10,607
Corrected Sensible Cooling	=	9,200	x	1.030	x	0.974	=	9,230
Corrected Heat of Extraction	=	13,600	x	0.992	x	0.981	=	13,235

Compare the corrected capacities to the load requirements established in Step I. If the capacities are within 10% of the load requirements, the equipment is acceptable. It is better to undersize than oversize as undersizing improves humidity control, reduces sound levels and extends the life of the equipment.

VI Water temperature rise calculation and assessment.

Calculate the water temperature rise and assess the selection using the following calculation:

$$\text{Actual Temperature Rise} = \frac{\text{Correction of Heat Extraction}}{\text{gpm x 500}}$$

For example, using the Corrected Heat of Extraction from the last step:

$$\text{Actual Temperature Rise} = \frac{13{,}235}{3.0 \times 500} = 8.8 \text{ F}$$

If the units selected are not within 10% of the load calculations, review what effect changing the gpm, water temperature and/or airflow will have on the corrected capacities. If the desired capacity cannot be achieved, select the next larger or smaller unit and repeat Steps I through VI.

Selection procedure (cont)

VII ARI/ISO 13256-1 Conversion

Performance standard ARI/ISO 13256-1 became effective on January 1, 2000 and replaced the existing ARI Standards 320 Water-Loop Heat Pumps (WLHP), 325 Ground-Water Heat Pumps (GWHP), and 330 Ground-Loop Heat Pumps (GLHP).

The ARI/ISO Standard incorporates a consistent rating methodology for including fan and pump energy for calculating cooling capacity, heating capacity, and energy efficiency ratios (EER). This simplifies the use of rating data for heat pump performance modeling in seasonal energy analysis calculations, and allows for direct rating comparisons across applications.

a) ISO Capacity and Efficiency Equations

The following equations are used to calculate and correct cooling capacity, heating capacity, and respective EER:

ISO Cooling Capacity = (Cooling Capacity in Btuh) + (Fan Power Correction in watts x 3.412)

ISO Cooling EER = (ISO Cooling Capacity in Btuh/3.412)/(Power Input in watts – Fan Power Correction in watts + Pump Power Correction in watts) = watts/watts

NOTE: Do not divide ISO Cooling Capacity by 3.412 to obtain Btuh/watts.

ISO Heating Capacity = (Heating Capacity in Btuh) – (Fan Power Correction in watts x 3.412)

ISO Heating EER = (ISO Heating Capacity in Btuh/3.412)/(Power Input in watts – Fan Power Correction in watts + Pump Power Correction in watts) = watts/watts

NOTE: Do not divide ISO Heating Capacity by 3.412 to obtain Btuh/watts.

b) Identify the design conditions corrected for air and water conditions.

Airflow Cfm = 396 cfm

Water Flow
(Based upon 10 F rise in temp) = 3.1 gpm

External Static Pressure = 0.0 in. wg (non-ducted application)

Water Pressure Drop = 3.7 ft of head

Power input = 1,067 watts

Cooling Capacity = 10,750 Btuh

c) Perform Fan Power Correction Adjustment

Use the following formula to calculate Fan Power Correction:

Fan Power Correction = (Cfm x 0.472) x (External Static Pressure x 249)/300 = watts
= (396 x 0.472) x (0 x 249)/300
= 0 watts

d) Perform Pump Power Correction Adjustment

Use the following formula to calculate Pump Power Correction:

Pump Power Correction = (gpm x 0.0631) x (Pressure Drop x 2,990)/300
= watts
= (3.1 x 0.0631) x (3.7 x 2,990)/300
= 7.2 watts

e) Perform capacity and EER calculations

Use the following formula to calculate capacity and EER:

ISO Cooling Capacity = (Cooling Capacity) + (Fan Power Correction x 3.412)
= 10,750 + (0 x 3.412)
= 10,750 Btuh

f) Perform Corrections by using the ISO Equations

ISO EER = (ISO Cooling Capacity/3.412)/(Power Input – Fan Power Correction + Pump Power Correction)
= watts/watts

NOTE: Do not divide ISO Cooling Capacity by 3.412 to obtain Btuh/watts.

= (10,750/3.412)/(1,067 – 0 + 7.2)
= 2.97 watts/watts x 3.412 Btuh/watts
= 10.14 Btuh/watts

Performance data

50PEC09 — NOMINAL AIRFLOW 350 CFM

EWT (F)	GPM	WPD*		COOLING - EAT 80/67 F						HEATING - EAT 70 F				
		PSI	FT	TC	SC	Sensible/ Total Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	2.2	5.0	11.6	Operation Not Recommended						6.3	0.67	4.0	86.6	2.72
30	1.1	1.6	3.7	9.2	6.7	0.73	0.44	10.7	20.6	6.9	0.69	4.6	88.2	2.94
	1.6	2.6	6.0	8.9	6.6	0.74	0.43	10.4	20.7	7.2	0.69	4.8	89.0	3.04
	2.2	4.5	10.4	8.8	6.5	0.74	0.43	10.2	20.6	7.3	0.69	5.0	89.4	3.11
40	1.1	1.4	3.2	9.4	6.9	0.73	0.47	11.1	19.9	7.9	0.70	5.5	90.9	3.29
	1.6	2.3	5.3	9.3	6.8	0.73	0.45	10.9	20.5	8.3	0.71	5.9	91.8	3.41
	2.2	4.2	9.7	9.2	6.7	0.73	0.45	10.7	20.6	8.5	0.71	6.1	92.4	3.48
50	1.1	1.2	2.8	9.5	7.0	0.74	0.51	11.3	18.5	8.9	0.72	6.5	93.7	3.63
	1.6	2.2	5.1	9.5	6.9	0.73	0.49	11.1	19.5	9.3	0.73	6.9	94.7	3.76
	2.2	3.8	8.8	9.4	6.9	0.73	0.47	11.1	19.9	9.6	0.73	7.1	95.4	3.84
60	1.1	1.1	2.5	9.4	7.1	0.76	0.56	11.3	16.7	10.0	0.74	7.5	96.4	3.95
	1.6	2.1	4.9	9.5	7.0	0.74	0.53	11.3	17.9	10.4	0.75	7.9	97.6	4.08
	2.2	3.7	8.5	9.5	7.0	0.74	0.51	11.2	18.6	10.7	0.75	8.1	98.3	4.16
70	1.1	1.0	2.3	9.0	7.1	0.79	0.62	11.2	14.5	11.0	0.76	8.4	99.0	4.23
	1.6	2.0	4.6	9.3	7.1	0.77	0.58	11.3	15.9	11.4	0.77	8.8	100.2	4.36
	2.2	3.5	8.1	9.4	7.1	0.76	0.56	11.3	16.7	11.7	0.77	9.1	101.0	4.43
80	1.1	1.0	2.3	8.5	7.0	0.82	0.69	10.9	12.3	11.9	0.78	9.2	101.4	4.47
	1.6	1.9	4.4	8.8	7.1	0.80	0.65	11.1	13.7	12.3	0.79	9.6	102.6	4.58
	2.2	3.2	7.4	9.0	7.1	0.79	0.62	11.2	14.5	12.6	0.80	9.9	103.4	4.64
85	1.1	1.0	2.2	8.1	6.9	0.84	0.73	10.6	11.1	12.3	0.79	9.6	102.5	4.56
	1.6	1.9	4.4	8.5	7.0	0.82	0.68	10.9	12.5	12.7	0.80	10.0	103.6	4.66
	2.2	3.1	7.2	8.8	7.0	0.80	0.66	11.0	13.3	13.0	0.81	10.2	104.3	4.71
90	1.1	0.9	2.1	7.8	6.7	0.87	0.77	10.4	10.1	12.7	0.80	10.0	103.5	4.66
	1.6	1.9	4.4	8.2	6.9	0.84	0.72	10.7	11.4	13.1	0.81	10.3	104.6	4.74
	2.2	3.0	6.9	8.5	7.0	0.82	0.69	10.9	12.2	13.3	0.82	10.5	105.2	4.77
100	1.1	0.9	2.1	6.9	6.3	0.91	0.86	9.8	7.9	Operation Not Recommended				
	1.6	1.8	4.2	7.4	6.6	0.89	0.81	10.2	9.1					
	2.2	2.9	6.7	7.7	6.7	0.87	0.78	10.4	9.9					
110	1.1	0.9	2.1	5.8	5.6	0.97	0.96	9.1	6.0					
	1.6	1.8	4.2	6.4	6.0	0.94	0.91	9.5	7.0					
	2.2	2.9	6.7	6.7	6.2	0.92	0.87	9.7	7.7					
120	1.1	0.9	2.1	4.5	4.6	1.00	1.07	8.2	4.2					
	1.6	1.8	4.2	5.1	5.1	1.00	1.02	8.6	5.0					
	2.2	2.8	6.5	5.5	5.4	0.98	0.98	8.9	5.6					

LEGEND

ARI — Air Conditioning and Refrigeration Institute
db — Dry Bulb
COP — Coefficient of Performance
Cv — Coefficient of Velocity
EAT — Entering Air Temperature (F)
EER — Energy Efficiency Ratio
EWT — Entering Water Temperature (F)
GPM — Gallons per Minute
HC — Heating Capacity (MBtuh)
HE — Heat of Extraction (MBtuh)
HR — Heat of Rejection (MBtuh)
ISO — International Organization for Standardization
LAT — Latent Heat (MBtuh)
LWT — Leaving Water Temperature
MBtuh — Btuh in Thousands
MOPD — Maximum Opening Pressure Difference
SC — Sensible Capacity (MBtuh)
TC — Total Capacity (MBtuh)
wb — Wet Bulb
WPD — Water Pressure Differential

***WPD ADDER FOR MOTORIZED VALVE, 50PEC09 UNIT (Cv = 4.9, MOPD = 125 psi)**

GPM	WPD Adder	
	PSI	FT
1.1	0.3	0.6
1.6	0.6	1.3
2.2	1.2	2.7

NOTES:
1. Interpolation is permissible; extrapolation is not.
2. All entering air conditions are 80 F db and 67 F wb in cooling and 70 F db in heating.
3. ARI/ISO certified conditions are 80.6 F db and 66.2 F wb in cooling and 68 F db in heating.
4. Table does not reflect fan or pump power corrections for ARI/ISO conditions.
5. All performance is based upon the lower voltage of dual voltage rated units.
6. Operation below 40 F EWT is based upon a 15% antifreeze solution.
7. Operation below 60 F EWT requires optional insulated water/refrigerant circuit (standard on residential models).
8. See performance correction tables for operating conditions other than those listed above.
9. For operation in the shaded area when water is used instead of an antifreeze solution, the LWT must be calculated. Flow must be maintained to a level so that the LWT is maintained above 42 F when the JW3 jumper is not clipped. Because the refrigerant temperature can potentially reach as low as 32 F with 40 F LWT, a nuisance cutout could occur due to the activation of the low temperature protection. JW3 should never be clipped for standard range equipment or systems without antifreeze.

Performance data (cont)

50PEC12 — NOMINAL AIRFLOW 450 CFM

EWT (F)	GPM	WPD*		COOLING - EAT 80/67 F						HEATING - EAT 70 F				
		PSI	FT	TC	SC	Sensible/ Total Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	3.0	7.8	18.0	Operation Not Recommended						7.3	0.79	4.7	85.1	2.71
30	1.5	2.1	4.9	12.6	8.2	0.65	0.56	14.5	22.4	8.1	0.81	5.4	86.7	2.96
	2.3	4.5	10.4	12.4	8.0	0.65	0.53	14.2	23.3	8.5	0.81	5.7	87.5	3.06
	3.0	6.8	15.7	12.3	8.0	0.65	0.52	14.0	23.6	8.7	0.82	5.9	87.9	3.12
40	1.5	2.0	4.6	12.7	8.4	0.67	0.61	14.7	20.7	9.4	0.83	6.7	89.4	3.35
	2.3	4.2	9.7	12.6	8.2	0.65	0.58	14.6	21.9	9.9	0.83	7.1	90.4	3.48
	3.0	6.1	14.1	12.6	8.2	0.65	0.56	14.5	22.4	10.2	0.84	7.3	90.9	3.56
50	1.5	1.8	4.2	12.5	8.7	0.70	0.67	14.8	18.7	10.8	0.85	8.0	92.3	3.74
	2.3	3.8	8.8	12.6	8.5	0.68	0.63	14.8	20.0	11.4	0.86	8.5	93.5	3.91
	3.0	5.8	13.4	12.7	8.4	0.67	0.61	14.7	20.7	11.7	0.86	8.8	94.1	4.00
60	1.5	1.7	3.9	12.1	9.0	0.74	0.73	14.6	16.6	12.2	0.87	9.3	95.1	4.14
	2.3	3.7	8.5	12.4	8.8	0.71	0.69	14.7	17.9	12.9	0.87	9.9	96.5	4.32
	3.0	5.2	12.0	12.5	8.7	0.70	0.67	14.8	18.6	13.2	0.88	10.2	97.2	4.41
70	1.5	1.5	3.5	11.6	9.2	0.79	0.80	14.4	14.5	13.6	0.88	10.6	97.9	4.50
	2.3	3.5	8.1	12.0	9.1	0.76	0.76	14.5	15.8	14.3	0.89	11.2	99.4	4.69
	3.0	4.9	11.3	12.1	9.0	0.74	0.73	14.6	16.5	14.6	0.90	11.6	100.1	4.79
80	1.5	1.4	3.2	11.0	9.2	0.83	0.89	14.1	12.5	14.8	0.90	11.8	100.5	4.84
	2.3	3.2	7.4	11.4	9.2	0.81	0.83	14.3	13.7	15.5	0.91	12.4	101.9	5.01
	3.0	4.8	11.1	11.6	9.2	0.79	0.81	14.4	14.4	15.8	0.91	12.7	102.6	5.10
85	1.5	1.4	3.1	10.7	9.1	0.85	0.93	13.9	11.5	15.4	0.90	12.3	101.6	4.98
	2.3	3.1	7.2	11.1	9.2	0.83	0.88	14.1	12.7	16.0	0.91	12.9	102.9	5.13
	3.0	4.7	10.7	11.3	9.2	0.81	0.85	14.2	13.4	16.3	0.92	13.1	103.5	5.20
90	1.5	1.3	3.0	10.4	9.1	0.87	0.98	13.7	10.6	15.9	0.91	12.8	102.7	5.11
	2.3	3.0	6.9	10.8	9.2	0.85	0.92	13.9	11.7	16.5	0.92	13.3	103.9	5.25
	3.0	4.5	10.4	11.0	9.2	0.84	0.89	14.1	12.3	16.7	0.92	13.6	104.4	5.31
100	1.5	1.3	3.0	9.7	8.7	0.90	1.08	13.4	9.0	Operation Not Recommended				
	2.3	2.9	6.7	10.1	9.0	0.88	1.02	13.6	9.9					
	3.0	4.3	9.9	10.3	9.0	0.88	0.99	13.7	10.5					
110	1.5	1.2	2.8	9.0	8.2	0.91	1.20	13.1	7.5					
	2.3	2.9	6.7	9.4	8.5	0.90	1.13	13.3	8.4					
	3.0	4.2	9.7	9.6	8.7	0.90	1.09	13.4	8.8					
120	1.5	1.2	2.8	8.4	7.5	0.89	1.33	12.9	6.3					
	2.3	2.8	6.5	8.7	7.9	0.91	1.25	13.0	7.0					
	3.0	4.1	9.5	8.9	8.1	0.91	1.21	13.1	7.4					

LEGEND

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Cv — Coefficient of Velocity
EAT — Entering Air Temperature (F)
EER — Energy Efficiency Ratio
EWT — Entering Water Temperature (F)
GPM — Gallons per Minute
HC — Heating Capacity (MBtuh)
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ISO — International Organization for Standardization
LAT — Latent Heat (MBtuh)
LWT — Leaving Water Temperature
MBtuh — Btuh in Thousands
MOPD — Maximum Opening Pressure Difference
SC — Sensible Capacity (MBtuh)
TC — Total Capacity (MBtuh)
wb — Wet Bulb
WPD — Water Pressure Differential

NOTES:
1. Interpolation is permissible; extrapolation is not.
2. All entering air conditions are 80 F db and 67 F wb in cooling and 70 F db in heating.
3. ARI/ISO certified conditions are 80.6 F db and 66.2 F wb in cooling and 68 F db in heating.
4. Table does not reflect fan or pump power corrections for ARI/ISO conditions.
5. All performance is based upon the lower voltage of dual voltage rated units.
6. Operation below 40 F EWT is based upon a 15% antifreeze solution.
7. Operation below 60 F EWT requires optional insulated water/refrigerant circuit (standard on residential models).
8. See performance correction tables for operating conditions other than those listed above.
9. For operation in the shaded area when water is used instead of an antifreeze solution, the LWT must be calculated. Flow must be maintained to a level so that the LWT is maintained above 42 F when the JW3 jumper is not clipped. Because the refrigerant temperature can potentially reach as low as 32 F with 40 F LWT, a nuisance cutout could occur due to the activation of the low temperature protection. JW3 should never be clipped for standard range equipment or systems without antifreeze.

