Installation Manual: Johnson Controls Choice WD13 to WD25 Heat Pump

R-454B



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

www.johnsoncontrols.com

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General

Certifications

The units are tested in accordance with the following:

- UL 60335-1,CAN/ CSA-C22.2 No. 60335-1
- UL60335-2-40, CSA –C22.2 No.60335-2-40
- CSA/ANSI Z21.47:21/CSA 2.3:21
- AHRI Standard 340/360

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

This unit is not intended for use by persons, including children, with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure they do not play with the unit. Cleaning and maintenance shall not be performed by children without supervision.

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.

WARNING

Do not use any other means to clean or accelerate the defrosting process, use only what is recommended by the manufacturer. Store the appliance in a room without continuously operating ignition sources. For example, open flames, an operating gas appliance, or an operating electric heater.
Do not pierce or burn.
Be aware that refrigerants may not have an odor.

WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death, or property damage.
Improper servicing could result in dangerous operation, serious injury, death, or property damage.
*Before servicing, disconnect all electrical power to the furnace.
*When servicing controls, label all wires prior to disconnecting. Reconnect the wires correctly.
*Verify proper operation after servicing.

CAUTION

R-454B is a mildly flammable refrigerant. Unit installation must comply with UL/CSA 60335-2-40, the installation and operations manuals available on Solution Navigator, the DS Solutions app, and documentation shipped with the unit.

WARNING

Risk of fire

This unit has over 4 lb of mildly flammable A2L refrigerant, which may require the installation of an RDS (Refrigerant Detection System) for specific applications. To determine if a specific application needs a field-installed RDS, use the RDS calculator on Solution Navigator or the DS Solutions App.

CAUTION

This system uses R-454B refrigerant, which is a mildly flammable refrigerant. Do not use any other refrigerant in this system. Gage sets, hoses, refrigerant containers, and recovery systems, must be designed to handle R-454B. If you are unsure, consult the equipment manufacturer. Failure to use R-454B compatible servicing equipment may result in property damage or injury.

WARNING

FIRE OR EXPLOSION HAZARD

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.
Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
WHAT TO DO IF YOU SMELL GAS:
- Do not try to light any appliance.
- Do not touch any electrical switch.
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

Installation and service must be performed by a qualified installer or service agency.

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

Observe all the precautions in the literature, labels, and tags that accompany the equipment whenever you work on air conditioning equipment. Follow all other applicable safety precautions and codes including ANSI Z223.1 or CSA-B149.1-latest edition.

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

ⓘ **Note:** This unit is classified as an appliance not accessible to the general public and should be installed only in locations not accessible to the general public. Locate appliances in a secured location with restricted access, at a level that is not less than 2.5 m, or in secured areas such as rooftops or machine rooms.

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 -
- General installation -
- Smart Equipment Control Quick Start Guide 1136326
- A2L Refrigerant Installation Manual - 6651753

Renewal parts

Contact your local ducted systems parts distribution center for authorized replacement parts.

Approvals

The unit is certified by UL as follows:

- For use as a cooling only unit, cooling unit with supplemental electric heat, forced air furnace and heat pump.
- For outdoor installation only.
- For installation on combustible material and may be installed directly on combustible flooring or, in the United States, 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.

⚠ CAUTION

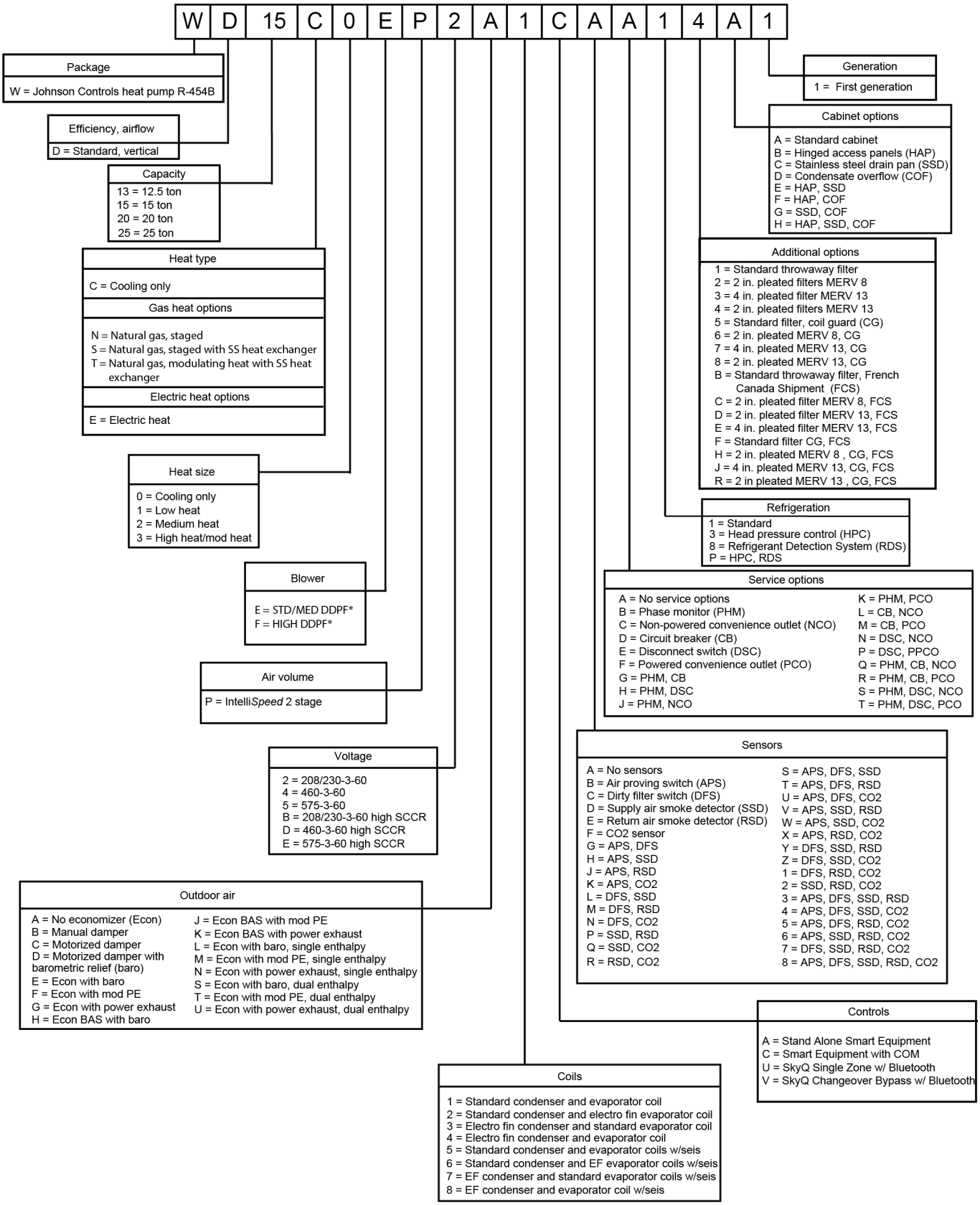
This system uses R-454B refrigerant, which is a mildly flammable refrigerant. Do not use any other refrigerant in this system.

⚠ WARNING

For installation only in locations not accessible to the general public. Definition: appliaces which are located either in a secured location with restricted access (e.g. machine rooms, rooftops and the like) are at a level not less than 8.2 ft (2.5 m) or in secured rooftop areas.

Nomenclature

Figure 1: Product 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 assure that these instructions are made available to the consumer. The installer must instruct the consumer to retain the instructions for future reference.

- Refer to the unit rating plate for the approved type of gas for this product.
- Install this unit only in a location and position as specified in the location section.
- Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when you check all connections.
- Always install the furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range. This information is specified on the unit name/rating plate. See **Adjustment of temperature rise**.
- This equipment is not to be used for the temporary heating of buildings or structures under construction.
- Provide adequate combustion and ventilation air to the furnace space as specified in the clearances section.

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.

Limitations

You must install these units in accordance with national wiring regulations and the following standards.

Requirements in the United States

- *National Electrical Code, ANSI/NFPA No. 70* (latest edition)
- *National Fuel Gas Code, ANSI Z223.1* (latest edition)
- *Gas-Fired Central Furnace Standard, ANSI Z21.47a.* (latest edition)
- Local building codes
- Local gas utility requirements

Requirements in Canada

- *Canadian Electrical Code, CSA C22.1*
- *Installation Codes, CSA - B149.1*
- Local plumbing and wastewater codes
- Other applicable local codes

See the application data found in this document and refer to the *A2L Refrigerant Installation Manual*.

After the installation is complete, you must adjust gas fired units to obtain a temperature rise in the range specified on the unit rating plate.

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

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

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

NOTICE

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, call the applications department for Ducted Systems at 1-877-874-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30°F.

Unit components

Figure 2: Components location

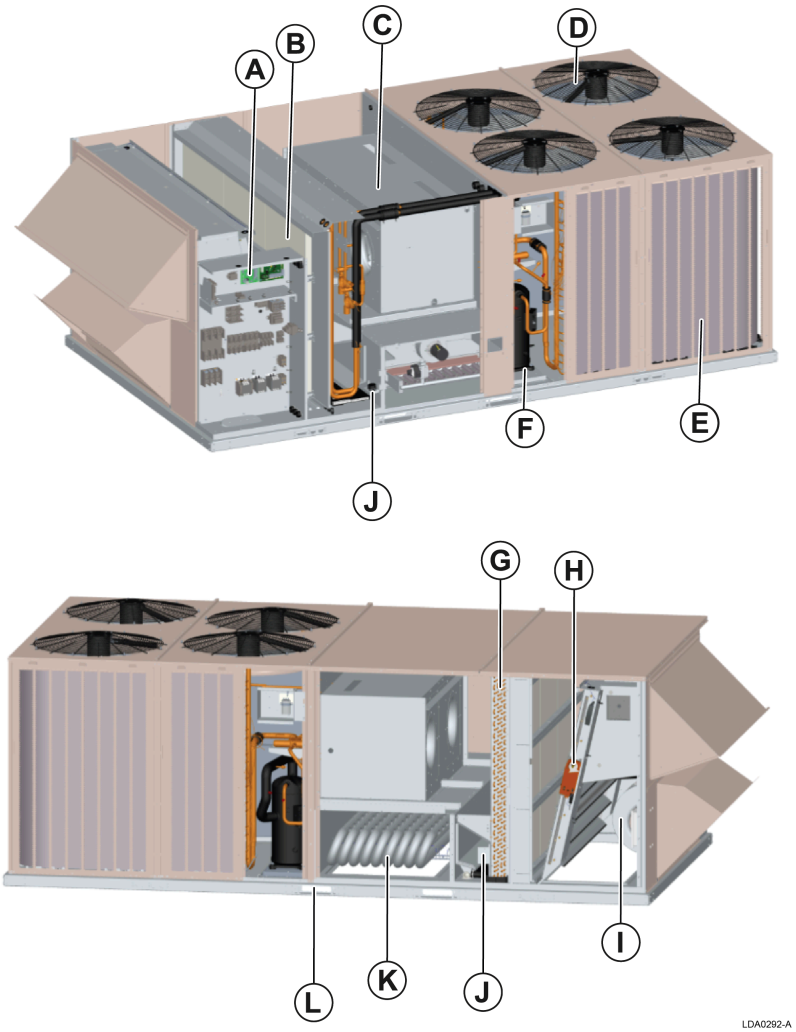


Table 1: Component location table

Item	Description	Item	Description
A	Smart Equipment controls	G	Copper tube and aluminum fin evaporator coil
B	Filter access, 2 in. or 4 in. filter options	H	Optional economizer. Optional manual or motorized outside air dampers not shown.
C	Direct drive plenum fan, with electronically commutated motor for Intellispeed	I	Optional powered exhaust. Optional barometric relief not shown.
D	Condenser fans	J	Refrigerant leak detection sensor
E	Round tube plate fin (RTPF) condenser coils	K	Optional staged or modulating gas heat with aluminized or stainless steel heat exchanger. Optional electric heat not shown.
F	Scroll compressors to produce two stages of cooling or heating depending on the selected model	L	Full perimeter base rails with holes for overhead rigging

Unit limitations

Table 2: WD13 to WD25 unit limitations

Unit voltage (V)	Applied voltage (V)		Outdoor DB temperature	Outdoor DB temperature for mechanical heating
	Minimum	Maximum	Maximum (°F)	Minimum (°F)
208/230-3-60	180	254	125	-5
460-3-60	416	508	125	-5
575-3-60	520	635	125	-5

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 the east side of the building.
- Suitable for mounting on a 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 on an 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. The installer must make provisions for adequate combustion and ventilation air in accordance with section 5.3 of *Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1* (latest edition in the U.S.A), or sections 7.2, 7.3, or 7.4 of *Gas Installation Codes, CSA-B149.1* (latest edition in Canada), and/or applicable provisions of the local building codes. See the *unit clearances table* for the clearances required for combustible construction, servicing, and proper unit operation

Detailed unit clearances are available in the Weights and dimensions section.

WARNING

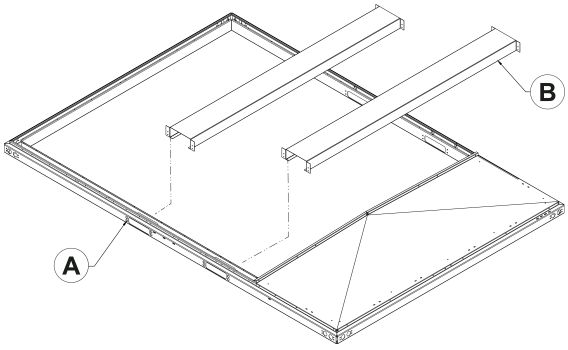
Do not permit overhanging structures or shrubs to obstruct the condenser air discharge outlet, combustion air discharge outlet, combustion air inlet, or vent outlets.

Removing the forklift tunnels

Note: Before placing a unit on a roof curb, you must remove the protective fork lift tunnels from the underside of the unit.

1. To remove the protective forklift tunnels, locate the fork pockets visible on the exterior of the unit base rail shown in Figure 3.

Figure 3: Protective forklift tunnels



Item	Description
A	Example screw location
B	Fork tunnel

2. Remove the 16 screws securing the fork tunnels to the unit base rail and remove the fork tunnels from the bottom of the unit as the unit is lifted.

   Note: You can discard the fork tunnels and screws after they are removed.

Rigging and handling

Adhere to the following guidelines when rigging and handling the unit.

- 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, make sure that the unit weight is distributed equally on the rigging cables so that it lifts evenly.

Units may be moved or lifted with a forklift from the side only.
The length of the forks must be a minimum of 52 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.

Weights and dimensions

Figure 4: WD13 physical dimensions

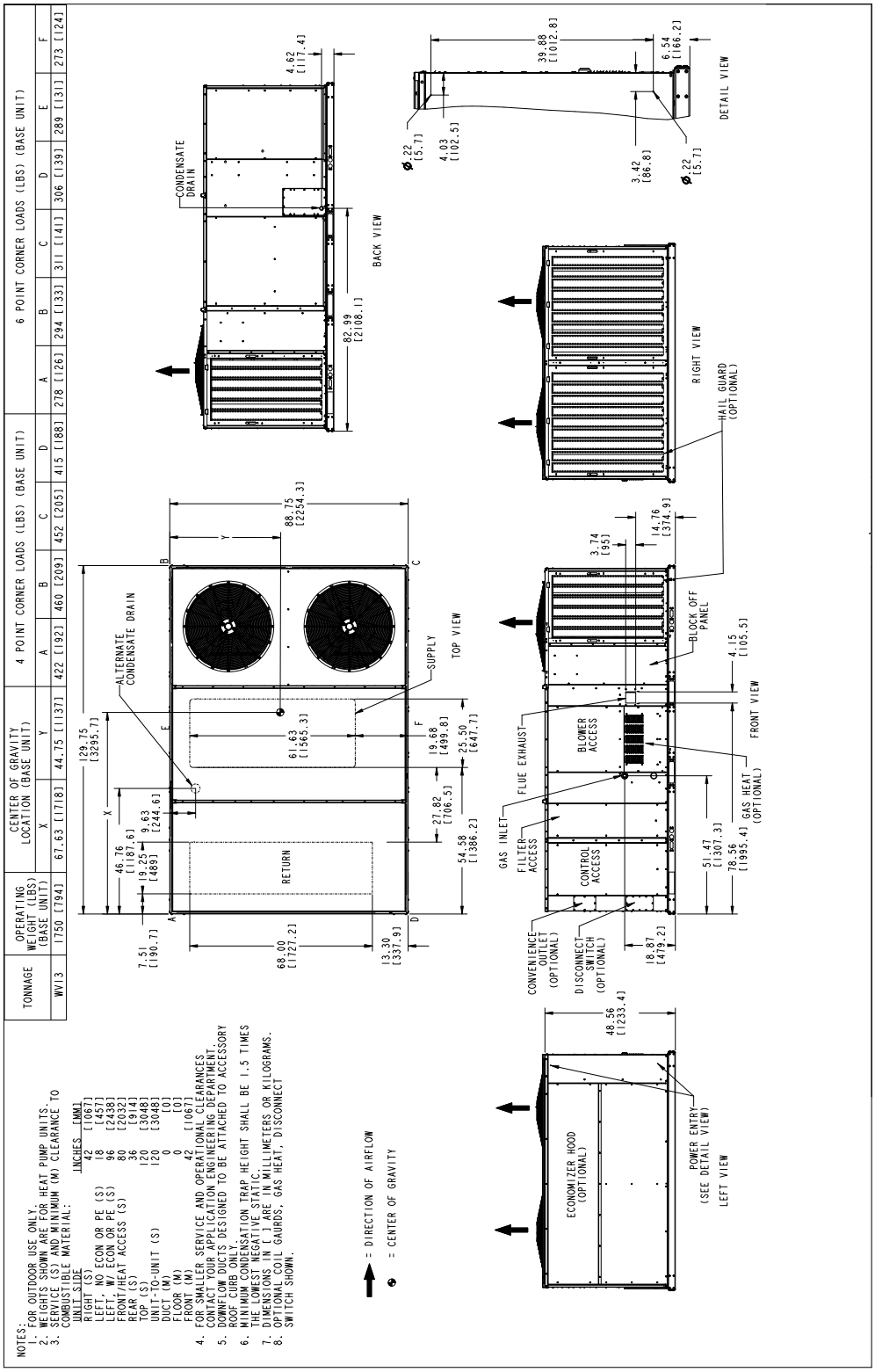


Figure 5: WD15 physical dimensions

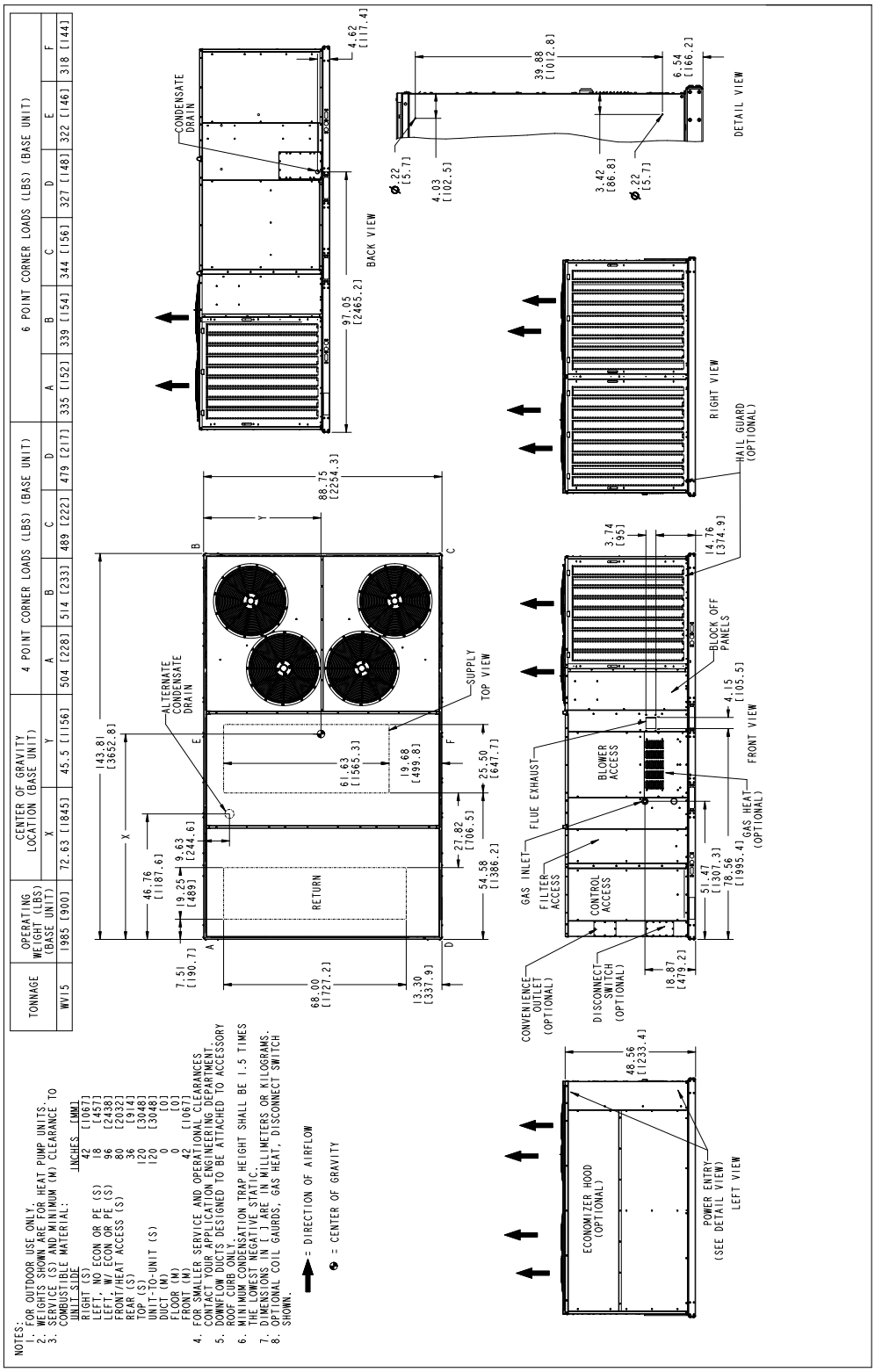


Figure 6: WD20 physical dimensions

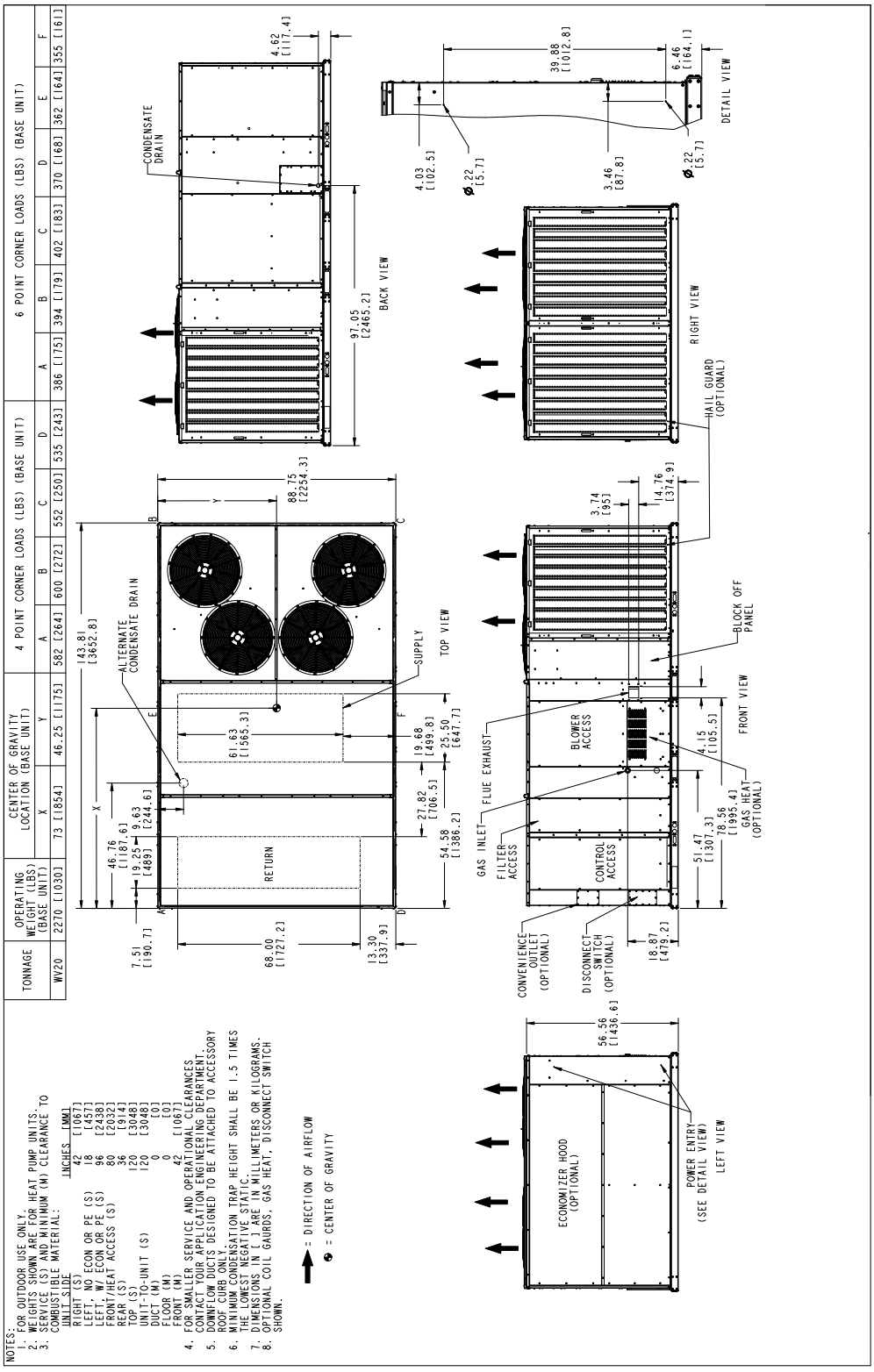
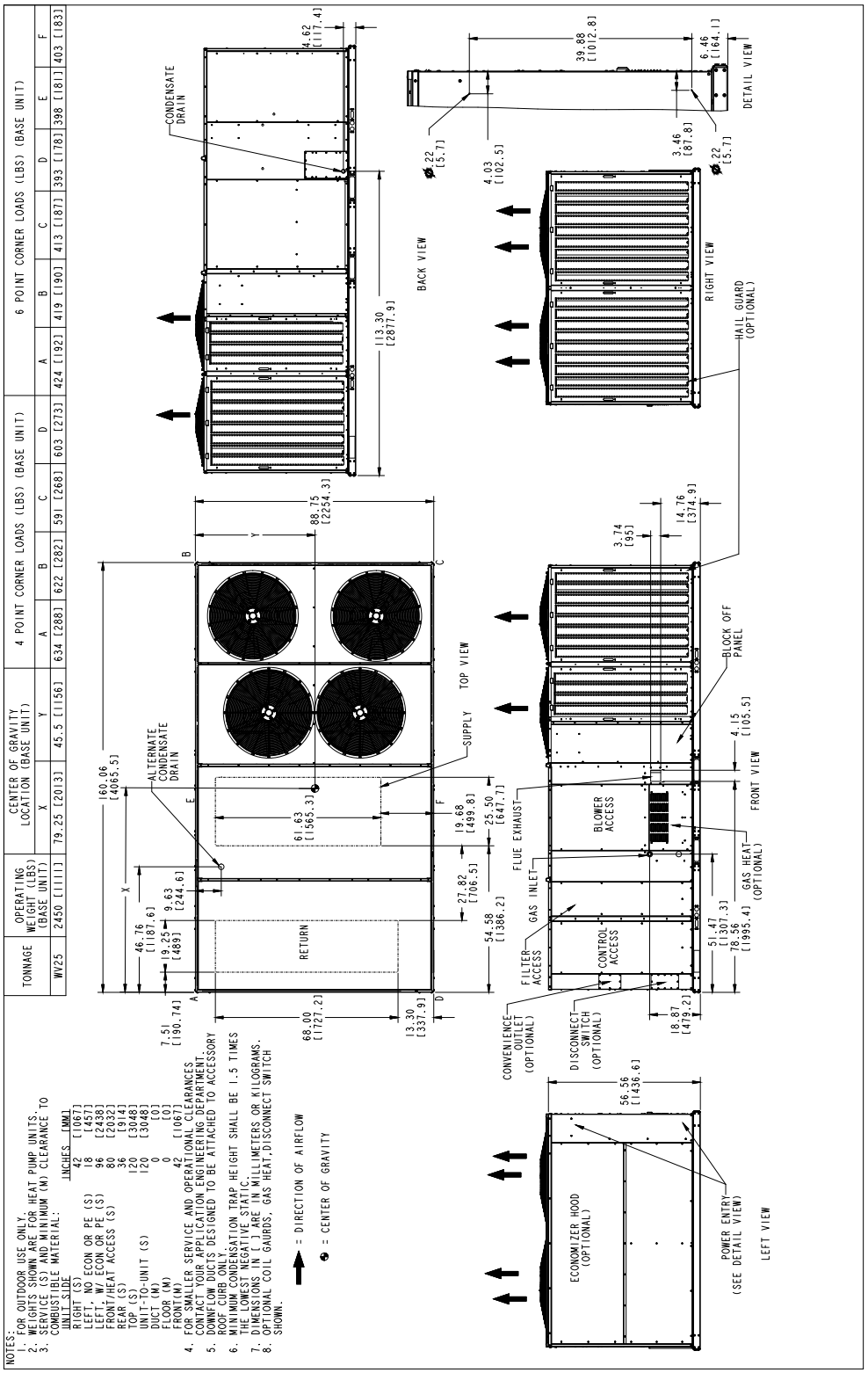
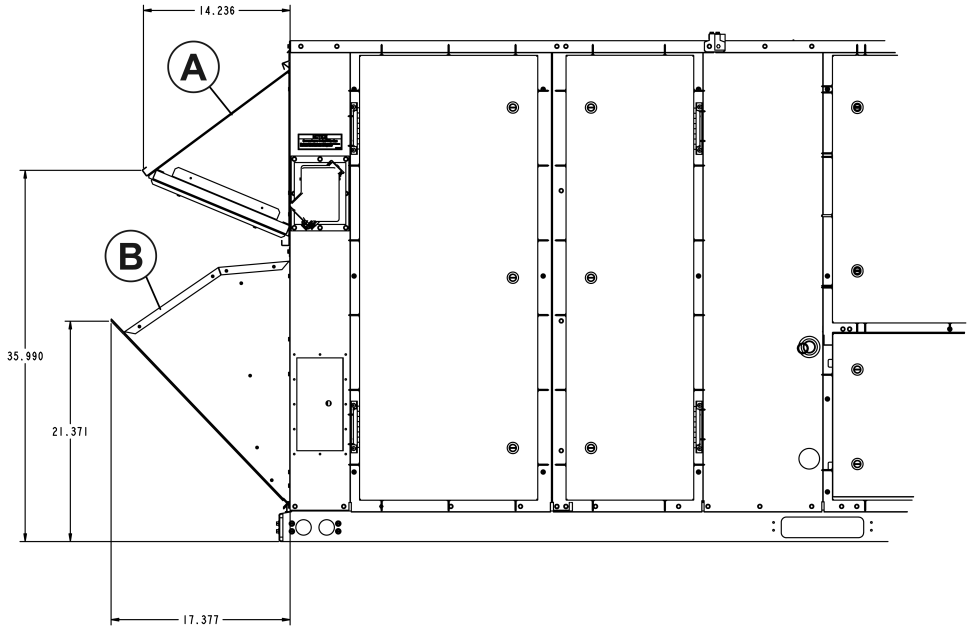


Figure 7: WD25 physical dimensions



Rain hood dimensions

Figure 8: Rain hood dimensions



Item	Description
A	Economizer, manual damper, and motorized damper rain hood
B	Power exhaust rain hood

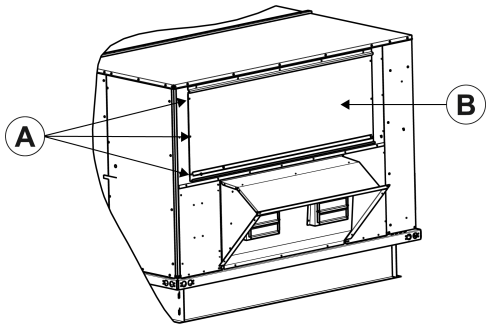
Outdoor air hood assembly

After a unit with an economizer, manual damper, or motorized damper is installed in the field, the outside air hood will need to be assembled.

To install the outdoor air hood, complete the following steps.

1. While transporting the unit, the hood top panel is used as a shipping cover attached to the unit exterior as shown in Figure 9.

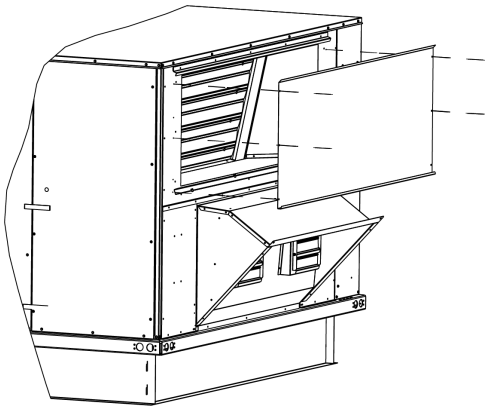
Figure 9: Hood top panel



Callout	Description
A	Corner Screws
B	Hood Top Panel

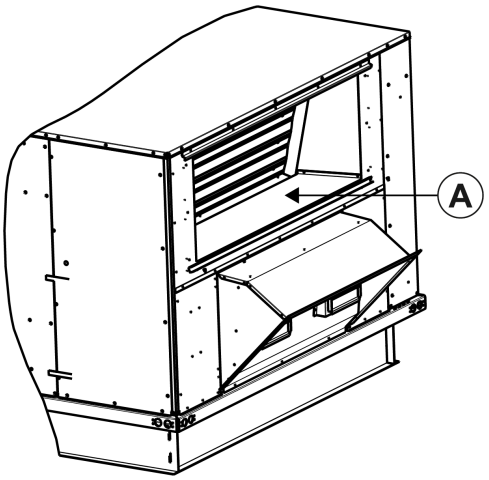
2. Remove the corner screws and the hood top panel as shown in Figure 9 and Figure 10. Keep both the screws and the top panel for use in a later step.

Figure 10: Removing the corner screws



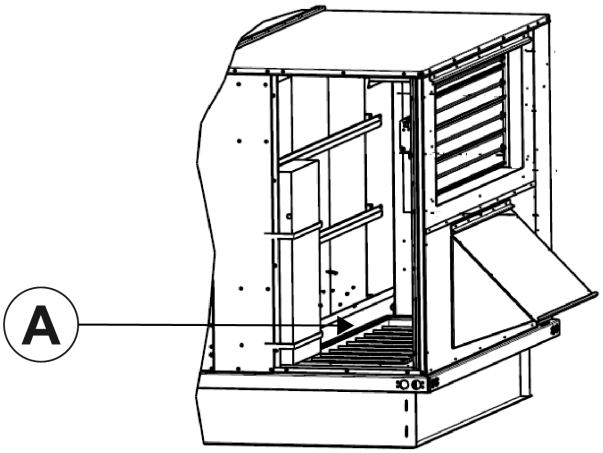
3. For units with an economizer, the additional outside air hood assembly parts are shipped behind the top panel removed in the previous step. This location is shown in Figure 11. For units with a manual or motorized damper, the additional outside air hood assembly parts are shipped in the return air section of the unit as shown in Figure 12.

