TO: Hight Jackson Associates
jandrade@hjarch.com

ATTN: Jorge Andrade
RE: Farm Credit - Russellville, AR
HVAC
DATE: 06/26/2023 JOB NO. 22-166

ELECTRONIC SUBMITTAL WAS REVIEWED AS FOLLOWS:

- ☒ CUT SHEETS
- ☐ DRAWINGS
- ☐ OTHER
- ☐ NO EXCEPTIONS TAKEN
- ☒ NOTE MARKINGS
- ☐ COMMENTS ATTACHED
- ☐ APPROVED
- ☐ REJECTED
- ☐ RESUBMIT
- ☒ RESUBMIT only items marked

REMARKS:

Submittal - 23 75 34 Variable Air Volume Packaged RTU Submittal

ENGINEER'S REVIEW IS FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AND CONTRACT DOCUMENT. MARKINGS OR COMMENTS SHALL NOT BE CONSTRUED AS RELIEVING THE CONTRACTOR FROM COMPLIANCE WITH THE PROJECT PLANS AND SPECIFICATIONS, NOR DEPARTURE THEREFROM. THE CONTRACTOR REMAINS RESPONSIBLE FOR DETAILS AND ACCURACY, FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS, FOR SELECTING FABRICATION PROCESSES, FOR TECHNIQUES OF ASSEMBLY AND PERFORMING HIS WORK IN A SAFE MANNER.

SUBMITTAL

Copies To:
X File
Owner
X Architect
Other

BY: Nathan Wilson, PE

HSA Engineering Consulting Services, Inc.
7405 Ellis Street
Fort Smith, AR 72916
479.452.8922
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CREATING CUSTOMERS FOR LIFE

POWERS

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PRODUCT	TEMPMASTER ZJ UNITS
MANUFACTURER	TEMPMASTER
JOB NAME	FARM CREDIT
LOCATION	RUSSELLVILLE
ENGINEER	
CONTRACTOR	CSUSA
CONTRACTOR POC	JON DAVIS
DATE	1/31/2024
SUBMITTED BY	ERIC BLAYLOCK

5440 Northshore Drive – North Little Rock, Arkansas 72118 – Tel: 501.374.5420 Fax: 501.370.9298

INSTALLATION MANUAL

R-410A
ZJ SERIES W/SMART EQUIPMENT™

6-1/2 - 12-1/2 Ton

60 Hertz



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General

ZJ078-150 units are single package air conditioners with optional gas heating designed for outdoor installation on a rooftop or slab and for non-residential use. These units can be equipped with factory or field installed electric heaters for heating applications.

These 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, gas supply (where applicable), and duct connections. The electric heaters 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, service agency or the gas supplier.

⚠ 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.

⚠WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

a. Do not try to light any appliance.
b. Do not touch any electrical switch; do not use any phone in your building.
c. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
d. If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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.

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

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

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

Reference

Additional information is available in the following reference forms:

- Technical Guide - ZF/ZJ/ZR 037-150
- General Installation - ZJ078-150
- Smart Equipment™ Control Quick Start Guide
- Economizer Accessory -
  Downflow Factory Installed
  Downflow Field Installed
  Horizontal Field Installed
- Motorized Outdoor Air Damper
- Manual Outdoor Air Damper (0-100%)
- Manual Outdoor Air Damper (0-35%)
- Gas Heat Propane Conversion Kit
- Gas Heat High Altitude Kit (Natural Gas)
- Gas Heat High Altitude Kit (Propane)
- –60°F Gas Heat Kit
- Electric Heater Accessory 50" cabinet

Renewal Parts

Contact your local Ducted Systems parts distribution center for authorized replacement parts.

Approvals

Design certified by CSA as follows:

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

⚠ CAUTION

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

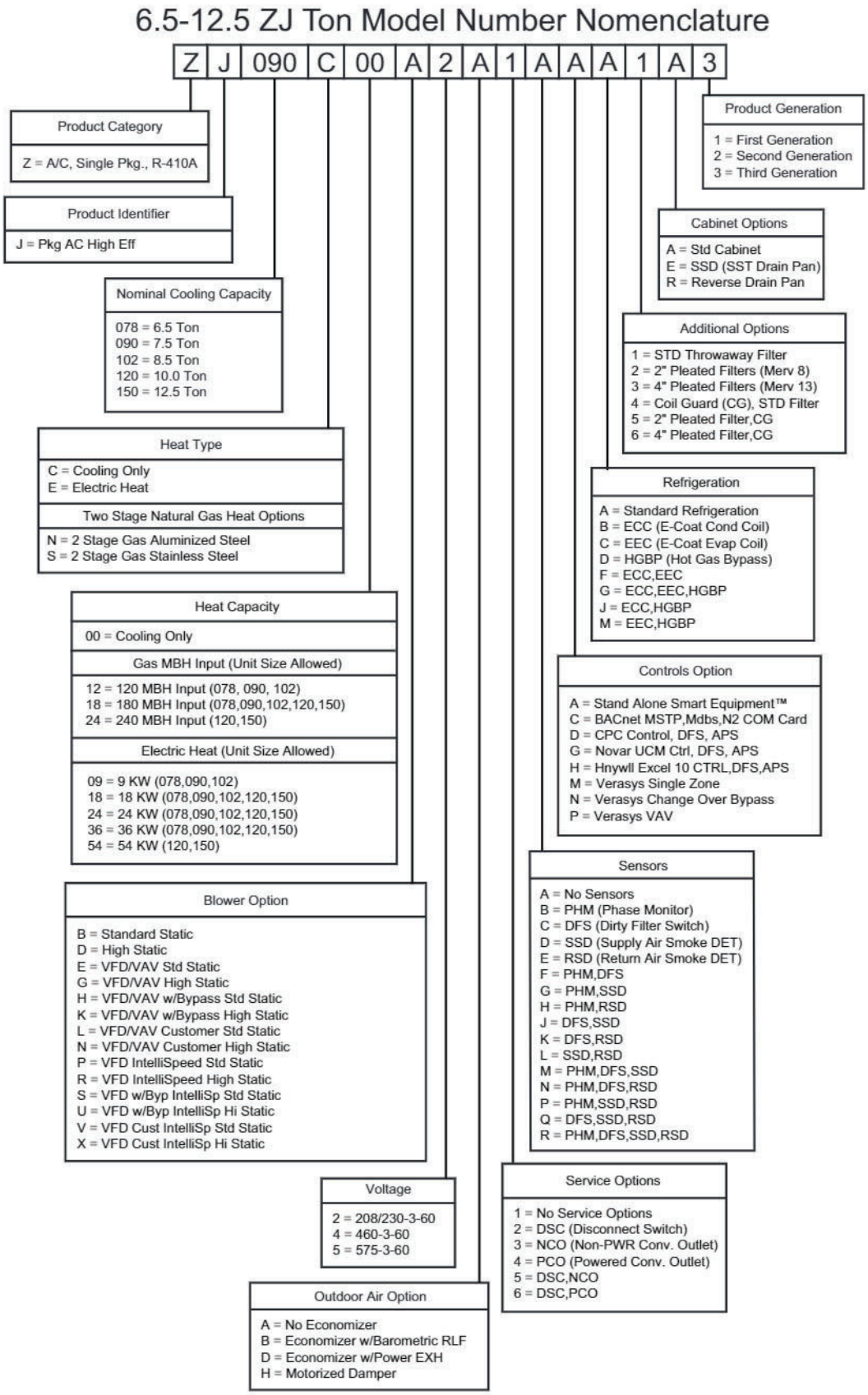
⚠WARNING

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

⚠ CAUTION

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

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. Refer to the unit rating plate for the approved type of gas for this product.
2. Install this unit only in a location and position as specified on Page 7 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 5, 33, 33 and 58 of these instructions.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 60 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

Preceding Installation

1. Remove the two screws holding the brackets in the front, rear and compressor side fork-lift slots.



Figure 1: Unit Shipping Bracket

2. Turn each bracket toward the ground and the protective plywood covering will drop to the ground.
3. Remove the condenser coil external protective covering prior to operation.
4. Remove the toolless doorknobs and instruction packet prior to installation.



Figure 2: Condenser Covering

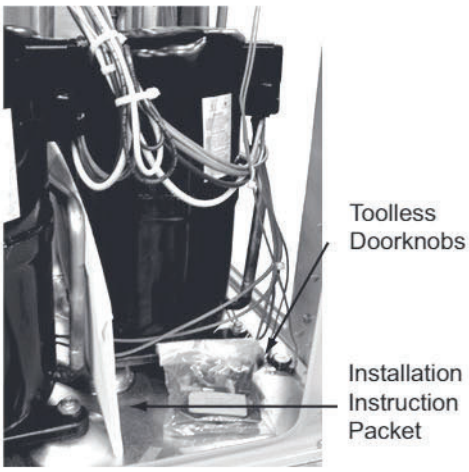


Figure 3: Compressor Section

5. If a factory option convenience outlet is installed, the weatherproof outlet cover must be field installed. The cover shall be located behind the filter access panel. 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 and 380/415-3-50 units with factory installed Powered Convenience Outlet Option are wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. 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. National Fuel Gas Code, ANSI Z223.1 - Latest Edition

3. Gas-Fired Central Furnace Standard, ANSI Z21.47 Latest Edition
4. Local building codes, and
5. Local gas 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.

After installation, gas fired units must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

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.), or 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.

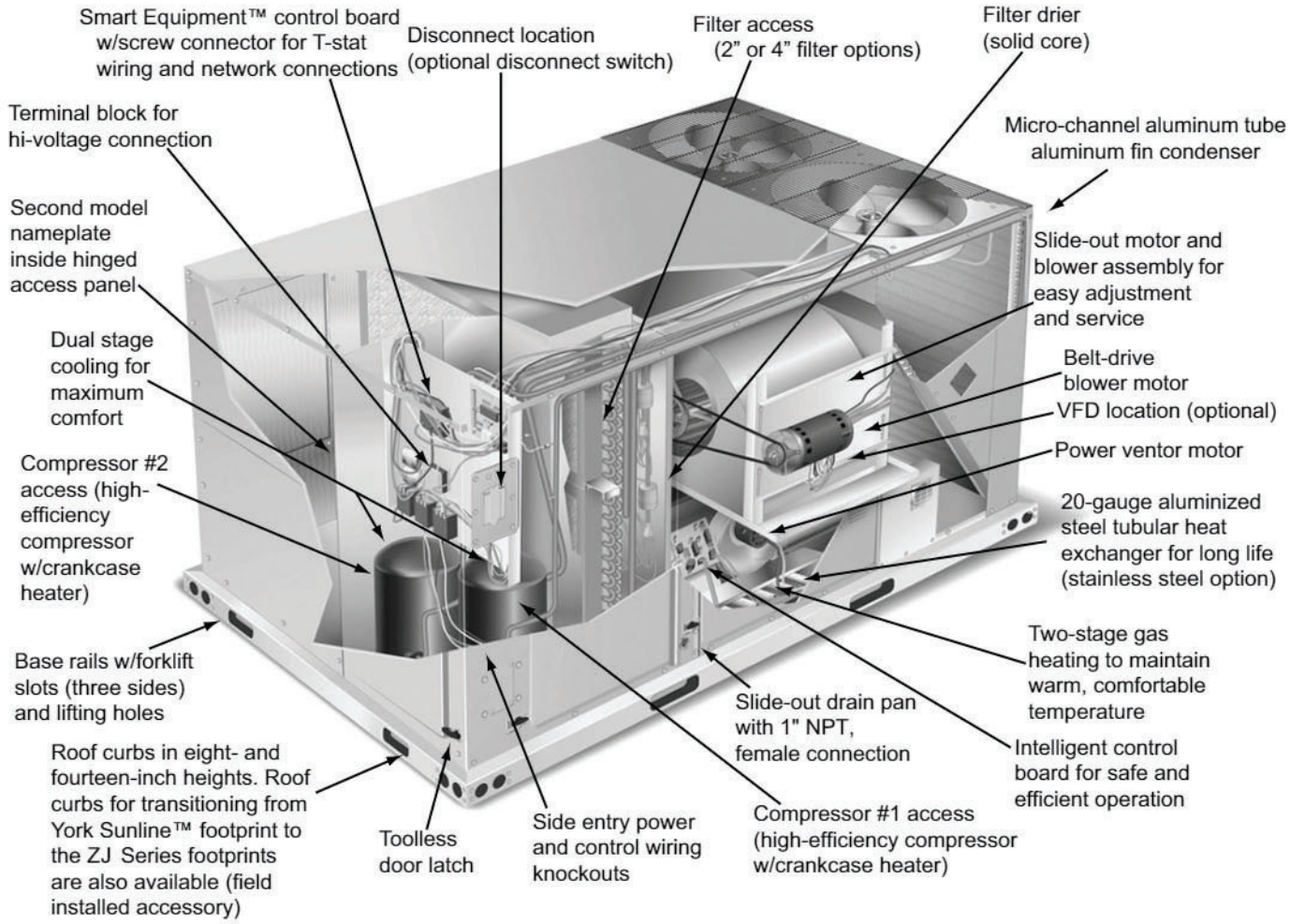


Figure 4: Component Location (ZJ120 Shown)

Table 1: ZJ078-150 Unit Limitations

Size (Tons)	Model	Unit Voltage	Unit Limitations		
			Applied Voltage		Outdoor DB Temp
			Min	Max	Max (°F)
078 (6.5)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
090 (7.5)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
102 (8.5)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
120 (10)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
150 (12.5)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	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.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solution, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

Clearances

All units require particular clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with section 5.3 of Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 – Latest Edition (in U.S.A.), or Sections 7.2, 7.3, or 7.4 of Gas Installation Codes, CSA-B149.1 (in Canada) - Latest Edition, and/or applicable provisions of the local building codes. Refer to Table 5 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, combustion air inlet 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 Ducted Systems 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. Slotted openings in the base rails are provided for this purpose.

LENGTH OF FORKS MUST BE A MINIMUM OF 60 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.

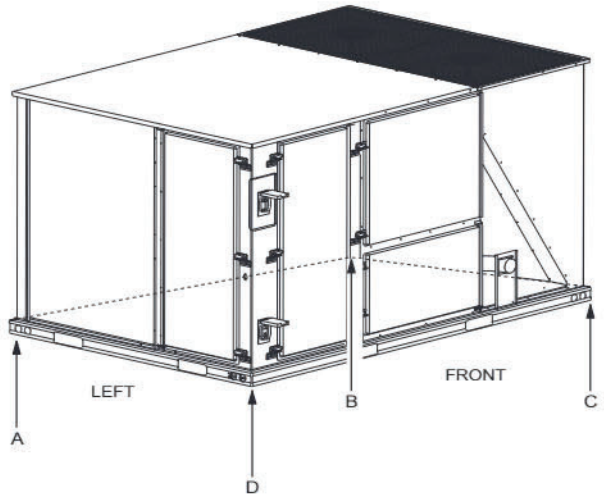


Figure 5: Unit 4 Point Load Weight

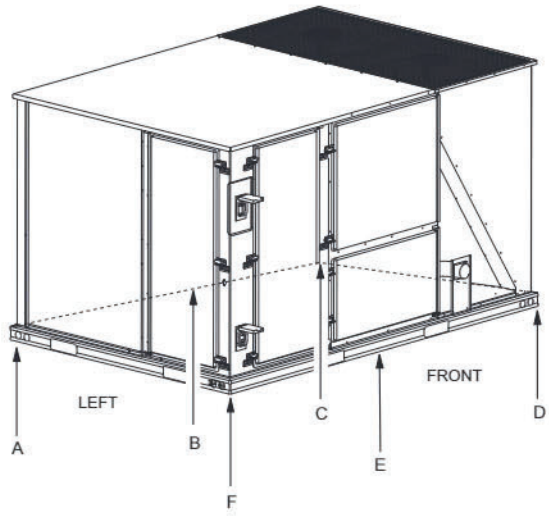


Figure 6: Unit 6 Point Load Weight

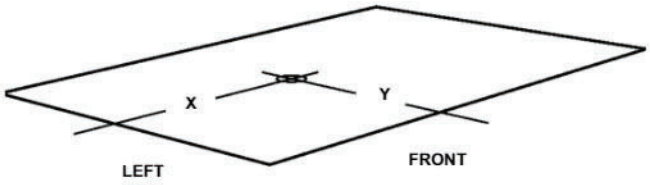


Figure 7: Center of Gravity

Table 2: Weights and Dimensions

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
078 (6.5)	ZJ	1035	1030	39	25	245	191	260	333	170	144	122	167	195	232
090 (7.5)	ZJ	1055	1050	39	25	250	195	265	340	174	146	125	170	199	236
102 (8.5)	ZJ	1065	1060	38	24	247	184	268	360	173	141	117	171	206	253
120 (10)	ZJ	1075	1070	39	24	245	191	278	357	170	143	122	178	209	248
150 (12.5)	ZJ	1285	1280	48	24	240	281	410	350	156	173	192	280	252	227

Table 3: ZJ078-150 Unit Accessory Weights

Unit Accessory	Weight (lbs.)	
	Shipping	Operating
Economizer	90	85
Power Exhaust	40	35
Electric Heat[1]	49	49
Gas Heat[2]	110	110
Variable Frequency Drive[3]	30	30

1. Weight given is for the maximum heater size available (54KW).
2. Weight given is for the maximum number of tube heat exchangers available (8 tube).
3. Weight includes mounting hardware, controls and manual bypass option.