***WPD ADDER FOR MOTORIZED VALVE, 50PEC12 UNIT (Cv = 4.9, MOPD = 125 psi)**

GPM	WPD Adder	
	PSI	FT
1.5	0.5	1.0
2.3	1.2	2.7
3.0	2.2	5.0

50PEC15 — NOMINAL AIRFLOW 520 CFM

EWT (F)	GPM	WPD*		COOLING - EAT 80/67 F						HEATING - EAT 70 F				
		PSI	FT	TC	SC	Sensible/ Total Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	3.7	5.1	11.8	Operation Not Recommended						8.9	0.92	5.8	85.9	2.86
30	1.9	1.5	3.5	16.9	11.0	0.65	0.62	19.0	27.1	10.0	0.94	6.8	87.8	3.11
	2.8	3.0	6.9	16.5	10.4	0.63	0.58	18.5	28.6	10.5	0.95	7.2	88.6	3.22
	3.7	4.7	10.9	16.3	10.1	0.62	0.56	18.2	29.2	10.7	0.96	7.5	89.1	3.28
40	1.9	1.2	2.8	16.9	11.4	0.67	0.70	19.3	24.1	11.7	0.98	8.4	90.8	3.51
	2.3	4.2	9.7	12.6	8.2	0.65	0.58	14.6	21.9	9.9	0.83	7.1	90.4	3.48
	3.7	4.3	9.9	16.9	11.0	0.65	0.62	19.0	27.1	12.6	0.99	9.2	92.4	3.71
50	1.9	1.0	2.3	16.6	11.5	0.69	0.79	19.3	21.0	13.4	1.01	10.0	93.9	3.91
	2.8	2.3	5.3	16.9	11.5	0.68	0.73	19.4	23.1	14.1	1.02	10.7	95.2	4.06
	3.7	3.9	9.0	16.9	11.4	0.67	0.70	19.3	24.2	14.5	1.03	11.0	95.9	4.15
60	1.9	0.9	2.1	15.9	11.3	0.71	0.89	18.9	17.9	15.2	1.04	11.7	97.1	4.29
	2.8	2.1	4.9	16.4	11.4	0.70	0.82	19.2	19.9	16.0	1.05	12.4	98.5	4.46
	3.7	3.5	8.1	16.6	11.5	0.69	0.79	19.3	21.0	16.4	1.06	12.8	99.3	4.56
70	1.9	0.9	2.1	15.0	10.9	0.73	0.99	18.4	15.2	16.9	1.06	13.3	100.1	4.66
	2.8	2.0	4.6	15.6	11.2	0.72	0.92	18.8	16.9	17.8	1.08	14.1	101.6	4.84
	3.7	3.3	7.6	15.9	11.3	0.71	0.89	18.9	17.9	18.2	1.08	14.5	102.5	4.93
80	1.9	0.9	2.1	14.0	10.5	0.75	1.10	17.8	12.7	18.5	1.09	14.8	103.0	4.99
	2.8	1.8	4.2	14.6	10.8	0.74	1.03	18.2	14.2	19.4	1.10	15.6	104.5	5.17
	3.7	3.1	7.2	15.0	10.9	0.73	1.00	18.4	15.0	19.8	1.10	16.1	105.3	5.26
85	1.9	0.9	2.0	13.4	10.3	0.77	1.16	17.4	11.6	19.2	1.10	15.5	104.3	5.14
	2.8	1.8	4.0	14.1	10.5	0.75	1.09	17.8	13.0	20.1	1.11	16.3	105.8	5.31
	3.7	3.0	6.9	14.4	10.7	0.74	1.05	18.0	13.8	20.5	1.11	16.7	106.5	5.40
90	1.9	0.8	1.8	12.9	10.0	0.78	1.22	17.0	10.5	20.0	1.11	16.2	105.6	5.29
	2.8	1.7	3.9	13.5	10.3	0.76	1.15	17.5	11.8	20.8	1.12	17.0	107.0	5.45
	3.7	2.9	6.7	13.9	10.5	0.75	1.11	17.7	12.5	21.2	1.12	17.3	107.7	5.53
100	1.9	0.8	1.8	11.7	9.6	0.82	1.35	16.3	8.7	Operation Not Recommended				
	2.8	1.6	3.7	12.4	9.8	0.80	1.27	16.7	9.7					
	3.7	2.8	6.5	12.7	10.0	0.78	1.23	17.0	10.3					
110	1.9	0.8	1.8	10.6	9.2	0.87	1.48	15.7	7.2					
	2.8	1.6	3.7	11.2	9.4	0.84	1.40	16.0	8.0					
	3.7	2.7	6.2	11.5	9.5	0.83	1.37	16.2	8.4					
120	1.9	0.7	1.6	9.6	9.0	0.94	1.62	15.1	5.9					
	2.8	1.5	3.5	10.1	9.1	0.90	1.54	15.4	6.5					
	3.7	2.7	6.2	10.4	9.2	0.88	1.51	15.5	6.9					

LEGEND

ARI — Air Conditioning and Refrigeration Institute
db — Dry Bulb
COP — Coefficient of Performance
Cv — Coefficient of Velocity
EAT — Entering Air Temperature (F)
EER — Energy Efficiency Ratio
EWT — Entering Water Temperature (F)
GPM — Gallons per Minute
HC — Heating Capacity (MBtuh)
HE — Heat of Extraction (MBtuh)
HR — Heat of Rejection (MBtuh)
ISO — International Organization for Standardization
LAT — Latent Heat (MBtuh)
LWT — Leaving Water Temperature
MBtuh — Btuh in Thousands
MOPD — Maximum Opening Pressure Difference
SC — Sensible Capacity (MBtuh)
TC — Total Capacity (MBtuh)
wb — Wet Bulb
WPD — Water Pressure Differential

***WPD ADDER FOR MOTORIZED VALVE, 50PEC15 UNIT (Cv = 4.9, MOPD = 125 psi)**

GPM	WPD Adder	
	PSI	FT
1.9	0.7	1.7
2.3	1.7	4.0
3.7	3.3	7.6

NOTES:
1. Interpolation is permissible; extrapolation is not.
2. All entering air conditions are 80 F db and 67 F wb in cooling and 70 F db in heating.
3. ARI/ISO certified conditions are 80.6 F db and 66.2 F wb in cooling and 68 F db in heating.
4. Table does not reflect fan or pump power corrections for ARI/ISO conditions.
5. All performance is based upon the lower voltage of dual voltage rated units.
6. Operation below 40 F EWT is based upon a 15% antifreeze solution.
7. Operation below 60 F EWT requires optional insulated water/refrigerant circuit (standard on residential models).
8. See performance correction tables for operating conditions other than those listed above.
9. For operation in the shaded area when water is used instead of an antifreeze solution, the LWT must be calculated. Flow must be maintained to a level so that the LWT is maintained above 42 F when the JW3 jumper is not clipped. Because the refrigerant temperature can potentially reach as low as 32 F with 40 F LWT, a nuisance cutout could occur due to the activation of the low temperature protection. JW3 should never be clipped for standard range equipment or systems without antifreeze.

Performance data (cont)

50PEC18 — NOMINAL AIRFLOW 620 CFM

EWT (F)	GPM	WPD*		COOLING - EAT 80/67 F						HEATING - EAT 70 F				
		PSI	FT	TC	SC	Sensible/ Total Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	4.5	7.5	17.3	Operation Not Recommended						13.9	1.24	9.8	90.8	3.29
30	2.3	2.2	5.1	18.6	12.3	0.66	0.72	21.0	25.7	15.3	1.28	11.0	92.8	3.51
	3.4	4.4	10.2	17.6	11.6	0.66	0.69	19.9	25.3	15.7	1.28	11.3	93.4	3.57
	4.5	6.9	15.9	16.9	11.1	0.66	0.68	19.3	24.8	15.8	1.29	11.5	93.7	3.61
40	2.3	2.0	4.6	19.3	13.2	0.68	0.80	22.1	24.2	16.6	1.30	12.2	94.8	3.74
	3.4	4.1	9.5	19.0	12.8	0.67	0.75	21.6	25.3	16.9	1.30	12.4	95.2	3.79
	4.5	6.3	14.6	18.8	12.5	0.67	0.73	21.3	25.6	17.0	1.31	12.6	95.4	3.81
50	2.3	1.8	4.2	19.1	13.5	0.70	0.90	22.2	21.4	17.5	1.31	13.0	96.1	3.91
	3.4	3.8	8.8	19.3	13.3	0.69	0.84	22.2	23.1	17.7	1.31	13.2	96.4	3.95
	4.5	6.0	13.9	19.4	13.2	0.68	0.81	22.1	23.9	17.8	1.31	13.3	96.5	3.97
60	2.3	1.6	3.7	18.4	13.3	0.72	1.01	21.8	18.2	18.2	1.31	13.8	97.2	4.07
	3.4	3.6	8.3	18.9	13.4	0.71	0.94	22.1	20.1	18.5	1.31	14.0	97.6	4.12
	4.5	5.6	12.9	19.1	13.5	0.70	0.91	22.2	21.0	18.6	1.31	14.2	97.8	4.15
70	2.3	1.5	3.5	17.2	12.8	0.75	1.13	21.1	15.3	19.3	1.32	14.8	98.8	4.27
	3.4	3.4	7.9	17.9	13.1	0.73	1.06	21.5	17.0	19.7	1.33	15.2	99.5	4.36
	4.5	5.2	12.0	18.2	13.3	0.73	1.02	21.7	17.9	20.0	1.33	15.5	99.9	4.40
80	2.3	1.4	3.2	15.9	12.1	0.76	1.25	20.2	12.7	21.0	1.35	16.4	101.3	4.55
	3.4	3.2	7.4	16.7	12.6	0.75	1.18	20.7	14.1	21.8	1.37	17.1	102.6	4.68
	4.5	5.0	11.6	17.0	12.7	0.75	1.14	21.0	14.9	22.3	1.38	17.6	103.3	4.75
85	2.3	1.4	3.1	15.3	11.7	0.77	1.32	19.8	11.6	22.2	1.38	17.6	103.2	4.73
	3.4	3.1	7.15	16.0	12.2	0.76	1.25	20.3	12.9	23.3	1.40	18.6	104.9	4.88
	4.5	4.9	11.35	16.4	12.4	0.76	1.21	20.6	13.6	24.0	1.42	19.2	105.9	4.97
90	2.3	1.3	3.0	14.6	11.3	0.77	1.39	19.4	10.5	23.5	1.40	18.7	105.1	4.91
	3.4	3.0	6.9	15.3	11.8	0.77	1.32	19.8	11.6	24.9	1.43	20.0	107.2	5.08
	4.5	4.8	11.1	15.7	12.0	0.76	1.28	20.1	12.3	25.7	1.45	20.8	108.4	5.18
100	2.3	1.3	3.0	13.5	10.5	0.78	1.53	18.8	8.8	Operation Not Recommended				
	3.4	2.9	6.7	14.1	10.9	0.78	1.46	19.1	9.6					
	4.5	4.6	10.6	14.4	11.1	0.77	1.42	19.2	10.1					
110	2.3	1.2	2.8	12.8	9.8	0.77	1.67	18.5	7.6					
	3.4	2.8	6.5	13.1	10.1	0.77	1.60	18.6	8.2					
	4.5	4.5	10.4	13.3	10.3	0.78	1.56	18.7	8.5					
120	2.3	1.2	2.8	12.6	9.4	0.74	1.82	18.9	6.9					
	3.4	2.8	6.5	12.6	9.5	0.76	1.75	18.6	7.2					
	4.5	4.4	10.2	12.7	9.7	0.76	1.71	18.5	7.4					

LEGEND

ARI — Air Conditioning and Refrigeration Institute
db — Dry Bulb
COP — Coefficient of Performance
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EAT — Entering Air Temperature (F)
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MBtuh — Btuh in Thousands
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wb — Wet Bulb
WPD — Water Pressure Differential

NOTES:
1. Interpolation is permissible; extrapolation is not.
2. All entering air conditions are 80 F db and 67 F wb in cooling and 70 F db in heating.
3. ARI/ISO certified conditions are 80.6 F db and 66.2 F wb in cooling and 68 F db in heating.
4. Table does not reflect fan or pump power corrections for ARI/ISO conditions.
5. All performance is based upon the lower voltage of dual voltage rated units.
6. Operation below 40 F EWT is based upon a 15% antifreeze solution.
7. Operation below 60 F EWT requires optional insulated water/refrigerant circuit (standard on residential models).
8. See performance correction tables for operating conditions other than those listed above.
9. For operation in the shaded area when water is used instead of an antifreeze solution, the LWT must be calculated. Flow must be maintained to a level so that the LWT is maintained above 42 F when the JW3 jumper is not clipped. Because the refrigerant temperature can potentially reach as low as 32 F with 40 F LWT, a nuisance cutout could occur due to the activation of the low temperature protection. JW3 should never be clipped for standard range equipment or systems without antifreeze.

***WPD ADDER FOR MOTORIZED VALVE, 50PEC18 UNIT (Cv = 4.9, MOPD = 125 psi)**

GPM	WPD Adder	
	PSI	FT
2.3	0.2	0.6
3.4	0.6	1.3
4.5	1.1	2.5

CORRECTION FACTORS — ENTERING AIR — HEATING

HEATING			
Entering Air Dry Bulb (F)	Heating Capacity	Power	Heat of Extraction
60	1.036	0.910	1.068
65	1.019	0.955	1.035
68	1.008	0.982	1.014
70	1.000	1.000	1.000
75	0.98	1.046	0.964
80	0.96	1.091	0.927

CORRECTION FACTORS — ENTERING AIR — COOLING

COOLING										
Entering Air Wet Bulb (F)	Total Capacity	Sensible Cooling Capacity Multiplier - Entering Dry Bulb (F)							Power	Heat of Extraction
		65	70	75	80	80.6	85	90		
60	0.926	0.632	0.820	1.004	1.182	*	*	*	1.003	0.931
65	0.976		0.615	0.856	1.071	1.095	1.260	*	1.000	0.979
66.2	0.990		0.555	0.807	1.030	1.055	1.224	*	1.000	0.992
67	1.000		0.507	0.765	1.000	1.017	1.188	*	1.000	1.000
70	1.039			0.620	0.865	0.893	1.076	1.252	1.001	1.032
75	1.113				0.566	0.597	0.805	1.013	1.002	1.089

LEGEND

ARI — Air Conditioning and Refrigeration Institute
ASHRAE — American Society of Heating, Refrigeration and Air Conditioning Engineers
ISO — International Organization for Standardization

*Sensible capacity equals total capacity.

NOTES:
1. ARI/ISO/ASHRAE 13256-1 uses entering air conditions of cooling - 80.6 F dry bulb/66.2 F wet bulb.
2. ARI/ISO/ASHRAE 13256-1 uses entering air conditions of heating - 68 F dry bulb/59 F wet bulb.

CORRECTION FACTORS — AIRFLOW

AIRFLOW	COOLING				HEATING		
% of Rated	Total Capacity	Sensible Capacity	Power	Heat of Rejection	Heating Capacity	Power	Heat of Extraction
73	0.946	0.898	0.971	0.951	0.967	1.084	0.937
78	0.954	0.927	0.976	0.958	0.976	1.062	0.954
83	0.964	0.953	0.981	0.967	0.983	1.042	0.968
89	0.974	0.974	0.987	0.977	0.990	1.026	0.981
94	0.987	0.990	0.993	0.988	0.995	1.012	0.991
100	1.000	1.000	1.000	1.000	1.000	1.000	1.000
106	1.015	1.002	1.008	1.014	1.004	0.991	1.007
111	1.031	0.996	1.016	1.028	1.006	0.985	1.011

50PEC CONSOLE BLOWER PERFORMANCE

50PEC UNIT SIZE	RATED AIRFLOW (cfm)	AIRFLOW (cfm)		
		Low Speed	Medium Speed	High Speed
09	350	270	310	350
12	450	290	360	450
15	520	360	440	520
18	620	400	500	620

LEGEND

ARI — Air Conditioning and Refrigeration Institute
ISO — International Organization for Standardization

NOTES:
1. Fan speed is field adjustable.
2. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230 v units.
3. All units are ARI/ISO 13256-1 rated on high fan speed.
4. All units are designed and rated for zero external static pressure (non-ducted) application.

Application data

Aquazone™ water source heat pump products are available in a flexible, efficient array of models, which can be used in all types of water loop, ground water, and ground loop type systems. Use Aquazone products to provide optimal energy efficient solutions and adapt to the most challenging design requirements.

AQUAZONE PRODUCT GUIDE

50 SERIES	TYPE SIZE (tons)	APPLICATION
50HQP,VQP	Large Capacity 6-10 (HQP) $6^1/_2$-25 (VQP)	Environmentally sound unit with Puron® refrigerant (R-410A) designed to handle large zoned areas for all geothermal and boiler/tower applications.
50PC	Compact $1^1/_4$-5	Compact WSHP with Puron refrigerant (R-410A) for boiler/tower, ground water, or ground loop systems.
50PS	Premium Efficiency $^1/_2$-6	Premium, ultra efficient unit with Puron refrigerant (R-410A) for new boiler/tower, ground water, or ground loop systems
50PEC	High Efficiency Console $^3/_4$-$1^1/_2$	Efficient console unit with Puron refrigerant (R-410A) and attractive design for finished interior, under-window installations.
50PT	Premium Efficiency 2-6	Premium, ultra efficient 2-stage unit with Puron refrigerant (R-410A) for new boiler/ tower, ground water, or ground loop systems
50PSW	Water-to-Water 3-28	Efficient unit with Puron refrigerant (R-410A) serves as an alternative to pre-heat or cool air. Unit can be used as a stand-alone or supplemental boiler/chiller in most hydronic heating applications. Also conditions process fluids, lubricants, and refrigerants.
50RTG	Rooftop 3-20	Economical solution for indoor air quality (IAQ) problems and tempering ventilation air.
50VS	Premium Efficiency Vertical Stack Heat Pump $^3/_4$ to 3 Tons	Ultra efficient unit with environmentally sound Puron refrigerant (R-410A) for boiler/tower and geothermal applications (condominiums, hotels, etc.). Stacked design allows for common piping and simplistic design.

