

INSTALLATION MANUAL

R-410A XP SERIES W/SMART EQUIPMENT™

15/20 Ton

60 Hertz



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General

YORK® Model XP units are single package Heat Pump with electric heaters (Field Installed Accessory Only). Designed for outdoor installation on a rooftop or slab.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, duct connections and fixed outdoor air intake damper (units without economizer or motorized damper option only) at the point of installation.

The electric heater accessories have nickel-chrome elements and utilize single point power connection.

Safety Considerations

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

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

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

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

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

WARNING

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

CAUTION

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

WARNING

Before performing service or maintenance operations on unit, turn off 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 or service agency.

CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gage sets, hoses, refrigerant containers and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

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

Observe all precautions in the literature, labels, and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other applicable safety precautions and codes including ANSI Z223.1 or CSA-B149.1- latest edition.

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

Inspection

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made 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.

Reference

Additional information is available in the following reference forms:

- Technical Guide - XP180/240, 5168280
- General Installation - XP180/240, 5168273
- Electric Heat Accessory Installation - 5128261
- Smart Equipment™ Control Quick Start Guide - 1136326

Renewal Parts

Contact your local York® parts distribution center for authorized replacement parts.

Approvals

Design certified by CSA as follows:

1. For use as a Heat Pump unit with supplemental electric heat.

2. For outdoor installation only.
3. For installation on combustible material..

⚠ WARNING

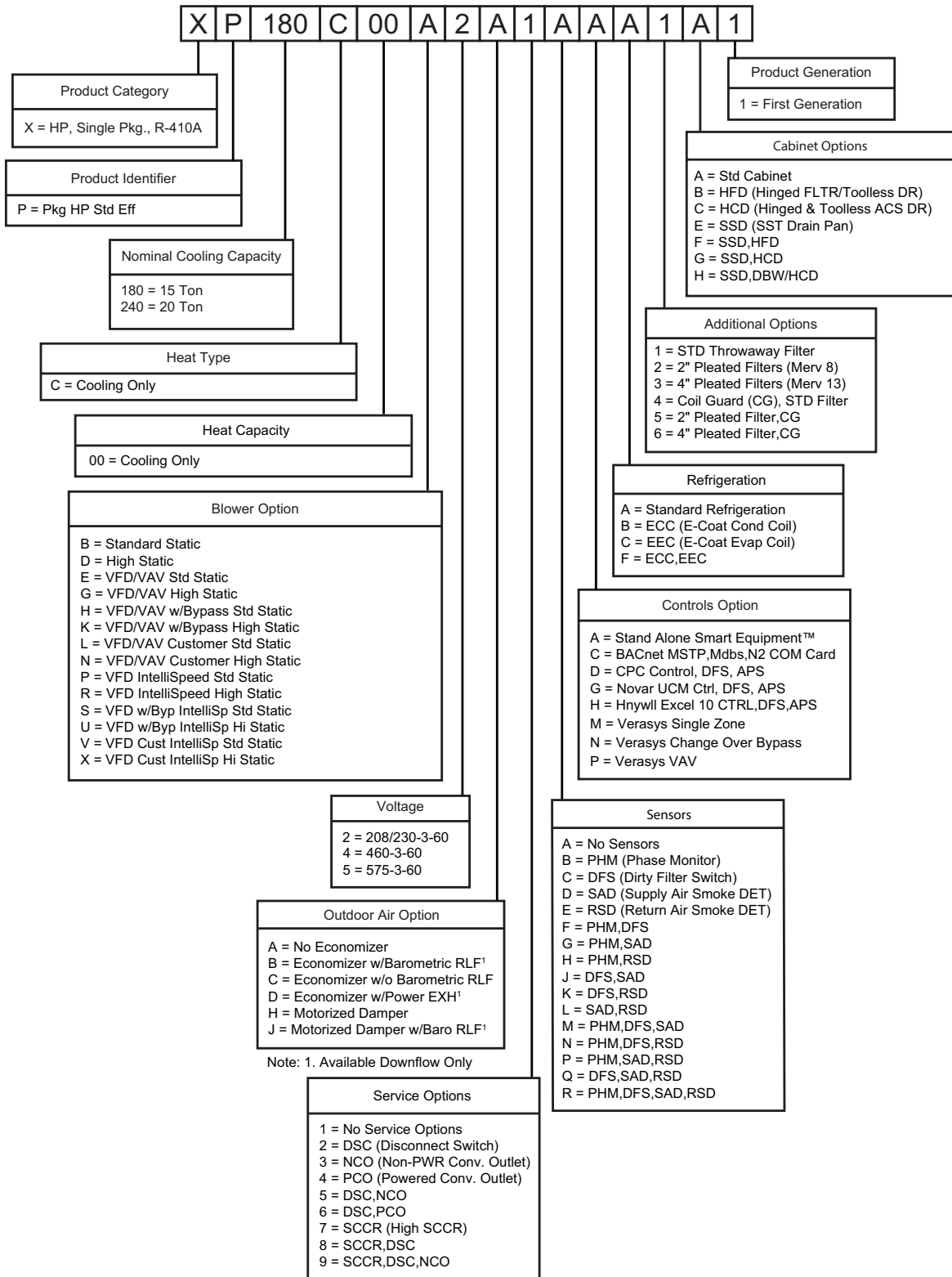
Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

Nomenclature

15 & 20 Ton York® Model Number Nomenclature



Installation

Installation Safety Information

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. This equipment is not to be used for temporary heating of buildings or structures under construction.
2. If a factory option convenience outlet is installed, the weatherproof outlet cover must be field installed. The cover shall be located in the unit control box. To install the cover, remove the shipping label covering the convenience outlet, follow the instructions on the back of the weatherproof cover box, and attach the cover to the unit using the (4) screws provided.

CAUTION

208/230-3-60 units with factory installed Powered Convenience Outlet Option are wired for 230v power supply. Change tap on transformer for 208-3-60. See unit wiring diagram.

Limitations

These units must be installed in accordance with the following:

In U.S.A.:

1. National Electrical Code, ANSI/NFPA No. 70 - Latest Edition

2. Local building codes, and
3. Local electric utility requirements

In Canada:

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

Refer to unit application data found in this document.

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

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

This furnace is not to be used for temporary heating of buildings or structures under construction.

CAUTION

The Smart Equipment™ control board used in this product will 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 applying this product for process cooling applications (computer rooms, switchgear, etc.), call the applications department for Ducted Systems @ 1-877-874-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30°F.

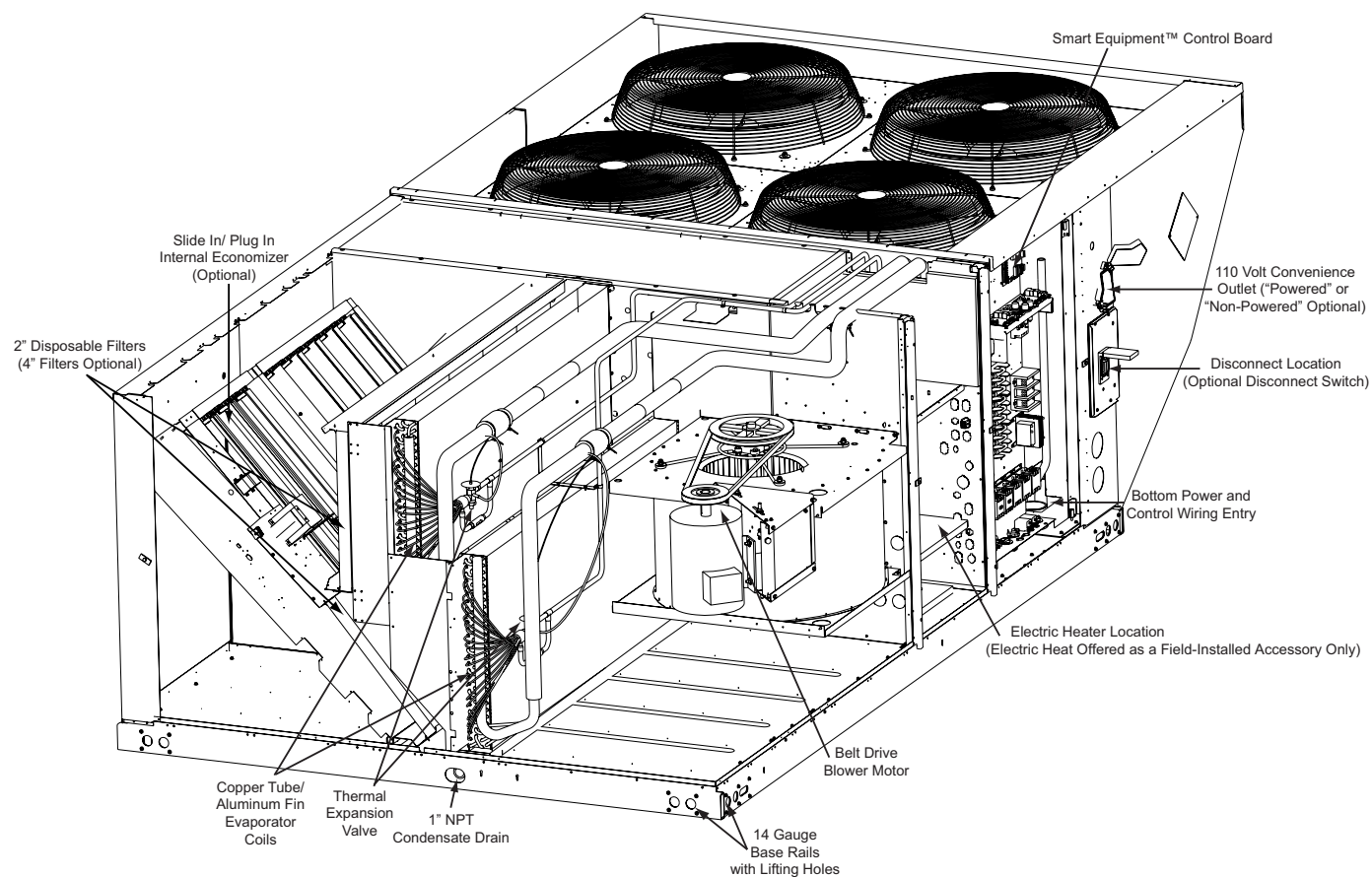


Figure 1: XP240 Component Location

Table 1: XP180/240 Unit Limitations

Size (Tons)	Unit Voltage	SCCR (kVA)	Unit Limitations		
			Applied Voltage		Outdoor DB Temp
			Min	Max	Max (°F)
180 (15)	208/230-3-60	5	187	252	125
	460-3-60	5	432	504	125
	575-3-60	5	540	630	125
240 (20)	208/230-3-60	5	187	252	125
	460-3-60	5	432	504	125
	575-3-60	5	540	630	125

Location

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

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

Clearances

All units require particular clearances for proper operation and service. Refer to Table 4 for clearances required for combustible construction, servicing, and proper unit operation.

WARNING

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

Rigging And Handling

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars, whose length exceeds the largest dimension across the unit, **MUST** be used across the top of the unit.

CAUTION

If a unit is to be installed on a roof curb other than a York® roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

CAUTION

Before lifting, make sure the unit weight is distributed equally on the rigging cables so it will lift evenly.

Units may be moved or lifted with a forklift, from the side only, providing an accessory skid is used.

LENGTH OF FORKS MUST BE A MINIMUM OF 90 INCHES.