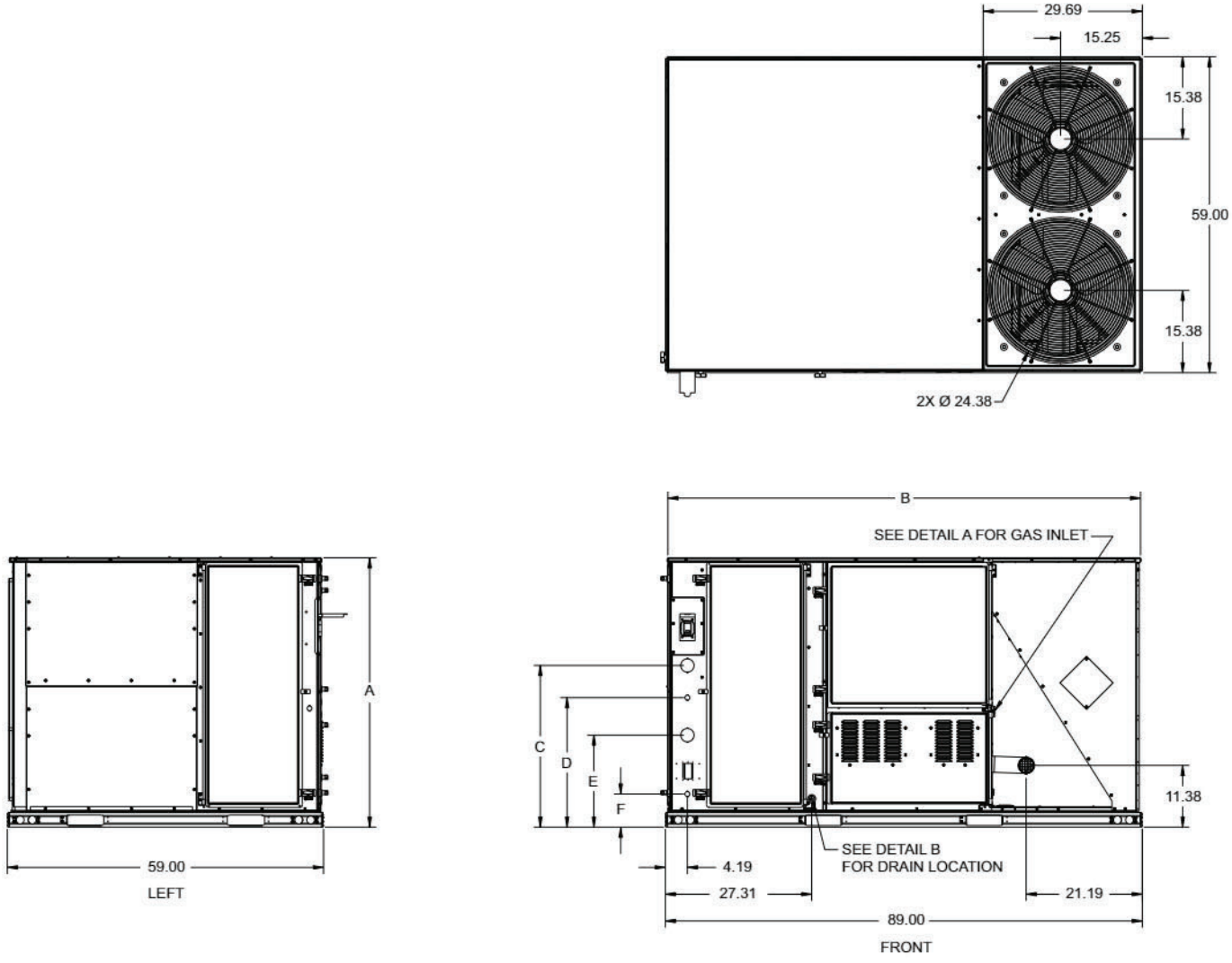


Figure 8: ZJ078-120 Physical Dimensions

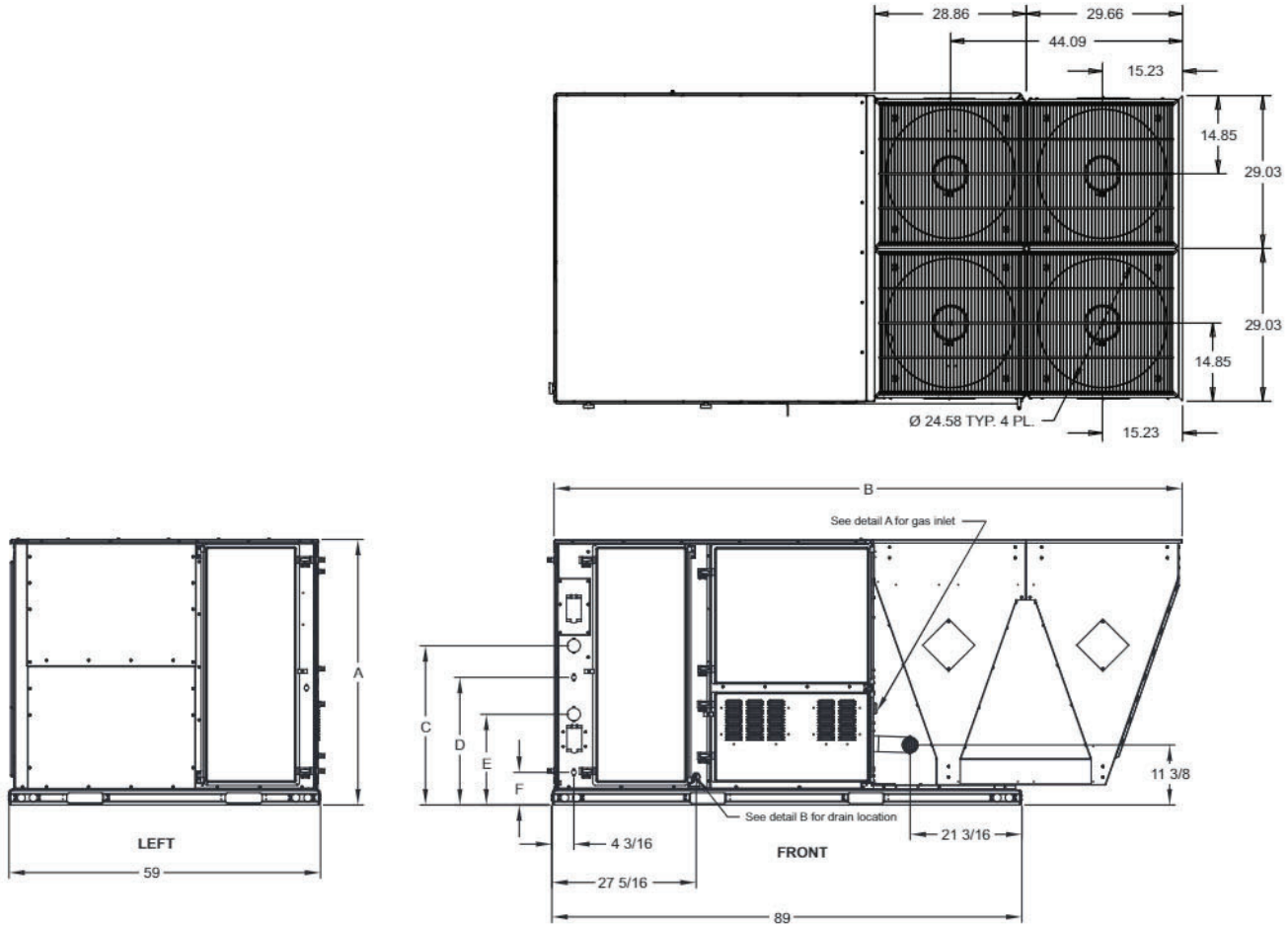
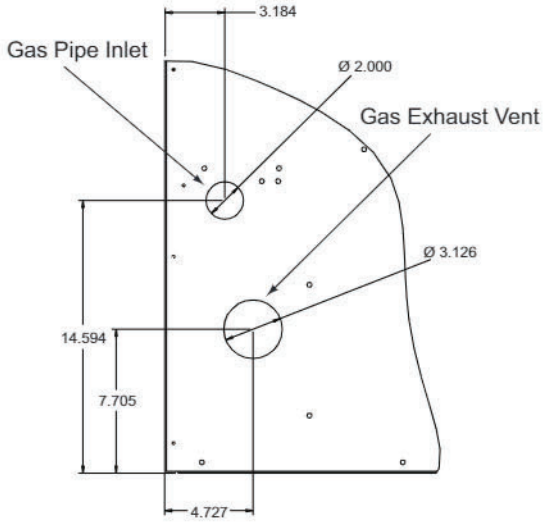


Figure 9: ZJ150 Physical Dimensions

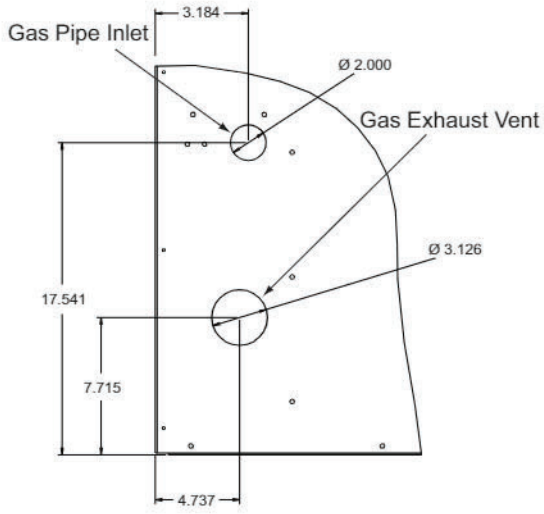
Table 4: ZJ078-150 Unit Physical Dimensions

Unit Model Number	Dimension (in.)					
	A	B	C	D	E	F
ZJ078	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
ZJ090	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
ZJ102	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
ZJ120	50 3/4	89	30 3/16	24 3/16	17 3/16	6 3/16
ZJ150	50 3/4	119 1/2	30 3/16	24 3/16	17 3/16	6 3/16

Detail A



42" CABINET



50 3/4" CABINET

Detail B

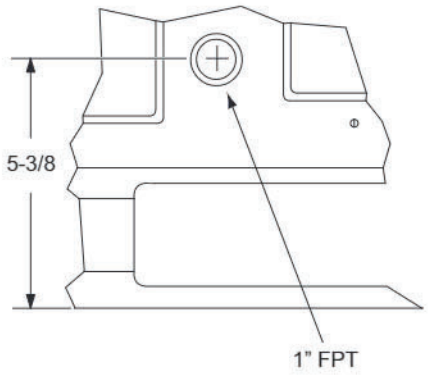
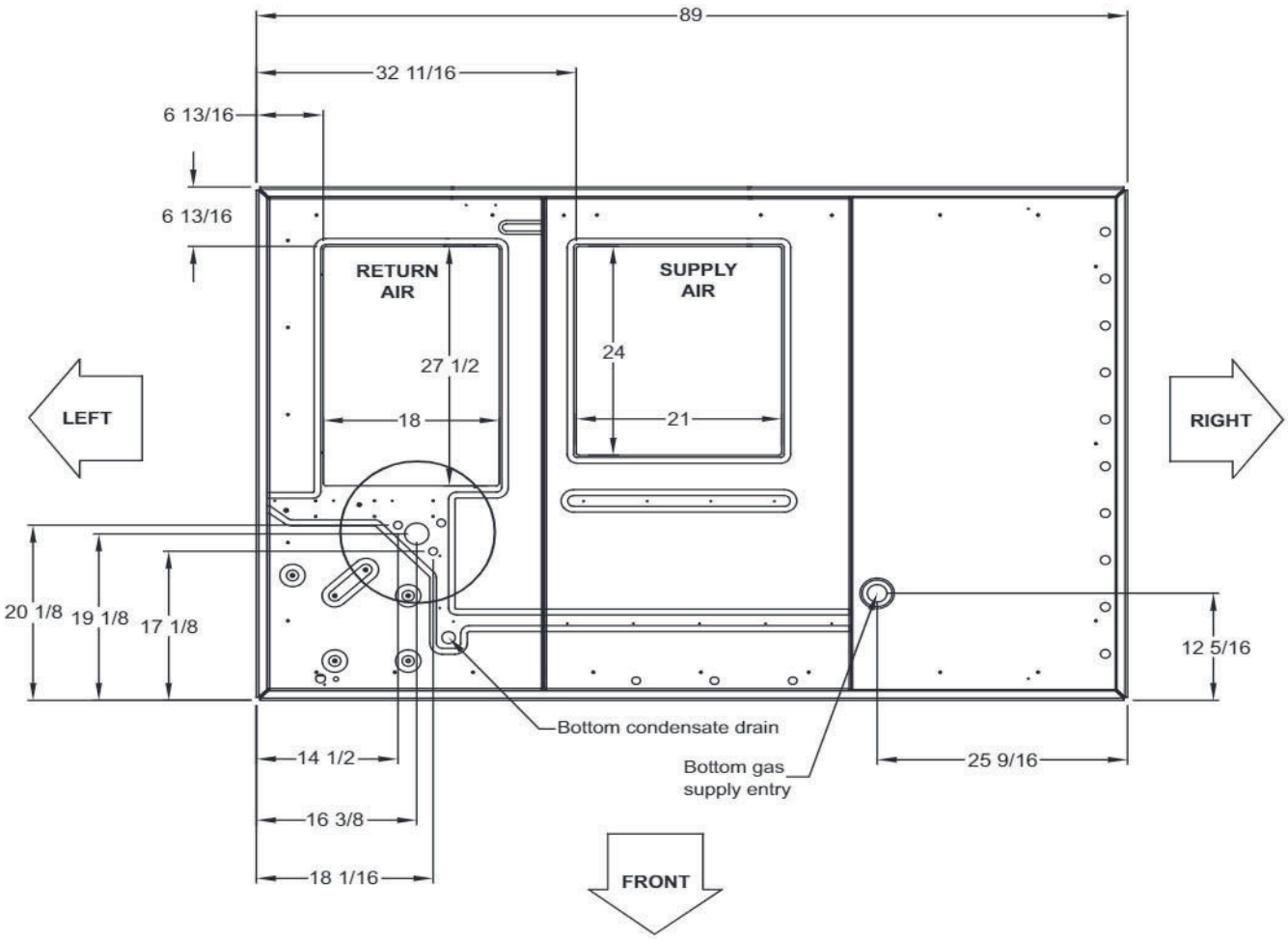


Table 5: ZJ078-150 Unit Clearances

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

1. Units must be installed outdoors. Over hanging structure or shrubs should not obscure condenser air discharge outlet.
2. Units may be installed on combustable floors made from wood or class A, B or C roof covering materials.



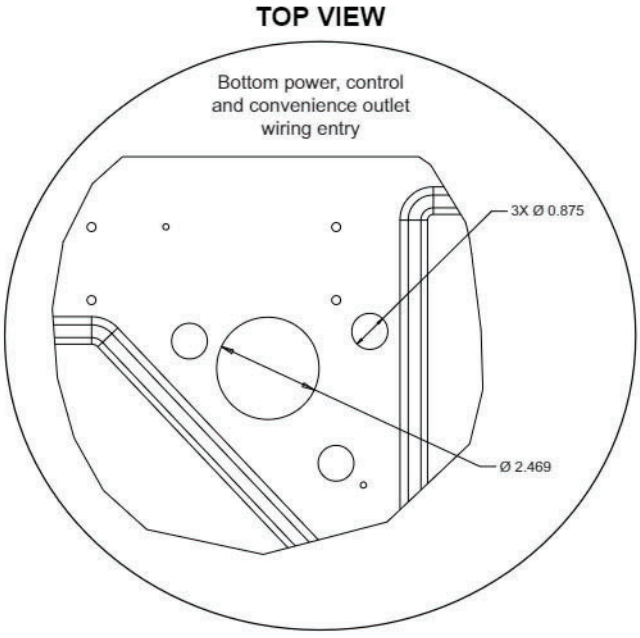


Figure 10: ZJ078-150 Unit Bottom Duct Openings

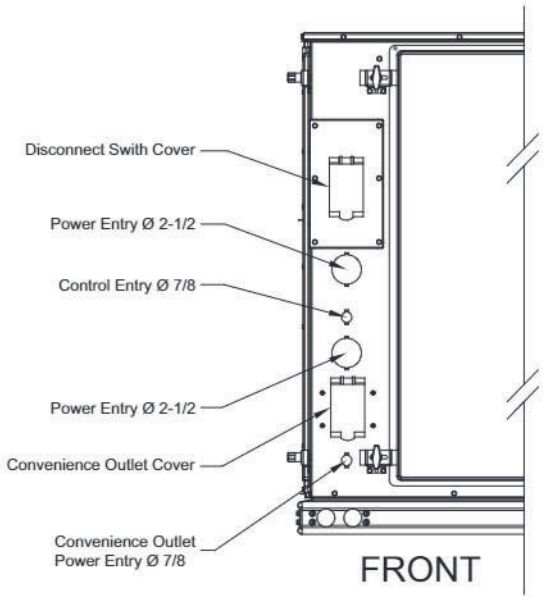


Figure 11: ZJ078-150 Unit Electrical Entry

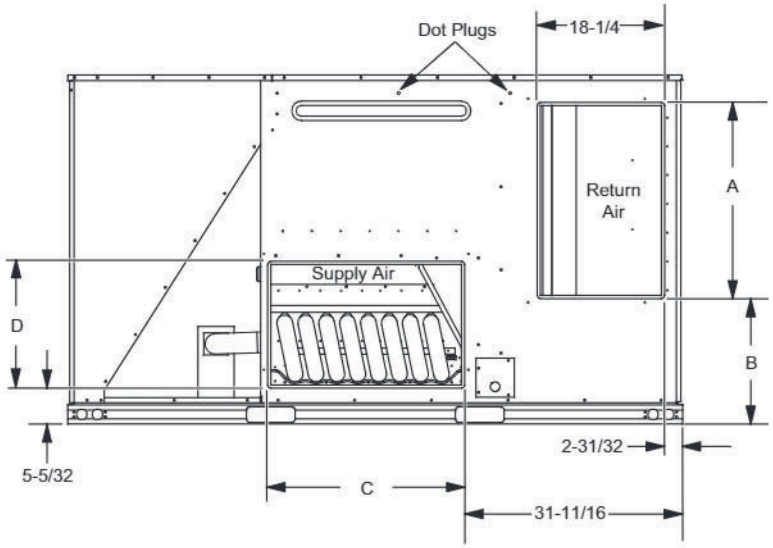


Figure 12: ZJ078-120 Unit Side Duct Openings

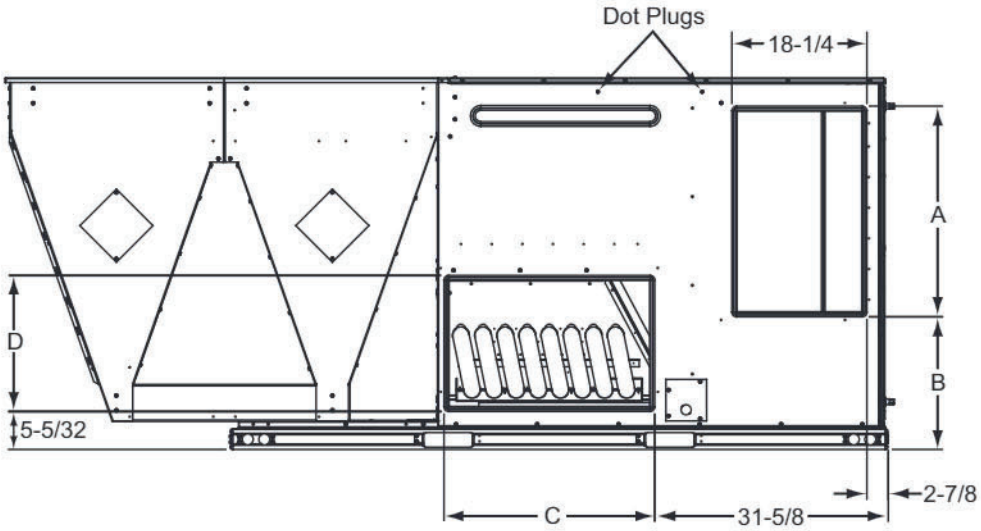


Figure 13: ZJ150 Unit Side Duct Openings

Table 6: Side Duct Dimensions

Unit Model Number	Dimension (in.)			
	A	B	C	D
ZJ078	28 1/4	18 1/16	28 1/4	18 1/4
ZJ090	28 1/4	18 1/16	28 1/4	18 1/4
ZJ102	28 1/4	18 1/16	28 1/4	18 1/4
ZJ120	28 1/4	18 1/16	28 1/4	18 1/4
ZJ150	28 1/4	18 1/16	28 1/4	18 1/4