Water loop system

Water loop (or boiler/tower) system applications typically include a number of units plumbed to a common piping system. For optimal performance, design this system between 2.25 and 3 gpm per ton of cooling capacity. The system is comprised of highly efficient packaged reverse cycle heat pump units interconnected by a water loop. The water circuit serves as both a sink and source for heat absorption and rejection and is designed for entering water temperatures between 60 F and 90 F. Within this temperature range, units can heat or cool from the same water source. Transferring heat from warm to cold spaces in the building, whenever they coexist, conserves energy rather than creating new heat.

Refer to the **Carrier Water Source Heat Pump System Design Guide** for assistance designing water loop systems. The guide includes a practical approach for the latest and most current design recommendations including:

- Horizontal, vertical, console, rooftop and water-to-water product applications.
- Ventilation methods and system design including energy recovery.
- Acoustical considerations for different product types.
- Addressing IAQ issues such as condensate removal, humidity control.
- Air distribution design including diffuser selection/ layout and ductwork design.
- Hydronic system design including pipe sizing/layout and boiler/tower sizing.
- Control configurations such as stand alone, DDC, DCV, and VVT®.
- WSHP efficiency/operational cost comparison chart.
- System variations such as a system without a boiler, variable pumping, and VAV for interior use.

Ground water systems

To use Aquazone units in ground water applications, the extended range should be specified. This will provide factory-installed coaxial coil insulation to prevent condensate from dripping when entering water temperatures are below 60 F. In addition, the copper coaxial coil installed on the Aquazone units may not be suitable for all water conditions. Refer to the Water Conditioning section for proper coaxial coil material selection.

Surface water system — This system is typically located near a lake or pond. In this application, the loop can be submerged in a series of coils beneath the water surface. The number of coils required depends on system load and design. This application requires minimum piping and excavation.

Open loop system — Use this system where ground water is plentiful. In this application, ground water is pumped through supply piping from the well to the building. The water is then pumped back into the ground through a discharge well as it leaves the building. An additional heat exchanger is usually installed between the building water piping system and the ground water piping system. This design limits piping and excavation.

Aquazone units include a standard TXV and are rated to extremely low temperatures to self-adjust the refrigeration circuit. Therefore, open loop systems do not require water regulating valves. Use a slow opening/closing solenoid valve to conserve water.

Ground loop systems

There are many commonly specified designs for ground loop applications. Typical designs include vertical loops and horizontal loops. In some applications, water is piped from the ground or lake directly to the water source heat pump. This system only requires piping to get the water from the source to the unit.

NOTE: When utilizing Aquazone water source heat pumps in ground loop systems, refer to the design considerations in the ground water system section.

Horizontal ground loop — Use this system when adequate space is available and trenching can be easily accomplished. A series of parallel pipes are laid out in trenches 3 to 6 feet below the ground surface, and then back-filled. Often, multiple pipes are used to maximize each trench's heat transfer capability. Ground conditions, heating and cooling requirements, and system design determine piping requirements and ground loop field size.

Vertical ground loop — Use this system in vertical borehole applications. This design is well suited for retrofit applications when space is limited or where landscaping is already complete and minimum site disruption is desired. The vertical ground loop system contains a single loop of

pipe inserted into a hole. The hole is back-filled and grouted after the pipe is inserted. The completed loop is concealed below ground. The number of loops required depends on ground conditions, heating and cooling requirements, and the depth of each hole.

Hybrid systems — In some applications, it may be beneficial to incorporate a cooling tower into the ground loop system to reduce the overall cost. A hybrid system discards excess heat into the air and increases the cooling performance of the ground loop.

Condensate drainage

Connect the console unit condensate drain to the building condensate drain with a flexible, non-pressure rate plastic hose. Be sure to avoid kinks in this hose to ensure an unobstructed flow of condensate from the unit to the drain. The condensate hose's horizontal run is usually too short to pose any drainage problems, however, make sure this line is pitched at least 1 in. for every 10 ft of run (in the direction of the flow.) Avoid low points and unpitched piping since dirt collects in these areas and may cause stoppage and overflow.

Installing a trap or drain in the field is not required unless specified by local codes. The 50PEC units are designated in a blow-thru configuration. The condensate drain pan is located on the outlet side of the blower so that the pressure in the drain pan is higher than the atmospheric pressure.

Water conditioning

In some applications, maintaining proper water quality may require higher corrosion protection for the water-to-refrigerant heat exchanger. Water quality varies from location to location and is unique for each job. Water characteristics such as pH value, alkalinity, hardness, and specific conductance are important when considering any WSHP application. Water typically includes impurities and hardness that must be removed. The required treatment depends on the water quality as well as system type. Water problems fall into three main categories:

1. Scale formation caused by hard water reduces the heat transfer rate and increases the water pressure drop through the heat exchanger. As water is heated, minerals and salts are precipitated from a solution and deposited on the inside surface of the pipe or tube.
2. Corrosion is caused by absorption of gases from the air coupled with water on exposed metal. Corrosion is also common in salt-water areas.
3. Organic growths, such as algae, can reduce the heat transfer rate by forming an insulating coating on the inside tube surface. Algae can also promote corrosion by pitting.

NOTE: In most commercial water loop applications, Aquazone™ WSHP units use copper water-to-refrigerant heat exchanger. Units can also be equipped with a cupronickel heat exchanger for applications where water is outside the copper heat exchanger's standard contaminant limits.

WATER QUALITY GUIDELINES

CONDITION	ACCEPTABLE LEVEL		
pH	7 to 9 range for copper. Cupronickel may be used in the 5 to 9 range.		
Total Hardness	Calcium and magnesium carbonate should not exceed 20 grains per gallon (350 ppm).		
Iron Oxides	Less than 1 ppm.		
Iron Bacteria	No level allowable.		
Corrosion*		Max Allowable Level	Coaxial Metal
	Ammonia, Ammonium Hydroxide	0.5 ppm	Cu
	Ammonium Chloride, Ammonium Nitrate	0.5 ppm	Cu
	Ammonium Sulfate	0.5 ppm	Cu
	Chlorine/Chlorides	0.5 ppm	CuNi
	Hydrogen Sulfide†	None Allowable	—
Brackish	Use Cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

*If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.

†Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.

NOTE: To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

Acoustical design

Sound power levels represent the sound that the source, the WSHP unit, produces with no regard to attenuation between the source and the space. Acoustical design goals are necessary to provide criteria for occupied spaces. These goals help ensure that people can be comfortable and communicate effectively over the background noise of the air-conditioning system and other background noise sources.

Acoustical design goals are desirable sound pressure levels within a given conditioned space and are represented by noise criteria (NC) curves. Noise criteria (NC) curve levels represent a peak over a full frequency spectrum. A high value in a low frequency band has the same effect on NC level as a lower value in a high frequency band. It is important that sound levels be balanced over the entire spectrum relative to the NC curve. The lower the NC criteria curve, the more stringent the room acoustical design must be to meet the design goals.

It is important to know how to convert the unit ratings from sound power (Lw) to sound pressure (Lp). This conversion depends on the specifics of the installation's acoustical environment. Assessing an area's acoustical design requires that you compare the sound pressure (Lp) with the NC curve for the selected area.

The resulting calculations are compared to the NC curve selected for the area to assess the acoustical design.

Application data (cont)

Some of the factors that affect conversion of sound power to sound pressure and consequent NC level include:

- Type of acoustical ceiling
- Use of metal or flex duct
- Absorption in the occupied space
- Location in the occupied space
- Open or closed layout plan
- Use of open or ducted returns
- Orientation of unit to occupant
- Use of lined or unlined duct

OCTAVE BAND SOUND PRESSURE LEVEL (Lp) ASSOCIATED WITH NC CURVES

NOISE CRITERIA CURVES	OCTAVE BAND SOUND PRESSURE LEVEL (Lp) Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
NC-15	49	36	26	17	17	14	12	11
NC-20	52	41	33	27	22	19	17	16
NC-25	54	45	38	31	27	24	22	21
NC-30	58	49	41	36	31	29	28	27
NC-35	61	53	45	40	36	34	33	32
NC-40	64	57	50	45	41	39	38	37
NC-45	67	61	54	49	46	44	43	42
NC-50	71	64	58	54	51	49	48	47
NC-55	74	68	63	58	56	54	53	52
NC-60	77	71	67	63	61	59	58	57
NC-65	80	75	71	68	66	64	63	62

WSHP sound control

Analyzing the projected sound level in the conditioned space caused by a WSHP unit is quite involved. The key is to have good sound power ratings (Lw) in dB on the equipment to determine the ductwork, ceiling and room sound attenuation effect.

Console units

With console units, the fan and compressor are located within the space, and only the casing design attenuates the transmission of sound sources into the space. The designer should carefully review the manufacturer's acoustical data when selecting console units and use lower fan speeds to minimize space noise.

Operating limits

Environment

This equipment is designed for indoor installation ONLY.

Power supply

A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

Starting conditions

The 50PEC unit will start and operate in an ambient temperature of 50 F, with entering-air temperature at 50 F, with entering-water temperature at 60 F, with both air and water at the flow rates used in the ARI/ISO Standard 13256-1 rating test, for initial start-up in winter.

NOTE: These are not normal or continuous operating conditions. Such a start-up should be used to bring the building space up to occupancy temperature.

AIR LIMITS

	50PEC UNIT	
	Cooling	Heating
Min. Ambient Air	50 F	50 F
Rated Ambient Air	80 F	68 F
Max. Ambient Air	100 F	85 F
Min. Entering Air	50 F	50 F
Rated Entering Air, db/wb	80/66 F	68 F
Max. Entering Air, db/wb	100/82 F	80 F

WATER LIMITS

	50PEC UNIT	
	Cooling	Heating
Min. Entering Water	30 F*	20 F*
Normal Entering Water	85 F	70 F
Max. Entering Water	120 F	90 F

LEGEND

db — Dry Bulb
wb — Wet Bulb

*Requires optional extended range insulation package when operating below the dew point.

NOTES:
1. Minimum air and water conditions can only be used at ARI/ISO 13256-1 flow rates.
2. The 50PEC units may have up two values at maximum or minimum with all other parameters at normal conditions.

Solenoid valves

In applications using variable flow pumping, solenoid valves can be factory installed and operated from the control board in the Aquazone™ WSHP unit.

Freeze protection

Applications where systems are exposed to outdoor temperatures below freezing (32 F) must be protected from freezing. The most common method of protecting water systems from freezing is adding glycol concentrations into the water. Use design care when selecting both the type and concentrations of glycol due to the following:

- Equipment and performance may suffer with high concentrations of glycol and other antifreeze solutions
- Loss of piping pressure may increase greatly, resulting in higher pumping costs
- Higher mixture viscosity may cause excess corrosion and wear on the entire system
- The water's acidity may be greatly increased, promoting corrosion

Glycol promotes galvanic corrosion in systems of dissimilar metals. The result is corrosion of one metal by the other, causing leaks.

COMPLETE C AND DELUXE D ELECTRONIC CONTROL FEATURES COMPARISON

BASIC FEATURES	COMPLETE C	COMPLETE C WITH LON	DELUXE D	DELUXE D WITH LON	COMPLETE C OR DELUXE D WITH WSHP OPEN CONTROLLER
High and Low Refrigerant Pressure Protection	S	S	S	S	S
Water Coil Freeze Protection	S	S	S	S	S
True 24 VA Thermostat Signals	S	S	S	S	S
Thermostat Inputs Compatible with Triacs	S	S	S	S	S
Condensate Overflow Sensor	S	S	S	S	S
Anti-Short-Cycle Time Delay	S	S	S	S	S
Random Start	S	S	S	S	S
Alarm (selectable dry contact or 24 VA)	S	S	S	S	S
Water Valve Relay	S	S	S	S	S
Water Valve Relay with Compressor Delay	N/A	N/A	S	S	S
Emergency Shutdown	N/A	DDC	S	DDC	DDC
Night Setback with Override	N/A	DDC	S	DDC	DDC
Outdoor Air Damper Control	N/A	N/A	S	S	S
ADVANCED FEATURES					
Intelligent Reset	S	S	S	S	S
High and Low Voltage Protection	S	S	S	S	S
Air Coil Freeze Protection	S	S	S	S	S
Freeze Set Point Field Select (water, antifreeze)	S	S	S	S	S
Electric Heat Control Outputs	S	S	S	S	S
Boilerless Electric Heat Control	N/A	N/A	S	S	S
Intelligent Reversing Valve Operation	N/A	DDC	S	S	S
High/Low Fan Speed Outputs	N/A	N/A	S	S	S
Intelligent Fan Speed Control	N/A	N/A	S	S	S
Thermostat Type Select (Y,O or Y,W)	N/A	N/A	S	N/A	N/A
Reversing Valve Signal Select (O or B)	N/A	N/A	S	N/A	N/A
Dehumidistat Input	N/A	N/A	S	S	S
Reheat Dehumidification Control	N/A	N/A	O	O	O
Multiple Units on One Thermostat/Wall Sensor	N/A	DDC	S	DDC	DDC
Condenser Waterside/Airside Linkage	N/A	N/A	N/A	N/A	S
Waterside Economizer	N/A	N/A	N/A	N/A	S
Proactive Diagnostics	N/A	N/A	N/A	N/A	S
CO_2 Sensor Capable	N/A	N/A	N/A	N/A	S
IAQ Capable	N/A	N/A	N/A	N/A	S
SERVICE AND RELIABILITY FEATURES					
Service Test Mode	S	S	S	S	S
LED Fault and Status Lights	S	S	S	S	S
Fault Memory After Reset	S	S	S	S	S
Unit Performance Sentinel	S	S	S	S	S
Harness-Type Factory Wiring Connections	S	S	S	S	S
Fully Noise-Tested Design	S	S	S	S	S
CE Approval	S	S	S	S	S
Removable Low Voltage Connector	N/A	N/A	S	S	S
DDC/ENERGY MANAGEMENT FEATURES					
LONMark® Compliant	N/A	S	N/A	S	S
BACnet™ Compliant	N/A	N/A	N/A	N/A	S
Johnson N2 Compliant	N/A	N/A	N/A	N/A	S
Modbus Compliant	N/A	N/A	N/A	N/A	S
Leaving Air and Water Temperature Sensor	N/A	S	N/A	S	S
Digital Wall Sensor	N/A	O	N/A	O	O

LEGEND

Complete C — Complete C Control System
DDC — Direct Digital Controls
Deluxe D — Deluxe D Control System
IAQ — Indoor Air Quality
LON — LONMark® Controller
N/A — Not Available
O — Optional
S — Standard

Application data (cont)

ANTIFREEZE CORRECTION TABLE

ANTIFREEZE TYPE	ANTIFREEZE %	COOLING EWT 90 F			HEATING EWT 30 F		WPD CORRECTION FACTOR EWT 30 F
		Total Capacity	Sensible Capacity	Power	Heating Capcity	Power	
Water	0	1.000	1.000	1.000	1.000	1.000	1.000
Propylene Glycol	5	0.995	0.995	1.003	0.989	0.997	1.070
	15	0.986	0.986	1.009	0.968	0.990	1.210
	25	0.978	0.978	1.014	0.947	0.983	1.360
Methanol	5	0.997	0.997	1.002	0.989	0.997	1.070
	15	0.990	0.990	1.007	0.968	0.990	1.160
	25	0.982	0.982	1.012	0.949	0.984	1.220
Ethanol	5	0.998	0.998	1.002	0.981	0.994	1.140
	15	0.994	0.994	1.005	0.944	0.983	1.300
	25	0.986	0.986	1.009	0.917	0.974	1.360
Ethylene Glycol	5	0.998	0.998	1.002	0.993	0.998	1.040
	15	0.994	0.994	1.004	0.980	0.994	1.120
	25	0.988	0.988	1.008	0.966	0.990	1.200

LEGEND

EWT — Entering Water Temperature

Electrical data

50PEC UNIT SIZE	VOLTAGE CODE	V-Ph-Hz	MIN/MAX VOLTAGE	COMPRESSOR			FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMPS	MAX FUSE/ HACR
				QTY	RLA	LRA				
09	1	115-1-60	104/126	1	8.1	46.5	0.6	8.6	10.7	15
	3	208/230-1-60	197/254	1	4.5	23.0	0.4	4.9	6.0	15
	4	265-1-60	239/292	1	3.1	24.0	0.4	3.5	4.3	15
12	1	115-1-60	104/126	1	10.6	55.8	1.0	11.6	14.3	25
	3	208/230-1-60	197/254	1	5.2	24.0	0.6	5.8	7.1	15
	4	265-1-60	239/292	1	4.2	25.0	0.4	4.6	5.7	15
15	3	208/230-1-60	197/254	1	6.1	30.0	0.8	6.9	8.4	15
	4	265-1-60	239/292	1	4.7	28.5	0.6	5.3	6.5	15
18	3	208/230-1-60	197/254	1	6.8	38.0	0.7	7.5	9.2	15
	4	265-1-60	239/292	1	6.2	29.0	0.6	6.8	8.4	15

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
RLA — Rated Load Amps

WSHP Open sequence of operation

The WSHP Open multi-protocol controller will control mechanical cooling, heating and waterside economizer outputs based on its own space temperature input and set points. An optional CO_2 IAQ (indoor air quality) sensor mounted in the space can maximize the occupant comfort. The WSHP Open controller has its own hardware clock that is automatically set when the heat pump software is downloaded to the board. Occupancy types are described in the scheduling section below. The following sections describe the functionality of the WSHP Open multi-protocol controller. All point objects referred to in this sequence of operation will be referenced to the objects as viewed in the BACview6 handheld user interface.

