Installation Manual: WP Series, 6.5 ton to 12.5 ton, heat pump

R-454B, 60 Hz



BHC Residential & Light Commercial LLC, 5005 York Drive, Norman, OK 73069

6671931-UIM-D-0526

Supersedes: 6671931-UIM-C-0925

2026-05-20

Contents

General....5
GoTemp Pro App....5
Safety considerations....5
Inspection....6
Reference....6
Renewal parts....6
Approvals....6
Certifications....6
Nomenclature....7
Installation....8
Installation safety information....8
Preceding installation....8
Limitations....9
Unit components....10
Location....11
Clearances....11
Rigging and handling....11
Ductwork....19
Changing the duct covers - side duct applications....19
Side panels....20
Installing a condensate drain....20
Compressors....21
Filters....21
Power and control wiring....21
Power wiring detail....22
Thermostat wiring....22
Electrical data....24
Physical data....34
Optional electric heat....35
Optional gas heat....36
Gas piping....36
Gas connection....37
Propane units, tanks, and piping....38
Vent and combustion air....38
Options and accessories....38
Electric heat....38
Smoke detectors....38
Motorized outdoor damper....39
Economizer....39
Power exhaust....39
Rain hood....39
Economizer sequences....39
Economizer minimum position....39
Free cooling....39
Dry bulb changeover....39
Single enthalpy changeover....39
Dual enthalpy changeover....39
Auto....40
Free cooling operation....40
Thermostat....40
Sensor....40
Power exhaust....40
Setpoints....40
Inputs....40
Outputs....40
Operation....40
Smart Equipment Control Board....41
Indoor air quality....44
Phasing....44
Blower rotation....44
Adjusting the belt tension....44
CFM static pressure and power-altitude and temperature corrections....45
Airflow performance....48
WP078-150 side duct application....48
WP078-150 bottom duct application....51
Indoor blower and power exhaust specifications....53
Air balance....53
Checking air quantity....54
Method one....54
Method two....54
Supply air drive adjustment....55
Operation....56
Cooling sequence of operation....56
Heat pump cooling....56
Continuous blower....56
Intermittent blower....56
No outdoor air options....56
Economizer with single enthalpy sensor....57
Economizer with dual enthalpy sensors....57
Economizer with power exhaust....57

Motorized outdoor air dampers....57
Refrigerant detection system (optional)....58
Cooling operation errors....58
High-pressure limit switch....58
Low-pressure limit switch....58
Evaporator low limit....58
Low ambient cooling....58
Safety controls....59
Compressor protection....59
Reset....59
Reheat mode sequence of operation....59
Normal cooling mode....59
Normal reheat mode....59
Alternate mode....60
Optional aux mode....60
Heat pump heating sequence of operation....60
With electric heat....60
Without electric heat....61
Defrost initiation....61
Defrost termination....61
Interval between defrosts....61
Forced defrost....61
Electric heat operation errors....61
Temperature limit....61
Safety controls....61
Limit Switch (LS)....61
Reset....62
Electric heat anticipator setpoints....62
Gas heating sequence of operations....62
Backup heating mode for dual fuel units....62
Ignition control board....62
First stage of heating....62
Auto staging (dual fuel only)....62
Retry operation....62
Recycle operation....62
Gas heating operation errors....62
Lockout....62
Temperature Limit....63
Flame sense....63
Gas valve....63
Safety controls....63
Limit switch....63
Auxiliary limit switch....63
Pressure switch....63
Roll-out switch....63
Internal microprocessor failure....63
Flash codes....64
Resets....64
Gas heat anticipator setpoints....64
Cooling start-up....64
Pre-start checklist....64
Operating the unit....64
Post-start checklist....64
Gas heat start-up....64
Pre-start check list....64
Operating the unit....64
Lighting the main burners....64
Post start checklist....65
Shutting down the unit....65
Checking gas heat input....65
Manifold gas pressure adjustment....66
Adjustment of temperature rise....66
Charging tables....67
Smart Equipment control board navigation components....72
Smart Equipment unit control board....73
Start-up sheet....80

General

WP078-150 heat pumps are single package, reverse cycle air conditioners designed for outdoor installation on a rooftop or slab and for non-residential use. The units can be equipped with factory or field-installed electric heaters for heating applications.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power and duct connections. The electric heaters have nickel-chrome elements and use single-point power connection.

GoTemp Pro App

BHC Residential and Light Commercial LLC believes in empowering our customers with up-to-date, unit-specific information. Download the GoTemp Pro app, a powerful-comprehensive app designed for contractors on the jobsite, available now in the App Store for iOS and Google Play for Android. Use the App to scan the unique QR code on the unit rating plate for easy access to product information and resources such as nomenclature, technical guide, installation manual, wiring diagrams, parts list, product registration, warranty and much more. Simplify your tasks, save time, and stay ahead with the most comprehensive app built for professionals.

GoTemp Pro integrates functionality previously provided by CWa and MAP, allowing you to utilize the on-board communication card or simply plug in the CWCVT to enable Bluetooth connectivity.



Safety considerations

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention the signal words **DANGER**, **WARNING** or **CAUTION**.

DANGER indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury.**

WARNING indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury.**

CAUTION indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving only property damage.

⚠ WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer or service agency.

⚠ CAUTION

This product must be installed in strict compliance with the installation instructions and any applicable local, state and national codes including, but not limited to building, electrical, and mechanical codes.

⚠ WARNING

Before you perform service or maintenance operations on the unit, turn off the main power switch to unit. Electrical shock could cause personal injury. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency, or the gas supplier.

Due to system pressure, moving parts, and electrical components, the installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained service personnel must install, repair, or service this equipment. Untrained personnel can perform basic maintenance functions such as cleaning coils and filters, and replacing filters.

Observe all precautions in the literature, labels, and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other applicable safety precautions and codes including National Electric Code, ANSI/NFPA No. 70 - latest edition U.S.A. and Canadian Electric Code, CSA C22.1 in Canada.

Wear safety glasses and work gloves. Use quenching cloth and have a fire extinguisher available during brazing operations.

Inspection

As soon as you receive a unit, you must inspect it for possible damage during transit. If damage is evident, note the extent of the damage on the carrier's freight bill. You must make a separate request for inspection by the carrier's agent in writing.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state and national codes including, but not limited to, building, electrical, and mechanical codes.

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG.

Reference

Additional information is available in the following reference forms:

- Technical Guide - WP078-150
- General Installation - WP078-150
- Smart Equipment Control Quick Start Guide
- Economizer Accessory:
  - Downflow Factory Installed
  - Downflow Field Installed
  - Horizontal Field Installed
- Motorized Outdoor Air Damper
- Manual Outdoor Air Damper (0-100%)
- Manual Outdoor Air Damper (0-35%)
- Gas Heat Propane Conversion Kit
- Gas Heat High Altitude Kit (Natural Gas)
- Gas Heat High Altitude Kit (Propane)
- Electric Heater Accessory

Renewal parts

Contact your localDucted Systems parts distribution center for authorized replacement parts.

Approvals

The design is certified by CSA as follows:

- For use as a cooling only unit, cooling unit with supplemental electric heat or a forced air furnace.
- For outdoor installation only.
- For installation on combustible material and may be installed directly on combustible flooring or, in the U.S., on wood flooring or Class A, Class B or Class C roof covering materials.
- For use with natural gas. The unit can be converted to LP with a kit.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to, building, electrical, and mechanical codes.

⚠ WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

Certifications

Tested in accordance with:



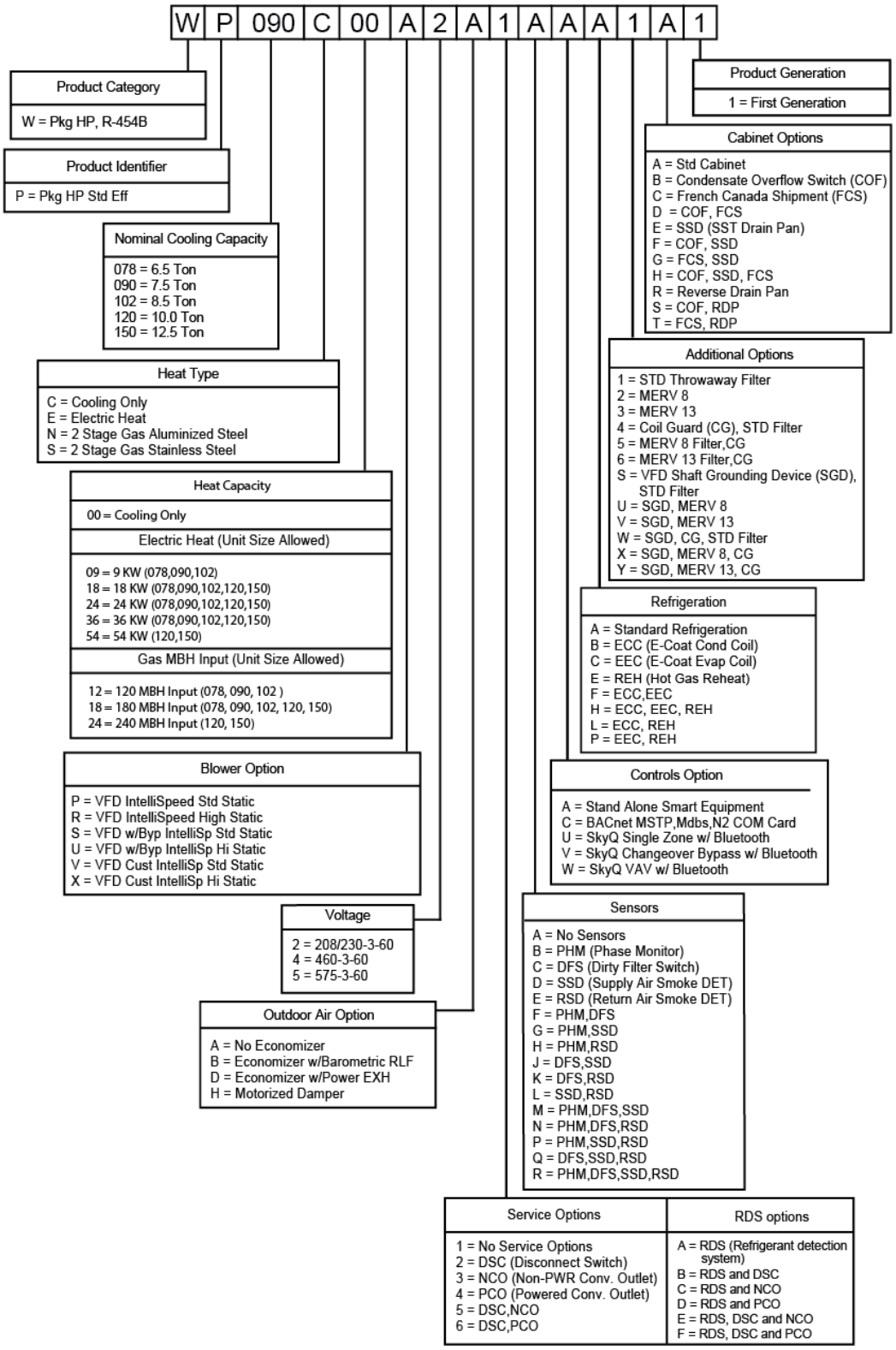






Nomenclature

6.5-12.5 Ton Model Number Nomenclature



Installation

Installation safety information

Read the following instructions before you install this appliance. This is an outdoor combination heating and cooling unit. The installer must ensure that these instructions are made available to the consumer. The installer must instruct the consumer to retain the instructions for future reference.

Do not use this equipment for temporary heating of buildings or structures under construction.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death, or property damage.

Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire, or explosion may result causing property damage, personal injury, or loss of life.

Preceding installation

1. Remove the two screws that hold the brackets in the front, rear, and compressor side fork-lift slots. See Figure 1.

Figure 1: Unit shipping bracket



Item	Description
A	Bracket screws
B	Bracket

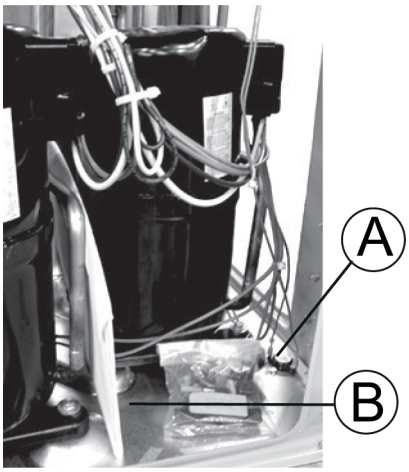
2. Turn each bracket toward the ground. The protective plywood covering drops to the ground.
3. Remove the condenser coil protective covering.
4. Remove the toolless doorknobs and instruction packet, see Figure 3.

Figure 2: Condenser covering



Item	Description
A	Condenser coil protective covering
B	Barometric relief hood in shipping location (if included)

Figure 3: Compressor section



Item	Description
A	Toolless doorknob
B	Installation instruction packet

5. If a factory option convenience outlet is installed, you must install the weatherproof outlet in the field. The cover is located behind the filter access panel:
   a. Remove the shipping label that covers the convenience outlet.
   b. Follow the instructions on the back of the weatherproof cover box.
   c. Attach the cover to the unit with the four screws provided.

CAUTION

208/230-3-60 and 380/415-3-50 units with a factory-installed powered convenience outlet option are wired for 230v and 415v power supply respectively. Change the tap on the transformer for 208-3-60 or 380-3-50 operation. See the unit wiring diagram.

Limitations

These units must be installed in accordance with the following:

In U.S.A.:

1. National Electrical Code, ANSI/NFPA No. 70 - Latest Edition
2. National Fuel Gas Code, ANSI Z223.1 - Latest Edition
3. Gas-Fired Central Furnace Standard, ANSI Z21.47a. - Latest Edition
4. Local building codes
5. Local gas utility requirements
6. Local electric utility requirements

In Canada:

1. Canadian Electrical Code, CSA C22.1
2. Installation Codes, CSA - B149.1.
3. Local plumbing and waste water codes
4. Other applicable local codes.

Refer to unit application data found in this document.

If components are added to a unit to meet local codes, they are installed at the dealer's or customer's expense.

Base the size of the unit for the proposed installation on a heat loss/heat gain calculation made according to the methods of the Air Conditioning Contractors of America (ACCA).

Do not use the unit for temporary heating of buildings or structures under construction.

You can use the unit to heat and cool building or structures under construction if the application and use comply with all manufacturer's installation instructions, including the following:

- The unit must be operated under thermostatic control.
- Return and supply air ducts must be sealed to the unit.
- Air filters are in place.
- The return air temperature must be maintained between 55°F (13°C) and 80°F (27°C).
- When the construction phase is completed and before formal start up and commissioning, the unit, duct work and components must be thoroughly cleaned and inspected. This is to ensure that the operation of the unit during construction has not contaminated the unit.

Note: If the unit is used during the construction phase, the standard limited warranty provisions go into effect when the unit is placed into operation.

CAUTION

The Smart Equipment control board used in this product can effectively operate the cooling system down to 0°F when this product is applied in a comfort cooling application for people. An economizer is typically included in this type of application. When you apply this product for process cooling applications (such as computer rooms or switchgear), please call the applications department for Ducted Systems @ 1-877-874-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30°F.

Unit components

Figure 4: Component location

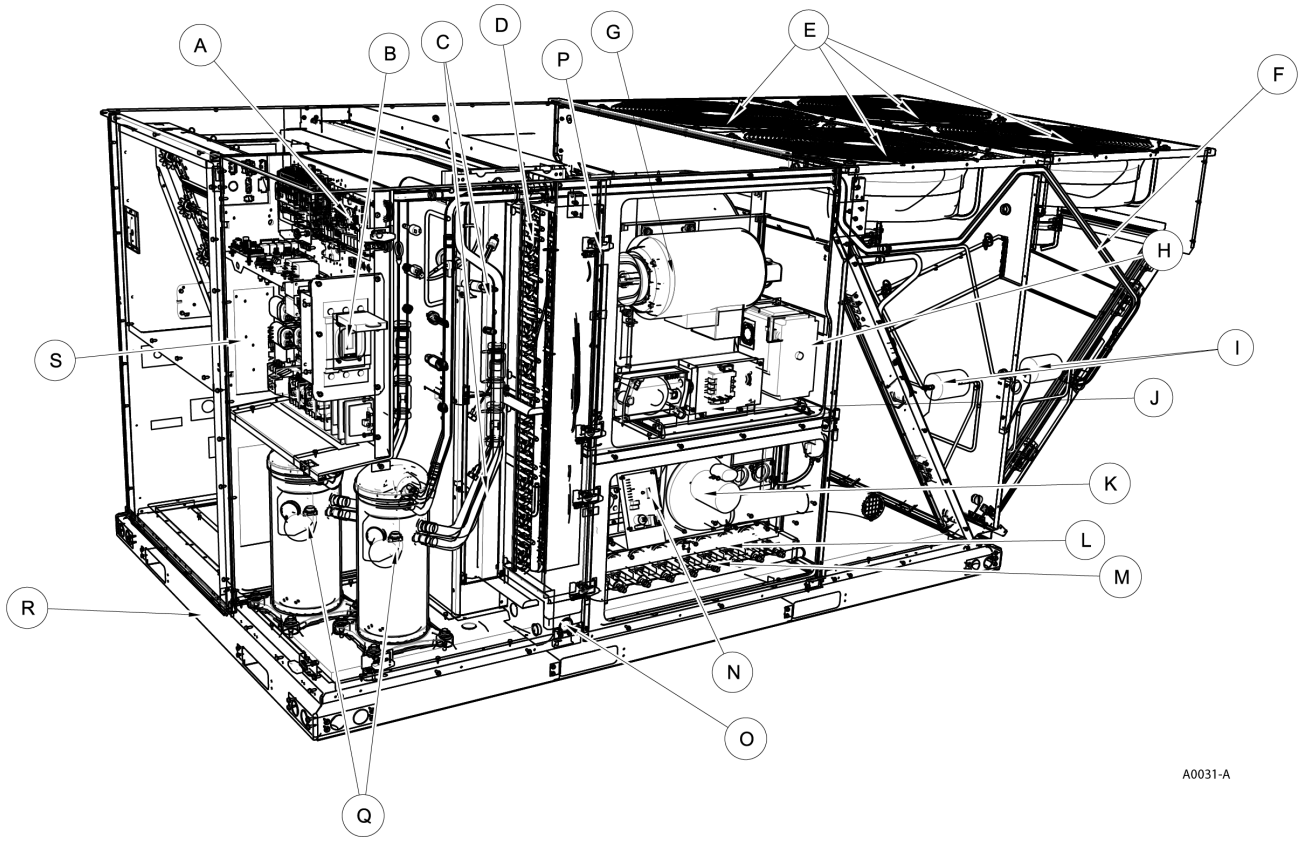


Figure 4 shows the WP078-150 unit. Table 1 lists the components of the unit.

Table 1: Component location table

Item	Description	Item	Description
A	Smart Equipment supply fan controls with IntelliSpeed™. Includes screw connectors for thermostat wiring and network connections	**K**	Power ventor motor
B	Disconnect location, optional disconnect switch	**L**	Two stage gas heating to maintain a warm, comfortable temperature
C	Filter access, 2-inch filter option	**M**	20-gauge aluminized steel tubular heat exchanger for long life. Stainless steel option
D	High efficiency sine wave fin evaporator coil	**N**	Intelligent control board for safe and efficient operation
E	ECM outdoor fan motor	**O**	Slide-out drain pan with 1-inch NPT connection
F	Micro-channel aluminum tube/aluminum fin condenser	**P**	Toolless door latch
G	Premium efficiency belt-drive blower motor	**Q**	Compressor access (High-efficiency 2-stage compressor)
H	Variable frequency drive	**R**	Base rails with forklift slots (three sides) and lifting holes[1]
I	Solid core filter drier	**S**	Second model nameplate inside hinged access panel
J	Slide-out motor and blower assembly for easy adjustment and service		

1. Roof curbs in eight-and fourteen-inch heights. Roof curbs to transition from a Sunline™ footprint to the KT Series footprint are available as a field-installed accessory.

Table 2: WP078-150 unit limitations

Size (ton)	Model	Unit voltage	Unit limitations		
			Applied voltage		Outdoor DB temp
			Minimum	Maximum	Maximum (°F)
078 (6.5)	WP	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
090 (7.5)	WP	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
102 (8.5)	WP	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
120 (10)	WP	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
150 (12.5)	WP	208/230-3-60	187	252	125
		460-3-60	432	504	125

Location

Use the following guidelines to select a suitable location for these units:

- The unit is designed for outdoor installation only.
- Condenser coils must have an unlimited supply of air. Where a choice of location is possible, position the unit on either the north or east side of the building.
- Suitable for mounting on roof curb.
- For ground level installation, use a level concrete slab with a minimum thickness of 4 in.. The length and width must be at least 6 in. greater than the unit base rails. Do not tie the slab to the building foundation.
- Roof structures must be able to support the weight of the unit and its options and accessories. The unit must be installed on a solid, level roof curb or appropriate angle iron frame.
- Maintain level tolerance to 1/2 in. across the entire width and length of the unit.

Clearances

All units require particular clearances for proper operation and service. See Table 7 for the clearances required for construction, servicing, and proper unit operation.

Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 – Latest Edition (in U.S.A.), or Sections 7.2, 7.3, or 7.4 of Gas Installation Codes, CSA-B149.1 (in Canada) - Latest Edition, and/or applicable provisions of the local building codes. Refer to Table 7 for the clearances required for combustible construction, servicing, and proper unit operation.

⚠ WARNING

Do not permit overhanging structures or shrubs to obstruct the condenser air discharge outlet, combustion air inlet, or vent outlets.

Rigging and handling

Exercise care when you move the unit. Do not remove any packaging until the unit is near the place of installation. To rig the unit, attach chain or cable slings to the lifting holes provided in the base rails. You must use spreader bars across the top of the unit. The spreader bars must have a length that exceeds the largest dimension across the unit.

⚠ CAUTION

If a unit is installed on a roof curb other than a Ducted Systems roof curb, you must apply gasketing to all surfaces that come in contact with the unit underside.

⚠ CAUTION

Before lifting the unit, ensure the unit weight is distributed equally on the rigging cables so that it lifts evenly.

You can use a forklift to move or lift the units. Slotted openings in the base rails are provided for this purpose.**The length of the forks must be a minimum of 60 in.**

⚠ CAUTION

All panels must be secured in place when the unit is lifted. The condenser coils must be protected from rigging cable damage with plywood or other suitable material.

Figure 5: Unit 4 point load weight

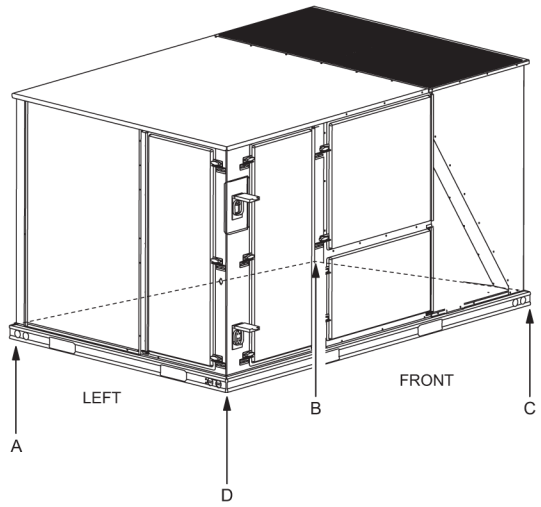


Figure 6: Unit 6 point load weight

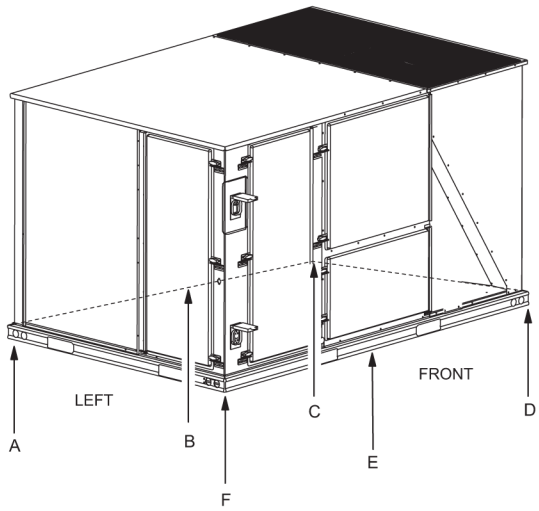


Figure 7: Center of gravity

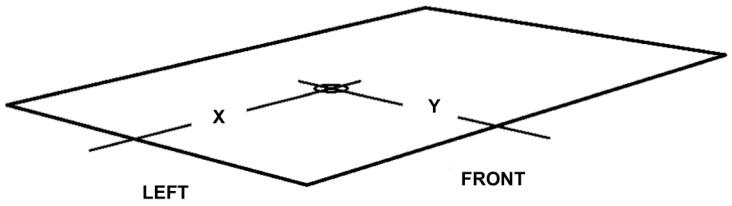


Table 3: WP078-150 standard unit weights

Size (ton)	Model	Weight (lb)		Center of gravity		4 point load location (lb)				6 point load location (lb)					
		Shipping	Operating	X	Y	A	B	C	D	A	B	C	D	E	F
078 (6.5)	WP	1085	1080	38	25	262	195	266	357	184	150	124	169	204	250
090 (7.5)	WP	1095	1090	38	23	243	181	284	381	171	139	115	181	217	267
102 (8.5)	WP	1142	1137	38	25.5	282	210	276	370	197	161	133	175	211	259
120 (10)	WP	1140	1135	38	25.5	281	209	275	369	197	160	133	175	211	259
150 (12.5)	WP	1408	1403	51	25.5	259	347	456	340	165	198	244	320	260	216

Table 4: WP078-150 with MagnaDry option unit weights

Size (ton)	Model	Weight (lb)		Center of gravity		4 point load location (lb)				6 point load location (lb)					
		Shipping	Operating	X	Y	A	B	C	D	A	B	C	D	E	F
078 (6.5)	WP	1105	1100	40.6	24	243	204	298	355	167	148	132	193	216	244
090 (7.5)	WP	1145	1140	39.5	24	258	206	300	376	179	153	132	193	223	261
102 (8.5)	WP	1145	1140	39.3	23.5	254	201	303	383	176	150	129	194	226	266
120 (10)	WP	1165	1160	39.75	24	261	211	307	381	180	156	136	198	227	263
150 (12.5)	WP	1475	1470	48	24.5	365	245	345	514	261	196	153	216	277	367

Table 5: WP078-150 unit accessory weights

Unit accessory	Weight (lb)	
	Shipping	Operating
Economizer	90	85
Power exhaust	40	35
Electric heat[1]	49	49
Gas heat[2]	110	110

1. Weight given is for the maximum heater size available (54kW).
2. The weight given is for the maximum number of tube heatexchangers available (8 tubes).

Figure 8: WP078-120 physical dimensions

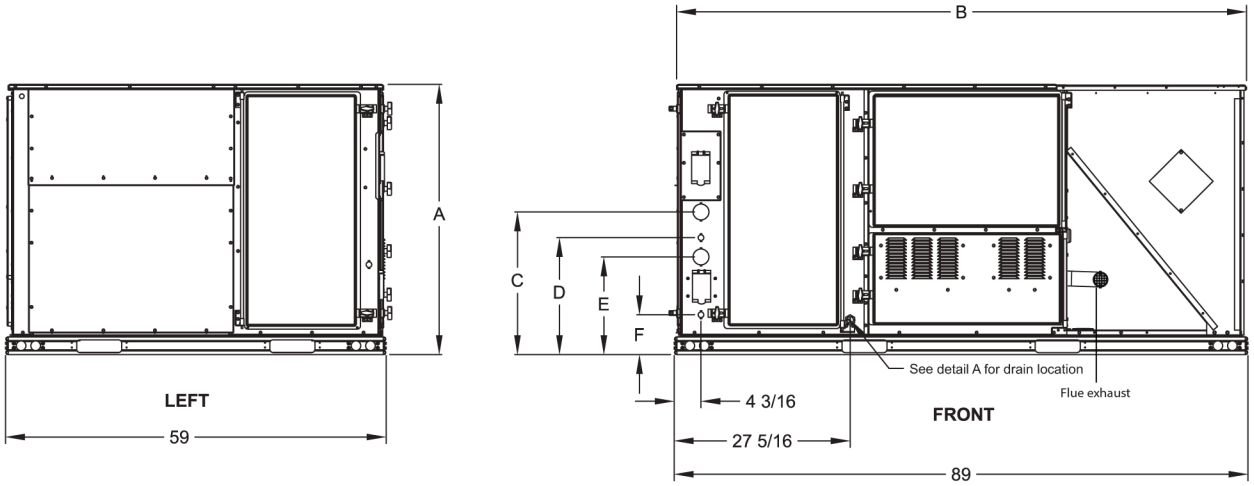


Figure 9: WP150 physical dimensions

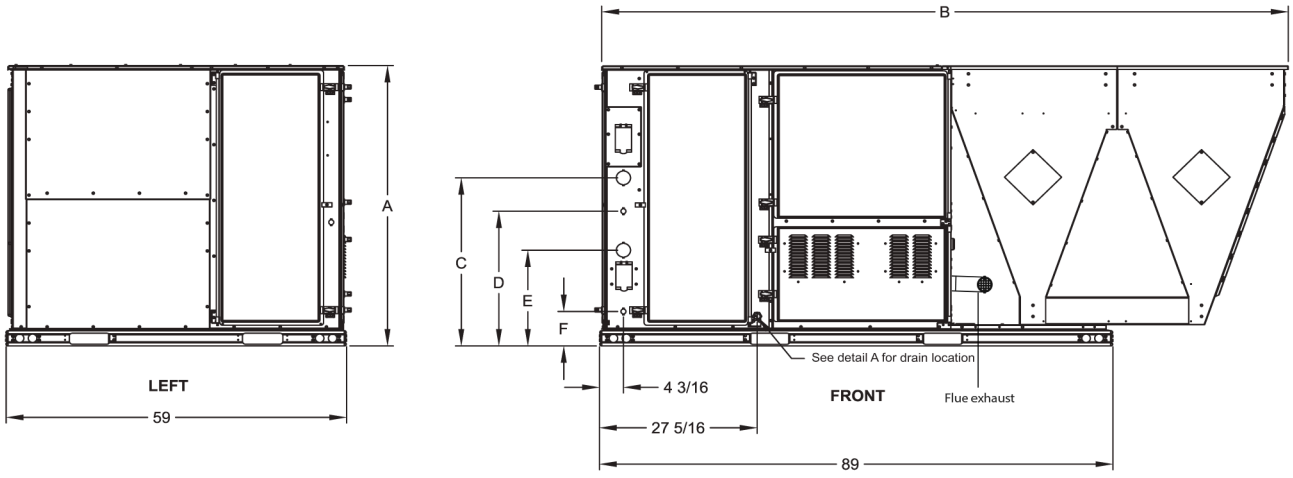
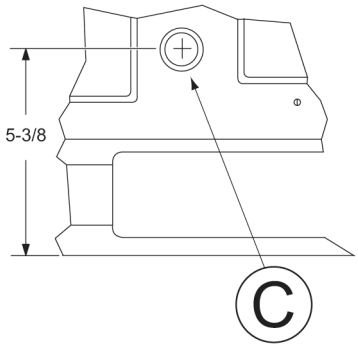


Table 6: WP078-150 unit physical dimensions

Unit model number	A	B	C	D	E	F
WP078	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
WP090	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
WP102	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
WP120	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
WP150	50 3/4	119 1/2	30 3/16	24 3/16	17 3/16	6 3/16



Detail A

Table 7: WP078-150 unit clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top[1]	72	Right	12
Front	48	Left	36
Rear	36	Bottom[2]	0

1. Units must be installed outdoors. Make sure that overhanging structures or shrubs do not obscure the condenser air discharge outlet.
2. Units may be installed on combustable floors made from wood or class A, B or C roof covering materials.