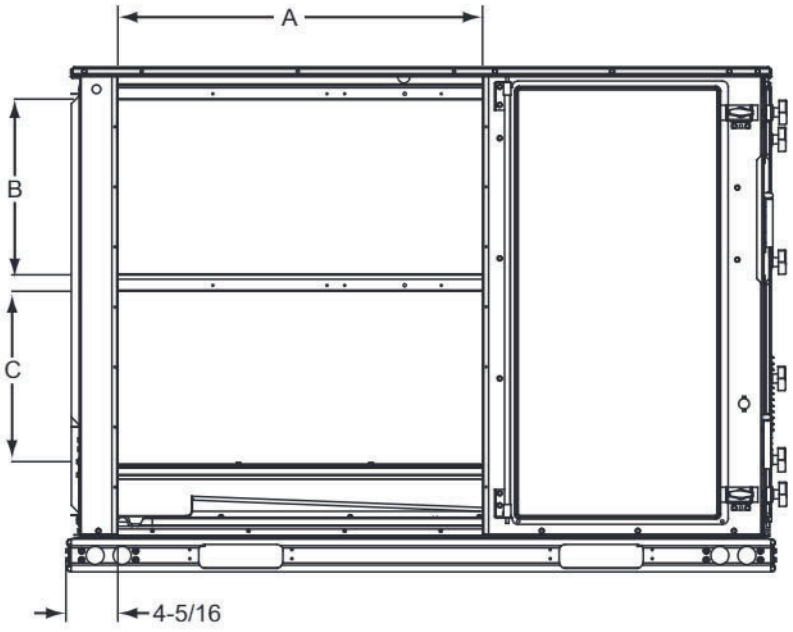


Figure 14: ZJ078-150 Unit Left/End Duct Opening

Table 7: Left/End Duct Dimensions

Unit Model Number	Dimension (in.)		
	A	B	C
ZJ078	30.358	22.580	22.330
ZJ090	30.358	22.580	22.330
ZJ102	30.358	22.580	22.330
ZJ120	30.358	22.580	22.330
ZJ150	30.358	22.580	22.330

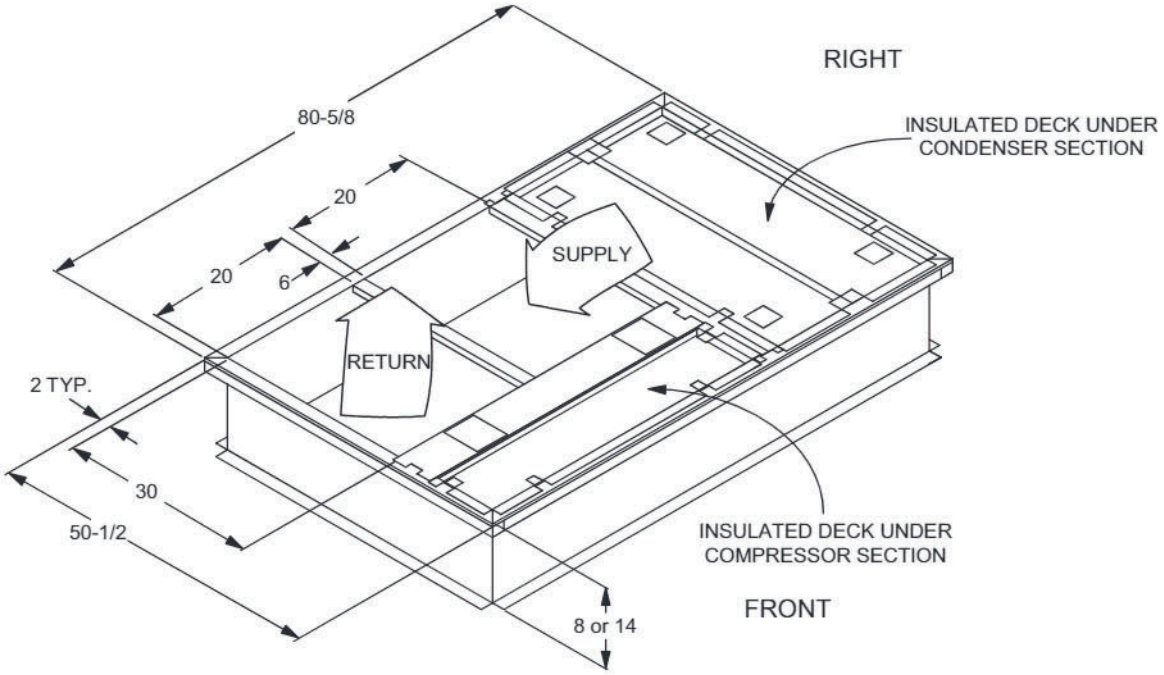


Figure 15: ZJ078-150 Roof Curb

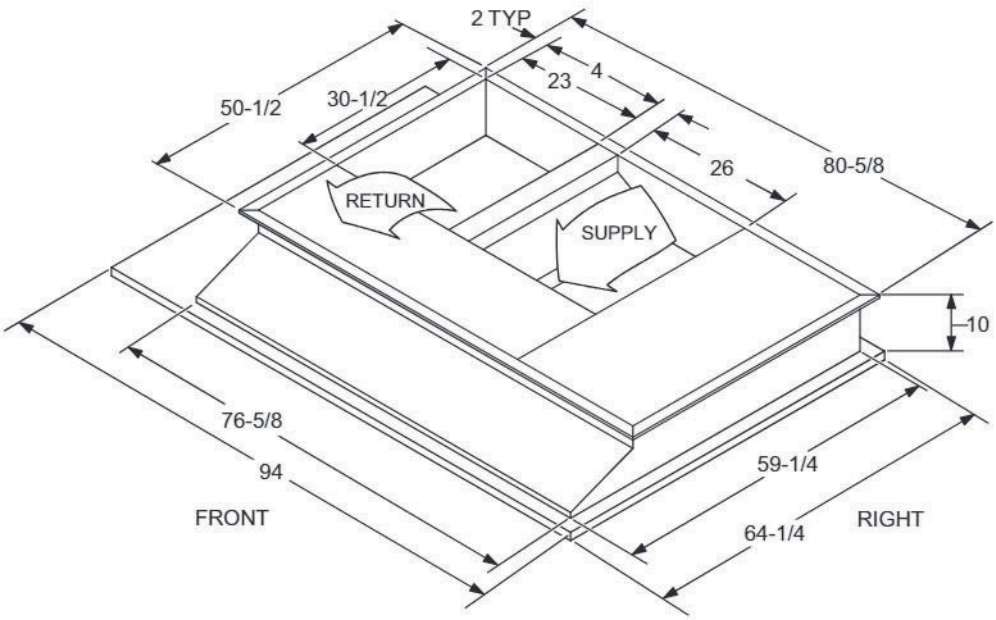


Figure 16: ZJ078-150 Transition Roof Curb

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 Figure 10 for bottom air duct openings. Refer to Figures 12, 13 and Table 6 for side air duct openings.

Duct Covers

Units are shipped with the side duct openings covered and a covering over the bottom of the unit. For bottom duct application, no duct cover changes are necessary. For side duct application, remove the side duct covers and install over the bottom duct openings. The panels removed from the side duct connections are designed to be reused by securing each panel to its respective down flow opening. But keep in mind that the supply panel is installed with the painted surface UP, facing the heat exchanger, while the return panel is installed with the painted surface DOWN, facing the down flow duct opening. The supply panel is secured with the bracket (already in place from the factory) and two screws. It's a snug fit for the panel when sliding it between the heat exchanger and unit bottom, but there is room. The return panel is secured with four screws.

⚠ CAUTION

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and water-proofed.



Figure 17: Side Panels With Hole Plugs

NOTE: Orientation. Panel is "insulation" side up.



Figure 18: Return Down Flow Plenum With Panel



Figure 19: Discharge Panel In Place

Side Panels

Units are shipped with side panels to cover the area where an economizer or motorized damper may be installed. These panels must be saved and used as tops for the Economizer rain hoods (See Figure 20)



Figure 20: Save Side Panels For Economizer Hood Tops

Condensate Drain

The side condensate drain is reversible and maybe re-oriented to the rear of the cabinet to facilitate condensate piping. A condensate drain connection is available through the base pan

for piping inside the roof curb. Trap the connection per Figure 21. The trap and drain lines should be protected from freezing.

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install condensate drain line from the 1 inch NPT female connection on the unit to an open drain.

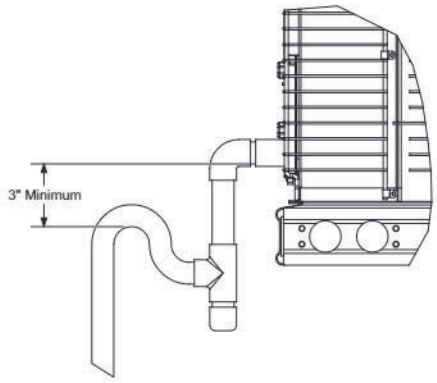


Figure 21: Condensate Drain

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. One-inch filters may be used with no modification to the filter racks. Filters must always be installed ahead of evaporator coil and must be kept clean or replaced with same size and type. Dirty filters reduce the capacity of the unit and result in frosted coils or safety shutdown. Refer to physical data tables, for the number and size of filters needed for the unit. The unit should not be operated without filters properly installed.

⚠ CAUTION

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

Power And Control Wiring

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

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.

⚠ CAUTION

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

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes 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 accessory), refer to Figure 4 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 22, 23, and 24 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.

Power Wiring Detail

Units are factory wired for the voltage shown on the unit nameplate. Refer to Electrical Data Table 9 to size power wiring, fuses, and disconnect switch.

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

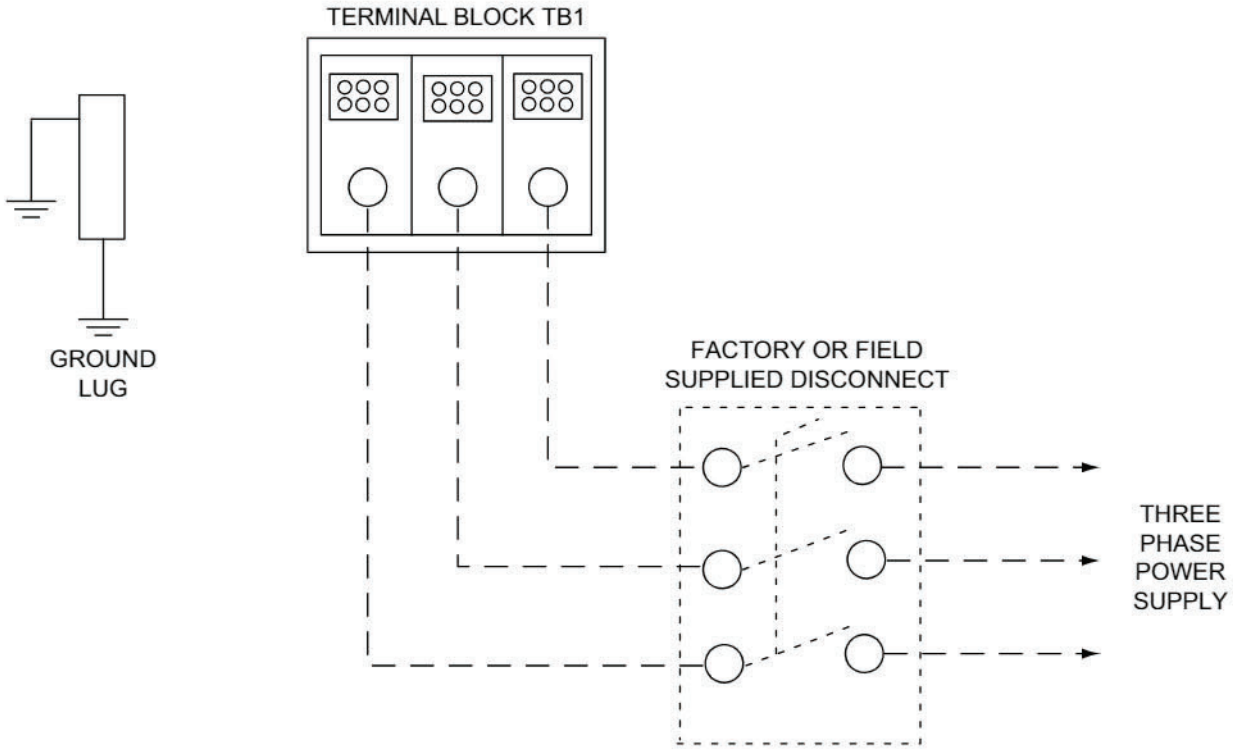


Figure 22: Field Wiring Disconnect - Cooling Unit With/Without Electric Heat and All Units With VFD Option

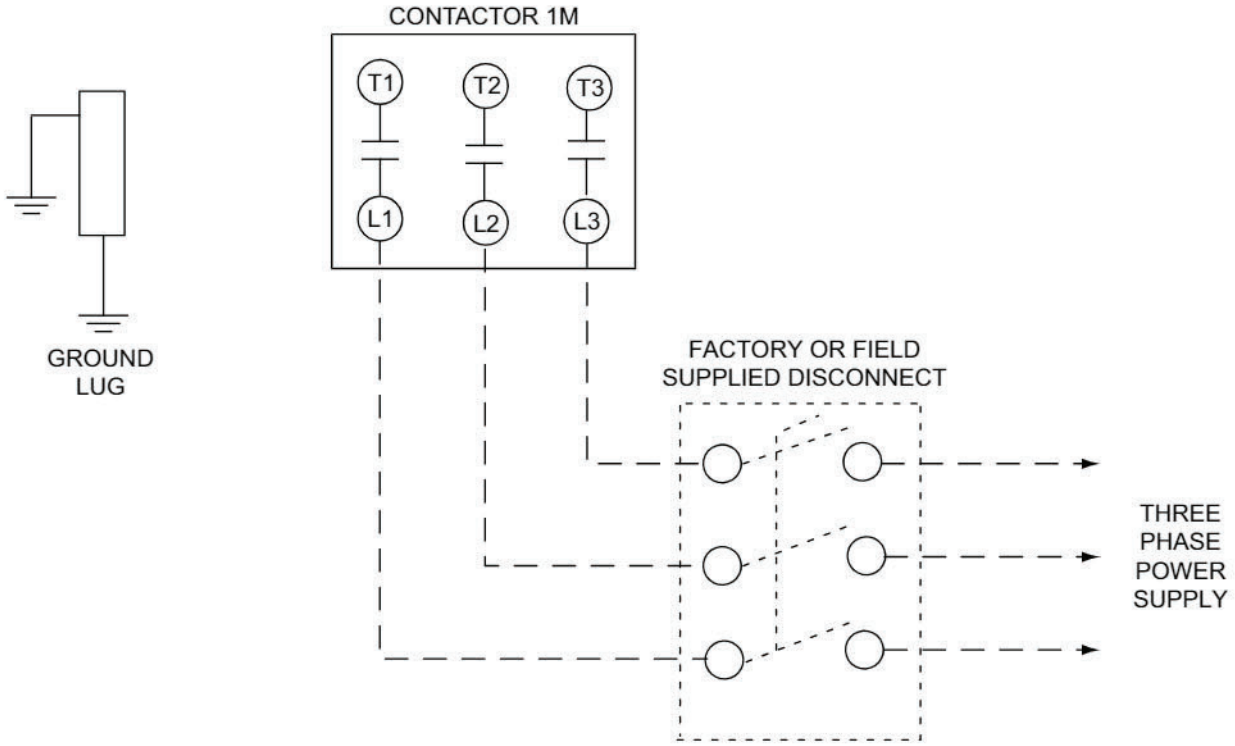


Figure 23: Field Wiring Disconnect - Cooling Unit With Gas Heat Without VFD Option

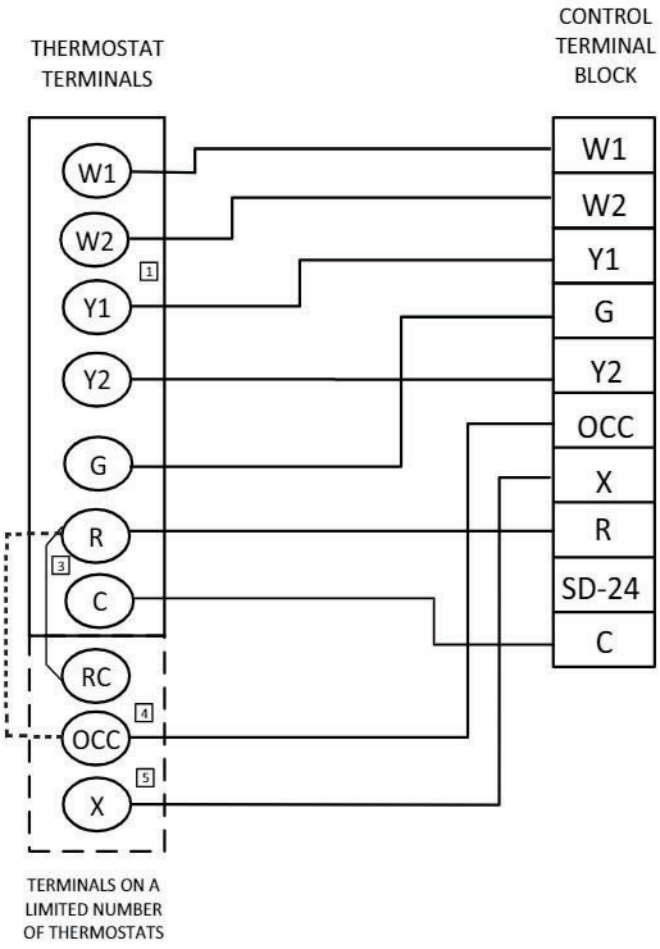
Thermostat Wiring

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 8 for control wire sizing and maximum length.

Table 8: 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.