Scheduling — Scheduling is used to start/stop the unit based on a time period to control the space temperature to specified occupied heating and cooling set points. The controller is defaulted to control by occupied set points all the time, until either a time schedule is configured with BACview6, Field Assistant, i-Vu® Open, or a third party control system to enable/disable the BAS (Building Automation System) on/off point. The local time and date must be set for these functions to operate properly. The occupancy source can be changed to one of the following:

Occupancy schedules — The controller will be occupied 24/7 until a time schedule has been configured using either Field Assistant, i-Vu Open, BACview6 or a third party control system to enable/disable the BAS on/off point. The BAS point can be disabled by going to Config, then Unit, then Occupancy Schedules and changing the point from enable to disable then clicking OK.

NOTE: This point must be enabled in order for the i-Vu Open, Field Assistant, or BACview6 control system to assign a time schedule to the controller.

Schedule_schedule — The unit will operate according to the schedule configured and stored in the unit. The schedule is accessible via the BACview6 Handheld tool, i-Vu Open, or Field Assistant control system. The daily schedule consists of a start/stop time (standard or 24-hour mode) and seven days of the week, starting with Monday and ending on Sunday. To enter a daily schedule, navigate to Config, then Sched, then enter BACview6 Admin Password (1111), then go to schedule_schedule. From here, enter either a Weekly or Exception schedule for the unit.

Occupancy input contact — The WSHP Open controller has the capability to use an external dry contact closure to determine the occupancy status of the unit. The Occupancy Schedules will need to be disabled in order to utilize the occupancy contact input.

NOTE: Scheduling can only be controlled from one source.

BAS (Building Automation System) on/off — A BAS system that supports network scheduling can control the unit through a network communication and the BAS scheduling function once the Occupancy Schedules have been disabled.

NOTE: Scheduling can either be controlled via the unit or the BAS, but not both.

Indoor fan — The indoor fan will operate in any one of three modes depending on the user configuration selected.

Fan mode can be selected as Auto, Continuous, or Always On. In Auto mode, the fan is in intermittent operation during both occupied and unoccupied periods. Continuous fan mode is intermittent during unoccupied periods and continuous during occupied periods. Always On mode operates the fan continuously during both occupied and unoccupied periods. In the default mode, Continuous, the fan will be turned on whenever any one of the following is true:

- The unit is in occupied mode as determined by its occupancy status.
- There is a demand for cooling or heating in the unoccupied mode.
- There is a call for dehumidification (optional).

When power is reapplied after a power outage, there will be a configured time delay of 5 to 600 seconds before starting the fan. There are also configured fan delays for Fan On and Fan Off. The Fan On delay defines the delay time (0 to 30 seconds; default 10) before the fan begins to operate after heating or cooling is started while the Fan Off delay defines the delay time (0 to 180 seconds; default 45) the fan will continue to operate after heating or cooling is stopped. The fan will continue to run as long as the compressors, heating stages, or the dehumidification relays are on. If the SPT failure alarm or condensate overflow alarm is active; the fan will be shut down immediately regardless of occupancy state or demand.

Fan speed control (during heating) — Whenever heat is required and active, the control continuously monitors the supply-air temperature to verify it does not rise above the configured maximum heating SAT limit (110 F default). As the SAT approaches this value, the control will increase the fan speed as required to ensure the SAT will remain within the limit. This feature provides the most quiet and efficient operation by operating the fan at the lowest speed possible.

Fan speed control (during cooling) — Whenever mechanical cooling is required and active, the control continuously monitors the supply-air temperature to verify it does not fall below the configured minimum cooling SAT limit (50 F default). As the SAT approaches this value, the control will increase the fan speed as required to ensure the SAT will remain within the limit. The fan will operate at lowest speed to maximize latent capacity during cooling.

Cooling — The WSHP Open controller will operate one or two stages of compression to maintain the desired cooling set point. The compressor outputs are controlled by the PI (proportional-integral) cooling loop and cooling stages capacity algorithm. They will be used to calculate the desired number of stages needed to satisfy the space by comparing the space temperature (SPT) to the appropriate cooling set point. The water side economizer, if applicable, will be used for first stage cooling in addition to the compressor(s). The following conditions must be true in order for the cooling algorithm to run:

- Cooling is set to Enable.
- Heating mode is not active and the compressor time guard has expired.

- Condensate overflow input is normal.
- If occupied, the SPT is greater than the occupied cooling set point.
- Space temperature reading is valid.
- If unoccupied, the SPT is greater than the unoccupied cooling set point.
- If economizer cooling is available and active and the economizer alone is insufficient to provide enough cooling.
- OAT (if available) is greater than the cooling lockout temperature.

If all the above conditions are met, the compressors will be energized as required, otherwise they will be deenergized. If cooling is active and should the SAT approach the minimum SAT limit, the fan will be indexed to the next higher speed. Should this be insufficient and if the SAT falls further (equal to the minimum SAT limit), the fan will be indexed to the maximum speed. If the SAT continues to fall 5° F below the minimum SAT limit, all cooling stages will be disabled.

During Cooling mode, the reversing valve output will be held in the cooling position (either B or O type as configured) even after the compressor is stopped. The valve will not switch position until the Heating mode is required.

The configuration screens contain the minimum SAT parameter as well as cooling lockout based on outdoor-air temperature (OAT). Both can be adjusted to meet various specifications.

There is a 5-minute off time for the compressor as well as a 5-minute time delay when staging up to allow the SAT to achieve a stabile temperature before energizing a second stage of capacity. Likewise, a 45-second delay is used when staging down.

After a compressor is staged off, it may be restarted again after a normal time-guard period of 5 minutes and if the supply-air temperature has increase above the minimum supply-air temperature limit.

The WSHP Open controller provides a status input to monitor the compressor operation. The status is monitored to determine if the compressor status matches the commanded state. This input is used to determine if a refrigerant safety switch or other safety device has tripped and caused the compressor to stop operating normally. If this should occur, an alarm will be generated to indicate the faulted compressor condition.

Heating — The WSHP Open controller will operate one or two stages of compression to maintain the desired heating set point. The compressor outputs are controlled by the heating PI (proportional-integral) loop and heating stages capacity algorithm. They will be used to calculate the desired number of stages needed to satisfy the space by comparing the space temperature (SPT) to the appropriate heating set point. The following conditions must be true in order for the heating algorithm to run:

- Heating is set to Enable.
- Cooling mode is not active and the compressor time guard has expired.
- Condensate overflow input is normal.
- If occupied, the SPT is less than the occupied heating set point.
- Space temperature reading is valid.
- If unoccupied, the SPT is less than the unoccupied heating set point.
- OAT (if available) is less than the heating lockout temperature.

If all the above conditions are met, the heating outputs will be energized as required, otherwise they will be deenergized. If the heating is active and should the SAT approach the maximum SAT limit, the fan will be indexed to the next higher speed. Should this be insufficient, and the SAT rises further reaching the maximum heating SAT limit, the fan will be indexed to the maximum speed. If the SAT still continues to rise 5° F above the maximum limit, all heating stages will be disabled.

During Heating mode, the reversing valve output will be held in the heating position (either B or O type as configured) even after the compressor is stopped. The valve will not switch position until the Cooling mode is required.

The configuration screens contain the maximum SAT parameter as well as heating lockout based on outdoor-air temperature (OAT); both can be adjusted to meet various specifications.

There is a 5-minute off time for the compressor as well as a 5-minute time delay when staging up to allow the SAT to achieve a stable temperature before energizing a second stage of capacity. Likewise, a 45-second delay is used when staging down.

After a compressor is staged off, it may be restarted again after a normal time-guard period of 5 minutes and if the supply-air temperature has fallen below the maximum supply air temperature limit.

The WSHP Open controller provides a status input to monitor the compressor operation. The status is monitored to determine if the compressor status matches the commanded state. This input is used to determine if a refrigerant safety switch or other safety device has tripped and caused the compressor to stop operating normally. If this should occur, an alarm will be generated to indicate the faulted compressor condition. Also, if auxiliary heat is available (see below), the auxiliary heat will operate to replace the reverse cycle heating and maintain the space temperature as required.

Auxiliary heat — The WSHP Open controller can control a two-position, modulating water, or steam valve connected to a coil on the discharge side of the unit and supplied by a boiler or a single-stage ducted electric heater in order to maintain the desired heating set point. Should the compressor capacity be insufficient or a compressor failure occurs, the auxiliary heat will be used. Unless the compressor fails, the auxiliary heat will only operate to supplement the heat provided by the compressor if the space temperature falls more than one degree below the desired heating set point (the amount is configurable). The heat will be controlled so the SAT will not exceed the maximum heating SAT limit.

Auxiliary modulating hot water/steam heating reheat — The control can modulate a hot water or steam valve

connected to a coil on the discharge side of the unit and supplied by a boiler in order to maintain the desired heating set point should the compressor capacity be insufficient or a compressor failure occurs. Unless a compressor fault condition exists, the valve will only operate to supplement the heat provided by the compressor if the space temperature falls more than one degree below the desired heating set point. The valve will be controlled so the SAT will not exceed the maximum heating SAT limit.

Two-position hot water/steam heating reheat — The control can operate a two-position, NO or NC, hot water or steam valve connected to a coil on the discharge side of the unit and supplied by a boiler in order to maintain the desired heating set point should the compressor capacity be insufficient or a compressor failure occurs. Unless a compressor fault condition exists, the valve will only open to supplement the heat provided by the compressor if the space temperature falls more than one degree below the desired heating set point. The valve will be controlled so the SAT will not exceed the maximum heating SAT limit. The heat stage will also be subject to a 2-minute minimum OFF time to prevent excessive valve cycling.

Single stage electric auxiliary heat — The control can operate a field-installed single stage of electric heat installed on the discharge side of the unit in order to maintain the desired heating set point should the compressor capacity be insufficient or a compressor failure occurs. Unless a compressor fault condition exists, the heat stage will only operate to supplement the heat provided by the compressor if the space temperature falls more than one degree below the desired heating set point. The heat stage will be controlled so the SAT will not exceed the maximum heating SAT limit. The heat stage will also be subject to a 2-minute minimum OFF time to prevent excessive cycling.

Indoor air quality (IAQ) and demand controlled ventilation (DCV) — If the optional indoor air quality sensor is installed, the WSHP Open controller can maintain indoor air quality via a modulating OA damper providing demand controlled ventilation. The control operates the modulating OA damper during occupied periods. The control monitors the CO_2 level and compares it to the configured set points, adjusting the ventilation rate as required. The control provides proportional ventilation to meet the requirements of ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) specifications by providing a base ventilation rate and then increasing the rate as the CO_2 level increases. The control will begin to proportionally increase ventilation when the CO_2 level rises above the start ventilation set point and will reach the full ventilation rate when the CO_2 level is at or above the maximum set point. A user-configurable minimum damper position ensures that proper base ventilation is delivered when occupants are not present. The IAQ configurations can be accessed through the configuration screen. The following conditions must be true in order for this algorithm to run:

- Damper control is configured for DCV.
- The unit is in an occupied mode.
- The IAQ sensor reading is greater than the DCV start control set point.

The control has four user adjustable set points: DCV start control set point, DCV maximum control set point, minimum damper position, and DCV maximum damper position.

Two-position OA damper — The control can be configured to operate a ventilation damper in a two-position ventilation mode to provide the minimum ventilation requirements during occupied periods.

Waterside economizer — The WSHP Open controller has the capability of providing modulating or two-position water economizer operation (for a field-installed economizer coil mounted to the entering air side of the unit and connected to the condenser water loop) in order to provide free cooling (or preheating) when water conditions are optimal. Water economizer settings can be accessed through the equipment status screen. The following conditions must be true for economizer operation:

- SAT reading is available.
- EWT reading is available.
- If occupied, the SPT is greater than the occupied cooling set point or less than the occupied heating set point and the condenser water is suitable.
- Space temperature reading is valid.
- If unoccupied, the SPT is greater than the unoccupied cooling set point or less than the unoccupied heating set point and the condenser water is suitable.

Modulating water economizer control — The control has the capability to modulate a water valve to control condenser water flowing through a coil on the entering air side of the unit.

Cooling — The purpose is to provide an economizer cooling function by using the water loop when the entering water loop temperature is suitable (at least 5° F below space temperature). If the water loop conditions are suitable, then the valve will modulate open as required to maintain a supply air temperature that meets the load conditions. Should the economizer coil capacity alone be insufficient for a period greater than 5 minutes, or should a high humidity condition occur, then the compressor will also be started to satisfy the load. Should the SAT approach the minimum cooling SAT limit, the economizer valve will modulate closed during compressor operation.

Heating — Additionally, the control will modulate the water valve should the entering water loop temperature be suitable for heating (at least 5° F above space temperature) and heat is required. The valve will be controlled in a similar manner except to satisfy the heating requirement. Should the economizer coil capacity alone be insufficient to satisfy the space load conditions for more than 5 minutes, then the compressor will be started to satisfy the load. Should the SAT approach the maximum heating SAT limit, the economizer valve will modulate closed during compressor operation.

Two-position water economizer control — The control has the capability to control a NO or NC, two-position water valve to control condenser water flow through a coil on the entering air side of the unit.

Cooling — The purpose is to provide a cooling economizer function directly from the condenser water loop when

the entering water loop temperature is suitable (at least 5° F below space temperature). If the optional coil is provided and the water loop conditions are suitable, then the valve will open to provide cooling to the space when required. Should the capacity be insufficient for a period greater than 5 minutes, or should a high humidity condition occur, then the compressor will be started to satisfy the load. Should the SAT reach the minimum cooling SAT limit, the economizer valve will close during compressor operation.

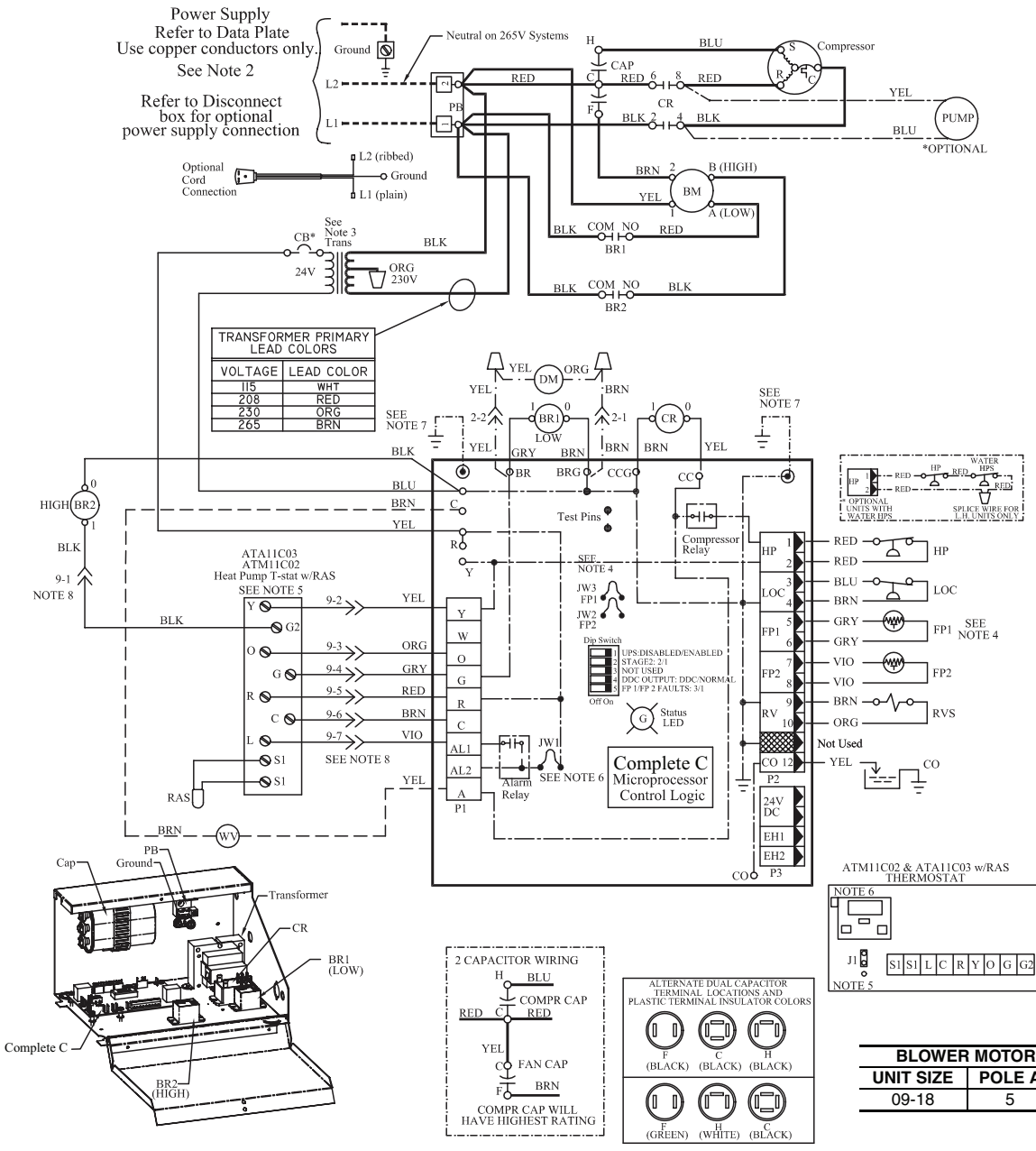
Heating — Additionally, the economizer control will open the water valve should the entering water loop temperature be suitable for heating (at least 5° F above space temperature) and heat is required. The valve will be controlled in a similar manner except to satisfy the heating requirement. Should the coil capacity be insufficient to satisfy the space load for more than 5 minutes, then the compressor will be started to satisfy the load. Should the SAT reach the maximum heating SAT limit, the economizer valve will close during compressor operation.