CAUTION

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

Figure 2: XP240 Unit 4 Point Load Weight

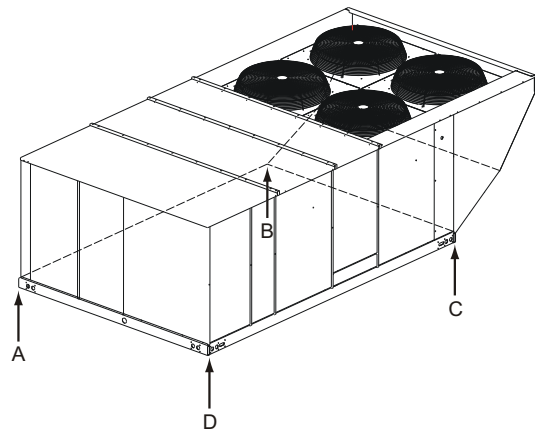


Figure 3: XP240 Unit 6 Point Load Weight

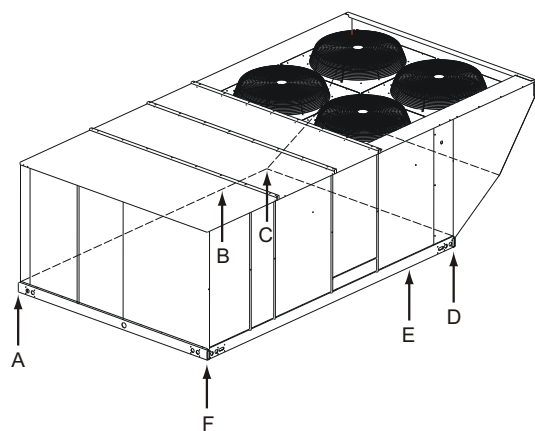


Figure 4: XP180 Unit 4 Point Load Weight

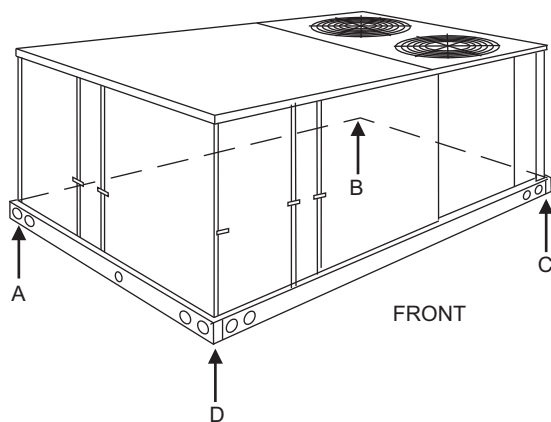


Figure 5: XP180 Unit 6 Point Load Weight

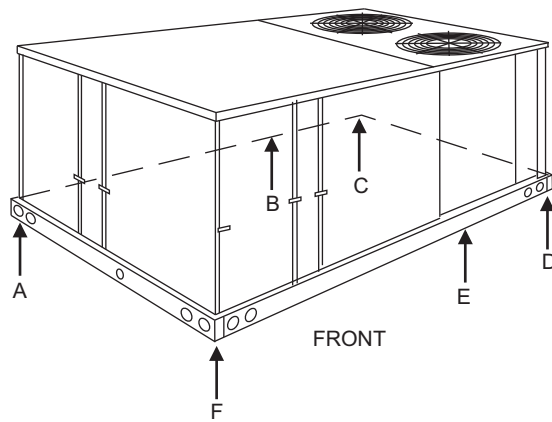


Figure 6: Center of Gravity

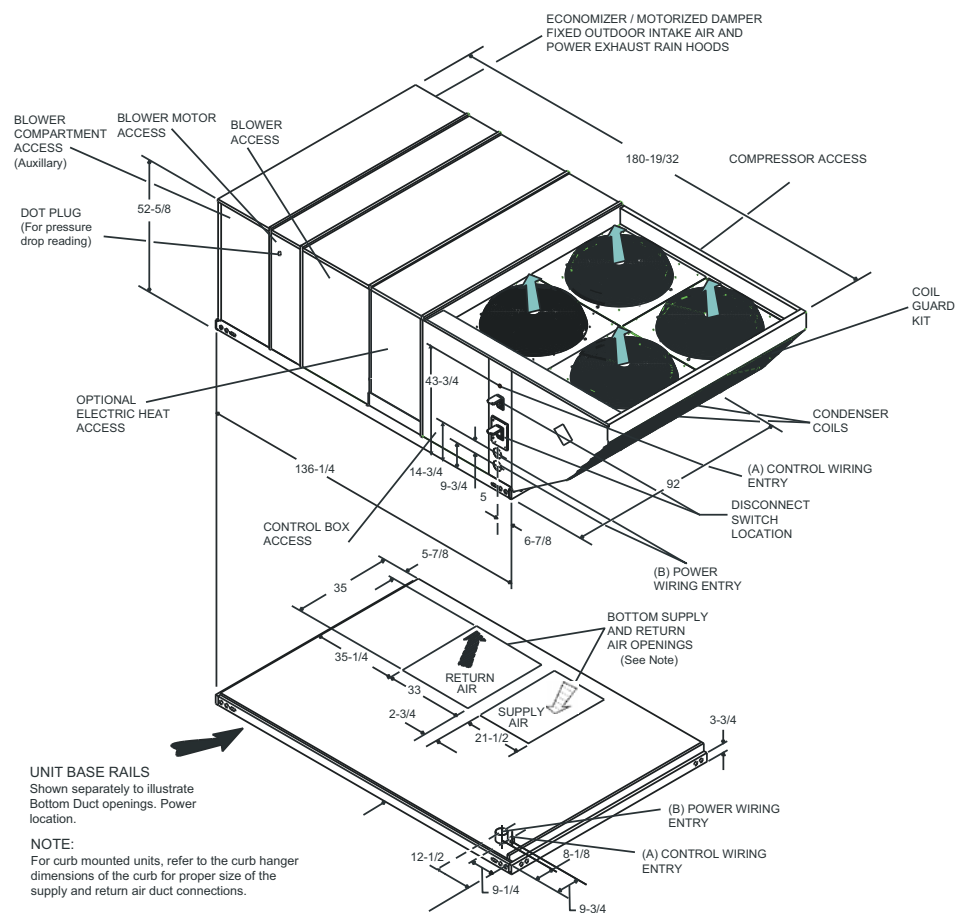
Table 2: XP180/240 Unit Weight

Size (Tons)	Model	Weight (lbs.)		Center of Gravity		4 Point Load Location (lbs.)				6 Point Load Location (lbs.)					
		Shipping	Operating	X	Y	A	B	C	D	A	B	C	D	E	F
180 (15)	XP	2145	2140	77.1	45	454	592	619	475	290	344	413	431	359	303
240 (20)	XP	2655	2650	88.8	46	462	863	863	462	280	405	640	640	405	280

Table 3: XP180/240 Unit Accessory Weights

Unit Accessory	Weight (lbs.)	
	Shipping	Operating
Economizer	165	160
Power Exhaust	90	85
Electric Heat ¹	40	40
Double Wall ²	260	260
Motorized Damper	150	150
Barometric Damper	50	45
Econ./Motorized Damper Rain Hood	60	55
Econ./Power Exhaust Rain Hood	95	90
Wood Skid	220	220
Roof Curb	190	185

1. Weight given is for the maximum heater size available (72KW).
2. Available on XP240 only.

**Figure 7: XP240 Unit Dimensions Front View****Utilities Entry**

Hole	Opening Size Diameter	Used For	
A	1-1/8" KO	Control Wiring	Front
	3/4" NPS (Fem.)		Bottom
B	3-5/8" KO	Power Wiring	Front
	3" NPS (Fem.)		Bottom

NOTE: All entry holes should be field sealed to prevent rain water entry into the building.

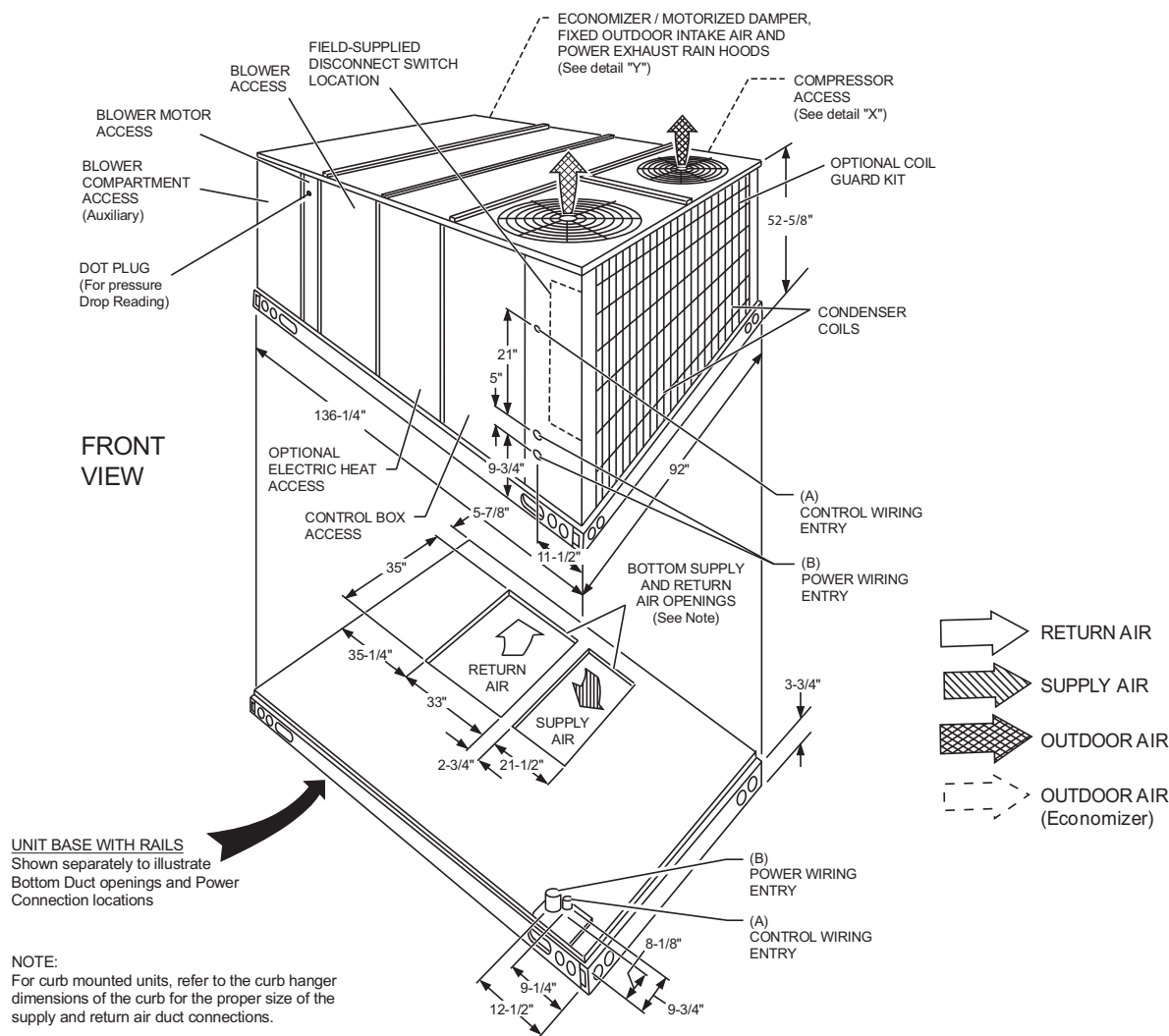


Figure 8: XP180 Unit Dimensions Front View

Utilities Entry

Hole	Opening Size Diameter	Used For	
A	1-1/8" KO	Control Wiring	Front
	3/4" NPS (Fem.)		Bottom
B	3-5/8" KO	Power Wiring	Front
	3" NPS (Fem.)		Bottom

NOTE: All entry holes should be field sealed to prevent rain water entry into the building.

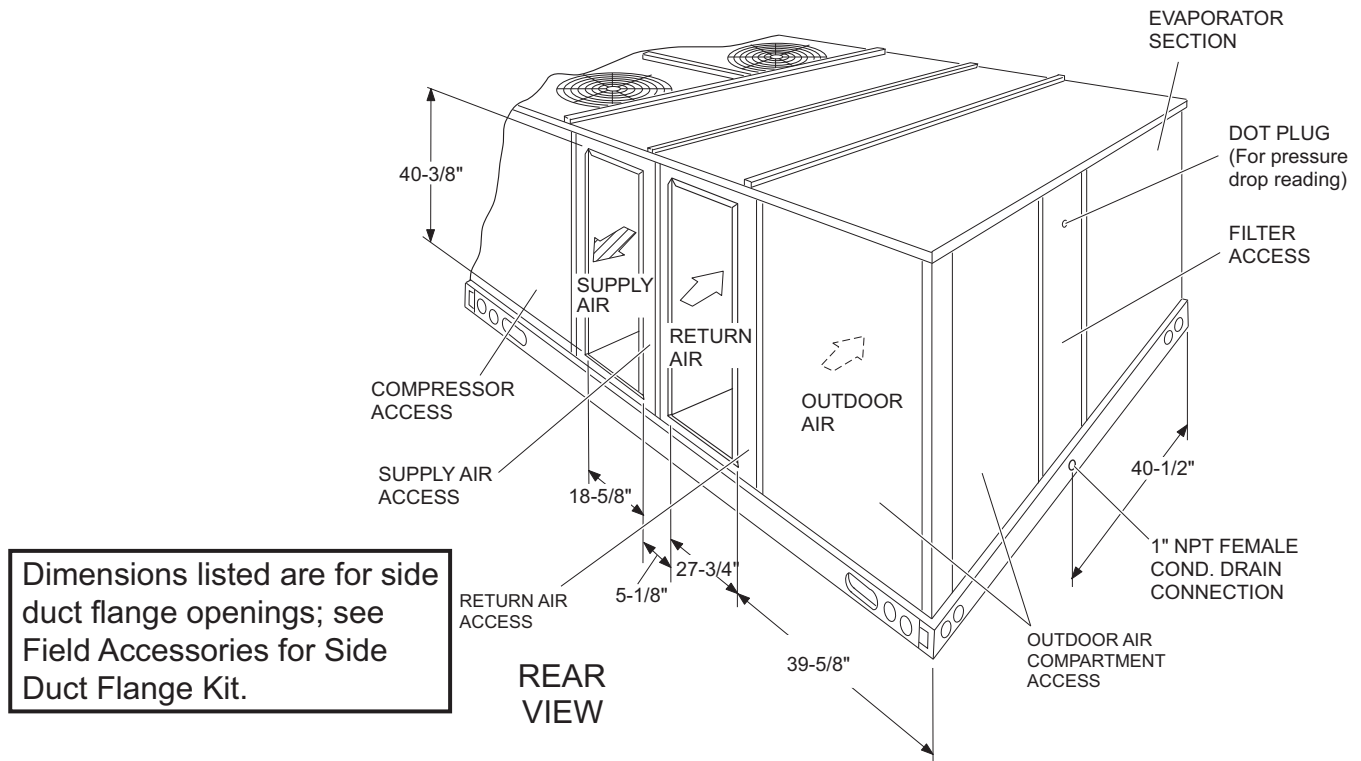


Figure 9: XP180/240 Unit Dimensions Rear View

NOTE: Units are shipped with the bottom duct openings covered. An accessory flange kit is available for connecting side ducts.

For bottom duct applications:

1. Remove the side panels from the supply and return air compartments to gain access to the bottom supply and return air duct covers.
2. Remove and discard the bottom duct covers. Duct openings are closed with sheet metal covers except when the unit includes a power exhaust option. The covering consists of a heavy black paper composition.
3. Replace the side supply and return air compartment panels.

For side duct applications:

1. Replace the side panels on the supply and return air compartments with the accessory flange kit panels.
2. Connect ductwork to the flanges on those panels.

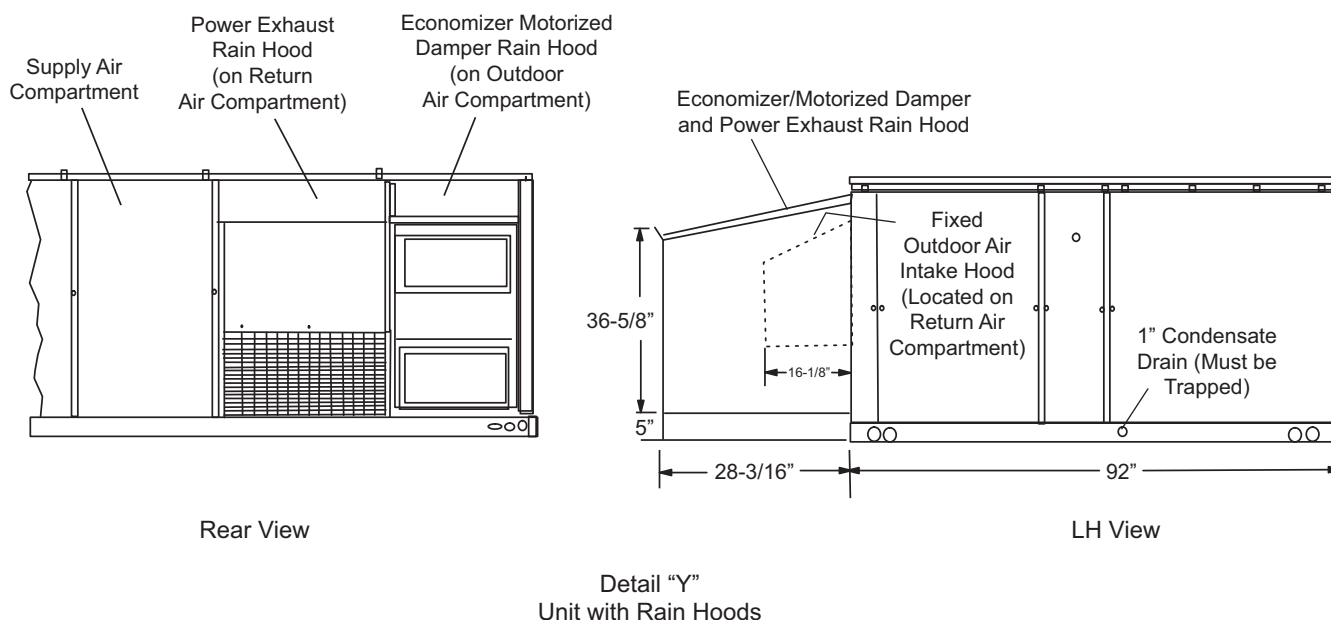


Figure 10: XP180/240 Unit Dimensions Rain Hood

Table 4: XP180/240 Unit Clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top ¹	72 With 36 Maximum Horizontal Overhang (For Condenser Air Discharge)	Right	36
Front	36	Bottom ²	0
Rear	24 (W/O Economizer)	Left	24 (W/O Economizer)
	49 (W/Economizer)		36 (W/Economizer) ³

- Units must be installed outdoors. Over hanging structure or shrubs should not obscure condenser air discharge outlet.
- Units may be installed on combustible floors made from wood or class A, B or C roof covering materials.
- If economizer is factory installed, the unassembled rain hood must be removed from its ride along position in front of the evaporator coil, or in the outdoor air compartment, prior to final installation.