Figure 10: WP078-150 unit bottom duct openings

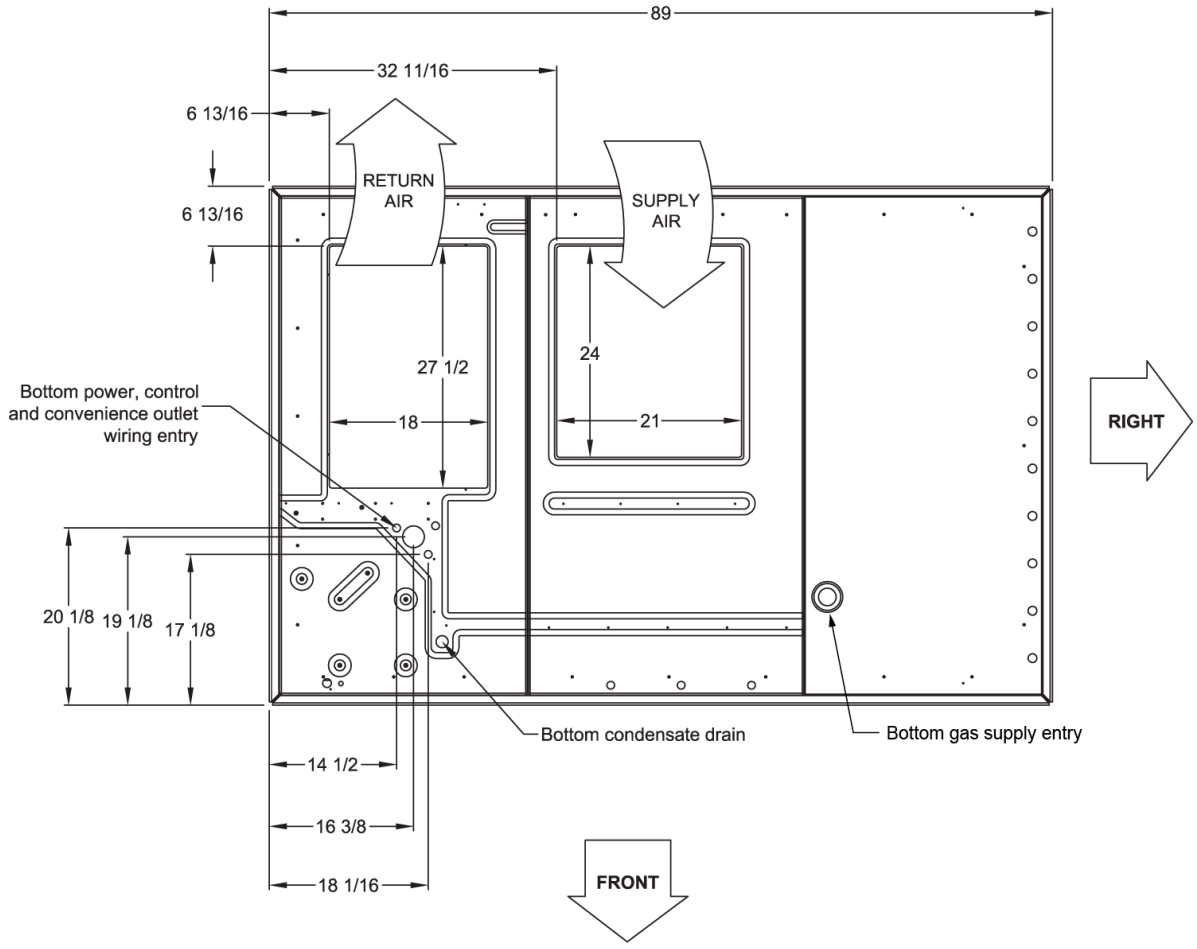


Figure 11: Top view with dimensions

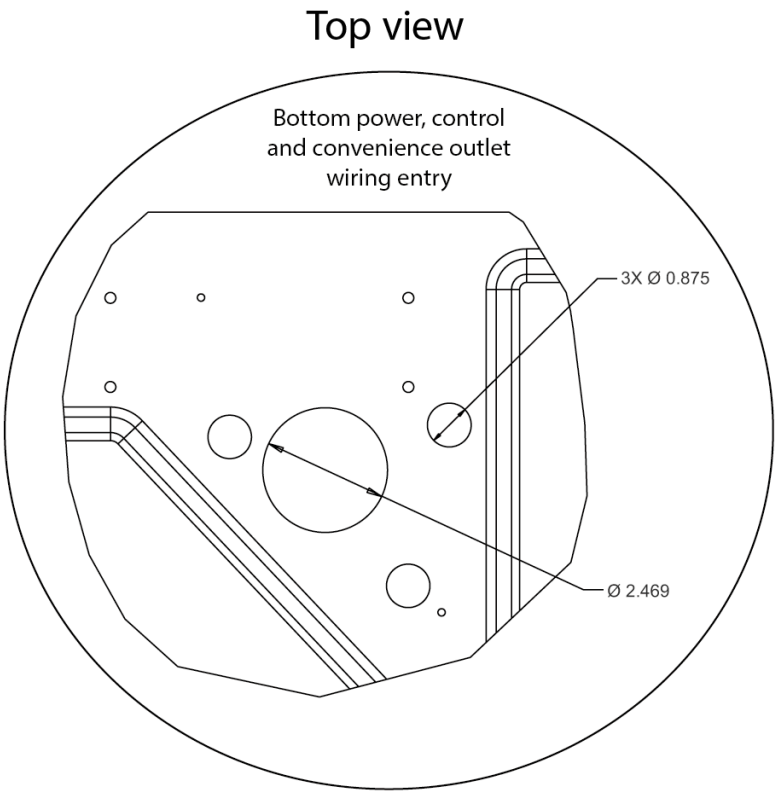
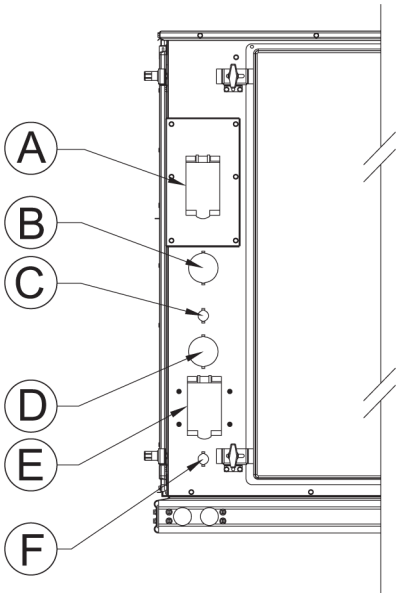


Figure 12: WP078-150 unit electrical entry



Item	Description
A	Disconnect switch cover
B	Power entry Ø 2-1/2
C	Control entry Ø 7/8
D	Power entry Ø 2-1/2

Item	Description
E	Convenience outlet cover
F	Convenience outlet power entry Ø 7/8

Figure 13: WP078-120 unit side duct openings

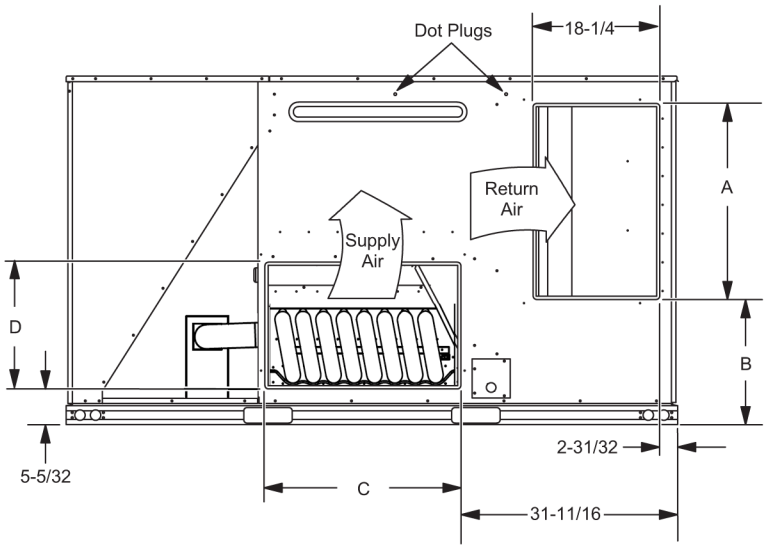


Figure 14: WP150 unit side duct openings

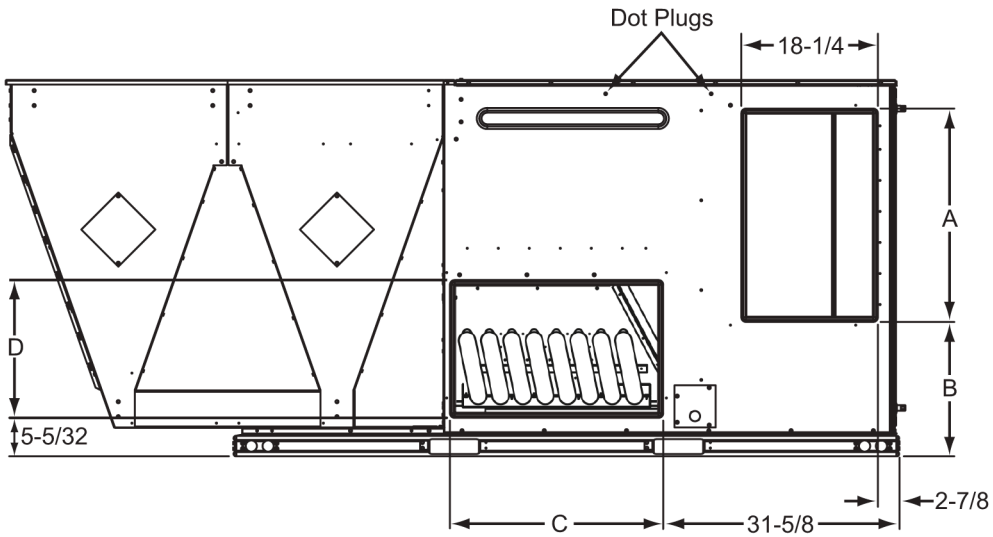


Table 8: Side duct dimensions

Unit model number	A	B	C	D
WP078	28 1/4	18 1/16	28 1/4	18 1/4
WP090	28 1/4	18 1/16	28 1/4	18 1/4
WP102	28 1/4	18 1/16	28 1/4	18 1/4
WP120	28 1/4	18 1/16	28 1/4	18 1/4
WP150	28 1/4	18 1/16	28 1/4	18 1/4

Figure 15: WP078-150 unit left - end duct opening

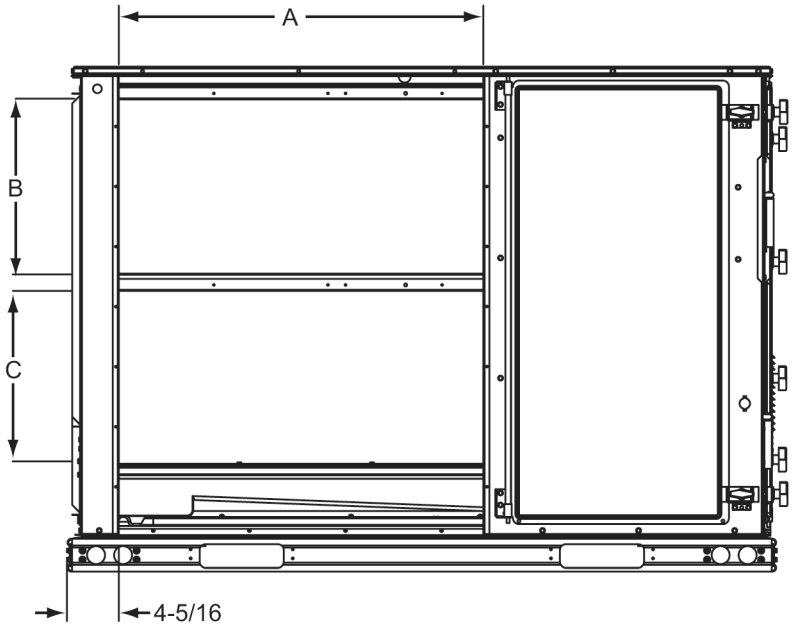


Table 9: WP078-150 Left - end duct dimensions

Unit model number	A	B	C
WP078	30.358	22.580	22.330
WP090	30.358	22.580	22.330
WP102	30.358	22.580	22.330
WP120	30.358	22.580	22.330
WP150	30.358	22.580	22.330

Figure 16: WP078-150 roof curb

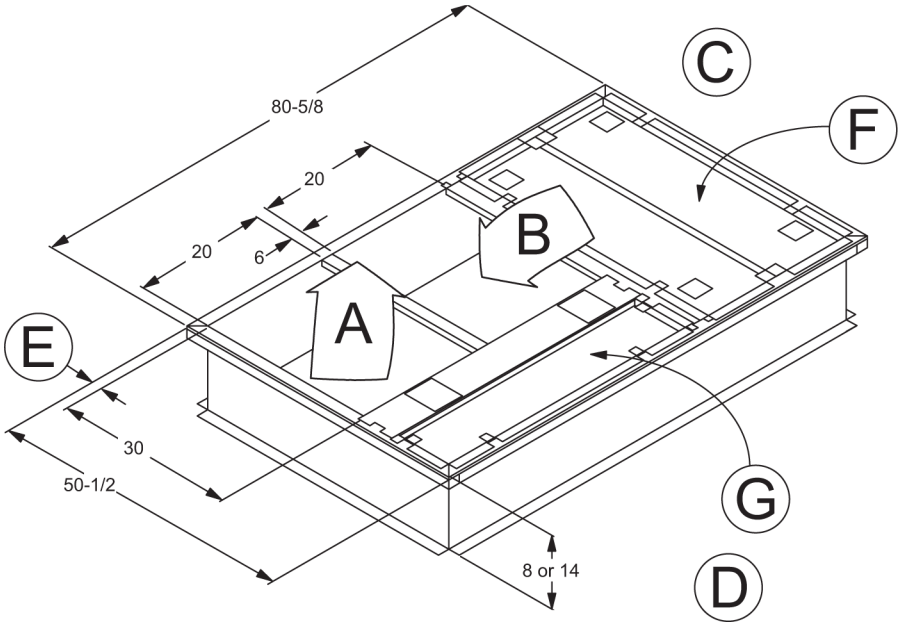


Figure 17: WP078-150 transition roof curb

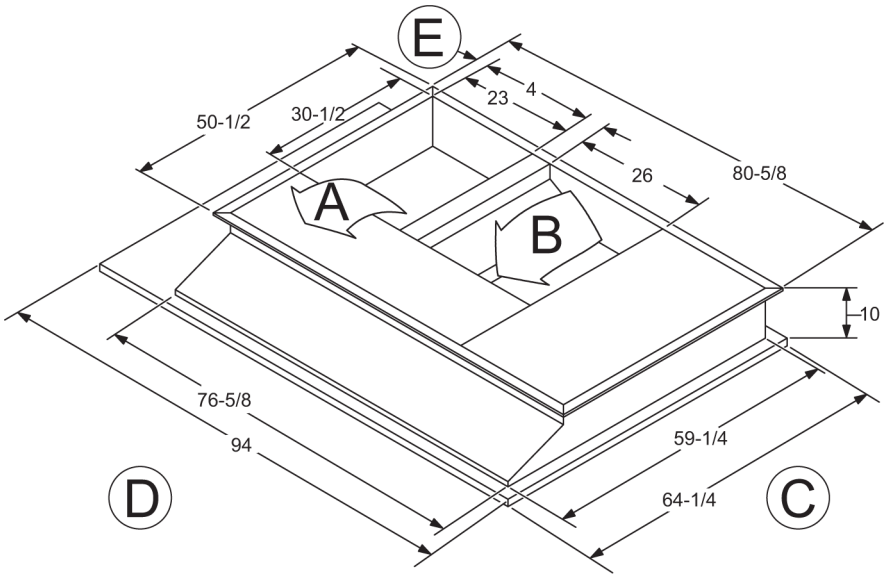
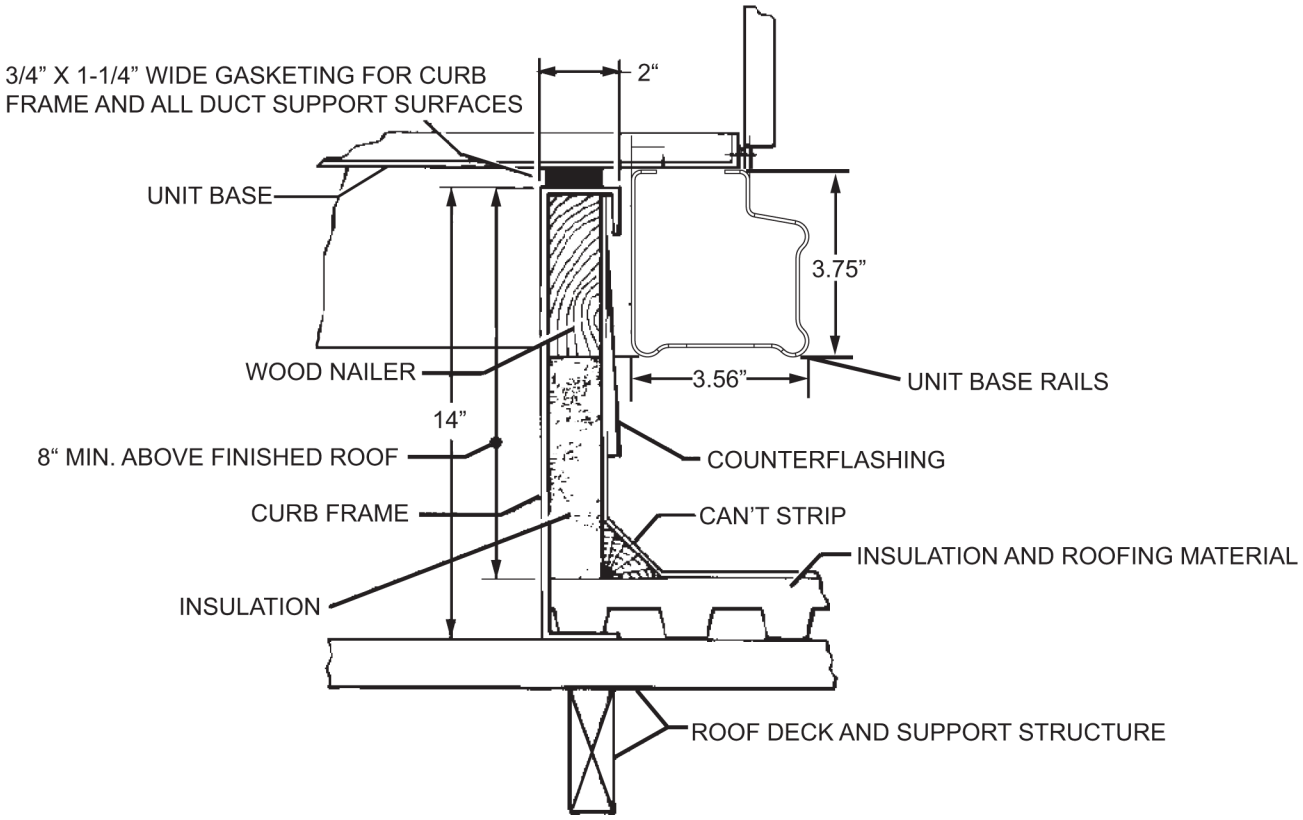


Table 10: Roof curb components

Item	Description
A	Return air
B	Supply air
C	Right side of the unit
D	Front side of the unit
E	2 typ.
F	Insulated deck under the condenser section
G	Insulated deck under the compressor section

Figure 18: WP078-150 roof curb cut away



Ductwork

You must design and size ductwork according to the methods in Manual D of the Air Conditioning Contractors of America (ACCA) or as recommended by any other recognized authority such as ASHRAE or SMACNA. When you design the duct system, apply the following recommendations:

- Use a closed return duct system. This does not preclude the use of economizers or outdoor fresh air intake.
- Make the supply and return air duct connections at the unit with flexible joints to minimize noise.
- Design the supply and return air duct systems for the CFM and static pressure requirements of the job. Do not size them to match the dimensions of the duct connections on the unit.

See Figure 10 for bottom air duct openings. See Figure 13 and Figure 14, and Table 8 for side air duct openings.

Changing the duct covers - side duct applications

Before you begin:

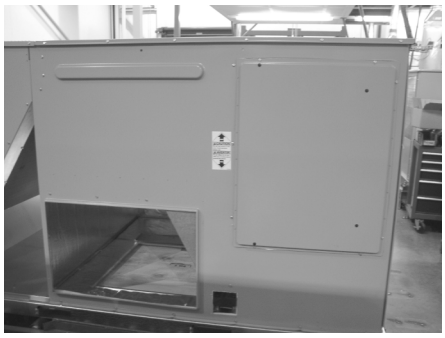
Units are shipped with the side duct openings covered. For a bottom duct application, no duct cover changes are necessary. For a side duct application, complete the following steps:

1. Remove the side duct covers.
2. Orient the supply panel with the painted surface up.
3. Slide the supply panel between the heat exchanger and the unit bottom. The painted surface must face the heat exchanger. The space is narrow but there is adequate room to install the panel.
4. Secure the supply panel with the factory-installed bracket and two screws.
5. Orient the return panel with the painted surface down.
6. Install the return panel over the corresponding side duct. The painted surface must face the down flow duct opening.
7. Secure the return panel with four screws.

CAUTION

When you fasten ductwork to the side duct flanges on the unit, insert the screws through duct flanges only. DO NOT insert the screws through the casing. You must insulate and water-proof outdoor ductwork.

Figure 19: Side panels with hole plugs

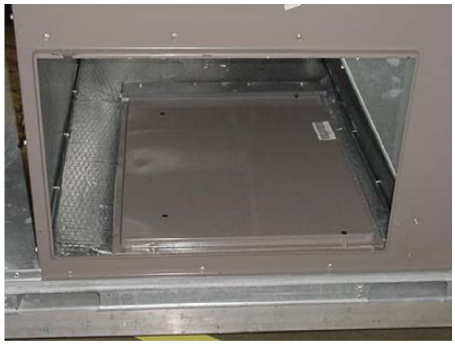


Note: the orientation of the panel with the insulation side facing up.

Figure 20: Return down flow plenum with panel



Figure 21: Discharge panel in place



Side panels

Units are shipped with side panels to cover the area where an economizer or motorized damper may be installed. You must keep these panels to use them as tops for the economizer rain hoods. See Figure 22 for more details.

Figure 22: Side panels for economizer hood tops



Installing a condensate drain

The side condensate drain is reversible and can be re-oriented to the rear of the cabinet to facilitate condensate piping. A condensate drain connection is available through the base pan for piping inside the roof curb.

Note: Plumbing must conform to local codes.

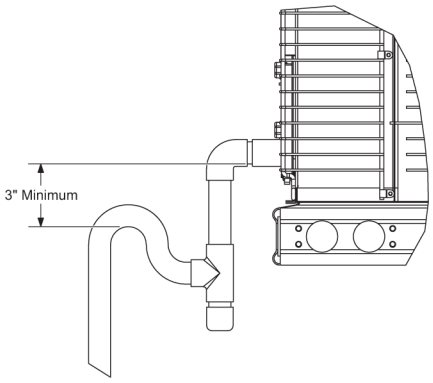
To install the connection, complete the following steps:

1. Trap the connection according to Figure 23.

   Note: You must protect the trap and drain lines from freezing.

2. Install the condensate drain line from the 1 in. NPT female connection on the unit to an open drain. Use a sealing compound on male pipe threads.

Figure 23: Condensate drain



Compressors

The scroll compressor used in this product is specifically designed to operate with R-454B refrigerant and cannot be interchanged.

The compressor also uses a polyolester (POE oil), Mobil 3MA POE. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oil can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all the necessary precautions to avoid exposure of the oil to the atmosphere.

⚠ CAUTION

Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the **POE oil** in the system. This type of oil is highly susceptible to moisture absorption

POE compressor lubricants are known to cause long term damage to some synthetic roofing materials.

⚠ CAUTION

Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When you perform any service that may risk exposure of compressor oil to the roof, take precautions to protect the roofing.

Procedures that risk oil leakage include, but are not limited to, the following:

- Compressor replacement
- Repairing refrigerant leaks
- Replacing refrigerant components such as the filter drier, pressure switch, metering device or coil

Units are shipped with compressor mountings that are factory-adjusted and ready for operation.

⚠ CAUTION

Do not loosen compressor mounting bolts.

Filters

2 in. filters are supplied with each unit.

Always install filters ahead of evaporator coil. Keep the filters clean and replace them with filters of the same size and type. Dirty filters reduce the capacity of the unit and result in frosted coils or safety shutdown. See the Physical data for the number and size of filters needed for the unit.

Do not operate the unit without filters correctly installed.

⚠ CAUTION

Make sure that panel latches are properly positioned on the unit to maintain an airtight seal.

Power and control wiring

Field wiring to the unit, fuses, and disconnects must conform to provisions of National Electrical Code (NEC), ANSI/NFPA No. 70 – Latest Edition (in U.S.A.), current Canadian Electrical Code C221, and local ordinances. The unit must be electrically grounded in accordance with NEC and CEC as specified above and local codes.

Voltage tolerances must be maintained at the compressor terminals during starting and running conditions. The voltage tolerances are indicated on the unit rating plate and in Table 2.

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units control transformers are factory wired for 230v and 415v power supply respectively. Change the tap on the transformer for 208-3-60 or 380-3-50 operation. See the unit wiring diagram.

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes is not required.

If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

A disconnect must be used for these units. Factory-installed disconnects are available. If you install a disconnect (field supplied accessory), see Figure 4 for the recommended mounting location.

⚠ CAUTION

Avoid damage to internal components if you drill holes to install a disconnect mounting.

ⓘ **Note:** Not all local codes allow the installation of a disconnect on the unit. Confirm compliance with local code before you install a disconnect on the unit.

Electrical line must be sized correctly to carry the load.

ⓘ **Note:** Use copper conductors only.

Each unit must be wired with a separate branch circuit fed directly from the meter panel and correctly fused.

See Figure 24 and Figure 25 for typical field wiring. Refer to the appropriate unit wiring diagram mounted inside the control doors for control circuit and power wiring information.

⚠ CAUTION

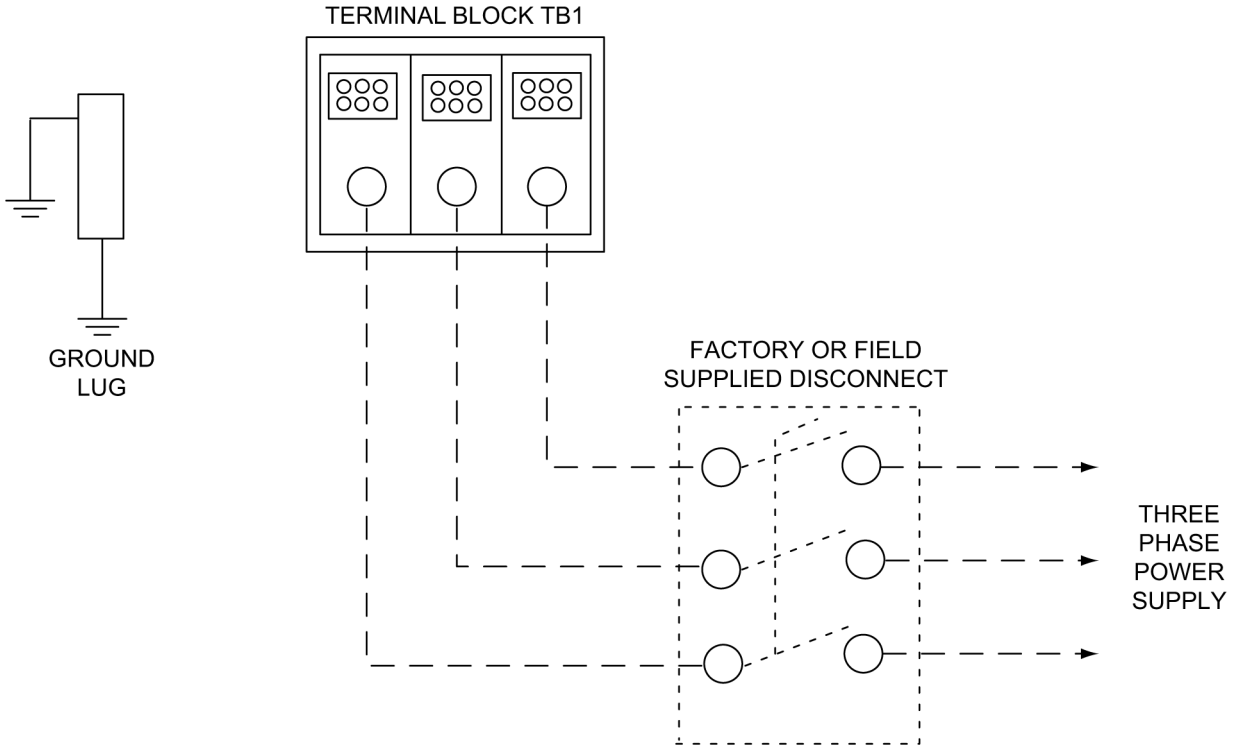
When you connect electrical power and control wiring to the unit, you must use water-proof connectors so that water or moisture cannot be drawn into the unit during normal operation. These water-proofing conditions also apply when you install a field-supplied disconnect switch.

Power wiring detail

Units are factory wired for the voltage shown on the unit nameplate. See Electrical data to size power wiring, fuses, and the disconnect switch.

Power wiring is brought into the unit through the side of the unit or the basepan inside the curb.

Figure 24: Field wiring disconnect - cooling unit with or without electric heat



Thermostat wiring

Install the thermostat on an inside wall approximately 56 in. above the floor. The thermostat must not be subject to drafts, sun exposure, or heat from electrical fixtures or appliances.

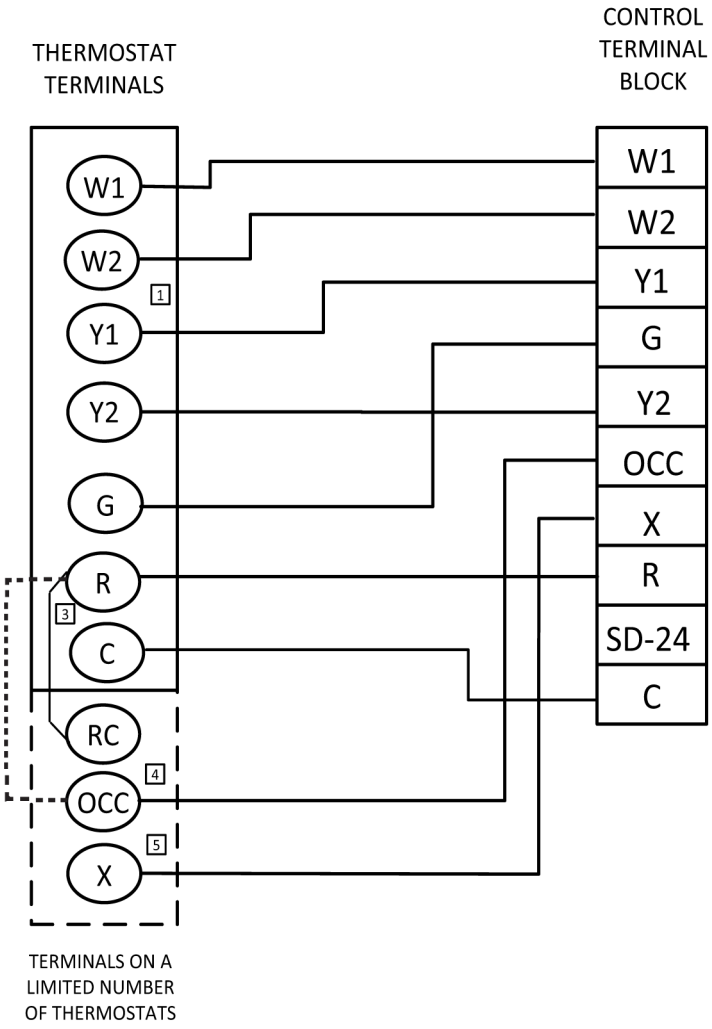
Follow the manufacturer's instructions enclosed with thermostat for the general installation procedure. Use color-coded, insulated wires to connect the thermostat to the unit. See Table 11 for control wire sizing and maximum length.