Demand limit — The WSHP Open controller has the ability to accept three levels of demand limit from the network. In response to a demand limit, the unit will decrease its heating set point and increase its cooling set point to widen the range in order to immediately lower the electrical demand. The amount of temperature adjustment in response is user adjustable for both heating and cooling and for each demand level. The response to a particular demand level may also be set to zero.

Condenser water linkage — The control provides optimized water loop operation using an universal controller (UC) open loop controller. Loop pump operation is automatically controlled by WSHP equipment occupancy schedules, unoccupied demand and tenant override conditions. Positive pump status feedback prevents nuisance fault trips. The condenser water linkage operates when a request for condenser water pump operation is sent from each WSHP to the loop controller. This request is generated whenever any WSHP is scheduled to be occupied, is starting during optimal start (for warm-up or pull down prior to occupancy), there is an unoccupied heating or cooling demand, or a tenant pushbutton override. At each WSHP, the water loop temperature and the loop pump status is given. The WSHP will NOT start a compressor until the loop pumps are running or will shutdown the compressors should the pumps stop. This prevents the WSHP from operating without water flow and thus tripping out on refrigerant pressure, causing a lockout condition. The WSHP Open controller will prevent this from occurring. Also, the loop controller can be configured to start the pumps only after a configurable number of WSHPs are requesting operation (from 1-"N"). This can be used to prevent starting the entire loop operation for only one WSHP. Meanwhile, the WSHPs will not operate if the loop pump status is off and therefore the WSHP compressor will not run.

Typical control wiring schematics

50PEC UNIT MANUAL OR AUTO CHANGEOVER WITH COMPLETE C CONTROLLER WIRING



BLOWER MOTOR WIRING		
UNIT SIZE	POLE A	POLE B
09-18	5	4

LEGEND

AL	—	Alarm Relay Contacts
BM	—	Blower Motor
BR	—	Blower Relay
CAP	—	Capacitor
CB	—	Circuit Breaker
CO	—	Sensor, Condensate Overflow
CR	—	Compressor Relay
DM	—	Damper Motor
FP1	—	Sensor, Water Coil Freeze Protection
FP2	—	Sensor, Air Coil Freeze Protection
HP	—	High-Pressure Switch
JW1	—	Jumper Wire for Alarm
LOC	—	Loss of Charge Pressure Switch
PB	—	Power Terminal Block
RAS	—	Return Air Sensor
RVS	—	Reversing Valve Solenoid
TRANS	—	Transformer
WV	—	Water Valve
----------		Field Line Voltage Wiring
– – – –		Field Low-Voltage Wiring
—·—		Printed Circuit Trace
▬▬▬		Option Low Voltage Wiring

Relay/Contactor Coil
Solenoid Coil
Thermistor
Circuit Breaker
Relay Contacts-N.O.
Switch-Temperature
Switch-High Pressure
Switch-Low Pressure
Ground
Wire Nut
Mate-N-Lok

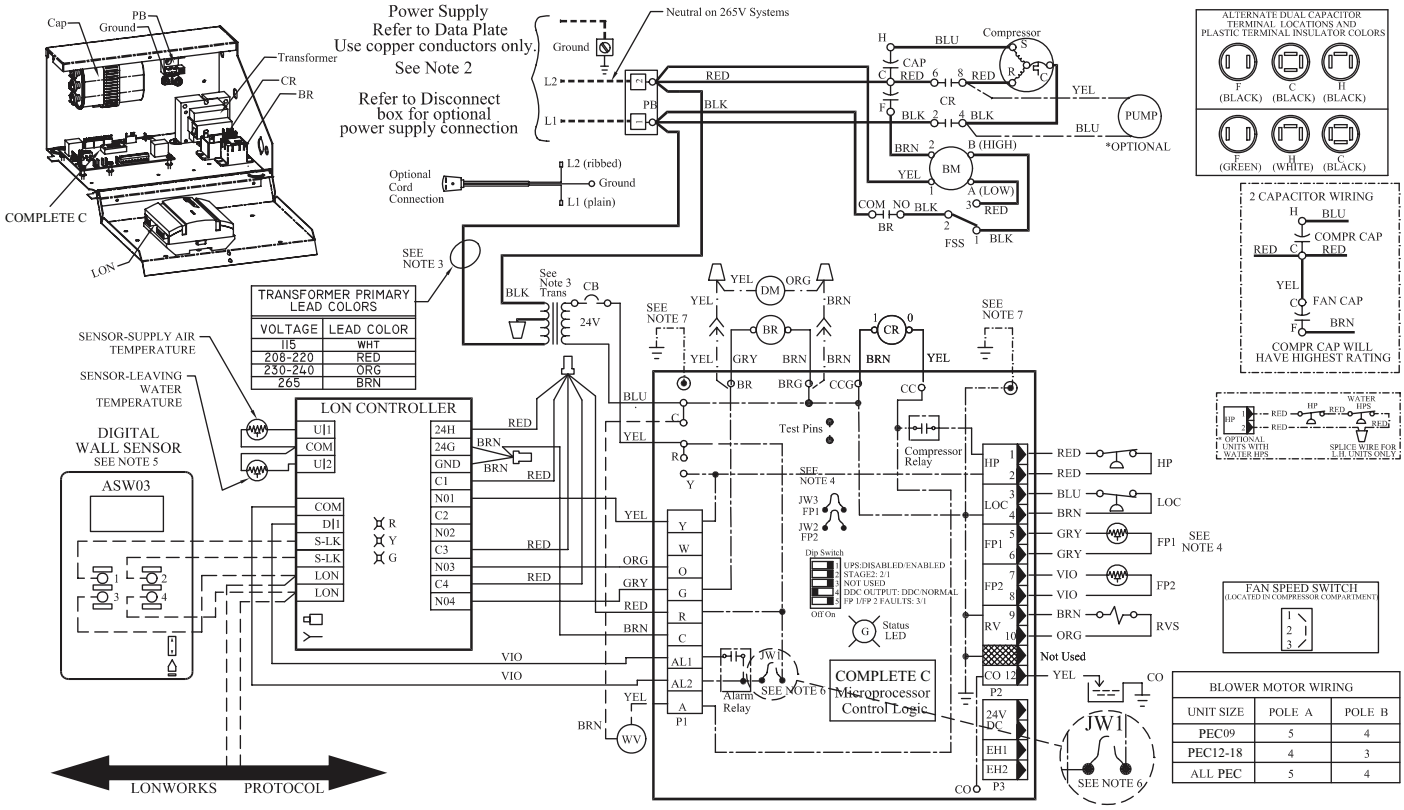
*Optional wiring.
†Registered trademark of AMP Incorporated.

NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 115-V (WHT) lead for 115/1/60 units; 265-V (BRN) lead for 265/1/60 units; or 208-V (RED) lead for 208/1/60 units. For 230/1/60 operation, switch the RED and ORG leads at L1 and insulate the RED lead. Transformer is energy limiting or may have a circuit breaker.
4. FP1 thermistor provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut JW3 jumper.
5. For remote sensor, position jumper J1 on upper 2 pins.
6. 24-v alarm signal shown. For dry alarm contact, cut JW1 jumper. Dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Complete C board standoffs and screws to control box. (Ground available from top two standoffs as shown.)
8. Mate-N-Lok®† plug is optional.

Typical control wiring schematics (cont)

50PEC UNIT WITH COMPLETE C AND LON CONTROLLERS



LEGEND

AL	—	Alarm Relay Contacts
BM	—	Blower Motor
BR	—	Blower Relay
CAP	—	Capacitor
CB	—	Circuit Breaker
CO	—	Sensor, Condensate Overflow
CR	—	Compressor Relay
DM	—	Damper Motor
FP1	—	Sensor, Water Coil Freeze Protection
FP2	—	Sensor, Air Coil Freeze Protection
HP	—	High-Pressure Switch
JW1	—	Jumper Wire for Alarm
LOC	—	Loss of Charge Pressure Switch
PB	—	Power Terminal Block
RVS	—	Reversing Valve Solenoid
TRANS	—	Transformer
WV	—	Water Valve
----------		Field Line Voltage Wiring
– – – –		Field Low-Voltage Wiring
— - —		Option Low-Voltage Wiring
—— - ——		Printed Circuit Trace

*Optional wiring.

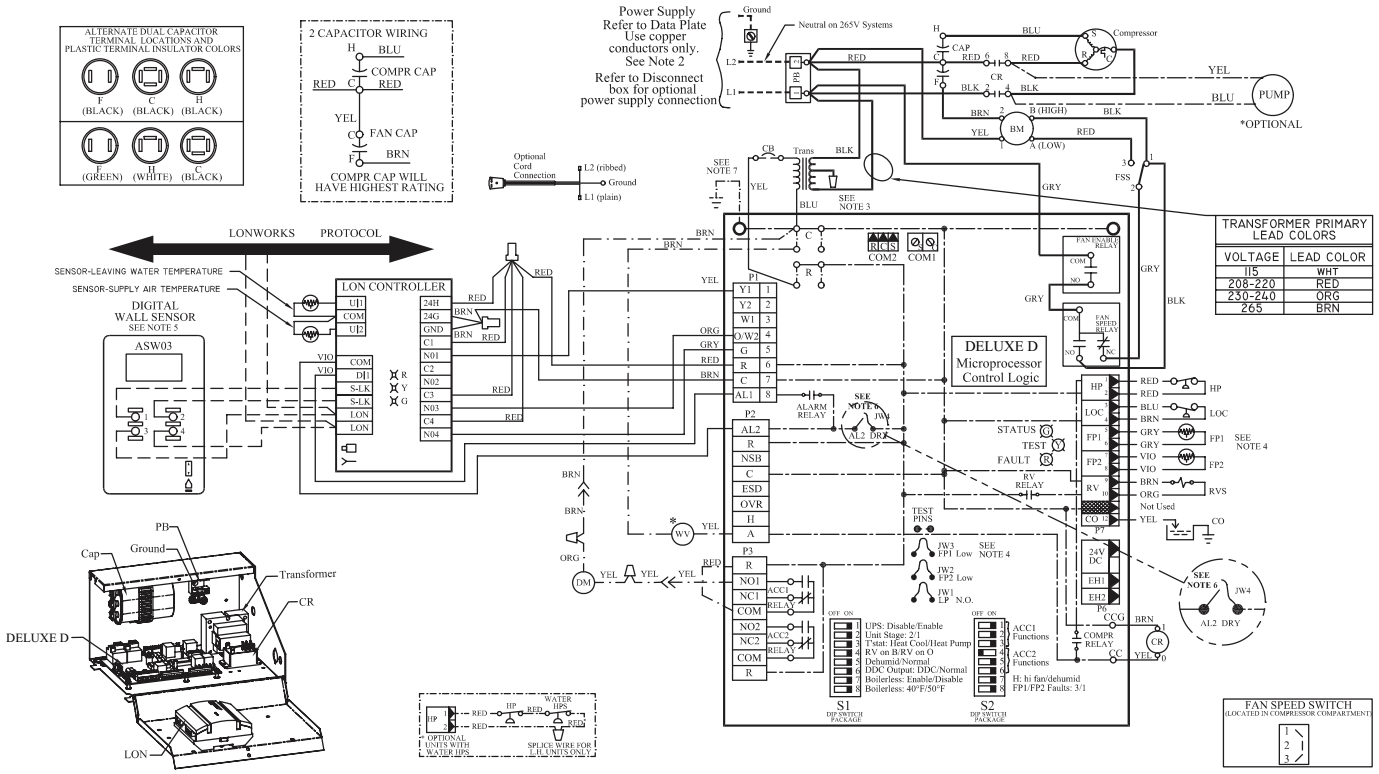
- Relay/Contactor Coil
- Solenoid Coil
- Thermistor
- Circuit Breaker
- Relay Contacts-N.O.
- Switch-Temperature
- Switch-High Pressure
- Switch-Low Pressure
- Ground
- Wire Nut
- Mate-N-Lock

NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 115-V (WHT) lead for 115/1/60 units, 265-V (BRN) lead for 265/1/60 units, 240-V (ORG) lead for 240/1/50 units, or 208-V (RED) lead for 208/1/60 units.

   Rewire transformer L1 connection if voltage is 230-1-60 or 220-1-50, insulate unused lead.
4. FP1 thermistor provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut JW3 jumper.
5. Refer to LonWorks® Installation, Application, and Operation manual for control wiring to the unit. Low voltage wiring must be “class 1” and voltage rated equal to or greater than unit supply voltage.
6. 24-v alarm signal shown. For dry alarm contact, cut JW1 jumper. Dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Complete C board standoffs and screws to control box. (Ground available from top 2 standoffs as shown.)

50PEC UNIT WITH DELUXE D AND LON CONTROLLERS



LEGEND

AL	—	Alarm Relay Contacts
BM	—	Blower Motor
CAP	—	Capacitor
CB	—	Circuit Breaker
CO	—	Sensor, Condensate Overflow
CR	—	Compressor Relay
DM	—	Damper Motor
FP1	—	Sensor, Water Coil Freeze Protection
FP2	—	Sensor, Air Coil Freeze Protection
HP	—	High-Pressure Switch
JW1	—	Jumper Wire for Alarm
LOC	—	Loss of Charge Pressure Switch
LON	—	Local Operating Network
PB	—	Power Terminal Block
RVS	—	Reversing Valve Solenoid
TRANS	—	Transformer
WV	—	Water Valve
----------		Field Line Voltage Wiring
– – – –		Field Low-Voltage Wiring
— – —		Printed Circuit Trace

*Optional wiring.

Relay/Contactor Coil
Solenoid Coil
Thermistor
Circuit Breaker
Relay Contacts-N.O.
Switch-Temperature
Switch-High Pressure
Switch-Low Pressure
Ground
Wire Nut
Mate-N-Lock

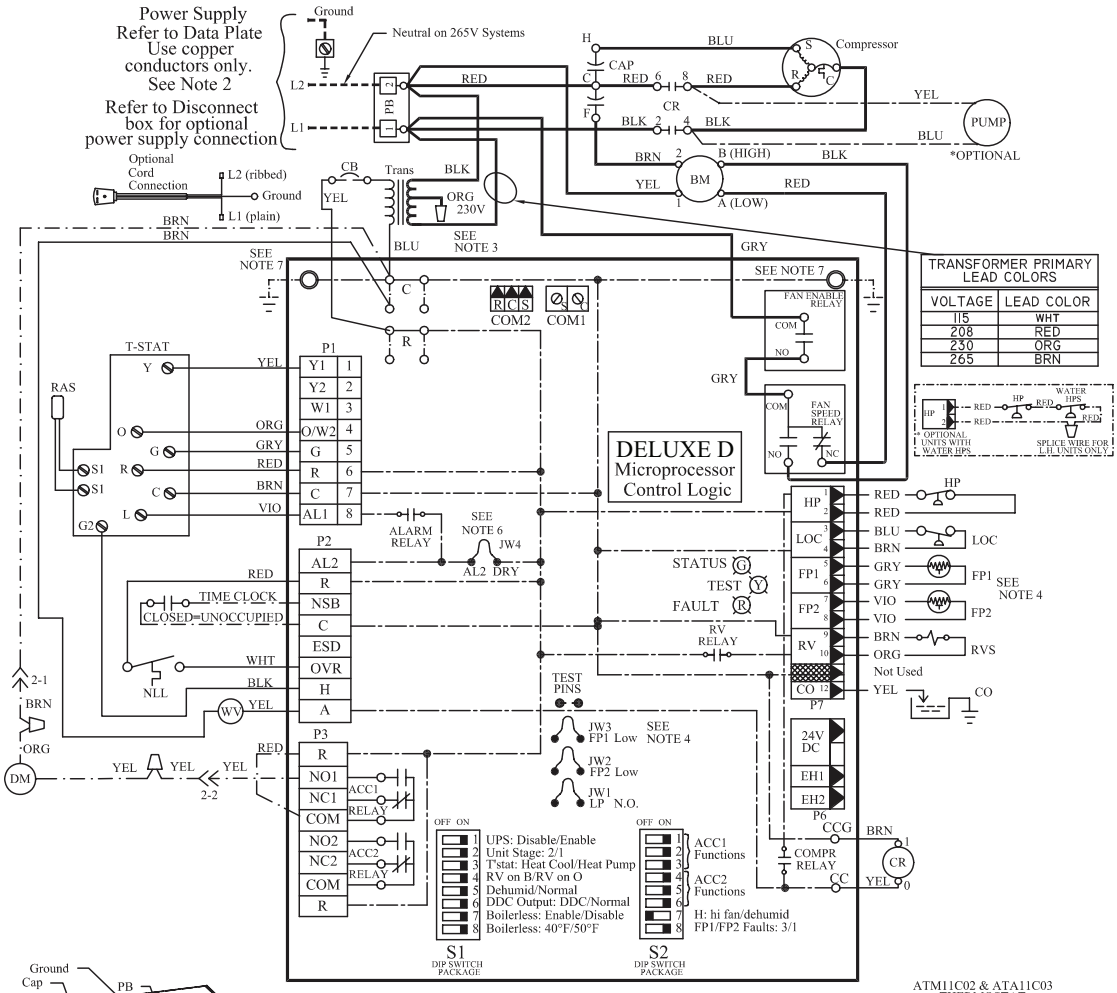
NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 115-V (WHT) lead for 115/1/60 units, 265-V (BRN) lead for 265/1/60 units, 240-V (ORG) lead for 240/1/50 units, or 208-V (RED) lead for 208/1/60 units.