Figure 11: Economizer hood assembly parts



Callout	Description
A	Economizer hood assembly parts shipping location

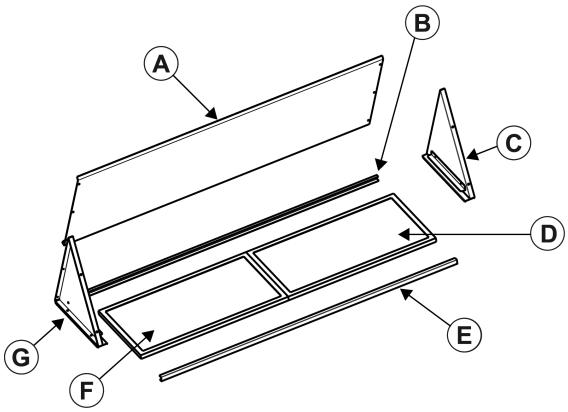
Figure 12: Manual or motorized damper hood assembly parts



Callout	Description
A	Manual or motorized damper hood assembly parts shipping location

4. Before beginning assembly, check that you have all of the factory provided parts for the economizer outside air hood as shown in Figure 13.

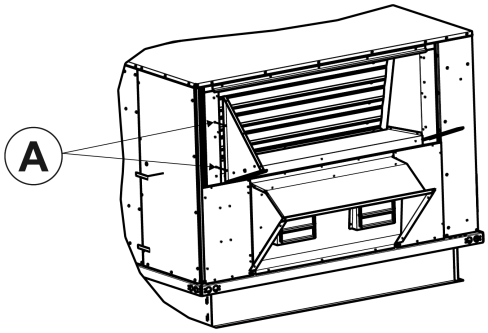
Figure 13: Economizer outside air hood parts



Callout	Description
A	Hood Top Panel
B	Filter Channel 1
C	Right side panel sub-assembly
D	Filter 1
E	Filter Channel 2
F	Filter 2
G	Left side panel sub-assembly

5. Using two no. 10 screws from the hardware bag, fasten the left side panel sub-assembly on the unit as shown in Figure 14. Note that the flange should be oriented at the bottom of the side panel and facing the center of the unit.

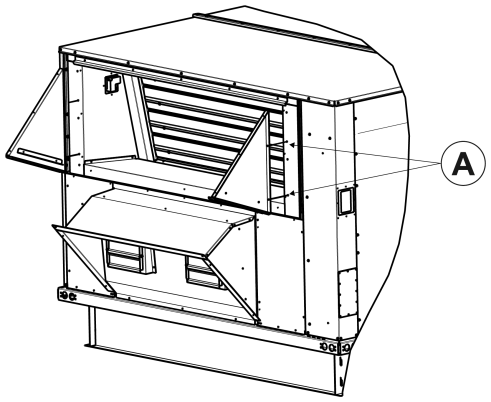
Figure 14: Fastening the left side panel



Callout	Description
A	Screws

6. Using two no. 10 screws from the hardware bag, fasten the right side panel sub-assembly on the unit as shown in Figure 15. Note that the flange should be oriented at the bottom of the side panel and facing the center of the unit.

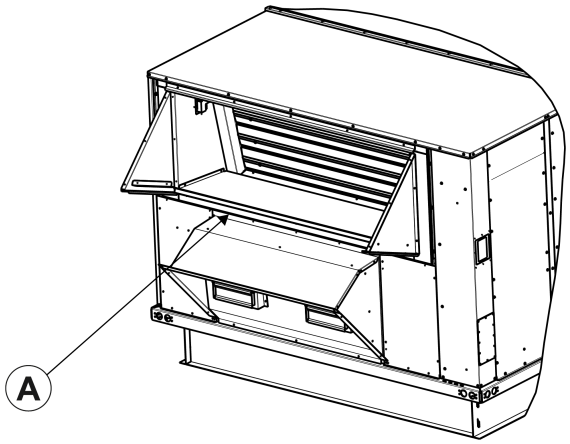
Figure 15: Right side panel



Callout	Description
A	Screws

7. Prior to inserting the filter channel, ensure the open end of the channel is pointing away from the unit. The filters will be inserted into this opening. Insert filter channel 1 as shown in Figure 16. This should rest on top of the flange of both of the side panels installed in the previous step.

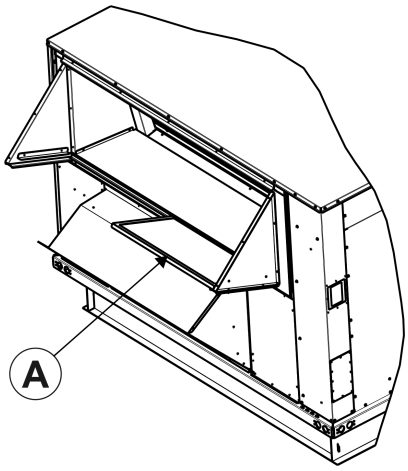
Figure 16: Filter channel 1



Callout	Description
A	Filter Channel 1

8. Insert the first filter into the filter channel to rest with one edge inside of the filter channel and the other on top of the flange of the side panel. See Figure 17.

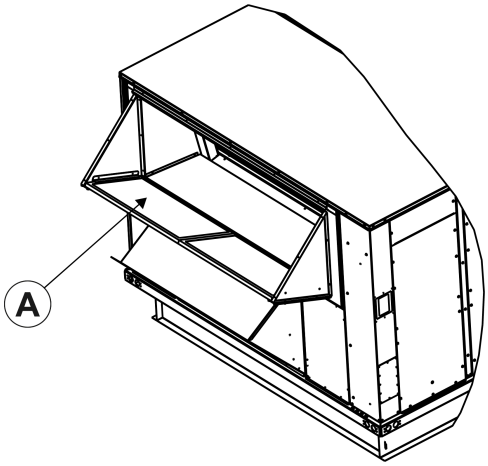
Figure 17: Filter



Callout	Description
A	Filter

9. Insert the second filter into the filter channel in the same way the first filter was inserted in Step 8, and as shown in Figure 18.

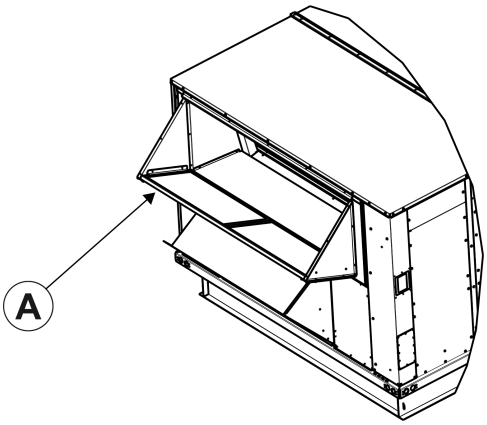
Figure 18: Filter



Callout	Description
A	Filter

10. Insert filter channel 2 with the open end of the channel facing toward the unit and going over the end of the filters. See Figure 19.

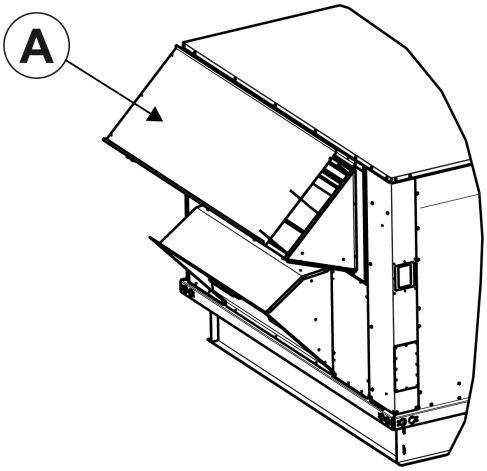
Figure 19: Inserting filter channel 2



Callout	Description
A	Filter Channel 2

11. Taking the hood top panel removed in Step 2, hook the angled flange under the top bracket and then set on top of the side panels.. Using the screws removed earlier, attach the top panel to the side panels as shown in Figure 20.

Figure 20: Hood top panel



Callout	Description
A	Hood Top Panel

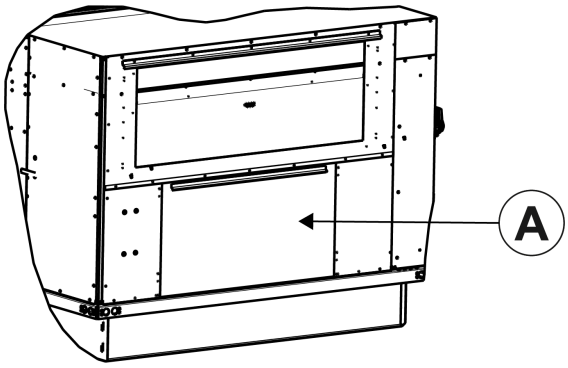
Assembling the barometric relief hood

After a unit with barometric relief is installed in the field, assemble the barometric relief hood.

To install the barometric relief hood, complete the following steps.

1. While transporting the unit, the hood top panel is used as a shipping cover attached to the unit exterior as shown in Figure 21.

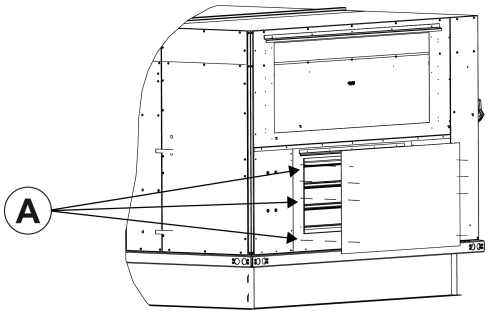
Figure 21: Hood top panel



Callout	Description
A	Hood top panel

2. Remove the corner screws and the hood top panel as shown in Figure 22. Keep both the screws and the top panel for use in a later step.

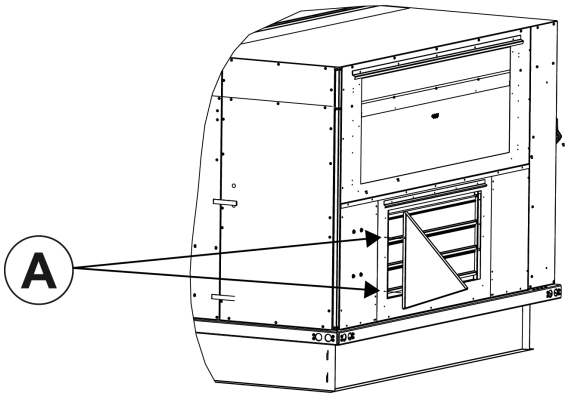
Figure 22: Removing the corner screws



Callout	Description
A	Corner screws

3. Unscrew the two triangular hood sides from inside the barometric relief assembly.
4. Using two of the No. 10 screws removed in step 3, fasten the left side panel sub-assembly on the unit as shown in Figure 23.

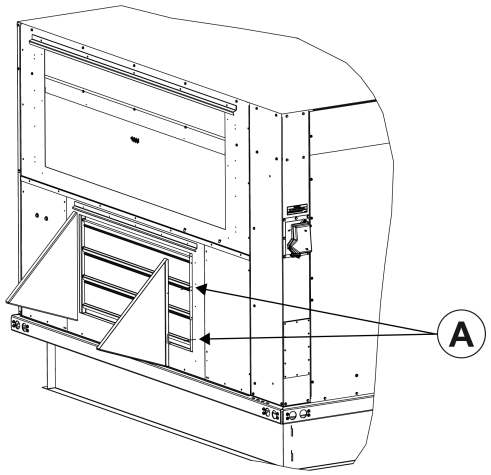
Figure 23: Fastening the left side panel sub-assembly



Callout	Description
A	Screws

5. Using two of the No. 10 screws removed in step 3, fasten the right side panel sub-assembly on the unit as shown in Figure 24.

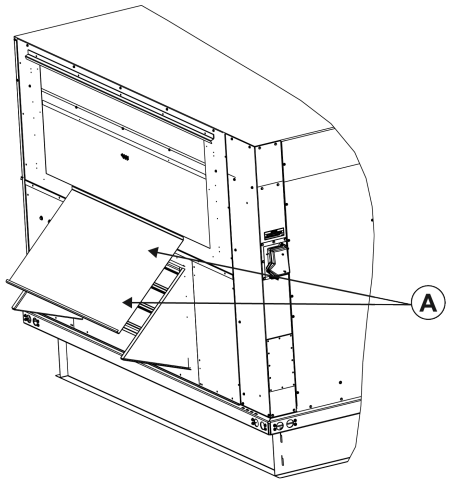
Figure 24: Fastening the right side panel sub-assembly



Callout	Description
A	Screws

6. Taking the hood top panel removed in Step 2, hook the angled flange under the top bracket and then set on top of the side panels. Using the screws removed earlier, attach the top panel to the side panels as shown in Figure 25.

Figure 25: Attaching the top panel



Callout	Description
A	Screws

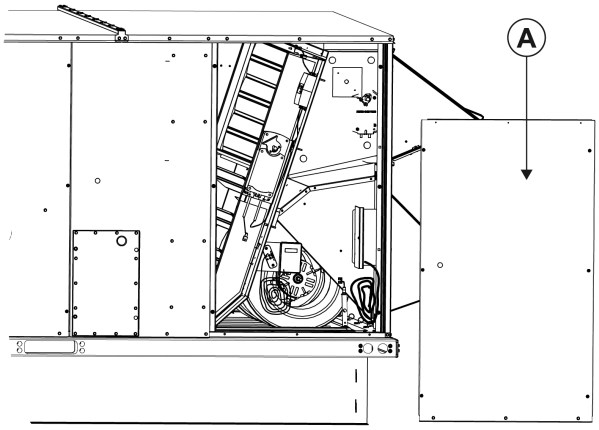
Power exhaust fold out instructions

After the unit is installed in the field the, power exhaust assembly requires field setup for operation.

To setup the power exhaust assembly, complete the following steps.

1. Remove the return air access panel shown in Figure 26.

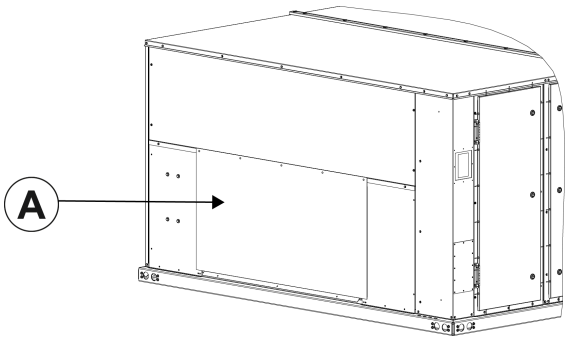
Figure 26: Removing the access panel



Item	Description
A	Return air access panel

2. Locate the power exhaust transit cover on the fresh air side of the unit as shown in Figure 27.

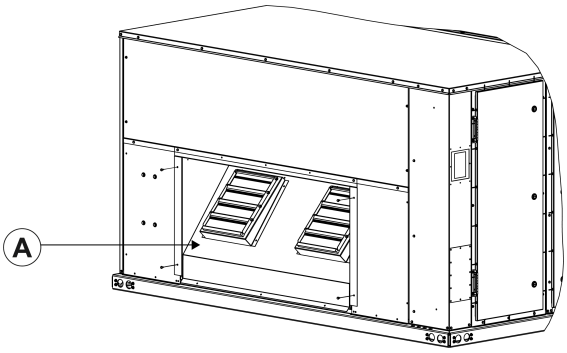
Figure 27: Cover



Item	Description
A	Cover

3. Remove the power exhaust transit cover by removing the screws at the top and bottom of the transit cover. Keep the screws for use in securing the power exhaust in a later step, the transit cover can be discarded.

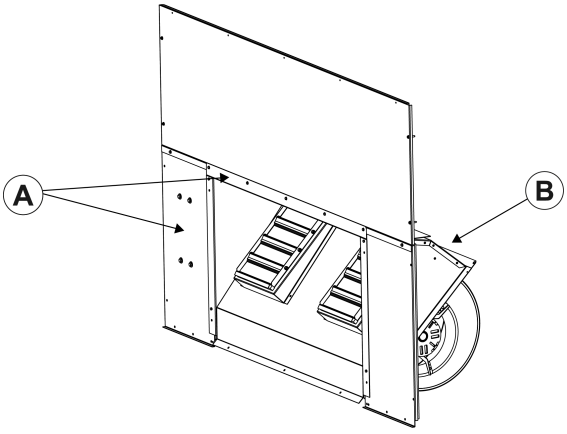
Figure 28: Removing the power exhaust transit cover



Item	Description
A	Power exhaust assembly

4. Before folding out the power exhaust assembly, ensure the wiring to the power exhaust motor is loose and not caught on internal components in the fresh air section of the unit. Visually locate the rear flange on the exhaust assembly shown in Figure 29, the mounting holes will need to be aligned with the through holes in the cabinet in the next steps.

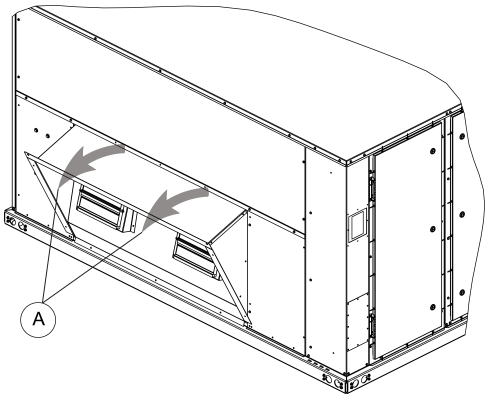
Figure 29: Rear flange location



Item	Description
A	Cabinet parts
B	Rear flange

5. From the outside of the unit, grabbing the top flange of the power exhaust assembly, pull the exhaust assembly away from the unit as shown in Figure 30. The assembly will rotate out and down using the base of the assembly as the pivot point.

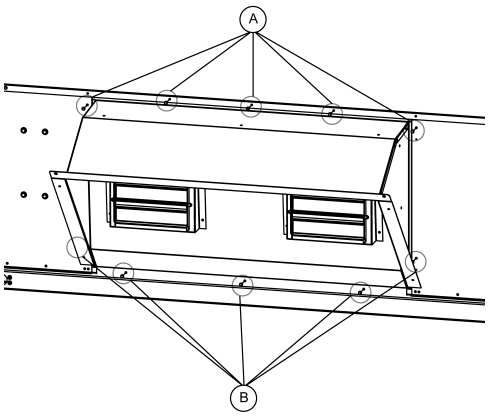
Figure 30: Exhaust Assembly



Item	Description
A	Pullout direction

6. While keeping the power exhaust assembly pivoted in its operational position, match the holes on the rear flange of the power exhaust assembly that was located in Step 4 to the holes on the corresponding cabinet parts.
7. Use the screws removed in Step 3 to attach the cabinet frame to the power exhaust assembly in the locations shown in Figure 31.

Figure 31: Flange screw locations



Item	Description
A	Top flange screw locations
B	Bottom flange screw locations

8. Use caulk, gasket, or other sealing means to ensure a watertight seal around the power exhaust assembly.
9. For a constant volume power exhaust, replace the return air access panel removed in Step 1. The setup is now complete. For a modulating power exhaust, continue to the next section for setting the location of the building pressure sensor.

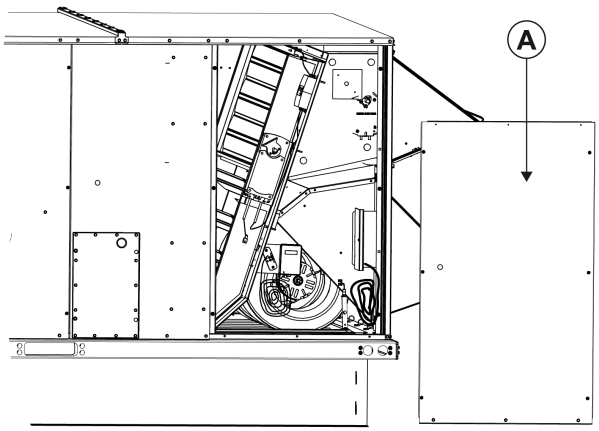
Relocating the RA pressure sensor

Field locating of building pressure sensor for modulating power exhaust

Complete these additional steps after completing the previous steps for field setup of a factory installed modulating power exhaust.

1. If not already removed, remove the return air access panel shown in Figure 32.

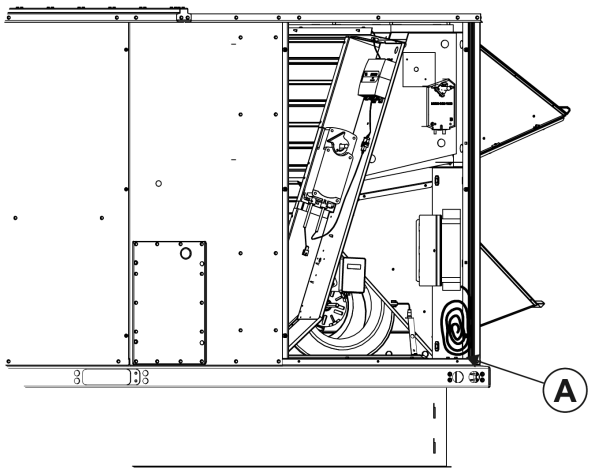
Figure 32: Removing the access panel



Item	Description
A	Return air access panel

2. The building pressure sensor and tubing are bundled from the factory and kept below the power exhaust control box as shown in Figure 33.

Figure 33: Building pressure sensor and tubing



Item	Description
A	RA pressure sensor tube bundled

3. Cut the wire ties holding the tubing in place for shipping.
4. Lower the end of the tubing with the pressure sensor down into the return ductwork. Note that the provided sensor will negate the effects of return dynamic pressure to give a representative building pressure. If you require a different location for obtaining building pressure, you can route the tubing accordingly.
5. Use field-supplied gasket or other protective measures to keep the tube from rubbing on any sharp edges that could cut the tube over time.
6. Replace the return air compartment access panel.

Utilities entry

Table 3: Utilities entry

Entry description		Opening size diameter (in.)
Control wiring	Left	Field drilled[1] to maximum of 7/8 in.
	Bottom	Field drilled[1] to maximum of 7/8 in.
Power wiring	Left	Field drilled[1] to maximum of 3 in.
	Bottom	Field drilled[1] to maximum of 3 in.
Gas piping	Left[2,3]	2 in. hole with 3/4 in. grommet
	Bottom[3]	1 1/4 in. hole
Condensate drain	Front[4]	1 1/2 in. hole
	Bottom[4]	2 in. hole with 1 1/4-in. grommet

ⓘ **Note:**
1. Factory provided dimples show the hole location to facilitate the drilling of entry holes.
2. 3/4 in. NPT gas piping is required.
3. You must insert the piping through the factory-installed grommet for a watertight seal.
4. 1 in. NPT female connection piping is required.

ⓘ **Note:** You must field seal all entry holes to prevent rain water entry into the building.

Refrigerant detection system

Choice refrigeration detection systems (RDS) includes two refrigerant leak detection sensors to protect the unit from any damage caused by the leakage of the mildly flammable R454B refrigerant.

Choice units provide an RDS as factory and field installed options.

The RDS sensor can detect a refrigerant leak according to UL60335-2-40 (edition 4.0) with an accuracy of +/- 5% LFL across the working range (0-25% LFL)

Mounting suggestions are as follows:

- Mounting holes are sized for #10 sheet metal screws.
- For optimal performance, put the sensor on a flat, smooth, surface.
- Connector location is crucial. Position the sensor as indicated in the mounting instructions.
- Do not position sensors in an open-up orientation because this prevents any condensation on the mounting surface from dripping onto the sensor membrane.
- Refer to the *A2L Refrigerant Installation Manual* for RDS operation and safety requirements.

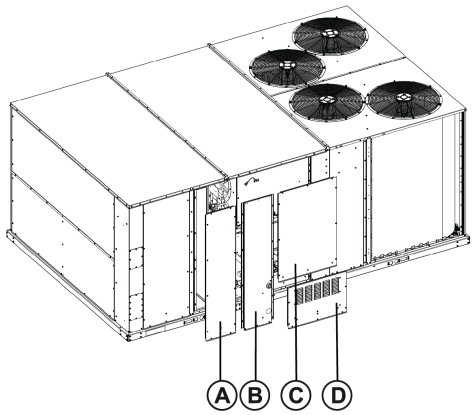


Field mounting the RDS

Mounting instructions for sensor 1

1. Remove or open the following section panels:
   - Filter
   - Blower
   - Heating section
   - Evaporator

Figure 34: Unit with section panels

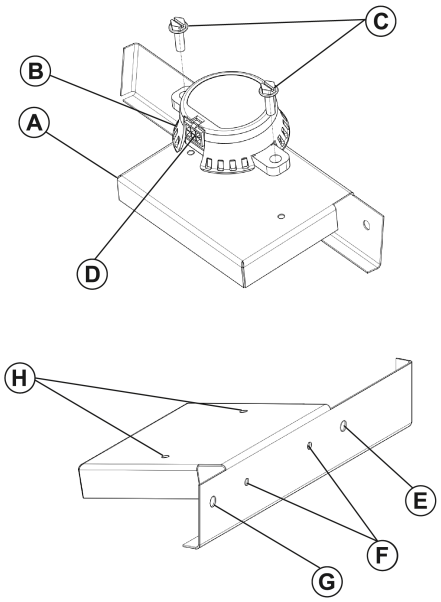


Item	Description
A	Filter section panel
B	Evaporator section panel
C	Blower section panel
D	Heating section panel

2. Use the bracket to install the RDS sensor 1. Secure the sub-assembly of the RDS sensor 1 and the bracket with two #10 screws as shown in Figure 35.

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Figure 35: Refrigerant detection sensor



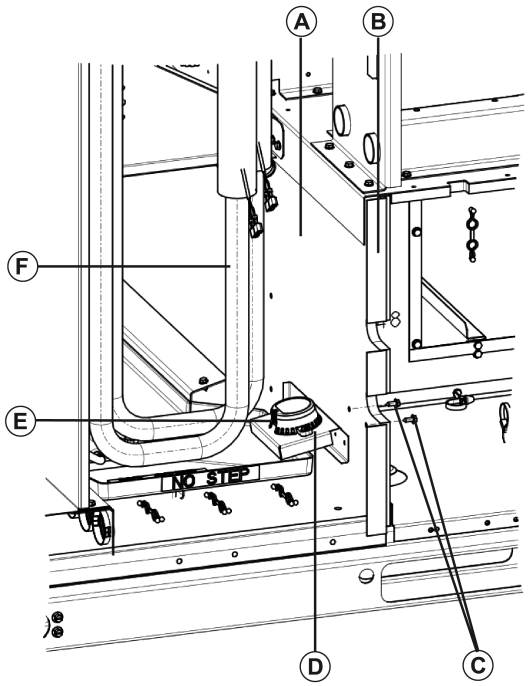
Item	Description
A	RDS bracket
B	RDS sensor
C	Number 10 screws
D	RDS connector position
E	Sensor 2 location mounting holes
F	Sensor 1 location mounting holes
G	Sensor 2 location mounting holes
H	Sensor mounting holes

3. Assemble the RDS sensor 1 and the bracket sub-assembly to the supply base pan, using the locating holes given on insulation.

   Note: The connector position for the RDS Sensor 1 is critical. The sensor position must be the same as shown in the sub-assembly, see Figure 35, Figure 36 and Figure 37

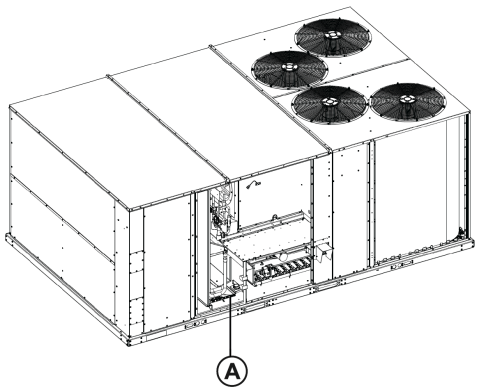
   Use two #10 screws to assemble the sub-assembly to the supply base pan.
   Mount the sub-assembly using the inner holes on the bracket. For the precise placement, see Figure 36
   Fasten the screws from the heating section toward the evaporator section.

Figure 36: Assembly for RDS detail



Item	Description
A	Insulation
B	Supply base pan
C	Number 10 screws
D	RDS 1 Sub assembly
E	Connector position facing evaporator
F	Evaporator headers

Figure 37: RDS location

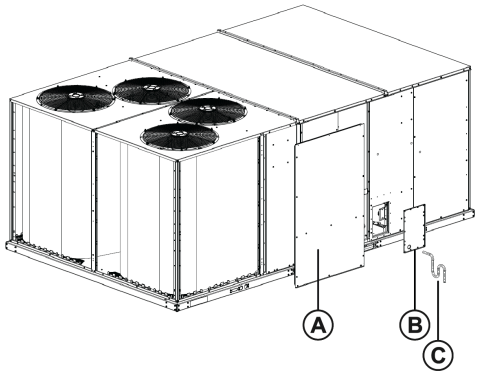


Item	Description
A	RDS sensor location

Mounting Instructions for sensor 2

1. Remove the access patch plate and drain-pipe. If necessary, remove the blower section panel.

Figure 38: Unit with access section panels

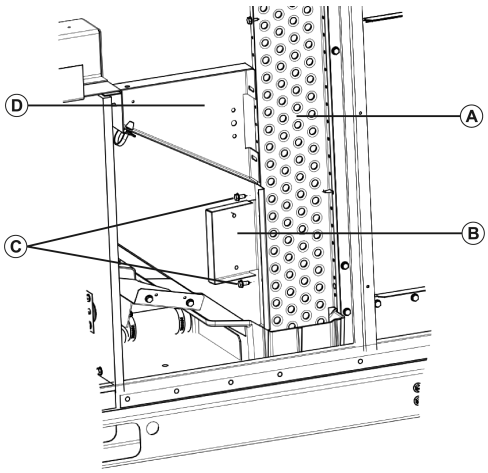


Item	Description
A	Blower section panel
B	Access patch plate
C	Drainpipe

2. Use the bracket to install RDS sensor 2. The sub-assembly of the RDS sensor 2 and the bracket requires two #10 screws, similar to the RDS sensor 1 sub-assembly, see Figure 35.
3. The sub-assembly of the RDS sensor 2 and the bracket must be placed below the evaporator coil support bracket to align with the locating holes. Use the outer holes on the bracket flange to connect the sub-assembly to the evaporator end sheet.

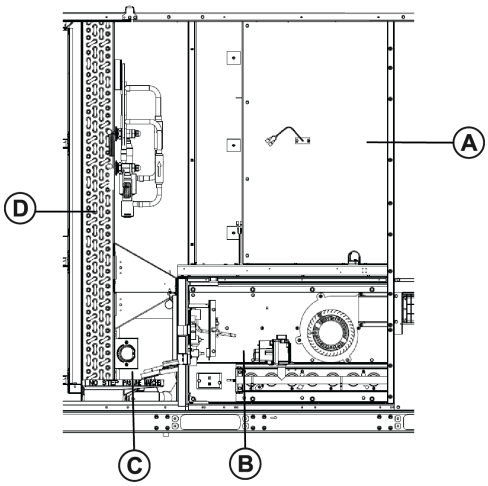
   Use two #10 screws to assemble the RDS sensor 2 and the bracket sub-assembly to the evaporator end sheet. See Figure 39

Figure 39: RDS Sensor 2 assembly



Item	Description
A	Evaporator end sheet
B	RDS sensor 2 sub assembly
C	#10 screws
D	Evaporator coil support

Figure 40: RDS Sensor 2 assembly - front side view



Item	Description
A	Blower
B	Heating section
C	Sensor 2 inside position
D	Evaporator

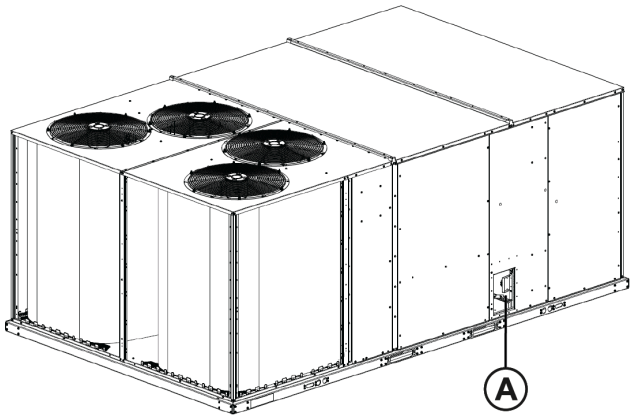
4. Position the RDS sensor 2 inside the unit facing toward the front side-panels. See Figure 41.

   Position the sensor inside the unit while you are assembling the RDS sensor 2 and the bracket sub-assembly. This positioning is critical for sensing the refrigerant leak.

   The refrigerant detection sensors have a common mounting bracket.

   Note: The connector position for RDS sensor 2 is critical. The sensor position must be the same as shown in the sub-assembly, see Figure 35 and Figure 41.

Figure 41: RDS sensor 2 location



Item	Description
A	RDS sensor 2 sub assembly

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Connecting the RDS sensors wiring harness

1. When you have installed both RDS sensors, you must connect the harness. Route the harness from the UCB board connector points, see Figure 42, to RDS sensor 1, and from RDS sensor 1 to RDS sensor 2, see Figure 43, the highlighted routing direction.