Note: Units and ductwork are approved for zero clearance to combustible material when equipped with electric heaters.

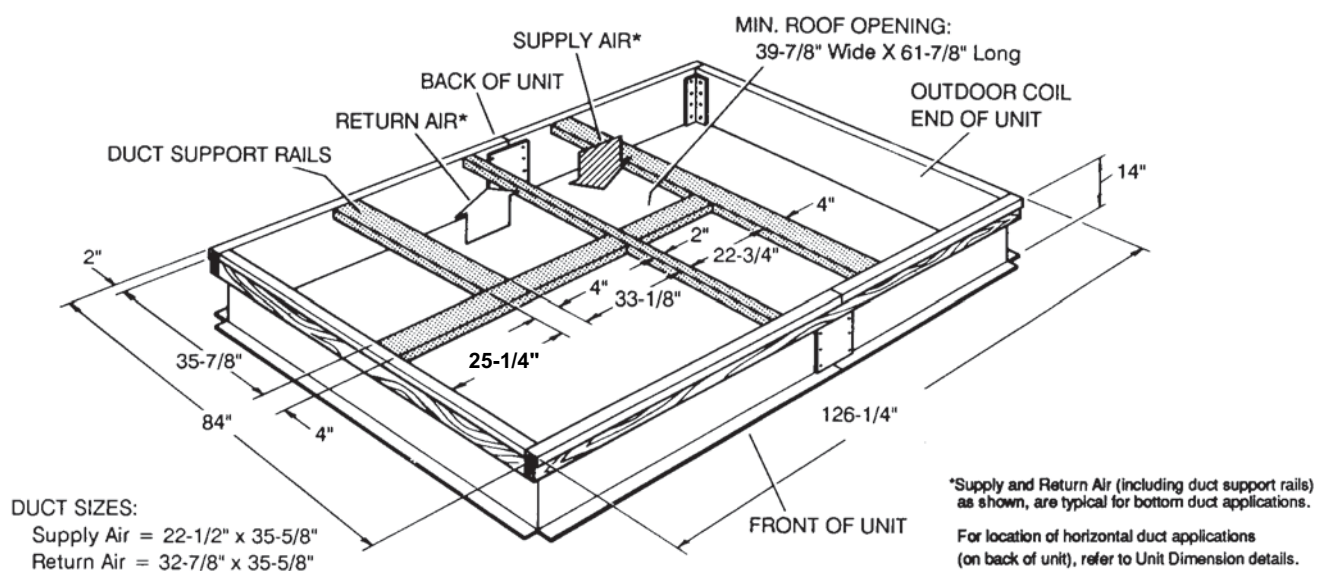


Figure 11: XP180/240 Roof Curb

Ductwork

Ductwork should be designed and sized 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.

A closed return duct system should be used. This will not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static pressure requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

Refer to Figures 7 and 8 for bottom air duct openings. Refer to Figure 9 for side air duct openings.

NOTE: It is recommended that, in Canada, the outlet duct be provided with a removable access panel. It is recommended that this opening be accessible when the unit is installed in service, and of a size such that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover should be attached in a manner adequate to prevent leakage.

Fixed Outdoor Air Intake Damper

This damper is shipped inside the return air compartment. It is completely assembled and ready for installation. A damper baffle inside of the hood is adjustable to provide variable amounts of outdoor air intake on units that are not provided with an economizer or a motorized damper option. Refer to the Fixed Outdoor Damper Figure 12.

Gasketing and mounting screws are provided in a parts bag attached to the hood assembly. Apply gasketing to the three flange surfaces on the hood prior to installing the hood. Extend gasketing 1/4 inch beyond the top and bottom of the two side flanges to insure adequate sealing.

Adjusting the damper to the desired air flow may be done before mounting the hood into position or after installation by removing the front hood panel or the screen on the bottom of the hood. Damper baffle in position 1 will allow approximately 10% outdoor air flow, position 2 approximately 15% and, to allow approximately 25%, remove the damper baffle.

On units with bottom return air application install the damper assembly over the opening in the side return air access panel. Remove and discard the opening cover and the covering over the hood mounting holes (used for shipping) before installing. Secure with the screws provided.

On units with side return air applications, install the damper assembly on the return air ductwork as close to the unit as possible. Cut an opening 16 inches high by 18 inches wide in the ductwork to accommodate the damper. Using the holes in the

hood flanges as a template, drill 9/64 inch diameter (#26 drill) holes into the ductwork and secure with the screws provided.

CAUTION

If outdoor air intake will not be required on units with bottom return air applications, the damper assembly should still be mounted on the side return air access panel, per the instructions above, to insure moisture is not drawn into the unit during operation. The covering over the mounting holes only need be removed. Do not remove the opening cover.

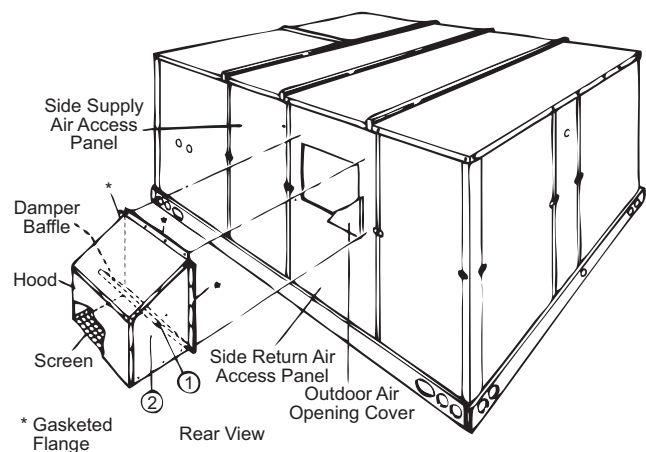


Figure 12: Fixed Outdoor Air Damper

Condensate Drain

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install a condensate drain line from the one-inch NPT female connection on the unit to an open drain.

NOTE: The condensate drain operates in a negative pressure in the cabinet. The condensate drain line MUST be trapped to provide proper drainage. See Figure 13.

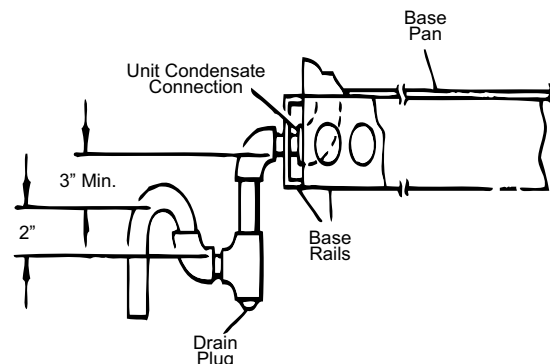


Figure 13: Condensate Drain

Compressors

The scroll compressor used in this product is specifically designed to operate with R-410A Refrigerant and cannot be interchanged.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

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

⚠ CAUTION

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

POE (polyolester) 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 performing any service that may risk exposure of compressor oil to the roof, take precautions to protect roofing.

Procedures which risk oil leakage include, but are not limited to, compressor replacement, repairing refrigerant leaks, replacing refrigerant components such as filter drier, pressure switch, metering device or coil.

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

⚠ CAUTION

Do not loosen compressor mounting bolts.

Filters

Two-inch filters are supplied with each unit. For XP240 models, the filter rack can be easily modified to accommodate four inch filters. Filters must always be installed ahead of the evaporator

coil and must be kept clean or replaced with same size and type. Dirty filters will reduce the capacity of the unit and will result in frosted coils or safety shutdown. Minimum filter area and required sizes are shown in Physical Data Table 7.

⚠ CAUTION

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

Power And Control Wiring

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

⚠ CAUTION

208/230-3-60 unit control transformers are factory wired for 230v power supply. Change tap on transformer for 208-3-60 operation. See unit wiring diagram.

Voltage tolerances which must be maintained at the compressor terminals during starting and running conditions are indicated on the unit Rating Plate and Table 1.

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes should not be required. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

A disconnect must be utilized for these units. Factory installed disconnects are available. If installing a disconnect (field supplied or York International® supplied accessory), refer to Figure 1 for the recommended mounting location.

⚠ CAUTION

Avoid damage to internal components if drilling holes for disconnect mounting.

NOTE: Since not all local codes allow the mounting of a disconnect on the unit, please confirm compliance with local code before mounting a disconnect on the unit.

Electrical line must be sized properly to carry the load. USE COPPER CONDUCTORS ONLY. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

Refer to Figures 14 and 15 for typical field wiring and to the appropriate unit wiring diagram mounted inside control doors for control circuit and power wiring information.

CAUTION

When connecting electrical power and control wiring to the unit, water-proof connectors must be used so that water or moisture cannot be drawn into the unit during normal operation. The above water-proofing conditions will also apply when installing a field supplied disconnect switch.

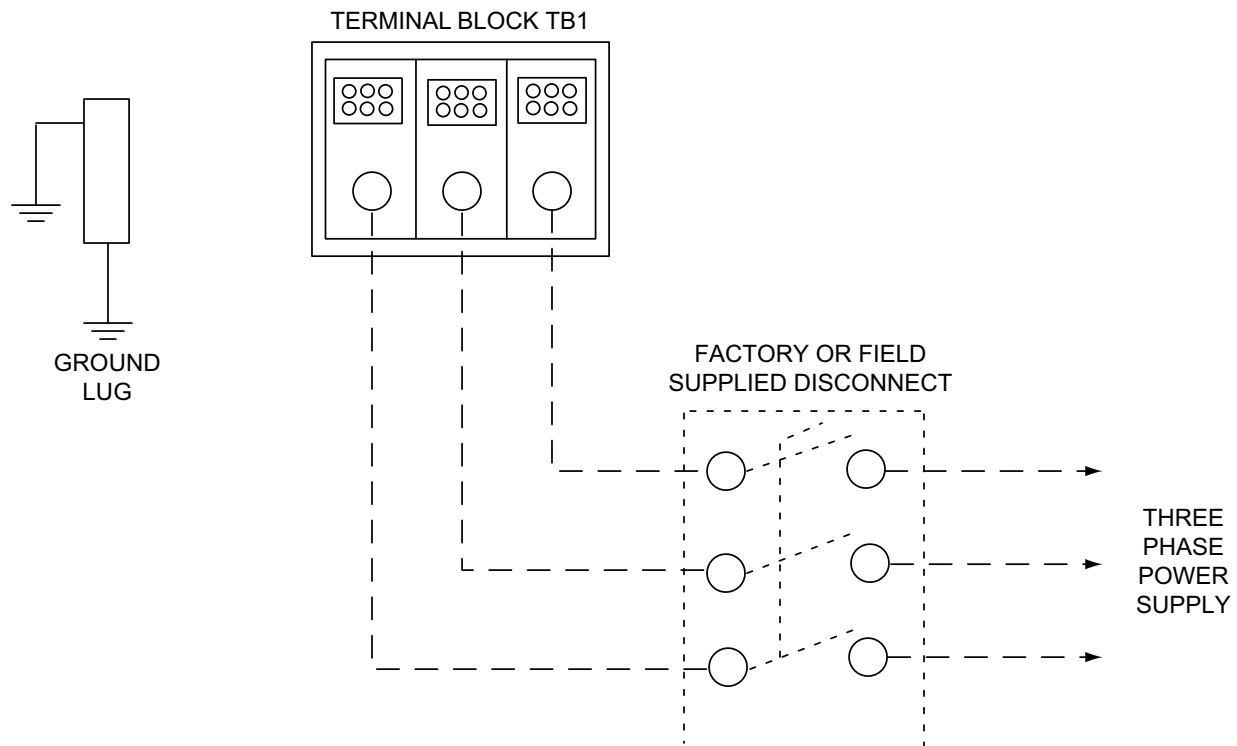


Figure 14: Field Wiring Disconnect - Heat Pump Unit With/Without Electric Heat

Thermostat Wiring

The thermostat should be located on an inside wall approximately 56 inch above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with thermostat for general installation procedure. Color-coded, insulated wires should be used to connect the thermostat to the unit. Refer to Table 5 for control wire sizing and maximum length.

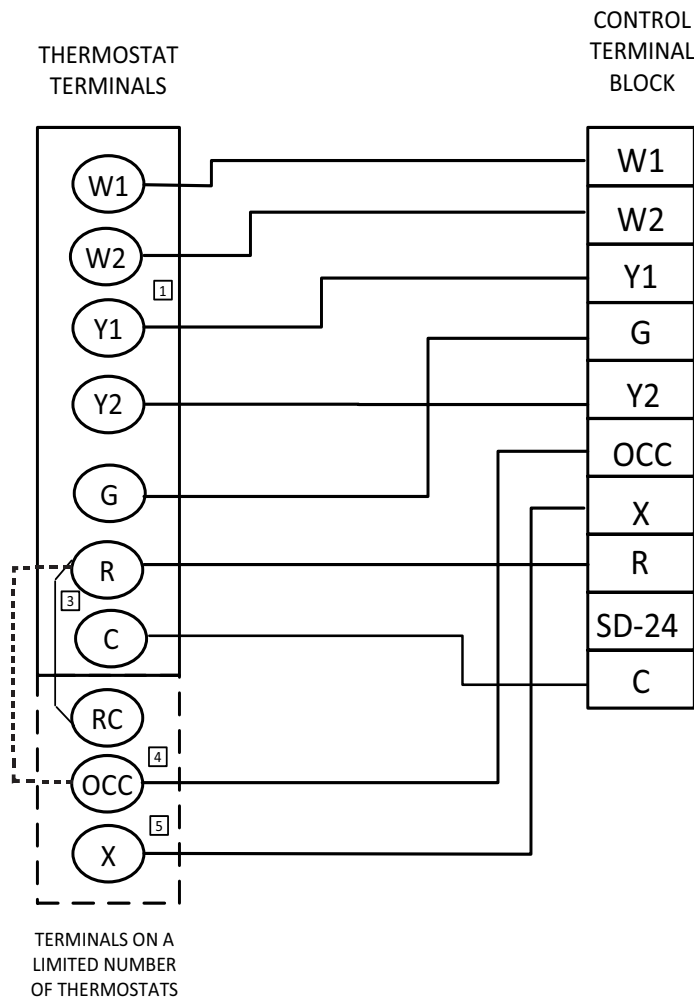
Space Sensor

The space sensor, if used, should be located on an inside wall approximately 56 inches above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow manufacturer's instructions enclosed with sensor for general installation procedure.