   Rewire transformer L1 connection if voltage is 230-1-60 or 220-1-50, insulate unused lead.
4. FP1 thermistor provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut JW3 jumper.
5. Refer to Microprocessor Control Installation, Application, and Operation manual for control wiring to the unit. Low voltage wiring must be “class 1” and voltage rated equal to or greater than unit supply voltage.
6. Factory-cut jumper (JW4). Dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D board standoffs and screws to control box. (Ground available from top 2 standoffs as shown.)

Typical control wiring schematics (cont)

50PEC UNIT WITH MANUAL OR AUTO CHANGEOVER AND DELUXE D CONTROLLER



LEGEND

AL	—	Alarm Relay Contacts
BM	—	Blower Motor
BR	—	Blower Relay
CAP	—	Capacitor
CB	—	Circuit Breaker
CO	—	Sensor, Condensate Overflow
CR	—	Compressor Relay
DM	—	Damper Motor
FP1	—	Sensor, Water Coil Freeze Protection
FP2	—	Sensor, Air Coil Freeze Protection
HP	—	High-Pressure Switch
JW1	—	Jumper Wire for Alarm
LOC	—	Loss of Charge Pressure Switch
NLL	—	Night Low Limit Switch
PB	—	Power Terminal Block
RAS	—	Return Air Sensor
RVS	—	Reversing Valve Solenoid
TRANS	—	Transformer
WV	—	Water Valve
----------		Field Line Voltage Wiring
– – – –		Field Low-Voltage Wiring
— – —		Printed Circuit Trace

*Optional wiring.

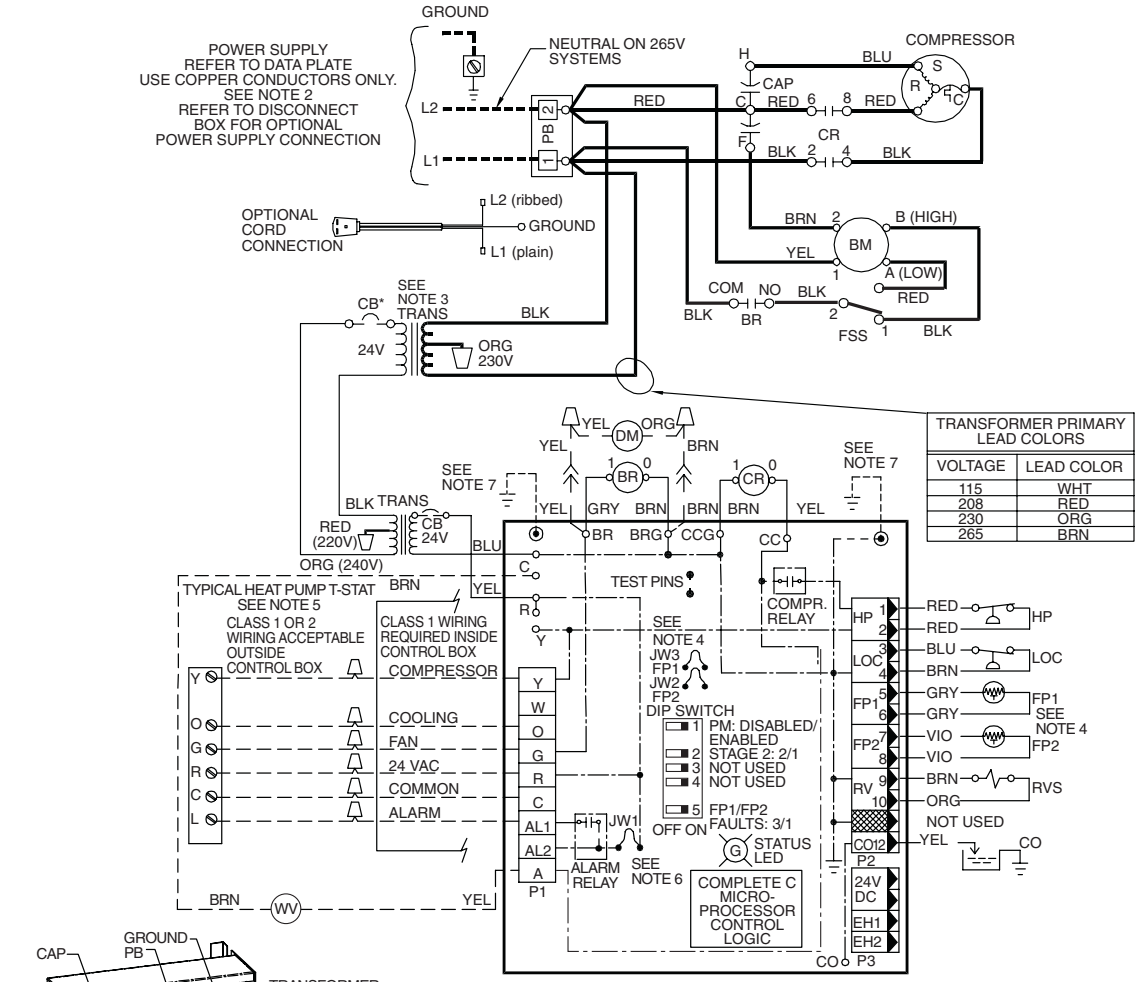
Relay/Contactor Coil
Solenoid Coil
Thermistor
Circuit Breaker
Relay Contacts-N.O.
Switch-Temperature
Switch-High Pressure
Switch-Low Pressure
Ground
Wire Nut
Mate-N-Lock

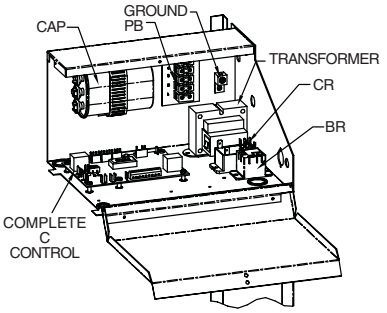
NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 115-V (WHT) lead for 115/1/60 units, 265-V (BRN) lead for 265/1/60 units, 240-V (ORG) lead for 240/1/50 units, or 208-V (RED) lead for 208/1/60 units.

   Rewire transformer L1 connection if voltage is 230-1-60 or 220-1-50, insulate unused lead.
4. FP1 thermistor provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut JW3 jumper.
5. Refer to Microprocessor Control Installation, Application, and Operation manual for control wiring to the unit. Low voltage wiring must be “class 1” and voltage rated equal to or greater than unit supply voltage.
6. 24-v alarm signal shown. For dry alarm contact, cut AL2DRY (JW4) jumper. Dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D board standoffs and screws to control box. (Ground available from top 2 standoffs as shown.)

50PEC UNIT REMOTE-MOUNTED THERMOSTAT WITH COMPLETE C CONTROLLER WIRING





BLOWER MOTOR WIRING		
UNIT SIZE	POLE A	POLE B
09	5	4
12	4	3
15	4	3
18	4	3

LEGEND

AL	—	Alarm Relay Contacts
BM	—	Blower Motor
BR	—	Blower Relay
CAP	—	Capacitor
CB	—	Circuit Breaker
CO	—	Sensor, Condensate Overflow
CR	—	Compressor Relay
DM	—	Damper Motor
FP1	—	Sensor, Water Coil Freeze Protection
FP2	—	Sensor, Air Coil Freeze Protection
FSS	—	Fan Speed Switch
HP	—	High-Pressure Switch
JW1	—	Jumper Wire for Alarm
LOC	—	Loss of Charge Pressure Switch
PB	—	Power Terminal Block
PM	—	Performance Monitor
RVS	—	Reversing Valve Solenoid
TRANS	—	Transformer
WV	—	Water Valve
----------		Field Line Voltage Wiring
– – – –		Field Low-Voltage Wiring

— — —	Printed Circuit Trace
▬▬▬	Option Low Voltage Wiring
	Relay/Contactor Coil
	Solenoid Coil
	Thermistor
	Circuit Breaker
	Relay Contacts-N.O.
	Switch-High Pressure
	Switch-Low Pressure
	Ground
	Wire Nut
	Mate-N-Lock

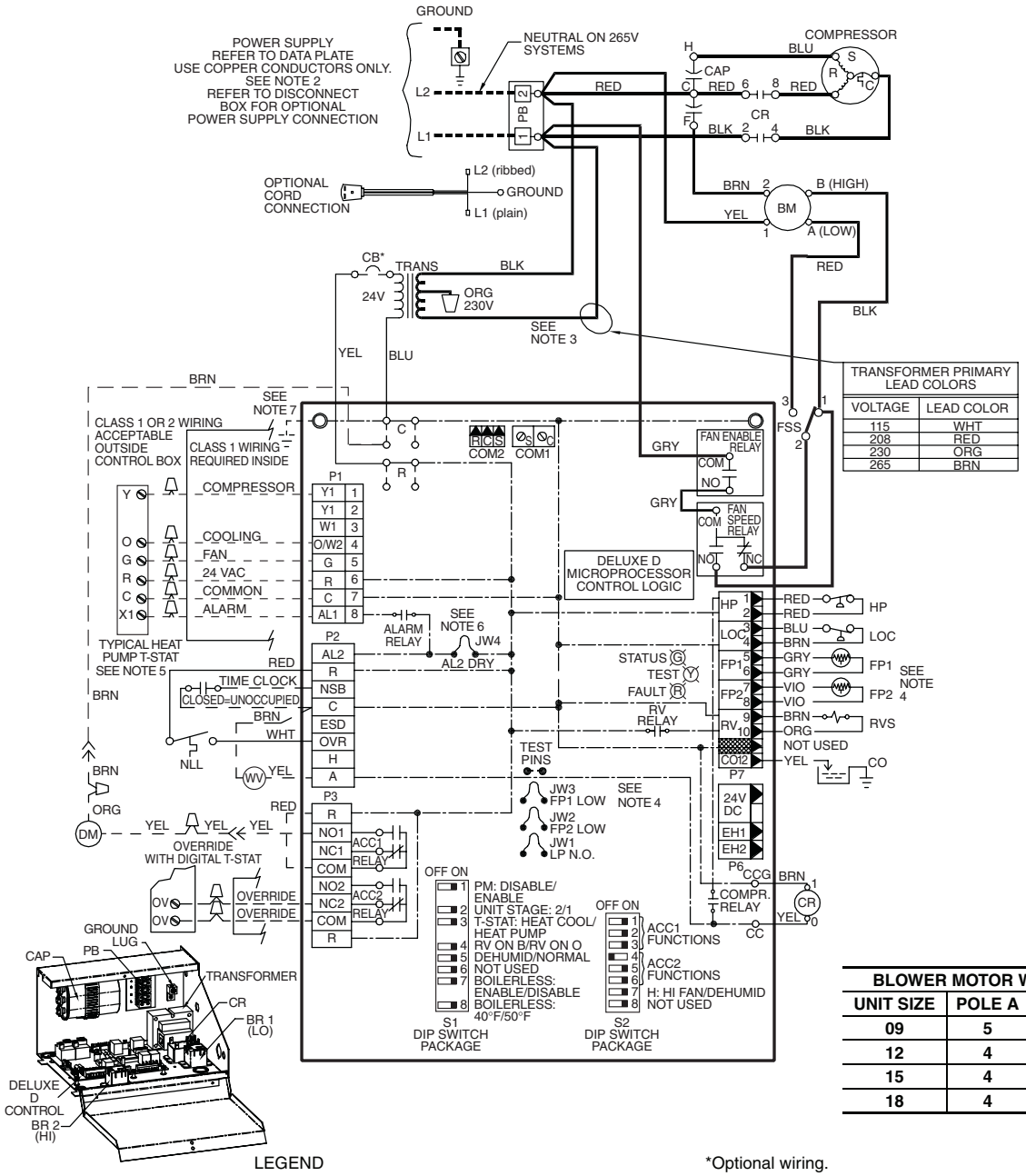
*Optional wiring.

NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 115-V (WHT) lead for 115/1/60 units; 265-V (BRN) lead for 265/1/60 units; or 208-V (RED) lead for 208/1/60 units. For 230/1/60 operation, switch the RED and ORG leads at L1 and insulate the RED lead. Transformer is energy limiting or may have a circuit breaker.
4. FP1 thermistor provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat Installation Instructions for wiring to the unit.
6. 24-V alarm signal shown. For dry alarm contact, cut JW1 jumper and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Complete C board standoffs and screws to control box. (Ground available from top two standoffs as shown.)

Typical control wiring schematics (cont)

50PEC UNIT REMOTE-MOUNTED THERMOSTAT WITH DELUXE D CONTROLLER WIRING



LEGEND

AL	—	Alarm Relay Contacts
BR	—	Blower Relay
CAP	—	Capacitor
CB	—	Circuit Breaker
CO	—	Sensor, Condensate Overflow
CR	—	Compressor Relay
DM	—	Damper Motor
FP1	—	Sensor, Water Coil Freeze Protection
FP2	—	Sensor, Air Coil Freeze Protection
FSS	—	Fan Speed Switch
HP	—	High-Pressure Switch
JW1	—	Jumper Wire for Alarm
LOC	—	Loss of Charge Pressure Switch
NLL	—	Night Low Limit
PB	—	Power Terminal Block
PM	—	Performance Monitor
RVS	—	Reversing Valve Solenoid
TRANS	—	Transformer
WV	—	Water Valve
----------		Field Line Voltage Wiring
– – – –		Field Low-Voltage Wiring
— — —		Printed Circuit Trace
▬▬▬		Option Low Voltage Wiring
		Relay/Contactor Coil
		Solenoid Coil
		Thermistor
		Circuit Breaker
		Relay Contacts-N.O.
		Switch-High Pressure
		Switch-Low Pressure
		Ground
		Wire Nut
		Mate-N-Lock

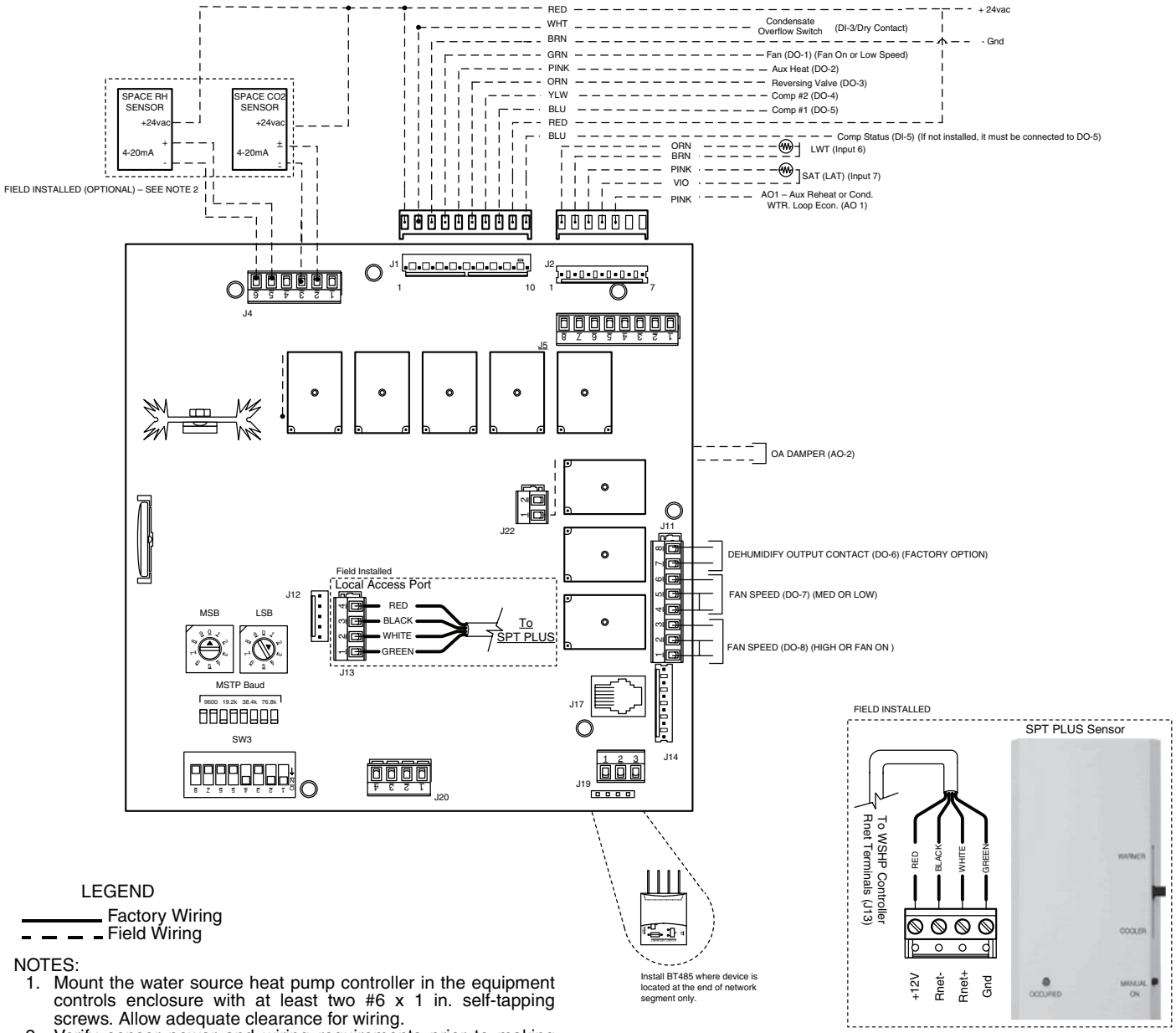
BLOWER MOTOR WIRING		
UNIT SIZE	**POLE A**	**POLE B**
09	**5**	**4**
12	**4**	**3**
15	**4**	**3**
18	**4**	**3**

*Optional wiring.

NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 115-V (WHT) lead for 115/1/60 units; 265-V (BRN) lead for 265/1/60 units; or 208-V (RED) lead for 208/1/60 units.
   For 230/1/60 operation, switch the RED and ORG leads at L1 and insulate the RED lead.
   Transformer is energy limiting or may have a circuit breaker.
4. FP1 thermistor provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat Installation Instructions for wiring to the unit.
6. 24-V alarm signal shown. For dry alarm contact, cut AL2 DRY (JW4) jumper and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D board standoffs and screws to control box. (Ground available from top two standoffs as shown.)

WSHP OPEN CONTROL



LEGEND

Factory Wiring

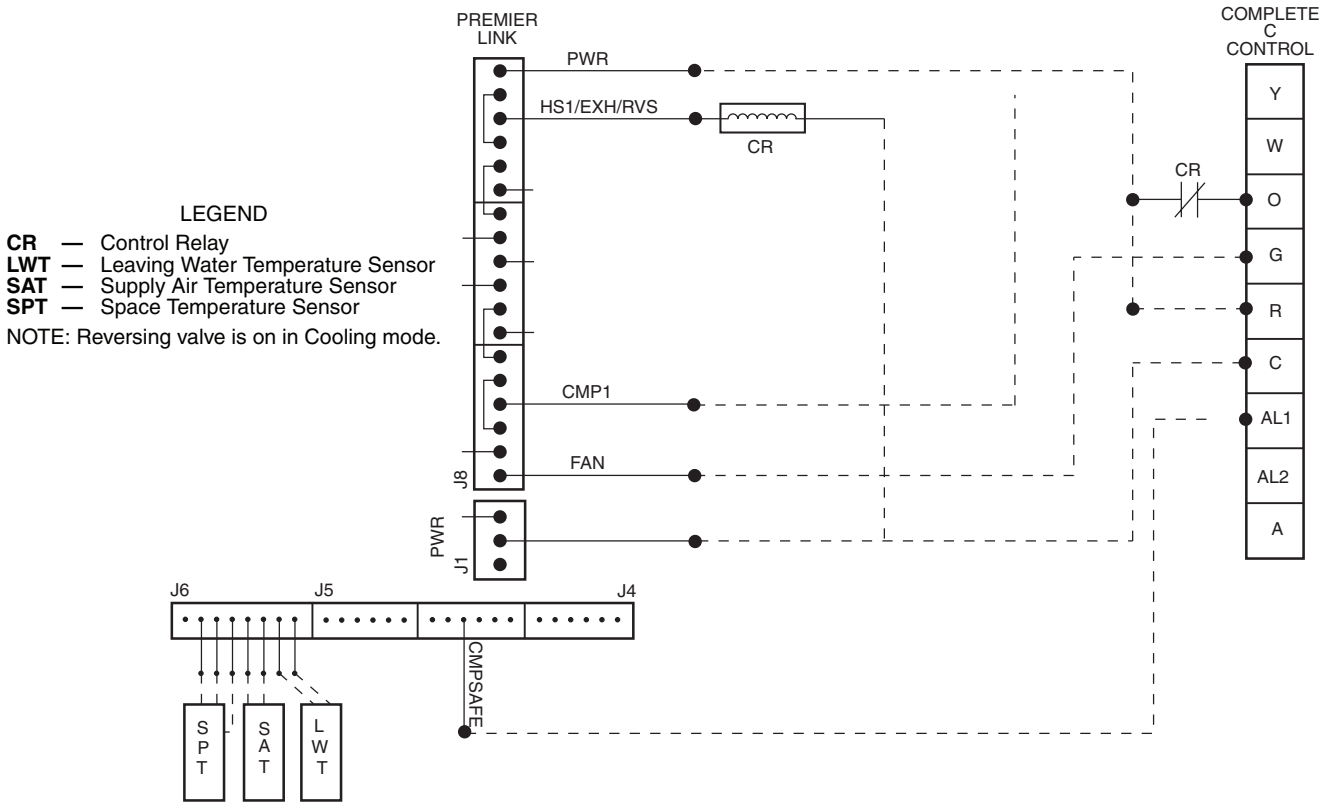
Field Wiring

NOTES:

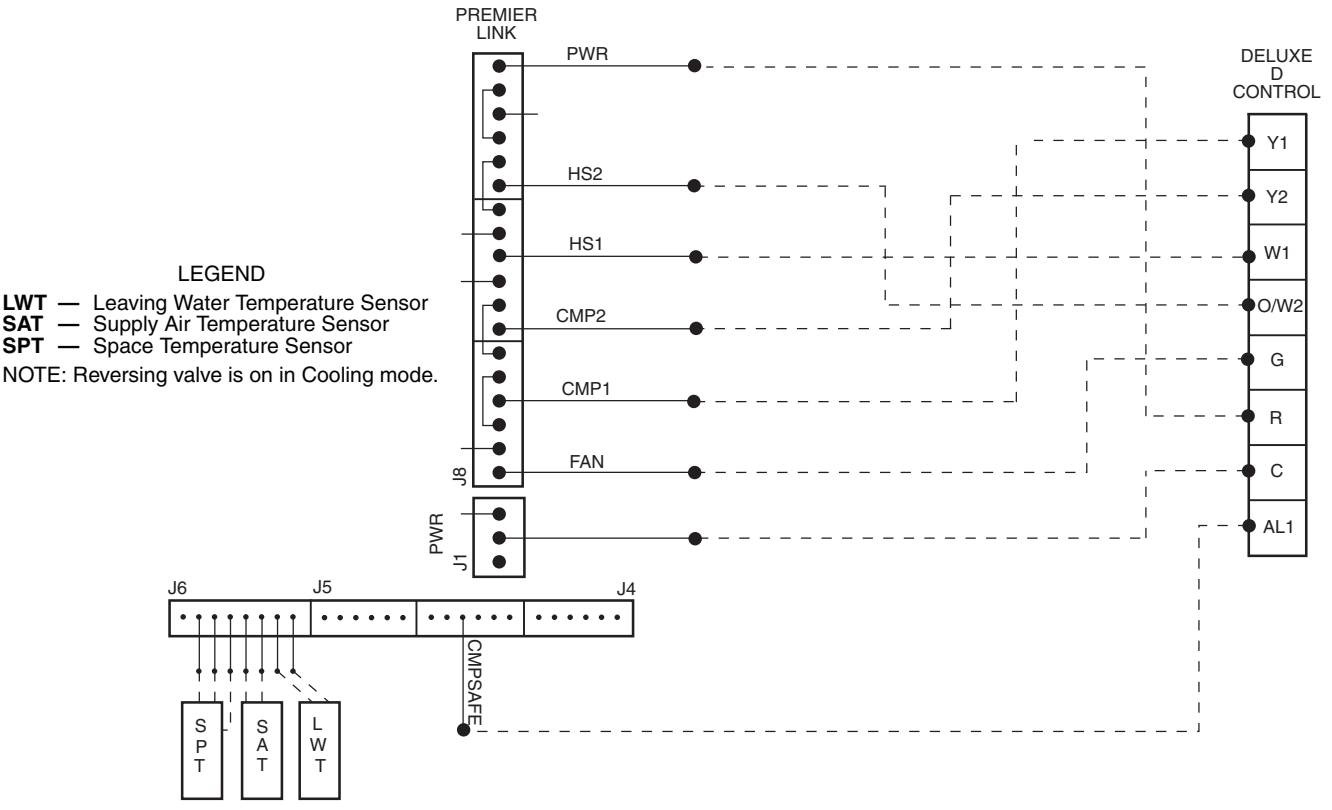
1. Mount the water source heat pump controller in the equipment controls enclosure with at least two #6 x 1 in. self-tapping screws. Allow adequate clearance for wiring.
2. Verify sensor power and wiring requirements prior to making any terminations. Sensors requiring a separate isolated 24 vac power source will not utilize WSHP terminals J4-1, or 4.

Typical control wiring schematics (cont)

PREMIERLINK™ CONTROLLER APPLICATIONS WITH COMPLETE C CONTROL



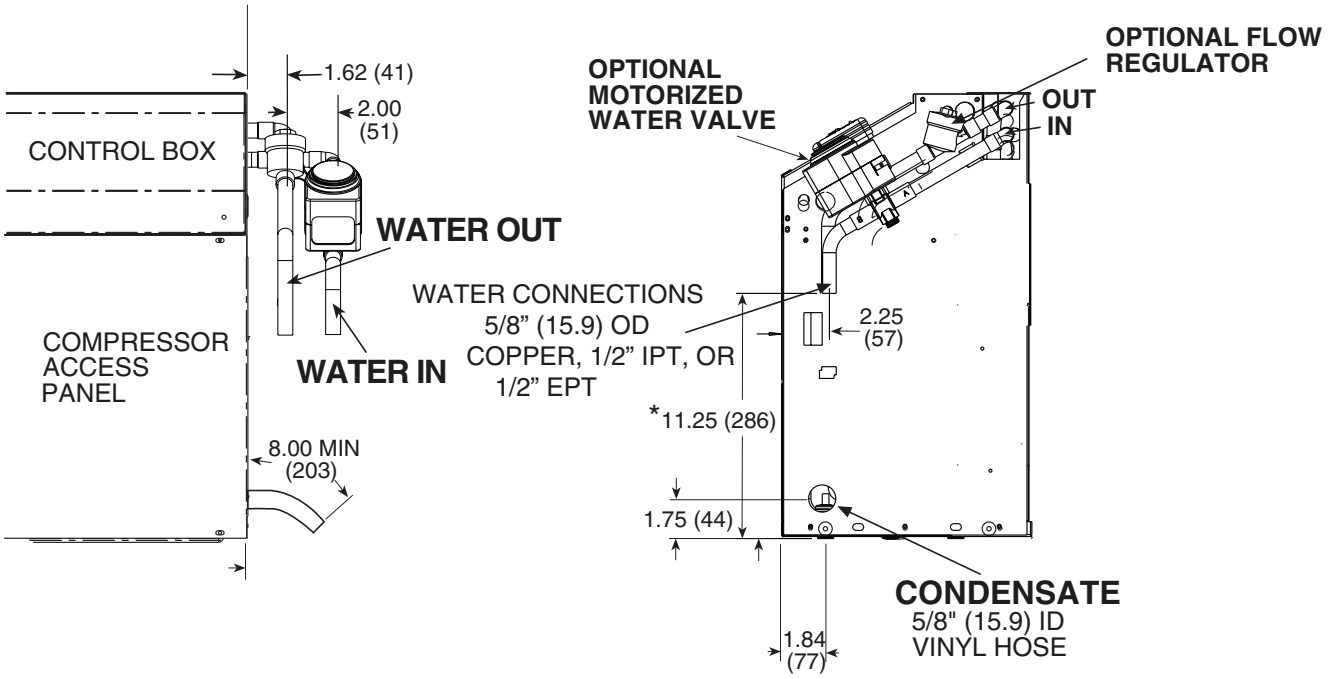
PREMIERLINK CONTROLLER APPLICATIONS WITH DELUXE D CONTROL



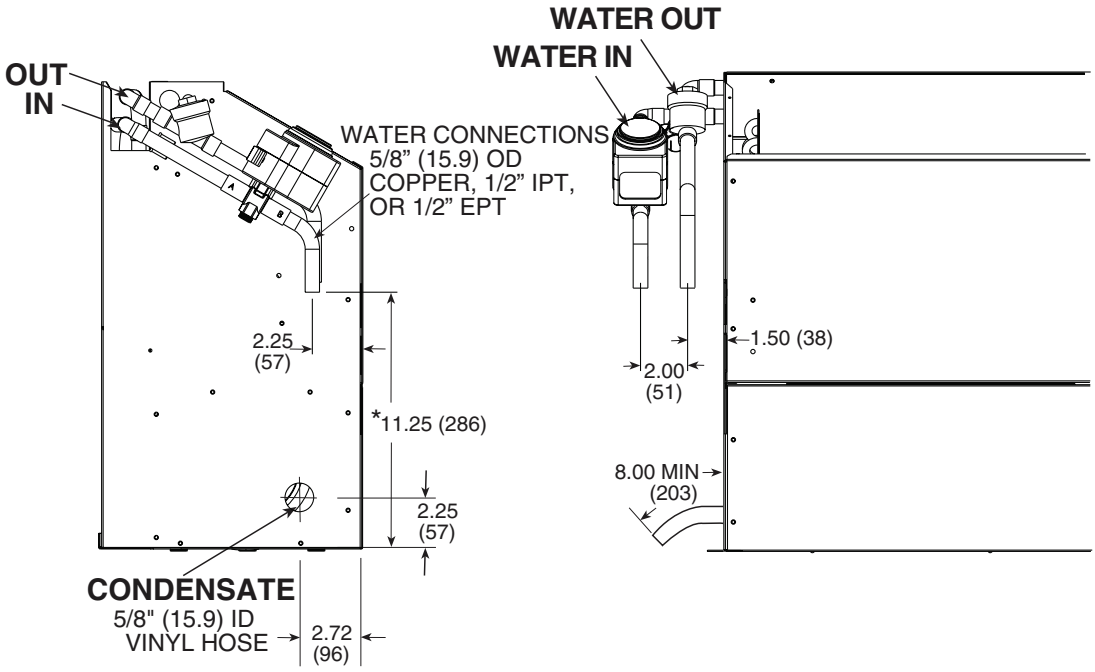
Typical piping

50PEC09-15 PIPING DIMENSIONS

RIGHT HAND CONFIGURATION



LEFT HAND CONFIGURATION



LEGEND

EPT — External Pipe Thread
IPT — Internal Pipe Thread

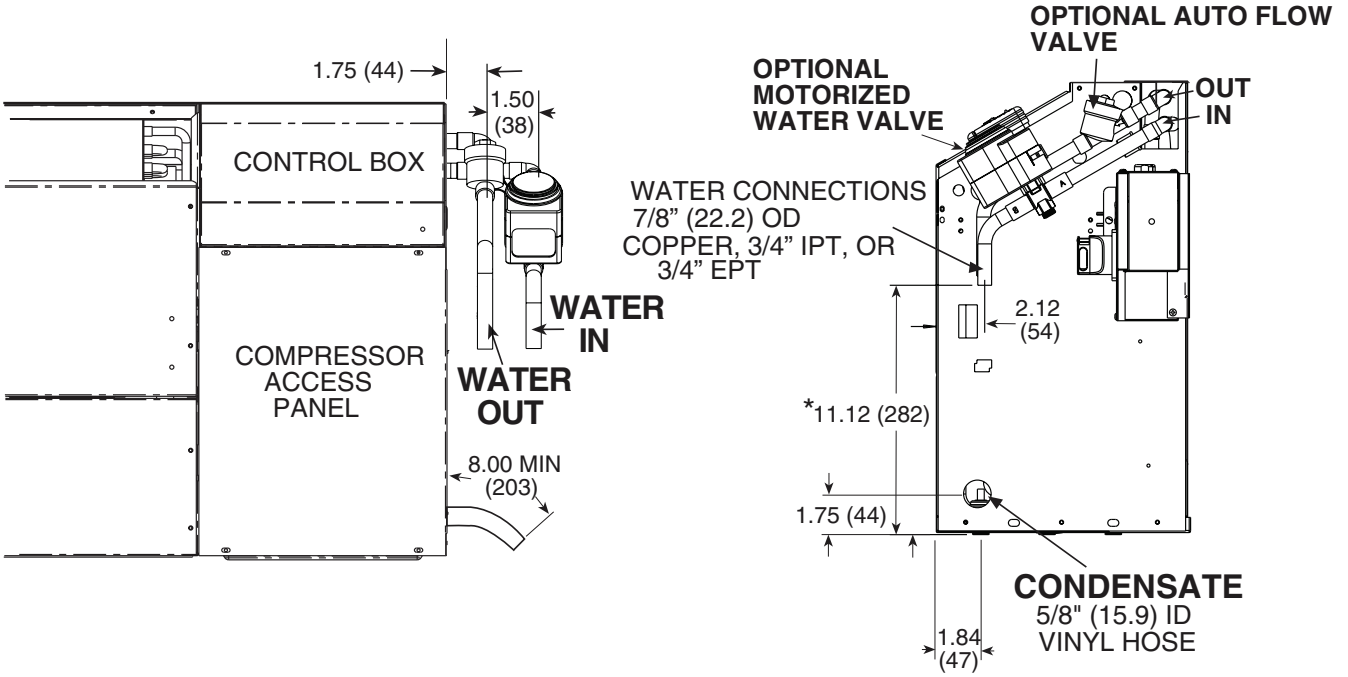
*Dimension reduced by fitting if selected.