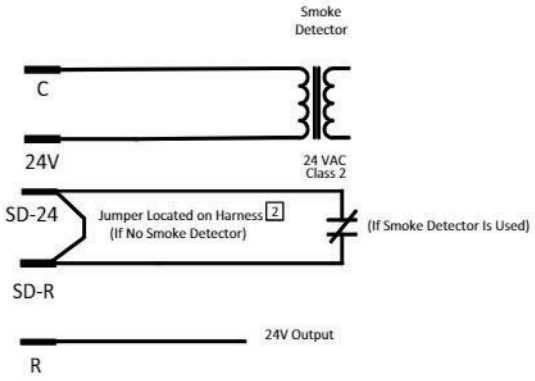


Figure 24: Typical Electronic Thermostat Field Wiring

⚠ CAUTION

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

Table 9: Electrical Data

ZJ078-150 Standard Motor - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	11.2	84	18	1.65	5.2	5.5		None	-	-	-	33.7	39.2	40	50
									E09	6.8	1	18.9	33.7	39.2	40	50
									E18	13.5	2	37.5	53.4	60.3	60	70
									E24	18	2	50	69	75.9	70	80
									E36	25.5	2	70.8	95	101.9	100	110
	230-3-60	11.2	84	18	1.65	5.2	5.5		None	-	-	-	33.7	39.2	40	50
									E09	9	1	21.7	33.7	40.5	40	50
									E18	18	2	43.3	60.6	67.5	70	70
									E24	24	2	57.7	78.6	85.5	80	90
									E36	34	2	81.8	108.8	115.6	110	125
	460-3-60	5.6	44	9	1.1	2.6	2.2		None	-	-	-	17.4	19.6	20	25
									E09	9	1	10.8	17.4	19.6	20	25
									E18	18	2	21.7	30.4	33.1	35	35
									E24	24	2	28.9	39.4	42.1	40	45
									E36	34	2	40.9	54.4	57.1	60	60
	575-3-60	3.8	34	6	0.65	2	1.8		None	-	-	-	11.9	13.7	15	15
									E09	9	1	8.7	13.4	15.6	15	20
									E18	18	2	17.3	24.1	26.4	25	30
									E24	24	2	23.1	31.4	33.6	35	35
									E36	34	2	32.7	43.4	45.6	45	50
090 (7.5)	208-3-60	13.6	83.1	21	2.8	5.2	5.5		None	-	-	-	41.4	46.9	50	60
									E09	6.8	1	18.9	41.4	46.9	50	60
									E18	13.5	2	37.5	53.4	60.3	60	70
									E24	18	2	50	69	75.9	70	80
									E36	25.5	2	70.8	95	101.9	100	110
	230-3-60	13.6	83.1	21	2.8	5.2	5.5		None	-	-	-	41.4	46.9	50	60
									E09	9	1	21.7	41.4	46.9	50	60
									E18	18	2	43.3	60.6	67.5	70	70
									E24	24	2	57.7	78.6	85.5	80	90
									E36	34	2	81.8	108.8	115.6	110	125
	460-3-60	6.1	41	10	1.6	2.6	2.2		None	-	-	-	19.5	21.7	25	25
									E09	9	1	10.8	19.5	21.7	25	25
									E18	18	2	21.7	30.4	33.1	35	35
									E24	24	2	28.9	39.4	42.1	40	45
									E36	34	2	40.9	54.4	57.1	60	60
	575-3-60	4.2	33	7	1.2	2	1.8		None	-	-	-	13.9	15.7	15	20
									E09	9	1	8.7	13.9	15.7	15	20
									E18	18	2	17.3	24.1	26.4	25	30
									E24	24	2	23.1	31.4	33.6	35	35
									E36	34	2	32.7	43.4	45.6	45	50
102 (8.5)	208-3-60	14.5	98	23	2.8	6.8	5.5		None	-	-	-	45	50.5	50	60
									E09	6.8	1	18.9	45	50.5	50	60
									E18	13.5	2	37.5	55.4	62.3	60	70
									E24	18	2	50	71	77.9	80	80
									E36	25.5	2	70.8	97	103.9	100	110
	230-3-60	14.5	98	23	2.8	6.8	5.5		None	-	-	-	45	50.5	50	60
									E09	9	1	21.7	45	50.5	50	60
									E18	18	2	43.3	62.6	69.5	70	70
									E24	24	2	57.7	80.6	87.5	90	90
									E36	34	2	81.8	110.8	117.6	125	125
	460-3-60	6.3	55	10	1.6	3.4	2.2		None	-	-	-	20.8	23	25	25
									E09	9	1	10.8	20.8	23	25	25
									E18	18	2	21.7	31.4	34.1	35	35
									E24	24	2	28.9	40.4	43.1	45	45
									E36	34	2	40.9	55.4	58.1	60	60
	575-3-60	6	41	9	1.2	2.4	1.8		None	-	-	-	18.3	20.1	20	25
									E09	9	1	8.7	18.3	20.1	20	25
									E18	18	2	17.3	24.6	26.9	25	30
									E24	24	2	23.1	31.9	34.1	35	35
									E36	34	2	32.7	43.9	46.1	45	50

ZJ078-150 Standard Motor - Without Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
120 (10)	208-3-60	13.2	93	21	2.8	6.8	5.5		None	-	-	-	42.1	47.6	50	60
									E18	13.5	2	37.5	55.4	62.3	60	70
									E24	18	2	50	71	77.9	80	80
									E36	25.5	2	70.8	97	103.9	100	110
									E54	40.6	2	112.7	149.4	156.3	150	175
	230-3-60	13.2	93	21	2.8	6.8	5.5		None	-	-	-	42.1	47.6	50	60
									E18	18	2	43.3	62.6	69.5	70	70
									E24	24	2	57.7	80.6	87.5	90	90
									E36	34	2	81.8	110.8	117.6	125	125
									E54	54	2	129.9	138.4	145.3	150	175
	460-3-60	6.3	60	10	1.6	3.4	2.2		None	-	-	-	20.8	23	25	25
									E18	18	2	21.7	31.4	34.1	35	35
									E24	24	2	28.9	40.4	43.1	45	45
									E36	34	2	40.9	55.4	58.1	60	60
									E54	54	2	65	69.3	72	80	80
	575-3-60	4.9	41	8	1.2	2.4	1.8		None	-	-	-	15.8	17.6	20	20
									E18	18	2	17.3	24.6	26.9	25	30
									E24	24	2	23.1	31.9	34.1	35	35
									E36	34	2	32.7	43.9	46.1	45	50
									E54	54	2	52	55	57.3	60	60
150 (12.5)	208-3-60	23.1	160	36	1.65	9.6	5.5		None	-	-	-	68.2	73.7	90	90
									E18	13.5	2	37.5	68.2	73.7	90	90
									E24	18	2	50	74.5	81.4	90	90
									E36	25.5	2	70.8	100.5	107.4	110	110
									E54	40.6	2	112.7	152.9	159.8	175	175
	230-3-60	23.1	160	36	1.65	9.6	5.5		None	-	-	-	68.2	73.7	90	90
									E18	18	2	43.3	68.2	73.7	90	90
									E24	24	2	57.7	84.1	91	90	100
									E36	34	2	81.8	114.3	121.1	125	125
									E54	54	2	129.9	141.9	148.8	175	175
	460-3-60	12.2	87	19	1.1	4.7	2.2		None	-	-	-	36.6	38.8	45	50
									E18	18	2	21.7	36.6	38.8	45	50
									E24	24	2	28.9	42	44.8	45	50
									E36	34	2	40.9	57	59.8	60	60
									E54	54	2	65	70.9	73.6	80	80
	575-3-60	8.7	62	14	0.65	3.6	1.8		None	-	-	-	25.8	27.6	30	35
									E18	18	2	17.3	26.1	28.4	30	35
									E24	24	2	23.1	33.4	35.6	35	40
									E36	34	2	32.7	45.4	47.6	50	50
									E54	54	2	52	56.5	58.8	70	70

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

ZJ078-150 Hi Static Motor - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	11.2	84	18	1.65	6.8	5.5		None	-	-	-	35.3	40.8	45	50
									E09	6.8	1	18.9	35.3	40.8	45	50
									E18	13.5	2	37.5	55.4	62.3	60	70
									E24	18	2	50	71	77.9	80	80
									E36	25.5	2	70.8	97	103.9	100	110
	230-3-60	11.2	84	18	1.65	6.8	5.5		None	-	-	-	35.3	40.8	45	50
									E09	9	1	21.7	35.6	42.5	45	50
									E18	18	2	43.3	62.6	69.5	70	70
									E24	24	2	57.7	80.6	87.5	90	90
									E36	34	2	81.8	110.8	117.6	125	125
	460-3-60	5.6	44	9	1.1	3.4	2.2		None	-	-	-	18.2	20.4	20	25
									E09	9	1	10.8	18.2	20.5	20	25
									E18	18	2	21.7	31.4	34.1	35	35
									E24	24	2	28.9	40.4	43.1	45	45
									E36	34	2	40.9	55.4	58.1	60	60
	575-3-60	3.8	34	6	0.65	2.4	1.8		None	-	-	-	12.3	14.1	15	15
									E09	9	1	8.7	13.9	16.1	15	20
									E18	18	2	17.3	24.6	26.9	25	30
									E24	24	2	23.1	31.9	34.1	35	35
									E36	34	2	32.7	43.9	46.1	45	50
090 (7.5)	208-3-60	13.6	83.1	21	2.8	9.6	5.5		None	-	-	-	45.8	51.3	50	60
									E09	6.8	1	18.9	45.8	51.3	50	60
									E18	13.5	2	37.5	58.9	65.8	60	70
									E24	18	2	50	74.5	81.4	80	90
									E36	25.5	2	70.8	100.5	107.4	110	110
	230-3-60	13.6	83.1	21	2.8	9.6	5.5		None	-	-	-	45.8	51.3	50	60
									E09	9	1	21.7	45.8	51.3	50	60
									E18	18	2	43.3	66.1	73	70	80
									E24	24	2	57.7	84.1	91	90	100
									E36	34	2	81.8	114.3	121.1	125	125
	460-3-60	6.1	41	10	1.6	4.7	2.2		None	-	-	-	21.6	23.8	25	25
									E09	9	1	10.8	21.6	23.8	25	25
									E18	18	2	21.7	33	35.8	35	40
									E24	24	2	28.9	42	44.8	45	45
									E36	34	2	40.9	57	59.8	60	60
	575-3-60	4.2	33	7	1.2	3.6	1.8		None	-	-	-	15.5	17.3	20	20
									E09	9	1	8.7	15.5	17.6	20	20
									E18	18	2	17.3	26.1	28.4	30	30
									E24	24	2	23.1	33.4	35.6	35	40
									E36	34	2	32.7	45.4	47.6	50	50
102 (8.5)	208-3-60	14.5	98	23	2.8	9.6	5.5		None	-	-	-	47.8	53.3	60	60
									E09	6.8	1	18.9	47.8	53.3	60	60
									E18	13.5	2	37.5	58.9	65.8	60	70
									E24	18	2	50	74.5	81.4	80	90
									E36	25.5	2	70.8	100.5	107.4	110	110
	230-3-60	14.5	98	23	2.8	9.6	5.5		None	-	-	-	47.8	53.3	60	60
									E09	9	1	21.7	47.8	53.3	60	60
									E18	18	2	43.3	66.1	73	70	80
									E24	24	2	57.7	84.1	91	90	100
									E36	34	2	81.8	114.3	121.1	125	125
	460-3-60	6.3	55	10	1.6	4.7	2.2		None	-	-	-	22.1	24.3	25	30
									E09	9	1	10.8	22.1	24.3	25	30
									E18	18	2	21.7	33	35.8	35	40
									E24	24	2	28.9	42	44.8	45	45
									E36	34	2	40.9	57	59.8	60	60
	575-3-60	6	41	9	1.2	3.6	1.8		None	-	-	-	19.5	21.3	25	25
									E09	9	1	8.7	19.5	21.3	25	25
									E18	18	2	17.3	26.1	28.4	30	30
									E24	24	2	23.1	33.4	35.6	35	40
									E36	34	2	32.7	45.4	47.6	50	50

ZJ078-150 Hi Static Motor - Without Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
120 (10)	208-3-60	13.2	93	21	2.8	9.6	5.5		None	-	-	-	44.9	50.4	50	60
									E18	13.5	2	37.5	58.9	65.8	60	70
									E24	18	2	50	74.5	81.4	80	90
									E36	25.5	2	70.8	100.5	107.4	110	110
									E54	40.6	2	112.7	152.9	159.8	175	175
	230-3-60	13.2	93	21	2.8	9.6	5.5		None	-	-	-	44.9	50.4	50	60
									E18	18	2	43.3	66.1	73	70	80
									E24	24	2	57.7	84.1	91	90	100
									E36	34	2	81.8	114.3	121.1	125	125
									E54	54	2	129.9	141.9	148.8	175	175
	460-3-60	6.3	60	10	1.6	4.7	2.2		None	-	-	-	22.1	24.3	25	30
									E18	18	2	21.7	33	35.8	35	40
									E24	24	2	28.9	42	44.8	45	45
									E36	34	2	40.9	57	59.8	60	60
									E54	54	2	65	70.9	73.6	80	80
	575-3-60	4.9	41	8	1.2	3.6	1.8		None	-	-	-	17	18.8	20	20
									E18	18	2	17.3	26.1	28.4	30	30
									E24	24	2	23.1	33.4	35.6	35	40
									E36	34	2	32.7	45.4	47.6	50	50
									E54	54	2	52	56.5	58.8	70	70
150 (12.5)	208-3-60	23.1	160	36	1.65	14	5.5		None	-	-	-	72.6	78.1	90	100
									E18	13.5	2	37.5	72.6	78.1	90	100
									E24	18	2	50	80	86.9	90	100
									E36	25.5	2	70.8	106	112.9	110	125
									E54	40.6	2	112.7	158.4	165.3	175	175
	230-3-60	23.1	160	36	1.65	14	5.5		None	-	-	-	72.6	78.1	90	100
									E18	18	2	43.3	72.6	78.5	90	100
									E24	24	2	57.7	89.6	96.5	90	100
									E36	34	2	81.8	119.8	126.6	125	150
									E54	54	2	129.9	147.4	154.3	175	175
	460-3-60	12.2	87	19	1.1	6.6	2.2		None	-	-	-	38.5	40.7	50	50
									E18	18	2	21.7	38.5	40.7	50	50
									E24	24	2	28.9	44.4	47.1	50	50
									E36	34	2	40.9	59.4	62.1	60	70
									E54	54	2	65	73.3	76	80	90
	575-3-60	8.7	62	14	0.65	5.2	1.8		None	-	-	-	27.4	29.2	35	35
									E18	18	2	17.3	28.1	30.4	35	35
									E24	24	2	23.1	35.4	37.6	40	40
									E36	34	2	32.7	47.4	49.6	50	50
									E54	54	2	52	58.5	60.8	70	70

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

ZJ078-150 Standard Motor - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	11.2	84	18	1.65	5.2	5.5	20	None	-	-	-	43.7	49.2	50	60
									E09	6.8	1	18.9	43.7	49.5	50	60
									E18	13.5	2	37.5	65.9	72.8	70	80
									E24	18	2	50	81.5	88.4	90	90
									E36	25.5	2	70.8	107.5	114.4	110	125
	230-3-60	11.2	84	18	1.65	5.2	5.5	20	None	-	-	-	43.7	49.2	50	60
									E09	9	1	21.7	46.1	53	50	60
									E18	18	2	43.3	73.1	80	80	80
									E24	24	2	57.7	91.1	98	100	100
									E36	34	2	81.8	121.3	128.1	125	150
	460-3-60	5.6	44	9	1.1	2.6	2.2	20	None	-	-	-	22.4	24.6	25	30
									E09	9	1	10.8	23	25.8	25	30
									E18	18	2	21.7	36.6	39.4	40	40
									E24	24	2	28.9	45.6	48.4	50	50
									E36	34	2	40.9	60.6	63.4	70	70
	575-3-60	3.8	34	6	0.65	2	1.8	20	None	-	-	-	15.9	17.7	20	20
									E09	9	1	8.7	18.4	20.6	20	25
									E18	18	2	17.3	29.1	31.4	30	35
									E24	24	2	23.1	36.4	38.6	40	40
									E36	34	2	32.7	48.4	50.6	50	60
090 (7.5)	208-3-60	13.6	83.1	21	2.8	5.2	5.5	20	None	-	-	-	51.4	56.9	60	70
									E09	6.8	1	18.9	51.4	56.9	60	70
									E18	13.5	2	37.5	65.9	72.8	70	80
									E24	18	2	50	81.5	88.4	90	90
									E36	25.5	2	70.8	107.5	114.4	110	125
	230-3-60	13.6	83.1	21	2.8	5.2	5.5	20	None	-	-	-	51.4	56.9	60	70
									E09	9	1	21.7	51.4	56.9	60	70
									E18	18	2	43.3	73.1	80	80	80
									E24	24	2	57.7	91.1	98	100	100
									E36	34	2	81.8	121.3	128.1	125	150
	460-3-60	6.1	41	10	1.6	2.6	2.2	20	None	-	-	-	24.5	26.7	30	30
									E09	9	1	10.8	24.5	26.7	30	30
									E18	18	2	21.7	36.6	39.4	40	40
									E24	24	2	28.9	45.6	48.4	50	50
									E36	34	2	40.9	60.6	63.4	70	70
	575-3-60	4.2	33	7	1.2	2	1.8	20	None	-	-	-	17.9	19.7	20	20
									E09	9	1	8.7	18.4	20.6	20	25
									E18	18	2	17.3	29.1	31.4	30	35
									E24	24	2	23.1	36.4	38.6	40	40
									E36	34	2	32.7	48.4	50.6	50	60
102 (8.5)	208-3-60	14.5	98	23	2.8	6.8	5.5	20	None	-	-	-	55	60.5	60	70
									E09	6.8	1	18.9	55	60.5	60	70
									E18	13.5	2	37.5	67.9	74.8	70	80
									E24	18	2	50	83.5	90.4	90	100
									E36	25.5	2	70.8	109.5	116.4	110	125
	230-3-60	14.5	98	23	2.8	6.8	5.5	20	None	-	-	-	55	60.5	60	70
									E09	9	1	21.7	55	60.5	60	70
									E18	18	2	43.3	75.1	82	80	90
									E24	24	2	57.7	93.1	100	100	100
									E36	34	2	81.8	123.3	130.1	125	150
	460-3-60	6.3	55	10	1.6	3.4	2.2	20	None	-	-	-	25.8	28	30	30
									E09	9	1	10.8	25.8	28	30	30
									E18	18	2	21.7	37.6	40.4	40	45
									E24	24	2	28.9	46.6	49.4	50	50
									E36	34	2	40.9	61.6	64.4	70	70
	575-3-60	6	41	9	1.2	2.4	1.8	20	None	-	-	-	22.3	24.1	25	30
									E09	9	1	8.7	22.3	24.1	25	30
									E18	18	2	17.3	29.6	31.9	30	35
									E24	24	2	23.1	36.9	39.1	40	40
									E36	34	2	32.7	48.9	51.1	50	60

ZJ078-150 Standard Motor - With Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
120 (10)	208-3-60	13.2	93	21	2.8	6.8	5.5	20	None	-	-	-	52.1	57.6	60	70
									E18	13.5	2	37.5	67.9	74.8	70	80
									E24	18	2	50	83.5	90.4	90	100
									E36	25.5	2	70.8	109.5	116.4	110	125
									E54	40.6	2	112.7	161.9	168.8	175	175
	230-3-60	13.2	93	21	2.8	6.8	5.5	20	None	-	-	-	52.1	57.6	60	70
									E18	18	2	43.3	75.1	82	80	90
									E24	24	2	57.7	93.1	100	100	100
									E36	34	2	81.8	123.3	130.1	125	150
									E54	54	2	129.9	150.9	157.8	175	175
	460-3-60	6.3	60	10	1.6	3.4	2.2	20	None	-	-	-	25.8	28	30	30
									E18	18	2	21.7	37.6	40.4	40	45
									E24	24	2	28.9	46.6	49.4	50	50
									E36	34	2	40.9	61.6	64.4	70	70
									E54	54	2	65	75.5	78.3	80	90
	575-3-60	4.9	41	8	1.2	2.4	1.8	20	None	-	-	-	19.8	21.6	20	25
									E18	18	2	17.3	29.6	31.9	30	35
									E24	24	2	23.1	36.9	39.1	40	40
									E36	34	2	32.7	48.9	51.1	50	60
									E54	54	2	52	60	62.3	70	70
150 (12.5)	208-3-60	23.1	160	36	1.65	9.6	5.5	10	None	-	-	-	78.2	83.7	100	100
									E18	13.5	2	37.5	78.2	83.7	100	100
									E24	18	2	50	87	93.9	100	100
									E36	25.5	2	70.8	113	119.9	125	125
									E54	40.6	2	112.7	165.4	172.3	175	175
	230-3-60	23.1	160	36	1.65	9.6	5.5	10	None	-	-	-	78.2	83.7	100	100
									E18	18	2	43.3	78.6	85.5	100	100
									E24	24	2	57.7	96.6	103.5	100	110
									E36	34	2	81.8	126.8	133.6	150	150
									E54	54	2	129.9	154.4	161.3	175	175
	460-3-60	12.2	87	19	1.1	4.7	2.2	5	None	-	-	-	41.6	43.8	50	50
									E18	18	2	21.7	41.6	43.8	50	50
									E24	24	2	28.9	48.3	51	50	60
									E36	34	2	40.9	63.3	66	70	70
									E54	54	2	65	77.1	79.9	90	90
	575-3-60	8.7	62	14	0.65	3.6	1.8	4	None	-	-	-	29.8	31.6	35	40
									E18	18	2	17.3	31.1	33.4	35	40
									E24	24	2	23.1	38.4	40.6	40	45
									E36	34	2	32.7	50.4	52.6	60	60
									E54	54	2	52	61.5	63.8	70	70