Figure 42: SSE board

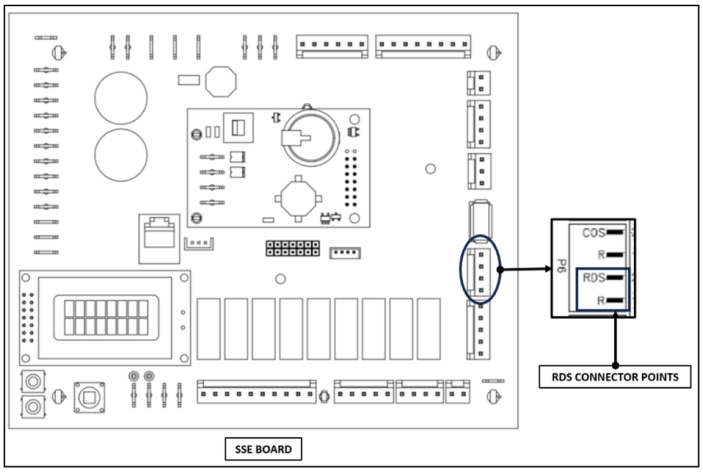
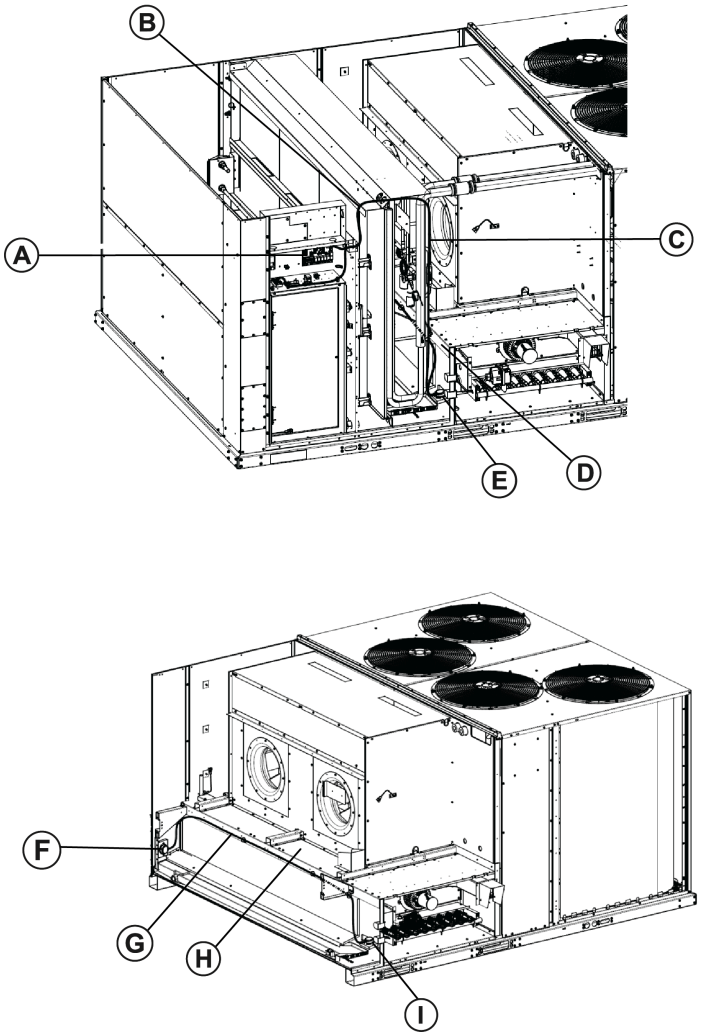


Figure 43: RDS sensor routing



Item	Description
A	SSE board
B	RDS harness
C	Wire routing
D	Blower deck
E	RDS sensor 1
F	RDS sensor 2
G	RDS harness
H	Blower deck
I	RDS sensor 1

2. After you complete routing the harness, close all the panels removed in Step 1 and Step 4.

Installing the condensate drain line

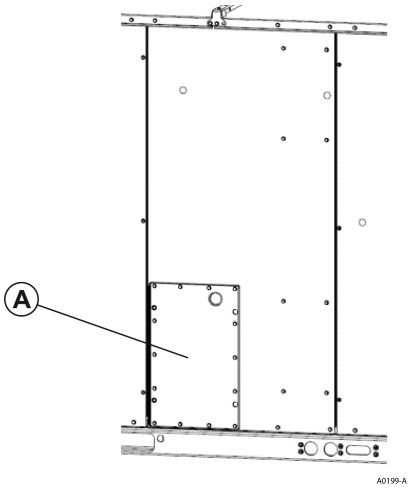
After a unit is installed in the field, the condensate drain line will need to be connected to the field supplied drain line. The orientation of the condensate drain connection is adjustable. The drain connection leaves the factory oriented to the rear

of the cabinet for a through the side connection. The drain connection can be reoriented downward through the base pan for piping inside the roof curb. Separate instructions are included in the following section for each orientation.

Through the side condensate drain:

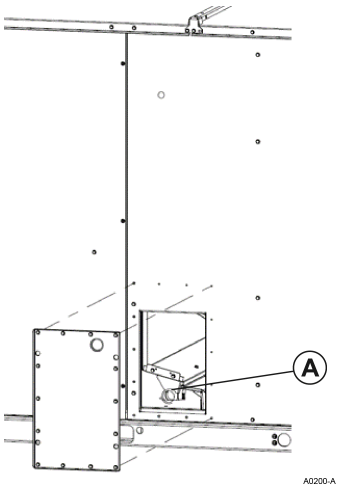
1. Remove the condensate drain line access patch plate shown in Figure 44 and Figure 45. Keep the screws for use in a later step.

Figure 44: Access patch plate



Item	Description
A	Access patch plate

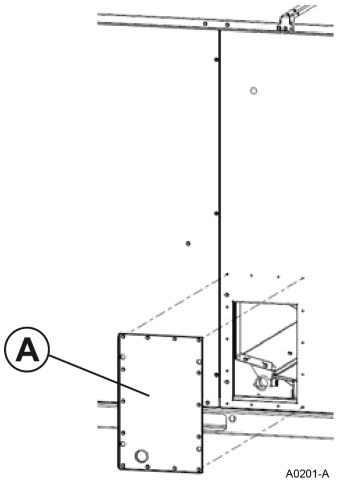
Figure 45: Patch plate removal



Item	Description
A	Threaded elbow

2. Rotate the patch plate 180° clockwise from its original orientation so that the drain line hole is in bottom left corner as shown in Figure 46.

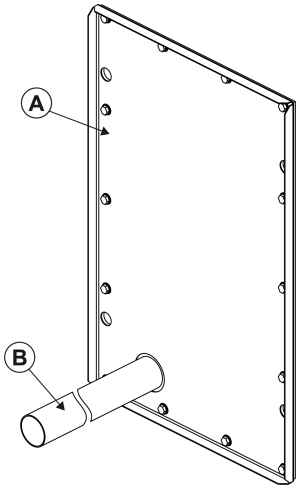
Figure 46: Access patch plate rotated orientation



Item	Description
A	Access patch plate rotated orientation

3. Pass the field-supplied condensate drain line through hole in the patch plate while it is detached from the unit. See Figure 47.

Figure 47: Detached patch plate

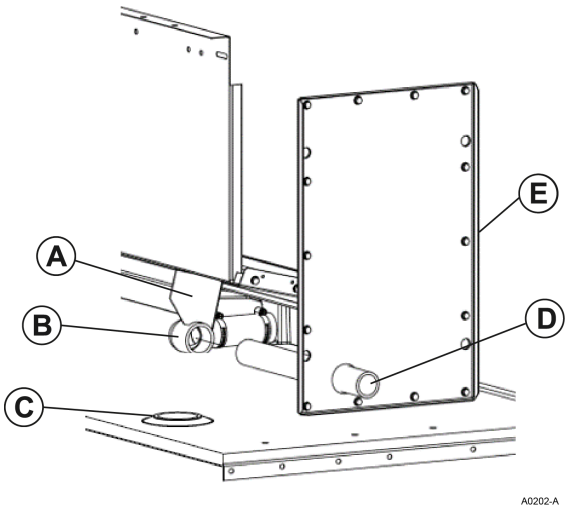


Item	Description
A	Access patch plate
B	Condensate drain line

4. Check that the plug C is fully inserted in the hole on the unit floor and the elbow is correctly secured and orientated using the elbow retaining bracket E. See Figure 48.
5. Connect the drain line to the 1 in. NPT female connection on the elbow located inside of the unit. Ensure that there is a correct seal between the drain line and the elbow. See Figure 48 for the component orientation.

Note: The condensate line should be supported external to the unit so it does not stress the internal connection

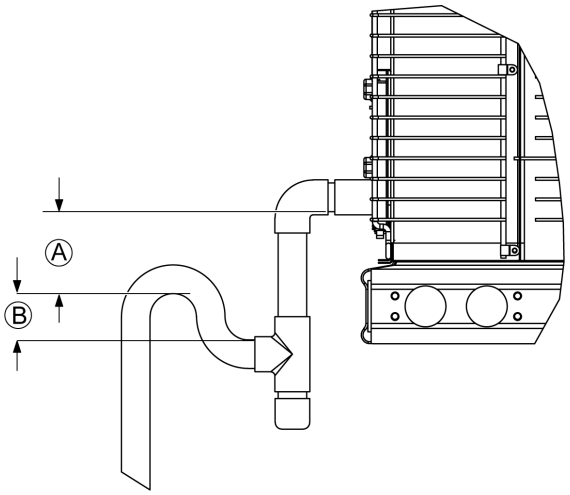
Figure 48: Correct component orientation



Item	Description
A	Elbow retaining bracket
B	Threaded elbow
C	Plug
D	Drain line
E	Patch plate

6. Trap the condensate drain line per Figure 49. The trap and drain lines should be protected from freezing and the plumbing must conform to local codes. Use a sealing compound on male pipe threads. The condensate line should be supported external to the unit so it does not stress the internal connection.

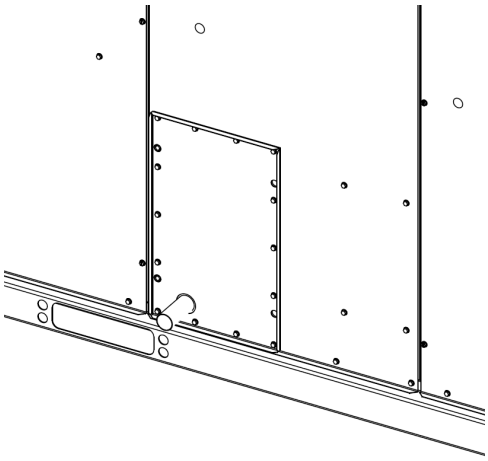
Figure 49: Trap and drain lines



Item	Description
A	3 in. minimum
B	2 in.

7. Using the screws that were removed in Step 1, attach the patch plate to the unit as shown in Figure 50. This will be in the same position the patch plate was rotated to in Step 2.

Figure 50: Attaching the patch plate

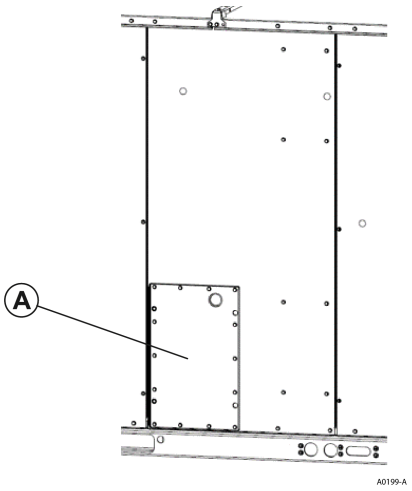


8. Use caulk, gasket, and/or other means to create a water-tight seal around the drain line where it passes through the patch plate to ensure no water enters the unit.
9. Ensure the drain line is installed horizontally level for proper drainage. If the drain line sags outside of the unit then the elbow/tube assembly inside lifts upward and do not allow proper drainage.

Through the base condensate drain:

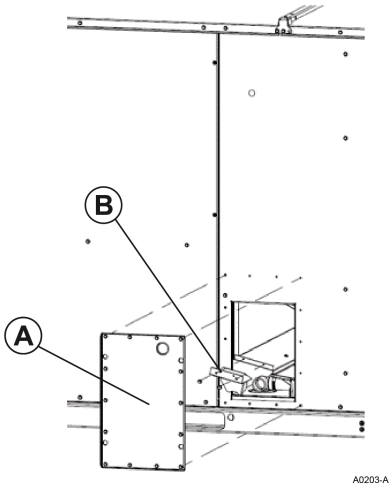
1. Remove the condensate drain line access patch plate shown in Figure 51 and the elbow retaining bracket as shown in Figure 52. Keep the screws for use in a later step.

Figure 51: Access patch plate



Item	Description
A	Access patch plate

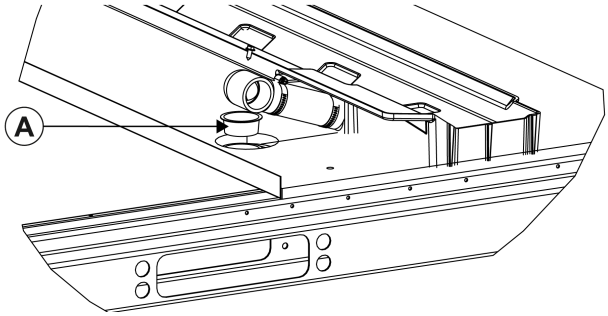
Figure 52: Access patch plate and elbow retaining bracket



Item	Description
A	Access patch plate
B	Elbow retaining bracket

2. Remove the plug from the grommet under the threaded elbow shown in Figure 52 and Figure 53.

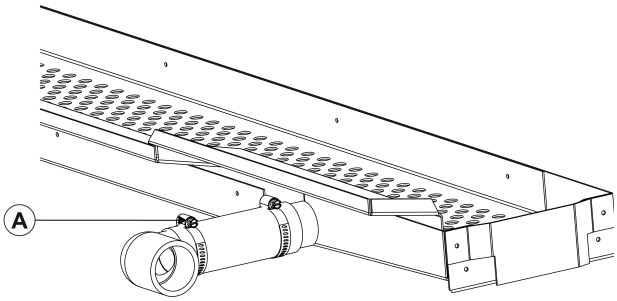
Figure 53: Removing the plug



Item	Description
A	Plug

3. Loosen the hose clamp holding the elbow to the hose. See Figure 54.

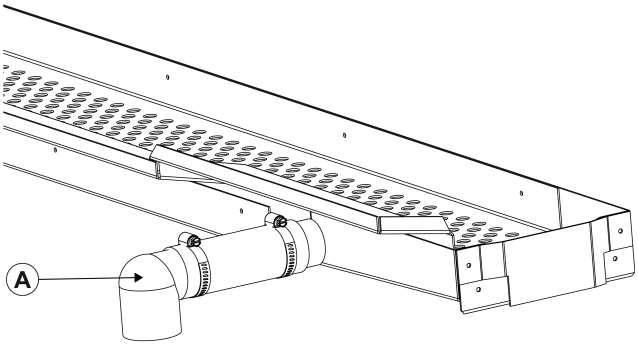
Figure 54: Loosening the hose clamp



Item	Description
A	Clamp

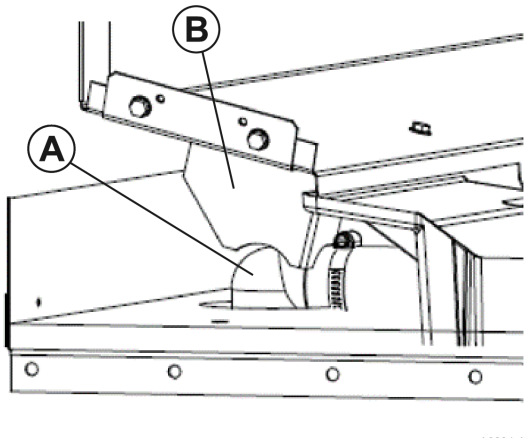
4. Rotate the elbow 90° so that the elbow points downward as shown in Figure 55. Push the elbow into the grommet as shown in Figure 56. Ensure that the hose from the drain pan to the elbow is horizontally level for proper drainage.

Figure 55: Rotating the elbow



Item	Description
A	Elbow rotated by 90°

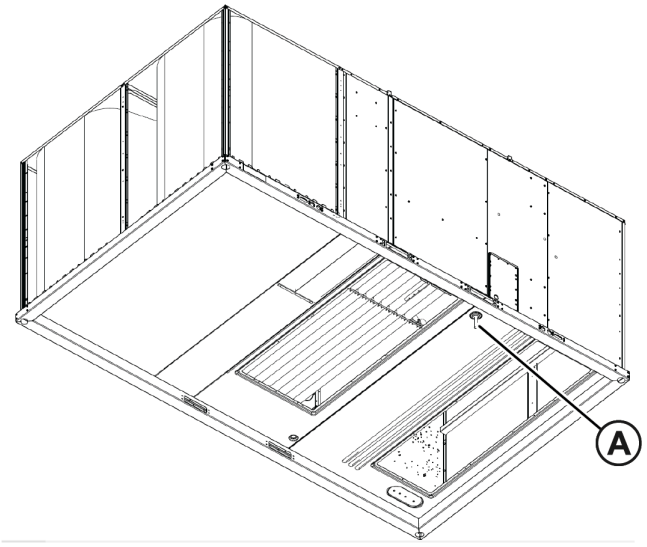
Figure 56: Inserting the elbow



Item	Description
A	Elbow inserted into grommet
B	Elbow retaining bracket

5. Tighten the hose clamp that you loosened in Step 3 to a maximum torque of 15 in-lb.
6. Secure the elbow firmly with the elbow retaining bracket as shown in Figure 56.
7. From below the unit, connect the field supplied drain line to the 1 in. NPT female connection on the elbow that is now sticking out of the grommet in the unit base pan. Ensure a proper seal is achieved between the drain line and the elbow. The through the base connection location can be seen in Figure 57.

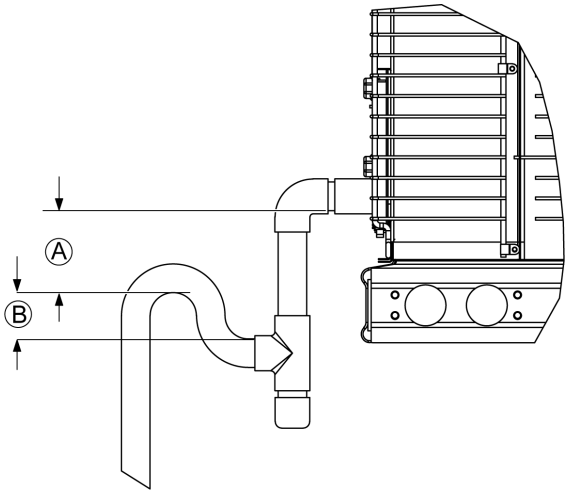
Figure 57: Connecting the drain line



Item	Description
A	Field supplied pipe

8. Route the field supplied drain line to the building exterior.
9. Trap the condensate drain line per Figure 58 .Protect the trap and drain lines from freezing. The plumbing must conform to local codes. Use a sealing compound on male pipe threads.

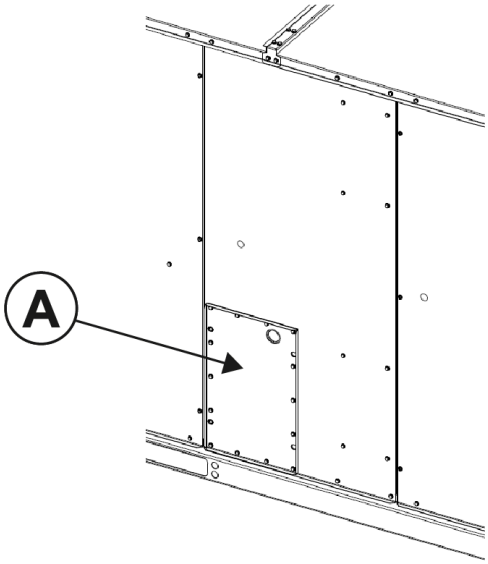
Figure 58: Trap and drain lines



Item	Description
A	3 in. minimum
B	2 in.

10. Using the screws that were removed in Step 1, replace the patch plate in its original orientation as shown in Figure 59.

Figure 59: Access patch plate



Item	Description
A	Access patch plate

Accessory weights

Table 4: Unit accessory weights

Unit accessory	Unit size			
	12.5 ton	15 ton	20 ton	25 ton
Economizer	145	145	165	165
Motorized damper	65	65	75	75
Power exhaust (CV, Std CFM)	170	170	170	170
Power exhaust (Mod, Std CFM)	212	212	212	212
Power exhaust (CV/Mod, Hi CFM)	450	450	450	450
Barometric damper	50	50	50	50
Electric heat,75 kW	75	75	75	75
Gas heat, largest	155	155	155	155
Hail guards	80	86	107	132
Wood skid and shipping brackets	60	70	70	80
Roof curb	215	230	230	250

Roof curbs

The following figures show the roof curbs for the units. All dimensions are in inches.

Return air

Supply air

Figure 60: 1RC0443 and 1RC0446 roof curb dimensions

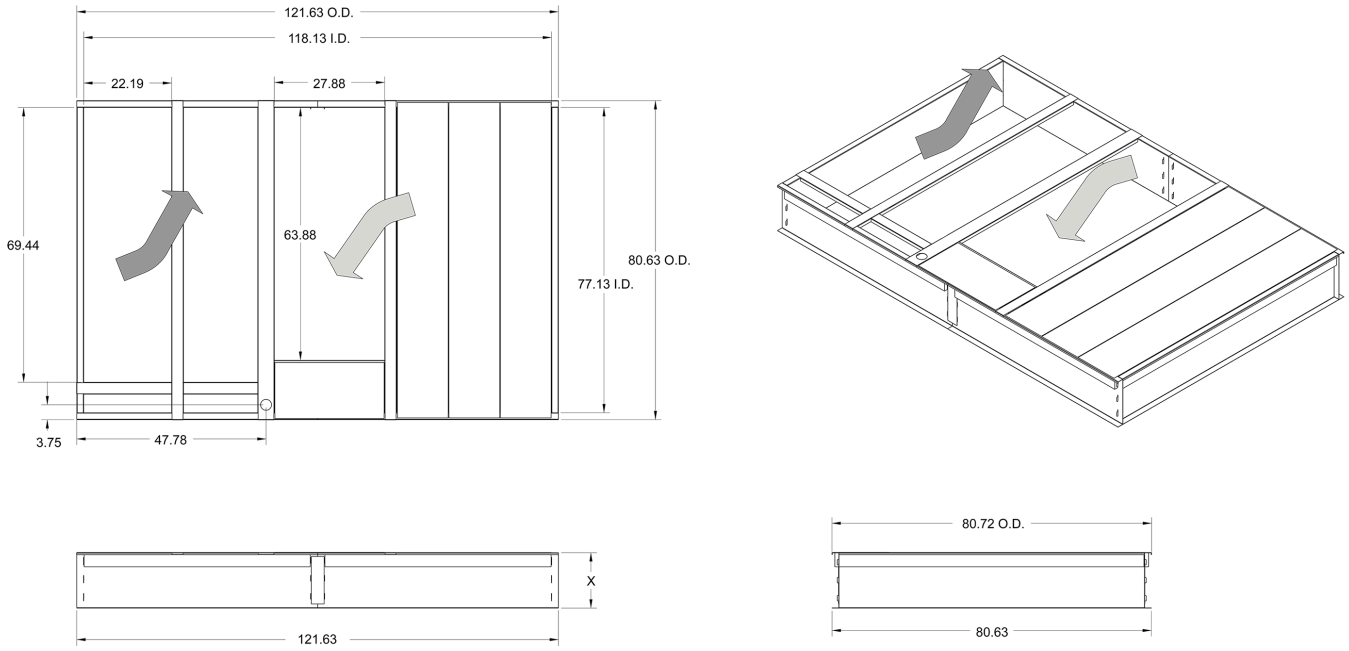


Table 5: 1RC0443 and 1RC0446 dimensions

Roof curb	X measurement (in.)
1RC0443	14
1RC0446	24

The following units are compatible with 1RC0443 and 1RC0446 roof curbs.

- WD13

Figure 61: 1RC0444 and 1RC0447 roof curb dimensions

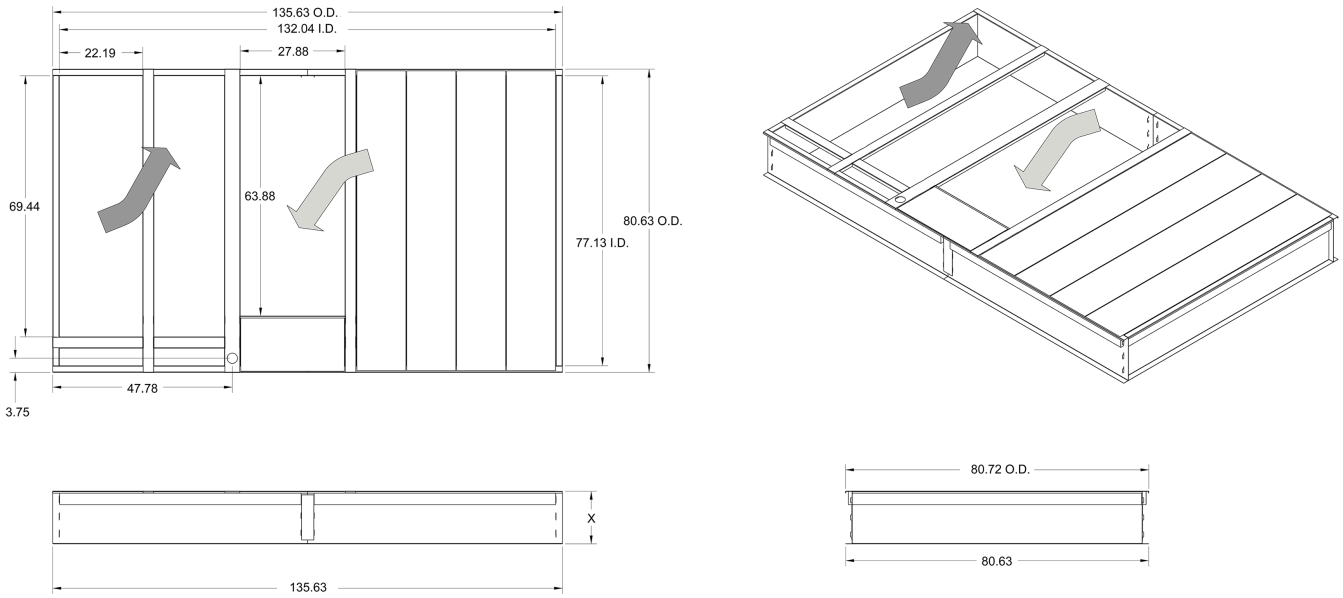


Table 6: 1RC0444 and 1RC0447 dimensions

Roof curb	X measurement (in.)
1RC0444	14
1RC0447	24

The following units are compatible with 1RC0444 and 1RC0447 roof curbs.

- WD15
- WD20

Figure 62: 1RC0445 and 1RC0448 roof curb dimensions

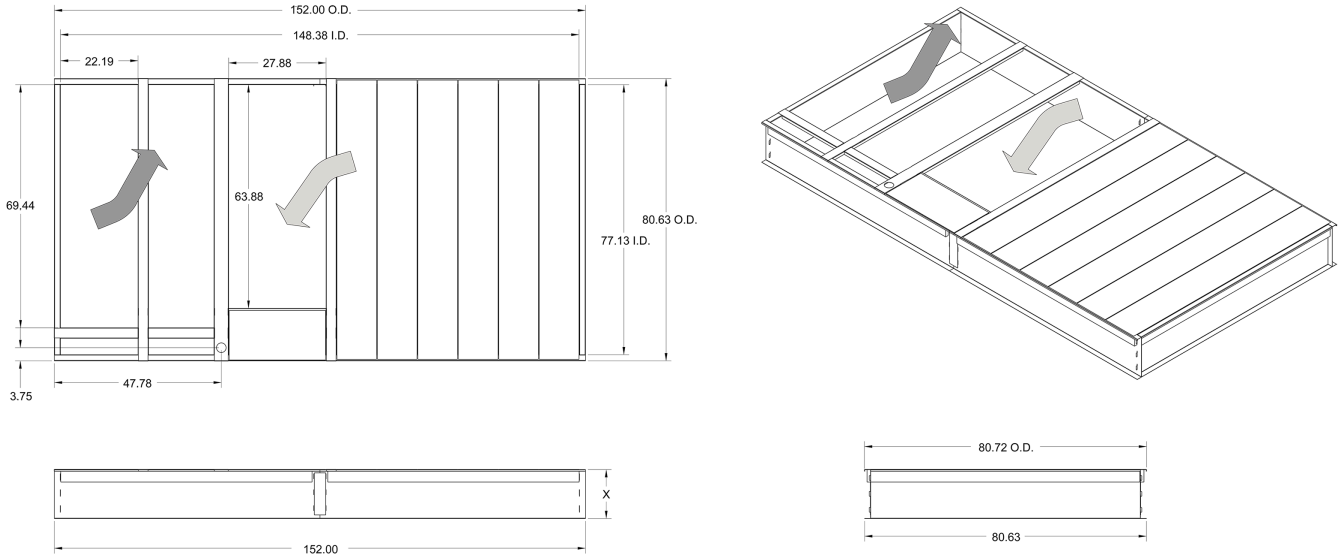


Table 7: 1RC0445 and 1RC0448 dimensions

Roof curb	X measurement (in.)
1RC0445	14
1RC0448	24

The following unit is compatible with 1RC0445 and 1RC0448 roof curbs.

- WD25

Figure 63: Roof curb cutaway

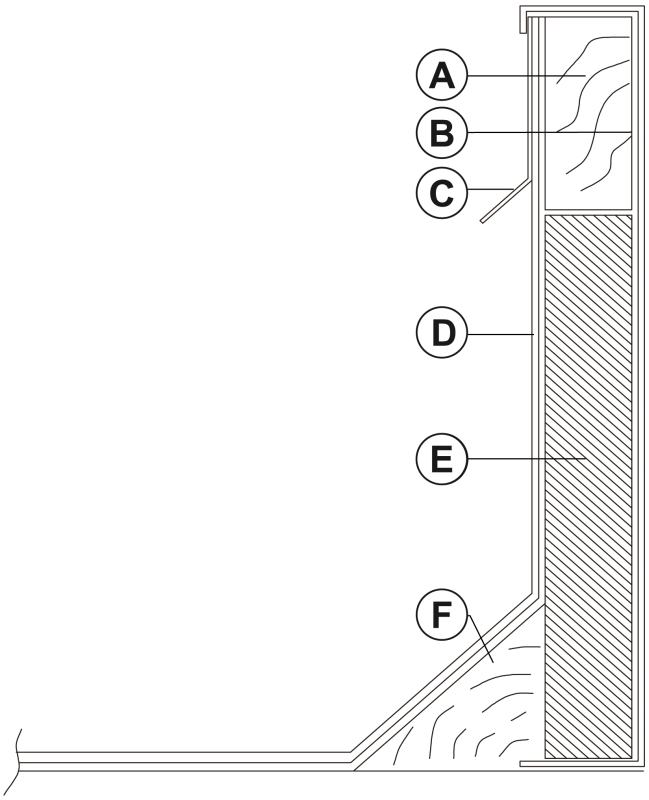


Table 8: Roof curb cutaway components

Item	Description	Item	Description
A	Wood nailer	D	Roof felt (field supplied)
B	Curb frame	E	Rigid insulation (field supplied)
C	Counter flashing (field supplied)	F	Cant strip (field supplied)

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 the Duct openings section for information on the side and bottom air duct openings.

Note: In Canada, it is recommended that the outlet duct be fitted with a removable access panel. It is recommended that this opening is accessible when the unit is installed in service, and of such a size that smoke or reflected light can be observed inside the casing to indicate the presence of leaks in the heat exchanger. You must attach the cover in a manner adequate to prevent leakage.

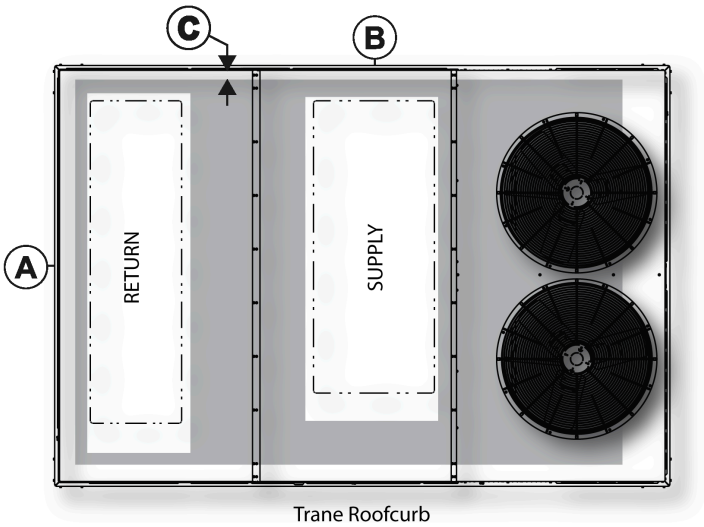
Placing the equipment over a Trane curb

When using this product to directly replace select Trane branded equipment without a transition curb, the placement of the unit on the existing Trane roof curb is required to follow these placement guidelines. The unit will be slightly longer and wider than the existing roof curb with the actual dimensional difference varying depending on tonnage. When positioning the unit on the roof curb the extra length and width will be left to overhang on the unit's right side (condenser end) and front (side with control access).

To properly align the supply and return air openings with the roof curb, complete the following step.

1. Leave a 1/2 in. gap between the unit baserail and the roof curb on both the left side (fresh air side) and back of the unit. See Figure 64.

Figure 64: Roof curb positioning



Item	Description
A	Left of Unit
B	Back of Unit
C	1/2 in. Gap

Compressors

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

CAUTION

This system uses R-454B refrigerant which is a mildly flammable refrigerant. Do not use any other refrigerant in this system.

The compressor also uses a polyolester oil (POE oil). This oil is extremely hygroscopic, meaning that 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. Refer to the compressor nameplate or label for the correct oil grade.

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, four-way reversing valve, or coil

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

CAUTION

Do not loosen compressor mounting bolts.

Filters

Units are provided with the selected 2 in. or 4 in. filter and can easily be converted in the field to accept either size in the standard filter rack.

Always install filters ahead of the 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 tables for the number and size of filters needed for the unit.

Do not operate the unit without filters correctly installed.

CAUTION

Ensure that panel latches are correctly positioned on the unit to maintain an airtight seal.

Dirty filter switch pressure setting

If a factory-installed dirty filter switch is present, you can change the pressure setting of the switch using the adjustment screw that is accessible with the metal cover removed. A setting of 0.5 in. WC serves as a general starting point but will likely need to be adjusted for the specific application to detect the increased pressure drop associated with a dirty filter.

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/or local ordinances. You must electrically ground the unit in accordance with NEC and CEC as specified above and/or 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 the unit limitations table.

CAUTION

208/230-3-60 units control transformers are factory wired for 230 V power supply. Change the tap on the transformer for 208-3-60 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 wires supplied with the unit need to be replaced, you must replace them with the same type shown on the wiring diagram and the same minimum gauge as the replaced wire.

Use a disconnect with these units. Factory- and field-installed disconnects are available.

CAUTION

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

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 properly 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 properly fused.

See the Figure 65 following figures for typical field wiring. Refer to the appropriate unit wiring diagram mounted inside the control doors for control circuit and power wiring information.

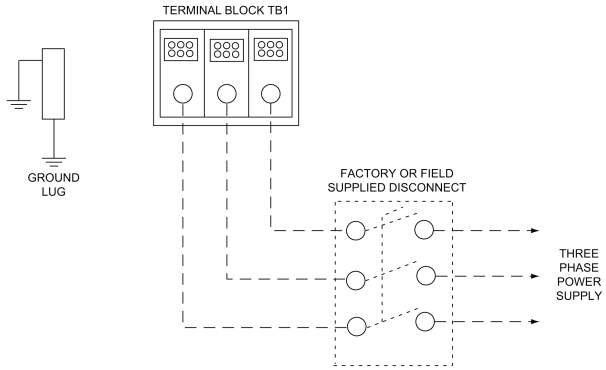
CAUTION

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 the electrical data tables 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 65: Field wiring disconnect



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 the thermostat for the general installation procedure. Use color-coded, insulated wires to connect the thermostat to the unit. See the following table for control wire sizing and maximum length.