NOTE: Dimensions shown are in inches. Dimensions in parentheses are in millimeters.

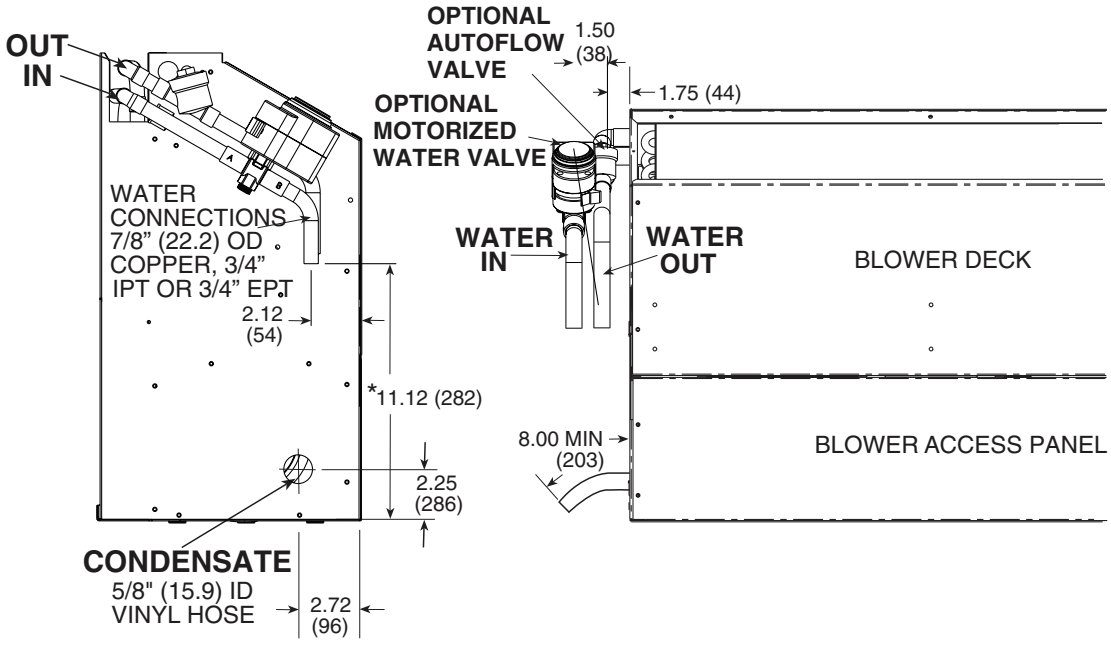
Typical piping (cont)

50PEC18 PIPING DIMENSIONS

RIGHT HAND CONFIGURATION



LEFT HAND CONFIGURATION



LEGEND

EPT — External Pipe Thread
IPT — Internal Pipe Thread

*Dimension reduced by fitting if selected.

NOTE: Dimensions shown are in inches. Dimensions in parentheses are in millimeters.

Guide specifications

Console Water Source Heat Pumps

HVAC Guide Specifications

Size Range: **8,600 to 16,200 Btuh Cooling Capacity**
11,400 to 20,100 Btuh Heating Capacity

Carrier Model Number: **50PEC**

Part 1 — General

1.01 SYSTEM DESCRIPTION

A. Install water source heat pumps, as indicated on the plans with capacities and characteristics as listed in the schedule and the specifications that follow.

B. Units shall be individually packaged with wooden skid covered with protective corner posts and plastic stretch wrapping for maximum protection.

1.02 QUALITY ASSURANCE

A. All equipment listed in this section must be performance rated and certified in accordance with ARI/ISO Standard 13256-1, latest edition, and safety listed in accordance with NRTL or CSA. All units shall have ARI/ISO and NRTL or CSA labels.

B. All units shall be factory tested under normal operating conditions at nominal water flow rates. Units which are tested without water flow are not acceptable. Standard operating range is 60 to 95 F entering water temperature.

Part 2 — Product

2.01 EQUIPMENT

A. Heat Pump Assembly:

Factory-tested and assembled single-piece packaged heating and cooling heat pump units shall be factory wired, charged with Puron® refrigerant (R-410A), contain refrigerant-to-water heat exchanger, air-to-refrigerant heat exchanger, 4-way reversing valve, fan motor assembly, compressor, thermostatic expansion valve (TXV) metering device, and all internal controls and safety devices.

B. Unit Cabinet:

1. The cabinet shall be constructed of heavy gage steel with welded corner bracing. A removable front cabinet allows easy service access to the chassis. The cabinet shall have a 30-degree sloped top with an aluminum rigid bar type discharge grille.
2. An access door shall be provided to cover the swing down control section.
3. Options include a locking control panel for added security; a bottom or front return with left or right hand configurations for ease of installation. Available with 5 in. subbase (bottom return units only), with or without motorized damper.
4. The cabinet shall be powder painted.
5. Optional mute package shall consist of additional sound attenuating materials strategically applied to the compressor compartment, and substitution of $^1/_2$ in. noise dampening insulation for all surfaces that normally have $^1/_4$ in. insulation. Insulation shall meet NFPA 90A requirements.

C. Fan and Motor Assembly:

The fan motors shall be multi-speed permanently lubricated, PSC (permanent split capacitor) type with thermal overload protection. To facilitate field service all units shall have a slide-out fan deck and quick electrical disconnect.

D. Refrigerant Components:

1. Units shall have a sealed refrigerant circuit including a rotary compressor, a refrigerant metering device, a finned tube refrigerant-to-air heat exchanger, a reversing valve, a coaxial (tube-in-tube) refrigerant-to-water heat exchanger, and safety controls including a high-pressure sensor, a loss-of-charge sensor to protect against loss of refrigerant, and low water temperature (freeze-stat) sensor.
2. Rotary compressors shall have thermal overload protection and shall be located in an insulated compartment to minimize sound transmission. Units shall have the compressor mounted on isolators to reduce noise and vibration transmission.
3. Refrigerant-to-air heat exchangers shall utilize enhanced aluminum fins and rifled copper tube construction rated to withstand 600 psig refrigerant working pressure.
4. Refrigerant-to-water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design rated to withstand 600 psig working refrigerant pressure.
5. Drain pan shall be constructed of galvanized steel and have powder coated application to inhibit corrosion.
6. Reversing valve shall be four-way solenoid-activated refrigerant valves which shall fail to heating operation. If the unit fails to cooling a low-temperature thermostat must be provided to prevent over-cooling of the room.
7. Optional coaxial water-to-refrigerant heat exchangers shall be cupronickel.
8. Optional extended range for units operating with entering water temperatures below dew point. For use in operating range with entering water temperatures from 20 to 120 F.

E. Controls and Safeties:

Units which may be reset at the disconnect switch only shall not be acceptable.

Guide specifications (cont)

1. Electrical:

   A control box shall be located within the unit and shall contain controls for compressor, reversing valve and fan motor operation.
2. Piping:
   a. Copper tubes with a 5/8-in. OD dimension shall be provided on the supply and return water connections for the purpose of forming a sweat connection to field-supplied distribution piping.
   b. Optional threaded connections: A 1/2-in. male or female pipe threaded fitting shall be factory mounted on the supply and return water connections.
3. Unit Controls:

   Safety devices on all units shall include low-pressure sensor or loss-of-charge switch, high-pressure switch, low water temperature sensor, and condensate overflow switch.
4. The standard Complete C electronic control system shall interface with the unit mounted or remote heat pump (Y,O) wall thermostat (mechanical or electronic). The control system shall have the following features:
   a. 50 va transformer.
   b. Anti-short cycle time delay on compressor operation; time delay shall be 5 minutes minimum.
   c. Random start on power-up.
   d. Low voltage protection.
   e. High voltage protection.
   f. Condensate overflow shutdown.
   g. Unit shutdown on low refrigerant pressures.
   h. Unit shutdown on high or low water temperature (selectable for antifreeze solutions).
   i. Option to reset unit at thermostat or disconnect. Fault type shall be retained in memory if reset at thermostat.
   j. Automatic intelligent reset. Unit shall automatically restart 5 minutes after shutdown if the fault has cleared. Should a fault occur 3 times sequentially, then lockout will occur.
   k. Ability to defeat time delays for servicing.
   l. Light-emitting diode (LED) to indicate high pressure, low pressure, improper voltage, water coil freeze protection, air coil freeze protection, condensate overflow, and control status.
   m. Unit performance monitor to indicate inefficient operating conditions prior to unit lockout.
   n. Remote fault type indication at thermostat.
   o. Single harness connection for all safety devices.
   p. Selectable 24-v or pilot duty dry contact alarm output.
   q. 24-v output to cycle a motorized water valve with compressor contactor.
   r. The control box components shall be easily accessible with a swing out control compartment.
   s. Standard unit-mounted MCO (manual changeover) thermostat operating controls shall consist of temperature setting dial knob, push button switches for Stop, Fan only, Hi Cool, Lo Cool, Hi Heat, Lo Heat. Unit-mounted thermostats shall have a remote sensor for sensing the return-air temperature.
5. The optional Deluxe D electronic control shall have all the features of the Complete C control, with the following additional features:
   a. 75 va transformer.
   b. A removable thermostat connector.
   c. Random start on return from night setback.
   d. Minimized reversing value operation for extended life and quiet operation.
   e. Night setback control from low temperature thermostat, with 2-hour override initiated by a momentary signal from the thermostat.
   f. Dry contact night setback output for digital night setback thermostats.
   g. Ability to work with heat/cool (Y, W) thermostats.
   h. Ability to work with heat pump thermostats using O or B reversing valve control.
   i. Single grounded wire to initiate night setback or emergency shutdown.
   j. Boilerless system control can switch automatically to electric heat at low loop water temperature.
   k. Control board shall allow up to 3 units to be operated from one thermostat without any auxiliary controls.
   l. A relay to operate an external damper. The control to be such that the damper will not open until 30 minutes after the unit comes back from Unoccupied mode.
   m. Fan speed selection at thermostat.
   n. A relay to restart a central pump or control a 24-v motorized water valve.
   o. Intelligent fan speed selection based upon thermostat demand and/or dehumidistat signal.
6. WSHP Open Multiple Protocol Control:

   Units shall have all the features above (either C or D boards) and the state of the art WSHP Open multiple protocol interface board. All point objects will have the ability to be viewed in the BACview6 Handheld user interface. This

will permit all units to be daisy chain connected by a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:

a. space temperature
b. leaving water temperature
c. discharge air temperature
d. command of space temperature set point
e. cooling status
f. heating status
g. low temperature sensor alarm
h. high pressure switch alarm
i. fan on/off position of space thermostat
j. unoccupied/occupied command
k. cooling demand
l. heating demand
m. fan “ON/AUTO” command
n. fault prevention with auto reset
o. itemized fault code viewed with BACview interface

Additional WSHP Open multiple protocol control features shall include:

a. two-position OA damper
b. modulating OA damper with DCV
c. auxiliary modulating hot water/steam heating
d. two-position hot water/steam heating
e. single stage electric auxiliary heat
f. auto fan speed control (heating/cooling)
g. power fail restart delay
h. dehumidification
i. modulating water economizer control
j. two-position water economizer control

7. PremierLink™ Controller:

   This control will function with CCN (Carrier Comfort Network®) and ComfortVIEW™ software. It shall also be compatible with *Comfort*Link™ controllers. It shall be ASHRAE 62-99 compliant and Internet ready. It shall accept a CO_2 sensor in the conditioned space and be demand controlled ventilation (DCV) ready. The communication rate must be 38.4K or faster.

8. LonWorks® Interface System:

   Units shall have all features listed above (either Complete C or Deluxe D) and the control board shall be supplied with a LonWorks® interface board, which is LONMark® certified. This will permit all units to be daisy chained via a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:

   a. space temperature
   b. leaving-water temperature
   c. discharge-air temperature
   d. command of space temperature set point
   e. cooling status
   f. heating status
   g. low temperature sensor alarm
   h. low pressure sensor alarm
   i. high pressure switch alarm
   j. condensate sensor alarm
   k. high/low voltage alarm
   l. fan "ON/AUTO" position of space thermostat
   m. unoccupied / occupied command
   n. cooling command
   o. heating command
   p. fan "ON / AUTO" command
   q. fault reset command
   r. itemized fault code revealing reason for specific shutdown fault (any one of 7)

   This option also provides the upgraded 75 va control transformer with load side short circuit and overload protection via a built in circuit breaker.

9. Optional Controls:

   a. Unit-mounted ACO (automatic changeover) thermostat operating controls shall consist of temperature setting dial knob, push button switches for Stop, Fan only, Hi fan, Lo fan. Unit-mounted thermostats shall have a remote sensor for sensing the return-air temperature.
   b. Units designed for connection to remote wall mounted thermostat shall be wired such that the operating controls are at the thermostat. The controller shall be provided with a low voltage field wiring terminal block. The control scheme shall accommodate MCO or ACO heat pump thermostats with Y, G, and O outputs. An alternate controller shall be available from the factory to accommodate the Heat/Cool thermostats.
   c. Motorized (2-way) water valves shall be factory installed and wired. The valve shall remain open when there is a cooling or heating demand and the compressor is running. The valve shall close when the compressor stops after satisfying the demand or due to lockout condition.
   d. Fresh air dampers shall be motorized with a spring return. The damper shall open when Cooling or Heating mode selection is made from the unit-mounted switches. With a remote thermostat, the damper shall open any time the fan is in operation.
   e. Night low limit thermostats shall include a unit-mounted thermostat sensing space

temperature. Should the space temperature fall below the limit, the night low limit thermostat shall start the fan and compressor operation in Heating mode.

f. Units with the unit-mounted thermostat shall include a 2-hour override function. The override switch shall be readily accessible. In override mode the unit operation shall be the same as in occupied mode. Override mode shall be terminated automatically at the end of a 2-hour period.

F. Electrical Requirements:

1. A control box shall be located within the unit compressor compartment and shall contain a 50 va transformer, 24-volt activated, 3-pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Electro-mechanical operation WILL NOT be accepted.
2. Units shall be nameplated for use with time-delay fuses or HACR circuit breakers.
3. Unit controls shall be 24-volt and provide heating or cooling as required by the remote thermostat.

G. Special Features:

1. Aquazone™ Thermostat Controls (for use with remote thermostat units):
   a. Programmable multi-stage thermostat with 7-day clock, holiday scheduling, large backlit display and remote sensor capability.
   b. Programmable 7-day light-activated thermostat offers occupied comfort settings with lights on, unoccupied energy savings with lights off.
   c. Programmable 7-Day flush-mount thermostat offers locking coverplate with tamper proof screws, flush to wall mount, dual point with adjustable deadband, O or B terminal, and optional remote sensor.
   d. Programmable 5-day thermostat offers 2-stage heat, 2-stage cool, auto changeover, 5-minute built-in compressor protection, locking cover included.
   e. Non-programmable thermostat with 2 heat stages, 2 cool stages, auto changeover, 5-minute built-in compressor protection, locking cover included.
2. Fire-rated hose kits come with a fixed MPT on one end and a swivel with an adapter on the other end. Hose kits can be either stainless steel or galvanized.
3. Ball valves (brass body) are for shutoff and balancing water flow. Valves are available with memory, memory stop, and pressure temperature ports.
4. Y Strainers (bronze body) are "Y" type configuration with a brass cap and a stainless steel strainer screen. Maximum operating pressure rating of strainers is 450 psi.
5. Solenoid valves (brass body) provide slow operation for quiet system application.
6. Hose kit assemblies include a ported ball valve with pressure temperature (P/T) plug ports, flexible stainless steel hose with swivel and nipple. Return hose includes a ball valve, preset measure flow (gpm) with two P/T ports, flexible stainless steel hose with a swivel and nipple, balancing valve, and low-pressure drop water control valve.
7. Multiple-protocol WSHP Open controller remote sensors for Aquazone flush-mount thermostats and DDC control options. Only Carrier sensors can be used with the WSHP Open controller. Sensors are available as follows:
   a. SPT Standard offers space temperature sensor with communication port.
   b. SPT Plus offers space temperature sensor with set point adjust, local override with indicating light and communication port.
   c. SPT Pro offers space temperature sensor with LCD display, set point adjust, local override, alarm icon, outside air, and unit status with heating and cooling set points.
   d. SPT Pro+ offers space temperature sensor with LCD display, set point adjust, local override, alarm icon, outside air, unit status with heating and cooling set points, and fan speed control.
8. PremierLink™ accessories include air temperature sensors, CO_2 sensors, communicating room sensors, and linkage thermostats.
9. An Aquazone™ system control panel as specified in 50RLP Product Data (525-00040) is available.
10. UC Open XP loop controller with six stages (2 stages for heating and 4 stages for heat rejection).
11. LON wall sensors are available in 3 models: sensor only, sensor with status override indicator, and sensor with set point, status adjustment override, and digital LCD display.