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

ZJ078-150 Hi Static Motor - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
078 (6.5)	208-3-60	11.2	84	18	1.65	6.8	5.5	20	None	-	-	-	45.3	50.8	50	60
									E09	6.8	1	18.9	45.3	51.5	50	60
									E18	13.5	2	37.5	67.9	74.8	70	80
									E24	18	2	50	83.5	90.4	90	100
									E36	25.5	2	70.8	109.5	116.4	110	125
	230-3-60	11.2	84	18	1.65	6.8	5.5	20	None	-	-	-	45.3	50.8	50	60
									E09	9	1	21.7	48.1	55	50	60
									E18	18	2	43.3	75.1	82	80	90
									E24	24	2	57.7	93.1	100	100	100
									E36	34	2	81.8	123.3	130.1	125	150
	460-3-60	5.6	44	9	1.1	3.4	2.2	20	None	-	-	-	23.2	25.4	25	30
									E09	9	1	10.8	24	26.8	25	30
									E18	18	2	21.7	37.6	40.4	40	45
									E24	24	2	28.9	46.6	49.4	50	50
									E36	34	2	40.9	61.6	64.4	70	70
	575-3-60	3.8	34	6	0.65	2.4	1.8	20	None	-	-	-	16.3	18.1	20	20
									E09	9	1	8.7	18.9	21.1	20	25
									E18	18	2	17.3	29.6	31.9	30	35
									E24	24	2	23.1	36.9	39.1	40	40
									E36	34	2	32.7	48.9	51.1	50	60
090 (7.5)	208-3-60	13.6	83.1	21	2.8	9.6	5.5	20	None	-	-	-	55.8	61.3	60	70
									E09	6.8	1	18.9	55.8	61.3	60	70
									E18	13.5	2	37.5	71.4	78.3	80	80
									E24	18	2	50	87	93.9	90	100
									E36	25.5	2	70.8	113	119.9	125	125
	230-3-60	13.6	83.1	21	2.8	9.6	5.5	20	None	-	-	-	55.8	61.3	60	70
									E09	9	1	21.7	55.8	61.3	60	70
									E18	18	2	43.3	78.6	85.5	80	90
									E24	24	2	57.7	96.6	103.5	100	110
									E36	34	2	81.8	126.8	133.6	150	150
	460-3-60	6.1	41	10	1.6	4.7	2.2	20	None	-	-	-	26.6	28.8	30	30
									E09	9	1	10.8	26.6	28.8	30	30
									E18	18	2	21.7	39.3	42	40	45
									E24	24	2	28.9	48.3	51	50	60
									E36	34	2	40.9	63.3	66	70	70
	575-3-60	4.2	33	7	1.2	3.6	1.8	20	None	-	-	-	19.5	21.3	20	25
									E09	9	1	8.7	20.4	22.6	25	25
									E18	18	2	17.3	31.1	33.4	35	35
									E24	24	2	23.1	38.4	40.6	40	45
									E36	34	2	32.7	50.4	52.6	60	60
102 (8.5)	208-3-60	14.5	98	23	2.8	9.6	5.5	20	None	-	-	-	57.8	63.3	70	70
									E09	6.8	1	18.9	57.8	63.3	70	70
									E18	13.5	2	37.5	71.4	78.3	80	80
									E24	18	2	50	87	93.9	90	100
									E36	25.5	2	70.8	113	119.9	125	125
	230-3-60	14.5	98	23	2.8	9.6	5.5	20	None	-	-	-	57.8	63.3	70	70
									E09	9	1	21.7	57.8	63.3	70	70
									E18	18	2	43.3	78.6	85.5	80	90
									E24	24	2	57.7	96.6	103.5	100	110
									E36	34	2	81.8	126.8	133.6	150	150
	460-3-60	6.3	55	10	1.6	4.7	2.2	20	None	-	-	-	27.1	29.3	30	35
									E09	9	1	10.8	27.1	29.3	30	35
									E18	18	2	21.7	39.3	42	40	45
									E24	24	2	28.9	48.3	51	50	60
									E36	34	2	40.9	63.3	66	70	70
	575-3-60	6	41	9	1.2	3.6	1.8	20	None	-	-	-	23.5	25.3	25	30
									E09	9	1	8.7	23.5	25.3	25	30
									E18	18	2	17.3	31.1	33.4	35	35
									E24	24	2	23.1	38.4	40.6	40	45
									E36	34	2	32.7	50.4	52.6	60	60

ZJ078-150 Hi Static Motor - With Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
120 (10)	208-3-60	13.2	93	21	2.8	9.6	5.5	20	None	-	-	-	54.9	60.4	60	70
									E18	13.5	2	37.5	71.4	78.3	80	80
									E24	18	2	50	87	93.9	90	100
									E36	25.5	2	70.8	113	119.9	125	125
									E54	40.6	2	112.7	165.4	172.3	175	175
	230-3-60	13.2	93	21	2.8	9.6	5.5	20	None	-	-	-	54.9	60.4	60	70
									E18	18	2	43.3	78.6	85.5	80	90
									E24	24	2	57.7	96.6	103.5	100	110
									E36	34	2	81.8	126.8	133.6	150	150
									E54	54	2	129.9	154.4	161.3	175	175
	460-3-60	6.3	60	10	1.6	4.7	2.2	20	None	-	-	-	27.1	29.3	30	35
									E18	18	2	21.7	39.3	42	40	45
									E24	24	2	28.9	48.3	51	50	60
									E36	34	2	40.9	63.3	66	70	70
									E54	54	2	65	77.1	79.9	90	90
	575-3-60	4.9	41	8	1.2	3.6	1.8	20	None	-	-	-	21	22.8	25	25
									E18	18	2	17.3	31.1	33.4	35	35
									E24	24	2	23.1	38.4	40.6	40	45
									E36	34	2	32.7	50.4	52.6	60	60
									E54	54	2	52	61.5	63.8	70	70
150 (12.5)	208-3-60	23.1	160	36	1.65	14	5.5	10	None	-	-	-	82.6	88.1	100	110
									E18	13.5	2	37.5	82.6	88.1	100	110
									E24	18	2	50	92.5	99.4	100	110
									E36	25.5	2	70.8	118.5	125.4	125	150
									E54	40.6	2	112.7	170.9	177.8	175	200
	230-3-60	23.1	160	36	1.65	14	5.5	10	None	-	-	-	82.6	88.1	100	110
									E18	18	2	43.3	84.1	91	100	110
									E24	24	2	57.7	102.1	109	110	110
									E36	34	2	81.8	132.3	139.1	150	150
									E54	54	2	129.9	159.9	166.8	175	175
	460-3-60	12.2	87	19	1.1	6.6	2.2	5	None	-	-	-	43.5	45.7	50	50
									E18	18	2	21.7	43.5	45.7	50	50
									E24	24	2	28.9	50.6	53.4	60	60
									E36	34	2	40.9	65.6	68.4	70	70
									E54	54	2	65	79.5	82.3	90	90
	575-3-60	8.7	62	14	0.65	5.2	1.8	4	None	-	-	-	31.4	33.2	40	40
									E18	18	2	17.3	33.1	35.4	40	40
									E24	24	2	23.1	40.4	42.6	45	45
									E36	34	2	32.7	52.4	54.6	60	60
									E54	54	2	52	63.5	65.8	70	70

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

Table 10: Physical Data

ZJ078-150 Physical Data

Component	Models									
	ZJ078		ZJ090		ZJ102		ZJ120		ZJ150	
Nominal Tonnage	**6.5**		**7.5**		**8.5**		**10**		**12.5**	
AHRI COOLING PERFORMANCE										
Gross Capacity @ AHRI A point (Btu)	76000		88000		99700		124000		154000	
AHRI net capacity (Btu)	74000		86000		96000		120000		150000	
EER	11.8[1]/11.8[2]		12.2[1]/12.0[2]		12.2[1]/12.0[2]		12.0		12.1[1]/12[2]	
IEER with Constant Volume	13.20[1]/13.20[2]		13.2[1]/13.0[2]		13.0		12.9[1]/12.8[2]		13.7[1]/13.5[2]	
IEER with Intellispeed	14.8[1]/14.6[2]		14.8[1]/14.6[2]		14.0[1]/13.8[2]		14.8[1]/14.6[2]		15.2[1]/15.0[2]	
IEER with VAV	14.1[1]/13.9[2]		13.2[1]/13.0[2]		13.45[1]/13.25[2]		13.85[1]/13.65[2]		13.8[1]/13.6[2]	
CFM	2500		2500		3300		3400		3500	
System power (KW)	6.40		7.17		8.00		9.80		12.50	
Refrigerant type	R-410A		R-410A		R-410A		R-410A		R-410A	
Refrigerant charge (lb-oz)										
System 1	5-12		7-12		8-2		7-12		10-8	
System 2	5-12		7-5		7-14		7-10		9-12	
AHRI HEATING PERFORMANCE										
Heating model	N12	N18	N12	N18	N12	N18	N18	N24	N18	N24
Heat input (K Btu)	120	180	120	180	120	180	180	240	180	240
Heat output (K Btu)	96	144	96	144	96	144	144	192	144	192
AFUE %	-	-	-	-	-	-	-	-	-	-
Steady state efficiency (%)	80	80	80	80	80	80	80	80	80	80
No. burners	4	6	4	6	4	6	6	8	6	8
No. stages	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]	2[3]
Temperature Rise Range (°F)	20-50	35-65	15-45	30-60	10-40	25-55	20-50	35-65	10-40	25-55
Gas Limit Setting (°F)	165	165	165	165	215	195	195	160	195	160
Gas piping connection (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
DIMENSIONS (inches)										
Length	89		89		89		89		119-1/2	
Width	59		59		59		59		59	
Height	50-3/4		50-3/4		50-3/4		50-3/4		50-3/4	
OPERATING WT. (lbs.)	1030		1050		1060		1070		1280	
COMPRESSORS[4]										
Type	Scroll		Scroll		Scroll		Scroll		Scroll	
Quantity	2		2		2		2		2	
Unit Capacity Steps (%)	50 / 100		50 / 100		50 / 100		50 / 100		50 / 100	
CONDENSER COIL DATA										
Face area (Sq. Ft.)	29.0		23.8		29.0		29.0		47.5	
Rows	1		1		1		1		1	
Fins per inch	23		23		23		23		23	
Tube diameter (in./MM)	.71/18		1/25		1/25		1/25		.71/18	
Circuitry Type	2-pass Microchannel		2-pass Microchannel		2-pass Microchannel		2-pass Microchannel		2-pass Microchannel	
EVAPORATOR COIL DATA										
Face area (Sq. Ft.)	13.2		13.2		13.2		13.2		13.2	
Rows	3		4		4		4		4	
Fins per inch	15		15		15		15		15	
Tube diameter	0.375		0.375		0.375		0.375		0.375	
Circuitry Type	Intertwined		Intertwined		Intertwined		Intertwined		Intertwined	
Refrigerant control	TXV		TXV		TXV		TXV		TXV	

ZJ078-150 Physical Data (Continued)

Component	Models									
	ZJ078		ZJ090		ZJ102		ZJ120		ZJ150	
Nominal Tonnage	**6.5**		**7.5**		**8.5**		**10**		**12.5**	
CONDENSER FAN DATA										
Quantity of fans	2		2		2		2		4	
Fan diameter (Inch)	24		24		24		24		24	
Type	Prop		Prop		Prop		Prop		Prop	
Drive type	Direct		Direct		Direct		Direct		Direct	
Quantity of motors	2		2		2		2		4	
Motor HP each	1/3		3/4		3/4		3/4		1/3	
No. speeds	1		1		1		1		1	
RPM	850		1110		1110		1110		850	
Total CFM	7400		8000		9000		9400		14000	
BELT DRIVE EVAP FAN DATA										
Quantity	1		1		1		1		1	
Fan Size (Inch)	15 x 15		15 x 15		15 x 15		15 x 15		15 x 15	
Type	Centrifugal		Centrifugal		Centrifugal		Centrifugal		Centrifugal	
Motor Sheave	1VL40	1VM50	1VL40	1VM50	1VM50	1VM50	1VM50	1VM50	1VM50	1VP56
Blower Sheave	AK74	AK74	AK69	AK69	AK89	AK74	AK84	AK74	AK74	BK77
Belt	A53	A54	A52	A54	A56	A54	A56	A54	A54	BX56
Motor HP each	1-1/2	2	1-1/2	3	2	3	2	3	3	5
RPM	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725
Frame size	56	56	56	56	56	56	56	56	56	184T
FILTERS										
Quantity - Size	4 - (24 x 20 x 2)[5,6]		4 - (24 x 20 x 2)[5,6]		4 - (24 x 20 x 2)[5,6]		4 - (24 x 20 x 2)[5,6]		4 - (24 x 20 x 2)[5,6]	
	4 - (24 x 20 x 4)[7]		4 - (24 x 20 x 4)[7]		4 - (24 x 20 x 4)[7]		4 - (24 x 20 x 4)[7]		4 - (24 x 20 x 4)[7]	

1. Cooling Only Unit or Cooling Unit with Electric Heat
2. Cooling Unit with Gas Heat
3. 1st Stage 50% of Full Capacity.
4. ZJ078 through ZJ150 have crankcase heaters standard
5. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.
6. 2 In. Pleated, Optional, MERV 8.
7. 4 In. Pleated, Optional, MERV 13.

Optional Electric Heat

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending in to the supply air chamber.

Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. refer to Table 11 for minimum CFM limitations and to Table 9 for electrical data.

Table 11: Electric Heat Minimum Supply Air

Size (Tons)	Model	Voltage	Minimum Supply Air (CFM) Heater kW				
			9	18	24	36	54
078 (6.5)	ZJ	208/230-3-60	1950	1950	1950	1950	-
		460-3-60	1950	1950	1950	1950	-
		600-3-60	1950	1950	1950	1950	-
090 (7.5)	ZJ	208/230-3-60	2250	2250	2250	2250	-
		460-3-60	2250	2250	2250	2250	-
		600-3-60	2250	2250	2250	2250	-
102 (8.5)	ZJ	208/230-3-60	2550	2550	2550	2550	-
		460-3-60	2550	2550	2550	2550	-
		600-3-60	2550	2550	2550	2550	-
120 (10)	ZJ	208/230-3-60	-	3000	3000	3000	3500
		460-3-60	-	3000	3000	3000	3000
		600-3-60	-	3000	3000	3000	3500
150 (12.5)	ZJ	208/230-3-60	-	3750	3750	3750	4000
		460-3-60	-	3750	3750	3750	3750
		600-3-60	-	3750	3750	3750	3750

Optional Gas Heat

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

NOTE: On VAV units, individual VAV boxes must be fully open in heating mode to insure airflow falls within specified Temperature Rise range.

Gas Piping

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. "National Fuel Gas Code" Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 12. The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

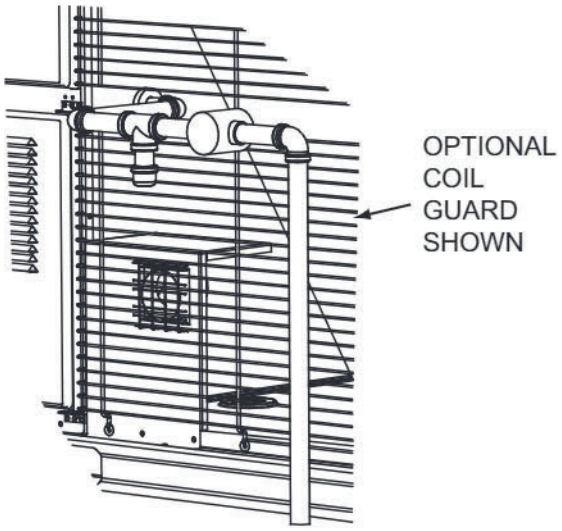


Figure 25: Side Entry Gas Piping

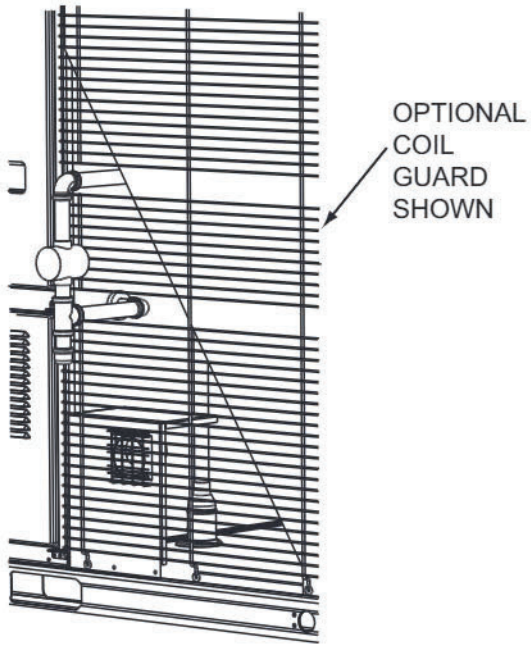


Figure 26: Bottom Entry Gas Piping

Table 12: Gas Pipe Sizing - Capacity of Pipe

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

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

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

Table 13: Gas Heat Minimum Supply Air

Size (Tons)	Model	Heat Size	Supply Air (CFM)			
			Cooling		Heating	
			Min	Max	Min	Max
078 (6.5)	ZJ	N12	1950	3250	1950	3250
		N18	1950	3250	1950	3250
090 (7.5)	ZJ	N12	2250	3750	2250	3750
		N18	2250	3750	2250	3750
102 (8.5)	ZJ	N12	2550	4250	2550	4250
		N18	2550	4250	2550	4250
120 (10)	ZJ	N18	3000	5000	3000	5000
		N24	3000	5000	3000	5000
150 (12.5)	ZJ	N18	3750	6250	3750	6250
		N24	3750	6250	3750	6250

Gas Connection

The gas supply line can be routed within the space and roof curb, exiting through the unit's basepan. Refer to Figures 8 and 9 for the gas piping inlet location. Typical supply piping arrangements are shown in Figures 25 and 26. All pipe nipples, fittings, and the gas cock are field supplied or may be purchased in Ducted Systems accessory kit #1GP0405.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.
2. Where required by local codes, a manual shut-off valve must be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe dope should be applied sparingly to male threads only.

⚠WARNING

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

4. All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out loose particles. Before initial start-up, be sure that all gas lines external to the unit have been purged of air.
5. The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under "Limitations".