Table 9: Control wire sizes

Wire size	Maximum length[1]
18 AWG	150 ft

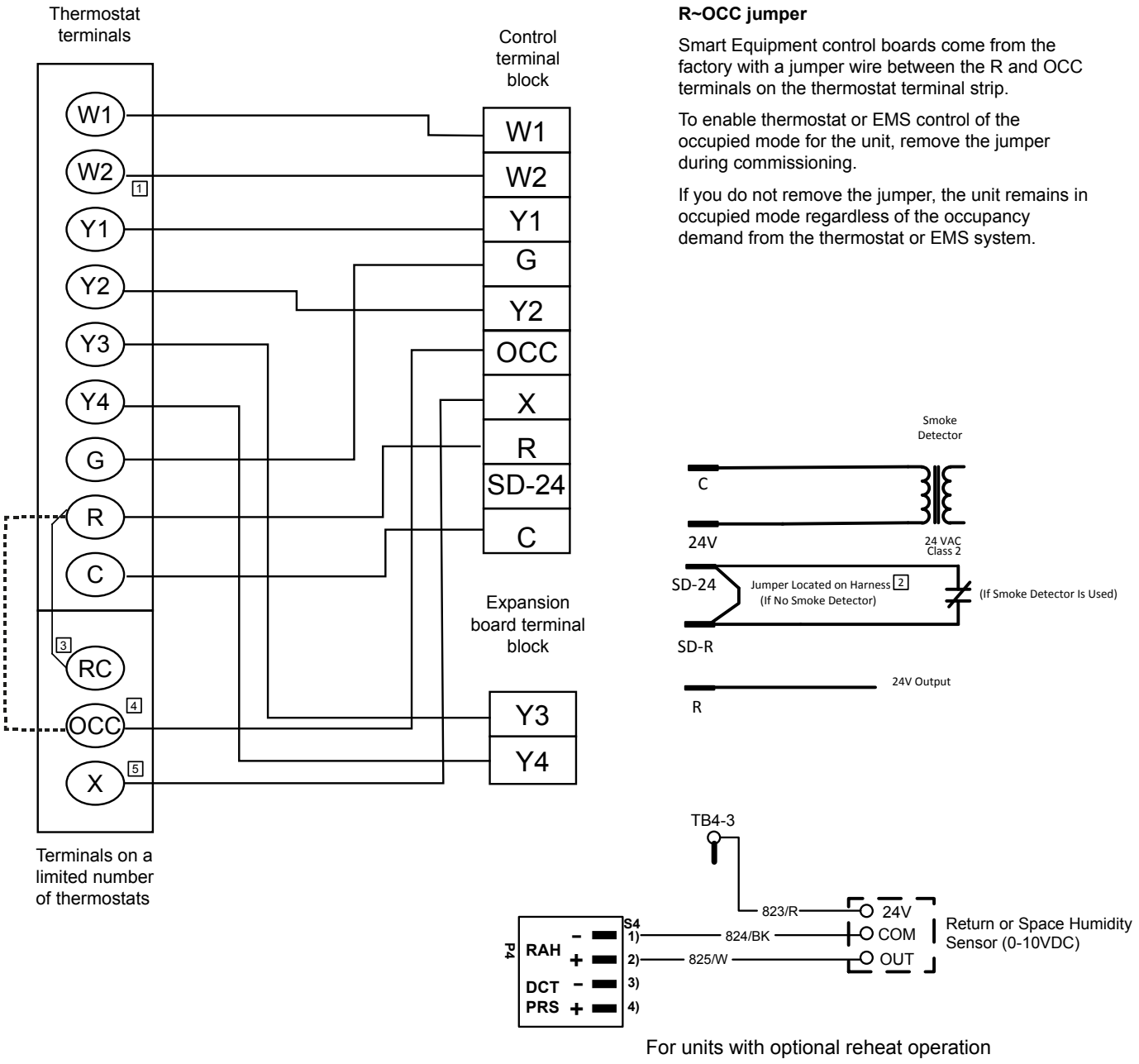
Note:

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

CAUTION

208/230-3-60 unit control transformer is factory wired for 230 V power supply. Change the tap on the transformer for 208-3-60 operation. See the unit wiring diagram.

Figure 66: Typical electronic thermostat field wiring



For units with optional reheat operation

R~OCC jumper

Smart Equipment control boards come from the factory with a jumper wire between the R and OCC terminals on the thermostat terminal strip.

To enable thermostat or EMS control of the occupied mode for the unit, remove the jumper during commissioning.

If you do not remove the jumper, the unit remains in occupied mode regardless of the occupancy demand from the thermostat or EMS system.

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.

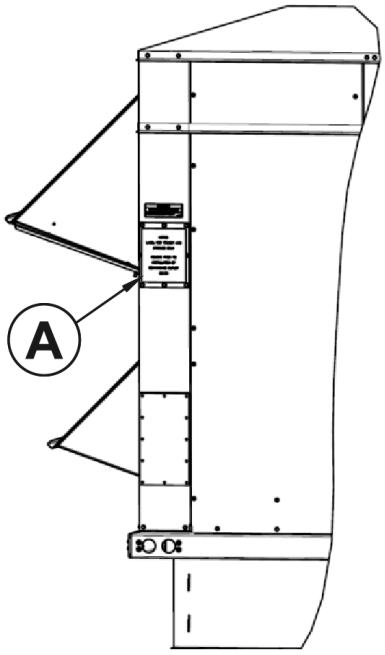
Convenience outlet cover installation

For units with a powered or non-powered convenience outlet, the convenience outlet cover is required to be installed in the field after the unit is installed.

To install the convenience outlet cover, complete the following steps.

1. The unit will leave the factory with a transit label covering the convenience outlet receptacle as shown in Figure 67. Remove and discard the convenience outlet transit label.

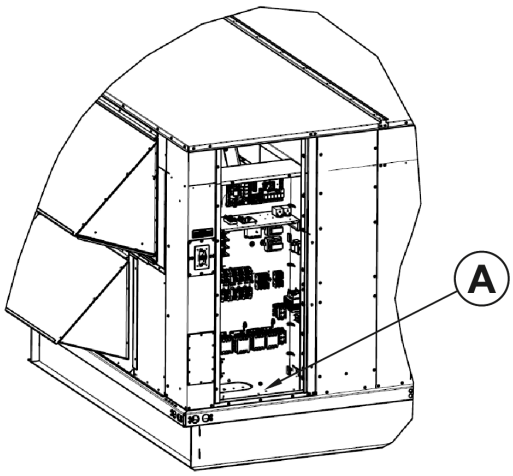
Figure 67: Convenience outlet transit label



Item	Description
A	Convenience outlet transit label

2. The convenience outlet cover will be shipped in the floor of the control box behind the high-voltage access panel as shown in Figure 68.

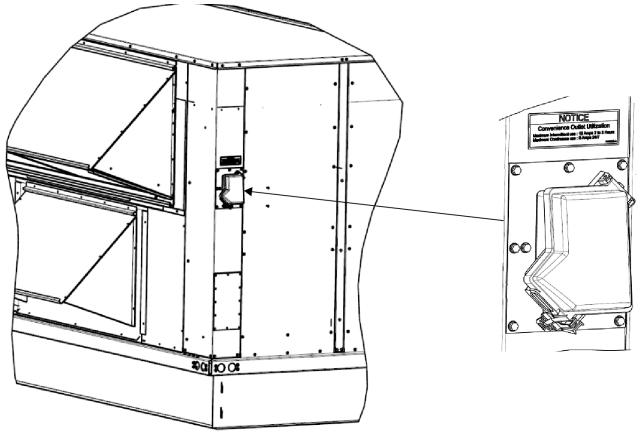
Figure 68: Location of convenience outlet cover



Item	Description
A	Location of convenience outlet cover

3. To mount the cover, follow the cover manufacturer's installation instructions that are provided with the cover. The final assembly should resemble Figure 69.

Figure 69: Convenience outlet cover



CAUTION

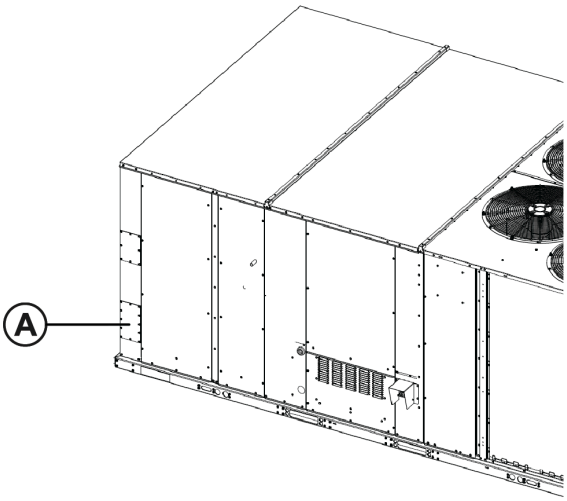
208/230-3-60 units with a factory-installed powered convenience outlet option are wired for 230v power supply. Change the tap on the transformer for 208-3-60 operation. See the unit wiring diagram.

Installing the circuit breaker and service disconnect handle

For units with a circuit breaker or a service disconnect, you must install the disconnect handle in the field after the unit is installed.

1. The unit will leave the factory with a patch plate covering the disconnect switch as shown in Figure 70.

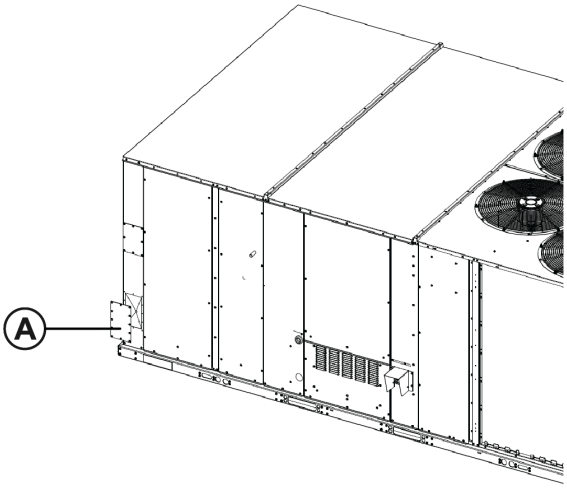
Figure 70: Patch plate



Item	Description
A	Patch plate

2. Remove the screws holding the patch plate to the unit cabinet as shown in Figure 71. Place the screws in a safe location to use in a later step. You can discard the patch plate.

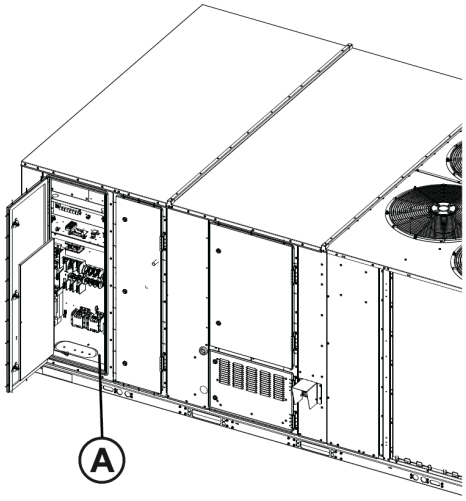
Figure 71: Removing the patch plate



Item	Description
A	Patch plate

3. The parts you need to complete the assembly are located in a box on the floor of the control box compartment, as shown in Figure 72. These parts include the permanent mounting plate with a hole for the disconnect handle, the disconnect handle, the handle manufacturer's installation instruction, and the additional parts to connect the handle to the disconnect switch.

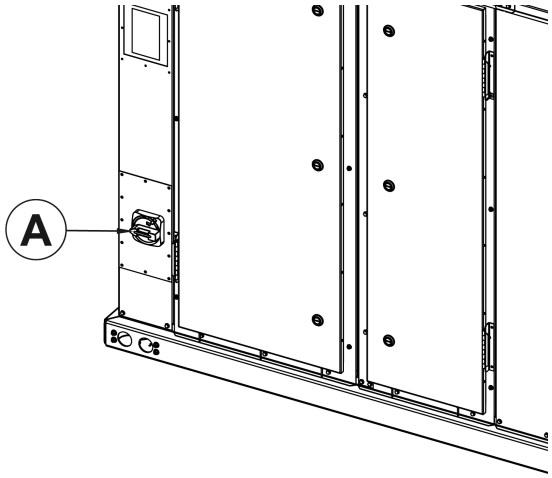
Figure 72: Disconnect handle and assembly parts



Item	Description
A	Control box floor

4. Attach the permanent mounting plate, gathered in Step 3, to the unit cabinet covering the opening that was created by removing the patch plate in Step 2. Attach the plate using the screws that you removed in step 2. Ensure that you attach the mounting plate with the hole aligned with the disconnect shaft.
5. To complete the field setup of the disconnect switch handle, follow the handle manufacturer's installation instructions that were included in the unit control box. These instructions show the installation of the disconnect handle and rod. The final assembly should resemble Figure 73.

Figure 73: Disconnect handle



Item	Description
A	Disconnect handle

Electrical data

The following note applies to all electrical data tables.

Note:

- MCA = minimum circuit ampacity
- f/b = fuse/breaker
- Fuse is a dual element, time delay type
- Breaker is a HACR type per NEC

2 stage standard static without power exhaust

Table 10: 2 stage standard static without power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (Amps)	Max f/b size (Amps)	Min disconnect rating		MCA w/ 120 V trans (Amps)	Max f/b size w/ 120 V trans (Amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA				Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD13 (12.5)	208-3-60	22.4	166.2	22.4	190	2.1	6.1	9.6	None	-	-	-	66.8	80	70	378	76.4	90	81	388
									2EL04502525	18.8	1	52.1	132.1	150	130	378	141.7	150	141	388
									2EL04505025	37.6	2	104.3	152.8	175	150	378	162.4	175	161	388
									2EL04507525	56.3	2	156.2	171.5	200	194	378	183.5	200	205	388
	230-3-60	22.4	166.2	22.4	190	2.1	5.7	8.7	None	-	-	-	66.0	80	69	378	74.7	90	79	386
									2EL04502525	23.0	1	57.7	138.1	150	136	378	146.8	150	146	386
									2EL04505025	45.9	2	115.2	161.1	175	157	378	169.8	175	167	386
									2EL04507525	68.9	2	172.9	187.2	200	212	378	198.0	225	222	386
	460-3-60	8.8	74.6	11.5	100	1.1	2.9	4.3	None	-	-	-	31.2	40	33	186	35.5	45	37	190
									2EL04502546	23.0	1	28.8	67.3	70	66	186	71.6	80	71	190
									2EL04505046	45.9	2	57.6	79.3	80	76	186	84.6	90	81	190
									2EL04507546	68.9	2	86.4	93.7	100	106	186	99.0	110	111	190
	575-3-60	7.2	54	9.0	72	0.9	3.1	3.5	None	-	-	-	26.5	35	28	136	30.0	35	32	140
									2EL04502558	23.0	1	23.0	55.3	60	54	136	58.8	60	58	140
									2EL04505058	45.9	2	46.0	65.3	70	63	136	69.6	70	67	140
									2EL04507558	68.9	2	69.1	76.9	80	87	136	81.2	90	91	140
WD15 (15)	208-3-60	27.7	178.5	27.7	178.5	2.0	6.1	9.6	None	-	-	-	82.5	110	87	387	92.1	110	98	396
									2EL04502525	18.8	1	52.1	147.8	150	147	387	157.4	175	158	396
									2EL04505025	37.6	2	104.3	168.5	175	166	387	178.1	200	177	396
									2EL04507525	56.3	2	156.2	180.4	200	194	387	190.0	200	205	396
	230-3-60	27.7	178.5	27.7	178.5	2.3	5.7	8.7	None	-	-	-	82.9	110	87	388	91.6	110	97	397
									2EL04502525	23.0	1	57.7	155.1	175	154	388	163.8	175	164	397
									2EL04505025	45.9	2	115.2	178.1	200	175	388	186.8	200	185	397
									2EL04507525	68.9	2	172.9	190.9	200	212	388	199.6	225	222	397
	460-3-60	11.5	103	11.5	103	1.3	2.9	4.3	None	-	-	-	36.9	45	39	223	41.2	50	44	228
									2EL04502546	23.0	1	28.8	73.0	80	72	223	77.3	80	77	228
									2EL04505046	45.9	2	57.6	84.4	90	83	223	88.7	90	88	228
									2EL04507546	68.9	2	86.4	93.7	100	106	223	99.0	110	111	228
	575-3-60	9.0	78	9.0	78	1.0	3.1	3.5	None	-	-	-	30.5	35	32	171	34.0	40	36	175
									2EL04502558	23.0	1	23.0	59.3	60	59	171	62.8	70	63	175
									2EL04505058	45.9	2	46.0	68.5	70	67	171	72.0	80	71	175
									2EL04507558	68.9	2	69.1	76.9	80	87	171	81.2	90	91	175

Table 10: 2 stage standard static without power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (Amps)	Max f/b size (Amps)	Min disconnect rating		MCA w/ 120 V trans (Amps)	Max f/b size w/ 120 V trans (Amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA				Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD20 (20)	208-3-60	28.5	255	33.3	255	2.0	10.8	9.6	None	-	-	-	99.7	125	105	549	109.3	125	116	559
									2EL04502525	18.8	1	52.1	165.0	175	165	549	174.6	175	176	559
									2EL04505025	37.6	2	104.3	185.7	200	184	549	195.3	200	195	559
									2EL04507525	56.3	2	156.2	197.6	200	204	549	207.2	225	216	559
	230-3-60	28.5	255	33.3	255	2.3	10.0	8.7	None	-	-	-	99.3	125	105	550	108.0	125	115	558
									2EL04502525	23.0	1	57.7	171.5	175	171	550	180.2	200	181	558
									2EL04505025	45.9	2	115.2	194.5	200	192	550	203.2	225	202	558
									2EL04507525	68.9	2	172.9	207.3	225	222	550	216.0	225	232	558
	460-3-60	13.5	123	15.4	140	1.3	4.9	4.3	None	-	-	-	47.8	60	50	284	52.1	60	55	289
									2EL04502546	23.0	1	28.8	83.9	90	84	284	88.2	90	89	289
									2EL04505046	45.9	2	57.6	95.3	100	94	284	99.6	100	99	289
									2EL04507546	68.9	2	86.4	101.8	110	111	284	106.1	110	116	289
	575-3-60	10.7	93.7	12.9	107.6	1.0	4.4	3.5	None	-	-	-	39.6	50	42	219	43.1	50	46	223
									2EL04502558	23.0	1	23.0	68.5	70	68	219	72.0	80	72	223
									2EL04505058	45.9	2	46.0	77.6	80	77	219	81.1	90	81	223
									2EL04507558	68.9	2	69.1	82.8	90	90	219	86.3	90	94	223
WD25 (25)	208-3-60	40.8	270	40.8	270	2.1	10.8	9.6	None	-	-	-	121.8	150	128	582	131.4	150	139	591
									2EL04502525	18.8	1	52.1	187.1	200	188	582	196.7	200	199	591
									2EL04505025	37.6	2	104.3	207.8	225	207	582	217.4	225	219	591
									2EL04507525	56.3	2	156.2	219.7	225	218	582	229.3	250	229	591
	230-3-60	40.8	270	40.8	270	2.1	10.0	8.7	None	-	-	-	120.2	150	127	580	128.9	150	137	589
									2EL04502525	23.0	1	57.7	192.3	200	193	580	201.0	225	203	589
									2EL04505025	45.9	2	115.2	215.3	225	214	580	224.0	225	224	589
									2EL04507525	68.9	2	172.9	228.2	250	226	580	236.9	250	236	589
	460-3-60	19.4	147	19.4	147	1.1	4.9	4.3	None	-	-	-	57.9	70	61	315	62.2	80	66	319
									2EL04502546	23.0	1	28.8	94.0	100	94	315	98.3	110	99	319
									2EL04505046	45.9	2	57.6	105.4	110	105	315	109.7	110	110	319
									2EL04507546	68.9	2	86.4	111.9	125	111	315	116.2	125	116	319
	575-3-60	13.7	109	13.7	109	0.9	4.4	3.5	None	-	-	-	43.2	50	46	235	46.7	60	50	238
									2EL04502558	23.0	1	23.0	72.1	80	72	235	75.6	80	76	238
									2EL04505058	45.9	2	46.0	81.2	90	81	235	84.7	90	85	238
									2EL04507558	68.9	2	69.1	86.4	90	90	235	89.9	90	94	238

2 stage standard static with on/off power exhaust

Table 11: 2 stage standard static with on/off power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD13 (12.5)	208-3-60	22.4	166.2	22.4	190	2.1	6.1	5.0	9.6	None	-	-	-	76.8	90	82	399	86.4	100	93	409
										2EL04502525	18.8	1	52.1	142.1	150	142	399	151.7	175	153	409
										2EL04505025	37.6	2	104.3	162.8	175	161	399	172.4	175	172	409
										2EL04507525	56.3	2	156.2	184.0	200	205	399	196.0	200	216	409
	230-3-60	22.4	166.2	22.4	190	2.1	5.7	5.0	8.7	None	-	-	-	76.0	90	81	399	84.7	100	91	407
										2EL04502525	23.0	1	57.7	148.1	150	147	399	156.8	175	157	407
										2EL04505025	45.9	2	115.2	171.1	175	168	399	181.6	200	178	407
										2EL04507525	68.9	2	172.9	199.7	225	223	399	210.5	225	233	407
	460-3-60	8.8	74.6	11.5	100	1.1	2.9	2.2	4.3	None	-	-	-	35.6	45	38	195	39.9	50	43	200
										2EL04502546	23.0	1	28.8	71.7	80	71	195	76.0	80	76	200
										2EL04505046	45.9	2	57.6	84.8	90	81	195	90.1	100	86	200
										2EL04507546	68.9	2	86.4	99.2	110	111	195	104.5	110	116	200
	575-3-60	7.2	54	9.0	72	0.9	3.1	1.5	3.5	None	-	-	-	29.5	35	31	143	33.0	40	35	146
										2EL04502558	23.0	1	23.0	58.3	60	58	143	61.8	70	62	146
										2EL04505058	45.9	2	46.0	69.0	70	66	143	73.4	80	70	146
										2EL04507558	68.9	2	69.1	80.6	90	90	143	85.0	90	94	146
WD15 (15)	208-3-60	27.7	178.5	27.7	178.5	2.0	6.1	5.0	9.6	None	-	-	-	92.5	110	98	408	102.1	125	109	417
										2EL04502525	18.8	1	52.1	157.8	175	158	408	167.4	175	170	417
										2EL04505025	37.6	2	104.3	178.5	200	178	408	188.1	200	189	417
										2EL04507525	56.3	2	156.2	190.4	200	205	408	200.0	200	216	417
	230-3-60	27.7	178.5	27.7	178.5	2.3	5.7	5.0	8.7	None	-	-	-	92.9	110	99	409	101.6	125	109	418
										2EL04502525	23.0	1	57.7	165.1	175	165	409	173.8	175	175	418
										2EL04505025	45.9	2	115.2	188.1	200	186	409	196.8	200	196	418
										2EL04507525	68.9	2	172.9	200.9	225	223	409	210.5	225	233	418
	460-3-60	11.5	103	11.5	103	1.3	2.9	2.2	4.3	None	-	-	-	41.3	50	44	233	45.6	50	49	237
										2EL04502546	23.0	1	28.8	77.4	80	77	233	81.7	90	82	237
										2EL04505046	45.9	2	57.6	88.8	90	88	233	93.1	100	93	237
										2EL04507546	68.9	2	86.4	99.2	110	111	233	104.5	110	116	237
	575-3-60	9.0	78	9.0	78	1.0	3.1	1.5	3.5	None	-	-	-	33.5	40	36	178	37.0	45	40	181
										2EL04502558	23.0	1	23.0	62.3	70	62	178	65.8	70	66	181
										2EL04505058	45.9	2	46.0	71.5	80	71	178	75.0	80	75	181
										2EL04507558	68.9	2	69.1	80.6	90	90	178	85.0	90	94	181

Table 11: 2 stage standard static with on/off power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD18 (20)	208-3-60	28.5	255	33.3	255	2.0	10.8	5.0	9.6	None	-	-	-	109.7	125	117	570	119.3	150	128	580
										2EL04502525	18.8	1	52.1	175.0	175	177	570	184.6	200	188	580
										2EL04505025	37.6	2	104.3	195.7	200	196	570	205.3	225	207	580
										2EL04507525	56.3	2	156.2	207.6	225	216	570	217.2	225	227	580
	230-3-60	28.5	255	33.3	255	2.3	10.0	5.0	8.7	None	-	-	-	109.3	125	116	571	118.0	150	126	579
										2EL04502525	23.0	1	57.7	181.5	200	183	571	190.2	200	193	579
										2EL04505025	45.9	2	115.2	204.5	225	204	571	213.2	225	214	579
										2EL04507525	68.9	2	172.9	217.3	225	233	571	226.0	250	243	579
	460-3-60	13.5	123	15.4	140	1.3	4.9	2.2	4.3	None	-	-	-	52.2	60	56	294	56.5	70	60	298
										2EL04502546	23.0	1	28.8	88.3	90	89	294	92.6	100	94	298
										2EL04505046	45.9	2	57.6	99.7	100	99	294	104.0	110	104	298
										2EL04507546	68.9	2	86.4	106.2	110	116	294	110.5	125	121	298
	575-3-60	10.7	93.7	12.9	107.6	1.0	4.4	1.5	3.5	None	-	-	-	42.6	50	45	226	46.1	50	49	229
										2EL04502558	23.0	1	23.0	71.5	80	72	226	75.0	80	76	229
										2EL04505058	45.9	2	46.0	80.6	90	80	226	84.1	90	84	229
										2EL04507558	68.9	2	69.1	85.8	90	93	226	89.3	90	97	229
WD25 (25)	208-3-60	40.8	270	40.8	270	2.1	10.8	5.0	9.6	None	-	-	-	131.8	150	140	603	141.4	175	151	612
										2EL04502525	18.8	1	52.1	197.1	200	200	603	206.7	225	211	612
										2EL04505025	37.6	2	104.3	217.8	225	219	603	227.4	250	230	612
										2EL04507525	56.3	2	156.2	229.7	250	230	603	239.3	250	241	612
	230-3-60	40.8	270	40.8	270	2.1	10.0	5.0	8.7	None	-	-	-	130.2	150	138	601	138.9	175	148	610
										2EL04502525	23.0	1	57.7	202.3	225	204	601	211.0	225	214	610
										2EL04505025	45.9	2	115.2	225.3	250	226	601	234.0	250	236	610
										2EL04507525	68.9	2	172.9	238.2	250	237	601	246.9	250	247	610
	460-3-60	19.4	147	19.4	147	1.1	4.9	2.2	4.3	None	-	-	-	62.3	80	66	324	66.6	80	71	329
										2EL04502546	23.0	1	28.8	98.4	110	99	324	102.7	110	104	329
										2EL04505046	45.9	2	57.6	109.8	110	110	324	114.1	125	115	329
										2EL04507546	68.9	2	86.4	116.3	125	116	324	120.6	125	121	329
	575-3-60	13.7	109	13.7	109	0.9	4.4	1.5	3.5	None	-	-	-	46.2	50	49	241	49.7	60	53	245
										2EL04502558	23.0	1	23.0	75.1	80	76	241	78.6	80	80	245
										2EL04505058	45.9	2	46.0	84.2	90	84	241	87.7	90	88	245
										2EL04507558	68.9	2	69.1	89.4	90	93	241	92.9	100	97	245

2 stage standard static with mod power exhaust

Table 12: 2 stage standard static with mod power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD13(12.5)	208-3-60	22.4	166.2	22.4	190	2.1	6.1	6.7	9.6	None	-	-	-	80.2	100	86	392	89.8	110	97	401
										2EL04502525	18.8	1	52.1	145.5	150	146	392	155.1	175	157	401
										2EL04505025	37.6	2	104.3	166.2	175	165	392	175.8	200	176	401
										2EL04507525	56.3	2	156.2	188.2	200	209	392	200.2	225	220	401
	230-3-60	22.4	166.2	22.4	190	2.1	5.7	6.7	8.7	None	-	-	-	79.4	100	85	391	88.1	110	95	400
										2EL04502525	23.0	1	57.7	151.5	175	151	391	160.2	175	161	400
										2EL04505025	45.9	2	115.2	175.0	175	172	391	185.9	200	182	400
										2EL04507525	68.9	2	172.9	203.9	225	227	391	214.8	225	237	400
	460-3-60	8.8	74.6	11.5	100	1.1	2.9	3.4	4.3	None	-	-	-	38.0	45	40	193	42.3	50	45	197
										2EL04502546	23.0	1	28.8	74.1	80	74	193	78.4	80	79	197
										2EL04505046	45.9	2	57.6	87.8	90	84	193	93.1	100	89	197
										2EL04507546	68.9	2	86.4	102.2	110	114	193	107.5	110	119	197
	575-3-60	7.2	54	9.0	72	0.9	3.1	2.7	3.5	None	-	-	-	31.9	40	34	142	35.4	40	38	145
										2EL04502558	23.0	1	23.0	60.7	70	61	142	64.2	70	65	145
										2EL04505058	45.9	2	46.0	72.0	80	69	142	76.4	80	73	145
										2EL04507558	68.9	2	69.1	83.6	90	93	142	88.0	90	97	145
WD15(15)	208-3-60	27.7	178.5	27.7	178.5	2.0	6.1	6.7	9.6	None	-	-	-	95.9	110	102	400	105.5	125	113	410
										2EL04502525	18.8	1	52.1	161.2	175	162	400	170.8	175	173	410
										2EL04505025	37.6	2	104.3	181.9	200	181	400	191.5	200	193	410
										2EL04507525	56.3	2	156.2	193.8	200	209	400	203.4	225	220	410
	230-3-60	27.7	178.5	27.7	178.5	2.3	5.7	6.7	8.7	None	-	-	-	96.3	110	103	401	105.0	125	113	410
										2EL04502525	23.0	1	57.7	168.5	175	169	401	177.2	200	179	410
										2EL04505025	45.9	2	115.2	191.5	200	190	401	200.2	225	200	410
										2EL04507525	68.9	2	172.9	204.3	225	227	401	214.8	225	237	410
	460-3-60	11.5	103	11.5	103	1.3	2.9	3.4	4.3	None	-	-	-	43.7	50	47	230	48.0	50	52	235
										2EL04502546	23.0	1	28.8	79.8	80	80	230	84.1	90	85	235
										2EL04505046	45.9	2	57.6	91.2	100	91	230	95.5	100	96	235
										2EL04507546	68.9	2	86.4	102.2	110	114	230	107.5	110	119	235
	575-3-60	9.0	78	9.0	78	1.0	3.1	2.7	3.5	None	-	-	-	35.9	40	39	177	39.4	45	43	180
										2EL04502558	23.0	1	23.0	64.7	70	65	177	68.2	70	69	180
										2EL04505058	45.9	2	46.0	73.9	80	74	177	77.4	80	78	180
										2EL04507558	68.9	2	69.1	83.6	90	93	177	88.0	90	97	180

Table 12: 2 stage standard static with mod power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD20(20)	208-3-60	28.5	255	33.3	255	2.0	10.8	6.7	9.6	None	-	-	-	113.1	125	121	563	122.7	150	132	572
										2EL04502525	18.8	1	52.1	178.4	200	181	563	188.0	200	192	572
										2EL04505025	37.6	2	104.3	199.1	200	200	563	208.7	225	211	572
										2EL04507525	56.3	2	156.2	211.0	225	220	563	220.6	225	231	572
	230-3-60	28.5	255	33.3	255	2.3	10.0	6.7	8.7	None	-	-	-	112.7	125	120	563	121.4	150	130	572
										2EL04502525	23.0	1	57.7	184.9	200	186	563	193.6	200	196	572
										2EL04505025	45.9	2	115.2	207.9	225	208	563	216.6	225	218	572
										2EL04507525	68.9	2	172.9	220.7	225	237	563	229.4	250	247	572
	460-3-60	13.5	123	15.4	140	1.3	4.9	3.4	4.3	None	-	-	-	54.6	70	58	291	58.9	70	63	296
										2EL04502546	23.0	1	28.8	90.7	100	92	291	95.0	100	96	296
										2EL04505046	45.9	2	57.6	102.1	110	102	291	106.4	110	107	296
										2EL04507546	68.9	2	86.4	108.6	110	118	291	112.9	125	123	296
	575-3-60	10.7	93.7	12.9	107.6	1.0	4.4	2.7	3.5	None	-	-	-	45.0	50	48	225	48.5	60	52	228
										2EL04502558	23.0	1	23.0	73.9	80	75	225	77.4	80	79	228
										2EL04505058	45.9	2	46.0	83.0	90	83	225	86.5	90	87	228
										2EL04507558	68.9	2	69.1	88.2	90	96	225	91.7	100	100	228
WD25(25)	208-3-60	40.8	270	40.8	270	2.1	10.8	6.7	9.6	None	-	-	-	135.2	175	144	595	144.8	175	155	605
										2EL04502525	18.8	1	52.1	200.5	225	204	595	210.1	225	215	605
										2EL04505025	37.6	2	104.3	221.2	225	223	595	230.8	250	234	605
										2EL04507525	56.3	2	156.2	233.1	250	234	595	242.7	250	245	605
	230-3-60	40.8	270	40.8	270	2.1	10.0	6.7	8.7	None	-	-	-	133.6	150	142	593	142.3	175	152	602
										2EL04502525	23.0	1	57.7	205.7	225	208	593	214.4	225	218	602
										2EL04505025	45.9	2	115.2	228.7	250	229	593	237.4	250	239	602
										2EL04507525	68.9	2	172.9	241.6	250	241	593	250.3	300	251	602
	460-3-60	19.4	147	19.4	147	1.1	4.9	3.4	4.3	None	-	-	-	64.7	80	69	322	69.0	80	74	326
										2EL04502546	23.0	1	28.8	100.8	110	102	322	105.1	110	107	326
										2EL04505046	45.9	2	57.6	112.2	125	112	322	116.5	125	117	326
										2EL04507546	68.9	2	86.4	118.7	125	118	322	123.0	125	123	326
	575-3-60	13.7	109	13.7	109	0.9	4.4	2.7	3.5	None	-	-	-	48.6	60	52	240	52.1	60	56	244
										2EL04502558	23.0	1	23.0	77.5	80	79	240	81.0	90	83	244
										2EL04505058	45.9	2	46.0	86.6	90	87	240	90.1	100	91	244
										2EL04507558	68.9	2	69.1	91.8	100	96	240	95.3	100	100	244

2 stage high static without power exhaust

Table 13: 2 stage high static without power exhaust

Size (tons)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (Amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA				Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD13 (12.5)	208-3-60	22.4	166.2	22.4	190	2.1	7.4	9.6	None	-	-	-	69.4	90	73	381	79.0	100	84	391
									2EL04502525	18.8	1	52.1	134.7	150	133	381	144.3	150	144	391
									2EL04505025	37.6	2	104.3	155.4	175	152	381	165.0	175	164	391
									2EL04507525	56.3	2	156.2	174.7	200	197	381	186.7	200	208	391
	230-3-60	22.4	166.2	22.4	190	2.1	6.9	8.7	None	-	-	-	68.4	90	72	380	77.1	90	82	389
									2EL04502525	23.0	1	57.7	140.5	150	139	380	149.2	150	149	389
									2EL04505025	45.9	2	115.2	163.5	175	160	380	172.2	175	170	389
									2EL04507525	68.9	2	172.9	190.2	200	215	380	201.0	225	225	389
	460-3-60	8.8	74.6	11.5	100	1.1	3.4	4.3	None	-	-	-	32.2	40	34	187	36.5	45	39	191
									2EL04502546	23.0	1	28.8	68.3	70	67	187	72.6	80	72	191
									2EL04505046	45.9	2	57.6	80.5	90	77	187	85.9	90	82	191
									2EL04507546	68.9	2	86.4	94.9	100	107	187	100.3	110	112	191
	575-3-60	7.2	54	9.0	72	0.9	3.2	3.5	None	-	-	-	26.7	35	28	136	30.2	35	32	140
									2EL04502558	23.0	1	23.0	55.5	60	55	136	59.0	60	59	140
									2EL04505058	45.9	2	46.0	65.5	70	63	136	69.9	70	67	140
									2EL04507558	68.9	2	69.1	77.1	80	87	136	81.5	90	91	140
WD15 (15)	208-3-60	27.7	178.5	27.7	178.5	2.0	7.4	9.6	None	-	-	-	85.1	110	90	389	94.7	110	101	399
									2EL04502525	18.8	1	52.1	150.4	175	150	389	160.0	175	161	399
									2EL04505025	37.6	2	104.3	171.1	175	169	389	180.7	200	180	399
									2EL04507525	56.3	2	156.2	183.0	200	197	389	192.6	200	208	399
	230-3-60	27.7	178.5	27.7	178.5	2.3	6.9	8.7	None	-	-	-	85.3	110	90	390	94.0	110	100	399
									2EL04502525	23.0	1	57.7	157.5	175	157	390	166.2	175	167	399
									2EL04505025	45.9	2	115.2	180.5	200	178	390	189.2	200	188	399
									2EL04507525	68.9	2	172.9	193.3	200	215	390	202.0	225	225	399
	460-3-60	11.5	103	11.5	103	1.3	3.4	4.3	None	-	-	-	37.9	45	40	224	42.2	50	45	229
									2EL04502546	23.0	1	28.8	74.0	80	73	224	78.3	80	78	229
									2EL04505046	45.9	2	57.6	85.4	90	84	224	89.7	90	89	229
									2EL04507546	68.9	2	86.4	94.9	100	107	224	100.3	110	112	229
	575-3-60	9.0	78	9.0	78	1.0	3.2	3.5	None	-	-	-	30.7	35	33	172	34.2	40	37	175
									2EL04502558	23.0	1	23.0	59.5	60	59	172	63.0	70	63	175
									2EL04505058	45.9	2	46.0	68.7	70	68	172	72.2	80	72	175
									2EL04507558	68.9	2	69.1	77.1	80	87	172	81.5	90	91	175