Table 11: Control wire sizes

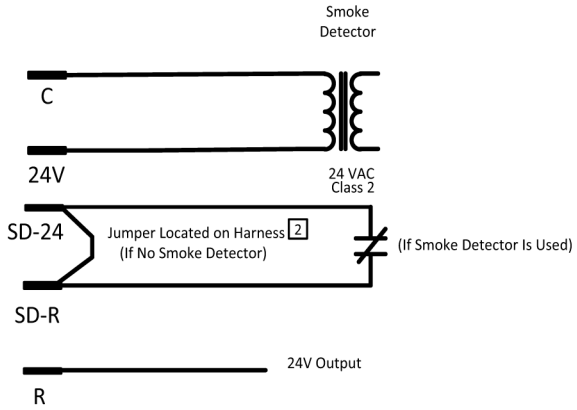
Wire size	Maximum length (ft)[1]
20 AWG	< 150
18 AWG	150 to 250
16 AWG	250 to 500

1. From the unit to the thermostat and back to the unit.

Figure 25: Typical electronic thermostat field wiring



R~Occ Jumper:
Smart Equipment Control boards come from the factory with a jumper wire between R and OCC terminals on the thermostat terminal strip. Failure to remove this jumper will place the unit into the Occupied mode no matter what the occupancy demand is from the thermostat or EMS system. To allow Thermostat or EMS control of the Occupied mode for the unit, this jumper must be removed during commissioning.



1 Second stage heating not required on single stage heating units.

2 Jumper is required if there is no Smoke Detector circuit.

3 Jumper is required for any combination of R, RC, or RH.

4 OCC is an output from the thermostat to indicate the Occupied condition.

5 X is an input to the thermostat to display Error Status conditions.

Electrical data

Note: This note relates to all electrical data tables.

1. MCA = Minimum Circuit Ampacity
2. Max fuse = Dual Element, Time Delay Type
3. Breaker size = HACR type per NEC.

Table 12: WP078-150 standard motor - without powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA[1] (A)	MCA[1] w/Pwr Exh (A)	Max fuse [2] / breaker [3] size (A)	Max fuse[1] /breaker[2] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	9.6	90	15	1.65	9	5.5		None	-	-	-	33.9	39.4	40	45
									E09	6.8	1	18.9	57.5	63	60	70
									E18	13.5	2	37.5	80.8	86.3	90	90
									E24	18	2	50	96.4	101.9	100	110
									E36	25.5	2	70.8	122.4	127.9	125	150
	230-3-60	9.6	90	15	1.65	9	5.5		None	-	-	-	33.9	39.4	40	45
									E09	9	1	21.7	61	66.5	70	70
									E18	18	2	43.3	88	93.5	90	100
									E24	24	2	57.7	106	111.5	110	125
									E36	34	2	81.8	136.2	141.7	150	150
	460-3-60	4.9	36	8	1.1	4.6	2.2		None	-	-	-	17.8	20	20	20
									E09	9	1	10.8	31.3	33.5	35	35
									E18	18	2	21.7	44.9	47.1	45	50
									E24	24	2	28.9	53.9	56.1	60	60
									E36	34	2	40.9	68.9	71.1	70	80
	575-3-60	3.7	29	6	0.65	3.5	1.8		None	-	-	-	13.1	14.9	15	15
									E09	9	1	8.7	24	25.8	25	30
									E18	18	2	17.3	34.7	36.5	35	40
									E24	24	2	23.1	42	43.8	45	45
									E36	34	2	32.7	54	55.8	60	60
090 (7.5)	208-3-60	12	123	19	1.65	9	5.5		None	-	-	-	39.3	44.8	50	50
									E09	6.8	1	18.9	62.9	68.4	70	70
									E18	13.5	2	37.5	86.2	91.7	90	100
									E24	18	2	50	101.8	107.3	110	110
									E36	25.5	2	70.8	127.8	133.3	150	150
	230-3-60	12	123	19	1.65	9	5.5		None	-	-	-	39.3	44.8	50	50
									E09	9	1	21.7	66.4	71.9	70	80
									E18	18	2	43.3	93.4	98.9	100	100
									E24	24	2	57.7	111.4	116.9	125	125
									E36	34	2	81.8	141.6	147.1	150	150
	460-3-60	6.3	60	10	1.1	4.6	2.2		None	-	-	-	21	23.2	25	25
									E09	9	1	10.8	34.5	36.7	35	40
									E18	18	2	21.7	48.1	50.3	50	60
									E24	24	2	28.9	57.1	59.3	60	60
									E36	34	2	40.9	72.1	74.3	80	80
	575-3-60	4.4	41	7	0.65	3.5	1.8		None	-	-	-	14.7	16.5	15	20
									E09	9	1	8.7	25.6	27.4	30	30
									E18	18	2	17.3	36.3	38.1	40	40
									E24	24	2	23.1	43.6	45.4	45	50
									E36	34	2	32.7	55.6	57.4	60	60

Table 12: WP078-150 standard motor - without powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA[1] (A)	MCA[1] w/Pwr Exh (A)	Max fuse [2] / breaker [3] size (A)	Max fuse[1] /breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
102 (8.5)	208-3-60	13.5	120.4	21	1.65	9	5.5		None	-	-	-	42	47.5	50	60
									E09	6.8	1	18.9	65.6	71.1	70	80
									E18	13.5	2	37.5	88.9	94.4	90	100
									E24	18	2	50	104.5	110	110	110
									E36	25.5	2	70.8	130.5	136	150	150
	230-3-60	13.5	120.4	21	1.65	9	5.5		None	-	-	-	42	47.5	50	60
									E09	9	1	21.7	69.1	74.6	70	80
									E18	18	2	43.3	96.1	101.6	100	110
									E24	24	2	57.7	114.1	119.6	125	125
									E36	34	2	81.8	144.3	149.8	150	150
	460-3-60	6.4	50	10	1.1	4.6	2.2		None	-	-	-	20.8	23	25	25
									E09	9	1	10.8	34.3	36.5	35	40
									E18	18	2	21.7	47.9	50.1	50	60
									E24	24	2	28.9	56.9	59.1	60	60
									E36	34	2	40.9	71.9	74.1	80	80
	575-3-60	5.1	41	8	0.65	3.5	1.8		None	-	-	-	17.2	19	20	20
									E09	9	1	8.7	28.1	29.9	30	30
									E18	18	2	17.3	38.8	40.6	40	45
									E24	24	2	23.1	46.1	47.9	50	50
									E36	34	2	32.7	58.1	59.9	60	60
120 (10)	208-3-60	16	156.4	25	1.65	9	5.5		None	-	-	-	48.3	53.8	60	60
									E18	13.5	2	37.5	95.2	100.7	100	110
									E24	18	2	50	110.8	116.3	125	125
									E36	25.5	2	70.8	136.8	142.3	150	150
									E54	40.6	2	112.7	152.1	159	175	175
	230-3-60	16	156.4	25	1.65	9	5.5		None	-	-	-	48.3	53.8	60	60
									E18	18	2	43.3	102.4	107.9	110	110
									E24	24	2	57.7	120.4	125.9	125	150
									E36	34	2	81.8	150.6	156.1	175	175
									E54	54	2	129.9	150.6	156.1	175	175
	460-3-60	7.1	69	11	1.1	4.6	2.2		None	-	-	-	22.8	25	25	30
									E18	18	2	21.7	49.9	52.1	50	60
									E24	24	2	28.9	58.9	61.1	60	70
									E36	34	2	40.9	73.9	76.1	80	80
									E54	54	2	65	73.9	76.1	80	80
	575-3-60	6.4	47.8	10	0.65	3.5	1.8		None	-	-	-	19.2	21	25	25
									E18	18	2	17.3	40.8	42.6	45	45
									E24	24	2	23.1	48.1	49.9	50	50
									E36	34	2	32.7	60.1	61.9	70	70
									E54	54	2	52	60.1	61.9	70	70

Table 12: WP078-150 standard motor - without powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA[1] (A)	MCA[1] w/Pwr Exh (A)	Max fuse [2] / breaker [3] size (A)	Max fuse[1] /breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
150 (12.5)	208-3-60	22.4	166.2	35	3.5	13.2	5.5		None	-	-	-	77.6	83.1	100	100
									E18	13.5	2	37.5	124.5	130	125	150
									E24	18	2	50	140.1	145.6	150	150
									E36	25.5	2	70.8	166.1	171.6	175	175
									E54	40.6	2	112.7	166.1	171.6	175	175
	230-3-60	22.4	166.2	35	3.5	13.2	5.5		None	-	-	-	77.6	83.1	100	100
									E18	18	2	43.3	131.7	137.2	150	150
									E24	24	2	57.7	149.7	155.2	150	175
									E36	34	2	81.8	179.9	185.4	200	200
									E54	54	2	129.9	179.9	185.4	200	200
	460-3-60	8.8	74.6	14	1.6	6.1	2.2		None	-	-	-	32.3	34.5	40	40
									E18	18	2	21.7	59.4	61.6	60	70
									E24	24	2	28.9	68.4	70.6	70	80
									E36	34	2	40.9	83.4	85.6	90	90
									E54	54	2	65	83.4	85.6	90	90

Table 13: WP078-150 Hi-Static motor - without powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA[1] (A)	MCA[1] w/ Pwr Exh (A)	Max fuse [2]/breaker [3] size (A)	Max fuse[1] / breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	9.6	90	15	1.65	9	5.5		None	-	-	-	33.9	39.4	40	45
									E09	6.8	1	18.9	57.5	63	60	70
									E18	13.5	2	37.5	80.8	86.3	90	90
									E24	18	2	50	96.4	101.9	100	110
									E36	25.5	2	70.8	122.4	127.9	125	150
	230-3-60	9.6	90	15	1.65	9	5.5		None	-	-	-	33.9	39.4	40	45
									E09	9	1	21.7	61	66.5	70	70
									E18	18	2	43.3	88	93.5	90	100
									E24	24	2	57.7	106	111.5	110	125
									E36	34	2	81.8	136.2	141.7	150	150
	460-3-60	4.9	36	8	1.1	4.6	2.2		None	-	-	-	17.8	20	20	20
									E09	9	1	10.8	31.3	33.5	35	35
									E18	18	2	21.7	44.9	47.1	45	50
									E24	24	2	28.9	53.9	56.1	60	60
									E36	34	2	40.9	68.9	71.1	70	80
	575-3-60	3.7	29	6	0.65	3.5	1.8		None	-	-	-	13.1	14.9	15	15
									E09	9	1	8.7	24	25.8	25	30
									E18	18	2	17.3	34.7	36.5	35	40
									E24	24	2	23.1	42	43.8	45	45
									E36	34	2	32.7	54	55.8	60	60

Table 13: WP078-150 Hi-Static motor - without powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA[1] (A)	MCA[1] w/ Pwr Exh (A)	Max fuse[2]/breaker[3] size (A)	Max fuse[2]/ breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
090 (7.5)	208-3-60	12	123	19	1.65	13.2	5.5		None	-	-	-	43.8	49.3	50	60
									E09	6.8	1	18.9	67.4	72.9	70	80
									E18	13.5	2	37.5	90.7	96.2	100	100
									E24	18	2	50	106.3	111.8	110	125
									E36	25.5	2	70.8	132.3	137.8	150	150
	230-3-60	12	123	19	1.65	13.2	5.5		None	-	-	-	43.8	49.3	50	60
									E09	9	1	21.7	70.9	76.4	80	80
									E18	18	2	43.3	97.9	103.4	100	110
									E24	24	2	57.7	115.9	121.4	125	125
									E36	34	2	81.8	146.1	151.6	150	175
	460-3-60	6.3	60	10	1.1	6.1	2.2		None	-	-	-	22.5	24.7	25	30
									E09	9	1	10.8	36	38.2	40	40
									E18	18	2	21.7	49.6	51.8	50	60
									E24	24	2	28.9	58.6	60.8	60	70
									E36	34	2	40.9	73.6	75.8	80	80
	575-3-60	4.4	41	7	0.65	4.9	1.8		None	-	-	-	16.2	18	20	20
									E09	9	1	8.7	27.1	28.9	30	30
									E18	18	2	17.3	37.8	39.6	40	40
									E24	24	2	23.1	45.1	46.9	50	50
									E36	34	2	32.7	57.1	58.9	60	60
102 (8.5)	208-3-60	13.5	120.4	21	1.65	13.2	5.5		None	-	-	-	46.2	51.7	50	60
									E09	6.8	1	18.9	69.8	75.3	70	80
									E18	13.5	2	37.5	93.1	98.6	100	100
									E24	18	2	50	108.7	114.2	110	125
									E36	25.5	2	70.8	134.7	140.2	150	150
	230-3-60	13.5	120.4	21	1.65	13.2	5.5		None	-	-	-	46.2	51.7	50	60
									E09	9	1	21.7	73.3	78.8	80	80
									E18	18	2	43.3	100.3	105.8	110	110
									E24	24	2	57.7	118.3	123.8	125	125
									E36	34	2	81.8	148.5	154	150	175
	460-3-60	6.4	50	10	1.1	6.1	2.2		None	-	-	-	22.3	24.5	25	30
									E09	9	1	10.8	35.8	38	40	40
									E18	18	2	21.7	49.4	51.6	50	60
									E24	24	2	28.9	58.4	60.6	60	70
									E36	34	2	40.9	73.4	75.6	80	80
	575-3-60	5.1	41	8	0.65	4.9	1.8		None	-	-	-	18.6	20.4	20	25
									E09	9	1	8.7	29.5	31.3	30	35
									E18	18	2	17.3	40.2	42	45	45
									E24	24	2	23.1	47.5	49.3	50	50
									E36	34	2	32.7	59.5	61.3	60	70

Table 13: WP078-150 Hi-Static motor - without powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA[1] (A)	MCA[1] w/ Pwr Exh (A)	Max fuse[2]/breaker[3] size (A)	Max fuse[1]/ breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
120 (10.0)	208-3-60	16	156.4	25	1.65	13.2	5.5		None	-	-	-	52.5	58	60	70
									E18	13.5	2	37.5	99.4	104.9	100	110
									E24	18	2	50	115	120.5	125	125
									E36	25.5	2	70.8	141	146.5	150	150
									E54	40.6	2	112.7	157.4	164.3	175	175
	230-3-60	16	156.4	25	1.65	13.2	5.5		None	-	-	-	52.5	58	60	70
									E18	18	2	43.3	106.6	112.1	110	125
									E24	24	2	57.7	124.6	130.1	125	150
									E36	34	2	81.8	154.8	160.3	175	175
									E54	54	2	129.9	154.8	160.3	175	175
	460-3-60	7.1	69	11	1.1	6.1	2.2		None	-	-	-	24.3	26.5	30	30
									E18	18	2	21.7	51.4	53.6	60	60
									E24	24	2	28.9	60.4	62.6	70	70
									E36	34	2	40.9	75.4	77.6	80	80
									E54	54	2	65	75.4	77.6	80	90
	575-3-60	6.4	47.8	10	0.65	4.9	1.8		None	-	-	-	20.6	22.4	25	25
									E18	18	2	17.3	42.2	44	45	45
									E24	24	2	23.1	49.5	51.3	50	60
									E36	34	2	32.7	61.5	63.3	70	70
									E54	54	2	52	61.5	63.3	70	70
150 (12.5)	208-3-60	22.4	166.2	35	3.5	20.4	5.5		None	-	-	-	84.8	90.3	100	110
									E18	13.5	2	37.5	131.7	137.2	150	150
									E24	18	2	50	147.3	152.8	150	175
									E36	25.5	2	70.8	173.3	178.8	175	200
									E54	40.6	2	112.7	173.3	178.8	175	200
	230-3-60	22.4	166.2	35	3.5	20.4	5.5		None	-	-	-	84.8	90.3	100	110
									E18	18	2	43.3	138.9	144.4	150	150
									E24	24	2	57.7	156.9	162.4	175	175
									E36	34	2	81.8	187.1	192.6	200	200
									E54	54	2	129.9	187.1	192.6	200	200
	460-3-60	8.8	74.6	14	1.6	9.9	2.2		None	-	-	-	36.4	38.6	45	45
									E18	18	2	21.7	63.5	65.7	70	70
									E24	24	2	28.9	72.5	74.7	80	80
									E36	34	2	40.9	87.5	89.7	90	90
									E54	54	2	65	87.5	89.7	90	90

Table 14: WP078-150 Standard motor - with powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA [1](A)	MCA[1]w/ Pwr Exh (A)	Max fuse [2]/breaker [3] size (A)	Max fuse[1]/ breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	9.6	90	15	1.65	9	5.5	20	None	-	-	-	44	49.5	50	50
									E09	6.8	1	18.9	67.6	73.1	70	80
									E18	13.5	2	37.5	90.9	96.4	100	100
									E24	18	2	50	106.5	112	110	125
									E36	25.5	2	70.8	132.5	138	150	150
	230-3-60	9.6	90	15	1.65	9	5.5	20	None	-	-	-	44	49.5	50	50
									E09	9	1	21.7	71.1	76.6	80	80
									E18	18	2	43.3	98.1	103.6	100	110
									E24	24	2	57.7	116.1	121.6	125	125
									E36	34	2	81.8	146.3	151.8	150	175
	460-3-60	4.9	36	8	1.1	4.6	2.2	20	None	-	-	-	22.9	25.1	25	30
									E09	9	1	10.8	36.4	38.6	40	40
									E18	18	2	21.7	50	52.2	50	60
									E24	24	2	28.9	59	61.2	60	70
									E36	34	2	40.9	74	76.2	80	80
	575-3-60	3.7	29	6	0.65	3.5	1.8	20	None	-	-	-	17.2	19	20	20
									E09	9	1	8.7	28.1	29.9	30	30
									E18	18	2	17.3	38.8	40.6	40	45
									E24	24	2	23.1	46.1	47.9	50	50
									E36	34	2	32.7	58.1	59.9	60	60
090 (7.5)	208-3-60	12	123	19	1.65	9	5.5	20	None	-	-	-	49.3	54.8	60	60
									E09	6.8	1	18.9	72.9	78.4	80	80
									E18	13.5	2	37.5	96.2	101.7	100	110
									E24	18	2	50	111.8	117.3	125	125
									E36	25.5	2	70.8	137.8	143.3	150	150
	230-3-60	12	123	19	1.65	9	5.5	20	None	-	-	-	49.3	54.8	60	60
									E09	9	1	21.7	76.4	81.9	80	90
									E18	18	2	43.3	103.4	108.9	110	110
									E24	24	2	57.7	121.4	126.9	125	150
									E36	34	2	81.8	151.6	157.1	175	175
	460-3-60	6.3	60	10	1.1	4.6	2.2	20	None	-	-	-	26	28.2	30	30
									E09	9	1	10.8	39.5	41.7	40	45
									E18	18	2	21.7	53.1	55.3	60	60
									E24	24	2	28.9	62.1	64.3	70	70
									E36	34	2	40.9	77.1	79.3	80	80
	575-3-60	4.4	41	7	0.65	3.5	1.8	20	None	-	-	-	18.7	20.5	20	25
									E09	9	1	8.7	29.6	31.4	30	35
									E18	18	2	17.3	40.3	42.1	45	45
									E24	24	2	23.1	47.6	49.4	50	50
									E36	34	2	32.7	59.6	61.4	60	70

Table 14: WP078-150 Standard motor - with powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA [1](A)	MCA[1]w/ Pwr Exh (A)	Max fuse [2]/breaker [3] size (A)	Max fuse[1]/ breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
102 (8.5)	208-3-60	13.5	120.4	21	1.65	9	5.5	20	None	-	-	-	52	57.5	60	70
									E09	6.8	1	18.9	75.6	81.1	80	90
									E18	13.5	2	37.5	98.9	104.4	100	110
									E24	18	2	50	114.5	120	125	125
									E36	25.5	2	70.8	140.5	146	150	150
	230-3-60	13.5	120.4	21	1.65	9	5.5	20	None	-	-	-	52	57.5	60	70
									E09	9	1	21.7	79.1	84.6	80	90
									E18	18	2	43.3	106.1	111.6	110	125
									E24	24	2	57.7	124.1	129.6	125	150
									E36	34	2	81.8	154.3	159.8	175	175
	460-3-60	6.4	50	10	1.1	4.6	2.2	20	None	-	-	-	25.8	28	30	30
									E09	9	1	10.8	39.3	41.5	40	45
									E18	18	2	21.7	52.9	55.1	60	60
									E24	24	2	28.9	61.9	64.1	70	70
									E36	34	2	40.9	76.9	79.1	80	80
	575-3-60	5.1	41	8	0.65	3.5	1.8	20	None	-	-	-	21.2	23	25	25
									E09	9	1	8.7	32.1	33.9	35	35
									E18	18	2	17.3	42.8	44.6	45	45
									E24	24	2	23.1	50.1	51.9	60	60
									E36	34	2	32.7	62.1	63.9	70	70
120 (10.0)	208-3-60	16	156.4	25	1.65	9	5.5	20	None	-	-	-	58.3	63.8	70	70
									E18	13.5	2	37.5	105.2	110.7	110	125
									E24	18	2	50	120.8	126.3	125	150
									E36	25.5	2	70.8	146.8	152.3	150	175
									E54	40.6	2	112.7	164.6	171.5	175	175
	230-3-60	16	156.4	25	1.65	9	5.5	20	None	-	-	-	58.3	63.8	70	70
									E18	18	2	43.3	112.4	117.9	125	125
									E24	24	2	57.7	130.4	135.9	150	150
									E36	34	2	81.8	160.6	166.1	175	175
									E54	54	2	129.9	160.6	166.1	175	175
	460-3-60	7.1	69	11	1.1	4.6	2.2	20	None	-	-	-	27.8	30	30	35
									E18	18	2	21.7	54.9	57.1	60	60
									E24	24	2	28.9	63.9	66.1	70	70
									E36	34	2	40.9	78.9	81.1	80	90
									E54	54	2	65	78.9	81.1	90	90
	575-3-60	6.4	47.8	10	0.65	3.5	1.8	20	None	-	-	-	23.2	25	25	30
									E18	18	2	17.3	44.8	46.6	45	50
									E24	24	2	23.1	52.1	53.9	60	60
									E36	34	2	32.7	64.1	65.9	70	70
									E54	54	2	52	64.1	65.9	70	70

Table 14: WP078-150 Standard motor - with powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD fan motors (each)	Supply blower motor	Pwr Exh motor	Pwr Conv outlet	Electric heat option				MCA [1](A)	MCA[1]w/ Pwr Exh (A)	Max fuse [2]/breaker [3] size (A)	Max fuse[1]/ breaker[3] size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
150 (12.5)	208-3-60	22.4	166.2	35	3.5	13.2	5.5	20	None	-	-	-	87.6	93.1	110	110
									E18	13.5	2	37.5	134.5	140	150	150
									E24	18	2	50	150.1	155.6	175	175
									E36	25.5	2	70.8	176.1	181.6	200	200
									E54	40.6	2	112.7	176.1	181.6	200	200
	230-3-60	22.4	166.2	35	3.5	13.2	5.5	20	None	-	-	-	87.6	93.1	110	110
									E18	18	2	43.3	141.7	147.2	150	150
									E24	24	2	57.7	159.7	165.2	175	175
									E36	34	2	81.8	189.9	195.4	200	200
									E54	54	2	129.9	189.9	195.4	200	200
	460-3-60	8.8	74.6	14	1.6	6.1	2.2	20	None	-	-	-	37.3	39.5	45	45
									E18	18	2	21.7	64.4	66.6	70	70
									E24	24	2	28.9	73.4	75.6	80	80
									E36	34	2	40.9	88.4	90.6	90	100
									E54	54	2	65	88.4	90.6	90	100

Table 15: WP078-150 Hi-Static motor - with powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA [1](A)	MCA[1]w/ Pwr Exh (A)	Max Fuse [2]/Breaker [3] Size (A)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	9.6	90	15	1.65	9	5.5	20	None	-	-	-	44	49.5	50	50
									E09	6.8	1	18.9	67.6	73.1	70	80
									E18	13.5	2	37.5	90.9	96.4	100	100
									E24	18	2	50	106.5	112	110	125
									E36	25.5	2	70.8	132.5	138	150	150
	230-3-60	9.6	90	15	1.65	9	5.5	20	None	-	-	-	44	49.5	50	50
									E09	9	1	21.7	71.1	76.6	80	80
									E18	18	2	43.3	98.1	103.6	100	110
									E24	24	2	57.7	116.1	121.6	125	125
									E36	34	2	81.8	146.3	151.8	150	175
	460-3-60	4.9	36	8	1.1	4.6	2.2	20	None	-	-	-	22.9	25.1	25	30
									E09	9	1	10.8	36.4	38.6	40	40
									E18	18	2	21.7	50	52.2	50	60
									E24	24	2	28.9	59	61.2	60	70
									E36	34	2	40.9	74	76.2	80	80
	575-3-60	3.7	29	6	0.65	3.5	1.8	20	None	-	-	-	17.2	19	20	20
									E09	9	1	8.7	28.1	29.9	30	30
									E18	18	2	17.3	38.8	40.6	40	45
									E24	24	2	23.1	46.1	47.9	50	50
									E36	34	2	32.7	58.1	59.9	60	60

Table 15: WP078-150 Hi-Static motor - with powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA [1](A)	MCA[1]w/ Pwr Exh (A)	Max Fuse [2]/Breaker [3] Size (A)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
090 (7.5)	208-3-60	12	123	19	1.65	13.2	5.5	20	None	-	-	-	53.8	59.3	60	70
									E09	6.8	1	18.9	77.4	82.9	80	90
									E18	13.5	2	37.5	100.7	106.2	110	110
									E24	18	2	50	116.3	121.8	125	125
									E36	25.5	2	70.8	142.3	147.8	150	150
	230-3-60	12	123	19	1.65	13.2	5.5	20	None	-	-	-	53.8	59.3	60	70
									E09	9	1	21.7	80.9	86.4	90	90
									E18	18	2	43.3	107.9	113.4	110	125
									E24	24	2	57.7	125.9	131.4	150	150
									E36	34	2	81.8	156.1	161.6	175	175
	460-3-60	6.3	60	10	1.1	6.1	2.2	20	None	-	-	-	27.5	29.7	30	35
									E09	9	1	10.8	41	43.2	45	45
									E18	18	2	21.7	54.6	56.8	60	60
									E24	24	2	28.9	63.6	65.8	70	70
									E36	34	2	40.9	78.6	80.8	80	90
	575-3-60	4.4	41	7	0.65	4.9	1.8	20	None	-	-	-	20.2	22	25	25
									E09	9	1	8.7	31.1	32.9	35	35
									E18	18	2	17.3	41.8	43.6	45	45
									E24	24	2	23.1	49.1	50.9	50	60
									E36	34	2	32.7	61.1	62.9	70	70
102 (8.5)	208-3-60	13.5	120.4	21	1.65	13.2	5.5	20	None	-	-	-	56.2	61.7	60	70
									E09	6.8	1	18.9	79.8	85.3	80	90
									E18	13.5	2	37.5	103.1	108.6	110	110
									E24	18	2	50	118.7	124.2	125	125
									E36	25.5	2	70.8	144.7	150.2	150	175
	230-3-60	13.5	120.4	21	1.65	13.2	5.5	20	None	-	-	-	56.2	61.7	60	70
									E09	9	1	21.7	83.3	88.8	90	90
									E18	18	2	43.3	110.3	115.8	125	125
									E24	24	2	57.7	128.3	133.8	150	150
									E36	34	2	81.8	158.5	164	175	175
	460-3-60	6.4	50	10	1.1	6.1	2.2	20	None	-	-	-	27.3	29.5	30	35
									E09	9	1	10.8	40.8	43	45	45
									E18	18	2	21.7	54.4	56.6	60	60
									E24	24	2	28.9	63.4	65.6	70	70
									E36	34	2	40.9	78.4	80.6	80	90
	575-3-60	5.1	41	8	0.65	4.9	1.8	20	None	-	-	-	22.6	24.4	25	30
									E09	9	1	8.7	33.5	35.3	35	40
									E18	18	2	17.3	44.2	46	45	50
									E24	24	2	23.1	51.5	53.3	60	60
									E36	34	2	32.7	63.5	65.3	70	70

Table 15: WP078-150 Hi-Static motor - with powered convenience outlet

Size (ton)	Voltage	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA [1](A)	MCA[1]w/ Pwr Exh (A)	Max Fuse [2]/Breaker [3] Size (A)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (A)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
120 (10.0)	208-3-60	16	156.4	25	1.65	13.2	5.5	20	None	-	-	-	62.5	68	70	80
									E18	13.5	2	37.5	109.4	114.9	110	125
									E24	18	2	50	125	130.5	125	150
									E36	25.5	2	70.8	151	156.5	175	175
									E54	40.6	2	112.7	169.9	176.8	175	200
	230-3-60	16	156.4	25	1.65	13.2	5.5	20	None	-	-	-	62.5	68	70	80
									E18	18	2	43.3	116.6	122.1	125	125
									E24	24	2	57.7	134.6	140.1	150	150
									E36	34	2	81.8	164.8	170.3	175	175
									E54	54	2	129.9	164.8	170.3	175	175
	460-3-60	7.1	69	11	1.1	6.1	2.2	20	None	-	-	-	29.3	31.5	35	35
									E18	18	2	21.7	56.4	58.6	60	60
									E24	24	2	28.9	65.4	67.6	70	70
									E36	34	2	40.9	80.4	82.6	90	90
									E54	54	2	65	80.4	82.6	90	90
	575-3-60	6.4	47.8	10	0.65	4.9	1.8	20	None	-	-	-	24.6	26.4	30	30
									E18	18	2	17.3	46.2	48	50	50
									E24	24	2	23.1	53.5	55.3	60	60
									E36	34	2	32.7	65.5	67.3	70	70
									E54	54	2	52	65.5	67.3	70	70
150 (12.5)	208-3-60	22.4	166.2	35	3.5	20.4	5.5	20	None	-	-	-	94.8	100.3	110	110
									E18	13.5	2	37.5	141.7	147.2	150	150
									E24	18	2	50	157.3	162.8	175	175
									E36	25.5	2	70.8	183.3	188.8	200	200
									E54	40.6	2	112.7	183.3	188.8	200	200
	230-3-60	22.4	166.2	35	3.5	20.4	5.5	20	None	-	-	-	94.8	100.3	110	110
									E18	18	2	43.3	148.9	154.4	150	175
									E24	24	2	57.7	166.9	172.4	175	175
									E36	34	2	81.8	197.1	202.6	200	225
									E54	54	2	129.9	197.1	202.6	200	225
	460-3-60	8.8	74.6	14	1.6	9.9	2.2	20	None	-	-	-	41.4	43.6	50	50
									E18	18	2	21.7	68.5	70.7	70	80
									E24	24	2	28.9	77.5	79.7	80	80
									E36	34	2	40.9	92.5	94.7	100	100
									E54	54	2	65	92.5	94.7	100	100