6. A 1/8-inch NPT plugged tapping, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the unit.
7. After the gas connections have been completed, open the main shut-off valve admitting normal gas pressure to the mains. Check all joints for leaks with soap solution or other material suitable for the purpose. **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

⚠ CAUTION

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

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

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

⚠WARNING

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

Lp Units, Tanks And Piping

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with LP gas with accessory kit model number 1NP0442.

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

For satisfactory operation, LP gas pressure must be 10.5 inch W.C. at the unit under full load. Maintaining proper gas pressure depends on three main factors:

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

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

⚠WARNING

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

Check all connections for leaks when piping is completed using a soap solution. **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

Vent And Combustion Air

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

Options/Accessories

Electric Heat

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

Smoke Detectors

⚠WARNING

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

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

⚠WARNING

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

⚠WARNING

To assure adequate airflow reaches the smoke detector's sensor, make sure that the holes of the sampling tube face into the air stream, and that the far-end of the sampling tube is sealed with the plastic end cap.

In addition, the unit's supply airflow must be adjusted to provide a pressure differential across the smoke detector's sampling and exhaust ports of at least 0.01 inches of water and no more than 1.11 inches of water, as measured by a manometer.

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

Motorized Outdoor Damper

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

Economizer

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

There are two Economizer options:

1. Down Flow, End Return Horizontal applications which include Fresh Air Hood, Exhaust Hood with Barometric Relief.
2. Horizontal Flow application (Field Installed Kit Only) that requires the purchase of a barometric relief hood.
3. With the Down Flow, End Return Horizontal application it is required to save the two Side Panels for the economizer hood tops (See Figure 20).

Power Exhaust

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

The Power Exhaust factory installed option is for Down Flow application only.

There are two field installed Power Exhaust accessories:

1. Down Flow application.
2. Horizontal Flow application that requires the purchase of a barometric relief hood.

Rain Hood

All of the hood components, including the filters, the gasketing and the hardware for assembling, are packaged and located between the condenser coil section and the main unit cabinet, if the unit has factory installed options. If field installed accessories are being installed all parts necessary for the installation comes in the accessory.

Optional Variable Air Volume (VAV)

A variable air volume (VAV) option using a variable frequency drive (VFD) is available for applications requiring a constant supply-duct static pressure. A differential pressure transducer is used to monitor supply duct static pressure and return a speed reference signal to the VFD to control the output of the indoor blower motor.

Duct Static Pressure Transducer

A 0-5" WC pressure transducer, located in the control box compartment, is used to sense static (gauge) pressure in the supply air duct and convert this pressure measurement to a proportional 0-5 VDC electrical output. Pressure-transmitting plastic tubing (1/4" diameter) must be field supplied and installed from the transducer to both the ductwork and to the atmosphere. Connect the tubing from the 'HIGH' pressure tap of

the transducer to a static pressure tap (field supplied) in the supply duct located at a point where constant pressure is expected. To prevent an unstable signal due to air turbulence, there should be no obstructions, turns or VAV terminal boxes up- or down-stream of the sensing tube location for at least a distance of 6-10 times the duct diameter. Tubing must also be run between the 'LOW' pressure tap of the transducer and atmospheric pressure (outside of the unit).

⚠ CAUTION

Do not run plastic tubing in the supply or return air ducts as air movement could cause erroneous pressure measurements. If the tubing penetrates through the bottom of the unit be sure openings are sealed to prevent air and water leakage.

Factory-installed VFD

The factory-installed VFD is mounted in the blower access compartment. The drive comes wired from the factory to include both 3-phase power and control connections (run permit signal, speed reference signal & fault signal). All required drive parameters are pre-programmed at the factory, except in the case of 208-volt applications, in which the parameter that defines motor nameplate voltage must be changed to a value of 208.00 and the parameter that defines motor-rated current must be changed to the appropriate value appearing on the motor's nameplate. Refer to the enclosed drive material for instructions on changing parameter settings.

For units with VFD and VAV control, the unit must first be put into the Occupied Mode to start operation. The default setting for all VAV units is 'Unoccupied', therefore the installer must add a jumper wire between terminals R - OCC on the UCB to put the unit into 'Occupied' Mode. Additionally, the unit can be switched between Unoccupied/Occupied mode through network communications.

Occupied mode can be set by any one of three methods.

1. A BAS writing to the UCB.
2. If not already equipped with a jumper between R-OCC, then installer shall add. Ensure the OccMode is set to External.
3. Using the schedule within the UCB.

Ensure OccMode is set to Schedule and use this feature to indicate occupied and unoccupied times each day.

Manual Bypass

An optional, factory-installed manual bypass switch available with factory-installed VFD can be found in the Blower Motor Access compartment and has the following three positions:

- **DRIVE -** routes power through the VFD for modulating control of the indoor blower motor.
- **LINE (or BYPASS) -** routes power directly to the motor which provides full-speed motor operation and complete electrical isolation of the drive.
- **TEST -** routes power to the VFD but not to the motor to allow for drive programming and/or diagnostics.

If a drive failure occurs, the unit does not automatically switch to bypass mode. The LINE/DRIVE/TEST switch must be manually switched to the LINE (BYPASS) position. If there is a call for the fan, the indoor blower motor will run at full-speed while in the bypass mode.

⚠ CAUTION

If the unit is operated with the manual bypass switch in the LINE (BYPASS) position and there are VAV boxes present in the duct system, then boxes must be driven to the full-open position using a customer-supplied power source to prevent over-pressurizing and possible damage to the ductwork.

⚠WARNING

Before beginning any service, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

'VFD-ready' For Customer-installation

Units configured as 'VFD-ready' provide provisions for a customer-installed drive. The physical dimensions of VFDs can vary greatly among manufacturers, horsepower ratings and voltage requirements. Keep in mind that drive manufacturers also require various minimum clearances to allow for adequate internal cooling of the drive during operation.

The unit comes with a mounting bracket installed in the Blower Access compartment which may accommodate other vendor's drives depending on their size. In order to utilize the unit's mounting bracket, the maximum recommended drive dimensions are limited to approximately 9" H x 5" W x 7.5" D.

If the drive will not fit in the allotted space, then it will need to be mounted elsewhere; either within the building on a perpendicular wall which is not subjected to excessive temperature, vibration, humidity, dust, corrosive gas, explosive gas, etc., or within an appropriate enclosure rated for outside installation to safeguard against moisture, dust and excessive heat.

The power leads to the drive (L1, L2, L3) and from the motor (T1, T2, T3) have been temporarily spliced together with wire nuts. After removing the wire nuts, connect the wires to the field-installed VFD per the VFD wiring diagram (See Figure 27).

The VFD should also be grounded per the manufacturer's specifications.

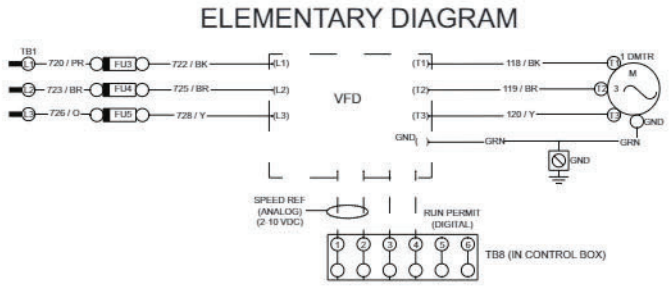


Figure 27: Simplified VFD Wiring

⚠ CAUTION

Do not connect AC power to the T1, T2, T3 drive terminals to prevent damage to the VFD.

⚠ CAUTION

The fuses (FU3, FU4, FU5) supplied with the unit are sized according to the electrical load of the blower motor, but may not provide adequate protection to the customer-installed drive, depending upon its specifications. Once a drive has been selected and installed, refer to the drive manufacturer's recommendations for proper fuse sizing.

A terminal block located in the control box is provided for field connection of the VFD speed reference signal (2-10 VDC) and to the normally-open, run-permit auxiliary contact. The use of shielded cable is recommended for the above control wiring connections.

Optional Hot Gas Bypass (HGBP)

To allow for low cooling load operation, a direct-acting, pressure-modulating bypass control valve installed on the system #1 discharge line is used to divert high temperature, high pressure refrigerant around the TXV in order to maintain a desired minimum evaporator pressure.

The opening pressure of the bypass valve is adjustable between 95 and 115 psig with a factory-setting of 105 psig. HGBP is standard on all units with VAV and optional with CV units.

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 +/- 1°F (default 55°F).

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

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

Sensor

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

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

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

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

a. 2-10 VDC from ECON on Economizer Expansion module
b. 24 VAC from EX-FAN to energize exhaust fan on Economizer Expansion module

Operation

Operation details include:

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



Figure 28: SE-ECO1001-0 Economizer Controller

Table 14: 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
		SA BUS[1] 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

Table 14: Smart Equipment™ Economizer Board Details (Continued)

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

Table 14: Smart Equipment™ Economizer Board Details (Continued)

Board Label	Cover Label	Description	Function & Comments
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
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.

Table 14: Smart Equipment™ Economizer Board Details (Continued)

Board Label	Cover Label	Description	Function & Comments
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 31.

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

Phasing

ZJ078-150 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').

Table 15: Supply Air Limitations

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

Belt Tension

The tension on the belt should be adjusted as shown in Figure 29.

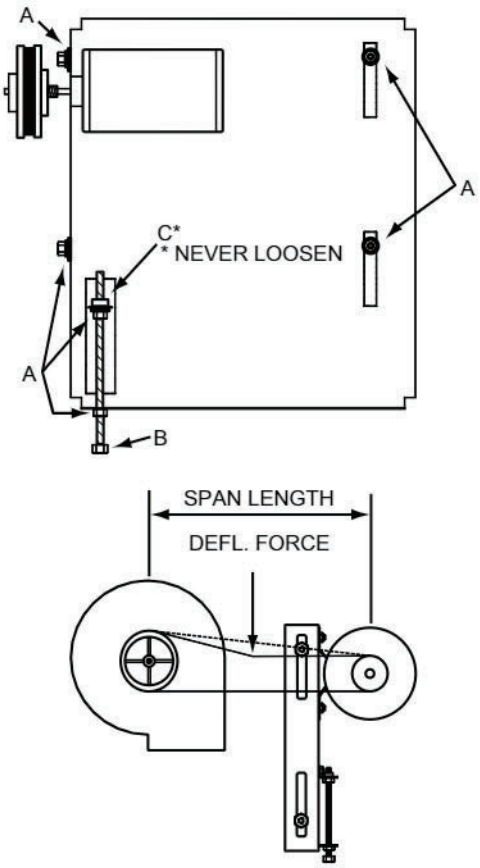


Figure 29: Belt Adjustment

⚠ CAUTION

Procedure for adjusting belt tension:

1. Loosen six 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 16 and Figure 30.

Table 16: 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

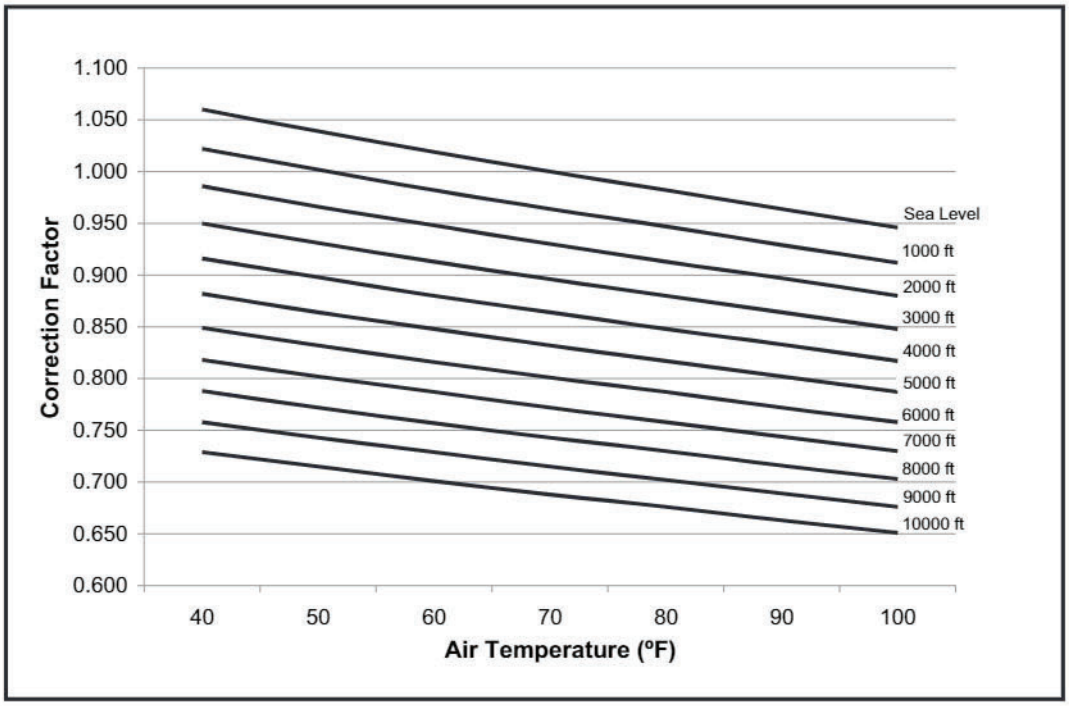


Figure 30: Altitude/Temperature Correction Factors

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 15 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 17 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

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

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.

BHP at 5,000 ft. = 3.2 x .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. 2600 CFM
2. 1.6 iwg
3. Using the supply air blower performance table below, the following data point was located: 1268 RPM & 1.95 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 1.95 BHP exceeds the maximum continuous BHP rating of the 1.5 HP motor. The 2 HP motor is required.
6. 1268 RPM is within the range of the 2 HP drives.
7. Using the 2 HP motor and drive, .5 turns open will achieve 1268 RPM.

Example Supply Air Blower Performance

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

Table 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	1.5	1.73	1VM50	AK74	N/A	897	945	991	1035	1079	1126
		2	2.30	1VM50	AK64	N/A	1039	1094	1150	1207	1256	1308

Airflow Performance

Table 17: Airflow Performance - Side Duct Application

ZJ078 (6.5 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]				Standard 1.5 HP & Drive										Hi Static 2 HP & Drive					
1800	514	0.15	586	0.33	657	0.52	727	0.71	794	0.89	857	1.07	917	1.23	972	1.38	1021	1.50	1064	1.59
2000	529	0.23	601	0.41	672	0.60	741	0.79	808	0.97	872	1.15	931	1.31	986	1.46	1036	1.58	1079	1.67
2200	544	0.33	616	0.51	687	0.69	756	0.88	823	1.07	886	1.24	946	1.41	1001	1.55	1051	1.67	1094	1.77
2400	559	0.43	631	0.61	702	0.80	771	0.98	838	1.17	902	1.35	961	1.51	1016	1.65	1066	1.78	1109	1.87
2600	574	0.54	646	0.72	717	0.91	787	1.10	853	1.28	917	1.46	977	1.62	1032	1.77	1081	1.89	1124	1.98
2800	590	0.67	662	0.85	733	1.03	802	1.22	869	1.41	933	1.59	993	1.75	1047	1.89	1097	2.02	1140	2.11
3000	607	0.80	679	0.98	750	1.17	819	1.36	886	1.54	949	1.72	1009	1.88	1064	2.03	1113	2.15	1157	2.24
3200	624	0.95	695	1.13	766	1.31	836	1.50	903	1.69	966	1.86	1026	2.03	1081	2.17	1130	2.29	-	-
3400	641	1.10	713	1.28	784	1.47	853	1.66	920	1.84	984	2.02	1043	2.18	1098	2.33	-	-	-	-
																	FS[4]			

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZJ090 (7.5 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]				Standard 1.5 HP & Drive										Hi Static 3 HP & Drive					
2000	-	-	656	0.24	711	0.48	768	0.73	826	0.96	886	1.19	945	1.41	1003	1.61	1058	1.79	1110	1.95
2200	619	0.07	670	0.32	724	0.57	781	0.81	840	1.04	899	1.27	959	1.49	1016	1.69	1072	1.87	1124	2.04
2400	631	0.16	682	0.41	736	0.66	793	0.90	852	1.14	911	1.36	970	1.58	1028	1.78	1084	1.97	1136	2.13
2600	642	0.27	692	0.52	747	0.76	804	1.01	862	1.24	922	1.47	981	1.69	1039	1.89	1094	2.07	1146	2.24
2800	652	0.39	703	0.64	757	0.88	814	1.13	873	1.36	932	1.59	992	1.81	1049	2.01	1105	2.19	1157	2.36
3000	663	0.53	714	0.77	768	1.02	825	1.26	884	1.50	943	1.73	1003	1.94	1060	2.14	1116	2.33	1168	2.49
3200	675	0.68	726	0.92	780	1.17	837	1.41	896	1.65	955	1.88	1014	2.09	1072	2.29	1128	2.48	1180	2.64
3400	688	0.84	739	1.09	793	1.34	850	1.58	909	1.82	968	2.04	1027	2.26	1085	2.46	1141	2.65	1193	2.81
3600	703	1.03	753	1.28	807	1.52	864	1.76	923	2.00	983	2.23	1042	2.44	1100	2.64	1155	2.83	-	-
3800	718	1.23	769	1.47	823	1.72	880	1.96	939	2.20	998	2.43	1058	2.64	1115	2.84	1171	3.03	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZJ102 (8.5 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard 2 HP & Drive								Hi Static 3 HP & Drive							
2200	654	0.32	706	0.53	755	0.73	803	0.92	849	1.10	893	1.27	937	1.44	979	1.62	1020	1.79	1061	1.96
2400	664	0.43	716	0.64	765	0.83	813	1.02	859	1.20	904	1.38	947	1.55	989	1.72	1030	1.89	1071	2.07
2600	675	0.53	726	0.74	776	0.94	824	1.12	870	1.30	914	1.48	957	1.65	1000	1.82	1041	1.99	1082	2.17
2800	686	0.63	738	0.84	787	1.04	835	1.23	881	1.41	925	1.58	969	1.76	1011	1.93	1052	2.10	1093	2.27
3000	699	0.75	750	0.96	800	1.16	847	1.34	893	1.52	938	1.70	981	1.87	1024	2.04	1065	2.21	1106	2.39
3200	713	0.88	764	1.09	814	1.28	861	1.47	907	1.65	952	1.83	995	2.00	1037	2.17	1079	2.34	1119	2.52
3400	728	1.02	779	1.23	829	1.43	877	1.61	923	1.79	967	1.97	1010	2.14	1053	2.31	1094	2.48	1135	2.66
3600	745	1.18	796	1.39	846	1.59	893	1.77	939	1.95	984	2.13	1027	2.30	1069	2.47	1111	2.64	1152	2.82
3800	763	1.36	815	1.57	864	1.76	912	1.95	958	2.13	1002	2.31	1046	2.48	1088	2.65	1129	2.82	1170	3.00
4000	783	1.55	835	1.76	884	1.96	932	2.15	978	2.33	1022	2.50	1066	2.67	1108	2.84	1149	3.02	1190	3.19
4200	805	1.77	856	1.98	906	2.17	953	2.36	999	2.54	1044	2.72	1087	2.89	1129	3.06	1171	3.23	1211	3.41
																	3 HP & Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