Table 5: Control Wire Sizes

Wire Size	Maximum Length ¹
18 AWG	150 Feet

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



- 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.

R~Occ Jumper:

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

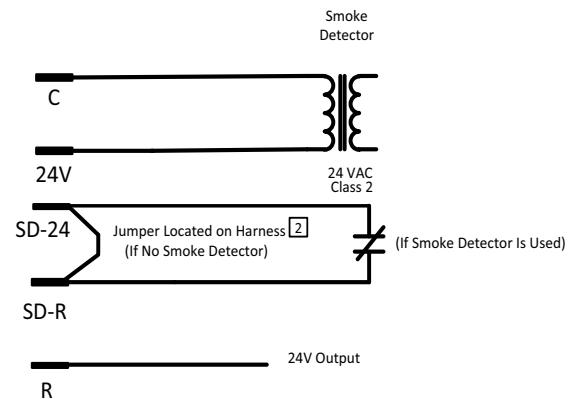


Figure 15: Typical Field Wiring 24 Volt Thermostat

CAUTION

208/230-3-60 unit control transformers are factory wired for 230v power supply. Change tap on transformer for 208-3-60 operation. See unit wiring diagram.

Table 6: Electrical Data
XP180/240 - Standard Drive Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat (Field Installed Accessory Only)				MCA ¹ (Amps)	Max Fuse ² / Breaker ³ Size (Amps)
		RLA	LRA	MCC				Model	kW	Stages	Amps		
180 (15)	208-3-60	25	164	39	4.1	13.5	0	NONE	-	-	-	78	100
								E18	13.5	1	37.5	124.8	125
								E36	27	2	74.9	124.8	125
								E54	40.6	2	112.7	157.7	175
								E72	54.1	2	150.2	171.6	200
	230-3-60	25	164	39	3.9	13	0	NONE	-	-	-	77.1	100
								E18	18	1	43.3	131.2	150
								E36	36	2	86.6	131.2	150
								E54	54	2	129.9	146.2	175
								E72	72	2	173.2	189.5	225
	460-3-60	12.2	100	19	2.15	6.5	0	NONE	-	-	-	38.3	50
								E18	18	1	21.7	65.3	70
								E36	36	2	43.3	65.3	70
								E54	54	2	65	73.1	80
								E72	72	2	86.6	94.7	110
	575-3-60	9	78	14	1.6	5.2	0	NONE	-	-	-	28.7	35
								E18	18	1	17.3	50.3	60
								E36	36	2	34.6	50.3	60
								E54	54	2	52	58.5	70
								E72	72	2	69.3	75.8	90
240 (20)	208-3-60	34.3	239	52	3.5	20	0	NONE	-	-	-	111.2	125
								E18	13.5	1	37.5	158	175
								E36	27	2	74.9	158	175
								E54	40.6	2	112.7	165.9	175
								E72	54.1	2	150.2	204.9	225
	230-3-60	34.3	239	52	3.5	19.4	0	NONE	-	-	-	110.6	125
								E18	18	1	43.3	164.7	175
								E36	36	2	86.6	164.7	175
								E54	54	2	129.9	164.7	175
								E72	72	2	173.2	218.8	225
	460-3-60	17.9	125	28	1.9	9.7	0	NONE	-	-	-	57.6	70
								E18	18	1	21.7	84.6	90
								E36	36	2	43.3	84.6	90
								E54	54	2	65	84.6	90
								E72	72	2	86.6	111.7	125
	575-3-60	12.8	80	20	1.5	7.8	0	NONE	-	-	-	42.6	50
								E18	18	1	17.3	64.3	70
								E36	36	2	34.6	64.3	70
								E54	54	2	52	64.3	70
								E72	72	2	69.3	85.9	90

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

XP180/240 - Standard Drive With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat (Field Installed Accessory Only)				MCA ¹ (Amps)	Max Fuse ² / Breaker ³ Size (Amps)
		RLA	LRA	MCC				Model	kW	Stages	Amps		
180 (15)	208-3-60	25	164	39	4.1	13.5	10	NONE	-	-	-	88	110
								E18	13.5	1	37.5	134.8	150
								E36	27	2	74.9	134.8	150
								E54	40.6	2	112.7	170.2	175
								E72	54.1	2	150.2	181.6	200
	230-3-60	25	164	39	3.9	13	10	NONE	-	-	-	87.1	110
								E18	18	1	43.3	141.2	150
								E36	36	2	86.6	141.2	150
								E54	54	2	129.9	158.7	175
								E72	72	2	173.2	202	225
	460-3-60	12.2	100	19	2.15	6.5	5	NONE	-	-	-	43.3	50
								E18	18	1	21.7	70.3	80
								E36	36	2	43.3	70.3	80
								E54	54	2	65	79.3	90
								E72	72	2	86.6	101	110
	575-3-60	9	78	14	1.6	5.2	4	NONE	-	-	-	32.7	40
								E18	18	1	17.3	54.3	60
								E36	36	2	34.6	54.8	60
								E54	54	2	52	63.5	70
								E72	72	2	69.3	80.8	90
240 (20)	208-3-60	34.3	239	52	3.5	20	10	NONE	-	-	-	121.2	150
								E18	13.5	1	37.5	168	175
								E36	27	2	74.9	168	175
								E54	40.6	2	112.7	178.4	200
								E72	54.1	2	150.2	214.9	225
	230-3-60	34.3	239	52	3.5	19.4	10	NONE	-	-	-	120.6	150
								E18	18	1	43.3	174.7	175
								E36	36	2	86.6	174.7	175
								E54	54	2	129.9	174.7	175
								E72	72	2	173.2	228.8	250
	460-3-60	17.9	125	28	1.9	9.7	5	NONE	-	-	-	62.6	80
								E18	18	1	21.7	89.6	100
								E36	36	2	43.3	89.6	100
								E54	54	2	65	89.6	100
								E72	72	2	86.6	116.7	125
	575-3-60	12.8	80	20	1.5	7.8	4	NONE	-	-	-	46.6	50
								E18	18	1	17.3	68.3	70
								E36	36	2	34.6	68.3	70
								E54	54	2	52	68.3	70
								E72	72	2	69.3	89.9	90

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

XP180/240 - High Static Drive Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat (Field Installed Accessory Only)				MCA ¹ (Amps)	Max Fuse ² / Breaker ³ Size (Amps)
		RLA	LRA	MCC				Model	kW	Stages	Amps		
180 (15)	208-3-60	25	164	39	4.1	20	0	NONE	-	-	-	84.5	100
								E18	13.5	1	37.5	131.3	150
								E36	27	2	74.9	131.3	150
								E54	40.6	2	112.7	165.9	175
								E72	54.1	2	150.2	178.1	200
	230-3-60	25	164	39	3.9	19.4	0	NONE	-	-	-	83.5	100
								E18	18	1	43.3	137.6	150
								E36	36	2	86.6	137.6	150
								E54	54	2	129.9	154.2	175
								E72	72	2	173.2	197.5	225
	460-3-60	12.2	100	19	2.15	9.7	0	NONE	-	-	-	41.5	50
								E18	18	1	21.7	68.5	70
								E36	36	2	43.3	68.5	70
								E54	54	2	65	77.1	90
								E72	72	2	86.6	98.7	110
	575-3-60	9	78	14	1.6	7.8	0	NONE	-	-	-	31.3	40
								E18	18	1	17.3	52.9	60
								E36	36	2	34.6	53.1	60
								E54	54	2	52	61.7	70
								E72	72	2	69.3	79	90
240 (20)	208-3-60	34.3	239	52	3.5	26	0	NONE	-	-	-	117.2	150
								E18	13.5	1	37.5	164	175
								E36	27	2	74.9	164	175
								E54	40.6	2	112.7	173.4	175
								E72	54.1	2	150.2	210.9	225
	230-3-60	34.3	239	52	3.5	25	0	NONE	-	-	-	116.2	150
								E18	18	1	43.3	170.3	175
								E36	36	2	86.6	170.3	175
								E54	54	2	129.9	170.3	175
								E72	72	2	173.2	224.4	225
	460-3-60	17.9	125	28	1.9	12.5	0	NONE	-	-	-	60.4	70
								E18	18	1	21.7	87.4	90
								E36	36	2	43.3	87.4	90
								E54	54	2	65	87.4	90
								E72	72	2	86.6	114.5	125
	575-3-60	12.8	80	20	1.5	10	0	NONE	-	-	-	44.8	50
								E18	18	1	17.3	66.5	70
								E36	36	2	34.6	66.5	70
								E54	54	2	52	66.5	70
								E72	72	2	69.3	88.1	90

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

XP180/240 - High Static Drive With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat (Field Installed Accessory Only)				MCA ¹ (Amps)	Max Fuse ² / Breaker ³ Size (Amps)
		RLA	LRA	MCC				Model	kW	Stages	Amps		
180 (15)	208-3-60	25	164	39	4.1	20	10	NONE	-	-	-	94.5	110
								E18	13.5	1	37.5	141.3	150
								E36	27	2	74.9	141.3	150
								E54	40.6	2	112.7	178.4	200
								E72	54.1	2	150.2	188.1	200
	230-3-60	25	164	39	3.9	19.4	10	NONE	-	-	-	93.5	110
								E18	18	1	43.3	147.6	150
								E36	36	2	86.6	147.6	150
								E54	54	2	129.9	166.7	175
								E72	72	2	173.2	210	225
	460-3-60	12.2	100	19	2.15	9.7	5	NONE	-	-	-	46.5	50
								E18	18	1	21.7	73.5	80
								E36	36	2	43.3	73.5	80
								E54	54	2	65	83.3	90
								E72	72	2	86.6	105	110
	575-3-60	9	78	14	1.6	7.8	4	NONE	-	-	-	35.3	40
								E18	18	1	17.3	56.9	60
								E36	36	2	34.6	58.1	60
								E54	54	2	52	66.7	70
								E72	72	2	69.3	84	90
240 (20)	208-3-60	34.3	239	52	3.5	26	10	NONE	-	-	-	127.2	150
								E18	13.5	1	37.5	174	175
								E36	27	2	74.9	174	175
								E54	40.6	2	112.7	185.9	200
								E72	54.1	2	150.2	220.9	225
	230-3-60	34.3	239	52	3.5	25	10	NONE	-	-	-	126.2	150
								E18	18	1	43.3	180.3	200
								E36	36	2	86.6	180.3	200
								E54	54	2	129.9	180.3	200
								E72	72	2	173.2	234.4	250
	460-3-60	17.9	125	28	1.9	12.5	5	NONE	-	-	-	65.4	80
								E18	18	1	21.7	92.4	100
								E36	36	2	43.3	92.4	100
								E54	54	2	65	92.4	100
								E72	72	2	86.6	119.5	125
	575-3-60	12.8	80	20	1.5	10	4	NONE	-	-	-	48.8	60
								E18	18	1	17.3	70.5	80
								E36	36	2	34.6	70.5	80
								E54	54	2	52	70.5	80
								E72	72	2	69.3	92.1	100

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

Table 7: XP180/240 Physical Data

Component	Models	
	XP180	XP240
Nominal Tonnage	15	20
AHRI COOLING PERFORMANCE		
Gross Capacity @ AHRI A point (Btu/hr)	181,600	261,400
AHRI net capacity (Btu/hr)	176,000	240,000
EER	10.6	9.5
IEER with Constant Volume	11.8	-
IEER with Intellispeed	13.2	12
Nominal CFM	5500	8000
System power (KW)	16.5	23.8
Refrigerant type	R-410A	R-410A
Refrigerant charge (lb-oz)		
System 1	23-0	28-0
System 2	23-4	29-0
AHRI HEATING PERFORMANCE		
47 F Net Capacity (Btu/hr)	162,000	260,000
System power (KW) / COP	14.62 / 3.24	23.80 / 3.20
17 F Net Capacity (Btu/hr)	99,000	136,000
System power (KW) / COP	13.62 / 2.05	20.96 / 2.05
DIMENSIONS (inches)		
Length	136-1/4	180-19/32
Width	92	92
Height	52-5/8	52-5/8
OPERATING WT. (lbs.)	2140	2650
COMPRESSORS		
Type	Scroll	Scroll
Quantity	2	2
Unit Capacity Steps (%)	50 / 100	50 / 100
CONDENSER COIL DATA		
Face area (Sq. Ft.)	43.3	63.8
Rows	3	2
Fins per inch	15	20
Tube diameter (in.)	3/8	3/8
Circuitry Type	Split-face	Split-face
EVAPORATOR COIL DATA		
Face area (Sq. Ft.)	20	25
Rows	4	4
Fins per inch	13.5	15
Tube diameter	3/8	3/8
Circuitry Type	Inter-twined	Split-face
Refrigerant control	TXV	TXV
CONDENSER FAN DATA		
Quantity	2	4
Fan diameter (Inch)	30	30
Type	Prop	Prop
Drive type	Direct	Direct
No. speeds	1	1
Number of motors	2	4
Motor HP each	1.25	0.5
RPM	1140	1075

Table 7: XP180/240 Physical Data (Continued)

Component	Models			
	XP180		XP240	
Nominal Tonnage	15		20	
BELT DRIVE EVAP FAN DATA				
Quantity	1		1	
Fan Size (Inch)	18 X 15		18 X 15	
Type	Centrifugal		Centrifugal	
Motor Sheave	1VP60	1VP60	1VP60	1VP60
Blower Sheave	BK120	BK100	BK110	BK090
Belt	BX81	BX78	BX78	BX75
Motor HP each	5	7.5	7.5	10
RPM	1750	1750	1750	1760
Frame size	184T	213T	213T	215T
FILTERS				
Quantity - Size	4 - (16 x 25 x 2),		12 - (12 x 24 x 2) ^{1,2}	
	4 - (16 x 20 x 2) ^{1,2}			
	4 - (16 x 25 x 4), 4 - (16 x 20 x 4) ³		2 - (20 x 24 x 4), 12 - (12x 24 x 4) ³	

1. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.

2. 2 In. Pleated, Optional, MERV 8.

3. 4 In. Pleated, Optional, MERV 13.

Field Installed Electric Heat Accessories

These field-installed heater accessories can be wired for single point power supply.

These CSA approved heater accessories shall be located within the central compartment of the unit with the heater elements extending into the supply air chamber.

Fuses are supplied, where required. Some kW sizes require fuses and others do not. Refer to Table 8 for minimum CFM limitations and to Table 6 for electrical data.

Table 8: Electric Heat Minimum Supply Air

Size (Tons)	Voltage	Minimum Supply Air (CFM)			
		Heater kW			
		18	36	54	72
180 (15)	208/230-3-60	4500	4500	5000	5000
	460-3-60	4500	4500	5000	5000
	600-3-60	4500	4500	4500	4500
240 (20)	208/230-3-60	6000	6000	6000	6000
	460-3-60	6000	6000	6000	6000
	600-3-60	6000	6000	6000	6000

Options/Accessories

Electric Heat

Electric heaters are available as a field-installed accessory. These heaters mount in the heat compartment with the heating elements extending into the supply air chamber. All electric heaters are fused and intended for use with single point power supply.