Physical data

Table 16: WP078-150 Physical data

Component	Models									
	WP078		WP090		WP102		WP120		WP150	
Nominal tonnage	**6.5**		**7.5**		**8.5**		**10**		**12.5**	
AHRI cooling performance										
Gross Capacity @ AHRI A point (Mbh)	86,000		99,000		106,000		120,000		156,000	
AHRI net capacity (Mbh)	84,000		96,000		101,000		116,000[1] / 115,000[2]		148,000[1] / 146,000[2]	
EER	12.2		12.2[1] / 12.1[2]		11.5		11.2[1] / 11.0[2]		10.8[1] / 10.6[2]	
IEER with Intellispeed	15.8		16.0		16.0		15.2[1] / 15.1[2]		15.2[1] / 15.1[2]	
Nominal CFM	2,600		3,000		3,400		3,300		4,600	
System power (kW)	6.7		7.8		8.7		10.2		13.7	
Refrigerant type	R-454B		R-454B		R-454B		R-454B		R-454B	
Refrigerant charge (lb-oz)										
System 1	12-8		10-8		12-4		12-0		14-8	
System 2	12-8		10-8		11-4		10-0		14-8	
AHRI heating performance - heat pump operation										
Refrigerant charge (lb-oz) with MagnaDry HGRH										
System 1	13-10		13-4		12-12		13-0		15-0	
System 2	11-14		11-14		10-12		9-8		14-8	
47°F capacity rating (Mbh)	75.0[1] / 74.6[2]		87.0		92.0[1] / 90.4[2]		104.0		148.0	
System power (kW) / COP	6.2[1] / 3.5[1] 6.3[2] / 3.4[2]		7.0 / 3.5		7.4 / 3.5		8.5 / 3.5		13.2 / 3.3	
17°F capacity rating (Mbh)	42.0		51.0[1] / 47.9[2]		53.0[1] / 51.4[2]		60.0		84.0[1] / 83.9[2]	
System power (kW) / COP	5.4 / 2.25		6.4 / 2.25		6.9 / 2.25		7.8 / 2.25		11.4[1] / 2.15[1] 11.4[2] / 2.14[2]	
AHRI heating performance - gas heat operation										
Heating model	N12	N18	N12	N18	N12	N18	N18	N24	N18	N24
Heat input (K Btu)	120	180	120	180	120	180	180	240	180	240
Heat output (K Btu)	97	146	97	146	97	146	146	194	146	194
AFUE %	-	-	-	-	-	-	-	-	-	-
Steady state efficiency (%)	81	81	81	81	81	81	81	81	81	81
No. burners	5	7	5	7	5	7	7	8	7	8
No. stages	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]
Temperature Rise Range (°F)	20-50	20-65	20-50	20-65	20-50	20-65	20-65	30-60	20-65	30-60
Gas piping connection (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Dimensions (in.)										
Length	89		89		89		89		119-7/16	
Width	59		59		59		59		59	
Height	50-3/4		50-3/4		50-3/4		50-3/4		50-3/4	
Operating weight (lb)	1,080		1,090		1,137		1,135		1,403	
Compressors[1]										
Type	Scroll		Scroll		Scroll		Scroll		Scroll	
Quantity	2		2		2		2		2	
Unit capacity steps (%)	50 / 100		50 / 100		50 / 100		50 / 100		50 / 100	
Condenser coil data										
Face area (sq ft)	29.0		29.0		29.0		29.0		47.5	
Rows	2		2		2		2		2	
Fins per inch	16		16		16		16		15	
Tube diameter (in.)	3/8		3/8		3/8		3/8		3/8	
Circuitry Type	Split-face		Split-face		Split-face		Split-face		Split-face	
Refrigerant control	TXV		TXV		TXV		TXV		TXV	
Evaporator coil data										
Face area (sq ft)	13.2		13.2		13.2		13.2		13.2	
Rows	4		4		4		4		4	
Fins per inch	15		15		15		15		15	
Tube diameter	3/8		3/8		3/8		3/8		3/8	

Table 16: WP078-150 Physical data

Component	Models									
	WP078		WP090		WP102		WP120		WP150	
Nominal tonnage	**6.5**		**7.5**		**8.5**		**10**		**12.5**	
Circuitry Type	Intertwined		Intertwined		Intertwined		Intertwined		Intertwined	
Refrigerant control	TXV		TXV		TXV		TXV		TXV	
Reheat option coil data										
Face area (sq ft)	10		10		10		10		10	
Rows	2		2		2		2		2	
Fins per inch	13		13		13		13		13	
Tube diameter	3/8		3/8		3/8		3/8		3/8	
Condenser fan data										
Quantity of fans	2		2		2		2		4	
Fan diameter (in.)	24		24		24		24		24	
Type	Prop		Prop		Prop		Prop		Prop	
Drive type	Direct		Direct		Direct		Direct		Direct	
Quantity of motors	2		2		2		2		4	
Motor hp each	1/3		1/3		1/3		1/3		1/3	
No. speeds	1		1		1		1		1	
RPM	850		850		850		850		850	
Nominal total cfm	6,800		6,800		6,800		6,800		14,000	
Belt drive evap fan data										
Quantity	1		1		1		1		1	
Fan size (in.)	15 x 15		15 x 15		15 x 15		15 x 15		15 x 15	
Type	Centrifugal		Centrifugal		Centrifugal		Centrifugal		Centrifugal	
Motor sheave	VL40	VL44	1VL40	1VM50	1VP50	1VP50	1VM50	1VM50	1VM50	1VP56
Blower sheave	AK74	AK71	AK69	AK69	AK89	AK74	AK84	AK74	AK74	BK77
Belt	A52	A52	A52	A54	A56	A54	A56	A54	A54	BX56
Motor HP each	1-1/2	2	1-1/2	3	2	3	2	3	3	5
RPM	1,725	1,725	1,725	1,725	1,725	17,25	1,725	1,725	1,725	1,725
Frame size	56	56	56	56	56	56	56	56	56	184T
Filters										
Quantity - size	4 - (24 x 20 x 2)		4 - (24 x 20 x 2)		4 - (24 x 20 x 2)		4 - (24 x 20 x 2)		4 - (24 x 20 x 2)	

Note:
1. Heat pump unit or heat pump unit with electric heat
2. Heat pump unit with gas heat
3. First Stage 60% of full capacity

Optional electric heat

The factory-installed heaters are wired for single point power supply. You only need to bring the power supply into the single point terminal block. These CSA approved heaters are located within the central compartment of the unit with the heater elements extending in to the supply air chamber. Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. See Table 17 for minimum CFM limitations. See Electrical data for electrical data.

Table 17: Electric heat minimum supply air

Size (ton)	Model	Voltage	Minimum supply air (CFM)				
			Heater kW				
			9	18	24	36	54
078 (6.5)	WP	208/230-3-60	1950	1950	1950	1950	—
		460-3-60	1950	1950	1950	1950	—
		600-3-60	1950	1950	1950	2150	—
090 (7.5)	WP	208/230-3-60	2250	2250	2250	2250	—
		460-3-60	2250	2250	2250	2250	—
		600-3-60	2250	2250	2250	2250	—

Table 17: Electric heat minimum supply air

Size (ton)	Model	Voltage	Minimum supply air (CFM)				
			Heater kW				
			9	18	24	36	54
102 (8.5)	WP	208/230-3-60	2550	2550	2550	2550	—
		460-3-60	2550	2550	2550	2550	—
		600-3-60	2550	2550	2550	2550	—
120 (10)	WP	208/230-3-60	—	3000	3000	3000	3500
		460-3-60	—	3000	3000	3000	3000
		600-3-60	—	3000	3000	3000	3500
150 (12.5)	WP	208/230-3-60	—	3750	3750	3750	4000
		460-3-60	—	3750	3750	3750	3750

Optional gas heat

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition.

Gas piping

Correct sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. *National Fuel Gas Code Z223.1* (in U.S.A.) or the current *Gas Installation Codes CSA-B149.1* (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. See Table 18. The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

Figure 26: Side entry gas piping

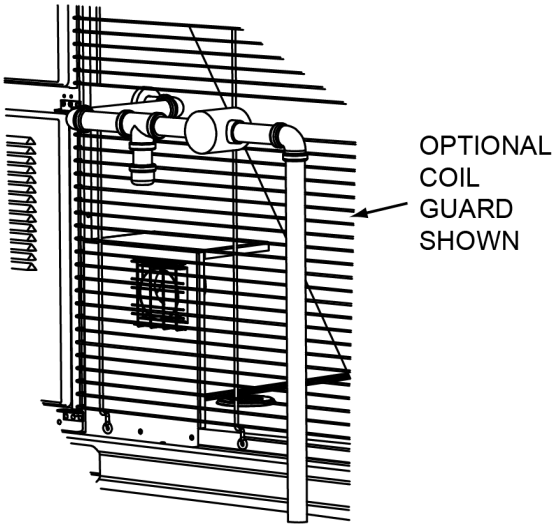


Figure 27: Bottom entry gas piping

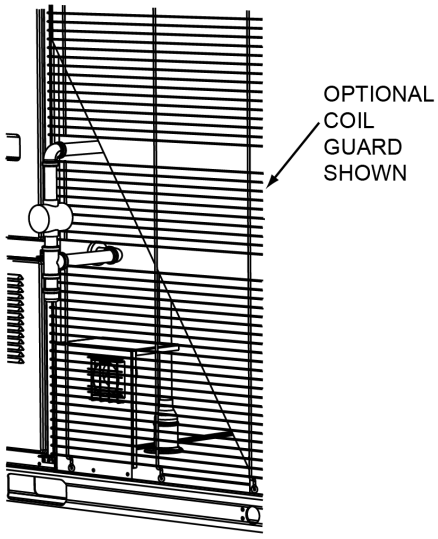


Table 18: Gas pipe sizing - capacity of pipe

Length of pipe (ft.)	Nominal iron pipe size		
	3/4 in.	1 in.	1 1/4 in.
10	278	520	1050
20	190	350	730
30	152	285	590
40	130	245	500
50	115	215	440
60	105	195	400
70	96	180	370
80	90	170	350
90	84	160	320
100	79	150	305

Note: Maximum capacity of pipe in cubic feet of gas per hour based upon a pressure drop of 0.3 in. W.C. and 0.6 specific gravity gas.

ⓘ **Note:** There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a 3/4 in. pipe connection at the entrance fitting. Line should not be sized smaller than the entrance fitting size.

Table 19: Gas heat minimum supply air

Size (ton)	Model	Heat size	Supply air (CFM)	
			Heating	
			Min	Max
78 (6.5)	WP	N12	1800	3250
		N18	2080	3250
90 (7.5)	WP	N12	1800	3750
		N18	2080	3750
102 (8.5)	WP	N12	1800	4250
		N18	2080	4250
120 (10)	WP	N18	2080	5000
		N24	3000	5000
150 (12.5)	WP	N18	2080	6250
		N24	3000	6250

Gas connection

Route the gas supply line within the space and roof curb, exiting through the unit's basepan. Refer to the instructions available online for the gas piping inlet location. Typical supply piping arrangements are shown in instructions available online.

Gas piping recommendations:

- You must install a drip leg and a ground joint union in the gas piping.
- When required by local codes, install a manual shut-off valve outside of the unit.
- Use wrought iron or steel pipe for all gas lines. Apply pipe dope sparingly to male threads only.

⚠ WARNING

Natural gas may contain some propane. Propane is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. You must use a special pipe dope when assembling wrought iron or steel pipe. Shellac based compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clydes's or John Crane may be used.

- Clean all piping of dirt and scale by hammering on the outside of the pipe and blowing out loose particles. Before initial start-up, make sure that all gas lines external to the unit have been purged of air.
- The gas supply must be a separate line and installed in accordance with all safety codes as prescribed under .
- A 1/8 in. NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the unit.
- After the gas connections have been completed, open the main shut-off valve admitting normal gas pressure to the mains. Check all joints for leaks with soap solution or other material suitable for the purpose. **Never use a flame.**

⚠ WARNING

Fire or explosion hazard

Failure to follow the safety warning exactly could result in serious injury, death or property damage. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ CAUTION

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG causes gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG.

⚠ WARNING

Threaded joints must be coated with a sealing compound that is resistant to the action of liquefied petroleum gases. Do not use Teflon tape.

Propane units, tanks, and piping

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with propane gas with an accessory kit.

All propane gas equipment must conform to the safety standards of the National Fire Protection Association

For satisfactory operation, propane gas pressure must be at the proper inlet pressure at the unit under full load. See the conversion kit instructions for minimum and maximum supply inlet pressure. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate,which depends on the temperature of the liquid and the **wetted surface** area of the container.
2. The proper pressure regulation,. Two-stage regulation is recommended.
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required depends on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and propane gas suppliers

⚠ WARNING

Propane gas is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe for propane. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde's, or John Crane may be used.

Check all connections for leaks when piping is completed using a soap solution. **Never use a flame.**

⚠ WARNING

Fire or explosion hazard

Failure to follow the safety warning exactly could result in serious injury, death or property damage. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Vent and combustion air

Venting slots in the heating compartment access panel remove the need for a combustion air hood. The gas heat flue exhaust is routed through factory installed exhaust piping with screen. If necessary, a flue exhaust extension may be installed at the point of installation.

Options and accessories

Electric heat

Electric heaters are available as factory-installed options or field-installed accessories. Refer to electric heat instructions for installation. These heaters mount in the heat compartment with the heating elements extending into the supply air chamber. All electric heaters are fused and intended for use with single point power supply.

Smoke detectors

⚠ WARNING

The use of duct smoke detectors have specific limitations as established by the National Fire Protection Association. Duct smoke detectors are not a substitute for an open area smoke detector, an early warning detection, or a building's regular fire detection system. Refer to NFPA Code 72 and Standard 90A for additional information.

The factory-installed smoke detector shuts down operation of the unit by interrupting power to the UCB when smoke is detected within its mounting compartment. The smoke detector option is available for both supply and return air configurations. Be aware that the supply air configuration has the sensor component mounted in the blower section, with its control module mounted in the return air compartment.

⚠ WARNING

Factory-installed smoke detectors may be subjected to extreme temperatures during off times due to outside air infiltration. These smoke detectors have an operational limit of -4°F to 158°F. Smoke detectors installed in areas that could be outside this range have to be relocated to prevent false alarms.

WARNING

To assure adequate airflow reaches the smoke detector's sensor, make sure that the holes of the sampling tube face into the air stream, and that the far-end of the sampling tube is sealed with the plastic end cap.
In addition, the unit's supply airflow must be adjusted to provide a pressure differential across the smoke detector's sampling and exhaust ports of at least 0.01 in. of water and no more than 1.11 in. of water, as measured by a manometer.

You must test and maintain the detector on a regular basis according to NFPA 72 requirements and cleaned at least once a year. For specific troubleshooting and maintenance procedures, please refer to the smoke detector's installation instructions which accompanies the unit.

Motorized outdoor damper

The motorized outdoor damper can be a factory-installed option or a field-installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field-installed motorized outdoor damper accessories include complete instructions for installation.

Economizer

The economizer can be a factory-installed option or a field-installed accessory. If factory installed, refer to the instructions included with the economizer to complete the assembly. Field-installed economizer accessories include complete instructions for installation.
There are two economizer options:

- Down flow, end return horizontal applications that include a fresh air hood and exhaust hood with barometric relief.
- Horizontal flow application that requires the purchase of a barometric relief hood. This is a field-installed kit.

Note: For the down flow, end return horizontal application, you must keep the two side panels for the economizer hood tops. See Figure 22.

Power exhaust

The power exhaust can be a factory-installed option or a field-installed accessory. If factory-installed, refer to the instructions included with the power exhaust to complete the assembly. Field-installed power exhaust accessories include complete instructions for installation.
The power exhaust factory-installed option is for down flow application only.
There are two field-installed power exhaust accessories:

- Down flow application.
- Horizontal flow application that requires the purchase of a barometric relief hood.

Rain hood

For factory-installed options, all of the hood components, including the filters, the gasketing, and the hardware for assembling, are packaged and located between the condenser coil section and the main unit cabinet. For field-installed accessories, all parts necessary for the installation come in the accessory kit.

Economizer sequences

Several functions can drive the economizer, including: minimum position, free cooling, economizer loading, and minimum outdoor air supply.

Economizer minimum position

The economizer minimum position is set during occupied mode when outside air is not suitable for free cooling. The position of the damper is set proportionally between the economizer minimum position and the economizer minimum position low speed fan setpoints, in relationship to the VFD output percentage. On a constant volume single speed supply fan system both setpoints should be set to the same value.

Free cooling

Four types of free cooling options are available: dry bulb changeover, single enthalpy, dual enthalpy changeover, and Auto.

Dry bulb changeover

For dry bulb economizer operation, the outside air is suitable for free cooling if the outside air temperature is 1°F below the economizer OAT enable setpoint and 1°F below the return air temperature (RAT).
Free cooling is no longer available if the outside air temperature rises above either the economizer OAT enable setpoint or the return air temperature.

Single enthalpy changeover

For single enthalpy economizer operation, the outside air is suitable for free cooling if the outside air enthalpy is at least 1 BTU/lb below the economizer outside air enthalpy setpoint and the outside air temperature is no greater than the RAT plus 9°F.
If the outside air temperature rises above the RAT plus 10°F, free cooling is no longer available. The outside air temperature must drop to no greater than RAT plus 9°F to enter free cooling again.
Free cooling is no longer available if the outside air enthalpy rises above the economizer outside air enthalpy setpoint.

Dual enthalpy changeover

For dual enthalpy economizer operation, the outside air enthalpy must be lower than the return air enthalpy by 1

BTU/lb and the outside air temperature is no greater than the RAT plus 9°F.

Auto

The control determines the type of free cooling changeover based on which sensors are present and reliable. Conditions include:

- Return and outside air dry bulb = dry bulb changeover
- Return and outside air dry bulb and outside air humidity = single enthalpy
- Return and outside air dry bulb and return and outside air humidity = dual enthalpy
- If either the return or outside air dry bulb sensors are unreliable, free cooling is not available

Free cooling operation

When the control determines that the outside air is suitable, the first stage of cooling will always be free cooling.

Thermostat

In free cooling, with a thermostat input to Y1, the dampers modulate to control the supply air temperature to the economizer setpoint +/- 1°F (default 55°F).

If the thermostat provides an input to Y2 and the parameter Compressors Off in Free Cooling is turned OFF a compressor output energizes. The economizer dampers continue to modulate to control the supply air temperature to the economizer setpoint.

If the supply air temperature cannot be maintained within 5°F of the economizer setpoint, the first stage compressor (C1) will be turned on. Second stage compressor (C2) will be added as needed to keep the supply air temperature within the 5°F of the economizer setpoint.

Sensor

In free cooling, with a demand from the zone/return sensor for the first stage of cooling, the dampers modulate to control the supply air temperature to the Economizer setpoint +/- 1°F.

If the economizer output is at 100% and the SAT is greater than the Economizer setpoint + 1°F, the control starts a 12 minute timer to energize a compressor output.

If at any time the economizer output drops below 100% the timer stops and resets when the economizer output returns to 100%.

After turning on a compressor output, the economizer dampers continue to modulate to control the supply air temperature to the Economizer setpoint.

At no time is a compressor output to be turned on if the economizer output is less than 100%, even if the differential between zone, or return, temperature and the current cooling setpoint is great enough to demand more than one stage of cooling.

If the economizer output goes to minimum position and the SAT is less than Economizer setpoint -1°F, the control starts a 12 minute timer to de-energize a compressor output.

If at any time the economizer output goes above the minimum position the timer stops and resets when the economizer output returns to minimum position.

If the demand for cooling from the space/return is satisfied, the economizer output modulates to the minimum position and the compressor outputs de-energizes as long as their minimum run timers have expired.

Power exhaust

Setpoints

- Economizer enable ON
- Power exhaust enable ON
- Modulating power exhaust OFF
- Exhaust VFD installed OFF
- Building pressure sensor enabled OFF
- Econo damper position for exh fan ON Percent
- Econo damper position for exh fan OFF Percent

Inputs

No inputs are present for non-modulating power exhaust.

Outputs

- 2-10 VDC from ECON on the economizer expansion module
- VAC from EX-FAN to energize the exhaust fan on the economizer expansion module

Operation

Operation details include:

- Compares the economizer output to the economizer damper position for exhaust fan on and off
- Energizes the exhaust fan when the economizer output is above the economizer damper position for exhaust fan on
- De-energizes the exhaust fan when the economizer output is below the economizer damper position for exhaust fan off

Smart Equipment Control Board

Figure 28: SE-ECO1001-0 Economizer Controller

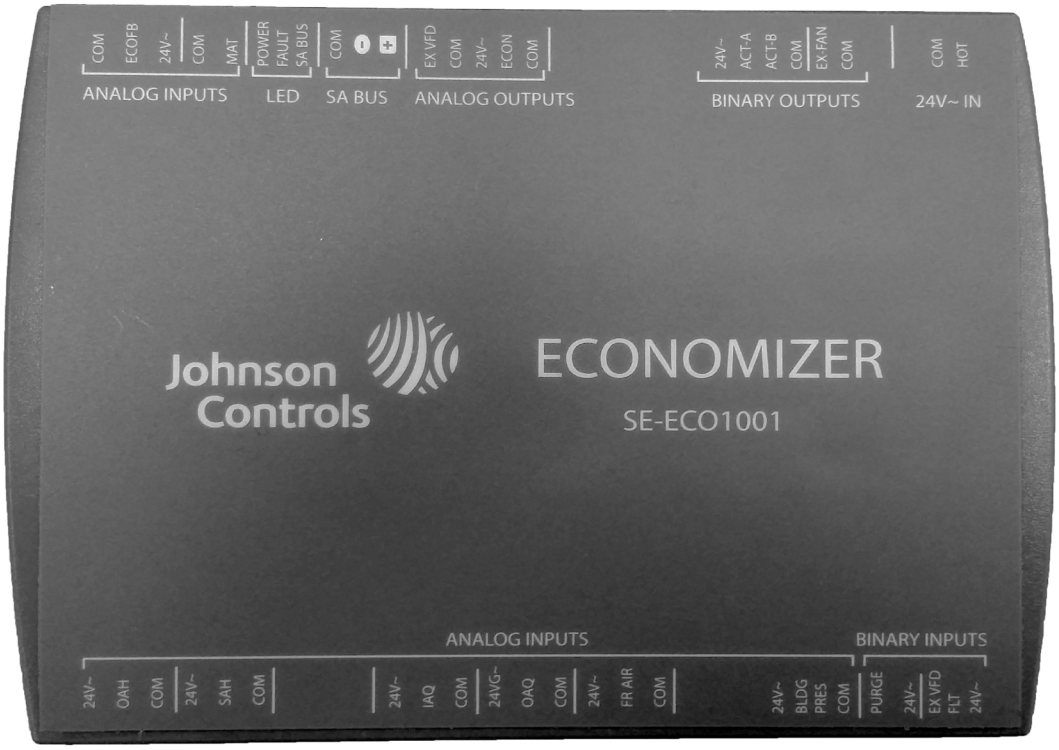


Table 20: Smart Equipment Economizer Board Details

Board label	Cover label	Description	Function and comments
		Directional orientation: viewed with the center text of the cover label upright	
		ANALOG INPUTS Terminal at left on upper edge of economizer board	
C	COM	24 VAC common/0-10 VDC negative for economizer actuator position feedback	Connects through circuit trace to 24V~ IN pin COM
IN2	ECOFB	0-10 VDC positive input from Economizer actuator position Feedback	EconDampPos parameter reports input status (0-100%). Used to meet Cali. Title 24 requirements for economizer actuator position feedback
R	24V~	24 VAC hot supplied for economizer actuator position feedback	Connects through circuit trace to 24V~ IN pin HOT
C	COM	Mixed Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	MAT parameter reports input status (°F/°C), 3.65 VDC reading MAT (+) to COM (−) with open circuit. Read-only use in current control revision.
IN1	MAT		
		LEDs at left on upper edge of economizer board	
POWER	POWER	Green UCB power indicator	Lit indicates 24 VAC is present at 24V~ IN COM and HOT pins
FAULT	FAULT	Red networking error and firmware error indicator	1/10th second on/off flashing indicates a networking error (polarity, addressing, etc.) or a firmware error (likely correctable with re-loading from USB flash drive)
SA BUS	SA BUS	Green UCB SA bus communication transmission indicator	Lit/flickering indicates UCB-to-economizer board SA bus communication is currently active, off indicates the economizer board is awaiting SA bus communication
		SA BUS[1] Pin connections at left on upper edge of economizer board	

Table 20: Smart Equipment Economizer Board Details

Board label	Cover label	Description	Function and comments
		Directional orientation: viewed with the center text of the cover label upright	
C	COM	Common for SA BUS power and communication circuits	EconCtrlr parameter reports UCB-to-economizer board SA bus communication status. Negative of the SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection & diagnostics board
–	–	Communication for SA BUS devices	EconCtrlr parameter reports UCB-to-economizer board SA BUS communication status. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts lower than +) SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection & diagnostics board
+	+	Communication for SA BUS devices	EconCtrlr parameter reports UCB-to-economizer board SA BUS communication status. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts higher than –) SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection & diagnostics board
		ANALOG OUTPUTS Pin at center on upper edge of economizer board	
J4	EX VFD	2-10 VDC positive output for the modulating power Exhaust fan Variable Frequency Drive/ discharge damper modulating power exhaust actuator	ExFanVFD parameter reports output status (0-100%) when ExFType selection is Variable Frequency Fan; EAD-O parameter reports output status (0-100%) when ExFType selection is Modulating Damper. Used to ramp the power exhaust fan VFD/ position the discharge damper actuator.
	COM	24 VAC common/0-10 VDC negative for the power exhaust variable frequency drive/ discharge damper modulating power exhaust actuator	Connects through circuit trace to 24V~ IN pin COM
	24V~	24 VAC hot supplied for the discharge damper modulating power exhaust actuator and economizer actuator	Connects through circuit trace to 24V~ IN pin HOT
	ECON	2-10 VDC output for the Economizer actuator	Econ parameter reports output status (0-100%). Used to position the economizer actuator for minimum position, free cooling, demand ventilation, cooling economizer loading and purge functions
	COM	24 VAC common/0-10 VDC negative for economizer actuator	Connects through circuit trace to 24V~ IN pin COM
		BINARY OUTPUTS Pin at right on upper edge of economizer board	
J3	24V~	24 VAC hot supplied for an incremental (floating control) economizer actuator	Connects through circuit trace to 24V~ IN pin HOT
	ACT-A	24 VAC hot outputs to position an incremental (floating control) economizer actuator	Unused in current control revision
	ACT-B	24 VAC return	Unused in current control revision
	COM	24 VAC common for an incremental (floating control) economizer actuator	Connects through circuit trace to 24V~ IN pin COM
	EX-FAN	24 VAC hot output to energize power exhaust fan contactor coil/VFD enable relay coil	ExFan parameter reports output status (Off-On) when ExFType selection is Non-Modulating, Modulating Damper or Variable Frequency Fan. Used to turn on/enable the power exhaust fan motor.
	COM	24 VAC common/0-10 VDC negative for economizer actuator	Connects through circuit trace to 24V~ IN pin COM
		24V~ IN Pin connections at right on upper edge of economizer board	

Table 20: Smart Equipment Economizer Board Details

Board label	Cover label	Description	Function and comments
		Directional orientation: viewed with the center text of the cover label upright	
C	COM	24 VAC transformer Common referenced to cabinet ground	24 VAC common connection to power the economizer board. Connects through circuit traces to C/COM terminals and pins distributed on the economizer board.
R	HOT	24 VAC transformer HOT	24 VAC hot connection to power the economizer board. Connects through circuit traces to R/24V~ terminals and pins distributed on the economizer board.
		ANALOG INPUTS Terminal on lower edge of economizer board	
R	24V~	24 VAC hot supplied for the outdoor air humidity sensor	Connects through circuit trace to 24V~ IN pin HOT
IN3	OAH	0-10 VDC positive input from the Outdoor Air Humidity sensor	OAH parameter reports input status (0-100%H). Used in outdoor air enthalpy calculation for dual enthalpy economizer free cooling changeover.
C	COM	24 VAC common/0-10 VDC negative for the outdoor air humidity sensor	Connects through circuit trace to 24V~ IN pin COM
R	24V~	24 VAC hot supplied for the supply air humidity sensor	Connects through circuit trace to 24V~ IN pin HOT
IN4	SAH	0-10 VDC positive input from the Supply Air Humidity sensor	SAH parameter reports input status (0-100%H). Unused in current control revision.
C	COM	24 VAC common/0-10 VDC negative for the supply air humidity sensor	Connects through circuit trace to 24V~ IN pin COM
R	24V~	24 VAC hot supplied for the indoor air quality sensor	Connects through circuit trace to 24V~ IN pin HOT
IN5	IAQ	0-10 VDC positive input from the Indoor Air Quality sensor	IAQRange parameter sets the CO2 parts per million measured by the indoor air quality sensor when it outputs 10 VDC; IAQ parameter reports input status (0-5000ppm). Used for demand ventilation functions if the NetIAQ parameter indicates ?Unrel.
C	COM	24 VAC common/0-10 VDC negative for the indoor air quality sensor	Connects through circuit trace to 24V~ IN pin COM
R	24V~	24 VAC hot supplied for the outdoor air quality sensor	Connects through circuit trace to 24V~ IN pin HOT
IN6	OAQ	0-10 VDC positive input from the Outdoor Air Quality sensor	OAQRange parameter sets the CO2 parts per million measured by the outdoor air quality sensor when it outputs 10 VDC; OAQ parameter reports input status (0-5000ppm). Used for demand ventilation function when DVent-Mode selection is Diff between IAQ and OAQ and the NetOAQ parameter indicates ?Unrel.
C	COM	24 VAC common/0-10 VDC negative for the outdoor air quality sensor	Connects through circuit trace to 24V~ IN pin COM
R	24V~	24 VAC hot supplied for the air monitoring station sensor	Connects through circuit trace to 24V~ IN pin HOT
IN7	FR AIR	0-10 VDC positive input from the air monitoring station sensor	MOA-Range parameter sets the cubic feet per minute/liters per second measured by the air monitoring station sensor when it outputs 10 VDC; Fr Air parameter reports input status (0-50000CFM/23595lps). Used for economizer minimum position reset in speed-controlled indoor blower applications.
C	COM	24 VAC common/0-10 VDC negative for the air monitoring station sensor	Connects through circuit trace to 24V~ IN pin COM
R	24V~	24 VAC hot supplied for the building pressure sensor	Connects through circuit trace to 24V~ IN pin HOT

Table 20: Smart Equipment Economizer Board Details

Board label	Cover label	Description	Function and comments
		Directional orientation: viewed with the center text of the cover label upright	
IN8	BLDG PRES	0-5 VDC positive input from the Building Pressure sensor	BldgPres parameter reports input status (-.250-.250"/ w/-.062-.062kPa). Used for modulating power exhaust functions when ExFType selection is Modulating Damper or Variable Frequency Fan.
C	COM	24 VAC common/0-5 VDC negative for the building pressure sensor	Connects through circuit trace to 24V~ IN pin COM
		BINARY INPUTS at right on lower edge of economizer board	
IN9	PURGE	24 VAC hot input from the PURGE dry contact	Purge parameter reports input status (False with 0 VAC input-True with 24 VAC input). When Purge status is True, heating and cooling operation is prevented, the indoor blower and power exhaust fan operate, the economizer actuator is positioned to 100%.
	24V~	24 VAC hot supplied for the purge dry contact	Connects through circuit trace to 24V~ IN pin HOT
IN10	EX VFD FLT	24 VAC hot input from the power Exhaust Variable Frequency Drive Fault contact	ExFanVFDFlt parameter reports input status (Normal with 0 VAC input-Alarm with 24 VAC input) when ExFType selection is Variable Frequency Fan. When ExFanVFDFlt status is Alarm, EX-FAN fan output is prevented.
	24V~	24 VAC hot supplied for the power exhaust variable frequency drive fault contact	Connects through circuit trace to 24V~ IN pin HOT

1 When wiring unit and other devices using the SA Bus and FC Bus, see Table 57.

Indoor air quality

Indoor air quality (IAQ) is regulated by an indoor sensor input. The IAQ sensor is connected to the economizer board through the IAQ analog input terminal and the associated COM and 24V~ inputs on the economizer board. Terminal IAQ accepts a 0 to +10 VDC signal with respect to the IAQ terminal. When the signal is below its setpoint, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the IAQ signal exceeds its setpoint setting and there is no call for free cooling, the actuator is proportionately modulated from the 0 to 10 VDC signal, with 0 VDC corresponding to full closed and 10 VDC corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ maximum damper position setting. When the signal exceeds its demand control ventilation setpoint and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the IAQ voltage input.