ZJ120 (10 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard 2 HP & Drive										Hi Static 3 HP & Drive					
2600	675	0.53	726	0.74	776	0.94	824	1.12	870	1.30	914	1.48	957	1.65	1000	1.82	1041	1.99	1082	2.17
2800	686	0.63	738	0.84	787	1.04	835	1.23	881	1.41	925	1.58	969	1.76	1011	1.93	1052	2.10	1093	2.27
3000	699	0.75	750	0.96	800	1.16	847	1.34	893	1.52	938	1.70	981	1.87	1024	2.04	1065	2.21	1106	2.39
3200	713	0.88	764	1.09	814	1.28	861	1.47	907	1.65	952	1.83	995	2.00	1037	2.17	1079	2.34	1119	2.52
3400	728	1.02	779	1.23	829	1.43	877	1.61	923	1.79	967	1.97	1010	2.14	1053	2.31	1094	2.48	1135	2.66
3600	745	1.18	796	1.39	846	1.59	893	1.77	939	1.95	984	2.13	1027	2.30	1069	2.47	1111	2.64	1152	2.82
3800	763	1.36	815	1.57	864	1.76	912	1.95	958	2.13	1002	2.31	1046	2.48	1088	2.65	1129	2.82	1170	3.00
4000	783	1.55	835	1.76	884	1.96	932	2.15	978	2.33	1022	2.50	1066	2.67	1108	2.84	1149	3.02	1190	3.19
4200	805	1.77	856	1.98	906	2.17	953	2.36	999	2.54	1044	2.72	1087	2.89	1129	3.06	1171	3.23	1211	3.41
4400	828	2.00	879	2.21	929	2.41	976	2.59	1022	2.77	1067	2.95	1110	3.12	1152	3.29	-	-	-	-
4600	852	2.25	904	2.46	953	2.66	1001	2.85	1047	3.03	1092	3.20	1135	3.37	-	-	-	-	-	-
4800	879	2.52	930	2.73	980	2.93	1027	3.12	1073	3.30	-	-	-	-	-	-	-	-	-	-
5000	906	2.81	958	3.02	1007	3.22	1055	3.41	-	-	-	-	-	-	-	-	-	-	-	-
									3 HP & Field Supplied Drive											

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

ZJ150 (12.5 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive								Standard 3 HP & Drive											
3200	713	0.88	764	1.09	814	1.28	861	1.47	907	1.65	952	1.83	995	2.00	1037	2.17	1079	2.34	1119	2.52
3400	728	1.02	779	1.23	829	1.43	877	1.61	923	1.79	967	1.97	1010	2.14	1053	2.31	1094	2.48	1135	2.66
3600	745	1.18	796	1.39	846	1.59	893	1.77	939	1.95	984	2.13	1027	2.30	1069	2.47	1111	2.64	1152	2.82
3800	763	1.36	815	1.57	864	1.76	912	1.95	958	2.13	1002	2.31	1046	2.48	1088	2.65	1129	2.82	1170	3.00
4000	783	1.55	835	1.76	884	1.96	932	2.15	978	2.33	1022	2.50	1066	2.67	1108	2.84	1149	3.02	1190	3.19
4200	805	1.77	856	1.98	906	2.17	953	2.36	999	2.54	1044	2.72	1087	2.89	1129	3.06	1171	3.23	1211	3.41
4400	828	2.00	879	2.21	929	2.41	976	2.59	1022	2.77	1067	2.95	1110	3.12	1152	3.29	1194	3.46	1235	3.64
4600	852	2.25	904	2.46	953	2.66	1001	2.85	1047	3.03	1092	3.20	1135	3.37	1177	3.54	1219	3.72	1259	3.89
4800	879	2.52	930	2.73	980	2.93	1027	3.12	1073	3.30	1118	3.47	1161	3.65	1203	3.82	1245	3.99	1285	4.16
5000	906	2.81	958	3.02	1007	3.22	1055	3.41	1101	3.59	1146	3.76	1189	3.94	1231	4.11	1273	4.28	1313	4.45
5200	936	3.12	987	3.33	1037	3.53	1084	3.72	1130	3.90	1175	4.07	1218	4.24	1260	4.42	1302	4.59	1343	4.76
5400	966	3.45	1018	3.66	1067	3.86	1115	4.05	1161	4.23	1206	4.40	1249	4.57	1291	4.74	1333	4.91	1373	5.09
5600	999	3.80	1050	4.01	1100	4.20	1147	4.39	1193	4.57	1238	4.75	1281	4.92	1323	5.09	1365	5.26	1405	5.44
5800	1032	4.16	1084	4.37	1133	4.57	1181	4.75	1227	4.93	1271	5.11	1315	5.28	1357	5.45	1398	5.62	-	-
6000	1067	4.54	1119	4.75	1168	4.95	1216	5.13	1262	5.31	1306	5.49	1350	5.66	-	-	-	-	-	-
6200	1103	4.94	1155	5.15	1204	5.34	1252	5.53	1298	5.71	-	-	-	-	-	-	-	-	-	-
	Hi Static 5 HP & Drive								5 HP & Field Supplied Drive											

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

Table 18: Airflow Performance - Bottom Duct Application

ZJ078 (6.5 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]		Standard 1.5 HP & Drive								Hi Static 2 HP & Drive									
1800	603	0.13	656	0.36	718	0.58	784	0.79	851	0.98	914	1.16	968	1.31	1010	1.43	1035	1.53	1039	1.59
2000	627	0.26	680	0.49	742	0.71	808	0.92	875	1.12	937	1.29	992	1.44	1034	1.57	1059	1.66	1063	1.72
2200	650	0.40	703	0.63	765	0.85	831	1.06	898	1.25	961	1.43	1015	1.58	1057	1.71	1082	1.80	1086	1.86
2400	673	0.55	726	0.78	788	1.00	854	1.21	921	1.40	984	1.58	1038	1.73	1080	1.85	1105	1.95	1109	2.01
2600	696	0.71	749	0.94	811	1.16	878	1.37	944	1.56	1007	1.73	1061	1.89	1103	2.01	1128	2.10	1133	2.16
2800	720	0.87	773	1.10	835	1.32	902	1.53	968	1.73	1031	1.90	1085	2.05	1127	2.18	1152	2.27	1157	2.33
3000	745	1.05	798	1.28	860	1.50	926	1.71	993	1.91	1056	2.08	1110	2.23	1152	2.36	1177	2.45	1181	2.51
3200	771	1.24	824	1.47	886	1.69	952	1.90	1019	2.09	1081	2.27	1136	2.42	1178	2.54	1203	2.64	1207	2.70
3400	797	1.44	850	1.67	912	1.89	979	2.10	1045	2.29	1108	2.47	1162	2.62	1204	2.74	1229	2.84	1234	2.90
															3 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZJ090 (7.5 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]		Standard 1.5 HP & Drive										Hi Static 3 HP & Drive							
2000	644	0.11	698	0.38	755	0.62	814	0.85	874	1.06	933	1.26	990	1.46	1043	1.66	1090	1.87	1131	2.09
2200	666	0.26	720	0.53	777	0.77	836	1.00	896	1.21	956	1.41	1012	1.61	1065	1.81	1113	2.02	1153	2.24
2400	689	0.42	743	0.69	800	0.93	859	1.16	919	1.37	978	1.57	1035	1.77	1088	1.97	1135	2.18	1176	2.40
2600	712	0.60	766	0.87	823	1.11	882	1.34	942	1.55	1002	1.75	1058	1.95	1111	2.15	1159	2.36	1199	2.58
2800	736	0.80	790	1.06	847	1.31	906	1.53	967	1.74	1026	1.94	1082	2.14	1135	2.34	1183	2.55	1223	2.78
3000	761	1.00	815	1.27	872	1.52	931	1.74	991	1.95	1051	2.15	1107	2.35	1160	2.55	1208	2.76	1248	2.98
3200	787	1.22	840	1.49	898	1.74	957	1.96	1017	2.17	1076	2.37	1133	2.57	1186	2.77	1233	2.98	1274	3.20
3400	813	1.46	867	1.73	924	1.97	984	2.19	1044	2.40	1103	2.61	1160	2.80	1212	3.01	1260	3.21	-	-
3600	841	1.70	894	1.97	952	2.21	1011	2.44	1071	2.65	1130	2.85	1187	3.05	-	-	-	-	-	-
3800	869	1.96	923	2.22	980	2.47	1039	2.69	1099	2.90	1158	3.10	1215	3.30	-	-	-	-	-	-
															3 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZJ102 (8.5 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]		Standard 2 HP & Drive								Hi Static 3 HP & Drive									
2200	685	0.59	739	0.74	791	0.88	841	1.01	889	1.14	936	1.27	981	1.39	1025	1.51	1069	1.63	1111	1.75
2400	702	0.70	756	0.85	808	0.99	858	1.12	906	1.25	953	1.37	999	1.49	1043	1.62	1086	1.74	1129	1.86
2600	722	0.83	776	0.97	828	1.11	878	1.25	926	1.37	973	1.50	1018	1.62	1063	1.74	1106	1.86	1149	1.99
2800	744	0.97	798	1.12	850	1.26	900	1.39	949	1.52	995	1.64	1041	1.76	1085	1.88	1128	2.00	1171	2.13
3000	769	1.13	823	1.28	875	1.42	925	1.55	974	1.68	1020	1.80	1066	1.92	1110	2.05	1153	2.17	1196	2.29
3200	797	1.32	851	1.46	903	1.60	953	1.74	1001	1.86	1048	1.99	1093	2.11	1138	2.23	1181	2.35	1224	2.48
3400	828	1.52	882	1.67	934	1.81	983	1.94	1032	2.07	1078	2.19	1124	2.32	1168	2.44	1212	2.56	1254	2.68
3600	861	1.75	915	1.90	967	2.04	1017	2.17	1065	2.30	1112	2.42	1157	2.54	1201	2.67	1245	2.79	1287	2.91
3800	897	2.00	951	2.15	1002	2.29	1052	2.42	1101	2.55	1147	2.67	1193	2.80	1237	2.92	1280	3.04	1323	3.16
4000	935	2.27	989	2.42	1041	2.56	1091	2.69	1139	2.82	1186	2.95	1231	3.07	1275	3.19	1319	3.31	1362	3.43
4200	976	2.57	1030	2.72	1082	2.86	1132	2.99	1180	3.12	1227	3.24	1272	3.36	-	-	-	-	-	-
															3 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZJ120 (10 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive		Standard 2 HP & Drive										Hi Static 3 HP & Drive							
2600	722	0.83	776	0.97	828	1.11	878	1.25	926	1.37	973	1.50	1018	1.62	1063	1.74	1106	1.86	1149	1.99
2800	744	0.97	798	1.12	850	1.26	900	1.39	949	1.52	995	1.64	1041	1.76	1085	1.88	1128	2.00	1171	2.13
3000	769	1.13	823	1.28	875	1.42	925	1.55	974	1.68	1020	1.80	1066	1.92	1110	2.05	1153	2.17	1196	2.29
3200	797	1.32	851	1.46	903	1.60	953	1.74	1001	1.86	1048	1.99	1093	2.11	1138	2.23	1181	2.35	1224	2.48
3400	828	1.52	882	1.67	934	1.81	983	1.94	1032	2.07	1078	2.19	1124	2.32	1168	2.44	1212	2.56	1254	2.68
3600	861	1.75	915	1.90	967	2.04	1017	2.17	1065	2.30	1112	2.42	1157	2.54	1201	2.67	1245	2.79	1287	2.91
3800	897	2.00	951	2.15	1002	2.29	1052	2.42	1101	2.55	1147	2.67	1193	2.80	1237	2.92	1280	3.04	1323	3.16
4000	935	2.27	989	2.42	1041	2.56	1091	2.69	1139	2.82	1186	2.95	1231	3.07	1275	3.19	1319	3.31	1362	3.43
4200	976	2.57	1030	2.72	1082	2.86	1132	2.99	1180	3.12	1227	3.24	1272	3.36	-	-	-	-	-	-
4400	1019	2.88	1073	3.03	1125	3.17	1175	3.30	1223	3.43	-	-	-	-	-	-	-	-	-	-
4600	1065	3.22	1119	3.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3 HP & Field Supplied Drive																			

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

ZJ150 (12.5 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard 3 HP & Drive										Hi Static 5 HP & Drive					
3200	797	1.32	851	1.46	903	1.60	953	1.74	1001	1.86	1048	1.99	1093	2.11	1138	2.23	1181	2.35	1224	2.48
3400	828	1.52	882	1.67	934	1.81	983	1.94	1032	2.07	1078	2.19	1124	2.32	1168	2.44	1212	2.56	1254	2.68
3600	861	1.75	915	1.90	967	2.04	1017	2.17	1065	2.30	1112	2.42	1157	2.54	1201	2.67	1245	2.79	1287	2.91
3800	897	2.00	951	2.15	1002	2.29	1052	2.42	1101	2.55	1147	2.67	1193	2.80	1237	2.92	1280	3.04	1323	3.16
4000	935	2.27	989	2.42	1041	2.56	1091	2.69	1139	2.82	1186	2.95	1231	3.07	1275	3.19	1319	3.31	1362	3.43
4200	976	2.57	1030	2.72	1082	2.86	1132	2.99	1180	3.12	1227	3.24	1272	3.36	1316	3.48	1360	3.60	1402	3.73
4400	1019	2.88	1073	3.03	1125	3.17	1175	3.30	1223	3.43	1270	3.55	1315	3.67	1360	3.80	1403	3.92	1446	4.04
4600	1065	3.22	1119	3.36	1171	3.50	1221	3.64	1269	3.76	1316	3.89	1361	4.01	1405	4.13	1449	4.25	1491	4.38
4800	1113	3.57	1167	3.72	1219	3.86	1269	3.99	1317	4.12	1364	4.24	1409	4.36	1453	4.48	1497	4.61	1540	4.73
5000	1163	3.94	1217	4.09	1269	4.23	1319	4.36	1367	4.49	1414	4.62	1459	4.74	1504	4.86	1547	4.98	1590	5.10
5200	1216	4.34	1270	4.48	1321	4.62	1371	4.76	1420	4.88	1466	5.01	1512	5.13	1556	5.25	1600	5.37	1642	5.50
5400	1270	4.75	1324	4.89	1376	5.03	1426	5.17	1474	5.29	1521	5.42	1566	5.54	1611	5.66	-	-	-	-
5600	1327	5.17	1381	5.32	1433	5.46	1483	5.59	1531	5.72	-	-	-	-	-	-	-	-	-	-
5800	1385	5.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5 HP & Field Supplied Drive																			

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

Table 19: 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
078 (6.5)	ZJ	1.5	1.73	1VL40	AK74	N/A	641	690	739	789	838	887
		2	2.30	1VM50	AK74	N/A	887	936	986	1035	1084	1134
090 (7.5)	ZJ	1.5	1.73	1VL40	AK69	N/A	690	743	796	849	902	955
		3	3.45	1VM50	AK69	N/A	955	1008	1062	1115	1168	1221
102 (8.5)	ZJ	2	2.30	1VM50	AK89	N/A	731	771	812	852	893	934
		3	3.45	1VM50	AK74	N/A	887	936	986	1035	1084	1134
120 (10)	ZJ	2	2.30	1VM50	AK84	N/A	776	819	863	906	949	992
		3	3.45	1VM50	AK74	N/A	887	936	986	1035	1084	1134
150 (12.5)	ZJ	3	3.45	1VM50	AK74	N/A	887	936	986	1035	1084	1134
		5	5.75	1VP56	BK77	1052	1095	1136	1175	1216	1272	N/A

Table 20: Indoor Blower Specifications

Size (Tons)	Model	Motor					Motor Sheave			Blower Sheave			Belt
		HP	RPM	Eff.	SF	Frame	Datum Dia. (in.)	Bore (in.)	Model	Datum Dia. (in.)	Bore (in.)	Model	
078 (6.5)	ZJ	1-1/2	1725	0.8	1.15	56	2.6 - 3.6	7/8	1VL40	7.0	1	AK74	A53
		2	1725	0.8	1.15	56	3.6 - 4.6	7/8	1VM50	7.0	1	AK74	A54
090 (7.5)	ZJ	1-1/2	1725	0.8	1.15	56	2.6 - 3.6	7/8	1VL40	6.5	1	AK69	A53
		3	1725	0.8	1.15	56	3.6 - 4.6	7/8	1VM50	6.5	1	AK69	A54
102 (8.5)	ZJ	2	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	8.5	1	AK89	A56
		3	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	7.0	1	AK74	A54
120 (10)	ZJ	2	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	8.0	1	AK84	A56
		3	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	7.0	1	AK74	A54
150 (12.5)	ZJ	3	1725	0.8	1.15	56	3.4 - 4.4	7/8	1VM50	7.0	1	AK74	A54
		5	1725	0.87	1.15	184T	4.3 - 5.3	1-1/8	1VP56	6.7	1	BK77	BX55

Table 21: Power Exhaust Specifications

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

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

Air Balance

⚠ CAUTION

On VAV units be certain that the VFD is set to maximum output, exhaust dampers are closed and individual space damper boxes are full open.

VFD units with manual bypass option must not be in the bypass mode ('LINE" position), unless all individual space dampers are full open.

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

⚠ 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. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Checking Air Quantity

Method One

1. Remove the dot plugs from the duct panel (for location of the dot plugs see Figures 12 and 13).
2. Insert eight-inches of 1/4 inch metal tubing into the airflow 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. Use an Inclined Manometer or Magnehelic to determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil can vary greatly, measuring the pressure drop across a wet coil under field conditions could be inaccurate. To assure a dry coil, the compressors should be de-activated while the test is being run.

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

4. The CFM through the unit can be determined from the pressure drop indicated by the manometer by referring to Figure 31. In order to obtain an accurate measurement, be certain that the air filters are clean.
5. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.
6. After readings have been obtained, remove the tubes and replace the dot plugs.
7. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

⚠WARNING

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

Method Two

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

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

3. Use an Inclined Manometer or Magnehelic to determine the pressure drop across the unit. This is the External Static Pressure (ESP). In order to obtain an accurate measurement, be certain that the air filters are clean.
4. Determine the number of turns the variable motor sheave is open.
5. Select the correct blower performance table for the unit from Tables 17 and 18. Tables are presented for side and down flow configuration.
6. Determine the unit Measured CFM from the Blower Performance Table, External Static Pressure and the number of turns the variable motor sheave is open.
7. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.
8. After reading has been obtained, remove the tubes and seal holes.
9. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

NOTE: With the addition of field installed accessories repeat this procedure.