Economizer/Motorized Outdoor Damper Rain Hood

The instruction for the optional economizer/motorized damper rain hood can be found in the rain hood kit. Use these instructions when field assembling an economizer rain hood onto a unit. The outdoor and return air dampers, the damper actuator, the damper linkage, the outdoor and return air divider baffles, and all the control sensors are factory mounted as part of the "Factory installed" economizer option.

Power Exhaust/Barometric Relief Damper and Rain Hood

The instructions for the power exhaust/barometric relief damper and rain hood can be found in the rain hood kit. The exhaust fan, all supporting brackets, angles, and the wiring are factory installed as part of the power exhaust option.

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" set points, in relationship to the VFD output percentage. On a constant volume single speed supply fan system both set-points should be set to the same value.

Free Cooling

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

Dry Bulb Changeover

For dry bulb economizer operation, the outside air is suitable for free cooling if the outside air temperature is 1°F below the Economizer OAT Enable Setpoint **and** 1°F below the Return Air Temperature.

Free cooling is no longer available if the outside air temperature rises above **either** the Economizer OAT Enable setpoint **or** the return air temperature.

Single Enthalpy Changeover

For single enthalpy economizer operation, the outside air is suitable for free cooling if the outside air enthalpy is at least 1 BTU/lb below the Economizer Outside Air Enthalpy Setpoint **and** the outside air temperature is no greater than the RAT plus 9°F.

If the outside air temperature rises above the RAT plus 10°F, free cooling is no longer available. The outside air temperature must drop to no greater than RAT plus 9°F to enter free cooling again.

Free cooling is no longer available if the outside air enthalpy rises above the Economizer Outside Air Enthalpy Setpoint.

Dual Enthalpy Changeover

For dual enthalpy economizer operation, the outside air enthalpy must be lower than the return air enthalpy by 1 btu/lb **AND** the outside air temperature is no greater than the RAT plus 9°F.

Auto

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

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

Free Cooling Operation

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

Thermostat

In free cooling, with a thermostat input to Y1, the dampers modulate to control the supply air temperature to the Economizer Setpoint +/- 0.5°F (default 55°F).

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

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

Once 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 will a compressor output be turned ON if the economizer output is less than 100%, even if the differential between zone (or return) temperature and the current cooling setpoint is great enough to demand more than one stage of cooling.

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

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

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

Power Exhaust

Setpoints

a. Economizer Enable	ON
b. Power Exhaust Enable	ON
c. Modulating Power Exhaust	OFF
d. Exhaust VFD Installed	OFF
e. Building Pressure Sensor Enabled	OFF
f. Econo Damper Position For Exh Fan	ON Percent
g. 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 Economizer Expansion module
- 24 VAC from EX-FAN to energize exhaust fan on Economizer Expansion module

Operation

Operation details include:

- Compares economizer output to the Economizer Damper Position For Exhaust Fan On and OFF.
- Energizes exhaust fan when economizer output is above Economizer Damper Position For Exhaust Fan On.
- De-energizes exhaust fan when economizer output is below the Economizer Damper Position for Exhaust Fan OFF

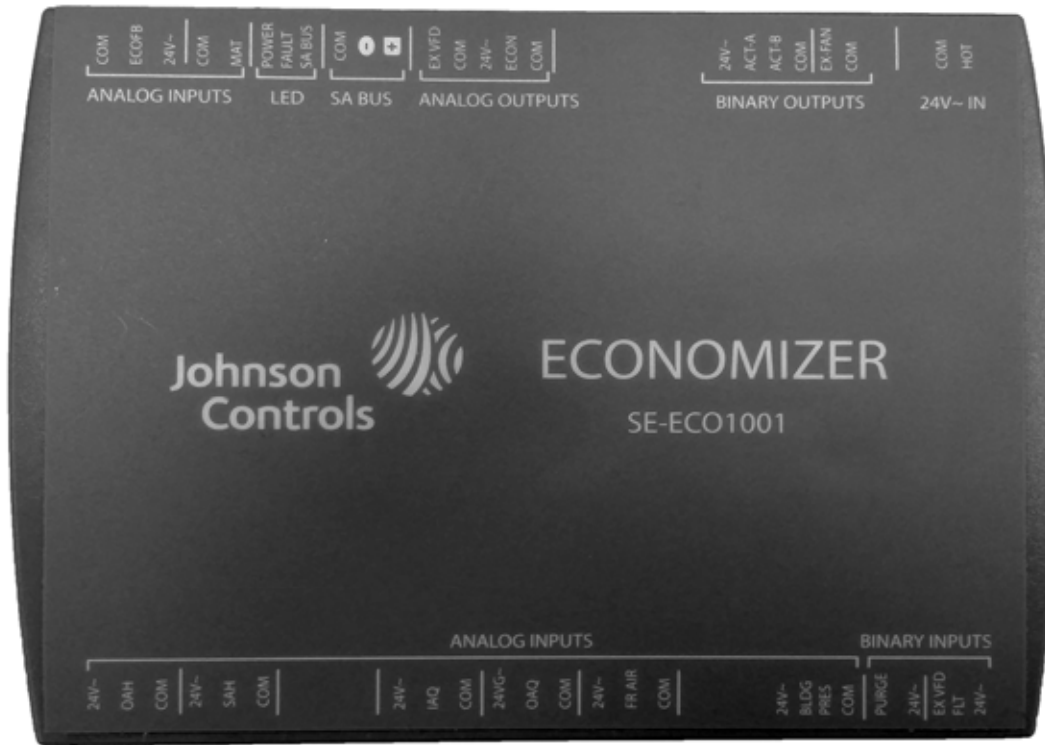


Figure 16: SE-ECO1001-0 Economizer Controller

Table 9: Smart Equipment™ Economizer Board Details

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

Table 9: Smart Equipment™ Economizer Board Details (Continued)

Board Label	Cover Label	Description	Function & Comments
SA BUS¹ Pin connections at left on upper edge of economizer board			
C	COM	Common for SA BUS power and communication circuits	EconCtrlr parameter reports UCB-to-economizer board SA bus communication status. Negative of the SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection & diagnostics board
-	-	Communication for SA BUS devices	EconCtrlr parameter reports UCB-to-economizer board SA BUS communication status. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts lower than +) SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection & diagnostics board
+	+	Communication for SA BUS devices	EconCtrlr parameter reports UCB-to-economizer board SA BUS communication status. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts higher than -) SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection & diagnostics board
ANALOG OUTPUTS Pin at center on upper edge of economizer board			
J4	EX VFD	2-10 VDC positive output for the modulating power Exhaust fan Variable Frequency Drive/ discharge damper modulating power exhaust actuator	ExFanVFD parameter reports output status (0-100%) when ExFType selection is Variable Frequency Fan; EAD-O parameter reports output status (0-100%) when ExFType selection is Modulating Damper. Used to ramp the power exhaust fan VFD/ position the discharge damper actuator.
	COM	24 VAC common/0-10 VDC negative for the power exhaust variable frequency drive/ discharge damper modulating power exhaust actuator	Connects through circuit trace to 24V~ IN pin COM
	24V~	24 VAC hot supplied for the discharge damper modulating power exhaust actuator and economizer actuator	Connects through circuit trace to 24V~ IN pin HOT
	ECON	2-10 VDC output for the Economizer actuator	Econ parameter reports output status (0-100%). Used to position the economizer actuator for minimum position, free cooling, demand ventilation, cooling economizer loading and purge functions
	COM	24 VAC common/0-10 VDC negative for economizer actuator	Connects through circuit trace to 24V~ IN pin COM
BINARY OUTPUTS Pin at right on upper edge of economizer board			
J3	24V~	24 VAC hot supplied for an incremental (floating control) economizer actuator	Connects through circuit trace to 24V~ IN pin HOT
	ACT-A	24 VAC hot outputs to position an incremental (floating control) economizer actuator	Unused in current control revision
	ACT-B	24 VAC return	Unused in current control revision
	COM	24 VAC common for an incremental (floating control) economizer actuator	Connects through circuit trace to 24V~ IN pin COM
	EX-FAN	24 VAC hot output to energize power exhaust fan contactor coil/VFD enable relay coil	ExFan parameter reports output status (Off-On) when ExFType selection is Non-Modulating, Modulating Damper or Variable Frequency Fan. Used to turn on/enable the power exhaust fan motor.
	COM	24 VAC common/0-10 VDC negative for economizer actuator	Connects through circuit trace to 24V~ IN pin COM

Table 9: Smart Equipment™ Economizer Board Details (Continued)

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

Table 9: Smart Equipment™ Economizer Board Details (Continued)

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

1. When wiring unit and other devices using the SA Bus and FC Bus, see Table 20.

Power Exhaust Damper Set Point

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer damper position (Percent Open). The exhaust fan on/off set-points can be changed via the Smart Equipment™ control. Factory defaults are as follows: Economizer damper position for exhaust fan to activate 60%. Economizer damper position for exhaust fan to de-activate 20%. The adjustable range is 10%-99%.

Indoor Air Quality - IAQ

Indoor Air Quality (indoor sensor input): The Indoor Air Quality 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 set point, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the IAQ signal exceeds its set point 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 Max damper position setting.

When the signal exceeds its set point (Demand Control Ventilation Set Point) 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 CO2 Space Sensor Kit Part #2AQ04700524
- Optional CO2 Sensor Kit Part #2AQ04700624

Optional BAS-Ready Economizer Power Exhaust Damper Set Point Adjustment

Remove the economizer access panel from the unit. Loosen, but do not remove the two panel latches. Locate the economizer actuator, where the following adjustment can be made.

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer's outdoor damper position. The actuator's auxiliary switch adjustment screw should be set at the damper position at which the power exhaust is needed. The adjustment screw can be set between 25 to 85 degrees open.

Replace the economizer access panel.

Phasing

York® Model XP units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the phasing of the **Field Line Connection at the factory or field supplied disconnect** to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased.)

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').

Belt Tension

The tension on the belt should be adjusted as shown in Figure 17.

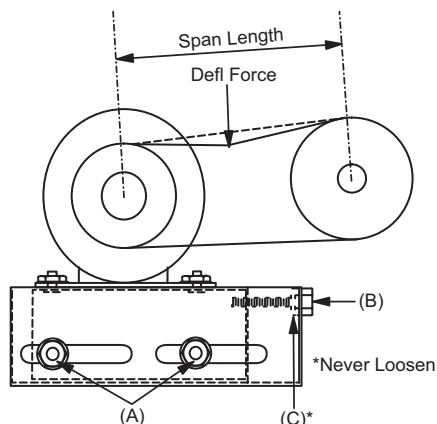


Figure 17: Belt Adjustment

CAUTION

Procedure for adjusting belt tension:

1. Loosen four nuts (top and bottom) A.
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. Deflection distance of 4mm (5/32") is obtained.

To determine the deflection distance from normal position, use a straight edge from sheave to sheave as reference line. The recommended deflection force is as follows:

Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any retensioning should fall between the min. and max. deflection force values.

5. After adjusting re-tighten nuts (A).

CFM Static Pressure and Power-Altitude and Temperature Corrections

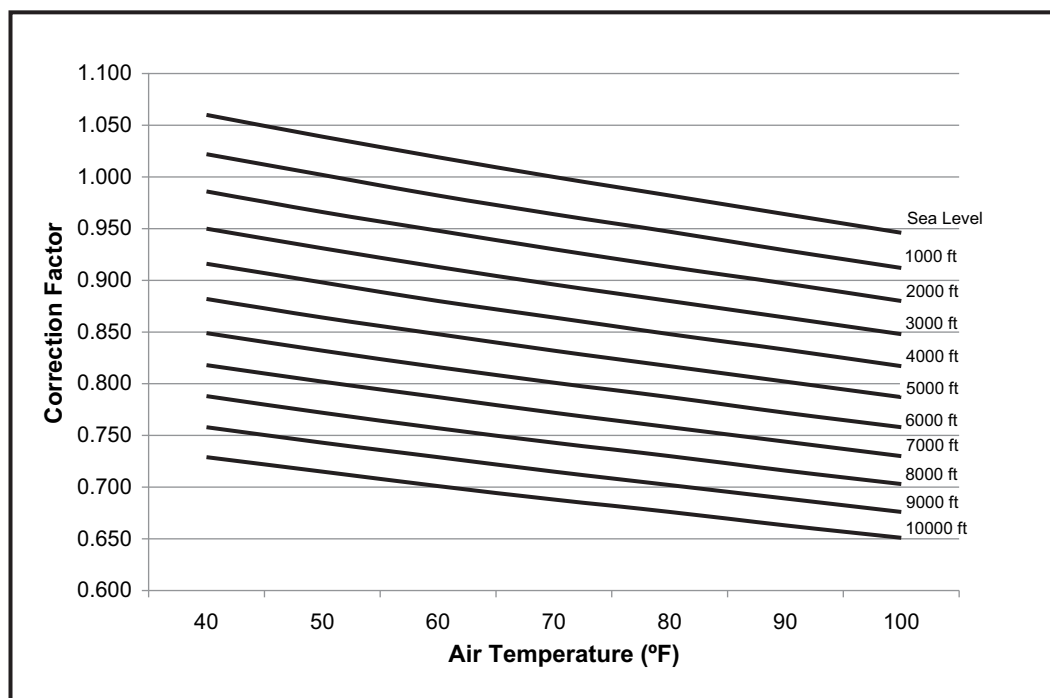
The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

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 will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 10 and Figure 18.

Table 10: Altitude/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 18: Altitude/Temperature Correction Factors**

The examples below will assist in determining the airflow performance of the product at altitude.

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

Solution: At an elevation of 5,000 ft. the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 11 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 10 shows the correction factor to be 0.832.

$$\text{Corrected static pressure} = 1.5 \times 0.832 = 1.248 \text{ IWC}$$

$$\text{Corrected BHP} = 4.0 \times 0.832 = 3.328$$

Example 2: A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit

blower tables to select the blower speed and the BHP requirement.

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

The 1.5" 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.

$$\text{Sea level static pressure} = 1.5 / .832 = 1.80"$$

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

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

$$\text{BHP at 5,000 ft.} = 3.2 \times .832 = 2.66$$

Drive Selection

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

Example

1. 6800 CFM
2. 2.0 iwq
3. Using the supply air blower performance table below, the following data point was located: 1020 RPM & 5.92 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 5.92 BHP exceeds the maximum continuous BHP rating of the 5.0 HP motor. The 7.5 HP motor is required.
6. 1020 RPM is within the range of the 7.5 HP drives.
7. Using the 7.5 HP motor and drive, 3.5 turns open will achieve 1020 RPM.