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Table 13: 2 stage high static without power exhaust

Size (tons)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (Amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA				Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD20 (20)	208-3-60	28.5	255	33.3	255	2.0	12.0	9.6	None	-	-	-	102.1	125	108	552	111.7	125	119	561
									2EL04502525	18.8	1	52.1	167.4	175	168	552	177.0	200	179	561
									2EL04505025	37.6	2	104.3	188.1	200	187	552	197.7	200	198	561
									2EL04507525	56.3	2	156.2	200.0	200	207	552	209.6	225	218	561
	230-3-60	28.5	255	33.3	255	2.3	10.9	8.7	None	-	-	-	101.1	125	107	551	109.8	125	117	560
									2EL04502525	23.0	1	57.7	173.3	175	173	551	182.0	200	183	560
									2EL04505025	45.9	2	115.2	196.3	200	194	551	205.0	225	204	560
									2EL04507525	68.9	2	172.9	209.1	225	224	551	217.8	225	234	560
	460-3-60	13.5	123	15.4	140	1.3	5.7	4.3	None	-	-	-	49.4	60	52	286	53.7	60	57	290
									2EL04502546	23.0	1	28.8	85.5	90	86	286	89.8	90	91	290
									2EL04505046	45.9	2	57.6	96.9	100	96	286	101.2	110	101	290
									2EL04507546	68.9	2	86.4	103.4	110	112	286	107.7	110	117	290
	575-3-60	10.7	93.7	12.9	107.6	1.0	4.8	3.5	None	-	-	-	40.4	50	43	220	43.9	50	47	224
									2EL04502558	23.0	1	23.0	69.3	70	69	220	72.8	80	73	224
									2EL04505058	45.9	2	46.0	78.4	80	78	220	81.9	90	82	224
									2EL04507558	68.9	2	69.1	83.6	90	91	220	87.1	90	95	224
WD25 (25)	208-3-60	40.8	270	40.8	270	2.1	12.0	9.6	None	-	-	-	124.2	150	131	584	133.8	150	142	594
									2EL04502525	18.8	1	52.1	189.5	200	191	584	199.1	225	202	594
									2EL04505025	37.6	2	104.3	210.2	225	210	584	219.8	225	221	594
									2EL04507525	56.3	2	156.2	222.1	225	221	584	231.7	250	232	594
	230-3-60	40.8	270	40.8	270	2.1	10.9	8.7	None	-	-	-	122.0	150	129	582	130.7	150	139	591
									2EL04502525	23.0	1	57.7	194.1	200	195	582	202.8	225	205	591
									2EL04505025	45.9	2	115.2	217.1	225	216	582	225.8	250	226	591
									2EL04507525	68.9	2	172.9	230.0	250	228	582	238.7	250	238	591
	460-3-60	19.4	147	19.4	147	1.1	5.7	4.3	None	-	-	-	59.5	70	63	317	63.8	80	68	321
									2EL04502546	23.0	1	28.8	95.6	100	96	317	99.9	110	101	321
									2EL04505046	45.9	2	57.6	107.0	110	106	317	111.3	125	111	321
									2EL04507546	68.9	2	86.4	113.5	125	112	317	117.8	125	117	321
	575-3-60	13.7	109	13.7	109	0.9	4.8	3.5	None	-	-	-	44.0	50	47	236	47.5	60	51	239
									2EL04502558	23.0	1	23.0	72.9	80	73	236	76.4	80	77	239
									2EL04505058	45.9	2	46.0	82.0	90	82	236	85.5	90	86	239
									2EL04507558	68.9	2	69.1	87.2	90	91	236	90.7	100	95	239

2 stage high static with on/off power exhaust

Table 14: 2 stage high static with on/off power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD13 (12.5)	208-3-60	22.4	166.2	22.4	190	2.1	7.4	5.0	9.6	None	-	-	-	79.4	100	85	402	89.0	110	96	412
										2EL04502525	18.8	1	52.1	144.7	150	145	402	154.3	175	156	412
										2EL04505025	37.6	2	104.3	165.4	175	164	402	175.0	175	175	412
										2EL04507525	56.3	2	156.2	187.2	200	208	402	199.2	200	219	412
	230-3-60	22.4	166.2	22.4	190	2.1	6.9	5.0	8.7	None	-	-	-	78.4	100	84	401	87.1	100	94	410
										2EL04502525	23.0	1	57.7	150.5	175	150	401	159.2	175	160	410
										2EL04505025	45.9	2	115.2	173.8	175	171	401	184.6	200	181	410
										2EL04507525	68.9	2	172.9	202.7	225	226	401	213.5	225	236	410
	460-3-60	8.8	74.6	11.5	100	1.1	3.4	2.2	4.3	None	-	-	-	36.6	45	39	196	40.9	50	44	201
										2EL04502546	23.0	1	28.8	72.7	80	72	196	77.0	80	77	201
										2EL04505046	45.9	2	57.6	86.0	90	82	196	91.4	100	87	201
										2EL04507546	68.9	2	86.4	100.4	110	112	196	105.8	110	117	201
	575-3-60	7.2	54	9.0	72	0.9	3.2	1.5	3.5	None	-	-	-	29.7	35	32	143	33.2	40	36	146
										2EL04502558	23.0	1	23.0	58.5	60	58	143	62.0	70	62	146
										2EL04505058	45.9	2	46.0	69.3	70	66	143	73.6	80	70	146
										2EL04507558	68.9	2	69.1	80.9	90	90	143	85.2	90	94	146
WD15 (15)	208-3-60	27.7	178.5	27.7	178.5	2.0	7.4	5.0	9.6	None	-	-	-	95.1	110	101	410	104.7	125	112	420
										2EL04502525	18.8	1	52.1	160.4	175	161	410	170.0	175	173	420
										2EL04505025	37.6	2	104.3	181.1	200	181	410	190.7	200	192	420
										2EL04507525	56.3	2	156.2	193.0	200	208	410	202.6	225	219	420
	230-3-60	27.7	178.5	27.7	178.5	2.3	6.9	5.0	8.7	None	-	-	-	95.3	110	102	411	104.0	125	112	420
										2EL04502525	23.0	1	57.7	167.5	175	168	411	176.2	200	178	420
										2EL04505025	45.9	2	115.2	190.5	200	189	411	199.2	200	199	420
										2EL04507525	68.9	2	172.9	203.3	225	226	411	213.5	225	236	420
	460-3-60	11.5	103	11.5	103	1.3	3.4	2.2	4.3	None	-	-	-	42.3	50	45	234	46.6	50	50	238
										2EL04502546	23.0	1	28.8	78.4	80	79	234	82.7	90	83	238
										2EL04505046	45.9	2	57.6	89.8	90	89	234	94.1	100	94	238
										2EL04507546	68.9	2	86.4	100.4	110	112	234	105.8	110	117	238
	575-3-60	9.0	78	9.0	78	1.0	3.2	1.5	3.5	None	-	-	-	33.7	40	36	178	37.2	45	40	182
										2EL04502558	23.0	1	23.0	62.5	70	63	178	66.0	70	67	182
										2EL04505058	45.9	2	46.0	71.7	80	71	178	75.2	80	75	182
										2EL04507558	68.9	2	69.1	80.9	90	90	178	85.2	90	94	182

Table 14: 2 stage high static with on/off power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD20 (20)	208-3-60	28.5	255	33.3	255	2.0	12.0	5.0	9.6	None	-	-	-	112.1	125	119	573	121.7	150	130	582
										2EL04502525	18.8	1	52.1	177.4	200	179	573	187.0	200	190	582
										2EL04505025	37.6	2	104.3	198.1	200	198	573	207.7	225	210	582
										2EL04507525	56.3	2	156.2	210.0	225	219	573	219.6	225	230	582
	230-3-60	28.5	255	33.3	255	2.3	10.9	5.0	8.7	None	-	-	-	111.1	125	118	572	119.8	150	128	581
										2EL04502525	23.0	1	57.7	183.3	200	185	572	192.0	200	195	581
										2EL04505025	45.9	2	115.2	206.3	225	206	572	215.0	225	216	581
										2EL04507525	68.9	2	172.9	219.1	225	235	572	227.8	250	245	581
	460-3-60	13.5	123	15.4	140	1.3	5.7	2.2	4.3	None	-	-	-	53.8	60	57	295	58.1	70	62	300
										2EL04502546	23.0	1	28.8	89.9	90	91	295	94.2	100	96	300
										2EL04505046	45.9	2	57.6	101.3	110	101	295	105.6	110	106	300
										2EL04507546	68.9	2	86.4	107.8	110	118	295	112.1	125	122	300
	575-3-60	10.7	93.7	12.9	107.6	1.0	4.8	1.5	3.5	None	-	-	-	43.4	50	46	227	46.9	50	50	230
										2EL04502558	23.0	1	23.0	72.3	80	73	227	75.8	80	77	230
										2EL04505058	45.9	2	46.0	81.4	90	81	227	84.9	90	85	230
										2EL04507558	68.9	2	69.1	86.6	90	94	227	90.1	100	98	230
WD13 (25)	208-3-60	40.8	270	40.8	270	2.1	12.0	5.0	9.6	None	-	-	-	134.2	175	143	605	143.8	175	154	615
										2EL04502525	18.8	1	52.1	199.5	225	203	605	209.1	225	214	615
										2EL04505025	37.6	2	104.3	220.2	225	222	605	229.8	250	233	615
										2EL04507525	56.3	2	156.2	232.1	250	233	605	241.7	250	244	615
	230-3-60	40.8	270	40.8	270	2.1	10.9	5.0	8.7	None	-	-	-	132.0	150	140	603	140.7	175	150	612
										2EL04502525	23.0	1	57.7	204.1	225	206	603	212.8	225	216	612
										2EL04505025	45.9	2	115.2	227.1	250	228	603	235.8	250	238	612
										2EL04507525	68.9	2	172.9	240.0	250	239	603	248.7	250	249	612
	460-3-60	19.4	147	19.4	147	1.1	5.7	2.2	4.3	None	-	-	-	63.9	80	68	326	68.2	80	73	330
										2EL04502546	23.0	1	28.8	100.0	110	101	326	104.3	110	106	330
										2EL04505046	45.9	2	57.6	111.4	125	112	326	115.7	125	116	330
										2EL04507546	68.9	2	86.4	117.9	125	118	326	122.2	125	122	330
	575-3-60	13.7	109	13.7	109	0.9	4.8	1.5	3.5	None	-	-	-	47.0	60	50	242	50.5	60	54	246
										2EL04502558	23.0	1	23.0	75.9	80	77	242	79.4	80	81	246
										2EL04505058	45.9	2	46.0	85.0	90	85	242	88.5	90	89	246
										2EL04507558	68.9	2	69.1	90.2	100	94	242	93.7	100	98	246

2 stage high static with mod power exhaust

Table 15: 2 stage high static with mod power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD13 (12.5)	208-3-60	22.4	166.2	22.4	190	2.1	7.4	6.7	9.6	None	-	-	-	82.8	100	89	394	92.4	110	100	404
										2EL04502525	18.8	1	52.1	148.1	150	149	394	157.7	175	160	404
										2EL04505025	37.6	2	104.3	168.8	175	168	394	178.4	200	179	404
										2EL04507525	56.3	2	156.2	191.5	200	212	394	203.5	225	223	404
	230-3-60	22.4	166.2	22.4	190	2.1	6.9	6.7	8.7	None	-	-	-	81.8	100	88	393	90.5	110	98	402
										2EL04502525	23.0	1	57.7	153.9	175	154	393	162.6	175	164	402
										2EL04505025	45.9	2	115.2	178.0	200	175	393	188.9	200	185	402
										2EL04507525	68.9	2	172.9	206.9	225	230	393	217.8	225	240	402
	460-3-60	8.8	74.6	11.5	100	1.1	3.4	3.4	4.3	None	-	-	-	39.0	50	42	194	43.3	50	46	198
										2EL04502546	23.0	1	28.8	75.1	80	75	194	79.4	80	80	198
										2EL04505046	45.9	2	57.6	89.0	90	85	194	94.4	100	90	198
										2EL04507546	68.9	2	86.4	103.4	110	115	194	108.8	110	120	198
	575-3-60	7.2	54	9.0	72	0.9	3.2	2.7	3.5	None	-	-	-	32.1	40	34	142	35.6	40	38	145
										2EL04502558	23.0	1	23.0	60.9	70	61	142	64.4	70	65	145
										2EL04505058	45.9	2	46.0	72.3	80	69	142	76.6	80	73	145
										2EL04507558	68.9	2	69.1	83.9	90	93	142	88.2	90	97	145
WD15 (15)	208-3-60	27.7	178.5	27.7	178.5	2.0	7.4	6.7	9.6	None	-	-	-	98.5	125	105	403	108.1	125	116	412
										2EL04502525	18.8	1	52.1	163.8	175	165	403	173.4	175	176	412
										2EL04505025	37.6	2	104.3	184.5	200	184	403	194.1	200	196	412
										2EL04507525	56.3	2	156.2	196.4	200	212	403	206.0	225	223	412
	230-3-60	27.7	178.5	27.7	178.5	2.3	6.9	6.7	8.7	None	-	-	-	98.7	125	106	404	107.4	125	116	413
										2EL04502525	23.0	1	57.7	170.9	175	172	404	179.6	200	182	413
										2EL04505025	45.9	2	115.2	193.9	200	193	404	202.6	225	203	413
										2EL04507525	68.9	2	172.9	206.9	225	230	404	217.8	225	240	413
	460-3-60	11.5	103	11.5	103	1.3	3.4	3.4	4.3	None	-	-	-	44.7	50	48	231	49.0	60	53	236
										2EL04502546	23.0	1	28.8	80.8	90	81	231	85.1	90	86	236
										2EL04505046	45.9	2	57.6	92.2	100	92	231	96.5	100	97	236
										2EL04507546	68.9	2	86.4	103.4	110	115	231	108.8	110	120	236
	575-3-60	9.0	78	9.0	78	1.0	3.2	2.7	3.5	None	-	-	-	36.1	45	39	177	39.6	45	43	181
										2EL04502558	23.0	1	23.0	64.9	70	65	177	68.4	70	69	181
										2EL04505058	45.9	2	46.0	74.1	80	74	177	77.6	80	78	181
										2EL04507558	68.9	2	69.1	83.9	90	93	177	88.2	90	97	181

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Table 15: 2 stage high static with mod power exhaust

Size (ton)	Nominal unit voltage	Comp. 1		Comp. 2		OD fan motors (each) FLA	Supply blower motor FLA	Pwr Exh motor FLA	120 V trans FLA	Electric heat option field installed kit				MCA (amps)	Max f/b size (amps)	Min disconnect rating		MCA w/ 120 V trans (amps)	Max f/b size w/ 120 V trans (amps)	Min disconnect rating 120 V	
		RLA	LRA	RLA	LRA					Model	kW	Stages	Amps			FLA	LRA			FLA	LRA
WD20 (20)	208-3-60	28.5	255	33.3	255	2.0	12.0	6.7	9.6	None	-	-	-	115.5	125	123	565	125.1	150	134	575
										2EL04502525	18.8	1	52.1	180.8	200	183	565	190.4	200	194	575
										2EL04505025	37.6	2	104.3	201.5	225	202	565	211.1	225	213	575
										2EL04507525	56.3	2	156.2	213.4	225	223	565	223.0	225	234	575
	230-3-60	28.5	255	33.3	255	2.3	10.9	6.7	8.7	None	-	-	-	114.5	125	122	565	123.2	150	132	574
										2EL04502525	23.0	1	57.7	186.7	200	188	565	195.4	200	198	574
										2EL04505025	45.9	2	115.2	209.7	225	210	565	218.4	225	220	574
										2EL04507525	68.9	2	172.9	222.5	225	239	565	231.2	250	249	574
	460-3-60	13.5	123	15.4	140	1.3	5.7	3.4	4.3	None	-	-	-	56.2	70	60	293	60.5	70	65	297
										2EL04502546	23.0	1	28.8	92.3	100	93	293	96.6	100	98	297
										2EL04505046	45.9	2	57.6	103.7	110	104	293	108.0	110	109	297
										2EL04507546	68.9	2	86.4	110.2	125	120	293	114.5	125	125	297
	575-3-60	10.7	93.7	12.9	107.6	1.0	4.8	2.7	3.5	None	-	-	-	45.8	50	49	226	49.3	60	53	229
										2EL04502558	23.0	1	23.0	74.7	80	76	226	78.2	80	80	229
										2EL04505058	45.9	2	46.0	83.8	90	84	226	87.3	90	88	229
										2EL04507558	68.9	2	69.1	89.0	90	97	226	92.5	100	101	229
WD25 (25)	208-3-60	40.8	270	40.8	270	2.1	12.0	6.7	9.6	None	-	-	-	137.6	175	147	597	147.2	175	158	607
										2EL04502525	18.8	1	52.1	202.9	225	207	597	212.5	225	218	607
										2EL04505025	37.6	2	104.3	223.6	225	226	597	233.2	250	237	607
										2EL04507525	56.3	2	156.2	235.5	250	237	597	245.1	250	248	607
	230-3-60	40.8	270	40.8	270	2.1	10.9	6.7	8.7	None	-	-	-	135.4	175	144	595	144.1	175	154	604
										2EL04502525	23.0	1	57.7	207.5	225	210	595	216.2	225	220	604
										2EL04505025	45.9	2	115.2	230.5	250	231	595	239.2	250	242	604
										2EL04507525	68.9	2	172.9	243.4	250	243	595	252.1	300	253	604
	460-3-60	19.4	147	19.4	147	1.1	5.7	3.4	4.3	None	-	-	-	66.3	80	71	323	70.6	90	76	328
										2EL04502546	23.0	1	28.8	102.4	110	104	323	106.7	110	109	328
										2EL04505046	45.9	2	57.6	113.8	125	114	323	118.1	125	119	328
										2EL04507546	68.9	2	86.4	120.3	125	120	323	124.6	125	125	328
	575-3-60	13.7	109	13.7	109	0.9	4.8	2.7	3.5	None	-	-	-	49.4	60	53	241	52.9	60	57	245
										2EL04502558	23.0	1	23.0	78.3	80	79	241	81.8	90	83	245
										2EL04505058	45.9	2	46.0	87.4	90	88	241	90.9	100	92	245
										2EL04507558	68.9	2	69.1	92.6	100	97	241	96.1	100	101	245

Physical data

Table 16: WD13 to WD25 physical data

Component	Models											
	WD13			WD15			WD20			WD25		
Nominal tonnage	**12.5**			**15**			**20**			**25**		
AHRI cooling performance												
Gross capacity @ AHRI A point (Btu)	150,500			187,500			248,300			291,500		
AHRI net capacity (Btu)	146,000			180,000			240,000			278,000		
EER	10.9[1] / 10.7[2]			10.9[1] / 10.7[2]			10.9[1] / 10.7[2]			10.2[1] / 10.0[2]		
IEER with Intellispeed	14.2[1] / 14.0[2]			13.8[1] / 13.6[2]			13.8[1] / 13.6[2]			13.6[1] / 13.4[2]		
CFM	5550			6750			7350			9250		
System power (kW)	13.64			16.82			22.43			27.80		
Refrigerant type	R–454B			R–454B			R–454B			R–454B		
Refrigerant charge (lb–oz)												
System 1	17–00			17–08			24–00			25–04		
System 2	15–12			18–08			25–04			25–08		
AHRI heating performance – heat pump operation												
47°F capacity rating (Btu)	136,000			172,000			218,000			278,000		
System power (kW) / COP	12.06/3.3			15.26/3.3			19.94/3.2			25.43/3.2		
17°F capacity rating (Btu)	80,000			100,000			126,000			162,000		
System power (kW) / COP	11.42/2.05			14.28/2.05			18.00/2.05			23.13/2.05		
AHRI heating performance – gas heat operation												
Heating model	N(S)1	N(S)3	T3	N(S)1	N(S)3	T3	N(S)1	N(S)3	T3	N(S)1	N(S)3	T3
Heating type	Stg. low	Stg. high	Mod. high	Stg. low	Stg. high	Mod. high	Stg. low	Stg. High	Mod. high	Stg. low	Stg. high	Mod. high
1st stage heat input (K Btu)	165	300	140	165	300	140	165	300	140	165	300	140
2nd stage heat input (K Btu)	220	400	400	220	400	400	220	400	400	220	400	400
1st stage heat output (K Btu)	134	243	113	134	243	113	134	243	113	134	243	113
2nd stage heat output (K Btu)	178	324	324	178	324	324	178	324	324	178	324	324
AFUE %	–	–	–	–	–	–	–	–	–	–	–	–
Steady state efficiency (%)	81	81	81	81	81	81	81	81	81	81	81	81
No. burners	5	9	9	5	9	9	5	9	9	5	9	9
No. stages / turn down	2	2	2.85 to 1	2	2	2.85 to 1	2	2	2.85 to 1	2	2	2.85 to 1
Temperature rise range (°F)	15–45	25–70	25–70	15–45	25–70	25–70	10–45	25–65	25–65	10–45	25–65	25–65
Gas piping connection (Inch)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Dimensions (in.)												
Length	129–3/4			143–13/16			143–13/16			160–1/16		
Width	88–3/4			88–3/4			88–3/4			88–3/4		
Height	48–9/16			48–9/16			56–9/16			56–9/16		
Operating weight (lb.)	1,750			1,985			2,270			2,450		
Compressors	2 Stage			2 Stage			2 Stage			2 Stage		
Type	Scroll			Scroll			Scroll			Scroll		
Quantity	2			2			2			2		
Unit capacity steps (%)	50/100			50/100			50/100			50/100		
Condenser coil data												
Coil type	RTPF			RTPF			RTPF			RTPF		
Face area (sq. ft.)	45.8			57.8			68.4			78.0		
Rows	2			2			2			2		
Fins per in.	18			18			18			18		
Tube diameter (in.)	0.375			0.375			0.375			0.375		
Circuitry type	Separate coil			Separate coil			Separate coil			Separate coil		
Refrigerant control	TXV			TXV			TXV			TXV		
Evaporator coil data												
Face area (sq. ft.)	22.0			22.0			26.0			26.0		
Rows	3			3			4			4		
Fins per in.	13			17			13			13		

Table 16: WD13 to WD25 physical data

Component	Models							
	WD13		WD15		WD20		WD25	
Tube diameter (in.)	0.375		0.375		0.375		0.375	
Circuitry type	Intertwined		Intertwined		Intertwined		Intertwined	
Refrigerant control	TXV		TXV		TXV		TXV	
Condenser fan data								
Quantity	2		4		4		4	
Fan diameter (in.)	30		24		24		30	
Type	Prop		Prop		Prop		Prop	
Drive type	Direct		Direct		Direct		Direct	
Number of motors	2		4		4		4	
Motor HP each	0.5		0.5		0.5		0.5	
RPM	850		1,085		1,085		850	
CFM	9,600		14,100		15,100		18,000	
Direct drive evaporator fan data								
Type	Plenum		Plenum		Plenum		Plenum	
No. used/diameter (in.)	2/17.9		2/17.9		2/17.9		2/17.9	
Drive type/no. speeds	Direct / variable		Direct / variable		Direct / variable		Direct / variable	
Motor HP each	2.69	3.24	2.69	3.24	4.82	5.66	4.82	5.66
Max Motor RPM	2,300	2,450	2,300	2,450	2,800	2,950	2,800	2,950
Filters								
Quantity – Size	6 – (20 x 25 x 2)[3,4,5]		6 – (20 x 25 x 2)[3,4,5]		9 – (16 x 25 x 2)[3,4,5]		9 – (16 x 25 x 2)[3,4,5]	
	6 – (20 x 25 x 4)[6]		6 – (20 x 25 x 4)[6]		9 – (16 x 25 x 4)[6]		9 – (16 x 25 x 4)[6]	

Note:

1. Heat pump unit only or heat pump with electric heat
2. Heat pump with gas heat (dual fuel)
3. 2 in. throwaway, standard, MERV (Minimum Efficiency Reporting Value)
4. Optional 2 in. pleated, MERV 8
5. Optional 2 in. pleated, MERV 13
6. Optional 4 in. pleated, MERV 13

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 UL 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. See Table 17 for minimum CFM limitations. See the electrical data tables for electrical data.

Table 17: Minimum airflow requirements

Minimum Airflow Requirements (up to 3 in. external static)			
Unit tons	Heater kW		
	75	50	25
12.5	4500	3750	3750
15	4500	4500	4500
20	6000	6000	6000
25	7500	7500	7500

All Electric Heat units shipped are from the factory equipped with a Refrigeration Detection System (RDS) to protect the unit from any damage caused by refrigerant leakage.

A Refrigeration Detection System (RDS) must be installed on all units with a field-installed Electric Heat before unit operation.

Optional gas heat

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

This unit is shipped from the factory for use with natural gas at elevations up to 2000 ft (610 m) above sea level. The unit may be field-converted for use with propane gas and/or elevations above 2000 ft with a listed conversion kit.

ⓘ **Note:** Modulating furnaces, gas model T3, are **not certified** for use with propane and cannot be converted.

ⓘ **Note:** Installation of this furnace at altitudes above 2000 ft (610 m) must be in accordance with local codes, or in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 or National Standard of Canada, Natural Gas and Propane Installation Code, CSA B149.1.

Table 18: Gas application data

Unit		Input MBH	Output MBH	Temp. rise °F
Size, ton	Heat size			
(12.5)	(N,S)1	220	178	15-45
	(N,S)3	400	324	25-70
	T3	400	324	25-70

Table 18: Gas application data

Unit		Input MBH	Output MBH	Temp. rise °F
Size, ton	Heat size			
(15)	(N,S)1	220	178	15-45
	(N,S)3	400	324	25-70
	T3	400	324	25-70
(20)	(N,S)1	220	178	10-45
	(N,S)3	400	324	25-65
	T3	400	324	25-65
(25)	(N,S)1	220	178	10-45
	(N,S)3	400	324	25-65
	T3	400	324	25-65

Table 19: Gas heat allowable air flow

Unit		Supply air CFM	
Size, ton	Heat size	Min	Max
(12.5)	(N,S)1	3750	6250
	(N,S)3	4300	6250
	T3	3500	6250
(15)	(N,S)1	3750	7500
	(N,S)3	4300	7500
	T3	3500	7500
(20)	(N,S)1	3750	10000
	(N,S)3	4700	10000
	T3	4500	10000
(25)	(N,S)1	3750	12000
	(N,S)3	4700	12000
	T3	4500	12000

Gas piping

Proper 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.

Follow the *National Fuel Gas Code Z223.1 (in U.S.A.)* or the current *Gas Installation Codes CSA-B149.1 (in Canada)* in all cases unless they are superseded by local codes or gas utility requirements.

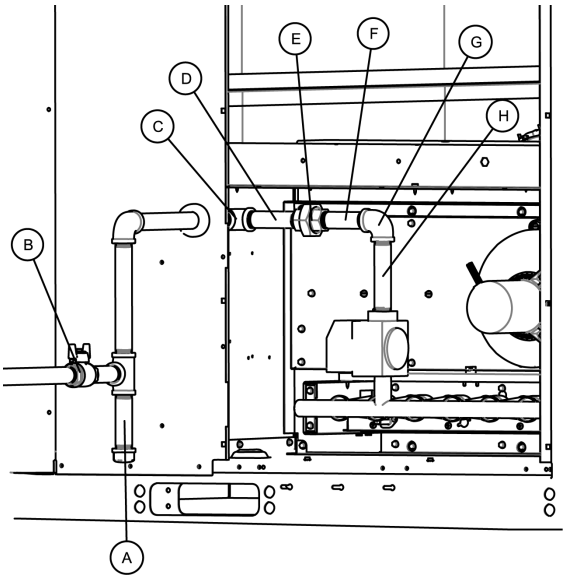
See Table 20. The heating value of the gas may vary by locality. You must check the value with the local gas utility.

ⓘ **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. The supply line should not be sized smaller than the entrance fitting size.

The following figures show the gas piping.

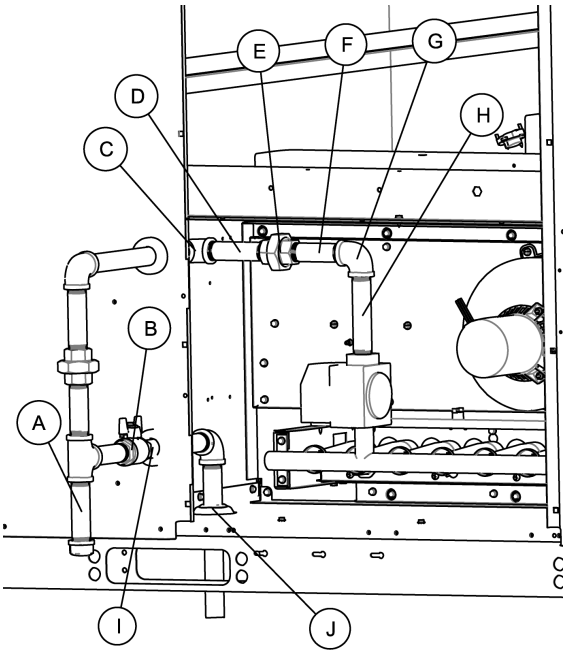
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Figure 74: Side entry gas piping



Item	Description
A	Sediment trap
B	Manual shut-off valve
C	90° elbow
D	4 ½ in. long nipple
E	Union
F	4 in. long nipple
G	90° elbow
H	5 ½ in. long nipple

Figure 75: Bottom entry gas piping



Item	Description
A	Sediment trap
B	Manual shut-off valve
C	90° elbow
D	4 ½ in. long nipple
E	Union
F	4 in. long nipple
G	90° elbow
H	5 ½ in. long nipple
I	Extra piping grommet (included)
J	Caulk between pipe and base pan hole to provide watertight seal

Table 20: 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.

Gas connection

The gas supply line can be routed within the space and roof curb with the exit through the unit's basepan. See the Physical dimensions for the gas piping inlet location. Typical supply piping arrangements are shown in the Gas piping section. All pipe nipples, fittings, and the gas cock are field supplied.

Apply the following gas piping recommendations.

- You must install a drip leg or sediment trap 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.
- If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector which has previously serviced another gas appliance.

⚠ WARNING

Natural gas may contain some propane. Propane 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. 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. Hammer on the outside of the pipe and blow out loose particles. Before initial start-up, make sure that all gas lines external to the unit are purged of air.
- The gas supply must be a separate line and installed in accordance with all safety codes as prescribed under Limitations.
- You must install a 1/8 in. NPT plugged tapping, accessible for test gage connection, immediately upstream of the gas supply connection to the unit.
- After the gas connections are complete, 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 greater than 1/2 psig (3.5 kPa). Pressures greater than 1/2 psig (3.5 kPa) cause gas valve damage resulting in a hazardous condition. If the gas valve is subjected to a pressure greater than 1/2 psig (3.5 kPa), it 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 (3.5 kPa).

⚠ 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 can be converted in the field for use with propane gas with an accessory kit.

ⓘ **Note:** Modulating gas furnaces, gas model T3, are **not certified** for use with propane and cannot be converted.

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 correct inlet pressure at the unit under full load. Refer to the conversion kit instructions for the minimum and maximum supply inlet pressure. Maintaining proper gas pressure depends on three main factors:

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

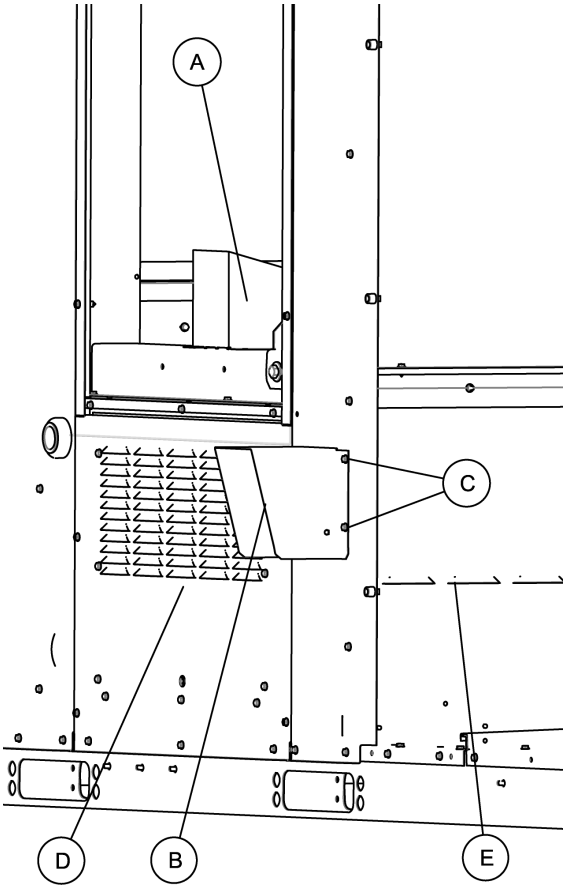
Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available

from most regulator manufacturers and propane gas suppliers.

Combustion air intake and flue exhaust

Combustion air intake louvers are incorporated into the heating compartment right outside wall and access panel. The flue exhaust is discharged out the front of the unit. Remove the factory shipping label and the four screws that cover the exhaust opening. The flue exhaust hood is shipped in the blower compartment and must be installed over the discharge opening, as shown in Figure 76, using these four screws. If necessary, you can install a flue exhaust extension accessory in place of the hood.

Figure 76: Flue exhaust hood detail



Item	Description
A	Flue exhaust hood (shipping location)
B	Flue exhaust hood (field-installed location)
C	Mounting screws, 4 x (included)
D	Combustion air intake louvers
E	Combustion air intake louvers

Options and accessories

The following sections describe options and accessories.

Electric heat

Electric heaters are available as factory-installed options or field-installed accessories. 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 a single point power supply and refrigerant detection system.

Motorized outdoor damper

The motorized outdoor damper can be a factory-installed option or a field-installed accessory. Field-installed motorized outdoor damper accessories include complete instructions for installation.

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, set both setpoints 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 the following:

- 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 is always 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) is turned on. The second stage compressor (C2) is 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%.

When a compressor output is turned ON, the economizer dampers continue to modulate to control the supply air temperature to the economizer setpoint.