- Optional CO^2 space sensor kit - part no. 2AQ04700524
- Optional CO^2 sensor kit - part no. 2AQ04700624

Phasing

WP078-150 units are phased correctly at the factory. Check for correct compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the phasing of the field line connection at the factory or field supplied disconnect to obtain correct rotation. Scroll compressors operate in only one direction. The scroll is misphased if it is drawing low amperage, has similar suction and discharge pressures, or it produces a high noise level.

⚠ CAUTION

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower condenser fans, or compressor rotate correctly.

Blower rotation

Check for proper supply air blower rotation. If the blower is rotating backwards, the line voltage at the unit point of power connection is misphased. See Phasing.

Table 21: Supply air limitations

Unit size (ton)	Minimum	Maximum
078 (6.5)	1950	3250
090 (7.5)	2250	3750
102 (8.5)	2550	4250
120 (10)	3000	5000
150 (12.5)	3750	6250

Adjusting the belt tension

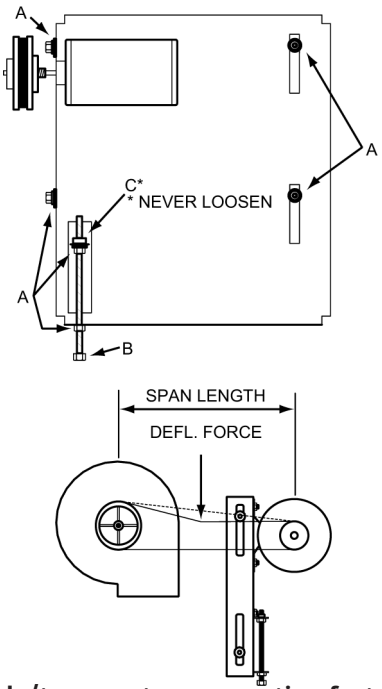
To adjust the belt tension complete the following steps:

1. Loosen the six belts nuts at the top and bottom. See Figure 29.

Note: Never loosen the static nut at the top of the adjustment bolt.

2. Turn the adjustment bolt.
3. Use a belt tension checker to apply a perpendicular force to one belt at the midpoint of the span shown in Figure 29. A deflection distance of 4 mm (5/32 in.) is obtained.
4. To determine the deflection distance from normal position, use a straight edge from sheave to sheave as a reference line. Tension new belts at the max. deflection force recommended for the belt section.
5. Re-tighten the belt nuts.

Figure 29: Belt adjustment



Item	Component
A	Belt nuts
B	Adjustment bolt
C	Static nut

1.

CAUTION

Check the belt tension at least two times during the first 24 hours of operation. Any retensioning must fall between the min. and max. deflection force values.

CFM static pressure and power-altitude and temperature corrections

Use the information below to assist in the application of the product at altitudes at or exceeding 1000 ft above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases.

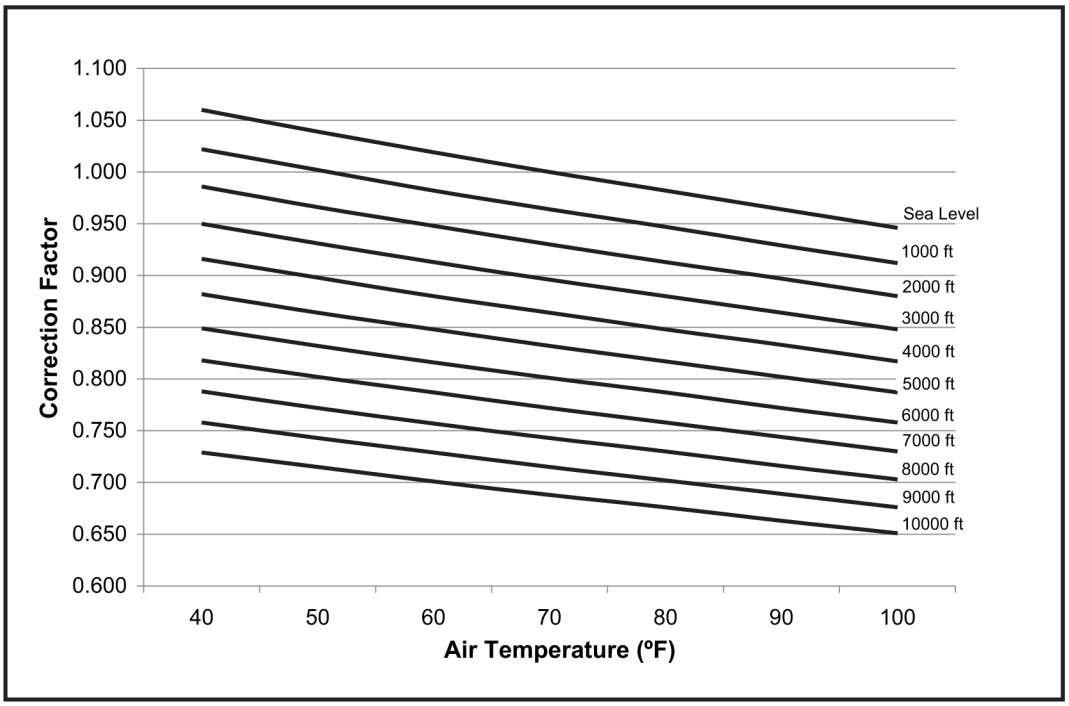
In order to use the indoor blower tables for high-altitude applications, certain corrections are necessary.

A centrifugal fan is a constant volume device. This means that, if the RPM remains constant, the CFM delivered is the same regardless of the density of the air. However, because the air at high-altitude is less dense, less static pressure is generated and less power is required than a similar application at sea level. Air density correction factors are shown in Table 22 and Figure 30.

Table 22: Altitude/temperature correction factors

Air temperature (°F)	Altitude (ft)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

Figure 30: Altitude - temperature correction factors



Use the examples below to assist in determining the airflow performance of the product at altitude.

Example 1: What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft if the blower performance data is 6,000 CFM, 1.5 IWC, and 4.0 BHP?

Solution: At an elevation of 5,000 ft the indoor blower delivers 6,000 CFM if the RPM is unchanged. However, Table Table 22 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table Table 25 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

Example 2: A system, located at 5,000 ft of elevation, is to deliver 6,000 CFM at a static pressure of 1.5 in. Use the unit blower tables to select the blower speed and the BHP requirement.

Solution: As in the example above, no temperature information is given so 70°F is assumed.

The 1.5 in. static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

Sea level static pressure = 1.5 / .832 = 1.80 in.

Enter the blower table at 6,000 CFM and static pressure of 1.8 in. The RPM listed will be the same RPM needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

BHP at 5,000 ft. = 3.2 x .832 = 2.66

Drive selection

1. Determine side or bottom supply duct application.
2. Determine the required airflow.
3. Calculate or measure the amount of external static pressure.
4. With the operating point determined from steps 1, 2, and 3, locate this point on the appropriate supply air blower performance table. Linear interpolation may be necessary.
5. Note the rpm and bhp from step 4 and locate the appropriate motor and drive.
6. Review the bhp compared to the motor options available. Select the appropriate motor and drive.
7. Review the rpm range for the motor options available. Select the appropriate drive if multiple drives are available for the chosen motor.
8. Determine the turns open to obtain the required operation point.

Example

1. 2600 CFM
2. 1.6 iwg
3. Using the supply air blower performance table below, the following data point was located: 1268 rpm and 1.95 bhp.
4. Using the rpm selection table below, Size X and Model Y is found.
5. 1.95 bhp exceeds the maximum continuous bhp rating of the 1.5 HP motor. The 2 hp motor is required.
6. 1268 rpm is within the range of the 2 hp drives.
7. Using the 2 hp motor and drive, .5 turns open will achieve 1268 rpm.

Table 23: Example supply air blower performance

Air flow (cfm)	Available external static pressure - IWG																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	1.5 HP and Field Supplied Drive								Standard 1.5 HP and Drive						Alternate 2 HP and Drive					
2200	804	0.50	866	0.71	925	0.90	982	1.06	1038	1.21	1092	1.35	1147	1.48	1203	1.61	1259	1.73	1317	1.87
2400	835	0.66	897	0.87	956	1.06	1013	1.22	1069	1.37	1124	1.51	1178	1.64	1234	1.77	1290	1.90	1348	2.03
2600	869	0.84	931	1.05	990	1.24	1047	1.40	1103	1.55	1158	1.69	1212	1.82	1268	1.95	1324	2.07	1382	2.21
2800	906	1.03	968	1.25	1027	1.43	1084	1.60	1139	1.75	1194	1.89	1249	2.02	1304	2.14	1361	2.27	-	-

Table 24: Selecting rpm

Size (ton)	Model	HP	Max BHP	Motor sheave	Blower sheave	6 turns open	5 turns open	4 turns open	3 turns open	2 turns open	1 turn open	Fully closed
X	Y	1.5	1.73	1VM50	AK74	N/A	897	945	991	1035	1079	1126
		2	2.30	1VM50	AK64	N/A	1039	1094	1150	1207	1256	1308

Airflow performance

WP078-150 side duct application

Table 25: WP078 (6.5 ton) side duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	Field Supplied Drive				Standard 1.5 HP and Drive						Hi Static 2 HP and Drive									
1800	551	0.15	617	0.35	682	0.53	747	0.71	810	0.89	872	1.06	932	1.24	989	1.42	1043	1.62	1093	1.83
2000	564	0.25	630	0.45	695	0.64	760	0.81	824	0.99	885	1.16	945	1.34	1002	1.53	1056	1.72	1106	1.93
2200	578	0.37	643	0.56	709	0.75	774	0.93	837	1.10	899	1.28	959	1.46	1016	1.64	1070	1.83	1120	2.04
2400	592	0.49	657	0.69	723	0.88	787	1.05	851	1.23	913	1.40	973	1.58	1030	1.77	1083	1.96	1134	2.17
2600	606	0.63	672	0.83	737	1.01	802	1.19	866	1.37	927	1.54	987	1.72	1044	1.90	1098	2.10	1148	2.30
2800	622	0.77	687	0.97	753	1.16	818	1.33	881	1.51	943	1.68	1003	1.86	1060	2.05	1113	2.24	-	-
3000	638	0.92	704	1.12	769	1.31	834	1.49	897	1.66	959	1.84	1019	2.01	1076	2.20	-	-	-	-
3200	655	1.08	721	1.28	786	1.47	851	1.64	915	1.82	976	1.99	1036	2.17	-	-	-	-	-	-
3400	673	1.25	739	1.44	804	1.63	869	1.81	933	1.98	995	2.16	-	-	-	-	-	-	-	-
															2 HP and Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .862

Table 26: WP090 (7.5 ton) side duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	Field Supplied Drive				Standard 1.5 HP and Drive										Hi Static 3 HP and Drive					
2000	-	-	656	0.24	711	0.48	768	0.73	826	0.96	886	1.19	945	1.41	1003	1.61	1058	1.79	1110	1.95
2200	619	0.07	670	0.32	724	0.57	781	0.81	840	1.04	899	1.27	959	1.49	1016	1.69	1072	1.87	1124	2.04
2400	631	0.16	682	0.41	736	0.66	793	0.90	852	1.14	911	1.36	970	1.58	1028	1.78	1084	1.97	1136	2.13
2600	642	0.27	692	0.52	747	0.76	804	1.01	862	1.24	922	1.47	981	1.69	1039	1.89	1094	2.07	1146	2.24
2800	652	0.39	703	0.64	757	0.88	814	1.13	873	1.36	932	1.59	992	1.81	1049	2.01	1105	2.19	1157	2.36
3000	663	0.53	714	0.77	768	1.02	825	1.26	884	1.50	943	1.73	1003	1.94	1060	2.14	1116	2.33	1168	2.49
3200	675	0.68	726	0.92	780	1.17	837	1.41	896	1.65	955	1.88	1014	2.09	1072	2.29	1128	2.48	1180	2.64
3400	688	0.84	739	1.09	793	1.34	850	1.58	909	1.82	968	2.04	1027	2.26	1085	2.46	1141	2.65	1193	2.81
3600	703	1.03	753	1.28	807	1.52	864	1.76	923	2.00	983	2.23	1042	2.44	1100	2.64	1155	2.83	-	-
3800	718	1.23	769	1.47	823	1.72	880	1.96	939	2.20	998	2.43	1058	2.64	1115	2.84	1171	3.03	-	-

1. Blower performance includes gas heat exchangers and 2 in. filters. See the *Static resistance* for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 27: WP102 (8.5 ton) side duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	2 HP and Field Supplied Drive				Standard 2 HP and Drive										Hi Static 3 HP and Drive					
2200	632	0.23	684	0.44	734	0.65	783	0.84	830	1.03	876	1.21	921	1.39	966	1.56	1009	1.74	1051	1.91
2400	639	0.32	691	0.53	741	0.74	790	0.93	837	1.12	883	1.30	928	1.48	972	1.65	1015	1.83	1058	2.00
2600	646	0.41	698	0.62	748	0.82	797	1.02	844	1.21	890	1.39	936	1.57	980	1.74	1023	1.92	1065	2.09
2800	654	0.50	706	0.71	756	0.92	805	1.11	852	1.30	898	1.48	943	1.66	987	1.83	1031	2.01	1073	2.18
3000	663	0.60	714	0.81	765	1.02	813	1.21	861	1.40	907	1.58	952	1.76	996	1.93	1039	2.11	1082	2.28
3200	673	0.71	724	0.93	774	1.13	823	1.32	871	1.51	917	1.69	962	1.87	1006	2.05	1049	2.22	1091	2.39
3400	684	0.84	735	1.05	785	1.25	834	1.45	882	1.63	928	1.82	973	2.00	1017	2.17	1060	2.34	1102	2.52
3600	696	0.98	747	1.19	798	1.39	846	1.59	894	1.78	940	1.96	985	2.14	1029	2.31	1072	2.48	1115	2.66
3800	709	1.14	761	1.35	811	1.55	860	1.75	907	1.93	953	2.12	999	2.29	1043	2.47	1086	2.64	1128	2.81

Table 27: WP102 (8.5 ton) side duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
4000	724	1.31	776	1.52	826	1.72	874	1.92	922	2.11	968	2.29	1013	2.47	1057	2.64	1100	2.82	1143	2.99
4200	740	1.50	792	1.71	842	1.92	890	2.11	938	2.30	984	2.48	1029	2.66	1073	2.83	1116	3.01	1159	3.18
																	3 HP and Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 28: WP120 (10 ton) side duct

Air flow (CFM)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	2 HP and Field Supplied Drive						Standard 2 HP and Drive										Hi Static 3 HP and Drive			
2600	646	0.41	698	0.62	748	0.82	797	1.02	844	1.21	890	1.39	936	1.57	980	1.74	1023	1.92	1065	2.09
2800	654	0.50	706	0.71	756	0.92	805	1.11	852	1.30	898	1.48	943	1.66	987	1.83	1031	2.01	1073	2.18
3000	663	0.60	714	0.81	765	1.02	813	1.21	861	1.40	907	1.58	952	1.76	996	1.93	1039	2.11	1082	2.28
3200	673	0.71	724	0.93	774	1.13	823	1.32	871	1.51	917	1.69	962	1.87	1006	2.05	1049	2.22	1091	2.39
3400	684	0.84	735	1.05	785	1.25	834	1.45	882	1.63	928	1.82	973	2.00	1017	2.17	1060	2.34	1102	2.52
3600	696	0.98	747	1.19	798	1.39	846	1.59	894	1.78	940	1.96	985	2.14	1029	2.31	1072	2.48	1115	2.66
3800	709	1.14	761	1.35	811	1.55	860	1.75	907	1.93	953	2.12	999	2.29	1043	2.47	1086	2.64	1128	2.81
4000	724	1.31	776	1.52	826	1.72	874	1.92	922	2.11	968	2.29	1013	2.47	1057	2.64	1100	2.82	1143	2.99
4200	740	1.50	792	1.71	842	1.92	890	2.11	938	2.30	984	2.48	1029	2.66	1073	2.83	1116	3.01	1159	3.18
4400	757	1.71	809	1.92	859	2.13	908	2.32	955	2.51	1001	2.69	1046	2.87	1091	3.04	1134	3.22	1176	3.39
4600	776	1.94	827	2.15	877	2.35	926	2.55	974	2.74	1020	2.92	1065	3.10	1109	3.27	1152	3.45	-	-
4800	795	2.19	847	2.40	897	2.60	946	2.79	993	2.98	1040	3.16	1085	3.34	-	-	-	-	-	-
5000	816	2.45	868	2.66	918	2.86	967	3.06	1014	3.25	1061	3.43	-	-	-	-	-	-	-	-
																	3 HP and Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 29: WP150 (12.5 ton) side duct

Air flow (CFM)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	3 HP and Field Supplied Drive										Standard 3 HP and Drive									
3200	673	0.71	724	0.93	774	1.13	823	1.32	871	1.51	917	1.69	962	1.87	1006	2.05	1049	2.22	1091	2.39
3400	684	0.84	735	1.05	785	1.25	834	1.45	882	1.63	928	1.82	973	2.00	1017	2.17	1060	2.34	1102	2.52
3600	696	0.98	747	1.19	798	1.39	846	1.59	894	1.78	940	1.96	985	2.14	1029	2.31	1072	2.48	1115	2.66
3800	709	1.14	761	1.35	811	1.55	860	1.75	907	1.93	953	2.12	999	2.29	1043	2.47	1086	2.64	1128	2.81
4000	724	1.31	776	1.52	826	1.72	874	1.92	922	2.11	968	2.29	1013	2.47	1057	2.64	1100	2.82	1143	2.99
4200	740	1.50	792	1.71	842	1.92	890	2.11	938	2.30	984	2.48	1029	2.66	1073	2.83	1116	3.01	1159	3.18
4400	757	1.71	809	1.92	859	2.13	908	2.32	955	2.51	1001	2.69	1046	2.87	1091	3.04	1134	3.22	1176	3.39
4600	776	1.94	827	2.15	877	2.35	926	2.55	974	2.74	1020	2.92	1065	3.10	1109	3.27	1152	3.45	1194	3.62
4800	795	2.19	847	2.40	897	2.60	946	2.79	993	2.98	1040	3.16	1085	3.34	1129	3.52	1172	3.69	1214	3.86
5000	816	2.45	868	2.66	918	2.86	967	3.06	1014	3.25	1061	3.43	1106	3.61	1150	3.78	1193	3.95	1235	4.13
5200	839	2.73	890	2.94	940	3.14	989	3.34	1037	3.53	1083	3.71	1128	3.89	1172	4.06	1215	4.23	1257	4.41
5400	862	3.03	914	3.24	964	3.44	1012	3.64	1060	3.82	1106	4.01	1151	4.18	1195	4.36	1238	4.53	1281	4.70
5600	886	3.34	938	3.55	988	3.76	1037	3.95	1084	4.14	1131	4.32	1176	4.50	1220	4.67	1263	4.85	1305	5.02
5800	912	3.67	964	3.89	1014	4.09	1063	4.28	1110	4.47	1156	4.65	1201	4.83	1246	5.01	1289	5.18	1331	5.35
6000	939	4.02	990	4.23	1041	4.44	1089	4.63	1137	4.82	1183	5.00	1228	5.18	1272	5.35	1315	5.53	1358	5.70
6200	967	4.39	1018	4.60	1068	4.80	1117	4.99	1165	5.18	1211	5.36	1256	5.54	1300	5.72	-	-	-	-

Table 29: WP150 (12.5 ton) side duct

Air flow (CFM)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	Hi Static 5 HP and Drive														5 HP and Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

WP078-150 bottom duct application

Table 30: WP078 (6.5 ton) bottom duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	Field Supplied Drive				Standard 1.5 HP and Drive				Hi Static 2 HP and Drive											
1800	596	0.34	659	0.52	724	0.68	791	0.84	856	0.98	919	1.12	978	1.25	1032	1.37	1077	1.49	1114	1.61
2000	612	0.44	674	0.62	740	0.79	806	0.94	872	1.08	935	1.22	994	1.35	1047	1.47	1093	1.60	1130	1.72
2200	628	0.56	691	0.74	757	0.90	823	1.05	889	1.20	952	1.33	1011	1.46	1064	1.59	1110	1.71	1147	1.83
2400	647	0.68	710	0.86	775	1.02	842	1.18	907	1.32	970	1.46	1030	1.59	1083	1.71	1128	1.83	1165	1.95
2600	667	0.82	730	0.99	795	1.16	862	1.31	927	1.46	990	1.59	1049	1.72	1103	1.85	1148	1.97	1185	2.09
2800	688	0.96	751	1.14	817	1.30	883	1.46	949	1.60	1012	1.74	1071	1.87	1124	1.99	1170	2.11	1207	2.23
3000	712	1.12	775	1.29	840	1.46	907	1.61	972	1.76	1035	1.89	1094	2.02	1148	2.15	1193	2.27	-	-
3200	737	1.28	800	1.46	865	1.62	932	1.78	997	1.92	1061	2.06	1120	2.19	-	-	-	-	-	-
3400	764	1.46	826	1.63	892	1.80	958	1.95	1024	2.09	1087	2.23	-	-	-	-	-	-	-	-
															2 HP and Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 31: WP090 (7.5 ton) bottom duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	Field Supplied Drive		Standard 1.5 HP and Drive										Hi Static 3 HP and Drive							
2000	644	0.11	698	0.38	755	0.62	814	0.85	874	1.06	933	1.26	990	1.46	1043	1.66	1090	1.87	1131	2.09
2200	666	0.26	720	0.53	777	0.77	836	1.00	896	1.21	956	1.41	1012	1.61	1065	1.81	1113	2.02	1153	2.24
2400	689	0.42	743	0.69	800	0.93	859	1.16	919	1.37	978	1.57	1035	1.77	1088	1.97	1135	2.18	1176	2.40
2600	712	0.60	766	0.87	823	1.11	882	1.34	942	1.55	1002	1.75	1058	1.95	1111	2.15	1159	2.36	1199	2.58
2800	736	0.80	790	1.06	847	1.31	906	1.53	967	1.74	1026	1.94	1082	2.14	1135	2.34	1183	2.55	1223	2.78
3000	761	1.00	815	1.27	872	1.52	931	1.74	991	1.95	1051	2.15	1107	2.35	1160	2.55	1208	2.76	1248	2.98
3200	787	1.22	840	1.49	898	1.74	957	1.96	1017	2.17	1076	2.37	1133	2.57	1186	2.77	1233	2.98	1274	3.20
3400	813	1.46	867	1.73	924	1.97	984	2.19	1044	2.40	1103	2.61	1160	2.80	1212	3.01	1260	3.21	-	-
3600	841	1.70	894	1.97	952	2.21	1011	2.44	1071	2.65	1130	2.85	1187	3.05	-	-	-	-	-	-
3800	869	1.96	923	2.22	980	2.47	1039	2.69	1099	2.90	1158	3.10	1215	3.30	-	-	-	-	-	-
															3 HP and Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 32: WP102 (8.5 ton) bottom duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	2 HP and Field Supplied Drive				Standard 2 HP and Drive								Hi Static 3 HP and Drive							
2200	662	0.53	717	0.68	770	0.83	821	0.96	870	1.09	918	1.22	965	1.35	1010	1.47	1055	1.59	1098	1.71
2400	677	0.63	732	0.78	784	0.93	835	1.06	885	1.19	933	1.32	979	1.44	1025	1.57	1069	1.69	1112	1.81
2600	693	0.75	748	0.90	801	1.04	852	1.18	901	1.31	949	1.44	996	1.56	1041	1.68	1085	1.80	1129	1.92
2800	712	0.88	767	1.03	819	1.17	871	1.31	920	1.44	968	1.57	1014	1.69	1060	1.81	1104	1.94	1148	2.06
3000	733	1.03	788	1.18	841	1.33	892	1.46	941	1.59	989	1.72	1036	1.84	1081	1.97	1125	2.09	1169	2.21
3200	757	1.20	811	1.36	864	1.50	915	1.64	964	1.77	1012	1.89	1059	2.02	1104	2.14	1149	2.26	1192	2.38
3400	782	1.40	837	1.55	890	1.69	941	1.83	990	1.96	1038	2.09	1085	2.21	1130	2.33	1174	2.45	1218	2.58
3600	810	1.61	865	1.76	918	1.91	969	2.04	1018	2.18	1066	2.30	1113	2.43	1158	2.55	1203	2.67	1246	2.79
3800	841	1.85	896	2.00	948	2.14	999	2.28	1049	2.41	1097	2.54	1143	2.66	1189	2.78	1233	2.91	1276	3.03

Table 32: WP102 (8.5 ton) bottom duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
4000	874	2.11	928	2.26	981	2.40	1032	2.54	1082	2.67	1130	2.80	1176	2.92	1222	3.04	1266	3.16	1309	3.28
4200	909	2.38	963	2.53	1016	2.68	1067	2.81	1117	2.95	1164	3.07	1211	3.20	1256	3.32	1301	3.44	-	-
									3 HP and Field Supplied Drive											

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 33: WP120 (10 ton) bottom duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	2 HP and Field Supplied Drive				Standard 2 HP and Drive								Hi Static 3 HP and Drive							
2600	693	0.75	748	0.90	801	1.04	852	1.18	901	1.31	949	1.44	996	1.56	1041	1.68	1085	1.80	1129	1.92
2800	712	0.88	767	1.03	819	1.17	871	1.31	920	1.44	968	1.57	1014	1.69	1060	1.81	1104	1.94	1148	2.06
3000	733	1.03	788	1.18	841	1.33	892	1.46	941	1.59	989	1.72	1036	1.84	1081	1.97	1125	2.09	1169	2.21
3200	757	1.20	811	1.36	864	1.50	915	1.64	964	1.77	1012	1.89	1059	2.02	1104	2.14	1149	2.26	1192	2.38
3400	782	1.40	837	1.55	890	1.69	941	1.83	990	1.96	1038	2.09	1085	2.21	1130	2.33	1174	2.45	1218	2.58
3600	810	1.61	865	1.76	918	1.91	969	2.04	1018	2.18	1066	2.30	1113	2.43	1158	2.55	1203	2.67	1246	2.79
3800	841	1.85	896	2.00	948	2.14	999	2.28	1049	2.41	1097	2.54	1143	2.66	1189	2.78	1233	2.91	1276	3.03
4000	874	2.11	928	2.26	981	2.40	1032	2.54	1082	2.67	1130	2.80	1176	2.92	1222	3.04	1266	3.16	1309	3.28
4200	909	2.38	963	2.53	1016	2.68	1067	2.81	1117	2.95	1164	3.07	1211	3.20	1256	3.32	1301	3.44	-	-
4400	946	2.68	1000	2.83	1053	2.98	1104	3.11	1154	3.24	1202	3.37	-	-	-	-	-	-	-	-
4600	985	3.00	1040	3.15	1092	3.29	1143	3.43	-	-	-	-	-	-	-	-	-	-	-	-
4800	1026	3.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3 HP and Field Supplied Drive																	

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 34: WP150 (12.5 ton) bottom duct

Air flow (cfm)	Available external static pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
	3 HP and Field Supplied Drive						Standard 3 HP and Drive										Hi Static 5 HP and Drive			
3200	757	1.20	811	1.36	864	1.50	915	1.64	964	1.77	1012	1.89	1059	2.02	1104	2.14	1149	2.26	1192	2.38
3400	782	1.40	837	1.55	890	1.69	941	1.83	990	1.96	1038	2.09	1085	2.21	1130	2.33	1174	2.45	1218	2.58
3600	810	1.61	865	1.76	918	1.91	969	2.04	1018	2.18	1066	2.30	1113	2.43	1158	2.55	1203	2.67	1246	2.79
3800	841	1.85	896	2.00	948	2.14	999	2.28	1049	2.41	1097	2.54	1143	2.66	1189	2.78	1233	2.91	1276	3.03
4000	874	2.11	928	2.26	981	2.40	1032	2.54	1082	2.67	1130	2.80	1176	2.92	1222	3.04	1266	3.16	1309	3.28
4200	909	2.38	963	2.53	1016	2.68	1067	2.81	1117	2.95	1164	3.07	1211	3.20	1256	3.32	1301	3.44	1344	3.56
4400	946	2.68	1000	2.83	1053	2.98	1104	3.11	1154	3.24	1202	3.37	1248	3.49	1294	3.62	1338	3.74	1381	3.86
4600	985	3.00	1040	3.15	1092	3.29	1143	3.43	1193	3.56	1241	3.69	1287	3.81	1333	3.93	1377	4.05	1420	4.18
4800	1026	3.33	1081	3.48	1133	3.63	1184	3.76	1234	3.90	1282	4.02	1328	4.15	1374	4.27	1418	4.39	1461	4.51
5000	1069	3.69	1124	3.84	1177	3.98	1228	4.12	1277	4.25	1325	4.38	1372	4.50	1417	4.62	1461	4.74	1505	4.87
5200	1114	4.06	1169	4.21	1222	4.35	1273	4.49	1322	4.62	1370	4.75	1417	4.87	1462	5.00	1506	5.12	1550	5.24
5400	1161	4.45	1216	4.60	1268	4.74	1319	4.88	1369	5.01	1417	5.14	1463	5.26	1509	5.38	1553	5.51	1596	5.63
5600	1210	4.86	1264	5.01	1317	5.15	1368	5.29	1418	5.42	1465	5.55	1512	5.67	-	-	-	-	-	-
5800	1260	5.28	1315	5.43	1367	5.57	1418	5.71	-	-	-	-	-	-	-	-	-	-	-	-
			5 HP and Field Supplied Drive																	

1. Blower performance includes gas heat exchangers and 2 in. filters. See the Table 39 for additional applications.
2. See the *Selecting rpm* table to determine the required motor sheave setting and to determine the maximum continuous bhp.
3. kW = BHP x .932.4. Field Supplied Drive.