Example Supply Air Blower Performance

Air Flow (CFM)	Available External Static Pressure - IWG											
	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP
	Standard 5 HP & Drive						High Static 7.5 HP & Drive					
6400	719 2.55	756 3.03	792 3.49	828 3.92	864 4.32	899 4.67	933 4.98	966 5.24	998 5.45	1028 5.59	1056 5.67	1083 5.68
6800	742 3.02	778 3.51	814 3.97	850 4.40	886 4.79	921 5.15	955 5.46	988 5.72	1020 5.92	1050 6.07	1078 6.15	1105 6.16
7200	765 3.54	802 4.03	838 4.49	874 4.92	910 5.32	945 5.67	979 5.98	1012 6.24	1044 6.44	1074 6.59	1102 6.67	1129 6.68
7600	790 4.11	827 4.60	863 5.06	899 5.49	935 5.88	970 6.24	1004 6.55	1037 6.81	1069 7.01	1099 7.16	1127 7.24	1154 7.25
							7.5 HP & Field Supplied Drive					

Table X: RPM Selection

Size (Tons)	Model	HP	Max BHP	Motor Sheave	Blower Sheave	6 Turns Open	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
X	Y	5	5.75	1VP60	BK110	730	765	800	835	870	905	N/A
		7.5	8.63	1VP60	BK090	905	950	990	1035	1075	1120	N/A

Table 11: Air Flow Performance - Side Duct Application
XP180 (15 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG ¹																							
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive				Standard 5 HP & Drive								High Static 7.5 HP & Drive											
4000	626	0.22	659	0.66	695	1.07	731	1.45	769	1.81	807	2.16	845	2.49	882	2.81	917	3.12	951	3.43	983	3.74	1011	4.05
4400	641	0.56	674	0.99	709	1.40	746	1.78	784	2.15	822	2.49	860	2.82	897	3.14	932	3.46	966	3.77	998	4.08	1026	4.39
4800	657	0.93	690	1.37	725	1.78	762	2.16	800	2.52	838	2.87	876	3.20	913	3.52	948	3.83	982	4.14	1014	4.45	1042	4.76
5200	674	1.35	708	1.78	743	2.19	780	2.58	817	2.94	855	3.28	893	3.61	930	3.94	966	4.25	1000	4.56	1031	4.87	1059	5.18
5600	693	1.81	726	2.24	762	2.65	798	3.03	836	3.40	874	3.74	912	4.07	949	4.39	985	4.71	1018	5.02	1050	5.33	1078	5.64
6000	714	2.30	747	2.74	782	3.15	819	3.53	857	3.89	895	4.24	932	4.57	969	4.89	1005	5.21	1039	5.51	1070	5.82	1099	6.14
6400	736	2.84	769	3.28	804	3.69	841	4.07	879	4.43	917	4.78	954	5.11	991	5.43	1027	5.74	1061	6.05	1092	6.36	1121	6.67
6800	759	3.42	792	3.85	828	4.26	865	4.65	902	5.01	940	5.35	978	5.68	1015	6.01	1051	6.32	1084	6.63	1116	6.94	1144	7.25
7200	784	4.03	818	4.47	853	4.87	890	5.26	927	5.62	965	5.97	1003	6.30	1040	6.62	1076	6.93	1110	7.24	1141	7.55	-	-
7600	811	4.68	844	5.11	880	5.52	916	5.90	954	6.27	992	6.61	1030	6.94	1067	7.26	1103	7.58	-	-	-	-	-	-
	7.5 HP & Field Supplied Drive																							

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine required motor sheave setting.
3. kW = BHP x 0.834.

XP240 (20 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG ¹																							
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 7.5 HP & Field Supplied Drive							Standard 7.5 HP & Drive										High Static 10 HP & Drive						
5200	665	1.01	696	1.59	728	2.07	761	2.49	793	2.85	826	3.20	859	3.54	890	3.91	921	4.32	951	4.81	979	5.39	1005	6.09
5600	685	1.39	716	1.97	749	2.45	781	2.87	814	3.23	847	3.57	879	3.92	911	4.29	941	4.70	971	5.19	999	5.77	1025	6.47
6000	705	1.82	737	2.40	769	2.89	801	3.30	834	3.67	867	4.01	899	4.36	931	4.72	962	5.14	991	5.62	1019	6.20	1045	6.90
6400	726	2.32	757	2.90	789	3.39	822	3.80	855	4.17	887	4.51	920	4.85	951	5.22	982	5.63	1012	6.12	1040	6.70	1066	7.40
6800	747	2.88	778	3.46	810	3.94	843	4.36	875	4.72	908	5.07	940	5.41	972	5.78	1003	6.19	1032	6.68	1060	7.26	1087	7.96
7200	768	3.49	800	4.07	832	4.56	864	4.97	897	5.34	930	5.68	962	6.02	994	6.39	1025	6.80	1054	7.29	1082	7.87	1108	8.57
7600	791	4.16	823	4.74	855	5.23	887	5.64	920	6.01	953	6.35	985	6.69	1017	7.06	1048	7.48	1077	7.96	1105	8.54	1131	9.24
8000	815	4.89	847	5.47	879	5.95	911	6.37	944	6.73	977	7.08	1009	7.42	1041	7.79	1072	8.20	1101	8.69	1129	9.27	1155	9.97
8400	841	5.67	872	6.25	904	6.73	937	7.15	969	7.51	1002	7.86	1035	8.20	1066	8.57	1097	8.98	1126	9.47	1154	10.05	-	-
8800	867	6.50	899	7.08	931	7.56	963	7.98	996	8.34	1029	8.69	1061	9.03	1093	9.40	1124	9.81	-	-	-	-	-	-
9200	896	7.38	927	7.96	959	8.45	992	8.86	1024	9.23	1057	9.57	1090	9.91	-	-	-	-	-	-	-	-	-	-
9600	925	8.31	957	8.89	989	9.38	1021	9.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10000	957	9.29	988	9.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine required motor sheave setting.
3. kW = BHP x 0.820.

Table 12: Air Flow Performance - Bottom Duct Application**XP180 (15 Ton) Bottom Duct**

Air Flow (CFM)	Available External Static Pressure - IWG ¹											
	0.4 RPM BHP	0.6 RPM BHP	0.8 RPM BHP	1.0 RPM BHP	1.2 RPM BHP	1.4 RPM BHP	1.6 RPM BHP	1.8 RPM BHP	2.0 RPM BHP	2.2 RPM BHP	2.4 RPM BHP	2.6 RPM BHP
	Standard 5 HP & Field Supplied Drive		Standard 5 HP & Drive						High Static 7.5 HP & Drive			
4000	642 0.25	676 0.72	711 1.14	746 1.52	782 1.87	818 2.19	853 2.49	887 2.79	920 3.08	951 3.38	980 3.69	1006 4.02
4400	659 0.59	693 1.06	728 1.48	763 1.86	799 2.21	835 2.53	870 2.83	904 3.13	937 3.42	968 3.71	997 4.03	1023 4.36
4800	678 0.95	712 1.43	746 1.85	782 2.23	818 2.58	854 2.90	889 3.20	923 3.49	956 3.78	987 4.08	1016 4.39	1042 4.73
5200	699 1.36	732 1.83	767 2.25	803 2.63	839 2.98	874 3.30	910 3.60	944 3.90	977 4.19	1008 4.48	1036 4.80	1062 5.13
5600	721 1.80	755 2.28	790 2.70	825 3.08	861 3.43	897 3.75	932 4.05	966 4.34	999 4.63	1030 4.93	1059 5.24	1085 5.58
6000	745 2.30	779 2.77	814 3.19	849 3.57	885 3.92	921 4.24	956 4.54	990 4.83	1023 5.12	1054 5.42	1083 5.73	1109 6.07
6400	770 2.83	804 3.31	839 3.73	874 4.11	910 4.46	946 4.78	981 5.08	1015 5.37	1048 5.66	1079 5.96	1108 6.27	1134 6.61
6800	797 3.42	830 3.89	865 4.31	901 4.70	936 5.04	972 5.36	1007 5.66	1042 5.96	1074 6.25	1105 6.55	1134 6.86	1160 7.19
7200	824 4.05	857 4.53	892 4.95	928 5.33	964 5.68	999 6.00	1035 6.30	1069 6.59	1102 6.88	1133 7.18	1161 7.49	- -
7600	852 4.73	885 5.21	920 5.63	956 6.01	992 6.36	1027 6.68	1063 6.98	1097 7.27	1130 7.56	- -	- -	- -
7.5 HP & Field Supplied Drive												

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.

2. See RPM SELECTION table to determine required motor sheave setting.

3. kW = BHP x 0.834.

XP240 (20 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG ¹											
	0.4 RPM BHP	0.6 RPM BHP	0.8 RPM BHP	1.0 RPM BHP	1.2 RPM BHP	1.4 RPM BHP	1.6 RPM BHP	1.8 RPM BHP	2.0 RPM BHP	2.2 RPM BHP	2.4 RPM BHP	2.6 RPM BHP
	Standard 7.5 HP & Field Supplied Drive			Standard 7.5 HP & Drive							High Static 10 HP & Drive	
5200	660 1.45	695 1.93	730 2.39	765 2.82	800 3.24	836 3.65	870 4.04	904 4.42	937 4.79	968 5.15	998 5.51	1026 5.87
5600	686 1.78	720 2.26	755 2.72	791 3.16	826 3.58	861 3.98	896 4.37	930 4.75	963 5.12	994 5.49	1024 5.85	1052 6.20
6000	711 2.19	746 2.67	781 3.13	816 3.57	851 3.99	887 4.39	921 4.78	955 5.16	988 5.54	1019 5.90	1049 6.26	1077 6.61
6400	736 2.68	771 3.16	806 3.62	841 4.06	876 4.48	912 4.88	946 5.27	980 5.65	1013 6.02	1044 6.39	1074 6.75	1102 7.10
6800	761 3.24	796 3.72	831 4.18	867 4.62	902 5.04	937 5.44	972 5.83	1005 6.21	1038 6.58	1070 6.95	1100 7.31	1128 7.66
7200	787 3.87	822 4.35	857 4.81	893 5.25	928 5.67	963 6.07	998 6.46	1031 6.84	1064 7.21	1096 7.58	1126 7.94	1154 8.29
7600	814 4.57	849 5.05	884 5.51	919 5.95	955 6.37	990 6.77	1024 7.16	1058 7.54	1091 7.91	1123 8.28	1152 8.63	1180 8.99
8000	842 5.33	877 5.81	912 6.27	947 6.71	982 7.13	1018 7.53	1052 7.92	1086 8.30	1119 8.67	1150 9.04	1180 9.40	- -
8400	871 6.16	905 6.64	941 7.09	976 7.53	1011 7.95	1046 8.36	1081 8.75	1115 9.13	1148 9.50	1179 9.86	- -	- -
8800	901 7.04	936 7.52	971 7.97	1006 8.41	1041 8.83	1076 9.24	1111 9.63	1145 10.01	- -	- -	- -	- -
9200	932 7.98	967 8.45	1002 8.91	1037 9.35	1073 9.77	- -	- -	- -	- -	- -	- -	- -
9600	965 8.97	999 9.45	1034 9.90	- -	- -	- -	- -	- -	- -	- -	- -	- -
10000	999 10.01	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.

2. See RPM SELECTION table to determine required motor sheave setting.

3. kW = BHP x 0.820.

Table 13: RPM Selection

Size (Tons)	Model	HP	Motor Sheave	Blower Sheave	6 Turns Open	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turns Open	Fully Closed
180 (15)	XP	5	1VP60	BK120	700	730	760	790	820	850	880
		7.5	1VP60	BK100	845	885	925	960	1000	1035	1070
240 (20)	XP	7.5	1VP60	BK110	765	800	835	870	900	935	965
		10	1VP60	BK090	930	970	1010	1050	1090	1130	1170

Table 14: Indoor Blower Specifications

Size (Tons)	Model	Motor					Motor Sheave			Blower Sheave			Belt
		HP	RPM	Eff.	SF	Frame	Datum Dia.	Bore (in)	Model	Datum Dia.	Bore (in)	Model	
180 (15)	XP	5	1750	0.895	1.15	184T	4.5 - 5.7	1-1/8	1VP60	11.4	1-3/16	BK120	BX81
		7.5	1750	0.91	1.15	213T	4.5 - 5.7	1-3/8	1VP60	9.4	1-3/16	BK100	BX78
240 (20)	XP	7.5	1750	0.91	1.15	213T	4.5 - 5.7	1-3/8	1VP60	10.4	1-3/16	BK110	BX78
		10	1760	0.895	1.15	215T	4.5 - 5.7	1-3/8	1VP60	8.4	1-3/16	BK090	BX75

Table 15: Power Exhaust Specifications

Voltage	Motor			Motor			CFM @ 0.1 ESP
	HP	RPM ¹	QTY	LRA	FLA	MCA	
208/230-1-60	3/4	1075	1	7.7	5.0	6.25	5250
460-1-60	3/4	1075	1	4.1	2.2	2.75	5250
575-1-60	3/4	1050	1	2.84	1.5	1.875	5250

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

Air Balance

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

To check the supply air CFM after the initial balancing has been completed:

1. Remove the two 5/16" dot plugs from the blower motor and the filter access panels shown in the Unit Dimensions Front View (Figures 7 and 8) and Unit Dimensions Rear View (Figure 9), respectively.
2. Insert at least 8" of 1/4 inch tubing into each of these holes for sufficient penetration into the air flow on both sides of the indoor coil.

NOTE: The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Using an inclined manometer, determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil may vary greatly, measuring the pressure drop across a wet coil under field conditions would be inaccurate. To assure a dry coil, the compressors should be deactivated while the test is being run.

After readings have been obtained, remove the tubes and

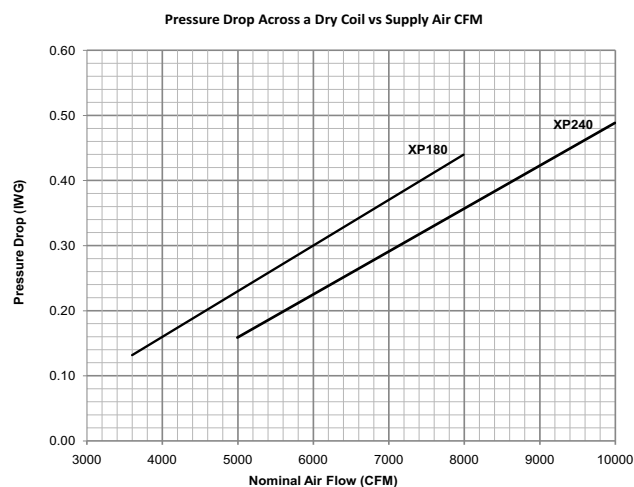


Figure 19: Pressure Drop Across A Dry Indoor Coil Vs. Supply Air CFM For All Unit Tonnages

4. Knowing the pressure drop across a dry coil, the actual CFM through the unit can be determined from the curve in Pressure Drop vs. Supply Air CFM Figure 19.

WARNING

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

reinstall the two 5/16" dot plugs that were removed in Step 1.

NOTE: De-energize the compressors before taking any test measurements to assure a dry indoor coil.

Supply Air Drive Adjustment

The RPM of the supply air blower will depend 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 motor pulley adjustment (turns open) can be determined from the Blower Performance Data Tables.