At no time is a compressor output 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 minimum position and the compressor outputs are de-energized 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
- 24 VAC from EX-FAN to energize the exhaust fan on the economizer expansion module

Operation

Operation details include the following items:

- 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

Modulating power exhaust

Set points and related data

The set points and related data include the following items:

- Power exhaust fan type (ExFType) variable frequency fan
- Building pressure setpoint (Bldg-Sp)
- Building pressure reading (Bldg-Pres)

Inputs

The input for modulating power exhaust is: 0 to 5 VDC from building pressure sensor to terminal Bldg-Pres.

Outputs

The outputs include the following items:

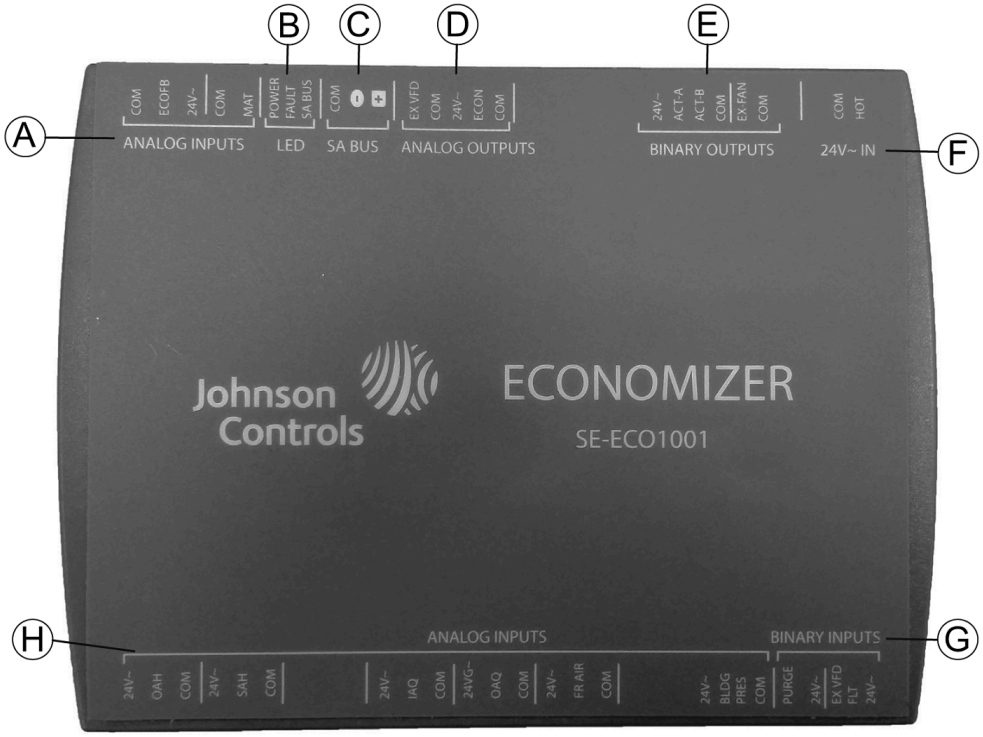
- 2 to 10 VDC from EX VFD for exhaust discharge damper modulation.
- 24 VAC from EX-FAN to energize exhaust fan.

Operation

If the building pressure is above the building pressure setpoint, the exhaust output (EX VFD) increases. If the building pressure is below the building pressure set point, the exhaust output (EX VFD) decreases. The EX-FAN binary output energizes when the EX VFD analog output is greater than 2.16 VDC. The EX-FAN binary output de-energizes when the EX VFD analog output is less than or equal to 2.16 VDC. The rate of change of the analog output is determined by the deviation from the set point and the length of time away from set point.

Smart Equipment economizer board

Figure 77: SE-ECO1001 economizer controller



The following tables describe the details of the economizer board. See the previous figure for connection locations.

Table 21: Smart Equipment economizer board - analog inputs

Location	Board label	Cover label	Description	Function and comments
A	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	The EconDampPos parameter reports input status (0-100%). Used to meet California 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	The 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		

Table 21: Smart Equipment economizer board - analog inputs

Location	Board label	Cover label	Description	Function and comments
H	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
	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

Table 22: Smart Equipment economizer board - LED details

Location	Board label	Cover label	Description	Function and comments
B	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) 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

Table 23: Smart Equipment economizer board - SA bus details

Location	Board label	Cover label	Description	Function and comments
[1]C[1]	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 and 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 V to 3.5 V reading to C; at least 0.25 V 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 and 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 V to 3.5 V reading to C; at least 0.25 V 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 and diagnostics board

1 When wiring the unit and other devices using the SA Bus and FC Bus, see Cable type for FC buses and SA buses in order of preference.

Table 24: Smart Equipment economizer board - analog outputs

Location	Board label	Cover label	Description	Function and comments
D	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

Table 25: Smart Equipment economizer board - binary outputs

Location	Board label	Cover label	Description	Function and comments
E	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

Table 26: Smart Equipment economizer board - 24 V~ IN connections

Location	Board label	Cover label	Description	Function and comments
F	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.

Table 27: Smart Equipment economizer board - binary inputs

Location	Board label	Cover label	Description	Function and comments
G	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%.
		24 V~	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.
		24 V~	24 VAC hot supplied for the power exhaust variable frequency drive fault contact	Connects through circuit trace to 24V~ IN pin HOT

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 can 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 setpoint (demand control ventilation setpoint) setting 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 (wall mount) - part no. 2AQ04700724
- Optional CO_2 sensor kit (unit mount) - part no. 2AQ04700624

Phasing

All units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the incorrect 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 proper 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

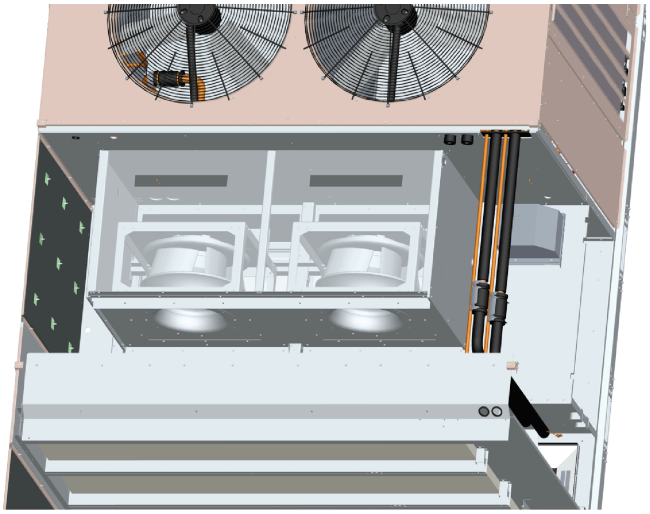
Check for proper supply air blower rotation. If the blower is rotating backwards, the line voltage at the unit point of power connection is misphased. See Phasing.

Direct drive plenum fan

Factory-installed direct drive plenum fan (DDPF) with electronically commutated motor (ECM)

The DDPF delivers precise speed control through an integrated controller and enhanced efficiency via IntelliSpeed operation. This design simplifies commissioning and enables seamless operation through the Standard Smart Equipment control board.

The blower enclosure features backward-curved twin plenum blowers directly driven by ECM motors, eliminating transmission losses. All tonnage options are available with direct-drive motor configurations for both standard and high-static applications. The DDPF supports a wide range of static pressures up to 3 in. W.C. ESP and is mounted on a robust enclosure with properly balanced blowers for quieter operation.



LDA0293-A

Table 28: Motor selection

Size (ton)	Static	HP (each)	Max BHP
WD13 (12.5)	Standard	2.69	4.84
	High	3.24	5.83
WD15 (15)	Standard	2.69	4.84
	High	3.24	5.83
WD20 (20)	Standard	4.82	8.67
	High	5.66	10.19
WD25 (25)	Standard	4.82	8.67
	High	5.66	10.19

CFM static pressure and power-altitude and temperature corrections

Use the following information to assist in the application of the product at altitudes at or exceeding 1,000 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.

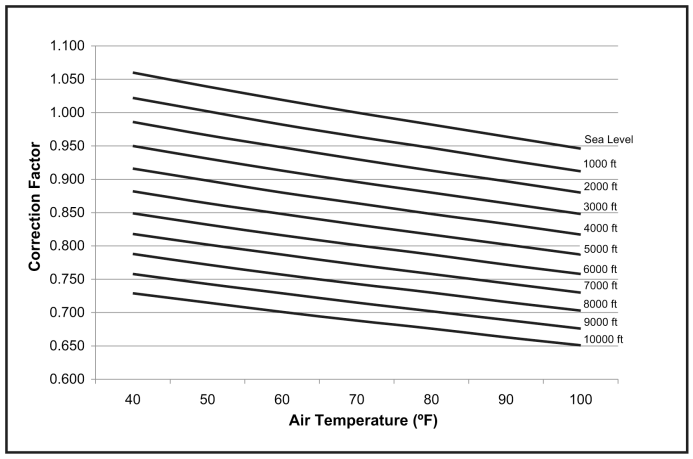
In order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

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, since 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 the following table and figure.

Table 29: Altitude or temperature correction factors

Air temp.	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 78: Altitude/temperature correction factors



Use the following examples 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 1

At an elevation of 5,000 ft. the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, you must use the supply air limitations table to determine the static pressure and bhp. Since no temperature data is given, we will assume an air temperature of 70°F. The airflow performance table 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 feet 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 2

As in the previous example, 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. You need to correct this value for elevation.

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

Supply fan RPM determination using multiplier

1. Determine the required airflow.
2. Calculate or measure the amount of external static pressure.
3. With the operating point determined from the previous step, locate this point on the appropriate supply air blower performance table.
4. From the supply air blower performance table, note the corresponding RPM, multiplier and watts.
5. Review the watts compared to the motor option available and select an appropriate motor.

   Note: If the exact point is not listed, you may need linear interpolation.

Program the identified multiplier from the previous step into the SSE controller using the following procedure in the SSE menu: Details → Fan → Setup → SupplyFanMultiplier (Default: 1, Range = 0.1 to 1)

Example:

1. Required airflow: 4500 CFM
2. External static pressure: 1 iwg
3. Using the supply air blower performance table below, the following operating point was located at 1685 RPM, 0.62 multiplier and 1284 watts.
4. The 1284 watts does not exceed the maximum watts rating of standard static motor option, so standard static motor is eligible for selection.
5. 1685 RPM falls within the operating range of the 2.69 HP drive.
6. Programming the above identified multiplier 0.62 into the SSE controller achieves the required 1685 RPM.

Table 30: WD13 bottom duct application

Available external static pressure - IWG																									
Air Flow (CFM)	0.2			0.4			0.6			0.8			1			1.2			1.4			1.6		
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts
	Standard static 1011-2300 RPM																							
3250	0.19	1011	464	0.28	1142	481	0.35	1253	563	0.41	1350	704	0.46	1438	870	0.51	1517	1052	0.56	1590	1259	0.60	1659	1467
3500	0.24	1081	472	0.32	1204	505	0.38	1309	605	0.44	1403	754	0.49	1487	936	0.54	1564	1127	0.58	1635	1334	0.63	1702	1549
3750	0.28	1148	481	0.35	1264	539	0.42	1365	663	0.47	1455	820	0.52	1537	1011	0.57	1611	1210	0.61	1680	1417	0.65	1745	1641
4000	0.32	1214	505	0.39	1324	588	0.45	1421	729	0.50	1507	895	0.55	1586	1094	0.60	1658	1301	0.64	1726	1516	0.68	1789	1740
4250	0.36	1278	539	0.43	1383	646	0.49	1476	804	0.54	1560	986	0.59	1636	1185	0.63	1706	1400	0.67	1771	1624	0.71	1833	1848
4500	0.40	1342	597	0.46	1442	721	0.52	1531	887	0.57	1612	1077	0.62	1685	1284	0.66	1754	1508	0.70	1817	1732	0.74	1878	1972
4750	0.44	1404	655	0.50	1500	804	0.55	1586	986	0.60	1664	1185	0.65	1735	1400	0.69	1802	1624	0.73	1864	1856	0.76	1923	2096
5000	0.48	1466	737	0.54	1559	895	0.59	1641	1085	0.64	1717	1301	0.68	1786	1516	0.72	1850	1748	0.76	1911	1989	0.79	1968	2237
5250	0.52	1528	829	0.57	1617	1003	0.62	1696	1201	0.67	1769	1417	0.71	1837	1649	0.75	1899	1889	0.79	1958	2138	0.82	2014	2386
5500	0.56	1589	928	0.61	1675	1119	0.66	1752	1326	0.70	1822	1558	0.74	1888	1790	0.78	1949	2038	0.82	2006	2287	0.85	2061	2544
5750	0.59	1650	1036	0.65	1733	1243	0.69	1807	1467	0.74	1876	1699	0.77	1939	1947	0.81	1999	2196	0.85	2055	2453	0.88	2108	2709
6000	0.63	1711	1160	0.68	1791	1375	0.73	1863	1607	0.77	1929	1856	0.81	1991	2105	0.84	2049	2361	0.88	2104	2627	0.91	2156	2892
6250	0.67	1772	1293	0.72	1849	1525	0.76	1919	1765	0.80	1984	2013	0.84	2044	2279	0.88	2100	2544	0.91	2153	2809	0.94	2204	3082

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

BHC Residential & Light Commercial LLC

Airflow performance

Table 31: WD13 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	0.2			0.4			0.6			0.8			1			1.2			1.4			1.6		
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts
	Standard static 1011-2300 RPM																							
3250	0.19	1011	464	0.28	1142	481	0.35	1253	563	0.41	1350	704	0.46	1438	870	0.51	1517	1052	0.56	1590	1259	0.60	1659	1467
3500	0.24	1081	472	0.32	1204	505	0.38	1309	605	0.44	1403	754	0.49	1487	936	0.54	1564	1127	0.58	1635	1334	0.63	1702	1549
3750	0.28	1148	481	0.35	1264	539	0.42	1365	663	0.47	1455	820	0.52	1537	1011	0.57	1611	1210	0.61	1680	1417	0.65	1745	1641
4000	0.32	1214	505	0.39	1324	588	0.45	1421	729	0.50	1507	895	0.55	1586	1094	0.60	1658	1301	0.64	1726	1516	0.68	1789	1740
4250	0.36	1278	539	0.43	1383	646	0.49	1476	804	0.54	1560	986	0.59	1636	1185	0.63	1706	1400	0.67	1771	1624	0.71	1833	1848
4500	0.40	1342	597	0.46	1442	721	0.52	1531	887	0.57	1612	1077	0.62	1685	1284	0.66	1754	1508	0.70	1817	1732	0.74	1878	1972
4750	0.44	1404	655	0.50	1500	804	0.55	1586	986	0.60	1664	1185	0.65	1735	1400	0.69	1802	1624	0.73	1864	1856	0.76	1923	2096
5000	0.48	1466	737	0.54	1559	895	0.59	1641	1085	0.64	1717	1301	0.68	1786	1516	0.72	1850	1748	0.76	1911	1989	0.79	1968	2237
5250	0.52	1528	829	0.57	1617	1003	0.62	1696	1201	0.67	1769	1417	0.71	1837	1649	0.75	1899	1889	0.79	1958	2138	0.82	2014	2386
5500	0.56	1589	928	0.61	1675	1119	0.66	1752	1326	0.70	1822	1558	0.74	1888	1790	0.78	1949	2038	0.82	2006	2287	0.85	2061	2544
5750	0.59	1650	1036	0.65	1733	1243	0.69	1807	1467	0.74	1876	1699	0.77	1939	1947	0.81	1999	2196	0.85	2055	2453	0.88	2108	2709
6000	0.63	1711	1160	0.68	1791	1375	0.73	1863	1607	0.77	1929	1856	0.81	1991	2105	0.84	2049	2361	0.88	2104	2627	0.91	2156	2892
6250	0.67	1772	1293	0.72	1849	1525	0.76	1919	1765	0.80	1984	2013	0.84	2044	2279	0.88	2100	2544	0.91	2153	2809	0.94	2204	3082

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Table 32: WD13 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	1.8			2			2.2			2.4			2.6			2.8			3					
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts			
	Standard static 1011-2300 RPM																							
3250	0.64	1724	1690	0.68	1787	1914	0.72	1847	2146	0.75	1906	2386	0.79	1965	2627	0.83	2024	2883	0.86	2083	3140			
3500	0.67	1766	1773	0.70	1827	2005	0.74	1886	2237	0.78	1944	2477	0.81	2002	2726	0.85	2059	2983	0.89	2117	3248			
3750	0.69	1807	1864	0.73	1867	2105	0.77	1925	2337	0.80	1982	2585	0.84	2039	2834	0.87	2095	3099	0.91	2152	3364			
4000	0.72	1850	1972	0.76	1908	2212	0.79	1965	2453	0.83	2021	2701	0.86	2076	2958	0.90	2132	3223	0.93	2188	3488			
4250	0.75	1892	2088	0.78	1949	2328	0.82	2005	2577	0.85	2060	2825	0.88	2114	3091	0.92	2169	3356	0.95	2224	3629			
4500	0.77	1935	2212	0.81	1991	2453	0.84	2046	2709	0.87	2099	2966	0.91	2153	3223	0.94	2207	3497	0.98	2261	3778			
4750	0.80	1979	2345	0.83	2034	2593	0.87	2087	2850	0.90	2140	3107	0.93	2192	3381	0.97	2245	3654	1.00	2298	3936			
5000	0.83	2023	2486	0.86	2077	2743	0.89	2129	2999	0.93	2181	3265	0.96	2232	3538	0.99	2284	3820	0.94	2337	4110			
5250	0.86	2068	2643	0.89	2120	2900	0.92	2172	3165	0.95	2223	3439	0.98	2273	3712	0.93	2324	3994	0.96	2376	4292			
5500	0.88	2114	2801	0.92	2165	3066	0.95	2215	3339	0.98	2265	3613	0.92	2315	3894	0.95	2365	4184	0.98	2416	4482			
5750	0.91	2160	2983	0.94	2210	3248	0.97	2259	3521	1.00	2300	3803	0.95	2357	4093	0.97	2406	4383	1.00	2450	4690			
6000	0.94	2206	3165	0.97	2255	3439	1.00	2300	3720	0.94	2352	4002	0.97	2400	4300	1.00	2448	4598	—	—	—			
6250	0.97	2254	3356	1.00	2300	3637	0.94	2349	3927	0.97	2396	4217	1.00	2443	4516	—	—	—	—	—	—			
							High static 1011-2450 RPM																	

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Table 33: WD15 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	0.2			0.4			0.6			0.8			1			1.2			1.4			1.6		
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts
	Standard static 1211-2300 RPM																							
3900	0.32	1211	464	0.38	1312	563	0.44	1403	696	0.49	1487	870	0.54	1565	1052	0.59	1638	1259	0.63	1708	1467	0.67	1774	1699
4200	0.36	1279	514	0.42	1374	638	0.48	1462	787	0.53	1542	961	0.57	1618	1160	0.62	1689	1367	0.66	1756	1583	0.70	1821	1823
4500	0.41	1350	588	0.46	1441	721	0.52	1525	887	0.56	1602	1077	0.61	1675	1284	0.65	1744	1500	0.69	1809	1715	0.73	1872	1964
4800	0.45	1425	671	0.51	1511	820	0.56	1591	1003	0.60	1665	1201	0.65	1735	1417	0.69	1802	1641	0.73	1865	1864	0.77	1926	2121
5100	0.50	1500	762	0.55	1582	936	0.60	1659	1127	0.64	1730	1342	0.69	1798	1566	0.73	1862	1798	0.76	1923	2022	0.80	1983	2287
5400	0.55	1576	878	0.60	1654	1069	0.64	1727	1276	0.69	1796	1500	0.73	1861	1732	0.76	1923	1972	0.80	1983	2204	0.84	2040	2477
5700	0.60	1652	1011	0.64	1727	1218	0.69	1797	1433	0.73	1863	1665	0.77	1926	1906	0.80	1986	2163	0.84	2043	2395	0.87	2099	2676
6000	0.64	1727	1160	0.69	1799	1375	0.73	1866	1607	0.77	1930	1856	0.81	1990	2105	0.84	2049	2361	0.88	2105	2602	0.91	2159	2900
6300	0.69	1802	1326	0.73	1871	1558	0.77	1935	1798	0.81	1997	2055	0.85	2056	2312	0.88	2112	2577	0.92	2166	2825	0.95	2219	3132
6600	0.74	1876	1508	0.78	1942	1757	0.82	2005	2005	0.85	2064	2270	0.89	2121	2535	0.92	2175	2817	0.96	2228	3066	0.99	2280	3381
6900	0.78	1949	1715	0.82	2013	1964	0.86	2074	2229	0.89	2131	2502	0.93	2186	2776	0.96	2239	3057	0.99	2290	3314	0.94	2340	3646
7200	0.83	2022	1931	0.87	2084	2196	0.90	2142	2469	0.94	2198	2751	0.97	2251	3033	1.00	2300	3323	0.94	2353	3579	0.97	2402	3919
7500	0.87	2095	2163	0.91	2154	2436	0.94	2211	2718	0.98	2265	3008	1.00	2300	3306	0.95	2367	3604	0.98	2415	3861	1.00	2450	4217
																High static 1211—2450 RPM								

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Table 34: WD15 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	1.8			2			2.2			2.4			2.6			2.8			3					
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts			
	Standard static 1211—2300 RPM																							
3900	0.71	1839	1939	0.75	1901	2179	0.79	1962	2428	0.83	2022	2685	0.86	2081	2950	0.90	2140	3223	0.94	2198	3505			
4200	0.74	1884	2063	0.78	1945	2312	0.82	2004	2560	0.85	2063	2825	0.89	2121	3091	0.92	2179	3364	0.96	2236	3654			
4500	0.77	1933	2204	0.81	1992	2461	0.84	2051	2718	0.88	2108	2983	0.92	2165	3256	0.95	2221	3530	0.99	2278	3820			
4800	0.80	1986	2370	0.84	2043	2627	0.88	2100	2892	0.91	2156	3157	0.95	2212	3439	0.98	2267	3720	0.93	2323	4010			
5100	0.84	2040	2544	0.87	2097	2809	0.91	2152	3074	0.94	2207	3356	0.98	2261	3637	0.92	2315	3927	0.95	2370	4226			
5400	0.87	2097	2743	0.91	2151	3008	0.94	2205	3281	0.97	2259	3563	0.92	2312	3853	0.95	2365	4151	0.98	2418	4458			
5700	0.91	2154	2950	0.94	2207	3223	0.98	2260	3505	0.92	2312	3795	0.95	2364	4093	0.98	2416	4391	—	—	—			
6000	0.95	2212	3173	0.98	2264	3455	0.92	2316	3745	0.95	2367	4043	0.98	2417	4342	—	—	—	—	—	—			
6300	0.98	2271	3414	0.93	2322	3704	0.96	2372	4002	0.98	2422	4300	—	—	—	—	—	—	—	—	—			
6600	0.93	2330	3671	0.96	2380	3969	0.99	2429	4267	—	—	—	—	—	—	—	—	—	—	—	—			
6900	0.97	2389	3944	0.99	2438	4242	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
7200	1.00	2449	4226	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
7500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
	High static 1011-2450 RPM																							

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

BHC Residential & Light Commercial LLC

Table 35: WD20 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	0.2			0.4			0.6			0.8			1			1.2			1.4			1.6		
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts
	Standard static 1367-2800 RPM																							
5000	0.32	1367	829	0.36	1456	953	0.40	1539	1102	0.44	1617	1284	0.47	1690	1475	0.50	1759	1690	0.54	1825	1906	0.57	1888	2146
5500	0.37	1484	994	0.41	1567	1143	0.45	1644	1326	0.48	1717	1516	0.52	1786	1732	0.55	1852	1955	0.58	1914	2187	0.61	1974	2436
6000	0.43	1602	1201	0.47	1678	1375	0.50	1751	1574	0.53	1819	1790	0.56	1885	2022	0.59	1947	2254	0.62	2007	2502	0.65	2064	2759
6500	0.49	1720	1450	0.52	1792	1649	0.55	1860	1873	0.58	1924	2105	0.61	1986	2345	0.64	2045	2602	0.67	2102	2859	0.69	2157	3132
7000	0.54	1839	1740	0.57	1906	1964	0.60	1970	2204	0.63	2032	2453	0.66	2090	2718	0.69	2146	2983	0.71	2201	3256	0.74	2253	3538
7500	0.60	1959	2080	0.63	2022	2320	0.66	2082	2577	0.69	2140	2850	0.71	2196	3124	0.74	2250	3405	0.76	2301	3695	0.79	2351	3994
8000	0.66	2078	2453	0.68	2137	2718	0.71	2195	2991	0.74	2250	3281	0.76	2303	3571	0.79	2354	3869	0.81	2403	4176	0.83	2451	4482
8500	0.71	2199	2875	0.74	2255	3165	0.77	2309	3455	0.79	2362	3762	0.82	2412	4068	0.84	2461	4383	0.86	2508	4706	0.88	2554	5029
9000	0.77	2320	3347	0.80	2373	3654	0.82	2425	3969	0.85	2475	4284	0.87	2523	4607	0.89	2570	4938	0.91	2615	5278	0.93	2659	5618
9500	0.82	2412	3861	0.84	2464	4184	0.86	2514	4516	0.89	2562	4855	0.91	2609	5195	0.93	2655	5543	0.95	2699	5891	0.97	2742	6247
10000	0.89	2560	4424	0.91	2609	4764	0.93	2656	5112	0.95	2701	5460	0.97	2745	5825	0.99	2788	6181	0.95	2830	6554	0.96	2871	6918
																			High static 1367-2950 RPM					

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Table 36: WD20 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	1.8			2			2.2			2.4			2.6			2.8			3					
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts			
	Standard static 1367-2800 RPM																							
5000	0.59	1948	2386	0.62	2005	2627	0.65	2060	2883	0.67	2114	3140	0.70	2165	3397	0.72	2215	3662	0.74	2262	3927			
5500	0.63	2031	2685	0.66	2087	2941	0.69	2140	3198	0.71	2191	3472	0.73	2240	3737	0.76	2288	4010	0.78	2335	4284			
6000	0.68	2119	3024	0.70	2172	3289	0.73	2223	3563	0.75	2272	3836	0.77	2320	4118	0.79	2366	4400	0.81	2411	4690			
6500	0.72	2209	3405	0.74	2260	3687	0.77	2309	3969	0.79	2357	4259	0.81	2403	4549	0.83	2448	4839	0.85	2491	5137			
7000	0.76	2303	3828	0.79	2352	4118	0.81	2399	4416	0.83	2445	4714	0.85	2489	5021	0.87	2532	5328	0.89	2574	5634			
7500	0.81	2400	4292	0.83	2446	4598	0.85	2492	4905	0.87	2536	5220	0.89	2579	5535	0.91	2620	5858	0.93	2661	6173			
8000	0.86	2498	4797	0.88	2543	5112	0.90	2586	5435	0.92	2629	5767	0.94	2670	6090	0.96	2710	6421	0.98	2750	6761			
8500	0.90	2599	5352	0.92	2642	5684	0.94	2684	6024	0.96	2725	6363	0.98	2765	6703	1.00	2800	7051	0.95	2842	7399			
9000	0.95	2702	5957	0.97	2743	6305	0.99	2784	6653	0.94	2823	7010	0.96	2862	7366	0.98	2899	7730	0.99	2936	8087			
9500	0.99	2783	6604	0.94	2824	6968	0.96	2864	7333	0.98	2902	7697	0.99	2928	8070	1.00	2950	8443	—	—	—			
10000	0.98	2910	7291	1.00	2939	7672	1.00	2950	8054	—	—	—	—	—	—	—	—	—	—	—	—			
	High static 1367-2950 RPM																							

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Table 37: WD25 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	0.2			0.4			0.6			0.8			1			1.2			1.4			1.6		
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts
	Standard static 1720-2800 RPM																							
6500	0.49	1720	1450	0.52	1792	1649	0.55	1860	1873	0.58	1924	2105	0.61	1986	2345	0.64	2045	2602	0.67	2102	2859	0.69	2157	3132
7000	0.54	1839	1740	0.57	1906	1964	0.60	1970	2204	0.63	2032	2453	0.66	2090	2718	0.69	2146	2983	0.71	2201	3256	0.74	2253	3538
7500	0.60	1959	2080	0.63	2022	2320	0.66	2082	2577	0.69	2140	2850	0.71	2196	3124	0.74	2250	3405	0.76	2301	3695	0.79	2351	3994
8000	0.66	2078	2453	0.68	2137	2718	0.71	2195	2991	0.74	2250	3281	0.76	2303	3571	0.79	2354	3869	0.81	2403	4176	0.83	2451	4482
8500	0.71	2199	2875	0.74	2255	3165	0.77	2309	3455	0.79	2362	3762	0.82	2412	4068	0.84	2461	4383	0.86	2508	4706	0.88	2554	5029
9000	0.77	2320	3347	0.80	2373	3654	0.82	2425	3969	0.85	2475	4284	0.87	2523	4607	0.89	2570	4938	0.91	2615	5278	0.93	2659	5618
9500	0.82	2412	3861	0.84	2464	4184	0.86	2514	4516	0.89	2562	4855	0.91	2609	5195	0.93	2655	5543	0.95	2699	5891	0.97	2742	6247
10000	0.89	2560	4424	0.91	2609	4764	0.93	2656	5112	0.95	2701	5460	0.97	2745	5825	0.99	2788	6181	0.95	2830	6554	0.96	2871	6918
10500	0.94	2680	5029	0.96	2726	5386	0.99	2771	5750	1.01	2815	6123	0.96	2857	6496	0.98	2899	6869	1.00	2939	7258	1.00	2950	7639
11000	1.00	2799	5676	0.95	2844	6048	0.97	2887	6430	0.99	2929	6819	1.00	2950	7109	—	—	—	—	—	—	—	—	—
11500	0.97	2887	6363	0.99	2930	6761	1.00	2950	7159	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12000	1.00	2950	7092	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	High static 1720-2950 RPM																							

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Table 38: WD25 bottom duct application

Available external static pressure - IWG																								
Air Flow (CFM)	1.8			2			2.2			2.4			2.6			2.8			3					
	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts	Supplier fan multiplier	RPM	Watts			
	Standard static 1720-2800 RPM																							
6500	0.72	2209	3405	0.74	2260	3687	0.77	2309	3969	0.79	2357	4259	0.81	2403	4549	0.83	2448	4839	0.85	2491	5137			
7000	0.76	2303	3828	0.79	2352	4118	0.81	2399	4416	0.83	2445	4714	0.85	2489	5021	0.87	2532	5328	0.89	2574	5634			
7500	0.81	2400	4292	0.83	2446	4598	0.85	2492	4905	0.87	2536	5220	0.89	2579	5535	0.91	2620	5858	0.93	2661	6173			
8000	0.86	2498	4797	0.88	2543	5112	0.90	2586	5435	0.92	2629	5767	0.94	2670	6090	0.96	2710	6421	0.98	2750	6761			
8500	0.90	2599	5352	0.92	2642	5684	0.94	2684	6024	0.96	2725	6363	0.98	2765	6703	1.00	2800	7051	0.95	2842	7399			
9000	0.95	2702	5957	0.97	2743	6305	0.99	2784	6653	0.94	2823	7010	0.96	2862	7366	0.98	2899	7730	0.99	2936	8087			
9500	0.99	2783	6604	0.94	2824	6968	0.96	2864	7333	0.98	2902	7697	0.99	2928	8070	1.00	2950	8443	—	—	—			
10000	0.98	2910	7291	1.00	2939	7672	1.00	2950	8054	—	—	—	—	—	—	—	—	—	—	—	—			
10500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
11000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
11500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
12000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
	High static 1720-2950 RPM																							

Note: Blower performance includes highest gas heat exchangers, wet coil and clean standard throwaway filters. See *Static resistance table* for additional applications.

Air balance

CAUTION

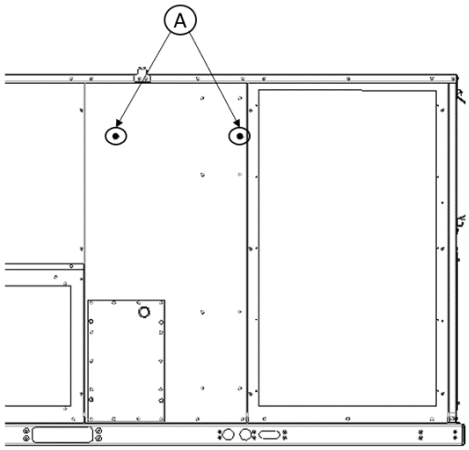
On these units verify that the blower drive is set to maximum output, exhaust dampers are closed, and individual space damper boxes are fully open.

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.

Checking air quantity

1. Remove the dot plugs from the supply and return air access panels on the back side of the unit. See Figure 79.

Figure 79: Dot plug location



Item	Description
A	Dot plug location

2. Insert at least 8 in. of 1/4 in. tubing into each of these holes for sufficient penetration into the air flow 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 to determine the pressure drop across the dry evaporator coil and filters. The moisture on an evaporator coil may vary greatly, measuring the pressure drop across a wet coil under field conditions could be inaccurate. To ensure that the coil is dry, deactivate the compressors while the test is being run.

   Note: De-energize the compressors before taking any test measurements to ensure that the indoor coil is dry.

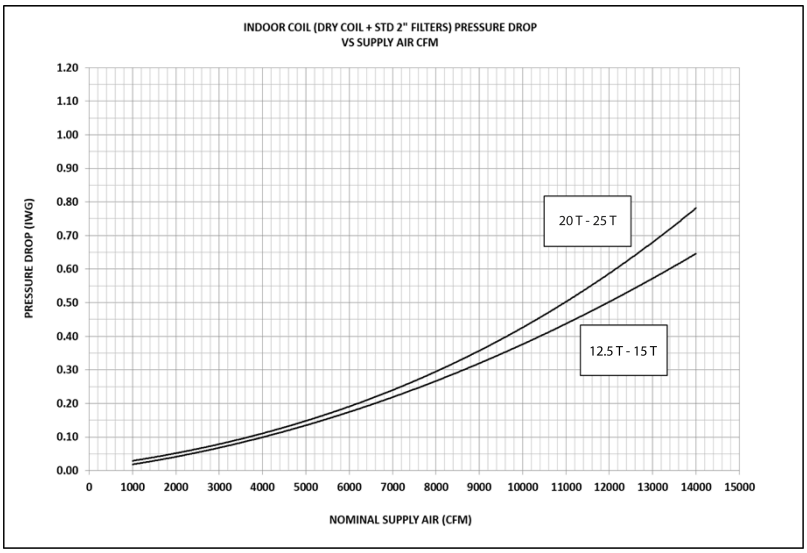
BHC Residential & Light Commercial LLC

4. Use the pressure drop across a dry coil, to determine the actual CFM through the unit from the curve in the following figure.

WARNING

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

Figure 80: Pressure drop



Supply air drive adjustment

The RPM of the supply air blower depends on the required CFM, the unit accessories or options, and the static resistances of both the supply and the return air duct systems. With this information, the RPM for the supply air blower and the supply fan multiplier can be determined from the blower performance data tables.

⚠ CAUTION

You must adjust the direct drive plenum blowers to the specific static and CFM requirements for the application. The direct drive plenum blowers are not set at the factory for any specific static or CFM. You must adjust the blower speed with supply fan multiplier to achieve required static or CFM.