Table 35: Selecting rpm

Size (ton)	Model	HP	Max BHP	Motor sheave	Blower sheave	6 turns open	5 turns open	4 turns open	3 turns open	2 turns open	1 turn open	Fully closed
078	WP	1.5	1.73	VL40	AK74	NA	640	689	738	787	836	885
(6.5)		2.0	2.30	VL44	AK71	NA	780	833	885	938	990	1043
090	WP	1.5	1.73	1VL40	AK69	N/A	690	743	796	849	902	955
(7.5)		3	3.45	1VM50	AK69	N/A	955	1008	1062	1115	1168	1221
102	WP	2	2.30	1VP50	AK89	N/A	735	775	815	851	889	930
(8.5)		3	3.45	1VP50	AK74	N/A	880	928	972	1016	1067	1110
120	WP	2	2.30	1VM50	AK84	N/A	785	821	858	901	940	980
(10)		3	3.45	1VM50	AK74	N/A	880	928	972	1016	1067	1110
150	WP	3	3.45	1VM50	AK74	N/A	880	928	972	1016	1067	1110
(12.5)		5	5.75	1VP56	BK77	1052	1095	1136	1175	1216	1272	N/A

Indoor blower and power exhaust specifications

Table 36: Indoor blower specifications

Size (ton)	Model	Motor					Motor sheave			Blower sheave			Belt
		HP	RPM	Eff.	SF	Frame	Datum diameter (in.)	Bore (in.)	Model	Datum diamter (in.)	Bore (in.)	Model	
078 (6.5)	WP	1-1/2	1725	0.8	1.15	56	2.4 - 3.4	7/8	VL40	7.0	1	AK74	A52
		2	1725	0.8	1.15	56	2.8 - 3.8	7/8	VL44	6.7	1	AK71	A52
090(7.5)	WP	1-1/2	1725	0.8	1.15	56	2.6 - 3.6	7/8	1VL40	6.5	1	AK69	A52
		3	1725	0.8	1.15	56	3.6 - 4.6	7/8	1VM50	6.5	1	AK69	A54
102(8.5)	WP	2	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VP50	8.5	1	AK89	A56
		3	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VP50	7.0	1	AK74	A54
120(10)	WP	2	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	8.0	1	AK84	A56
		3	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	7.0	1	AK74	A54
150(12.5)	WP	3	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	7.0	1	AK74	A54
		5	1725	0.87	1.15	184T	4.3 - 5.3	1-1/8	1VP56	6.7	1	BK77	BX56

Table 37: Power exhaust specifications

Model	Voltage	Motor			Unit (per circuit)			Fuse size	CFM @0.1 ESP
		HP	RPM[1]	QTY	LRA	FLA	MCA		
2PE04704706	208/230-1-60	3/4	1075	1	24.9	5	6.3	10	4800
2PE04704746	460-1-60	3/4	1075	1	N/A	2.2	2.8	5	4800
2PE04704758	575-1-60	3/4	1050	1	N/A	1.5	1.9	4	4800

1. Motors are multi-tapped and factory wired for high speed.

Air balance

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

⚠ CAUTION

You must adjust the belt drive blower systems to the specific static and CFM requirements for the application. The belt drive blowers are not set at the factory for any specific static or CFM. You must adjust the blower speed and belt tension. Verify proper sheave alignment. Tighten the blower pulley and motor sheave set screws after these adjustments. Re-check the set screws after 10-12 hours of run time.

Checking air quantity

Method one

1. Remove the dot plugs from the duct panel. See Figure 13 and Figure 14.
2. Insert 8 in. of 1/4 in. metal tubing into the airflow on both sides of the indoor coil.

   Note: You must insert the tubes and hold them in a position perpendicular to the air flow so that velocity pressure does not affect the static pressure readings.
3. Use an inclined manometer or Magnehelic® to determine the pressure drop across a dry evaporator coil. The moisture on an evaporator coil can vary greatly, measuring the pressure drop across a wet coil under field conditions could be inaccurate. To ensure that the coil is dry, de-activate the compressors de-activated while the test is being run.

   Note: De-energize the compressors before you take any test measurements to ensure that the evaporator coil is dry.
4. Use the pressure drop indicated by the manometer and the graph in Figure 31 to determine the unit CFM. To obtain an accurate measurement, verify that the air filters are clean.
5. To adjust measured CFM to required CFM, see Supply air drive adjustment.
6. After you note the readings, remove the tubes and replace the dot plugs.
7. Tighten the blower pulley and motor sheave set screws after any adjustments. Re-check the set screws after 10-12 hours run time.

WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

Method two

1. Drill two 5/16 in. holes, one in the return air duct as close to the inlet of the unit as possible, and another in the supply air duct as close to the outlet of the unit as possible.
2. Using the hole drilled in step 1, insert 8 in. of 1/4 in. metal tubing into the airflow of the return and supply air ducts of the unit.

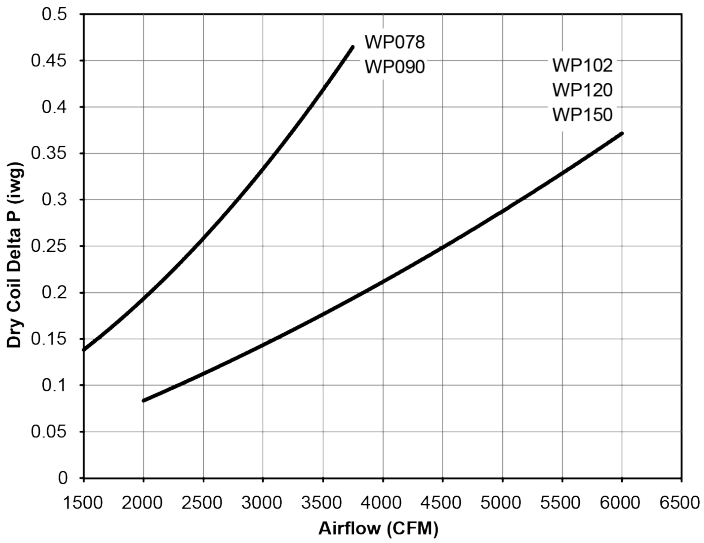
   Note: You must insert the tubes and hold them in a position perpendicular to the air flow so that velocity pressure does not affect the static pressure readings.
3. Use an inclined manometer or Magnehelic® to determine the pressure drop across the unit. This is the external static pressure (ESP). To obtain an accurate measurement, verify that the air filters are clean.
4. Determine the number of turns the variable motor sheave is open.
5. Select the correct blower performance table for the unit from . Tables are presented for side and bottom duct configuration.
6. Determine the unit measured CFM from the blower performance table, external static pressure, and the number of turns the variable motor sheave is open.
7. To adjust measured CFM to required CFM, see Supply air drive adjustment.
8. After you note the reading, remove the tubes and seal the holes.
9. Tighten the blower pulley and motor sheave set screws after any adjustments. Re-check the set screws after 10-12 hours run time.

   Note: You must repeat this procedure with the addition of field-installed accessories.

WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

Figure 31: Dry coil delta P



Supply air drive adjustment

CAUTION

Before you make any blower speed changes, review the installation for any installation errors, leaks, or undesirable systems effects that can result in loss of airflow. Even small changes in blower speed can result in substantial changes in static pressure and BHP. BHP and AMP draw of the blower motor increase by the cube of the blower speed. Static pressure increases by the square of the blower speed. Only qualified personnel can make blower speed changes, strictly adhering to the fan laws.

At unit start-up, the measured CFM may be higher or lower than the required CFM. To achieve the required CFM, you may need to adjust the speed of the drive by changing the datum diameter (DD) of the variable pitch motor sheave as described below:

$$\left(\frac{4{,}000\ \text{CFM}}{3{,}800\ \text{CFM}}\right) \bullet 4.0\ \text{in.} = 4.21\ \text{in.}$$

Use the following tables and the DD calculated according to the above equation to adjust the motor variable pitch sheave.

CAUTION

You must adjust the belt drive blower systems to the specific static and CFM requirements for the application. The belt drive blowers are not set at the factory for any specific static or CFM. You must adjust the blower speed and belt tension. Verify proper sheave alignment. Tighten the blower pulley and motor sheave set screws after these adjustments. Re-check the set screws after 10-12 hours of run time.

Example

A 12.5 ton unit was selected to deliver 4,000 CFM with a 3 hp motor, but the unit is delivering 3,800 CFM. The variable pitch motor sheave is set at 2 turns open.

Use the equation to determine the required DD for the new motor sheave:

$$\left(\frac{\text{Required CFM}}{\text{Measured CFM}}\right) \bullet \text{Existing DD} = \text{New DD}$$

Use Table 38 to locate the DD nearest to 4.21 in. Close the sheave to 1 turn open.

New BHP

= (Speed increase)^3 • bhp at 3,800 CFM

= (Speed increase)^3 • Original bhp

= New BHP

New motor amps

= (Speed increase)^3 • amps at 3,800 CFM

= (Speed increase)^3 • original amps

= new amps

Table 38: Motor sheave datum diameters

1VM50x7/8 (1-1/2, 2, and 3 HP motor)		1VP56x1-1/8 (5 HP motor)	
Turns open	Datum diameter (in.)	Turns open	Datum diameter (in.)
0	4.4	1	5.3
1/2	4.3	1-1/2	5.2
1	4.2	2	5.1
1-1/2	4.1	2-1/2	5.0
2	4.0	3	4.9
2-1/2	3.9	3-1/2	4.8
3	3.8	4	4.7
3-1/2	3.7	4-1/2	4.6
4	3.6	5	4.5
4-1/2	3.5	5-1/2	4.4
5	3.4	6	4.3

Table 39: Additional static resistance

Size (ton)	Model	CFM	Cooling only[1]	Reheat coil	Economizer[2, 3]	MERV 13 filter[2]	Electric Heat kW[2]				
							9	18	24	36	54
078 (6.5) 090 (7.5) 102 (8.5) 120 (10) 150 (12.5)	WP	1900	0.06	0.01	0.02	0.05	0.05	0.06	0.07	0.08	0.10
		2100	0.07	0.01	0.02	0.06	0.06	0.07	0.08	0.09	0.11
		2300	0.08	0.02	0.04	0.06	0.07	0.08	0.09	0.10	0.13
		2500	0.09	0.02	0.11	0.07	0.08	0.09	0.10	0.11	0.14
		2700	0.11	0.03	0.18	0.08	0.09	0.10	0.12	0.13	0.16
		2900	0.12	0.03	0.25	0.08	0.10	0.11	0.13	0.14	0.18
		3100	0.14	0.04	0.31	0.09	0.12	0.13	0.15	0.16	0.20
		3300	0.16	0.14	0.37	0.10	0.13	0.14	0.17	0.18	0.22
		3500	0.18	0.15	0.43	0.11	0.15	0.16	0.19	0.20	0.24
		3700	0.20	0.17	0.49	0.12	0.17	0.18	0.21	0.22	0.26
		3900	0.23	0.18	0.54	0.13	0.19	0.20	0.23	0.24	0.28
		4100	0.25	0.19	0.58	0.14	0.21	0.22	0.25	0.26	0.31
		4300	0.28	0.20	0.65	0.16	0.23	0.24	0.28	0.29	0.34
		4500	0.30	0.21	0.69	0.17	0.25	0.26	0.30	0.31	0.37
		4700	0.33	0.22	0.74	0.18	0.28	0.29	0.33	0.34	0.40
		4900	0.36	0.24	0.78	0.20	0.30	0.31	0.35	0.37	0.43
		5100	0.39	0.25	0.82	0.21	0.33	0.34	0.38	0.40	0.46
		5300	0.42	0.26	0.86	0.23	0.35	0.37	0.41	0.43	0.49
		5500	0.45	0.27	0.89	0.24	0.38	0.40	0.44	0.46	0.53
		5700	0.48	0.28	0.93	0.26	0.41	0.43	0.47	0.49	0.56
		5900	0.52	0.30	0.96	0.28	0.44	0.46	0.50	0.53	0.59
		6100	0.56	0.31	0.98	0.29	0.47	0.49	0.53	0.56	0.62
		6300	0.60	0.32	1.01	0.31	0.50	0.53	0.56	0.59	0.65

1. Add these values to the available static resistance in the respective *Blower performance*.
2. Deduct these values from the available external static pressure shown in the respective *Blower performance* tables.
3. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit will deliver less cfm during full economizer operation.

Operation

Cooling sequence of operation

Note: For more in-depth sequence of operation of the Smart Equipment control, refer to the *Smart Equipment Controls Sequence of Operation Overview* LIT-12011950 available from your equipment dealer or distributor.

For the WP series of units, the thermostat makes a circuit between R and Y1 for the first stage of cooling. The call is passed to the **Unit Control Board (UCB)**, which then determines whether the requested operation is available and, if so, energizes ID fan contactor M3, compressor #1 contactor M1, condenser fans contactor M4 and reversing valves relay RW1. If the (UCB) receives call for second stage cooling from the thermostat, R and Y2, then the UCB energizes compressor #2 contactor M2 for full cooling operation.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

Heat pump cooling

Cooling calls are handled the same way as non-heat pump cooling units, with one exception.

The H1 output to the reversing valve remains energized between calls for cooling. If a heating call arises, the H1 output turns off.

Note: The exception to this is during cooling. The control energizes the H1 output to turn on the reversing valve.

Continuous blower

By setting the room thermostat fan switch to ON, the supply air blower operates continuously.

Intermittent blower

With the room thermostat fan switch set to AUTO and the system switch set to either the AUTO or HEAT settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds minimum off.

No outdoor air options

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from R to Y1 and G is completed. The UCB energizes the economizer (if installed and free

cooling is available) or the first available compressor* and the condenser fans. For first stage cooling, compressor #1 is energized. If compressor #1 is unavailable, compressor #2 is energized. After completing the specified fan on delay for cooling, the UCB energizes the blower motor.

When the thermostat calls for the second stage of cooling, the low-voltage control circuit from R to Y2 is completed. The control board energizes the first available compressor. If free cooling is being used for the first stage of cooling, compressor #1 is energized. If compressor #1 is active for first stage cooling or the first compressor is locked-out, compressor #2 is energized. In free-cooling mode, if the call for the second stage of cooling continues for 20 minutes, compressor #2 is energized, provided it has not been locked-out.

If there is an initial call for both stages of cooling, the UCB delays energizing compressor #2 by 30 seconds in order to avoid a power rush.

When the thermostat is satisfied, it de-energizes Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.

* To be available, a compressor must not be locked-out due to a high or low-pressure switch or the **Evaporator Low Limit Sensor (EC1, 2)** detects a temperature below 26°F and the **Anti-Short Cycle Delay (ASCD)** must have elapsed.

Economizer with single enthalpy sensor

When the room thermostat calls for first-stage cooling, the low voltage control circuit from R to G and Y1 is completed. The UCB energizes the blower motor when the fan switch on the room thermostat is set in the AUTO position and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller, Y1 energizes the economizer. The dampers modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, Y1 energizes compressor #1.

When the thermostat calls for second-stage cooling, the low voltage control circuit from R to Y2 is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller, for example the first stage has energized the economizer, Y2 energizes compressor #1. If the outdoor air is above the setpoint, Y2l energizes compressor #2.

When the thermostat is satisfied, it de-energizes Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors are completed.

Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continuous fan operation, the economizer damper goes to the minimum position.

Economizer with dual enthalpy sensors

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

Economizer with power exhaust

A unit equipped with an economizer (single or dual enthalpy) and a power exhaust operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan set point on the economizer control. As always, the R to G connection provides minimum position but does not provide power exhaust operation.

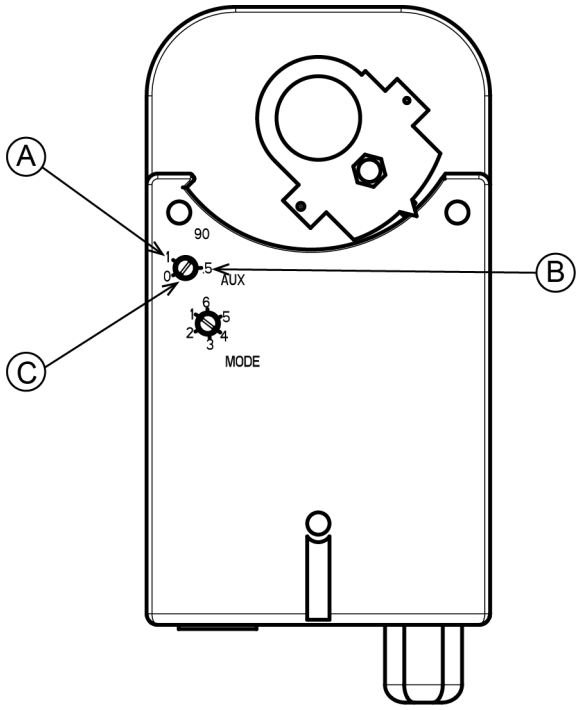
Motorized outdoor air dampers

This system operation is the same as the units with no outdoor air options with one exception. When the R to G circuit is complete, the motorized damper drives open to a chosen minimum damper position set by AUX selection dial (Mode selection dial shall be set to 4).

Actuator Settings:

1. Set the Mode dial to 4 for minimum position
2. Set the AUX selection dial to 10 for minimum damper position

Figure 32: Actuator settings



Callout	Description
A	AUX dial set to 100%
B	AUX dial set to 50%
C	AUX dial set to 10%

Note: Secure the bolt to the damper shaft. Tighten to a torque of 240 lb-in.

Refrigerant detection system (optional)

An A2L sensor is used to detect R454B refrigerant. When R454B refrigerant leak is detected by the Refrigerant detection system (RDS), it is considered an alarm condition.

When an A2L alarm is detected, the unit shuts down any cooling and heating outputs and the supply fan turns on (if not already on) at 50%.

Heating and cooling remain off and the supply fan remains on as long as the A2L sensor is in the alarm condition. The alarm condition remains active for 5 minutes after the sensor returns to the normal condition.

If the alarm happens three times within two hours, the unit locks out and requires a reset (ResetLO) to go back to normal operation.

Cooling operation errors

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

See Smart Equipment unit control board for instructions on how to access the Smart Equipment control points.

High-pressure limit switch

During cooling operation, if a high-pressure limit switch opens, the UCB de-energizes the associated compressor, initiates the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stops the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor.

If a high-pressure switch opens three times within 2 hours of operation, the UCB locks out the associated compressor. If the other compressor is inactive, the condenser fans are de-energized.

Low-pressure limit switch

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB monitors the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30 seconds monitoring phase, the UCB de-energizes the associated compressor, initiates the ASCD, and, if the other compressor is idle, stops the condenser fans.

When the low-pressure switch is proven (closed during the 30 seconds monitor period described above), the UCB monitors the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB de-energizes the associated compressor, initiates the ASCD, and, if the other compressor is idle, stops the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor.

If a low-pressure switch opens three times within 1 hour of operation, the UCB locks out the associated compressor. If the other compressor is inactive, the condenser fans are de-energized.

Evaporator low limit

During cooling operation, if the **Evaporator Low Limit Sensor (EC1, 2),** located on the suction line at the evaporator coil, detects a temperature below the default 26°F, the UCB de-energizes the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor. If the UCB detects the evaporator low limit sensor **(EC1, 2)** falling below 26°F (default) three times within 2 hours of operation, the UCB locks out the associated compressor. If the other compressor is inactive, the condenser fans are de-energized.

Low ambient cooling

To determine when to operate in low ambient mode, the UCB has an **Outdoor Air Temperature Sensor (OAT)** with a low ambient setpoint at 45°F (default). When the **OAT Sensor** senses a temperature below the low ambient setpoint and the thermostat is calling for cooling, the UCB operates in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated

throughout the cycle. The 5 minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The off cycle begins immediately following the elapse of the minimum run time.

When operating in low ambient mode, an evaporator low limit sensor **(EC1, 2)** temperature below 26ºF de-energizes the associated compressor. If the call for cooling is still present at the end of the ASCD and the and the evaporator temperature sensor **(EC1, 2)** temperature is above 26°F, the unit will resume operation.

Safety controls

The unit control board monitors the following inputs for each cooling system:

1. An evaporator low limit sensor **(EC1, 2),** located on the suction line at the evaporator coil, to protect against low evaporator temperatures due to a low airflow or a low return air temperature, set at 26°F.
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 22 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system is affected by any safety/preventive action. The other refrigerant system continues in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of units with electric heat.

Compressor protection

In addition to the external pressure switches, the compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An **Anti-Short Cycle Delay (ASCD)** is used to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

Reset

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature.

Reheat mode sequence of operation

The MagnaDRY reheat mode of operation is designed to remove latent heat (humidity) from a space when there are low load conditions and the air conditioning unit is not used to cool the space. The general sequence of operation of the patented MagnaDRY reheat is outlined in the following paragraphs.

The user can select three different modes of operation from the unit control board (UCB) within the Smart Equipment controller menu. The available modes are normal, alternate, and aux. The following sections describe each mode.

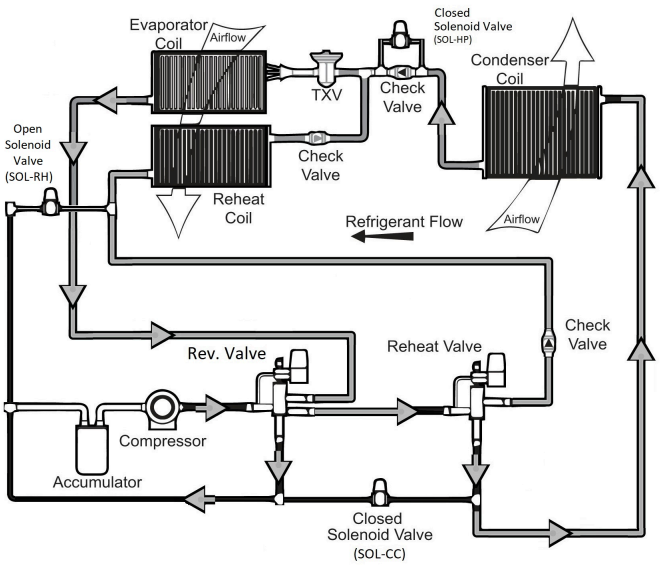
Normal cooling mode

When there is a call for first stage cooling, with or without a call for dehumidification, the UCB de-energizes SOL-CC and energizes SOL-RH. The unit is now in first stage cooling without HGRH. When there is a call for second stage cooling, the UCB engages both circuit #1 and circuit #2 in cooling mode.

The indoor blower operation is always initiated upon a call for first stage cooling, second stage cooling or dehumidification (HGRH). The unit does not operate in the reheat mode if there is any call for heating.

On units with economizers, the unit does not operate in the reheat mode if there is a call for cooling and the economizer is operating as first stage of cooling. All safety devices function as previously described.

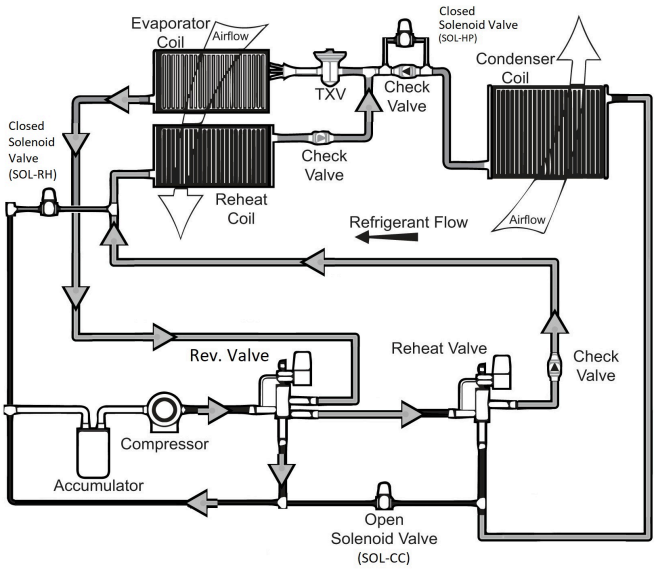
Figure 33: Cooling operation piping schematic - circuit no. 1



Normal reheat mode

When the UCB detects a need for dehumidification through the field installed return/space humidity sensor and there is not a call for cooling, the UCB energizes solenoid SOL-CC and the reheat relay (RHR), which de-energizes SOL-RH. The unit then operates with refrigerant flow in the evaporator reheat coil and condenser coil circuit no. 1. See Figure 34.

Figure 34: Reheat operation piping schematic - circuit no. 1



Alternate mode

When the Unit Control Board (UCB) detects a need for dehumidification via the field installed return/space humidity sensor and there is not a call for cooling, the UCB energizes SOL-CC, and de-energizes SOL-RH. The unit then operates with circuit #1 in reheat mode and circuit #2 in cooling mode.

When there is a call for first stage cooling while there is still a call for dehumidification, no operational change is made. The call for cooling is ignored and the unit continues to operate with circuit #1 in reheat mode and circuit #2 in cooling mode.

When there is a call for second stage cooling, the UCB de-energizes the HGR, which de-energizes SOL-CC, and energizes SOL-RH. Both circuits now operate in the cooling mode.

The indoor blower operation is always initiated upon a call for first stage cooling, second stage cooling or dehumidification (HGRH). The unit does not operate in the reheat mode if there is any call for heating or two stage cooling.

On units with economizers, the unit will not operate in the reheat mode if there is a call for cooling and the economizer is operating as first stage of cooling. All safety devices function as previously described.

Table 40: Dehumidification sequence in normal and alternate mode

Request	Normal mode			Alternate mode		
	HGR	C1	C2	HGR	C1	C2
Dehumidification	On	On	Off	On	On	Off
One stage of cooling (Y1)	Off	On	Off	On	On	On
Two stages of cooling (Y2)	Off	On	On	Off	On	On

Optional aux mode

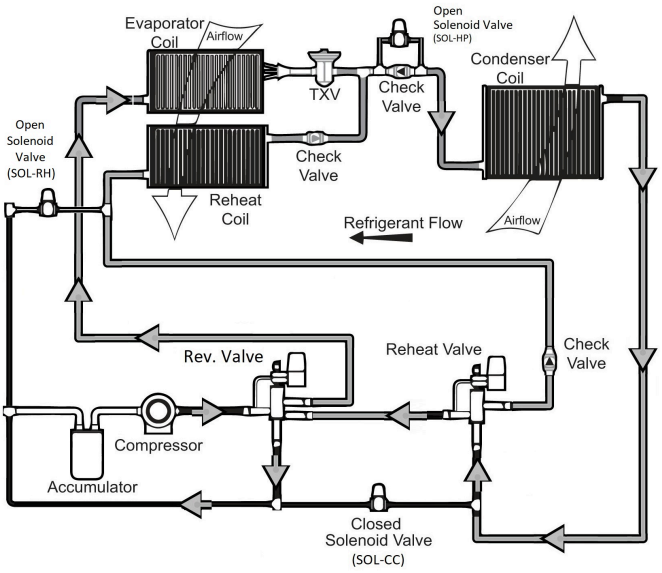
The aux mode available with hot gas reheat units introduces an operating mode that considers the dry bulb temperature in the space when choosing hot gas reheat staging. The aux mode reduces the amount of over cooling while maintaining humidity control in the space. The aux mode is only applicable when the unit is set up in the alternate reheat mode.

If there is a call for dehumidification and no call for cooling, the unit automatically reverts back to the normal hot gas reheat mode only allowing refrigerant stage one to run in reheat mode and refrigerant stage two remains off.

If there is a call for dehumidification and a call for cooling, the unit remains in the alternate hot gas reheat mode allowing refrigerant stage one to run in hot gas reheat or dehumidification mode and refrigerant stage two runs in cooling.

Heat pump heating sequence of operation

Figure 35: Heat pump heating operation piping schematic



With electric heat

When the thermostat calls for heating, the low voltage control circuit is completed between R and W1 for heating. The call is passed to the UCB, which then determines whether the requested operation is available and if so, energizes ID fan contactor M3, compressor #1 contactor M1. After a 2 second delay, it then energizes compressor #2 contactor M2. As a result, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 contactor which brings on the condenser fans.

If the compressors alone cannot satisfy the heating requirements a second stage call from the thermostat completes the circuit between R and W2. The call is passed through the UCB to the electric heat section (if available). For the 9 kW heater 9 kW is energized, for the 18 kW heater 18 kW is energized, for the 24 kW heater 24 kW is energized, for

the 36 kW heater 36 kW is energized, and for 54 kW heater 36 kW is energized. In the event that all compressors are locked out by the UCB, the total available kW of electric heat is energized.

In the event of a needed defrost the defrost control signals the UCB, which de-energizes the condenser fans contactor M4 and energizes the reversing valves relay RW1, putting the unit into defrost.

Without electric heat

When the thermostat calls for heating, the low voltage control circuit is completed between R and W1 for heating. The call is passed to the UCB, which then determines whether the requested operation is available and if so, energizes ID fan contactor M3, compressor #1 contactor M1. After a 2 second delay, it then energizes compressor #2 contactor M2. As a result, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 contactor which brings on the condenser fans.

In the event of a needed defrost, the defrost control signals the UCB, which de-energizes the condenser fans contactor M4 and energize the reversing valves relay RW1, putting the unit into defrost.

Defrost initiation

Defrost control implements a temperature differential, demand defrost algorithm. The heat pump operates in the heating mode until the combination of outdoor ambient temperature and outdoor coil temperature indicate that defrosting is necessary. When the coil temperature is maintained below the initiate point for a given ambient temperature, continuously for 4 1/2 minutes, the heat pump is put into a defrost cycle. This 4 1/2 minutes timer eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

For defrost, the UCB signals the energizing of the reversing valve and de-energizing the systems condenser fan motors. The unit's optional electric or gas first-stage heater is also energized via a 24 V VAC output terminal labeled H2.

Defrost termination

The UCB terminates the defrost mode when either of the following two conditions are met:

1. The outdoor coil temperature sensor reaches 50°F, or
2. The maximum allowable defrost run time of 8 minutes.

Interval between defrosts

A timed inhibit feature prevents the system from responding to a call for defrost less than 40 minutes after the initiation of the previous defrost. After this inhibit time has expired, temperature conditions must call for defrost continuously for 4 1/2 minutes before another defrost cycle is initiated. A temperature inhibit feature prohibits defrost if the coil temperature is above 40°F. All defrost timing occurs only while the compressor is on.

Forced defrost

A forced-defrost feature puts the system into a defrost cycle every 6 hours and 4 minutes to recirculate lubricants, unless the coil temperature is above 40°F. All defrost timing occurs only while the compressor is on.

For troubleshooting purposes, the defrost cycle can be manually initiated by selecting Test Defrost in the UCB menu.

Electric heat operation errors

Temperature limit

If the UCB senses 0 V from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, that is. the limit is monitored at all times.

If the temperature limit opens three times within 1 hr, it locks on the indoor blower motor.

Safety controls

The UCB monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

Limit Switch (LS)

The limit switch (LS) is located inside the heater compartment and is set to open at the temperature indicated in Table 41. It resets automatically. The limit switch operates when a high temperature condition caused by inadequate supply air flow occurs. This shuts down the heater and energizes the blower.

All electric heaters are provided with single use backup protection limits. These deenergize the heaters if the primary limit fails to open or the contactors fail to open in a failure mode. When the backup limit trips it will need to be replaced for the heater to be operational again.

Table 41: Electric heat limit setting 50 in. cabinet

Model (ton)	Voltage	Heater (kW)	Limit switch opens (°F)
WP078, 090, 102 (6.5, 7.5, 8.5)	208/230	9	150
		18	150
		24	150
		34	150
WP 120, 150 (10, 12.5)		18	150
		24	150
		34	150
		54	130
WP078, 090, 102 (6.5, 7.5, 8.5)	480	9	150
		18	150
		24	150
		34	150
WP 120, 150 (10, 12.5)		18	150
		24	150
		34	150
		54	150

Table 41: Electric heat limit setting 50 in. cabinet

Model (ton)	Voltage	Heater (kW)	Limit switch opens (°F)
WP078, 090, 102 (6.5, 7.5, 8.5)	600	9	140
		18	150
		24	150
		34	150
WP 120, 150 (10, 12.5)		18	150
		24	150
		34	150
		54	150

Reset

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature.