CAUTION

Belt drive blower systems **MUST** be adjusted to the specific static and CFM requirements for the application. The belt drive blowers are **NOT** set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are **REQUIRED**. Tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hours run time is recommended.

For the XP180 Model, high speed drive accessory 1LD0413 (containing a smaller blower pulley and a shorter belt) is available for applications requiring the supply air blower to produce higher CFM's and/or higher static pressures. Note the following:

1. The supply air CFM and external static pressure must be within the limitations shown in the Blower Performance Tables 11 and 12.
2. Pulleys can be adjusted in half turn increments.
3. The tension on the belt should be adjusted as shown in the Belt Adjustment, Figure 17.
4. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hours run time recommended.

Table 16: Additional Static Resistance

Size (Tons)	Model	CFM	Economizer ^{1, 2}	Electric Heat kW ¹			
				18	36	54	72
180 (15)	XP	4500	0.10	0.10	0.10	0.20	0.20
		6000	0.10	0.10	0.10	0.20	0.20
		7500	0.10	0.10	0.20	0.30	0.40
6000		0.10	0.10	0.10	0.20	0.20	
7500		0.10	0.10	0.20	0.30	0.40	
9000		0.15	0.10	0.30	0.40	0.60	
10000		0.15	0.15	0.35	0.55	0.75	
240 (20)							

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

Sequence Of Operation

Cooling Sequence Of Operation

For XP units, a "Y1" call for the first stage of cooling is passed to the Unit Control Board (UCB) which then determines whether the requested operation is available and if so, which components to energize. With a "Y1" call for first stage cooling the UCB will determine if a first stage cooling output is valid as long as all safeties and time-delays allow a C1 output for cooling. The C1 relay on the UCB will close and send 24 volts to the M1 contactor starting the first stage compressor and also energizing M4 contactor starting the associated condenser fans. During any call for fan or cooling the FAN output on the UCB will energize the M3 contactor starting the supply fan.

If a Y2 call is present it is passed to the Unit Control Board (UCB) which then determines whether the requested operation is available and if so, which components to energize. With a "Y2" call for second stage cooling the UCB will determine if a second stage cooling output is valid as long as all safeties and time-delays allow a C2 output for cooling. The C2 relay on the UCB will close and send 24v to the M2 contactor starting the second stage compressor also energizing M10 contactor starting the associated condenser fans. During any call for fan or cooling the FAN output on the UCB will energize the M3 relay starting the supply fan.

Heating Sequence of Operation

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 & M10 outdoor fan contactors and de-energizes RW1 to force the reversing valve into heat pump mode. A "W1" call runs 100% of compression for heating mode.

The thermostat makes a circuit between "R" and "W2" for the second stage of heating. The UCB passes the "W2" signal on energizing a relay (RW2), which energizes the electric heaters if available.

In both cases, when the "W1" call is sensed, the indoor air blower is energized following a specified heating delay.

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.

Continuous Blower

By setting the room thermostat fan switch to "ON," the supply air blower will operate 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.

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.

1. Local LCD on Unit Control Board.
OR
2. 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 cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor and. If the other compressor is inactive, the condenser fans will be de-energized.

Low-Pressure Limit Switch

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the LPS is still open after the ASCD, the compressor will not be energized for 30 seconds. The second and third times that the UCB sees an open LPS will count towards the three occurrences that will cause a UCB lock-out.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

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

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor. If the other compressor is inactive, the condenser fans will be de-energized.

Evaporator Low Limit

During cooling operation, if the **Evaporator Low Limit Sensor (EC1, 2)** (Located on the Suction Line at the Evaporator Coil.) detects a temperature below 26 Deg. F (default), the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor. Should the UCB detect the evaporator low limit sensor (**EC1, 2**) falling below 26 Deg. F (default) three times within two hours of operation, the UCB will lock-out the associated compressor. If the other compressor is inactive, the condenser fans will be de-energized.

Low Ambient Cooling

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

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The off cycle will begin 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 will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the and the evaporator temperature sensor (**EC1, 2**) temperature is above 26°F, the unit will resume operation.

Safety Controls

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

1. An evaporator low limit sensor (**EC1, 2**) (Located on the Suction Line at the Evaporator Coil.) to protect against low evaporator temperatures due to a low airflow or a low return air temperature, set at 26°F.
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig and resets 525 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 23 ± 5 psig and resets at 38 ± 5 psig).

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

With Electric Heat

When the thermostat calls for the first stage of heating, the low voltage control circuit is completed between "R" and "W1". This 24vac signal is passed through the UCB to the RW1 Relay. Contacts RW1 open, assuring the reversing valve cannot be energized, except during defrost. Contacts RW1 close. After its five minute ASCD timer is satisfied, the UCB closes its internal compressor relay contacts, sending a 24vac signal to the MV terminal of the UCB. If its ASCD timer is satisfied the UCB will energize compressor #1 contactor M1. After a two second delay, it then energizes compressor #2 contactor M2. Therefore, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 and M10 contactor which brings on the condenser fans.

If the compressors alone cannot satisfy the heating requirements a second stage call from the thermostat completes the circuit between "R" and "W2". This 24vac signal is passed through the UCB to the RW2 relay. Contacts RW2 close, completing the circuit to the electric heat section (if available). For the 18 kW heater 18 kW will be energized, for the 36 kW heater 18 kW will be energized, for the 54 kW heater 18 kW will be energized, and for 72 kW heater 36 kW will be energized. In the event that all compressors are locked out by the UCB, the total available kW of electric heat will be energized on a call for "W2". Take note that the MV terminal on the UCB is constantly monitored while there is a demand for heat. If the UCB does not see 24vac at terminal MV after six minutes, it initiates an LCD display alarm, indicating a heating problem.

Without Electric Heat

When the thermostat calls for heating, the low voltage control circuit is completed between "R" and "W1". This 24vac signal is passed through the UCB to the RW1 Relay and the MV terminal

on the UCB. Contacts RW1 open, assuring the reversing valve cannot be energized, except during defrost. Contacts RW1 close. If its ASCD timer is satisfied the UCB will energize compressor #1 contactor M1. After a two second delay, it then energizes compressor #2 contactor M2. Therefore, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 and M10 contactor, which brings on the condenser fans.

Take note that the MV terminal on the UCB is constantly monitored while there is a demand for heat. If the UCB does not see 24vac at terminal MV after six minutes, an LCD display alarm will indicate a heating issue.

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. 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.

For defrost, the UCB will signal the energizing of the reversing valve and de-energizing the systems condenser fan motor(s). The unit's optional electric 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;

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

Interval between Defrosts

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

Forced Defrost

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

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

Electric Heat Operation Errors

Temperature Limit

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

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

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

Safety Controls

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

Temperature Limit Switch (TLS 1, 2)

This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 17. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

Table 17: Limit Control Setting

VOLTAGE	HEATER	Limit Switch Opens, °F	
	kW	TLS1	TLS2
208/230	18	140	-
	36	140	140
	54	140	120
	72	140	120
460	18	120	-
	36	120	120
	54	120	110
	72	130	110
575	18	120	-
	36	120	120
	54	120	120
	72	120	120

Reset

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

Electric Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON" cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 18 for the required electric heat anticipator setting.

Table 18: Electric Heat Anticipator Setpoint

Heater Kw	Voltage	Setting, Amps	
		Th1	Th2
18	208/230-3-60	0.29	-
36		0.29	0.29
54		0.29	0.58
72		0.29	0.58
18	460-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29
18	575-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29

Start-Up (Cooling)

Prestart Check List

After installation has been completed:

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

Check blower drive belt tension.

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

Operating Instructions

1. Turn unit electrical power on.
2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

Post Start Check List

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 3 phase power wires.
4. Measure the condenser fan amperage draw.

Shut Down

1. Set the thermostat to the lowest temperature setting.
2. Turn "OFF" all electric power to unit.

Charging The Unit

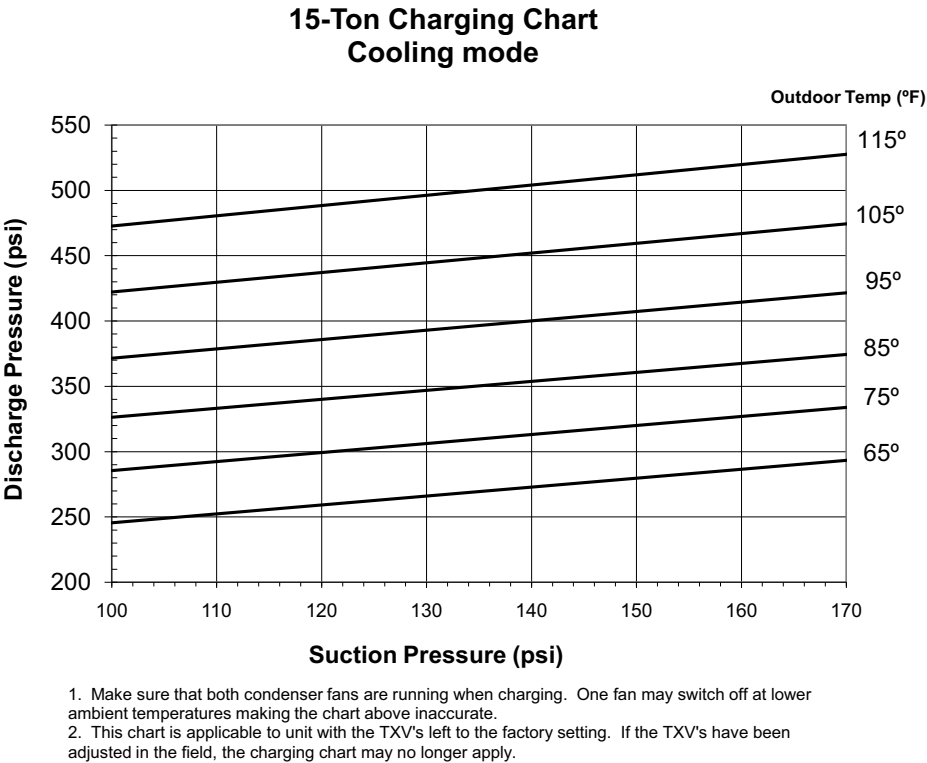


Figure 20: XP180 (15 Ton) Charging Chart

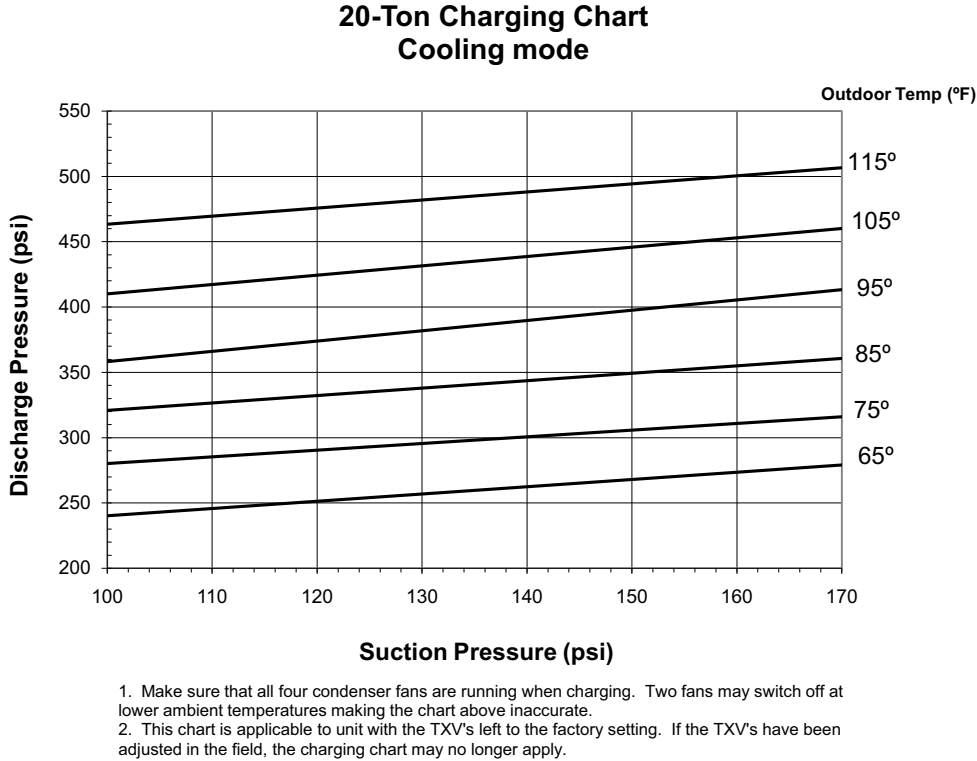


Figure 21: XP240 (20 Ton) Charging Chart

Maintenance

Normal Maintenance

CAUTION

Prior to any of the following maintenance procedures, shut off all electric power to the unit to prevent personal injury.

Filters

Inspect once a month. Replace disposable or clean permanent type as necessary. DO NOT replace permanent type with disposable. The dimensional size of the replacement filter must be the same as the replaced filter.

Motors

Outdoor fan motors are permanently lubricated and require no maintenance.

Indoor Blower Motor and Drive - The indoor blower motor features ball bearings that do not require periodic lubrication. Periodic lubrication of the motor and bearings can extend the life of components but is optional.

CAUTION

Damage can occur if the bearings are over-lubricated. Use grease sparingly.

WARNING

Perform all maintenance operations on the blower motor with electric power disconnected from the unit. Do not attempt to lubricate bearings with the unit in operation.

On an annual basis, check the motor for accumulations of dust, etc. that may block the cooling slots in the motor shell. Check for loose, damaged or misaligned drive components. Check that all mounting bolts are tight. Replace defective parts as required.

If desired, every three years remove both pipe plugs at each end shell and clean out any hardened grease or foreign matter. Replace one plug on each end with a clean grease fitting. Using a low pressure grease gun, pump grease (Chevron SRI-2 or equivalent) into the bearing cavity until new grease shows at the open port. Do not over lubricate. Run the motor for ten minutes until excess grease is purged from the cavity. Replace the plugs.

Blower Shaft Bearing

Blower shaft bearings should be inspected on a monthly basis. At a minimum, the bearings should be re-lubricated every 6 months using a lithium-based grease (NLGI grade 2) recommended for ball bearing service.

Outdoor Coil

Dirt should not be allowed to accumulate on the outdoor coil surface or other parts in the air circuit. Cleaning should be as often as necessary to keep coil clean. Use a brush, vacuum cleaner attachment, or other suitable means. If water is used to clean coil, be sure electric power to the unit is shut off prior to cleaning.

NOTE: Exercise care when cleaning the coil so that the coil fins are not damaged.