See the *RPM selection* and *airflow performance tables.*

Note the following:

- The supply air CFM must be within the limitations shown in the blower performance tables.
- Select the appropriate multiplier from the airflow performance table.
- Program the identified multiplier in to the SSE controller using the following procedure in the SSE menu: Click **Details > Fan > Setup > SupplyFanMultiplier (Default: 1, Range = 0.1 to 1)**

Table 39: Additional static resistance

Model	CFM	Cooling only	Economizer	Electric heat kW			4 in. MERV 13	2 in. MERV 8	2 in. MERV 13
				25	50	75			
WD13 WD15	3500	0.09	0.01	0	0.01	0.02	0.05	0.05	0.05
	4000	0.09	0.01	0	0.01	0.02	0.05	0.05	0.05
	5000	0.11	0.02	0.03	0.03	0.04	0.06	0.05	0.06
	6000	0.15	0.07	0.04	0.04	0.05	0.07	0.06	0.07
	7000	0.21	0.11	0.05	0.06	0.07	0.09	0.07	0.09
	8000	0.29	0.14	0.07	0.08	0.09	0.12	0.09	0.12
WD20 WD25	6000	0.11	0.07	0.04	0.04	0.05	0.06	0.05	0.06
	7000	0.2	0.11	0.05	0.06	0.07	0.07	0.06	0.07
	8000	0.29	0.16	0.07	0.08	0.09	0.09	0.07	0.09
	9000	0.38	0.16	0.09	0.1	0.11	0.1	0.08	0.1
	10000	0.47	0.19	0.12	0.13	0.14	0.13	0.09	0.13
	11000	0.56	0.23	0.18	0.2	0.22	0.15	0.11	0.15
	12000	0.65	0.28	0.26	0.29	0.32	0.18	0.13	0.18

Note:

- For cooling only models, add the cooling only value to the available static resistance in the respective blower performance tables.
- For models with electric heat, add the electric heat value for your heater size to the available static resistance in the respective blower performance tables.
- If the unit contains an economizer, deduct the corresponding value from the available external static pressure shown in the respective blower performance tables.
- 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 delivers less CFM during full economizer operation.

Operation

The following sections describe the sequences of operation for the units.

Cooling sequence of operation

This section assumes Free Cooling is not available.

1. During cooling, the control energizes the H1 output to turn on the Reversing Valve. The H1 output to the reversing valves SOL1 and SOL2 remains energized between calls for cooling. If a heating call arises, the H1 output turns off.
2. Compressors are controlled by the Y1 through Y2 thermostat inputs. If the Lead/Lag function is turned OFF, a Y1 input energizes the C1 output. Thermostat Input into Y2 energizes the C2 output respectively.
3. The FAN output for indoor fan operation energizes with any cooling output after the Fan On Delay for Cool expires.
4. CN-FAN output energizes when either C1 or C2 is energized
5. A 30 second interstage delay occurs when multiple stages are requested. When the thermostat cooling inputs are lost and the minimum runtime expires, the compressor outputs stage off.

   ⓘ **Note:** A Y2 input without a Y1 input with the Lead/Lag function is turned OFF energizes C1 first and then C2 30 seconds later.

Heat pump cooling

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

ⓘ **Note:** An exception to this is during cooling, the control energizes the H1 output to turn on the reversing valve.

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

Heating sequence of operation

1. For heating, a call for W1 for the first stage of heating or heat pump mode, the UCB drives both the C1, C2 compressor contactor, M4 & M6 outdoor fan contactors ON and de-energizes Sol1 & Sol2 reversing valve into heat pump mode. A "W1" call runs 100% of compression for heating mode.
2. The thermostat makes a circuit between “R” and “W2” for the second stage of heating. The UCB passes the “W2” signal on energizing a contactor (HC1), which energizes the first stage of electric heaters if available.
3. In both cases, when the W1 call is sensed, the indoor air blower is energized following a specified heating delay.
4. 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.
5. If both compressors C1 & C2 are in lock out condition the second stage of the electric heaters will be energized as 16.7 kW for 50 kW option, 37.5 kW for option of 75 kW.

Continuous blower

When the room thermostat fan switch is set to ON, the supply air blower operates continuously.

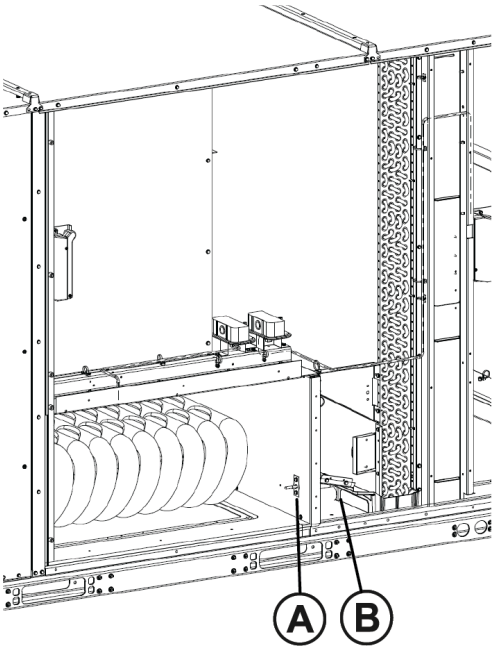
Intermittent blower

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.

Supply air temperature sensor

The SAT sensor is mounted inside the discharge section as shown in Figure 81. The sensor is connected to UCB with harness 306” long. This length is intentionally provided so the sensor can be easily positioned further in the supply duct as needed. The extra length of the harness is bundled and can be accessed from location shown in Figure 81.

Figure 81: SAT location



Callout	Description
A	SAT sensor
B	Extra wire bundle

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.

ⓘ **Note:** The following components are needed to access the control points in the Smart Equipment control.

- Local LCD on the unit control board.

OR

- Mobile Access Portal (MAP) Gateway (Portable).
  - Source 1 P/N S1-JC-MAP1810-OP
  - MAP Gateway Quick Start Guide P/N 24-10737-16
  - MAP Gateway Instruction P/N 24-10737-8

High-pressure limit switch

During compressor operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor and condenser fans, initiate the ASCD (Anti-short cycle delay). If the call for cooling or mechanical heating is still present at the conclusion of the ASCD AND the high-pressure switch has reset, the UCB will re-energize the halted compressor and condenser fans.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor.

Low-pressure limit switch

The low-pressure limit switch is not monitored during the initial 30 seconds of a compressor'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-second monitoring phase, the UCB de-energizes the associated compressor, initiating the ASCD. If the LPS is still open after the ASCD, the compressor is not be energized for 30 seconds. The second and third times that the UCB sees an open LPS will count toward the three occurrences that causes a UCB lock-out.

After the low-pressure switch has been proven (closed during the 30-second 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, initiating the ASCD.

If the call for cooling or mechanical heating is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor and condenser fans.

If a low-pressure switch opens three times in one hour of operation, the UCB locks out the associated compressor.

High discharge temperature limit switch

A bi-metal temperature switch is installed on each discharge line to protect the compressor from excessive temperatures that can potentially occur due to an outdoor coil restriction or condenser fan failure. The temperature switch on each system is wired in series with its corresponding high pressure limit switch.

During compressor operation, if a discharge temperature switch opens, the UCB de-energizes the associated compressor, initiating the ASCD (Anti-short cycle delay). If the call for cooling or heating is still present at the conclusion of the ASCD and the discharge temperature switch has reset, the UCB re-energizes the halted compressor and condenser fans.

If a discharge temperature switch open three times in two hours of operation, the UCB locks-out the associated compressor.

Evaporator low limit

During cooling operation, if the Evaporator Low Limit Sensor (EC1, 2) (located on the suction line at the indoor coil) detects a temperature below 26 °F (default), the UCB de-energizes the associated compressor, initiating the ASCD. If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor. If the UCB detect the evaporator low limit sensor (EC1, 2) falling below 26 °F (default) three times in two hours of operation, the UCB locks out the associated compressor.

Low ambient cooling - intermittent operation

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 the following 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 26°F de-energizes the associated compressor. If the call for cooling is still present at the end of the ASCD and the evaporator temperature sensor (EC1, 2) temperature is above 26°F, the unit resumes operation.

If continuous cooling operation is desired below an outdoor ambient temperature of 45°F, then an optional head pressure control kit is available (see next section).

Low ambient cooling option for continuous operation

The low ambient cooling option allows for mechanical cooling operation down to an ambient temperature as low as -10°F

by maintaining the refrigerant discharge pressure within an acceptable range.

The option includes head pressure controllers for each refrigeration system that modulate the speed of the respective condenser fan motor(s) based on input received from a pressure transducer installed on the refrigerant discharge line.

When the condenser motors start running, they hard start for the length of time dictated by the HARD START dial setting on the controller. The green indicator light on the controller illuminates when the motors are running at full speed.

After the hard start time has elapsed, the motor speed is controlled by the discharge pressure. As the sensed pressure decreases, the output voltage of the controller decreases and the yellow indicator light on the controller illuminates to indicate variable speed operation.

The output voltage may decrease to the cutout speed dictated by the CUT-OUT speed setting of the controller. Upon reaching the CUT-OUT speed setting, the output voltage will be zero volts and the yellow light will turn off.

The controllers maintains a condenser pressure determined by the SET POINT, within a range of +/- 20 psig. If the steady-state discharge pressure cannot be maintained above the set point due to low-load conditions, the respective condenser fan motor(s) turn off during cooling 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 indoor 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 (HPS1,2) to protect against excessive discharge pressures due to a blocked outdoor coil or a condenser motor failure, (opens at 625 ± 10 psig).
3. A low-pressure switch (LPS1,2) to protect against loss of refrigerant charge, (opens at 22 ± 5 psig).
4. A discharge line temperature switch to protect the compressor from excessive discharge temperatures due to a blocked outdoor coil or a condenser motor failure (opens at 255 ± 8°F and resets at 215 ± 11°F).
5. A defrost pressure switch, mounted on the discharge line of the refrigeration system, protects against excessive discharge pressure during defrost mode. It energizes the outdoor fans when the discharge pressure reaches 550 psig and de-energizes them when the pressure drops to 250 psig. This ensures a smooth operation while the unit continues in defrost mode

The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action. The other refrigerant system will continue in operation unless it is affected by the fault as well.

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

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 utilized 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 or heating, by raising or lowering thermostat setting higher than the conditioned space temperature.

Electric heating sequence of operations

The following sequence describes the operation of the electric heat section.

⚠ CAUTION

When the unit is in the heating mode, the reversing valves (SOL1 and SOL2 via H1) are positioned to change the refrigerant flow so the indoor refrigerant coil can provide heating. C1 and C2 will energize the stage 1 and stage 2 compressors (M1 and M2 contactors) as needed to provide heating as needed.

If both compressors cannot satisfy the heating need, the first stage of electric heat is energized via H2.

• If the unit has a 25kW heater the heater contactor (HC1) on electric heat module is energized for a 460V or 575V unit. For 208/230 V units the HC1 and HC2 heater contactors on electric heat module are energized.

• If the unit has a 50kW, or 75 kW heater the heater contactor (HC1) on electric heat module is energized for a 460V or 575V unit. For 208/230 V units the HC1 and HC2 heater contactors on electric heat module are energized.

Electric heat operation errors

Temperature limit - If the UCB senses zero volts from the temperature limit switches, the indoor blower motor is immediately energized. The limit is monitored at all times when the unit is in an operational mode where the electric heaters may be turned on. If the temperature limit opens three times within one hour, it locks on the indoor blower.

ⓘ **Note:** All electric heaters are provided with manual reset backup protection limit. These de-energize 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 manually reset for the heater to be operational again.

Reset

Removes the call for heating by lowering the thermostat setting

Electric heat safety controls

The controller monitors the temperature limit switch of electric heat units. The control circuit includes the following safety controls:

Temperature limit switch

Temperature limit switch (LS1)

This control is located inside the heater compartment and is set to open at 160° F for all the units. This temperature switch reset automatically. The temperature switch operates when a high temperature condition caused by inadequate supply air flow occurs. When the limit of the temperature switch is reached, the controller shuts down the heater and energize the blower.

Temperature limit switch (LS2)

This control is located inside the heater compartment and is set to open at 190° F for all the units. This temperature switch is a manual reset limit. This limit switch de-energize the heaters if the primary limit fails to open or the contactors fail to open in a failure mode. When this temperature limit trips, it will need to be manually reset for the heater to be operational again.

Gas heat sequence of operation

1. When the thermostat calls for the first stage of heating, the low-voltage control circuit from R to W1 is complete. If the outdoor air temperature is above the adjustable balance point (default 40°F) the unit operates in heat pump heating (compressors). If the outdoor air temperature is below the balance point the unit operates in gas heating. For gas heat, a call for heat passes through the UCB to the Ignition Control Board (ICB).
2. When the pre-ignition process is complete the ignition module energizes the gas valve and provides a 24 V input to the MV terminal on the UCB.
3. The FAN ON HEAT DELAY timer starts as soon as 24 V is present on MV terminal. When the timer expires the FAN output for the indoor fan operation energizes. If 24 V is not received on the MV terminal within 6 minutes, an alarm appears and the fan output energizes immediately and remains On until the alarm clears.
4. When the thermostat heat inputs are lost and the 120 second Minimum Heat Run Timers have expired, heating outputs stage off. The FAN OFF HEAT DELAY timer starts when 24 V is removed from the MV terminal. When the timer expires, the FAN output for the indoor fan operation de-energizes.

   ⓘ **Note:** If 24 V is lost on the MV terminal during the same heat cycle, an alarm appears and the fan output energizes and remains on until 24 V is present again on the MV terminal.

   ⓘ **Note:** If 24 V is present on the MV terminal without a call for heat, an alarm triggers and the fan output energizes. If this condition occurs for 6 minutes an alarm triggers, and remains, until the alarm condition is cleared.
5. At any time, if 24 V is lost on the LIMIT terminal, the FAN output for indoor fan operation is energized. If 24 V is lost on the LIMIT input 3 times in 1 hour, an alarm appears and the FAN output is energized. The heating H2 outputs are de-energized until the alarm is cleared.

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.

Additional heating operation for modulating furnaces

Normal heating

The modulating furnace control (MFC) is circuited between the UCB and ignition control board (ICB). The MFC determines the appropriate heat level demand to send to the ICB. When the MFC receives a W1 input (H2 output from the UCB), the MFC maintains the added value of W1 SAT plus W2 SAT ADDED VALUE pin selections. The MFC sends heat level demands to the ICB through a serial communication signal.

Air tempering mode

In air tempering mode, the MFC tries to maintain neutral supply air temperature to the conditioned air space when it senses cold incoming mixed air. This condition is typically created when there is a fresh outside air demand in cold ambient conditions.

If the air tempering pin jumper is set to any value other than OFF, the MFC initiates furnace operation if the mixed air temperature (MAT) sensor input reading is 3°F below the selected value. The MFC then adjusts the heat demand level to control the supply air temperature (SAT) to the selected value.

To operate Air Tempering, air proving switch (APS) input must be on, W1/W2 heat call from the UCB must be off, and all compressor inputs must have been off for 10 minutes.

If the MFC has been in tempering mode (heating) for 10 minutes and the SAT reading is 5°F or more above the air tempering selected value, heating is ended. If all conditions for Air Tempering are still met, it re-initiates after a 10 minute minimum off delay.

Two-stage gas heat ignition control board function

Ignition control board on standby

The Ignition Control Board (ICB) has all outputs de-energized and monitors the thermostat and flame sense. The ICB resets ignition trial and flame loss counters. The ICB begins a call for heat when W1 is energized at the Unit Control Board (UCB).

Pressure switch proving

The ICB energizes the induced draft motor and waits for the low pressure switch to close. When the low pressure switch closes, the control begins a Pre-purge period. If the call for heat is lost, the control de-energizes the inducer without post-purge and returns to standby.

If the low pressure switch does not close within 10 seconds of inducer energizing, the control flashes 2 on the LED. If the pressure switch does not close within 5 minutes of inducer energizing, the control shuts off the inducer for 30 seconds, then energizes the inducer for another 5 minutes try to close the pressure switch. This cycle continues indefinitely until either the pressure switch is proved closed, or the call for heat ends.

Pre-purge

The ICB monitors the low pressure switch and ensures it remains closed during pre-purge. If the pressure switch opens, the control returns to pressure switch proving mode. The control waits for a 15 seconds pre-purge period, and then begins the ignition trial.

Ignition trial period

When the ICB energizes the main gas valve, the second stage gas valve and the spark outputs for a 10 second ignition trial. The control de-energizes the spark when a flame is sensed and enters a flame stabilization period.

If a flame is not established within the ignition trial period, the control de-energizes the spark and gas valve and checks for the maximum number of ignition trials. The ICB has a maximum number of three ignition trials. If the control has attempted the maximum number of ignition trials in the same call for heat without flame, the control locks out flashing 4 on the LED. If the control has attempted less than maximum ignition trials, it begins an inter-purge period before attempting another ignition trial.

If the call for heat is lost during an ignition trial period, the control immediately de-energizes spark and gas. The control runs the inducer motor through a post purge period before de-energizing.

If the pressure switch is lost during an ignition trial period, the control immediately de-energizes spark and gas. The control begins pressure switch proving before an inter-purge and re-ignition attempt.

Flame stabilization period

If a flame is detected during the Ignition Trial Period, the ICB then enters the flame stabilization period. If a flame is not detected in 2 seconds, the main valve is de-energized and a retry operation begins. The flame stabilization period lasts 10 seconds. A flame detection must be lost for 2 seconds during flame stabilization for the main valve to be de-energized. When the flame stabilization period has ended, a loss of

flame detection for 3/4 seconds results in the main valve being de-energized.

If a flame is lost during the flame stabilization period, the control counts it as a flame loss and retries ignition or locks out as described in Low heat section.

Main burner operation

High heat warm-up

Upon receiving W1 (H2 from the UCB board), the gas heat ignition control turns on high heat for the normal 1 minute warmup and flame stabilization period.

High heat

After the high heat warm-up, the gas heat ignition control remains in high heat until the heat call ends. The ICB keeps the main gas valve and induced draft motor energized while continuously monitoring the call for heat, low pressure switch and flame status.

If the call for heat (W1) is lost, the control de-energizes the gas valve and begins post purge.

If the low pressure switch opens, the control deenergizes the gas valve and begins pressure switch proving mode.

If the flame is lost, the control de-energizes the gas valve within 2 seconds and counts the flame loss. If a flame is lost more than five times within the same call for heat, the control locks out flashing 5 on the LED. If the flame is lost less than five times, the control attempts reignition after a 30 second inter-purge period

Post purge

The ICB runs the induced draft motor for a 5 second post-purge period, then de-energizes the inducer. If a call for heat occurs during post-purge, the control finishes the post-purge, drops inducer out to re-prove open pressure switch before continuing with the heat cycle.

Lockout

While in lockout, the ICB keeps the main gas valve and induced draft motor de-energized.

Lockouts due to failed ignition or flame losses may be reset by removing the call for heat (W1) for more than 1 seconds, but less than 20 seconds, or by removing power from the control for over 1/4 seconds. The control automatically resets lockout after 60 minutes.

Lockouts due to detected internal control faults reset after 60 minutes or power interruption.

High temperature limit switch

If the high temperature limit switch is open the control runs the inducer, de-energizes the gas valve, and flashes 6 on the LED. When the high temperature switch closes, the control restarts the ignition sequence beginning with pre-purge.

If the high temperature limit is open for more than 6 minutes continuously during a call for heat, it is assumed that the main blower has failed and the control enters a hard lockout and flashes a 9 on the LED. During the hard lockout, the control continues to run the inducer as long as the limit switch is open. If the limit switch closes again in this hard lockout condition, the inducer runs a post-purge and then shuts off. The control remains locked out until power is removed and does not reset automatically.

Roll-out switch

If the roll-out switch opens for more than 1/4 seconds, the ICB runs the inducer for a post-purge period, immediately de-energizes the gas valve, and flashes 7 on the LED.

If the roll-out switch closes, the control remains locked out until power is removed or W is removed. Roll-out switch lockout does not reset automatically.

Power interruptions

Power interruptions less than 0.80 seconds do not cause the ICB to interrupt the heat sequence. Power interruptions over 1/4 seconds cause the control reset lockout and ignition trial counters. Power interruptions of any duration do not cause lockout or any operation requiring manual intervention.

Flame present with gas off

If a flame is sensed for longer than 2 seconds during a period when the gas valve should be closed, the ICB enters lockout. The control turns on the inducer blower while the flame is present.

Welded gas valve relay response

If either or both Main and Second Stage Gas valve outputs are sensed to be off for more than 1 second when commanded to be **ON**, the ICB shuts off all outputs and enters lockout.

If the Main valve output is sensed to be energized for more than 1 second when commanded to be off, the control de-energizes the induced draft motor (if flame is not present) to attempt to open the pressure switch to de-energize the gas valve. If the main gas valve is still sensed as energized after the inducer has been off for 15 seconds, the control re-energizes the inducer to attempt to vent the unburned gas. In either case, the control locks out.

Modulating gas heat ignition control board function

Ignition control board on standby

The ignition control board (ICB) has all outputs de-energized and monitors the communications port and flame sense. The ICB resets ignition trial and flame loss counters. The ICB begins a call for heat when a communicated demand level is requested from the modulating furnace control (MFC) on the RS485 port.

Call for heat

The ICB checks to see if the pressure switch is open and the RPM sensor input indicates that the inducer motor is not currently active. If the pressure switch is closed or the RPM sensor detects that the inducer is active, the ICB flashes 3 on

the LED and waits indefinitely for it to become inactive. When the inducer is sensed as inactive, the ICB begins an air flow proving period. If the call for heat is lost, the ICB goes back to Standby.

Air flow proving

The ICB energizes the induced draft motor and waits for the low pressure switch to close and for the RPM sensor to provide a feedback signal of at least a level of 500 RPM. When the low pressure switch closes and the RPM sensor indicates at least 500 RPM, the control begins a pre-purge period. If the call for heat is lost, the control de-energizes the inducer without post-purge and returns to standby. If the low pressure switch does not close and the RPM sensor does not reach 500 RPM within 10 seconds of the inducer energizing, the control flashes 2 on the LED. If the pressure switch does not close and the RPM sensor does not indicate at least 500 RPM within 5 minutes of inducer energizing, the control shuts off the inducer for 30 seconds, then energizes the inducer for another 5 minutes to try to close the pressure switch and reach 500 RPM. This cycle continues indefinitely until either the airflow is proven, or the call for heat ends.

Pre-purge

The ICB monitors the low pressure switch and RPM sensor to ensure air flow remains present during pre-purge. If the pressure switch opens or the RPM sensor drops under 500 RPM, the control goes back to pressure switch proving mode. The control waits for a 30 second pre-purge period, then begins the ignition trial.

Ignition trial period

The ICB energizes the main gas valve and spark outputs for a 10 second ignition trial. The control de-energizes the spark when flame is sensed and enters a flame stabilization period. If a flame is not established within the ignition trial period, the control de-energizes the spark and gas valves and checks for maximum number of ignition trials.

The ICB has a maximum number of 3 ignition trials. If the control has attempted the maximum number of ignition trials within the same call for heat without flame, the control locks out flashing 4 on the LED. If the control has attempted less than the maximum ignition trials, it begins an inter-purge period before attempting another ignition trial.

If the call for heat is lost during an ignition trial period, the control immediately de-energizes the spark and gas. The control runs the inducer motor through a post purge period before de-energizing.

If the pressure switch is lost during an ignition trial period, the control immediately de-energizes the spark and gas. The control begins pressure switch proving before an inter-purge and re-ignition attempt.

If the rpm sensor indicates a loss of air flow during an ignition trial period, the control de-energizes the spark and gas after the 10 second ignition period. The control begins air flow proving before an inter-purge and re-ignition attempt.

Flame stabilization period

If a flame is detected during the ignition trial period, the ICB then enters the flame stabilization period. If a flame is not detected in 3 seconds (+/-1 second), the main valve is de-energized and a retry operation begins. The flame stabilization period lasts 10 seconds. Flame detection must be lost for 3 seconds (+/-1 second) during flame stabilization for the main valve to be de-energized. When the flame stabilization period has ended, a loss of flame detection within 1 seconds to 2 seconds results in the main valve being de-energized. If flame is lost during the flame stabilization period, the control counts it as a flame loss and retries ignition, or locks out as described in the Steady heat section.

Main burner operation

High heat warm-up

The ICB runs high heat for the first 30 seconds following flame stabilization period regardless of demand. If high heat is not requested at the end of this 30 second period the control reduces the high gas output and steps the inducer to a lower speed requested by the demand level. If high heat is requested the control remains on high heat.

Steady heat

The ICB keeps the main gas valve and induced draft motor energized while continuously monitoring the call for heat, low pressure switch, RPM sensor, and flame status. If the call for heat demand is lost, the control de-energizes the gas valve and begins post purge. If the low pressure switch opens or the inducer motor RPM sensor drops below 500 RPM, the control de-energizes the gas valve and begins pressure switch proving mode. If the flame is lost, the control de-energizes the gas valve within 2 seconds and counts the flame loss. If the flame is lost more than 5 times within the same call for heat, the control locks out flashing 5 on the LED. If the flame is lost less than 5 times, the control attempts re-ignition after a 30 second inter-purge period.

Post purge

The ICB runs the induced draft motor for a 5 second post-purge period, then de-energizes the inducer. If a call for heat occurs during post-purge, the control finishes the post-purge, drops inducer out to re-prove air flow before continuing with the heat cycle.

Lockout

While in lockout, the ICB keeps the main gas valve and induced draft motor de-energized. Lockouts due to failed ignition or flame losses can be reset by removing the call for heat (communicated demand) for more than 1 second, but less than 20 seconds, or by removing power from the control for over 1/4 seconds. The control automatically resets lockout after 60 minutes. Lockouts due to detected internal control faults resets after 60 minutes or power interruption.

High temperature limit switch

Any time the high temperature limit switch is open the ICB runs the inducer, de-energize the gas valve, and flash 6 on the LED. When the high temperature switch closes, the control restarts the ignition sequence beginning with pre-purge. If the high temperature limit is open for more than 6 minutes continuously during a call for heat, it is assumed that the main blower has failed and the control enters a hard lockout and flash a 9 on the LED. During the hard lockout, the control continues to run the inducer as long as the limit switch is open. If the limit switch recloses in this hard lockout condition, the inducer runs a post purge and then shutoff. The control remains locked out until power is removed and does not reset automatically.

Roll-out switch

If the roll-out switch opens for more than 1/4 seconds, the ICB runs the inducer for a post-purge period, immediately de-energizes the gas valve, and flashes 7 on the LED. If the roll-out switch closes, the control remains locked out until the power is removed or the demand is removed. The roll-out switch lockout does not reset automatically.

Power interruptions

Power interruptions less than 80mS do not cause a change in operating mode. Power interruptions more than 100 mS may cause the ICB to interrupt its current operational mode and re-start the operational sequence. Power interruptions of any duration are not to cause lockout or any operation requiring manual intervention to recover.

Flame present with gas off

If a flame is sensed for longer than 2 seconds during a period when the gas valve should be closed, the ICB enters lockout. The control turns on the inducer blower while the flame is present.

Welded gas valve relay response

If the main gas valve output is sensed to be off for more than 1 second when commanded to be on, the ICB shuts off all outputs and enters lockout. If the main valve output is sensed to be energized for more than 1 second when commanded to be off, the control de-energizes the induced draft motor (if flame is not present) to attempt to open the pressure switch to de-energize the gas valve. If the main gas valve is still sensed as energized after the inducer has been off for 10 seconds, the control re-energizes the inducer to attempt to vent the unburned gas. In either case, the control locks out.

Defrost operation

Defrost is initiated by a temperature sensor (CC1 and CC2) located near the bottom of the outdoor coil. When the CC1 or CC2 temperature falls below a threshold value, the reversing valves (SOL1 and SOL2 via H1) are positioned to reverse the refrigerant flow so the refrigerant flows in a direction normally associated with cooling operation. The stage 1 and stage 2 compressors (M1 and M2 contactors) are activated. The hot discharge gas from the compressors will provide heat to the outdoor coil and clear it of frost and ice. The outdoor fans will not be on during a defrost cycle. Once the temperature sensors (CC1 and CC2) have increased above a threshold value, the reversing valves (SOL1 and SOL2 via H1) are positioned to reverse the refrigerant flow so the indoor refrigerant coil can provide heating.

Defrost - time driven

If the temperature sensors C1 and C2 do not drive a defrost within 6 hours from the last defrost cycle, a defrost cycle will automatically initiate to recirculate lubricants.

Defrost initiation

Defrost control implements a temperature differential, demand defrost algorithm. The heat pump is allowed to operate in the heating mode until the combination of outdoor ambient temperature and outdoor coil temperature indicate that defrosting is necessary. The outdoor coil temperature is determined by temperature sensors (CC1, CC2) located on the bottom circuit of each of the outdoor coils.

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 minute timer eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

In defrost mode, the UCB will signal the energizing of both reversing valves and de-energizing all the systems condenser fan motors. The unit's optional electric heat or gas heat first-stage heater is also energized via a 24-volt VAC output terminal labeled H2.

Defrost termination

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

- The outdoor coil temperature sensor reaches 50°F.

or

- 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 trouble shooting purposes, the defrost cycle can be manually initiated by selecting "Test Defrost" in the UCB menu.

Defrost Pressure Switch operation

Each unit is equipped with a defrost pressure switch, mounted on the discharge line of its refrigeration system, during defrost mode, Defrost Pressure Switch detects a discharge pressure rising to 550 psig (preset), the UCB energizes the outdoor fans. This action reduces the discharge pressure and prevents the high-pressure safety device from tripping, allowing the unit to continue operating smoothly in defrost mode. When the discharge pressure drops to 250 psig, the UCB de-energizes the outdoor fans.

If the call for defrost is still present, the UCB continues monitoring the pressure and repeats this cycle as needed to maintain safe operating conditions.

Defrost curve selection

Defrost initiation will occur when either of the outdoor coil temperatures (determined by CC1, CC2) falls below a particular threshold value, which varies depending upon the selected Defrost curve. The relative behavior of the various defrost curves is as follows:

- Above an outdoor ambient temperature of approximately 20°F, defrost initiation would occur the soonest on Curves 4 or 5, followed by Curve 3, then Curve 1 (default) and the latest on Curve 2.
- Below an outdoor ambient temperature of approximately 20°F, defrost initiation would occur the soonest on Curve 3, followed by Curves 4 or 5, then Curve 1 (default) and the latest on Curve 2.

For example, for applications in colder climates, where temperatures under 20°F are common with high humidity, a more aggressive defrost curve (such as Curve 3) may be appropriate. For applications in milder climates, a less aggressive defrost curve (such as Curve 1 or Curve 2) may be appropriate.

Blower shaft bearing

These units are supplied with blower shaft bearings that do not require maintenance.

Cooling/heating start-up

The following section describes the cooling/heating start-up procedures

Cooling/heating pre-start checklist

When the installation is complete, perform 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 section.
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 the electrical power to the unit.
2. Set the room thermostat setting lower than the room temperature.

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

   Additional stages of cooling will be energized by the thermostat if needed.

Post-start checklist

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.
3. Measure the system amperage draw across all legs of the three-phase power wires.
4. Measure the condenser fan amperage draw.

Gas heat start-up

The following sections describe the gas heat start-up procedures.

Gas heat pre-start checklist

When the installation is complete, perform the following checks.

1. Check the type of gas supply. Verify that it is the same as the gas supply listed on the unit nameplate.
2. Verify that the combustion air intake and flue exhaust are free of any debris or obstruction.
3. Verify that the hood is installed over the flue exhaust discharge opening.
4. For modulating furnaces, set the System Selection bottom pin jumper to COMMISSION on the Modulating Furnace Control to properly check the input rate and manifold pressure.

Operating instructions

⚠ CAUTION

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

Lighting the main burners

1. Turn off the electrical power to unit.
2. Set the room thermostat to the lowest setting.
3. Turn the gas valve switch to the ON position.
4. Turn on the electrical power to the unit.
5. Set the room thermostat to the required temperature.

   If the set temperature on the thermostat is above room temperature, the main burners ignite.

Gas heat post-start checklist

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

1. Check for gas leaks in the unit piping and 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 the correct manifold gas pressures, input rates, and air temperature rise. See Checking gas heat input section.
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate.

Note: You must check the supply pressure with all gas appliances in the building at full fire. The standby gas pressure must never exceed 13 in. or the operating pressure drop below the minimum as specified on the unit rating plate. If the gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Table 40: Natural gas inputs and pressures

Gas Model	Gas Input (MBH)		Manifold Pressure (in. w.c.)		Supply Pressure (in. w.c.)	
	Normal	Reduced	Normal	Reduced	Min	Max
(N,S)1	220	165	3.5	2.1	4.5	10.5
(N,S)3	400	300	3.5	2.1	4.8	10.5
T3	400	140	3.5	0.6	5.0	10.5

Note: Propane inputs and pressures are provided in the listed conversion kit instructions.

Note: Modulating furnaces, gas model T3, are **not certified** for use with propane and cannot be converted.

Shutting down the unit

1. Set the thermostat to the lowest temperature setting.
2. Turn off all electrical power to unit.
3. Open the gas heat access panel.
4. Turn the gas valve switch to the OFF position.
5. For modulating furnaces, when commissioning is complete return the System Selection bottom pin jumper to NORM OPERATION on the Modulating Furnace Control.

Checking gas heat input

For two-stage and modulating furnaces, input rate should be checked at full input and minimum input. The intended input for each furnace is shown in the physical data tables and on the unit rating plate. The table applies to units operating on 60 Hz power only.

Important

If this is a modulating furnace, the Modulating Furnace Control board must be in COMMISSION mode on the System Selection pin jumper when checking input rate. Otherwise, the furnace input will fluctuate automatically and not maintain a steady rate. In COMMISSION mode, a second stage thermostat call will run the furnace at full input and a first stage call will run at minimum input.

To determine the rate of gas flow at second stage (full input)

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

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for Second stage (100% input) heat.
3. Measure the time needed for one revolution of the hand on the lowest increment dial on the meter. A typical gas meter has a 1/2 ft^3 or a 1 ft^3 test dial.
4. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour.
5. If necessary, adjust the high pressure regulator as discussed in the section 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 Step 1 to Step 5.

To determine the rate of gas flow at first stage (minimum input)

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling 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.

4. Measure the time taken for one revolution of the hand on the lowest increment dial on the meter. A typical gas meter has a 1/2 or a 1 ft^3 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 the section 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 to 6.

Manifold gas pressure adjustment

Two stage

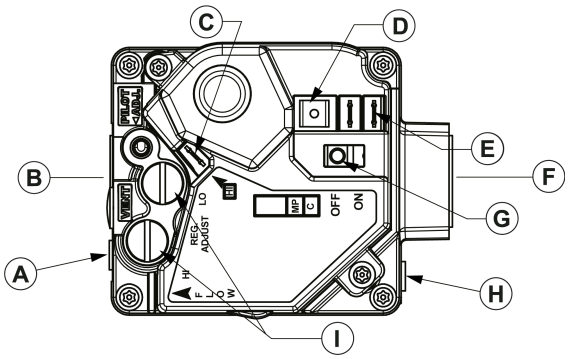
This gas furnace has two heat stages. Therefore, the gas valve has two adjustment screws located under two cover screws. The second stage adjustment screw is adjacent to the HI marking on the valve and the first stage adjustment screw is located adjacent to the LO marking on the valve.

Manifold pressure adjustment procedure.

Adjust the second stage first, then adjust the first stage pressure. See the in the physical data tables or the unit rating plate.

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 the cover screws covering the HI and LO pressure adjustment screws.
4. Turn on the power to the unit.
5. Set the thermostat to call for second stage heat and start the furnace.
6. If necessary, using a screwdriver, turn the second stage adjustment screw (adjacent to the HI marking on the valve) clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure.
7. After the high manifold pressure has been checked, you can 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.
9. After you have checked the pressure, replace the cover screws covering the HI and LO pressure adjustment screws.