Electric heat anticipator setpoints

The anticipator setpoint must be correct. Too high of a setting results in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint gives shorter ON cycles and may result in the lowering of the temperature within the conditioned space. See Table 42 for the required electric heat anticipator setting.

Table 42: Electric heat anticipator setpoints

Setting, amps	
W1	W2
0.13	0.1

Gas heating sequence of operations

When the thermostat calls for the first stage of heating, the low-voltage control circuit from R to W1 is completed. If the outdoor air temperature is above the adjustable balance point (default 40°F) the unit will operate in heat pump heating (compressors). If the outdoor air temperature is below the balance point the unit will operate in gas heating. For gas heat, a call for heat passes through the UCB to the Ignition Control Board (ICB). The UCB monitors the W1 call and acts upon any call for heat by monitoring the Gas Valve (GV). Once voltage has been sensed at the GV, the UCB will initiate the fan on delay for heating, energizing the indoor blower the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately closed. The blower is de-energized after the fan off delay for heating has elapsed. The draft motor performs a 30 second post purge.

Backup heating mode for dual fuel units

Backup heating mode is an available feature on dual fuel units. It is defaulted to 'Disable' in the Unit Control Board (UCB). With backup heating mode enabled, in the event of a heating failure (i.e. compressors locked out or disabled, gas valve shut down) the other source of heating will be brought online (e.g. if gas heating operation fails, heat pump heating is initiated) to continue heating the space. The unit will continue trying to resolve the reason for lockout and bring the original heat source back online.

Note: The unit activates an alarm indicating backup heating is in operation. Outdoor air temperature must be above dual fuel OAT HP cutout temperature setpoint for compressors to operate in backup heating mode.

Ignition control board

First stage of heating

When the ICB receives a call for first stage of heating, W1, the draft motor is energized. Once the draft motor has been proven, a 30-second purge is initiated. At the end of the purge, the GV is opened, and the spark igniter is energized for 10 seconds. The ICB then checks for the presence of flame. If flame is detected, the ICB enters a flame stabilization period. If flame was not detected, the GV closes, and a retry operation begins.

During the flame stabilization period, a loss of the flame for 2 seconds will cause the GV to close and the retry operation to begin. After the flame stabilization period, a loss of flame for 3/4 second will cause the GV to close and the retry operation to begin.

At the conclusion of the flame stabilization period, the ICB will operate the gas heat in high fire for an additional 60 seconds (for a total for 120 seconds of high fire operation). After this 60 seconds, the ICB will then use the call for the second stage of heat to control second stage operation of the GV.

When W1 is satisfied, both valves are closed.

Auto staging (dual fuel only)

Upon receiving W1 (H2 from the UCB board), the gas heat ignition control will turn on high heat for the normal 1 minute warmup and flame stabilization period, then operate low heat for 9 minutes. If the call for heat is still present after 10 minutes from ignition, then it will go to high heat until the heat call ends.

Retry operation

When a flame is lost or is not detected during an attempt to achieve ignition, a retry operation occurs. A 30-second purge is performed between ignition attempts.

If the unit fails after three ignition attempts, the furnace is locked-out for one hour. The furnace is monitored during this one-hour period for unsafe conditions.

Recycle operation

When a flame is lost after the flame stabilization period, a recycle operation occurs. If the unit fails after five recycle attempts, the furnace is locked-out for one hour.

Gas heating operation errors

Lockout

A one-hour lockout occurs following three retries or five recycles. During the one-hour lockout, flame detection, limit conditions, and main valves are tested. Any improper results

will cause the appropriate action to occur. Recycling the low voltage power cancels the lock-out.

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor.

Flame sense

Flame sensing occurs at all times. If W1 is not present and a flame is sensed for 2 seconds, the draft motor is energized and the GV is kept off. The ICB halts any operation until a flame is not detected. Once the flame detection is lost, the ICB performs a post-purge. Normal operation is allowed concurrently with the purge (i.e. this purge can be considered the purge associated with a call for W1).

If W1 is present, a flame is sensed, but the GV is not energized, the draft motor is energized until the flame detection is lost. Normal operation is now allowed.

The flame detection circuitry continually tests itself. If the ICB finds the flame detection circuitry to be faulty, the ICB will not permit an ignition sequence and the draft motor is energized. If this failure should occur during an ignition cycle the failure is counted as a recycle.

Gas valve

The UCB and ICB continuously monitor the GV.

If the ICB senses voltage at the GV when not requested, the ICB will energize the draft motor. The ICB will not operate the furnace until voltage is no longer sensed at the GV. The draft motor is stopped when voltage is not sensed at the GV.

Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock-on the indoor blower. When voltage is no longer sensed at the GV, the UCB will de-energize the indoor blower following the elapse of the fan off delay for heating.

If voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and GV voltage or W1 is lost, the indoor blower is forced on for the length of the fan off delay for heating.

During a call for heat, if the UCB does not sense voltage at the GV for a continuous five-minute period the UCB will initiate a error message. The indoor blower motor will not be locked-on while there is no GV voltage.

Safety controls

The unit control board monitors the following inputs for each cooling system:

1. An evaporator low limit sensor **(EC1, 2),** located on the suction line at the evaporator coil, to protect against low evaporator temperatures due to a low airflow or a low return air temperature, set at 26°F.
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 22 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system is affected by any safety/preventive action. The other refrigerant system continues in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of units with electric heat.

Limit switch

This control is located inside the gas heat compartment and is set to open at its temperature setting. The limit switch (LS) operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

If LS is open for more than 3 minutes and 20 seconds continuously during a call for heat, it is assumed that the indoor blower has failed and the ICB will enter a hard lockout. The control will remain locked out until power is reset.

Auxiliary limit switch

The auxiliary limit switch (ALS) is wired in series with the limit switch. As such, the UCB cannot distinguish the auxiliary limit and the gas heat limit switch operation except the auxiliary is manual reset. Consequently, the control will respond in the same manner as outlined under **Limit Switch**.

The ICB monitors the Pressure and Roll-out switches of gas heat units.

The control circuit includes the following safety controls:

Pressure switch

Once the draft motor has reached full speed and closes the pressure switch (PS) during a normal ignition sequence, if the PS opens for 2 seconds, the GV will be de-energized, the ignition cycle is aborted, and the ICB flashes the appropriate code. See Table 58. The draft motor is energized until the PS closes or W1 is lost.

Roll-out switch

The roll-out switch (ROS) is wired in series with the pressure switch. As such, the ICB cannot distinguish the ROS operation from that of the pressure switch.

Consequently, the control will only respond in the same manner as outlined above under “Pressure Switch”. An open roll-out will inhibit the gas valve from actuating.

Internal microprocessor failure

If the ICB detects an internal failure, it will cease all outputs, ignore inputs, and display the proper flash code for control replacement. The ICB remains in this condition until replaced.

Flash codes

The ICB will initiate a flash code associated with errors within the system. Refer to Table 58.

Resets

Resets remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes

Gas heat anticipator setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 43 for the required gas heat anticipator setting.

Table 43: Gas heat anticipator setpoints

Setting, amps	
W1	**W2**
0.65	0.1

Cooling start-up

Pre-start checklist

When the installation is complete, complete the following checks:

1. Check the electrical supply voltage being supplied. Verify that it is the same as the voltage listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn on electrical power to the unit.
4. Set the room thermostat fan switch to on.
5. Check the indoor blower rotation.
   - If the blower rotation is in the wrong direction, see Phasing.

   Check the blower drive belt tension.
6. Check the unit supply air (CFM).
7. Measure the evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn off electrical power to the unit.

Operating the unit

1. Turn on electrical power to the unit.

   Note: Before each cooling season, you must energize the crankcase heaters at least 10 hours before the system is put into operation.
2. Set the room thermostat setting lower than the room temperature.

   First stage compressors energize after the built-in time delay of 5 minutes.

   The second stage of the thermostat energizes the second stage compressor if needed.

Post-start checklist

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.

Gas heat start-up

Pre-start check list

Complete the following checks before starting the unit.:

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent outlet and combustion air inlet are free of any debris or obstruction.

Operating the unit

CAUTION

This furnace is equipped with an automatic re-ignition system. DO NOT attempt to manually light the pilot.

Lighting the main burners

1. Turn off electric power to the unit.
2. Set the room thermostat to the lowest setting.
3. Turn the gas valve to the on position.
4. Turn on electrical power to the unit.

Important: If the outdoor air temperature is above the balance point, gas heat will not turn on. To operate gas heat, either:

1. Increase the balance point setting (highest is 65°F) above the outdoor air temperature. After start-up, restore balance point to desired setting, **OR**
2. Use commissioning mode - set Fan > ON, Set VFD% > 100%, set H2 > ON. Indoor Fan does not automatically turn on.

Post start checklist

After the entire control circuit has been energized and the heating section is operating, check for the following:

1. Check for gas leaks in the unit piping as well as the supply piping.

> **WARNING**
>
> **FIRE OR EXPLOSION HAZARD**
>
> Failure to follow the safety warning exactly could result in serious injury, death or property damage. Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

2. Check for correct manifold gas pressures. See Checking gas heat input.
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate.

   Note: Check the supply pressure with all gas appliances in the building at full fire. The standby gas pressure must never exceed 10.5 in. or the operating pressure drop below 4.5 in. for natural gas units. If gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Shutting down the unit

1. Set the thermostat to the lowest temperature setting.
2. Turn off all electric power to the unit.
3. Open the gas heat access panel.
4. Turn the gas valve clockwise to the OFF position.

Checking gas heat input

This unit has two stages of gas heat. Input rate should be checked at full input and minimum input. The intended input for each furnace is shown on the unit rating plate.

Note: Dual fuel heat pump has an auto-staging ignition control board (ICB). The stage operation is time based, and the firing sequence is as follows:

1. Upon ignition, the ICB operates both stages for 1 minute (unit warmup).
2. After 1 minute, the ICB will reduce to the first stage heating for 9 minutes.
3. If after 10 minutes (unit warmup + 9 min first stage) the call for heat is present the ICB will bring on the second stage of heating until the call for heat is satisfied.

To determine the rate of gas flow (first stage):

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and wait 1 minute (See step 3) for the thermostat to call for first stage (minimum input) heat.
3. Even when the thermostat is calling for first stage heat, the unit will light on second stage and will run on second stage for 1 minute. Allow this one-minute time period to expire and be certain the unit is running on first stage. Remember, the unit will automatically go to second stage heat after 10 minutes.
4. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
5. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour (See example below).
6. If necessary, adjust the low pressure regulator as discussed in Manifold gas pressure adjustment. Be sure not to under-fire the furnace on first stage. If in doubt, it is better to leave the first stage of the furnace slightly over-fired. Repeat steps 1-6.

To determine the rate of gas flow (second stage):

1. After 10 minutes (see note above) from ignition the furnace will initiate second stage (100% input) heat.
2. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
3. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour. (See example below).
4. If necessary, adjust the high pressure regulator as discussed in Manifold gas pressure adjustment. Be sure not to over-fire the furnace on second stage. If in doubt, it is better to leave the second stage of the furnace slightly under-fired. Repeat steps 1-4.

Table 44: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113

Table 44: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

ⓘ **Note:** To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information as it varies widely from area to area).

EXAMPLE

By actual measurement, it takes 46 seconds for the hand on a 1 cubic foot dial to make a revolution with a 80,000 Btuh furnace running. To determine rotations per minute, divide 60 by 46 = 1.30. To calculate rotations per hour, multiply 1.30 • 60 = 78. Multiply 78 • 1 (0.5 if using a 1/2 cubic foot dial) = 78. Multiply 78 • (the Btu rating of the gas). For this example, assume the gas has a Btu rating of 1050 Btu/ft.^{3}. The result of 81,900 Btuh is within 5% of the 80,000 Btuh rating of the furnace.

Manifold gas pressure adjustment

This gas furnace has two heat stages. Therefore, the gas valve has two adjustment screws located under a plastic protective cover. The second stage adjustment screw is adjacent to the “HI” marking on the valve and the first stage adjustment screw is located adjacent to the “LO” marking on the valve .

Manifold pressure adjustment procedure.

Adjust second stage pressure first, then adjust first stage pressure.

1. Turn off all power to the unit.
2. Using the outlet pressure port on the gas valve, connect a manometer to monitor the manifold pressure.
3. Remove plastic cap covering HI and LO pressure adjustment screws.
4. Turn on power to the unit.
5. Set thermostat to call for second stage heat and start furnace.
6. If necessary, using a screwdriver, turn thesecond stage adjustment screw (adjacent to the “HI” marking on the valve) clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure. **Be sure not to over-fire the unit on second stage**.
7. After the high manifold pressure has been checked, adjust the thermostat to call for first stage heat.
8. If necessary, using a screwdriver, turn the first stage adjustment screw (adjacent to the “LO” marking on the valve) clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure. **Be sure not to under-fire the unit on first stage**.
9. Once pressure has been checked, replace the plastic cap covering the HI and LO pressure adjustment screws.

ⓘ **Note:** Refer to the unit rating plate for the typical manifold pressure settings. Pressure may need to be adjusted to achieve the input rate, depending on local heating value.

Table 45: Gas Heat Stages

# of Burner Tubes	2nd Stage Input(100% Btuh)	1st Stage Input(60% Btuh)
5	120,000	72,000
7	180,000	108,000
8	240,000	144,000

Adjustment of temperature rise

The temperature rise (the difference of temperature between the return air and the heated air from the furnace) must lie within the range shown on the unit rating plate and the data in Table 16.

After the temperature rise has been determined, the CFM can be calculated as follows:

$$\text{CFM} = \text{Btu Input} \cdot \frac{0.8}{(1.08 \cdot \Delta°\text{F})}$$

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about 6 feet from the furnace) where they will not be affected by radiant heat. Increase the blower CFM to decrease the temperature rise; decrease the blower CFM to increase the rise (See Supply air drive adjustment).

ⓘ **Note:** Each gas heat exchanger size has a minimum allowable CFM. Below this CFM, the limit will open.

Charging tables

All WP units use thermal expansion devices. Charge the unit to nameplate charge.

Table 46: WP078 SYS 1 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	128	61	269	81	-27	3.3
	85	127	60	311	91	-28	3.6
	95	126	59	354	100	-29	4.0
300 Cfm/Ton 80.01/67.03	75	128	60	270	81	-27	3.4
	85	131	61	314	91	-26	3.7
	95	135	63	358	101	-24	4.1
300 Cfm/Ton 80/72	75	128	60	271	81	-27	3.4
	85	136	63	317	91	-24	3.7
	95	144	66	363	101	-20	4.1
300 Cfm/Ton 75/62	75	122	58	267	80	-24	3.3
	85	123	58	310	90	-24	3.7
	95	124	58	354	100	-24	4.0
400 Cfm/Ton 80/62	75	133	62	272	81	-25	3.3
	85	134	62	314	91	-25	3.6
	95	136	63	356	100	-25	4.0
400 Cfm/Ton 80.01/67.07	75	135	63	273	81	-24	3.3
	85	138	64	317	91	-23	3.7
	95	141	65	361	101	-22	4.1
400 Cfm/Ton 80/72	75	137	63	274	81	-23	3.4
	85	142	65	320	91	-21	3.7
	95	146	67	366	101	-19	4.1
400 Cfm/Ton 75/62	75	128	60	270	81	-22	3.3
	85	130	60	313	90	-21	3.7
	95	132	61	356	100	-21	4.0

Table 47: WP078 SYS 2 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	127	59	279	80	-27	3.4
	85	126	59	321	90	-28	3.7
	95	124	58	364	99	-29	4.1
300 Cfm/Ton 80.01/67.03	75	126	60	280	80	-27	3.4
	85	130	60	325	90	-26	3.8
	95	133	60	369	100	-24	4.1
300 Cfm/Ton 80/72	75	125	61	280	80	-27	3.4
	85	133	62	328	90	-24	3.8
	95	141	62	375	100	-20	4.2
300 Cfm/Ton 75/62	75	122	57	277	80	-24	3.3
	85	122	57	320	89	-24	3.7
	95	123	58	364	99	-24	4.1
400 Cfm/Ton 80/62	75	132	61	280	80	-25	3.4
	85	133	61	324	90	-25	3.7
	95	134	61	367	99	-25	4.1
400 Cfm/Ton 80.01/67.07	75	133	62	282	80	-24	3.4
	85	136	62	327	90	-23	3.7
	95	139	62	372	100	-22	4.1
400 Cfm/Ton 80/72	75	135	63	283	80	-23	3.3
	85	140	63	330	90	-21	3.8
	95	144	63	376	100	-19	4.2
400 Cfm/Ton 75/62	75	127	59	279	80	-22	3.4
	85	129	59	322	89	-21	3.7
	95	131	59	366	99	-21	4.1

Table 48: WP090 SYS 1 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	126	65	269	83	-27	8.1
	85	124	65	311	93	-28	9.1
	95	122	65	353	102	-30	10.0
300 Cfm/Ton 80.15/67.09	75	127	66	272	83	-27	8.3
	85	130	66	315	93	-26	9.3
	95	133	65	359	103	-25	10.2
300 Cfm/Ton 80/72	75	127	66	274	84	-27	8.5
	85	135	66	320	94	-24	9.4
	95	143	66	365	105	-20	10.4
300 Cfm/Ton 75/62	75	121	61	268	83	-25	8.1
	85	121	62	310	92	-25	9.1
	95	122	63	352	101	-25	10.1
400 Cfm/Ton 80/62	75	130	67	272	84	-25	8.1
	85	131	66	316	94	-25	9.2
	95	133	66	359	104	-25	10.2
400 Cfm/Ton 79.965/66.99	75	133	67	274	84	-24	8.2
	85	136	67	319	94	-23	9.3
	95	139	67	363	104	-22	10.3
400 Cfm/Ton 80/72	75	136	68	276	85	-23	8.3
	85	141	68	322	95	-21	9.3
	95	145	68	367	105	-19	10.3
400 Cfm/Ton 75/62	75	126	64	271	84	-22	8.1
	85	128	64	314	93	-22	9.2
	95	130	64	358	103	-21	10.2

Table 49: WP090 SYS 2 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	129	62	289	83	-27	8.4
	85	127	62	330	92	-28	9.4
	95	125	62	371	101	-30	10.3
300 Cfm/Ton 80.15/67.09	75	131	61	289	84	-27	8.4
	85	133	62	334	93	-26	9.5
	95	135	63	380	102	-25	10.5
300 Cfm/Ton 80/72	75	133	59	289	84	-27	8.5
	85	139	62	338	94	-24	9.6
	95	145	65	388	104	-20	10.7
300 Cfm/Ton 75/62	75	123	59	286	82	-25	8.4
	85	123	59	328	92	-25	9.3
	95	124	60	371	101	-25	10.3
400 Cfm/Ton 80/62	75	135	63	292	85	-25	8.4
	85	135	63	336	94	-25	9.5
	95	136	63	380	103	-25	10.5
400 Cfm/Ton 79.965/66.99	75	137	63	293	84	-24	8.5
	85	139	63	339	94	-23	9.5
	95	142	64	385	104	-22	10.6
400 Cfm/Ton 80/72	75	138	62	294	84	-23	8.5
	85	143	64	342	94	-21	9.6
	95	147	65	390	104	-19	10.7
400 Cfm/Ton 75/62	75	129	60	289	84	-22	8.4
	85	131	61	334	93	-22	9.4
	95	132	61	378	102	-21	10.5

Table 50: WP102 SYS 1 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	131	63	283	81	-26	8.0
	85	130	63	328	91	-26	9.1
	95	129	63	372	100	-27	10.2
300 Cfm/Ton 79.68/67.17	75	132	64	284	81	-25	8.0
	85	135	64	331	91	-24	9.1
	95	137	65	378	101	-23	10.2
300 Cfm/Ton 80/72	75	133	64	284	81	-25	7.9
	85	139	66	333	91	-22	9.1
	95	145	67	383	101	-19	10.2
300 Cfm/Ton 75/62	75	125	61	281	81	-23	8.0
	85	126	61	326	90	-23	9.1
	95	127	61	371	100	-22	10.2
400 Cfm/Ton 80/62	75	136	65	286	82	-23	8.0
	85	137	65	331	91	-23	9.1
	95	139	65	377	101	-23	10.2
400 Cfm/Ton 79.92/67.065	75	138	65	287	82	-22	8.0
	85	140	66	334	92	-21	9.1
	95	143	66	380	101	-21	10.2
400 Cfm/Ton 80/72	75	139	66	288	82	-22	7.9
	85	143	67	336	92	-20	9.1
	95	148	68	384	101	-18	10.2
400 Cfm/Ton 75/62	75	131	62	283	81	-21	7.9
	85	133	63	329	91	-20	9.1
	95	134	63	375	100	-19	10.2

Table 51: WP102 SYS 2 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	133	63	294	90	-26	8.9
	85	132	63	337	99	-26	10.0
	95	130	63	381	108	-27	11.1
300 Cfm/Ton 79.68/67.17	75	133	64	294	90	-25	8.9
	85	135	65	341	99	-24	10.1
	95	138	65	387	109	-23	11.2
300 Cfm/Ton 80/72	75	133	65	294	90	-25	8.9
	85	139	66	344	100	-22	10.1
	95	145	68	393	110	-19	11.3
300 Cfm/Ton 75/62	75	127	61	291	88	-23	8.8
	85	127	61	335	98	-23	10.0
	95	128	61	380	107	-22	11.1
400 Cfm/Ton 80/62	75	138	65	296	91	-23	8.9
	85	139	65	341	100	-23	10.1
	95	139	65	386	110	-23	11.2
400 Cfm/Ton 79.92/67.065	75	139	65	298	91	-22	9.0
	85	141	66	344	101	-21	10.1
	95	143	67	390	110	-21	11.3
400 Cfm/Ton 80/72	75	140	66	300	91	-22	9.0
	85	144	67	347	101	-20	10.2
	95	147	69	394	110	-18	11.3
400 Cfm/Ton 75/62	75	132	62	294	89	-21	8.9
	85	133	63	339	99	-20	10.0
	95	135	63	384	109	-19	11.2

Table 52: WP120 SYS 1 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	129	62	292	82	-25	10.9
	85	128	62	338	91	-26	12.2
	95	127	62	384	100	-27	13.5
300 Cfm/Ton 79.94/67.12	75	129	62	292	82	-25	10.9
	85	131	63	341	91	-24	12.3
	95	134	65	390	101	-23	13.7
300 Cfm/Ton 80/72	75	129	62	292	81	-25	10.9
	85	134	65	344	91	-22	12.4
	95	140	68	395	101	-19	13.9
300 Cfm/Ton 75/62	75	124	59	289	81	-23	10.9
	85	124	60	336	91	-23	12.2
	95	125	60	383	100	-23	13.5
400 Cfm/Ton 80/62	75	134	64	295	82	-23	11.0
	85	135	65	343	92	-23	12.4
	95	136	66	390	101	-23	13.7
400 Cfm/Ton 79.905/67.065	75	134	64	296	82	-22	11.0
	85	137	66	345	92	-21	12.4
	95	139	67	393	101	-20	13.8
400 Cfm/Ton 80/72	75	134	65	297	82	-22	11.0
	85	138	67	346	92	-20	12.4
	95	142	69	396	101	-18	13.9
400 Cfm/Ton 75/62	75	128	61	293	82	-20	11.0
	85	130	62	341	91	-20	12.3
	95	132	64	388	101	-19	13.7

Table 53: WP120 SYS 2 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	129	61	301	87	-25	11.9
	85	129	61	346	97	-26	13.3
	95	128	60	390	107	-27	14.7
300 Cfm/Ton 79.94/67.12	75	129	61	301	87	-25	11.9
	85	132	62	349	97	-24	13.4
	95	136	62	396	108	-23	14.8
300 Cfm/Ton 80/72	75	129	61	301	87	-25	11.8
	85	136	63	352	98	-22	13.4
	95	144	65	402	109	-19	15.0
300 Cfm/Ton 75/62	75	123	59	298	86	-23	11.8
	85	124	58	344	96	-23	13.2
	95	125	58	390	106	-23	14.7
400 Cfm/Ton 80/62	75	135	63	304	88	-23	11.9
	85	136	63	350	98	-23	13.4
	95	137	63	396	108	-23	14.8
400 Cfm/Ton 79.905/67.065	75	135	64	305	88	-22	12.0
	85	138	64	352	98	-21	13.4
	95	141	64	399	108	-20	14.9
400 Cfm/Ton 80/72	75	136	64	305	88	-22	12.0
	85	141	65	354	98	-20	13.5
	95	145	66	402	109	-18	15.0
400 Cfm/Ton 75/62	75	128	60	301	87	-20	11.9
	85	131	61	348	97	-20	13.3
	95	133	61	394	107	-19	14.8

Table 54: WP150 SYS 1 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	124	60	265	85	-25	13.5
	85	124	59	304	95	-26	15.1
	95	123	58	344	104	-27	16.7
300 Cfm/Ton 79.91/66.94	75	123	59	266	85	-25	13.6
	85	127	60	306	95	-24	15.2
	95	130	61	346	104	-23	16.9
300 Cfm/Ton 80/72	75	122	57	266	85	-25	13.7
	85	129	60	308	95	-22	15.4
	95	136	64	349	104	-19	17.0
300 Cfm/Ton 75/62	75	119	57	263	84	-23	13.5
	85	120	57	303	94	-23	15.1
	95	121	56	343	104	-22	16.6
400 Cfm/Ton 80/62	75	127	61	265	85	-24	13.5
	85	129	61	306	95	-23	15.1
	95	130	60	346	105	-23	16.8
400 Cfm/Ton 79.985/66.95	75	128	61	267	85	-23	13.6
	85	131	62	307	95	-22	15.2
	95	134	62	348	105	-21	16.9
400 Cfm/Ton 80/72	75	130	61	268	85	-22	13.6
	85	134	63	309	95	-20	15.3
	95	138	64	349	104	-18	17.0
400 Cfm/Ton 75/62	75	122	59	264	84	-21	13.5
	85	125	58	304	94	-20	15.1
	95	127	58	345	104	-19	16.7

Table 55: WP150 SYS 2 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compr. amps
300 Cfm/Ton 80/62	75	124	61	263	83	-25	13.1
	85	124	59	304	93	-26	14.7
	95	124	57	344	102	-27	16.2
300 Cfm/Ton 79.91/66.94	75	123	60	265	83	-25	13.1
	85	126	61	306	93	-24	14.7
	95	130	61	347	102	-23	16.3
300 Cfm/Ton 80/72	75	122	59	268	83	-25	13.2
	85	129	62	308	93	-22	14.8
	95	135	65	349	102	-19	16.4
300 Cfm/Ton 75/62	75	119	58	262	82	-23	13.1
	85	120	57	303	92	-23	14.7
	95	121	55	343	102	-22	16.2
400 Cfm/Ton 80/62	75	127	62	264	83	-24	13.1
	85	129	61	305	93	-23	14.7
	95	130	61	347	102	-23	16.3
400 Cfm/Ton 79.985/66.95	75	128	62	266	83	-23	13.1
	85	131	63	308	93	-22	14.8
	95	134	64	349	102	-21	16.4
400 Cfm/Ton 80/72	75	129	63	269	83	-22	13.1
	85	133	64	310	92	-20	14.8
	95	138	66	351	102	-18	16.5
400 Cfm/Ton 75/62	75	122	59	263	82	-21	13.1
	85	125	59	304	92	-20	14.7
	95	127	59	346	102	-19	16.3

Smart Equipment control board navigation components

You need the following components to access the control points in the Smart Equipment control.

Note: Installation and operation guides are available from your equipment dealer or distributor.

1. A local LCD on the unit control board.
2. Tools to interact with the UCB.
   Choose from the following two options:
   a. • GoTemp Pro app (available for iOS or Android)

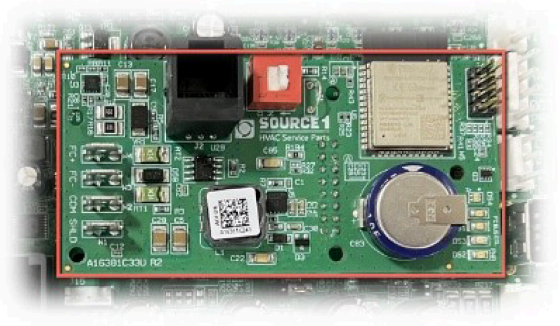
Note: You can connect the GoTemp Pro app to the controller via Bluetooth through the Connected Workflow Converter (CWCVT) or directly to the UCB if the controller has a communication card.

- *CWCVT Wireless MS/TP Converter User Guide*, literature part no. 12014120

Figure 36: CWCVT (S1-TL-CWCVT-0)



Figure 37: Communication card



b. Mobile Access Portal (MAP) Gateway (portable)
   - Source 1 part no. S1-YK-MAP1810-0P (no longer available for purchase - We strongly recommend that the GoTemp Pro app be used for all R-454B units for best user experience.)

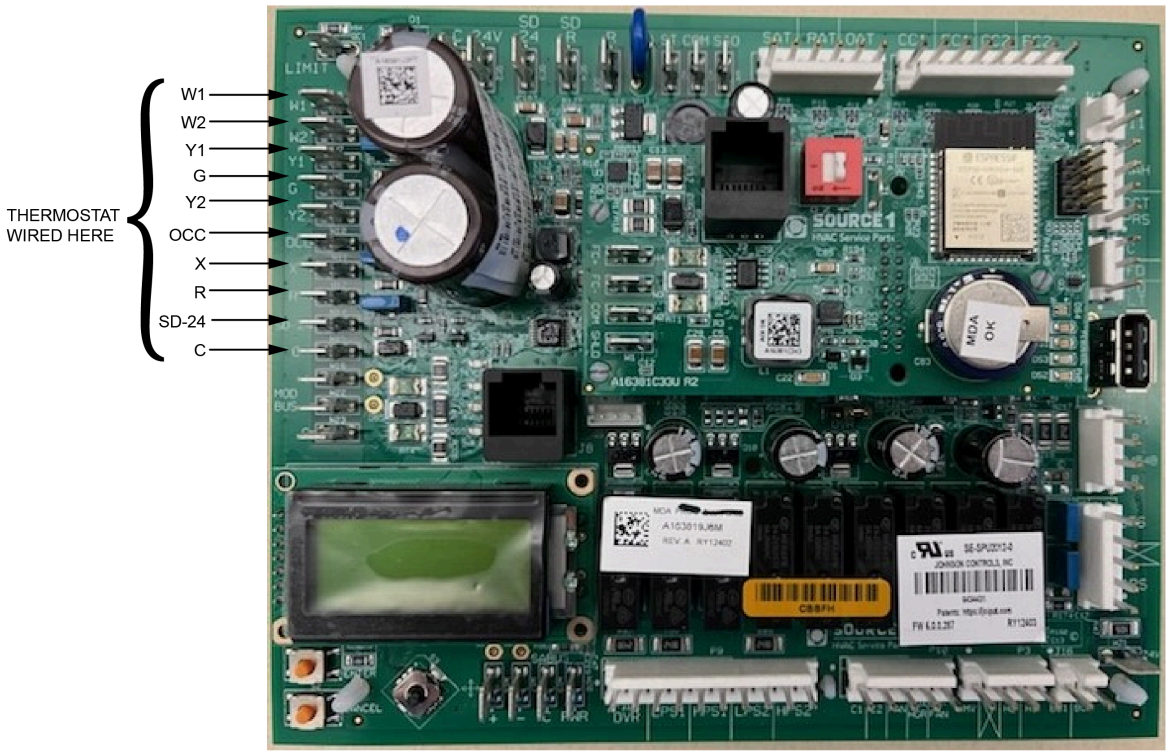
     Note: Although the MAP is no longer available for purchase, it continues to work with the UCB. The MAP does not receive firmware updates, so as additional points are added to the UCB those points will not render properly. However, the MAP will continue to work for the majority of typical applications.
   - *MAP Gateway Quick Start Guide*, part no. 24-10737-16
   - *MAP Gateway Instruction*, part no. 24-10737-8

For more information on the Smart Equipment unit control board navigation, refer to the *Smart Equipment Quick Start Guide*.