Table 19: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
Terminal Thermostat connection strip on left edge of UCB		
W1	1st stage heating request, 24 VAC input switched from R	Not effective for cooling-only units
W2	2nd stage heating request, 24 VAC input switched from R	Not effective for cooling-only units or units with single-stage heat sections
Y1	1st stage cooling request, 24 VAC input switched from R	
Y2	2nd stage cooling request, 24 VAC input switched from R	Visible in the display menu when the #ClgStgs parameter is set for 2 or more, also effective for economizer free cooling supply air temperature reset when the #ClgStgs parameter is set for 1 or more
G	Continuous indoor blower request, 24 VAC input switched from R	
OCC	Occupancy request, 24 VAC input switched from R	Must have the OccMode parameter set for External to be effective
X	Hard lockout indicator, 24 volt output to a light thermostat LED	
R	24 VAC hot for thermostat switching and power	If field-added external accessories for unit shutdown are used, 24 VAC hot return from smoke detector, condensate overflow and/or user shutdown relay switching in series
SD-24	If field-added external accessories for unit shutdown are used, 24 VAC hot out for smoke detector, condensate over- flow and/or user shutdown relay switching in series	Unit wiring harness jumper plug for factory shutdown accessories must be removed if the switching of field-added external accessories for unit shutdown are wired between thermo- stat connection strip SD-24 and R
C	24 VAC common for thermostat power	
LEDs on left edge of UCB		
POWER	Green UCB power indicator	Lit indicates 24 VAC is present at C and 24V terminals
FAULT	Red hard lockout, networking error and firmware error indicator	1/2 second on/off flashing indicates one or more alarm is currently active, 1/10th second on/off flashing indicates a networking error (polarity, addressing, etc.) or a firmware error (likely correctable with re-loading from USB flash drive)
SA BUS	Green UCB SA bus communication transmission indicator	Lit/flickering indicates UCB SA bus communication is currently active, off indicates the UCB is awaiting SA bus communication
Terminal Space temperature sensor connections at center on upper edge of UCB		
ST	Space Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Positive of VDC circuit (3.625 VDC reading to COM with open circuit), effective if "Thermo- stat-only Control" parameter is set OFF, space sensor override momentary shorts ST to COM to initiate/terminate temporary occupancy
COM	Common for ST and SSO inputs	Negative of VDC circuit for ST and SSO inputs
SSO	Space Sensor Offset input from 0 to 20KΩ potentiometer	Positive of VDC circuit (3.625 VDC reading to COM with open circuit), 10KΩ/2.5 VDC is 0°F offset, 0Ω/0 VDC is maximum above offset and 20KΩ/3.4 VDC is maximum below offset from active space temperature setpoint
Pin Temperature sensor connections at right on upper edge of UCB		
SAT+	Supply Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation; 3.625 VDC reading SAT+ to SAT- with open circuit. Used in heat/cool staging cutouts, free cooling operation, demand ventilation operation, comfort ventilation operation, economizer loading operation, VAV cooling operation, hydronic heat operation.

Table 19: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
RAT+	Return Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation; 3.625 VDC reading RAT+ to RAT– with open circuit. Used in return air enthalpy calculation. Substitutes for space temperature if no other space temperature input is present.
OAT+	Outside Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation but may be a communicated value; 3.625 VDC reading OAT+ to OAT– with open circuit. Used in heat/cool cutouts, low ambient cooling determination, dry bulb free cooling changeover, outside air enthalpy calculation, economizer loading operation, heat pump demand defrost calculation.
CC1+	#1 refrigerant circuit Condenser Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for heat pump units, not required for A/C units; 3.625 VDC reading CC1+ to CC1– with open circuit. Used in heat pump demand defrost calculation.
EC1+	#1 refrigerant circuit Evaporator Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation; 3.625 VDC reading EC1+ to EC1– with open circuit. Used in suction line temperature safety.
CC2+	#2 refrigerant circuit Condenser Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for 2-compressor heat pump units, not required for 2-compressor A/C units, not active for 1-compressor units; 3.625 VDC reading CC2+ to CC2– with open circuit. Used in heat pump demand defrost calculation.
EC2+	#2 refrigerant circuit Evaporator Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor	Input required for operation of 2-compressor units, not active for 1-compressor units; 3.625 VDC reading EC2+ to EC2– with open circuit. Used in suction line temperature safety.
Pinned connections on right edge of UCB		
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" w.c. sensor	Input required for variable air volume units. Used in VAV indoor blower operation.
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
C	Common for the VFD output	Negative of the VDC circuit for the VFD output
VFD	2-10 VDC (0-100%) output for the indoor blower Variable Frequency Drive	Output is active with indoor blower operation. For CV units: this output provides stepped IntelliSpeed control of the indoor blower VFD based on fan-only, cooling stage and heating stage outputs. For VAV units: this output provides control of the indoor blower VFD based on supply duct static pressure input and setpoint.
VFDFLT	24 VAC hot input from the normally open VFD alarm contact	The VFD alarm contact switches from R within the unit wiring harness. 24 VAC input results in unit shutdown and a "VFD fault" alarm

Table 19: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
Terminal at lower right corner of UCB		
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
Pin Heat section connections at right on lower edge of UCB		
H1	24 VAC hot output for heat section stage 1	Not effective for cooling-only units. Output if demand is present and permissions allow one stage or two stages of heat section operation
H2	24 VAC hot output for heat section stage 2	Not effective for cooling-only units or units with single-stage heat sections. Output if demand is present and permissions allow two stages of heat section operation
MV	24 VAC hot input confirming heat section operation	Sourced from gas valve in gas heat units or first stage heat contactor in electric heat units. Input within 5 minutes from initiation of H1 output initiates the "Heat On Fan Delay" timer, loss of input following the termination of H1 output initiates the "Heat On Fan Delay" timer, no input within 5 minutes from initiation of H1 output initiates an "Ignition Failure" alarm, input for longer than 5 minutes without H1 output initiates a "Gas Valve Mis-wire" alarm
Pin Cooling and fan output connections at right on lower edge of UCB		
CN-FAN	24 VAC hot output for the condenser fan contactor coil	Output with either C1 or C2 output; interrupted during defrost cycle for heat pump units
AUX HGR	24 VAC hot output for hot gas reheat components	Effective only for reheat units, output with reheat operation
FAN	24 VAC hot output for indoor blower contactor coil/indoor blower VFD enable relay coil	Output with heat/cool operation, G input or schedule demand
C1	24 VAC hot output for compressor 1	If demand is present and permissions allow compressor 1 operation; output with compressor cooling, comfort ventilation cooling, reheat or heat pump heating demands
C2	24 VAC hot output for compressor 2	Not effective for one stage compressor UCBs. If demand is present and permissions allow compressor 2 operation; output with compressor cooling, comfort ventilation cooling or heat pump heating demands
Pin Refrigerant circuit safety switch and indoor blower overload connections at center on lower edge of UCB		
HPS1 (right pin)	24 VAC hot out for refrigerant circuit 1 High Pressure Switch	Connects through circuit trace to the R terminal
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

Table 19: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
HPS2 (left pin)	24 VAC hot return from refrigerant circuit 2 High Pressure Switch	Not effective for one stage compressor UCBs. Input is only considered if C2 output is needed; input must be present to allow C1 output. Three HPS2 trips in a two hour period cause a "High Pressure Switch 1 Lockout" and C2 output is then prevented until alarm reset. Connects through circuit trace to the right LPS2 pin.
LPS2 (right pin)	24 VAC hot out for refrigerant circuit 2 Low Pressure Switch	Not effective for one stage compressor UCBs. Connects through circuit trace to the left HSP2 pin
LPS2 (left pin)	24 VAC hot return from refrigerant circuit 2 Low Pressure Switch	Not effective for one stage compressor UCBs. Input is only considered after 30 seconds of C2 output; afterwards, input must be present to allow C2 output. Three LPS2 trips in a one hour period cause a "Low Pressure Switch 2 Lockout" and C2 output is then prevented until alarm reset.
FAN OVR (right pin)	24 VAC hot out for indoor blower FAN Overload relay contact/motor protector switch	Connects through circuit trace to the R terminal
FAN OVR (left pin)	24 VAC hot return from indoor blower FAN Overload relay contact/motor protector switch	Input is only considered if FAN output is needed; input must be present to allow FAN output and unit operation. One FAN OVR trip lasting longer than 5 minutes or three FAN OVR trips in a two hour period cause a "Fan Overload Lockout" and unit operation is then prevented until alarm reset.
Terminal SA BUS¹ connections on at left on lower edge and center of UCB		
PWR	Power for SA ("Sensor-Actuator") BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the 15 VDC (reading to C) circuit for powering an optional netstat and/or Multi Touch gateway
C	Common for SA BUS power and communication circuits	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Negative of the SA BUS circuits
-	Communication for SA BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts lower than +) SA BUS communication circuit to optional economizer board, 4-stage board, fault detection & diagnostics board, netstat and/or Multi Touch gateway
+	Communication for SA BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts higher than -) SA BUS communication circuit to optional economizer board, 4-stage board, fault detection & diagnostics board, netstat and/or Multi Touch gateway
J8	6-pin phone jack connector	Incorporates the SA BUS terminals for convenience/alternate connection of SA BUS devices, primarily used for temporary service connection of the Multi Touch gateway
Item Integrated user interface at lower left corner of UCB		
Display	On-board, 2-line x 8-character back-lit display	On-board display, buttons and joystick allow access to UCB, economizer, 4-stage and FDD board parameters
ENTER	Button for display menu acknowledgment and navigation	
CANCEL	Button for display menu navigation and zeroing of active compressor ASCD timer	
JOY	4-way Joystick for display menu navigation	
Item USB connector at right of UCB		
J10	Type A female Universal Serial Bus connector	Used for backup, restoration, & copying of board parameters as well as board software updating through a flash drive

Table 19: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
J15	Factory wired SA Bus connector	
Optional communication sub-board at center of UCB		
Terminal FC BUS¹ connections on left edge of the communication board		
FC+	FC ("Field Connected") BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts higher than –) FC bus BACnet MSTP communication circuit
FC–	FC ("Field Connected") BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts lower than +) FC bus BACnet MSTP communication circuit
COM	Common for the FC ("Field Connected") BUS BACnet MSTP communication circuit	Negative of the VDC FC bus BACnet MSTP communication circuit
SHLD	Shield for the FC ("Field Connected") BUS BACnet MSTP communication circuit	Earth ground reference of the cable to prevent interference on the FC bus BACnet MSTP communication circuit
Item Selector in red housing at left on top edge of the communication board		
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"
LEDs on the communication board		
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
ISO PWR	Green communication board Isolated Power indicator	Lit indicates the UCB is supplying power to the communication sub-board

1. When wiring unit and other devices using the SA Bus and FC Bus, see Table 20.

Table 20: Cable for FC Buses and SA Buses in Order of Preference

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

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

Start-Up Sheet**START-UP & SERVICE DATA INSTRUCTION****COMMERCIAL PACKAGE UNITS****3.0 To 40.0 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

Johnson Controls/Ducted Systems 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 Johnson Controls/Ducted Systems 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 Johnson Controls/Ducted Systems 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 Mobile Access Portal (MAP) Gateway 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:

Johnson Controls/Ducted Systems
 Technical Services Department
 5005 York Drive
 Norman, OK 73069

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SAFETY WARNINGS

The inspections and recording of data outlined in this procedure are required for start-up of Johnson Controls/Ducted Systems' 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:

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REFERENCE

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

Air Moving Inspection	Completed	See Notes
Alignment of drive components	<input type="checkbox"/>	<input type="checkbox"/>
Belt tension adjusted properly	<input type="checkbox"/>	<input type="checkbox"/>
Blower pulleys tight on shaft, bearing set screws tight, wheel tight to shaft	<input type="checkbox"/>	<input type="checkbox"/>
Pressure switch or transducer tubing installed properly	<input type="checkbox"/>	<input type="checkbox"/>

Exhaust Inspection Powered <input type="checkbox"/> Barometric Relief <input type="checkbox"/>	Completed	See Notes
Check hub for tightness	<input type="checkbox"/>	<input type="checkbox"/>
Check fan blade for clearance	<input type="checkbox"/>	<input type="checkbox"/>
Check for proper rotation	<input type="checkbox"/>	<input type="checkbox"/>
Check for proper mounting (screen faces towards unit)	<input type="checkbox"/>	<input type="checkbox"/>
Prove operation by increasing minimum setting on economizer	<input type="checkbox"/>	<input type="checkbox"/>

Economizer Inspection Standard <input type="checkbox"/> BAS <input type="checkbox"/>	Completed	See Notes
CO ₂ sensor installed Yes <input type="checkbox"/> No <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check economizer setting (Reference Smart Equipment™ Control Board LCD menu location)	<input type="checkbox"/>	<input type="checkbox"/>
Prove economizer open/close through Smart Equipment™ Board Setting	<input type="checkbox"/>	<input type="checkbox"/>

Reheat Mode Normal <input type="checkbox"/> or Alternate <input type="checkbox"/> Not Applicable <input type="checkbox"/>
Humidity Sensor (2SH0401) _____

Ducted Systems

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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 <input type="checkbox"/>	Exh. Fans <input type="checkbox"/>	Cond. Fans <input type="checkbox"/>
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 or 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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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

REFRIGERANT SAFETIES

Action	Completed	See Notes
Prove Compressor Rotation (3 phase only) by gauge pressure	<input type="checkbox"/>	<input type="checkbox"/>
Prove High Pressure Safety, All Systems	<input type="checkbox"/>	<input type="checkbox"/>
Prove Low Pressure Safety, All Systems	<input type="checkbox"/>	<input type="checkbox"/>

OPERATING MEASUREMENTS - GAS HEATINGFuel Type: ☐ Natural Gas ☐ LP Gas

Action	Completed	See Notes
Check for gas leaks	<input type="checkbox"/>	<input type="checkbox"/>
Prove Ventor Motor Operation	<input type="checkbox"/>	<input type="checkbox"/>
Prove Primary Safety Operation	<input type="checkbox"/>	<input type="checkbox"/>
Prove Auxiliary Safety Operation	<input type="checkbox"/>	<input type="checkbox"/>
Prove Rollout Switch Operation	<input type="checkbox"/>	<input type="checkbox"/>
Prove Smoke Detector Operation	<input type="checkbox"/>	<input type="checkbox"/>
Manifold Pressure	Stage 1	IWC <input type="checkbox"/>
	Stage 2 (If Equipped)	IWC <input type="checkbox"/>
	Stage 3 (If Equipped)	IWC <input type="checkbox"/>
Supply gas pressure at full fire	IWC	<input type="checkbox"/>
Check temperature rise ¹	<input type="checkbox"/> measured at full fire	°F <input type="checkbox"/>

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

Ducted Systems

OPERATIONAL 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.	<input type="checkbox"/>
Create a heating demand at the Thermostat, BAS System or Smart Equipment™ Verify that heating stages are energized.	<input type="checkbox"/>

Verify Proper Operation of the Variable Frequency Drive (If Required)

Verify that motor speed modulates with duct pressure change.	<input type="checkbox"/>
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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.	<input type="checkbox"/>
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)	<input type="checkbox"/>
Verify that all access panels have been closed and secured	<input type="checkbox"/>
Save a backup file from the unit control board onto a USB flash drive.	<input type="checkbox"/>

OBSERVED PRODUCT DEFICIENCIES & CONCERNS:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.