Figure 82: Two Stage Gas Valve



Item	Description
A	Outlet pressure tap 1/8 in. - 27 NPT
B	Outlet
C	3/16 in. x .032 in. thk. male spade terminal - 2nd stage coil
D	External jumper
E	1/4 in. x .032 in. thk. male spade terminals (2) - common
F	Inlet
G	On/Off switch
H	Inlet pressure tap 1/8 in. - 27 NPT
I	Regulator cover screws (reg. adj. beneath these screws)

Modulating gas furnace

This gas furnace is a fully modulating system. The modulating furnace requires manifold pressure adjustment at both the highest setting (100%, full input) and lowest setting (35%, minimum input) of the gas valve to ensure it regulates correctly across the full range. Both settings are adjusted by a single Rotary DIP Switch on the valve. See Figure 83).

Important: The Modulating Furnace Control (MFC) board must be in COMMISSION mode on the System Selection pin jumper when checking input rate. Otherwise, the manifold pressure fluctuates automatically and does not maintain a steady rate. In COMMISSION mode, the MFC maintains a 100% (full input) heat demand with a second stage thermostat call and a 35% (minimum input) heat demand with a first stage call.

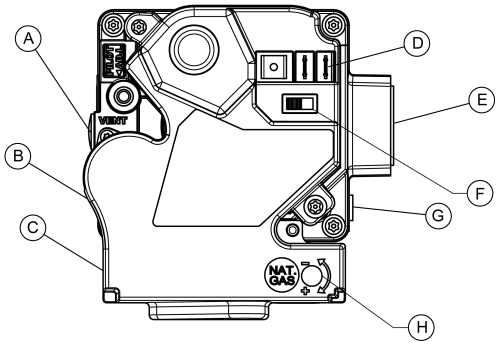
1. Turn off all power to the unit.
2. Using the outlet pressure port on the gas valve, connect a manometer to monitor the manifold pressure.
3. Remove the plastic cap covering the pressure adjustment rotary DIP switch.
4. Turn on power to the unit.
5. Set thermostat to call for second stage heat and start furnace.

6. If necessary, using a small flat-head screwdriver, turn the rotary DIP switch clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure.

   Note: When adjusting the rotary DIP switch, wait 1 second between steps to allow the software to register the change. If a change is not registered, the offset returns to its original setting.

7. After you have checked the manifold pressure at its highest setting, adjust the thermostat to call for the first stage heat to set the manifold pressure at its lowest setting.
8. Wait at least one minute for the furnace to step down to its lowest setting and adjust the manifold pressure, if necessary, using the same procedure in Step 6.
9. After you have checked the pressure, replace the plastic cap covering the rotary DIP switch.

Figure 83: Gas valve



Item	Description
A	Outlet
B	Outlet pressure tap, 1/8 in. – 27 NPT
C	5 pin plug (modulator)
D	1/4 in. x 0.032 in. thk male spade terminals (2) – main and common
E	Inlet
F	On/Off switch
G	Inlet pressure tap, 1/8 in. – 27 NPT
H	Regulator cap (regulator adjustment rotary dip switch beneath)

Adjustment of temperature rise

The temperature rise (the difference of temperature between the mixed air entering the furnace and the heated air leaving the furnace) must lie within the range shown on the unit rating plate and the data in the physical data tables when the unit is operating as full input.

Air temperature rise should be determined when the furnace is firing at full input. Two stage furnaces require a second stage thermostat call. Modulating furnaces require a second stage thermostat call and the Modulating Furnace Control must be in COMMISSION mode to maintain full input.

After the temperature rise has been determined, you can calculate the CFM using the following formula:

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

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.

Burners, orifices inspection, and servicing

Before checking or changing burners or orifices, **close main manual shut-off valve and shut off all power to the unit**.

1. Open the union fitting just upstream of the unit gas valve and downstream from the main manual shut-off valve in the gas supply line.
2. Remove the screws holding each end of the manifold to the manifold supports.
3. Disconnect the wiring to the gas valve. Remove the manifold and gas valve assembly. The orifices can now be inspected or replaced.

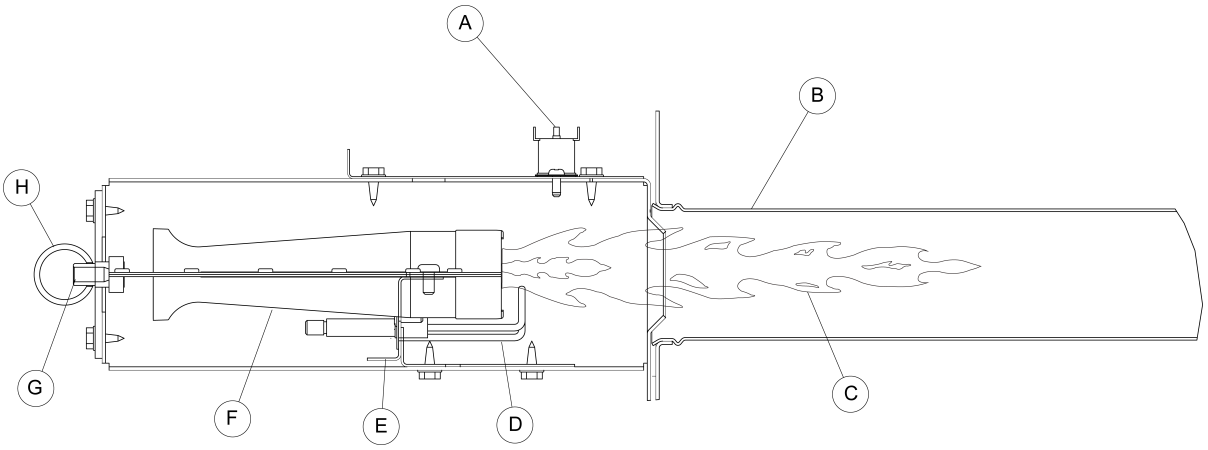
To service burners, complete step 4.

4. Remove the heat shield on top of the manifold supports. Burners are now accessible for inspection or replacement.

   Note: Reverse the previous procedure to replace the assemblies.

When reassembling, ensure that the burners are level and sit at the rear of the gas orifice.

Figure 84: Typical Flame



Item	Description
A	Roll out switch
B	Heat exchanger tube
C	Burner flame (blue only)
D	Ignitor
E	Burner bracket
F	Burner
G	Orifice
H	Manifold

Charging the unit

Table 42: WD13 charging table - system 1

Air flow indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	116	57	285	82	25
	85	117	58	328	93	25
	95	119	59	375	103	24
300 cfm/ton, 80/67	75	127	61	292	83	21
	85	129	62	335	94	20
	95	130	63	383	104	19
300 cfm/ton, 80/72	75	138	65	299	84	16
	85	140	66	344	95	15
	95	143	68	391	105	14
300 cfm/ton, 75/62	75	115	57	285	82	21
	85	117	58	328	92	20
	95	119	59	375	103	19
400 cfm/ton, 80/62	75	122	60	289	83	23
	85	124	61	332	93	23
	95	125	62	378	104	21
400 cfm/ton, 80/67	75	133	64	296	83	18
	85	135	65	340	94	17
	95	137	66	387	104	17
400 cfm/ton, 80/72	75	145	68	304	85	13
	85	147	69	348	95	13
	95	149	70	396	105	12
400 cfm/ton, 75/62	75	122	59	289	83	18
	85	123	60	332	93	17
	95	125	61	379	103	17
500 cfm/ton, 80/62	75	128	62	292	83	20
	85	130	63	336	94	19
	95	133	64	384	104	18
500 cfm/ton, 80/67	75	137	65	299	84	16
	85	139	66	343	94	16
	95	141	67	390	104	15
500 cfm/ton, 80/72	75	149	69	307	85	12
	85	151	70	352	95	11
	95	153	71	399	105	10
500 cfm/ton, 75/62	75	126	61	292	83	16
	85	127	62	335	93	15
	95	129	62	382	103	15

Table 43: WD13 charging table - system 2

Air flow Indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	113	53	286	85	27
	85	116	55	327	95	26
	95	118	56	373	106	25
300 cfm/ton, 80/67	75	125	57	292	86	22
	85	127	58	335	97	21
	95	129	60	381	107	20
300 cfm/ton, 80/72	75	137	62	300	88	17
	85	139	63	343	98	16
	95	141	64	390	109	15
300 cfm/ton, 75/62	75	113	53	286	85	22
	85	115	54	328	95	21
	95	118	56	373	106	20
400 cfm/ton, 80/62	75	120	56	290	86	24
	85	122	57	331	96	24
	95	124	58	377	107	22
400 cfm/ton, 80/67	75	132	60	297	87	19
	85	134	61	340	97	18
	95	136	62	386	108	18
400 cfm/ton, 80/72	75	144	64	304	88	14
	85	146	65	348	99	13
	95	148	66	395	109	13
400 cfm/ton, 75/62	75	120	56	290	85	19
	85	122	57	332	96	18
	95	124	58	378	106	17
500 cfm/ton, 80/62	75	125	58	292	87	22
	85	128	59	335	97	21
	95	131	60	382	107	20
500 cfm/ton, 80/67	75	136	62	300	88	17
	85	138	62	343	98	17
	95	139	63	389	108	16
500 cfm/ton, 80/72	75	149	66	307	89	12
	85	150	67	351	99	12
	95	152	67	398	109	11
500 cfm/ton, 75/62	75	124	57	293	86	17
	85	126	58	335	96	16
	95	128	59	381	107	16

Table 44: WD15 charging table - system 1

Air flow Indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	114	56	266	84	26
	85	115	57	306	94	25
	95	117	58	351	104	24
300 cfm/ton, 80/67	75	125	60	271	84	21
	85	126	61	312	95	20
	95	128	62	357	105	19
300 cfm/ton, 80/72	75	136	64	276	86	15
	85	138	65	318	96	15
	95	140	66	363	106	15
300 cfm/ton, 75/62	75	113	55	266	83	21
	85	115	56	306	94	20
	95	117	57	351	103	19
400 cfm/ton, 80/62	75	120	58	269	84	23
	85	122	59	309	94	22
	95	124	60	354	105	21
400 cfm/ton, 80/67	75	131	62	274	85	18
	85	132	63	315	95	18
	95	134	64	360	105	17
400 cfm/ton, 80/72	75	143	66	279	86	14
	85	144	67	321	96	13
	95	146	68	366	106	12
400 cfm/ton, 75/62	75	119	58	269	83	18
	85	121	59	310	94	17
	95	123	60	354	104	16
500 cfm/ton, 80/62	75	126	61	271	85	20
	85	129	62	313	95	19
	95	132	63	358	106	18
500 cfm/ton, 80/67	75	135	64	276	85	17
	85	137	65	317	96	16
	95	138	65	362	106	15
500 cfm/ton, 80/72	75	146	68	281	87	12
	85	148	69	323	97	11
	95	150	70	369	106	11
500 cfm/ton, 75/62	75	124	59	271	84	17
	85	125	60	312	94	16
	95	126	61	356	104	15

Table 45: WD15 charging table - system 2

Air flow Indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	116	57	266	84	26
	85	118	58	306	94	25
	95	120	59	350	104	25
300 cfm/ton, 80/67	75	128	61	271	85	21
	85	130	62	311	95	20
	95	132	63	356	105	20
300 cfm/ton, 80/72	75	140	65	276	86	17
	85	142	67	317	96	16
	95	144	68	363	106	15
300 cfm/ton, 75/62	75	116	57	266	83	21
	85	118	58	306	94	21
	95	120	59	351	104	20
400 cfm/ton, 80/62	75	123	59	269	84	23
	85	125	61	309	95	23
	95	126	61	353	105	22
400 cfm/ton, 80/67	75	135	64	274	85	18
	85	136	65	315	96	18
	95	138	66	360	106	17
400 cfm/ton, 80/72	75	147	68	279	87	14
	85	149	69	321	97	13
	95	151	70	366	107	12
400 cfm/ton, 75/62	75	123	59	269	84	18
	85	125	60	309	94	18
	95	126	61	354	104	17
500 cfm/ton, 80/62	75	129	62	271	85	21
	85	132	63	312	95	20
	95	135	64	357	106	18
500 cfm/ton, 80/67	75	139	65	275	86	17
	85	141	66	317	96	16
	95	142	67	362	106	16
500 cfm/ton, 80/72	75	151	70	281	87	12
	85	153	70	323	97	11
	95	155	71	368	107	11
500 cfm/ton, 75/62	75	127	61	271	84	16
	85	129	62	311	95	16
	95	130	62	356	105	15

Table 46: WD20 charging table - system 1

Air flow Indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	113	52	274	85	26
	85	115	53	316	95	25
	95	117	54	361	106	25
300 cfm/ton, 80/67	75	124	56	280	86	21
	85	126	57	322	97	20
	95	128	58	368	107	20
300 cfm/ton, 80/72	75	136	61	287	88	16
	85	138	62	330	98	15
	95	140	63	377	108	15
300 cfm/ton, 75/62	75	113	52	274	85	21
	85	115	53	316	95	20
	95	116	54	361	106	20
400 cfm/ton, 80/62	75	120	55	278	86	23
	85	121	56	319	96	23
	95	123	56	365	106	22
400 cfm/ton, 80/67	75	131	59	285	87	18
	85	133	60	327	97	17
	95	134	61	373	107	17
400 cfm/ton, 80/72	75	143	63	291	88	13
	85	145	64	335	98	13
	95	147	65	381	109	12
400 cfm/ton, 75/62	75	120	55	278	85	18
	85	121	55	320	96	17
	95	123	56	365	106	17
500 cfm/ton, 80/62	75	126	57	281	86	20
	85	128	58	324	97	19
	95	131	59	370	107	18
500 cfm/ton, 80/67	75	136	61	287	87	16
	85	137	61	330	98	16
	95	139	62	376	108	15
500 cfm/ton, 80/72	75	148	65	294	89	11
	85	149	66	338	99	11
	95	151	66	384	109	10
500 cfm/ton, 75/62	75	124	56	281	86	16
	85	125	57	323	96	16
	95	127	58	368	107	15

Table 47: WD20 charging table - system 2

Air flow Indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	108	53	284	84	28
	85	109	54	326	94	27
	95	111	55	372	104	26
300 cfm/ton, 80/67	75	118	57	291	85	23
	85	120	58	334	95	22
	95	122	59	381	106	22
300 cfm/ton, 80/72	75	130	62	299	87	18
	85	132	63	343	97	17
	95	134	64	390	107	16
300 cfm/ton, 75/62	75	107	53	284	84	23
	85	109	54	326	94	22
	95	111	55	372	104	21
400 cfm/ton, 80/62	75	114	56	288	85	25
	85	116	57	331	95	24
	95	118	58	377	105	23
400 cfm/ton, 80/67	75	125	60	296	86	20
	85	127	61	339	96	19
	95	129	62	386	106	18
400 cfm/ton, 80/72	75	137	65	304	88	15
	85	139	65	348	98	14
	95	141	66	396	108	14
400 cfm/ton, 75/62	75	114	55	289	84	20
	85	116	56	331	95	19
	95	117	57	377	105	18
500 cfm/ton, 80/62	75	119	57	291	85	23
	85	121	59	334	95	22
	95	123	60	381	106	21
500 cfm/ton, 80/67	75	130	62	299	87	18
	85	132	63	343	97	17
	95	133	63	389	107	17
500 cfm/ton, 80/72	75	142	66	308	88	13
	85	144	67	352	98	12
	95	145	68	399	108	12
500 cfm/ton, 75/62	75	119	57	292	85	18
	85	120	58	335	95	17
	95	121	59	381	105	17

Table 48: WD25 charging table - system 1

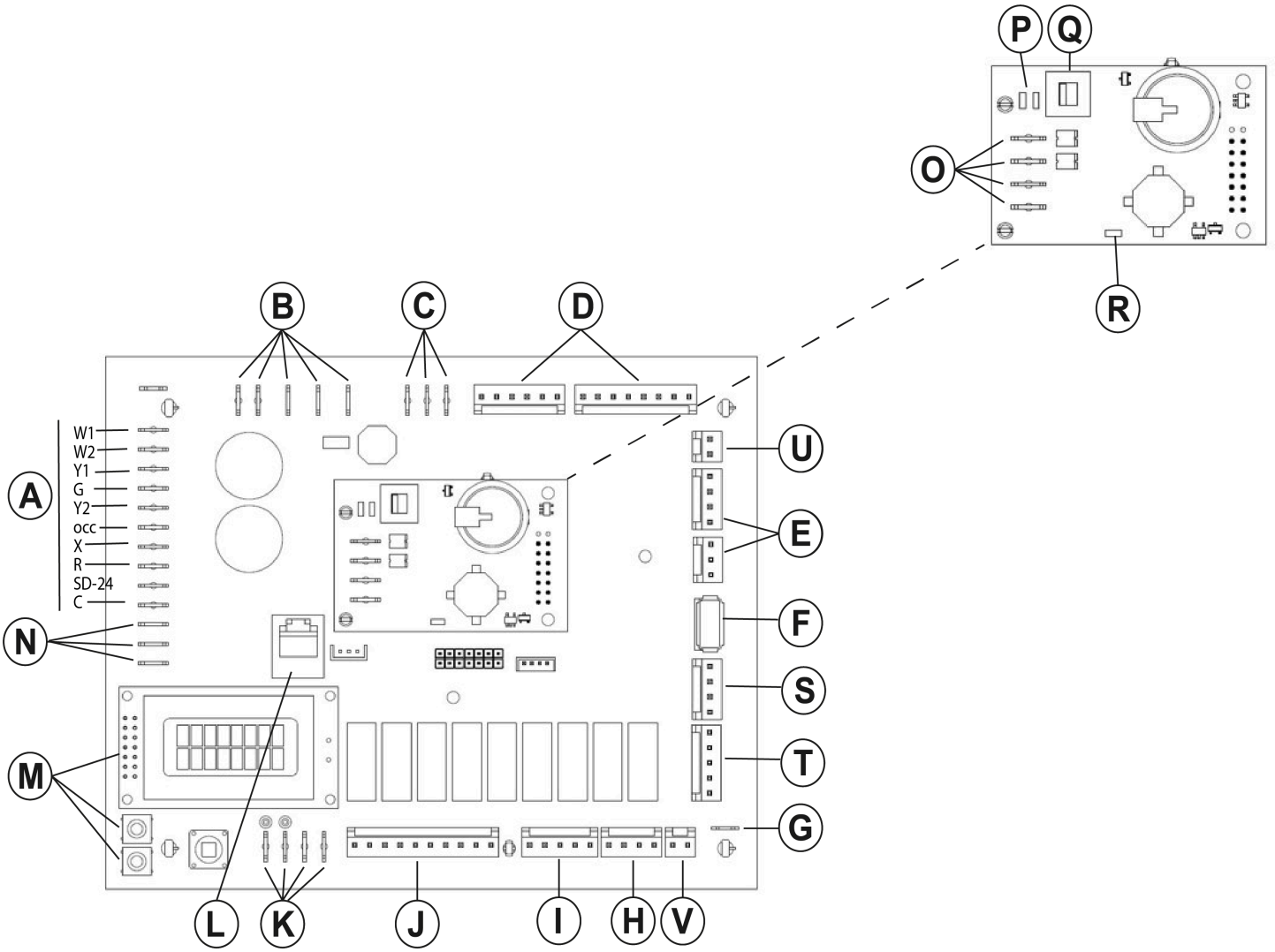
Air flow Indoor DB/WB	Outdoor dry bulb °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	109	53	284	85	27
	85	111	54	326	96	27
	95	113	55	371	106	25
300 cfm/ton, 80/67	75	120	57	290	87	22
	85	122	58	333	97	22
	95	124	59	379	108	20
300 cfm/ton, 80/72	75	131	62	297	89	17
	85	134	63	340	99	16
	95	136	64	386	110	15
300 cfm/ton, 75/62	75	109	53	284	85	22
	85	111	53	326	96	21
	95	113	54	372	106	21
400 cfm/ton, 80/62	75	116	55	288	86	24
	85	117	56	330	96	24
	95	119	57	375	107	22
400 cfm/ton, 80/67	75	126	60	294	88	19
	85	128	61	337	98	19
	95	130	62	383	109	18
400 cfm/ton, 80/72	75	138	64	301	90	14
	85	140	65	344	100	14
	95	142	66	391	110	13
400 cfm/ton, 75/62	75	115	55	288	85	19
	85	117	56	330	96	18
	95	119	57	376	106	18
500 cfm/ton, 80/62	75	121	57	290	87	22
	85	123	59	333	98	21
	95	126	60	380	108	19
500 cfm/ton, 80/67	75	131	61	297	89	17
	85	132	62	339	98	17
	95	134	63	385	109	16
500 cfm/ton, 80/72	75	142	66	304	90	13
	85	144	66	347	100	12
	95	146	67	393	111	11
500 cfm/ton, 75/62	75	119	57	290	86	18
	85	121	57	332	96	17
	95	122	58	378	107	16

Table 49: WD25 charging table - system 2

Air flow Indoor DB/WB	Outdoor DB °F	Suction pressure psig	Suction temp °F	Liquid pressure psig	Liquid temp °F	Delta T indoor DB °F
300 cfm/ton, 80/62	75	112	55	283	87	26
	85	114	56	324	97	25
	95	116	57	369	108	24
300 cfm/ton, 80/67	75	123	59	289	89	21
	85	125	60	331	99	20
	95	127	61	377	109	19
300 cfm/ton, 80/72	75	134	64	296	91	16
	85	136	65	339	101	15
	95	139	66	385	111	14
300 cfm/ton, 75/62	75	112	55	283	86	21
	85	113	56	325	97	20
	95	115	57	370	107	19
400 cfm/ton, 80/62	75	118	58	286	88	23
	85	120	59	328	98	22
	95	123	60	374	109	21
400 cfm/ton, 80/67	75	129	62	293	90	18
	85	130	62	335	99	18
	95	132	63	380	109	17
400 cfm/ton, 80/72	75	141	66	300	91	14
	85	142	67	343	101	13
	95	144	68	389	111	12
400 cfm/ton, 75/62	75	117	57	286	87	18
	85	119	58	328	97	18
	95	121	59	374	107	17
500 cfm/ton, 80/62	75	124	60	290	89	20
	85	127	61	332	100	19
	95	130	63	378	110	18
500 cfm/ton, 80/67	75	132	63	295	90	17
	85	134	64	337	100	16
	95	136	65	383	110	15
500 cfm/ton, 80/72	75	144	67	303	91	12
	85	146	68	345	101	11
	95	148	69	391	111	11
500 cfm/ton, 75/62	75	121	58	289	87	17
	85	123	59	331	98	16
	95	124	60	376	108	15

Smart Equipment unit control board

Figure 85: Unit control board



The following tables describe the details of the UCB, see the previous figure for the connection locations.

Table 50: Smart Equipment UCB - thermostat connection strip

Location	Label	Description	Function and comments
A	W1	1st stage heating request, 24 VAC input switched from R	Not effective for cooling-only units
	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 one 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	
	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 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 overflow, 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 the thermostat connection strip SD-24 and R.
	C	24 VAC common for thermostat power	
	+	MOD BUS	Future
	-	MOD BUS	Future
	C	MOD BUS	Future

Table 51: Smart Equipment UCB - limit, 24 VAC power, and shutdown connections

Location	Label	Description	Function and comments
B	LIMIT	Monitored 24 VAC input through heat section limit switch(es)	If voltage is absent, indicating the heat section is over-temperature, the UCB turns 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, that 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 the circuit trace to the thermostat connection strip SD-24. A wiring harness jumper plug connecting SD 24 to SD R is in place if the 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 the thermostat connection strip SD-24 and R.
	SD R	24 VAC hot return from factory accessory smoke detector, condensate overflow and user shutdown relay switching in series	Connects through the 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 the 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.

Table 52: Smart Equipment UCB - space temperature sensor connections

Location	Label	Description	Function and comments
C	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, is effective if the thermostat only control parameter is set to OFF, space sensor override momentary shorts ST to COM to initiate and 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

Table 53: Smart Equipment UCB - temperature sensor connections

Location	Label	Description	Function and comments
D	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.
	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.

Table 54: Smart Equipment UCB - pinned connections

Location	Label	Description	Function and comments
E	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 Direct Drive ECM Motor output	Negative of the VDC circuit for the Driect Drive ECM Motor output
	VFD	2-10 VDC (0-100%) output for the indoor blower Driect Drive ECM Motor	Output is active with indoor blower operation. For CV/IntelliSpeed units: this output provides stepped IntelliSpeed control of the indoor blower ECM motor based on fan-only, cooling stage and heating stage outputs. For VAV units: this output provides control of the indoor blower ECM motor based on supply duct static pressure input and setpoint.
	VFDFLT	Not used	Not Used

Table 55: Smart Equipment UCB - USB connector

Location	Label	Description	Function and comments
F	J10	Type A female Universal Serial Bus connector	Used for backup, restoration, and copying of board parameters as well as board software updating through a flash drive
	J15	Factory wired SA Bus connector	

Table 56: Smart Equipment UCB - 24 V terminal

Location	Label	Description	Function and comments
G	24V FOR OUTPUTS	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

Table 57: Smart Equipment UCB - heat section connections

Location	Label	Description	Function and comments
H	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

Table 58: Smart Equipment UCB - pin cooling and fan output

Location	Label	Description	Function and comments
I	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

Table 59: Smart Equipment UCB - refrigerant circuit safety switch and indoor blower overload connections

Location	Label	Description	Function and comments
J	HPS1 (right pin)	24 VAC hot out for refrigerant circuit 1 High Pressure Switch	Connects through circuit trace to the R terminal
	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.

Table 60: Smart Equipment UCB - SA BUS connections

Location	Label	Description	Function and comments[1]
K	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 and 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 and diagnostics board, netstat and/or Multi Touch gateway
L	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

Note:
1. When wiring unit and other devices using the SA Bus and FC Bus, see Cable type for FC buses and SA buses in order of preference.

Table 61: Smart Equipment UCB - user interface

Location	Label	Description	Function and comments
M	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	

Table 62: Smart Equipment UCB - LEDs

Location	Label	Description	Function and comments
N	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) 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

Table 63: Smart Equipment UCB - optional communication sub-board

Location	Label	Description	Function and comments
O Terminal FC BUS connections	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
Q	EOL switch	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”
P	EOL	Green End Of Line indicator	Lit indicates the EOL switch is selected ON
	FC BUS	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
R	ISO PWR	Green communication board Isolated Power indicator	Lit indicates the UCB is supplying power to the communication sub-board

Table 64: Smart Equipment UCB - pinned connections

Location	Label	Description	Function and comments
S	COS	Condensate Overflow Switch	COS is 24V input that senses the switch is closed if 24V is present. Binary Input – just senses 24V on/off. If COS opens, the compressor outputs are disabled. When COS is closed, compressors run normally. COS can be enabled/disabled by a menu option on the control board.
	R	R pin is 24V supply to the switch	Connects through circuit trace to the R terminal
	RDS	Refrigerant Detection System or Switch	If the switch opens, the control shuts off all outputs, except the indoor blower. Energizes the indoor blower, if it was off at the time. If the switch re-closes, there will be a five minute delay, then return to normal operation. For products without an RDS, these pins must be jumpered. There are no menu options to turn this function off.
	R	R pin is 24V supply to the Sensor	Connects through circuit trace to the R terminal

Table 65: Smart Equipment UCB - pinned connections

Location	Label	Description	Function and comments
T	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 indoor 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

Table 66: Smart Equipment UCB - pinned connections

Location	Label	Description	Function and comments
U	AI1 +	Not used	Not used
	AI1 -	Not used	Not used

Table 67: Smart Equipment UCB - pinned connections

Location	Label	Description	Function and comments
V	BO1	Not used	Not used
	BO2	Not used	Not used

Table 68: Smart Equipment UCB - Unique Equipment Identifier (UEI) settings

Unique Equipment Identifier				
Model	Tonnage	2-stage compressor layout		UEI*
		Circuit 1	Circuit 2	
WV/WD/MV/MD	13	1	1	0
	15	1	1	0
	20	1	1	0
	25	1	1	0

*Enum Member	
UEI=0	Standard
UEI=3	2-stage Cir 1, Single Cir 2
UEI=4	Tandem Cir 1, Single Cir 2
UEI=6	Single ModCir with 2-stage Cir 2
UEI=7	Single ModCir with Single Cir 2

Modulating furnace control

Figure 86: Modulating furnace control board

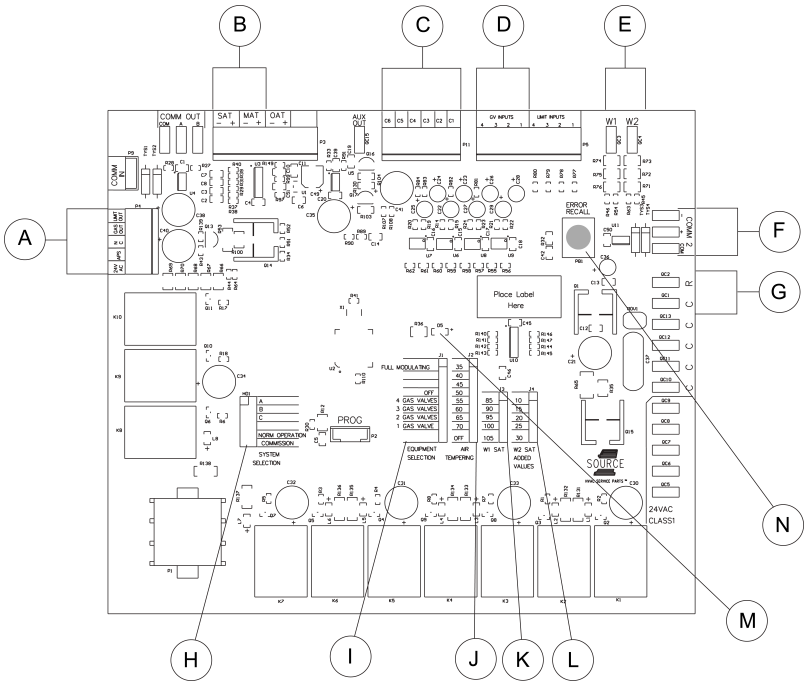


Table 69: Modulating furnace control board details

	Description		Function and comments
A	APS	24 VAC hot return from Air Proving Switch	Air Proving Switch input verifies indoor airflow operation. During Normal Heating, if APS input (closed switch) is not received within 2 min of heat call, LED alarm flashes **5** but does not interrupt heat demand output. APS input is required to operate Air Tempering.
	NC	Not used	Not used
	GAS OUT	24 VAC output confirming heat section operation	Sends gas valve operation signal to UCB. During Normal Heating, when GV INPUT is received the MFC immediately outputs gas signal to UCB. In Air Tempering, the MFC does not output gas signal to the UCB; this is to avoid UCB alarm (Air Tempering operates without thermostat heating call from UCB).
B	SAT+	Supply Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Senses temperature of air leaving heat section. Input required for normal operation; 5.0 VDC reading SAT+ to SAT– with open circuit. Used in Normal Heating and Air Tempering to adjust heat demand output to maintain target supply air temperature. If MFC receives invalid SAT input (indicating bad thermistor) during Normal Heating, heat demand defaults to 35% heat output (lowest level). MFC will not operate Air Tempering with invalid SAT input. LED alarm flashes **3** with invalid SAT.
	MAT+	Mixed Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Senses temperature of air entering heat section. 5.0 VDC reading SAT+ to SAT– with open circuit. Used in Normal Heating to limit air temperature rise (SAT minus MAT) to a maximum of 65°F. Used in Air Tempering to determine if MAT is below value on **AIR TEMPERING** pin selection. The MFC does not operate Air Tempering with invalid MAT input. LED alarm flashes **4** with invalid MAT.
C	C1 through C6	Compressor signals, 24 VAC inputs (not all used)	Sourced from compressor control voltage signals. Monitors all compressors in the unit. If any compressors are on, the LED flashes 6 (non-fault condition) and the MFC does not operate Air Tempering.
D	GV INPUTS, 1	24 VAC input confirming heat section operation	Sourced from main gas valve ON signal. Used in MFC logic for **GAS OUT** output. If GV INPUT is not received within 5 min of heat demand output, LED alarm flashes **2** but does not interrupt heat demand output.

Table 69: Modulating furnace control board details

	Description		Function and comments
E	W1	1st stage heating request, 24 VAC input from H1 on UCB	With W1 input only from the UCB, the MFC adjusts heat demand level to maintain supply air temperature value on **W1 SAT** pin selection.
	W2	2nd stage heating request, 24 VAC input from H2 on UCB	With W2 input (plus W1) from the UCB, the MFC adjusts heat demand level to maintain supply air temperature of the added value of **W1 SAT** plus **W2 SAT ADDED VALUE** pin selections.
F	COMM 2, -	Communication for ignition control	Heat call and demand level to ignition control. Negative of the VDC (typically, a fluctuating 1.5 V to 3.5 V reading to C; at least 0.25 V lower than +).
	COMM 2, +	Communication for ignition control	Heat call and demand level to ignition control. Positive of the VDC (typically, a fluctuating 1.5 V to 3.5 V reading to C; at least 0.25 V lower than -).
	COMM, COM	Common for ignition control communication circuit	
G	R	24 VAC hot for MFC board power	
	C	24 VAC common for MFC board power	
H	SYSTEM SELECTION (2 jumper pins)	System and operating mode pin selections	There are 2 jumpers for this pin bank. **A** and **NORM OPERATION** yields normal operation. **A** and **COMMISSION** is for rating the furnace and adjusting manifold pressure; automated modulation is bypassed, W1 input outputs a steady 35% (lowest) heat demand, W1 and W2 input outputs a steady 100% (highest) heat demand. **(BLANK)** and **COMMISSION** step through an auto-sequence routine with a W1 or W1 and W2 input.
I	EQUIPMENT SELECTION (2 jumper pins)	Equipment type pin selections	There are 2 jumpers for this pin bank. **FULL MODULATING** and **1 GAS VALVE** should always be selected for this system.
J	AIR TEMPERING (1 jumper pin)	Air Tempering pin selection.	Used to select whether the Air Tempering function is allowed to operate. If jumper is set to any value other than **OFF**, the MFC initiates furnace operation if the MAT sensor input reading is 3°F below the selected value. To operate Air Tempering, APS input must be on, W1/W2 heat call from UCB must be off, and all compressor inputs must have been off for 10 min. If MFC has been in tempering mode (heating) for 10 min and SAT reading is 5°F or more above the Air Tempering selected value, heating is ended. If all conditions for Air Tempering are still met, it is re-initiated after a 10 min minimum off delay.
K	W1 SAT (1 jumper pin)	W1 SAT setpoint pin selection.	With W1 input only from the UCB, the MFC adjusts heat demand level to maintain supply air temperature value on **W1 SAT** pin selection.
L	W2 SAT ADDED VALUE (1 jumper pin)	W2 SAT Added Value setpoint pin selection.	With W2 input (plus W1) from the UCB, the MFC adjusts heat demand level to maintain supply air temperature of the added value of **W1 SAT** plus **W2 SAT ADDED VALUE** pin selections.
M	LED Light	LED status or alarm code	Flash count corresponds to status or fault condition.
N	ERROR RECALL (Button)	Error recall button	When pushed, the last 5 alarms are flashed by the LED. The most recent is flashed first, followed by the next most recent, and continuing until all the alarms stored (5 maximum) are flashed.

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.

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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.	☐

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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:

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

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