Note: For more in-depth sequence of operation of the Smart Equipment control, refer to the *Smart Equipment Controls Sequence of Operation Overview*, literature part no. 12011950.

Smart Equipment unit control board

Figure 38: Unit control board



A0209-B

Table 56: Smart Equipment UCB Details (Version 5 Hardware)

Description		Function and comments
Terminal directional orientation: viewed with silkscreen labels upright		
Limit, 24 VAC power and shutdown connections from unit wiring harness at left on upper edge of UCB		
Limit	Monitored 24 VAC input through heat section limit switches	If the voltage is absent, indicating the heat section is over-temperature, the UCB brings on the indoor blower
C	24 VAC, 75 VA transformer common referenced to cabinet ground	Connects through circuit traces to thermostat connection strip C and indoor blower VFD pin C
24V	24 VAC, 75 VA transformer hot	Powers the UCB microprocessor, connects through circuit trace to the SD 24 terminal
SD 24	24 VAC hot out for factory accessory smoke detector, condensate overflow and/or user shutdown relay switching in series	Connects through circuit trace to thermostat connection strip SD-24. A wiring harness jumper plug connecting SD 24 to SD R is in place if factory accessories for unit shutdown are not used - this jumper plug must be removed if the switching of field-added external accessories for unit shutdown are wired between thermostat connection strip SD-24 and R
SD R	24 VAC hot return from factory accessory smoke detector and user shutdown relay switching in series	Connects through circuit trace to the R terminal on the upper left of the board
R	24 VAC hot for switched inputs to the UCB	Connects through circuit trace to the thermostat connection strip R terminal, right FAN OVR pin, right HPS1 pin, right HPS2 pin, lower DFS pin and lower APS pin
Terminal thermostat connection strip on left edge of UCB		
W1	1st stage heating request, 24 VAC input switched from R	Not effective for cooling-only units

Table 56: Smart Equipment UCB Details (Version 5 Hardware)

Description		Function and comments
W2	2nd stage heating request, 24 VAC input switched from R	Not effective for cooling-only units or units with single-stage heat sections
Y1	1st stage cooling request, 24 VAC input switched from R	
Y2	2nd stage cooling request, 24 VAC input switched from R	Visible in the display menu when the #ClgStgs parameter is set for 2 or more, also effective for economizer free cooling supply air temperature reset when the #ClgStgs parameter is set for 1 or more
G	Continuous indoor blower request, 24 VAC input switched from R	
OCC	Occupancy request, 24 VAC input switched from R	Must have the OccMode parameter set for external to be effective
X	Hard lockout indicator, 24 volt output to a light thermostat LED	24V positive half-wave rectified
R	24 VAC hot for thermostat switching and power	If field-added external accessories for unit shutdown are used, 24 VAC hot return from smoke detector, condensate overflow and/or user shutdown relay switching in series
SD-24	If field-added external accessories for unit shutdown are used, 24 VAC hot out for smoke detector, condensate over- flow and/ or user shutdown relay switching in series	Unit wiring harness jumper plug for factory shutdown accessories must be removed if the switching of field-added external accessories for unit shutdown are wired between thermo- stat connection strip SD-24 and R
C	24 VAC common for thermostat power	
+	Modbus Terminal +	N/A - Future
-	Modbus Terminal -	N/A - Future
C	Modbus Terminal C	N/A - Future
LEDs on left edge of UCB		
Power	Green UCB power indicator	Lit indicates 24 VAC is present at C and 24V terminals
Fault	Red hard lockout, networking error and firmware error indicator	1/2 second on/off flashing indicates one or more alarm is currently active, 1/10th second on/off flashing indicates a networking error (polarity, addressing, etc.) or a firmware error (likely correctable with re-loading from USB flash drive)
SA BUS	Green UCB SA bus communication transmission indicator	Lit/flickering indicates UCB SA bus communication is currently active, off indicates the UCB is awaiting SA bus communication
Terminal space temperature sensor connections at center on upper edge of UCB		
ST	Space Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Positive of VDC circuit (3.625 VDC reading to COM with open circuit), effective if “Thermo- stat-only Control” parameter is set OFF, space sensor override momentary shorts ST to COM to initiate/terminate temporary occupancy
COM	Common for ST and SSO inputs	Negative of VDC circuit for ST and SSO inputs
SSO	Space Sensor Offset input from 0 to 20KΩ potentiometer	Positive of VDC circuit (3.625 VDC reading to COM with open circuit), 10KΩ/2.5 VDC is 0°F offset, 0Ω/0 VDC is maximum above offset and 20KΩ/3.4 VDC is maximum below offset from active space temperature setpoint
Pin Temperature sensor connections at right on upper edge of UCB		
SAT+	Supply Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation; 3.625 VDC reading SAT + to SAT– with open circuit. Used in heat/cool staging cutouts, free cooling operation, demand ventilation operation, comfort ventilation operation, economizer loading operation, VAV cooling operation, hydronic heat operation.

Table 56: Smart Equipment UCB Details (Version 5 Hardware)

Description		Function and comments
RAT+	Return Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation; 3.625 VDC reading RAT+ to RAT– with open circuit. Used in return air enthalpy calculation. Substitutes for space temperature if no other space temperature input is present.
OAT+	Outside Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation but may be a communicated value; 3.625 VDC reading OAT+ to OAT– with open circuit. Used in heat/cool cutouts, low ambient cooling determination, dry bulb free cooling changeover, outside air enthalpy calculation, economizer loading operation, heat pump demand defrost calculation.
CC1+	#1 refrigerant circuit Condenser Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for heat pump units, not required for A/C units; 3.625 VDC reading CC1+ to CC1– with open circuit. Used in heat pump demand defrost calculation.
EC1+	#1 refrigerant circuit Evaporator Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation; 3.625 VDC reading EC1+ to EC1– with open circuit. Used in suction line temperature safety.
CC2+	#2 refrigerant circuit Condenser Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for 2-compressor heat pump units, not required for 2-compressor A/C units, not active for 1-compressor units; 3.625 VDC reading CC2+ to CC2– with open circuit. Used in heat pump demand defrost calculation.
EC2+	#2 refrigerant circuit Evaporator Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation of 2-compressor units, not active for 1-compressor units; 3.625 VDC reading EC2+ to EC2– with open circuit. Used in suction line temperature safety.
Pinned connections on right edge of UCB		
AI1	Analog Input 1	Future - 0-10VDC input
RAH+	Return Air Humidity input from 0-10 VDC @ 0-100% RH sensor	Input required for reheat units, optional in all other units, may be a communicated value. Used in return air enthalpy calculation, temperature/humidity setpoint reset, reheat operation.
DCT PRS+	Supply Duct Pressure input from 0-5 VDC @ 0-5 in. w.c. sensor	Input required for variable air volume units. Used in VAV indoor blower operation.
C	Common for the VFD output	Negative of the VDC circuit for the VFD output
VFD	2-10 VDC (0-100%) output for the indoor blower Variable Frequency Drive	Output is active with indoor blower operation. For CV units: this output provides stepped IntelliSpeed control of the indoor blower VFD based on fan-only, cooling stage and heating stage outputs. For VAV units: this output provides control of the indoor blower VFD based on supply duct static pressure input and setpoint.
VFD FLT	24 VAC hot input from the normally open VFD alarm contact	The VFD alarm contact switches from R within the unit wiring harness. 24 VAC input results in unit shutdown and a “VFD fault” alarm
J10	Type A female Universal Serial Bus connector	Used for backup, restoration, & copying of board parameters as well as board software updating through a flash drive
COS	24 VAC hot return from Condensate Overflow Switch	Optional input; switch opening will disable the control outputs to the unit compressors. Upon closure, the compressors will begun unit operation after off delay expires
R	24 VAC hot out for COS	Connects through circuit trace to the R terminal
RDS	24 VAC hot return from Refrigerant Detection System	Required input for RDS; when flammable refrigerant is used and RDS is required, the unit will monitor this input and enter mitigation mode if unit RDS contact opens

Table 56: Smart Equipment UCB Details (Version 5 Hardware)

Description		Function and comments
R	24 VAC hot out for RDS	Connects through circuit trace to the R terminal
DFS (upper pin)	24 VAC hot return from Dirty Filter Switch	Optional input; switch closure for greater than 15 seconds during indoor blower operation initiates a notification alarm
DFS (lower pin)	24 VAC hot out for Dirty Filter Switch	Connects through circuit trace to the R terminal
APS (upper pin)	24 VAC hot return from Air Proving Switch	When this optional input is enabled: the air proving switch must close within 30 seconds of initiation of indoor blower operation and not open for greater than 10 seconds during in- door blower operation to allow heat/cool operation and prevent an “APS open” alarm; the air proving switch must open within 30 seconds of termination of indoor blower operation to prevent an “APS stuck closed” notification alarm
APS (lower pin)	24 VAC hot out for Air Proving Switch	Connects through circuit trace to the R terminal
Terminal at lower right corner of UCB		
24V	24 VAC hot for H1, H2, CN-FAN, AUX HGR, FAN C1 and C2 output relay contact switching	Output relay circuitry is isolated from other UCB components and the 24 VAC hot source may be from a second transformer in the unit
Pin Heat section connections at right on lower edge of UCB		
BO2	Binary output 2	Future
BO1	Binary output 2	Future
H1	24 VAC hot output for heat section stage 1	Not effective for cooling-only units. Output if demand is present and permissions allow one stage or two stages of heat section operation
H2	24 VAC hot output for heat section stage 2	Not effective for cooling-only units or units with single-stage heat sections. Output if demand is present and permissions allow two stages of heat section operation
MV	24 VAC hot input confirming heat section operation	Sourced from gas valve in gas heat units or first stage heat contactor in electric heat units. Input within 5 minutes from initiation of H1 output initiates the “Heat On Fan Delay” timer, loss of input following the termination of H1 output initiates the “Heat On Fan Delay” timer, no input within 5 minutes from initiation of H1 output initiates an “Ignition Failure” alarm, input for longer than 5 minutes without H1 output initiates a “Gas Valve Mis-wire” alarm
Pin cooling and fan output connections at right on lower edge of UCB		
CN-FAN	24 VAC hot output for the condenser fan contactor coil	Output with either C1 or C2 output; interrupted during defrost cycle for heat pump units
AUX HGR	24 VAC hot output for hot gas reheat components	Effective only for reheat units, output with reheat operation
FAN	24 VAC hot output for indoor blower contactor coil/indoor blower VFD enable relay coil	Output with heat/cool operation, G input or schedule demand
C1	24 VAC hot output for compressor 1	If demand is present and permissions allow compressor 1 operation; output with compressor cooling, comfort ventilation cooling, reheat or heat pump heating demands
C2	24 VAC hot output for compressor 2	Not effective for one stage compressor UCBs. If demand is present and permissions allow compressor 2 operation; output with compressor cooling, comfort ventilation cooling or heat pump heating demands
Pin refrigerant circuit safety switch and indoor blower overload connections at center on lower edge of UCB		
HPS1(right pin)	24 VAC hot out for refrigerant circuit 1 High Pressure Switch	Connects through circuit trace to the R terminal

Table 56: Smart Equipment UCB Details (Version 5 Hardware)

Description		Function and comments
HPS1(left pin)	24 VAC hot return from refrigerant circuit 1 High Pressure Switch	Input is only considered if C1 output is needed; input must be present to allow C1 output. Three HPS1 trips in a two hour period cause a "High Pressure Switch 1 Lockout" and C1 output is then prevented until alarm reset. Connects through circuit trace to the right LPS1 pin.
LPS1(right pin)	24 VAC hot out for refrigerant circuit 1 Low Pressure Switch	Connects through circuit trace to the left HSP1 pin
LPS1(left pin)	24 VAC hot return from refrigerant circuit 1 Low Pressure Switch	Input is only considered after 30 seconds of C1 output; afterwards, input must be present to allow C1 output. Three LPS1 trips in a one hour period cause a "Low Pressure Switch 1 Lockout" and C1 output is then prevented until alarm reset.
HPS2(right pin)	24 VAC hot out for refrigerant circuit 2 High Pressure Switch	Not effective for one stage compressor UCBs. Connects through circuit trace to the R terminal
HPS2(left pin)	24 VAC hot return from refrigerant circuit 2 High Pressure Switch	Not effective for one stage compressor UCBs. Input is only considered if C2 output is needed; input must be present to allow C1 output. Three HPS2 trips in a two hour period cause a High Pressure Switch 1 Lockout and C2 output is then prevented until alarm reset. Connects through circuit trace to the right LPS2 pin.
LPS2(right pin)	24 VAC hot out for refrigerant circuit 2 Low Pressure Switch	Not effective for one stage compressor UCBs. Connects through circuit trace to the left HSP2 pin
LPS2(left pin)	24 VAC hot return from refrigerant circuit 2 Low Pressure Switch	Not effective for one stage compressor UCBs. Input is only considered after 30 seconds of C2 output; afterwards, input must be present to allow C2 output. Three LPS2 trips in a one hour period cause a Low Pressure Switch 2 Lockout and C2 output is then prevented until alarm reset.
FAN OVR(right pin)	24 VAC hot out for indoor blower FAN Overload relay contact/motor protector switch	Connects through circuit trace to the R terminal
FAN OVR(left pin)	24 VAC hot return from indoor blower FAN Overload relay contact/motor protector switch	Input is only considered if FAN output is needed; input must be present to allow FAN output and unit operation. One FAN OVR trip lasting longer than 5 minutes or three FAN OVR trips in a two hour period cause a "Fan Overload Lockout" and unit operation is then prevented until alarm reset.
Terminal SA BUS[1] connections on at left on lower edge and center of UCB		
PWR	Power for SA (Sensor-Actuator) BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the 15 VDC (reading to C) circuit for powering an optional netstat and/or Multi Touch gateway
C	Common for SA BUS power and communication circuits	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Negative of the SA BUS circuits
–	Communication for SA BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts lower than +) SA BUS communication circuit to optional economizer board, 4-stage board, fault detection & diagnostics board, netstat and/or Multi Touch gateway
+	Communication for SA BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts higher than –) SA BUS communication circuit to optional economizer board, 4-stage board, fault detection & diagnostics board, netstat and/or Multi Touch gateway

Table 56: Smart Equipment UCB Details (Version 5 Hardware)

Description		Function and comments
J8	6-pin phone jack connector	Incorporates the SA BUS terminals for convenience/ alternate connection of SA BUS devices, primarily used for temporary service connection of the Multi Touch gateway
Item Integrated user interface at lower left corner of UCB		
Display	On-board, 2-line x 8-character back-lit display	On-board display, buttons and joystick allow access to UCB, economizer, 4-stage and FDD board parameters
ENTER	Button for display menu acknowledgment and navigation	
CANCEL	Button for display menu navigation and zeroing of active compressor ASCD timer	
JOY	4-way joystick for display menu navigation	
Item USB connector at right of UCB		
J15	Factory wired SA Bus connector	
Optional communication sub-board at center of UCB		
Terminal FC BUS[1] connections on left edge of the communication board		
FC+	FC (“Field Connected”) BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts higher than –) FC bus BACnet MSTP communication circuit
FC–	FC (“Field Connected”) BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts lower than +) FC bus BACnet MSTP communication circuit
COM	Common for the FC (“Field Connected”) BUS BACnet MSTP communication circuit	Negative of the VDC FC bus BACnet MSTP communication circuit
SHLD	Shield for the FC (“Field Connected”) BUS BACnet MSTP communication circuit	Earth ground reference of the cable to prevent interference on the FC bus BACnet MSTP communication circuit
Item Selector in red housing at left on top edge of the communication board		
EOLswitch	End Of Line selector switch for the FC BUS BACnet MSTP communication circuit	ON selected only for the UCB that is the terminus of the FC bus BACnet MSTP communication cable to prevent signal bounce-back
RJ12	Connection to the TMR	Connection used for the wireless Transparent MS/TP Repeater (TMR)
LEDs on the communication board		
Bluetooth (DS4)	Bluetooth signal	Solid OFF means bluetooth disabled. Flashing means the bluetooth is available for a connection. Solid ON means a connection has been made
N/A (DS5)	N/A - No function defined	
FC BUS (DS1)	Green FC bus communication transmission indicator	Lit/flickering indicates outgoing UCB FC bus communication is currently active, off indicates the UCB is awaiting incoming FC bus communication
EOL (DS2)	Green end of line indicator	Lit indicates the EOL switch is selected ON
ISO PWR (DS3)	Green communication board Isolated Power indicator	Lit indicates the UCB is supplying power to the communication sub-board

ⓘ **Note:**

1. When wiring unit and other devices using the SA Bus and FC Bus, see Table 57 .

Table 57: Cable for FC buses and SA buses in order of preference

Bus and Cable Type	Non-plenum applications		Plenum applications	
	Part Number	O.D.	Part Number	O.D.
FC Bus: 22 AWG Stranded, 3-Wire Twisted Shielded Cable[1]	Anixter: CBL-22/3-FC-PVC Belden®: B5501FE	0.138 in.	Anixter: CBL-22/3-FC-PLN Belden: B6501FE	0.140 in.
SA Bus (Terminal Block): 22 AWG Stranded, 4-Wire, 2 Twisted-Pair Shielded Cable	Anixter: CBL-22/2P-SA-PVC Belden: B5541FE	0.209 in.	Anixter: CBL-22/2P-SA-PLN Belden: B6541FE	0.206 in.
SA Bus (Modular Jack): 26 AWG Solid 6-Wire, 3 Twisted-Pair Cable[2]	—	—	Anixter preassembled: CBL-NETWORK25 CBL-NETWORK50 CBL-NETWORK75 CBL-NETWORK100	0.15 in.
FC Bus: 22 AWG Stranded, 3-Wire Twisted Non-Shielded Cable	Belden: B5501UE	0.135 in.	Belden: B6501UE	0.131 in.
SA Bus (Terminal Block): 22 AWG Stranded, 4-Wire, 2 Twisted-Pair Non-Shielded Cable	Belden: B5541UE	0.206 in.	Belden: B6541UE	0.199 in.

Note:

1. We strongly recommend 3-wire (for FC bus) and 4-wire, 2 twisted-pair (for SA bus), 22 AWG stranded, shielded cable. A 22 gauge cable offers the best performance for various baud rates, cable distances, and number of trunk devices primarily due to lower conductor-to-conductor capacitance. Shielded cable offers better overall electrical noise immunity than non-shielded cable. Observe the shield grounding requirements.
2. We recommend 26 AWG solid, 6-wire (3 twisted pairs) cable as the best fit for fabricating modular cables with the modular jack housing assembly. Be sure the cable you use fits the modular jack housing. The preassembled cables that are available from Anixter (Part No. CBL-NETWORKxxx) use 24 gauge wire.

Table 58: Ignition control flash codes

Flashes	Fault conditions	Check
Steady on	Control failure	Control
Heartbeat	Normal operation	
1	Not applicable	
2	Pressure switch stuck closed	Pressure switch
3	Pressure switch failed to close	Venter pressure switch vent blocked
4	Limit switch open	Main limit aux limit
5	Flame present with gas off first stage gas valve energized with w1 off second stage gas valve energized with first stage gas valve off	Gas valve
6	Ignition lockout	Gas flow gas pressure gas valve flame sensor
7	Lockout, limit switch open too long	Indoor blower, main limit, aux limit
8	Line frequency fault	Supply power frequency
9	No power or control failure	24vac or control

Start-up & Service Data Instruction

Commercial Package Units

3.0 To 50.0 tons

Start-up Checklist

Date: _____

Job Name: _____

Customer Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Model Number: _____ Serial Number: _____

Qualified Start-up Technician: _____ Signature: _____

HVAC Contractor: _____ Phone: _____

Address: _____

Contractor's E-mail Address: _____

Electrical Contractor: _____ Phone: _____

Distributor Name: _____ Phone: _____

Warranty Statement

BHC Residential & Light Commercial LLC is confident that this equipment will operate to the owner's satisfaction if the proper procedures are followed and checks are made at initial start-up. This confidence is supported by the 30 day dealer protection coverage portion of our standard warranty policy which states that BHC Residential & Light Commercial LLC will cover parts and labor on new equipment start-up failures that are caused by a defect in factory workmanship or material, for a period of 30 days from installation. Refer to the current standard warranty policy and warranty manual for details.

In the event that communication with BHC Residential & Light Commercial LLC is required regarding technical and/or warranty concerns, all parties to the discussion should have a copy of the equipment start-up sheet for reference. A copy of the original start-up sheet should be filed with the Technical Services Department.

The packaged unit is available in constant or variable air volume versions with a large variety of custom options and accessories available. Therefore, some variation in the startup procedure will exist depending upon the products capacity, control system, options and accessories installed.

This start-up sheet covers all startup check points common to all package equipment. In addition it covers essential startup check points for a number of common installation options. Depending upon the particular unit being started not all sections of this startup sheet will apply. Complete those sections applicable and use the notes section to record any additional information pertinent to your particular installation.

Warranty claims are to be made through the distributor from whom the equipment was purchased.

Equipment Startup

Use the local LCD or GoTemp Pro mobile application to complete the start-up.

A copy of the completed start-up sheet should be kept on file by the distributor providing the equipment and a copy sent to:

BHC Residential & Light Commercial LLC
Technical Services Department
5005 York Drive
Norman, OK 73069

1034349-UCL-L-0426

Safety Warnings

The inspections and recording of data outlined in this procedure are required for start-up of BHC Residential & Light Commercial LLC' packaged products. Industry recognized safety standards and practices must be observed at all times. General industry knowledge and experience are required to assure technician safety. It is the responsibility of the technician to assess all potential dangers and take all steps warranted to perform the work in a safe manner. By addressing those potential dangers, prior to beginning any work, the technician can perform the work in a safe manner with minimal risk of injury.

⚠WARNING

Lethal voltages are present during some start-up checks. Extreme caution must be used at all times.

⚠WARNING

Moving parts may be exposed during some startup checks. Extreme caution must be used at all times.

NOTE: Read and review this entire document before beginning any of the startup procedures.

Design Application Information

This information will be available from the specifying engineer who selected the equipment. If the system is a VAV system the CFM will be the airflow when the remote VAV boxes are in the full open position and the frequency drive is operating at 60 HZ. **Do not proceed with the equipment start-up without the design CFM information.**

Design Supply Air CFM: _____ Design Return Air CFM:_____

Design Outdoor Air CFM At Minimum Position: _____

Total External Static Pressure: _____

Supply Static Pressure: _____

Return Static Pressure: _____

Design Building Static Pressure: _____

Outside Air Dilution: Economizer Position Percentage: _____ CFM: _____

Supply Gas Pressure After Regulator W/o Heat Active _____ Inches_____

ADDITIONAL APPLICATION NOTES FROM SPECIFYING ENGINEER:

Reference

General Inspection	Completed	See Notes
Unit inspected for shipping, storage, or rigging damage	☐	☐
Unit installed with proper clearances	☐	☐
Unit installed within slope limitations	☐	☐
Refrigeration system checked for gross leaks (presence of oil)	☐	☐
Terminal screws and wiring connections checked for tightness	☐	☐
Filters installed correctly and clean	☐	☐
Economizer hoods installed in operating position	☐	☐
Condensate drain trapped properly, refer to Installation Manual	☐	☐
Economizer damper linkage tight	☐	☐
Gas Heat vent hood installed	☐	☐
All field wiring (power and control) complete	☐	☐

Air Moving Inspection	Completed	See Notes
Alignment of drive components	☐	☐
Belt tension adjusted properly	☐	☐
Blower pulleys tight on shaft, bearing set screws tight, wheel tight to shaft	☐	☐
Pressure switch or transducer tubing installed properly	☐	☐

Exhaust Inspection Powered ☐ Barometric Relief ☐	Completed	See Notes
Check hub for tightness	☐	☐
Check fan blade for clearance	☐	☐
Check for proper rotation	☐	☐
Check for proper mounting (screen faces towards unit)	☐	☐
Prove operation by increasing minimum setting on economizer	☐	☐

Economizer Inspection Standard ☐ BAS ☐	Completed	See Notes
CO_2 sensor installed Yes ☐ No ☐	☐	☐
Check economizer setting (Reference Smart Equipment Control Board LCD menu location)	☐	☐
Prove economizer open/close through Smart Equipment Board Setting	☐	☐

Reheat Mode Normal ☐ or Alternate ☐ Not Applicable ☐
Humidity Sensor (2SH0401) _____

Operating Measurements - Air Flow

Fan operates with proper rotation (All VFD equipped units with the optional Manual Bypass must be phased for correct blower rotation with the Bypass switch set in the LINE position) ID Fans ☐ Exh. Fans ☐ Cond. Fans ☐	
Pressure drop across dry evaporator coil (At maximum design CFM) [1]	IWC
External Static Pressure	IWC
Return Static Pressure	IWC
Supply Static Pressure	IWC
Supply Air CFM Using Dry Coil Chart	CFM
Final Adjusted Supply Air CFM[2]	CFM

1. Consult the proper airflow to pressure drop table to obtain the actual airflow at the measured pressure differential.
2. Was a motor pulley adjustment or change required to obtain the correct airflow?
   Was it necessary to increase of decrease the airflow to meet the design conditions?
   If the motor pulley size was changed, measure the outside diameters of the motor and blower pulleys and record those diameters here;

Blower Motor HP _____ FLA_____ RPM_____

Pulley Pitch Diameter _____Turns Out_____ Final Turns Out_____

Blower Pulley Pitch Diameter _____ Fixed Sheave_____

Electrical Data

T1 - T2 _____ Volts T2 - T3 _____ Volts

Control Voltage _____ Volts T1 - T3 _____ Volts

Device	Nameplate	Measured List All Three Amperages
Supply Fan Motor[1, 2]	AMPS	AMPS
Exhaust Motor (Dampers 100%)	AMPS	AMPS
Condenser Fan #1	AMPS	AMPS
Condenser Fan #2 (if equipped)	AMPS	AMPS
Condenser Fan #3 (if equipped)	AMPS	AMPS
Condenser Fan #4 (if equipped)	AMPS	AMPS
Compressor #1	AMPS	AMPS
Compressor #2 (if equipped)	AMPS	AMPS
Compressor #3 (if equipped)	AMPS	AMPS
Compressor #4 (if equipped)	AMPS	AMPS

1. VAV units with heat section - simulate heat call to drive VAV boxes and VFD/IGV to maximum design airflow position.
2. VAV units without heat section - VAV boxes must be set to maximum design airflow position.

Refrigerant Safeties

Action	Completed	See Notes
Prove Compressor Rotation (3 phase only) by gauge pressure	☐	☐
Prove High Pressure Safety, All Systems	☐	☐
Prove Low Pressure Safety, All Systems	☐	☐

Refrigerant Detection System (RDS) Safety Test

Action	Completed	See Notes
Does the System have a Refrigerant Detection System (RDS) installed for R-454B?	☐	☐
Does Control Board Show any RDS alarms?	☐	☐
Are all available RDS Sensors pulsing with a green light?	☐	☐
Caution do not continue until any RDS alarms are resolved		
Prove Refrigerant Detection System Alarm Mitigation (Heating Units) – Shuts Down Active Heat Call[1]	☐	☐
Prove Refrigerant Detection System Alarm Mitigation (Cooling Mode) – Shuts Down Active Cooling Call[1]	☐	☐

1. Complete the above steps by pulling the J1 harness off the UCB during an active call for heat/cooling

Operating Measurements - Cooling

Stage	Discharge Pressure	Discharge Temp.	Liquid Line Temp.[1]	Subcooling[2]	Suction Pressure	Suction Temp.	Superheat
First	#	°	°	°	#	°	°
Second (if equipped)	#	°	°	°	#	°	°
Third (if equipped)	#	°	°	°	#	°	°
Fourth (if equipped)	#	°	°	°	#	°	°
Reheat 1st Stage	#	°	°	°	#	°	°

1. Liquid temperature should be taken before filter/drier.
2. Subtract 10 psi from discharge pressure for estimated liquid line pressure

Outside air temperature	_____	°F db	_____	°F wb	_____ %RH
Return Air Temperature	_____	°F db	_____	°F wb	_____ %RH
Mixed Air Temperature	_____	°F db	_____	°F wb	_____ %RH
Supply Air Temperature	_____	°F db	_____	°F wb	_____ %RH

Operating Measurements - Gas Heating

Fuel Type: ☐ Natural Gas ☐ LP Gas

Action		Completed	See Notes
Check for gas leaks		☐	☐
Prove Ventor Motor Operation		☐	☐
Prove Primary Safety Operation		☐	☐
Prove Auxiliary Safety Operation		☐	☐
Prove Rollout Switch Operation		☐	☐
Prove Smoke Detector Operation		☐	☐
Manifold Pressure	Stage 1	IWC	☐
	Stage 2 (If Equipped)	IWC	☐
	Stage 3 (If Equipped)	IWC	☐
Supply gas pressure at full fire		IWC	☐
Check temperature rise[1]	☐ measured at full fire	°F	☐

1. Input X Eff. (BTU output)
   1.08 X Temp. Rise

Operating Measurements Electric Heating

Heater kW _____kW Heater Voltage, Nameplate _____ Volts

Heater Model Number: _____

Serial Number: _____

Heater	Nameplate	Measured List All Three Amperages		
Stage 1	_____AMPS	_____AMPS	_____AMPS	_____AMPS
Stage 2	_____AMPS	_____AMPS	_____AMPS	_____AMPS
Stage 3	_____AMPS	_____AMPS	_____AMPS	_____AMPS
Stage 4	_____AMPS	_____AMPS	_____AMPS	_____AMPS
Checked Heater Limit			Yes ☐	No ☐
Air Moving Switch Installed?			Yes ☐	No ☐

Operating Measurements - Staging Controls

Verify Proper Operation of Heating/Cooling Staging Controls	
Create a cooling demand at the Thermostat, BAS System or Smart Equipment Verify that cooling/economizer stages are energized.	☐
Create a heating demand at the Thermostat, BAS System or Smart Equipment Verify that heating stages are energized.	☐
Verify Proper Operation of the Variable Frequency Drive (If Required)	
Verify that motor speed modulates with duct pressure change.	☐

Final - Inspection

Verify that all operational control set points have been set to desired value Scroll through all setpoints and change as may be necessary to suit the occupant requirements.	☐
Verify that all option parameters are correct Scroll through all option parameters and ensure that all installed options are enabled in the software and all others are disabled in the software. (Factory software settings should match the installed options)	☐
Verify that all access panels have been closed and secured	☐
Save a backup file from the unit control board onto a USB flash drive.	☐

Observed Product Deficiencies & Concerns:

Subject to change without notice. Printed in U.S.A.
Copyright © 2026 by BHC Residential & Light Commercial LLC. All rights reserved.

1034349-UCL-L-0426
Supersedes: 1034349-UCL-K-0126

BHC Residential & Light Commercial LLC
5005 York Drive
Norman, OK 73069