⚠WARNING

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

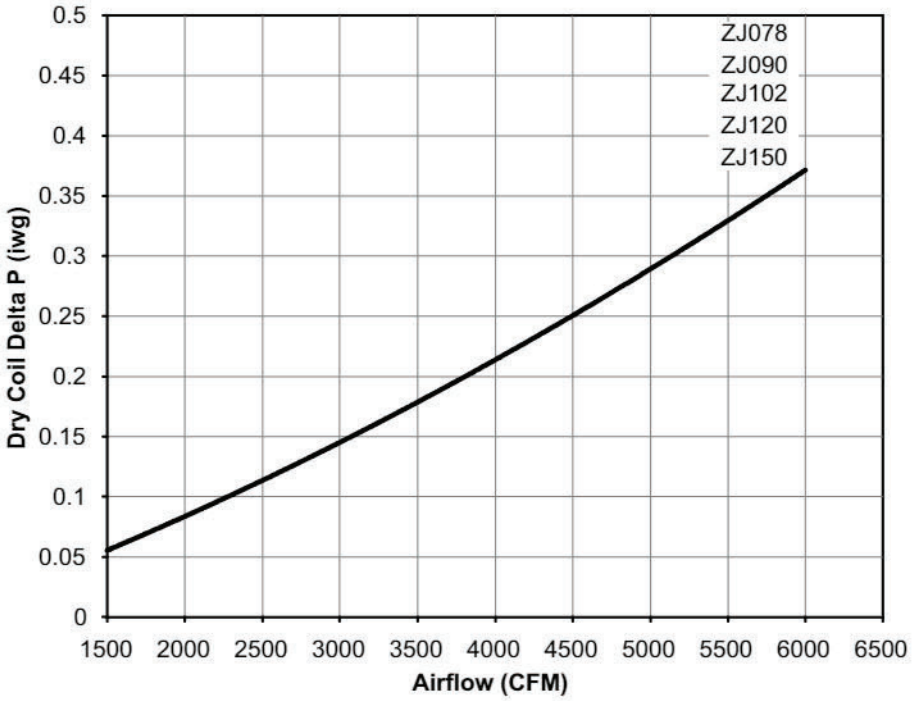


Figure 31: Dry Coil Delta P

Supply Air Drive Adjustment

⚠ CAUTION

Before making any blower speed changes review the installation for any installation errors, leaks or undesirable systems effects that can result in loss of airflow.

Even small changes in blower speed can result in substantial changes in static pressure and BHP. BHP and AMP draw of the blower motor will increase by the cube of the blower speed. Static pressure will increase by the square of the blower speed. Only qualified personnel should make blower speed changes, strictly adhering to the fan laws.

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

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

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

EXAMPLE

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

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

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

Use Table 22 to locate the DD nearest to 4.21 in. Close the sheave to 1 turn open.

New BHP

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

= (Speed increase)^3 • Original BHP

= New BHP

New motor Amps

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

= (Speed increase)^3 • Original Amps

= New Amps

Table 22: Motor Sheave Datum Diameters

1VM50x7/8 (1-1/2, 2 & 3 HP Motor)		1VP56x1-1/8 (5 HP Motor)	
Turns Open	Datum Diameter	Turns Open	Datum Diameter
0	4.4	1	5.3
1/2	4.3	1-1/2	5.2
1	4.2	2	5.1
1-1/2	4.1	2-1/2	5.0
2	4.0	3	4.9
2-1/2	3.9	3-1/2	4.8
3	3.8	4	4.7
3-1/2	3.7	4-1/2	4.6
4	3.6	5	4.5
4-1/2	3.5	5-1/2	4.4
5	3.4	6	4.3

⚠ 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. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Table 23: Additional Static Resistance

Size (Tons)	Model	CFM	Cooling Only[1]	Economizer[2,3]	4" Filter[2]	Electric Heat kW[2]				
						9	18	24	36	54
078 (6.5) 090 (7.5) 102 (8.5) 120 (10) 150 (12.5)	ZJ	1900	0.06	0.02	0.12	0.05	0.06	0.07	0.08	0.10
		2100	0.07	0.02	0.13	0.06	0.07	0.08	0.09	0.11
		2300	0.08	0.04	0.14	0.07	0.08	0.09	0.10	0.13
		2500	0.09	0.11	0.16	0.08	0.09	0.10	0.11	0.14
		2700	0.11	0.18	0.17	0.09	0.10	0.12	0.13	0.16
		2900	0.12	0.25	0.19	0.10	0.11	0.13	0.14	0.18
		3100	0.14	0.31	0.20	0.12	0.13	0.15	0.16	0.20
		3300	0.16	0.37	0.22	0.13	0.14	0.17	0.18	0.22
		3500	0.18	0.43	0.26	0.15	0.16	0.19	0.20	0.24
		3700	0.20	0.49	0.27	0.17	0.18	0.21	0.22	0.26
		3900	0.23	0.54	0.29	0.19	0.20	0.23	0.24	0.28
		4100	0.25	0.58	0.32	0.21	0.22	0.25	0.26	0.31
		4300	0.28	0.65	0.35	0.23	0.24	0.28	0.29	0.34
		4500	0.30	0.69	0.38	0.25	0.26	0.30	0.31	0.37
		4700	0.33	0.74	0.41	0.28	0.29	0.33	0.34	0.40
		4900	0.36	0.78	0.44	0.30	0.31	0.35	0.37	0.43
		5100	0.39	0.82	0.47	0.33	0.34	0.38	0.40	0.46
		5300	0.42	0.86	0.51	0.35	0.37	0.41	0.43	0.49
		5500	0.45	0.89	0.55	0.38	0.40	0.44	0.46	0.53
		5700	0.48	0.93	0.58	0.41	0.43	0.47	0.49	0.56
		5900	0.52	0.96	0.62	0.44	0.46	0.50	0.53	0.59
		6100	0.56	0.98	0.67	0.47	0.49	0.53	0.56	0.62
		6300	0.60	1.01	0.71	0.50	0.53	0.56	0.59	0.65

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

Operation

Cooling Sequence Of Operation

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

For ZJ 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 the associated condenser 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 first 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 24 volts to the M2 contactor starting the first stage compressor and the associated condenser fan.

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 minimum off.

Optional VAV Start-up and Control

⚠ CAUTION

If the unit is operated with the optional manual bypass switch in the LINE (BYPASS) position and there are VAV boxes present in the duct system, then boxes must be driven to the full-open position using a customer-supplied power source to prevent over-pressurizing and possible damage to the ductwork.

Once placed into the Occupied Mode, the speed of the indoor blower motor is controlled by duct static pressure. The Duct Static set point (default = 1.5") is the pressure that the VFD drive will maintain when operating the unit in VAV mode. If the duct static pressure reaches or exceeds the high-limit set-point (default = 4.5"), then the supply fan motor will be shutdown.

The Supply Air Temperature (SAT) is controlled by staging compressors on and off to satisfy the "Operating Cooling Supply Air Temp Set point". There are 3 set points that determine the resulting "Operating Cooling Supply Air Temp Set point".

1. VAV Cooling Supply Air Temp Upper Set point (default 60° F)
2. VAV Cooling Supply Air Temp Lower Set point (default 55° F)
3. VAV Supply Air Temp Reset Set point (default 72° F)

When the Return Air Temp (RAT) is above the "VAV Supply Air Temp Reset Set point" the SAT will be maintained at +/- 5 degrees of the "VAV Cooling Supply Air Temp Lower Set point".

When the Return Air Temp (RAT) is below the "VAV Supply Air Temp Reset Set point" the SAT will be maintained at +/- 5 degrees of the "VAV Cooling Supply Air Temp Upper Set point".

When the Outdoor air condition is sufficient for free cooling, the economizer will modulate to control the SAT to +/- 1 degrees of the operational set point.

No Outdoor Air Options

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from “R” to “Y1” and “G” is completed. The UCB energizes the economizer (if installed and free cooling is available) or the first available compressor* and the condenser fans. For first stage cooling, compressor #1 is energized. If compressor #1 is unavailable, compressor #2 is energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

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

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

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

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

Economizer With Single Enthalpy Sensor

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

When the thermostat calls for "second-stage" cooling, the low voltage control circuit from "R" to "Y2" is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (i.e. first stage has energized the economizer), "Y2" will energize compressor #1. If the outdoor air is above the set point, "Y2" will energize compressor #2.

Once the thermostat has been satisfied, it will de-energize “Y1” and “Y2”. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continuous fan operation, the economizer damper goes to the minimum position.

Economizer With Dual Enthalpy Sensors

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

Economizer With Power Exhaust

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

Motorized Outdoor Air Dampers

This system operation is the same as the units with no outdoor air options with one exception. When the "R" to "G" circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the "R" to "G" circuit is opened, the damper spring returns fully closed.

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. 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.

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 45ºF (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 26ºF 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).

3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 50 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system 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 and the temperature limit switch and the gas valve of gas furnace 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.

Electric Heating Sequence Of Operations

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

⚠ CAUTION

For units with VFD and electric heat, the speed of the indoor blower motor continues to be controlled by duct static pressure via the Smart Equipment™ control board.

If there are VAV boxes present in the duct system, the boxes must be driven to the full-open position using a customer-supplied power source to assure adequate airflow across the heating elements.

Two-stage heating:

a. Upon a call for first stage heat by the thermostat, the heater relay (RA) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor. If the second stage of heat is required, heater relay (RB) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

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.

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the heater compartment and is set to open at the temperature indicated in the Electric Heat Limit Setting Tables 24. 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 24: Electric Heat Limit Setting

UNIT (TONS)	VOLTAGE	HEATER kW	LIMIT SWITCH OPENS °F
ZJ078, 090 (6.5, 7.5)	208/230	9	150
		18	150
		24	150
		34	150
ZJ102, 120, 150 (8.5,10, 12.5)		18	150
		24	150
		34	150
		54	130
ZJ078, 090 (6.5, 7.5)	480	9	150
		18	150
		24	150
		34	150
ZJ102, 120, 150 (8.5, 10, 12.5)		18	150
		24	150
		34	150
		54	130
ZJ078, 090 (6.5, 7.5)	600	9	150
		18	150
		24	150
		34	150
ZJ102, 120, 150 (8.5, 10, 12.5)		18	150
		24	150
		34	150
		54	130

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 25 for the required electric heat anticipator setting.

Table 25: Electric Heat Anticipator Setpoints

SETTING, AMPS	
W1	W2
0.13	0.1

Gas Heating Sequence Of Operations

⚠ CAUTION

For units with VFD and gas heat, the speed of the indoor blower motor continues to be controlled by duct static pressure via the Smart Equipment™ control board.

If there are VAV boxes present in the duct system, the boxes must be driven to the full-open position using a customer-supplied power source to assure adequate airflow across the heat exchanger tubes.

When the thermostat calls for the first stage of heating, the low-voltage control circuit from "R" to "W1" is completed. A call for heat passes through the UCB to the **Ignition Control Board (ICB).** The UCB monitors the "W1" call and acts upon any call for heat by monitoring the **Gas Valve (GV).** Once voltage has been sensed at the GV, the UCB will initiate the fan on delay for heating, energizing the indoor blower the specified delay has elapsed.

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

Ignition Control Board

First Stage Of Heating

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

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

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

When "W1" is satisfied, both valves are closed.

Second Stage Of Heating

When the ICB receives a call for the second stage of heating, "W2," the ICB conducts a complete first stage ignition sequence. If this sequence is satisfied, the second main valve of the GV is opened.

When "W2" is satisfied, the second main valve is closed.

Retry Operation

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

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

Recycle Operation

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

Gas Heating Operation Errors

Lock-Out

A one-hour lockout occurs following three retries or five recycles. During the one-hour lockout, flame detection, limit conditions, and main valves are tested. Any improper results will cause the appropriate action to occur. Recycling the low voltage power cancels the lock-out.

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 15-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

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

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and flash code is initiated (See Table 32).

Flame Sense

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

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

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

Gas Valve

The UCB and ICB continuously monitor the GV.

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

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

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

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

Safety Controls

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

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the gas heat compartment and is set to open at the temperature indicated in the Gas Heat Limit Control Settings Table 26. 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.

Auxiliary Limit Switch (ALS)

This control is located inside the supply air compartment and is set to open at the temperature indicated in the Gas Heat Limit Control Settings Table 26. It resets manually. 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.

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

Table 26: Gas Heat Limit Control Settings[1]

Unit		Main Limit Setting
Size	Opt.	°F
ZJ078	N12	165
	N18	165
ZJ090	N12	165
	N18	165
ZJ102	N12	215
	N18	195
ZJ120	N18	195
	N24	160
ZJ150	N18	195
	N24	160

1. Roll-out = 300°F, Auxiliary Limit = 200°F.

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

The control circuit includes the following safety controls:

Pressure Switch (PS)

Once the draft motor has reached full speed and closes the pressure switch during a normal ignition sequence, if the pressure switch opens for 2 seconds, the GV will be de-energized, the ignition cycle is aborted, and the ICB flashes the appropriate code. See Table 32 Ignition Control Flash Codes. The draft motor is energized until the pressure switch closes or "W1" is lost.

Roll-out Switch (ROS)

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

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

Internal Microprocessor Failure

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

Flash Codes

The ICB will initiate a flash code associated with errors within the system. Refer to IGNITION CONTROL FLASH CODES Table 32.

Resets

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

Gas Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater

temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 27 for the required gas heat anticipator setting.

Table 27: Gas Heat Anticipator Setpoints

SETTING, AMPS	
W1	W2
0.65	0.1

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.

NOTE: Prior to each cooling season, the crankcase heaters must be energized at least 10 hours before the system is put into operation.

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.

Start-Up (Gas Heat)

Pre-Start Check List

Complete the following checks before starting the unit.

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

Operating Instructions

⚠ CAUTION

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

Lighting The Main Burners

1. Turn "OFF" electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve counter-clockwise to "ON" position (See Figure 33).
4. Turn "ON" electric power to unit.
5. If thermostat set temperature is above room temperature, the main burners will ignite. If a second stage of heat is called for, the main burners for second stage heat will ignite for the second stage heat.

Post Start Checklist

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

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

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

2. Check for correct manifold gas pressures. (See CHECKING GAS INPUT.)
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas pressure exceed 10.5 in. or the operating pressure drop below 4.5 in for natural gas units. If gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Shut Down

1. Set the thermostat to the lowest temperature setting.
2. Turn “OFF” all electric power to unit.
3. Open gas heat access panel.
4. Turn gas valve clockwise to “OFF” position (See Figure 33).

Checking Gas Heat Input

This unit has two stages of gas heat. The first stage is 60% of the full fire input and is considered the minimum input for the furnace. The intended input for each furnace is shown in Table 29. The table applies to units operating on 60 Hz power only.

To determine the rate of gas flow (Second Stage).

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for Second stage (100% input) heat.
3. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
4. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour. (See example below).
5. If necessary, adjust the high pressure regulator as discussed in the section “Manifold Gas Pressure Adjustment”. **Be sure not to over-fire** the furnace on Second stage. If in doubt, it is better to leave the Second stage of the furnace slightly under-fired. Repeat Steps 1-5.

To determine the rate of gas flow (First Stage)

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for first stage (60% input) heat.
3. Even when the thermostat is calling for first stage heat, the unit will light on second stage and will run on Second stage for 1 minute. Allow this one-minute time period to expire and be certain the unit is running on first stage.
4. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
5. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour (See example below).
6. If necessary, adjust the low pressure regulator as discussed in the section “Manifold Gas Pressure Adjustment”. **Be sure not to under-fire** the furnace on first stage. If in doubt, it is better to leave the first stage of the furnace slightly over-fired (greater than 60% input). Repeat Steps 1-6.

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

Table 28: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

EXAMPLE

By actual measurement, it takes 19 seconds for the hand on a 1 cubic foot dial to make a revolution with a 192,000 Btuh furnace running. To determine rotations per minute, divide 60 by 19 = 3.16. To calculate rotations per hour, multiply 3.16 • 60 = 189.6. Multiply 189.6 • 1 (0.5 if using a 1/2 cubic foot dial) = 189.6. Multiply 189.6 • (the Btu rating of the gas). For this example, assume the gas has a Btu rating of 1050 Btu/ft.^{3}. The result of 199,000 Btuh is within 5% of the 192,000 Btuh rating of the furnace.

Manifold Gas Pressure Adjustment

This gas furnace has two heat stages. Therefore, the gas valve has two adjustment screws located under a plastic protective cover. The second stage (100% input) adjustment screw is adjacent to the “HI” marking on the valve and the first stage (60% input) adjustment screw is located adjacent to the “LO” marking on the valve (See Figure 33).

Manifold pressure adjustment procedure.

Adjust second stage (100% input) pressure first, then adjust first stage (60% input) pressure.

1. Turn off all power to the unit.
2. Using the outlet pressure port on the gas valve, connect a manometer to monitor the manifold pressure.

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

NOTE: When using natural gas, the manifold pressure for second stage (100% input) should be 3.5 IWG ± 0.3. The manifold pressure for first stage (60% input) when using natural gas should be 1.5 IWG ± 0.3.

Table 29: Gas Heat Stages

# of Burner Tubes	2nd Stage Input (100% Btuh)	1st Stage Input (60% Btuh)
4	120,000	72,000
6	180,000	108,000
8	240,000	144,000

Adjustment Of Temperature Rise

The temperature rise (the difference of temperature between the return air and the heated air from the furnace) must lie within the range shown on the CSA rating plate and the data in Table 10.

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

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

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

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

Burners/Orifices Inspection/Servicing

Before checking or changing burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL POWER TO THE UNIT.

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

To service burners, complete step 4.

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

NOTE: Reverse the above procedure to replace the assemblies.

Make sure that burners are level and seat at the rear of the gas orifice.

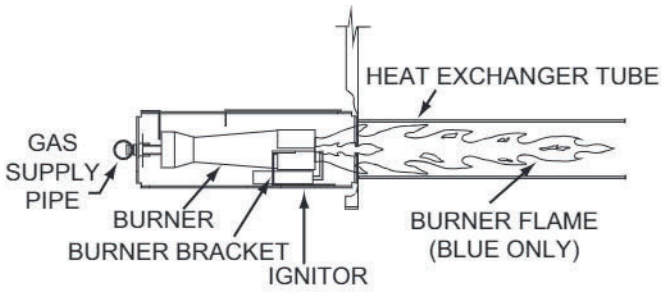


Figure 32: Typical Flame

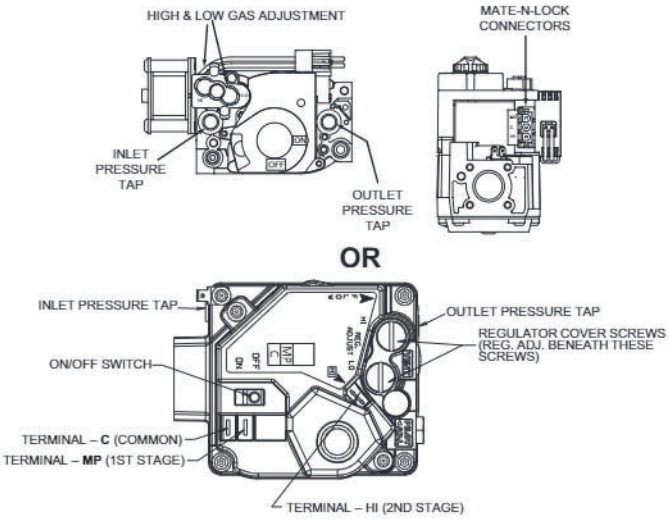


Figure 33: Typical Gas Valve

Charging The Unit

All ZJ units use Thermal Expansion Devices. Charge the unit to nameplate charge.

Control Board Navigation Components

The following components are needed to access the control points in the Smart Equipment™ control. Installation and operation guides are available from your equipment dealer or distributor.

1. Local LCD on Unit Control Board.
2. Mobile Access Portal (MAP) Gateway (Portable).
   - Source 1 P/N S1-JC-MAP1810-OP
3. *MAP Gateway Quick Start Guide* P/N 24-10737-16
4. *MAP Gateway Instruction* P/N 24-10737-8

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

NOTE: For more in-depth sequence of operation of the Smart Equipment™ control, refer to the *Smart Equipment™ Controls Sequence of Operation Overview* LIT-12011950.

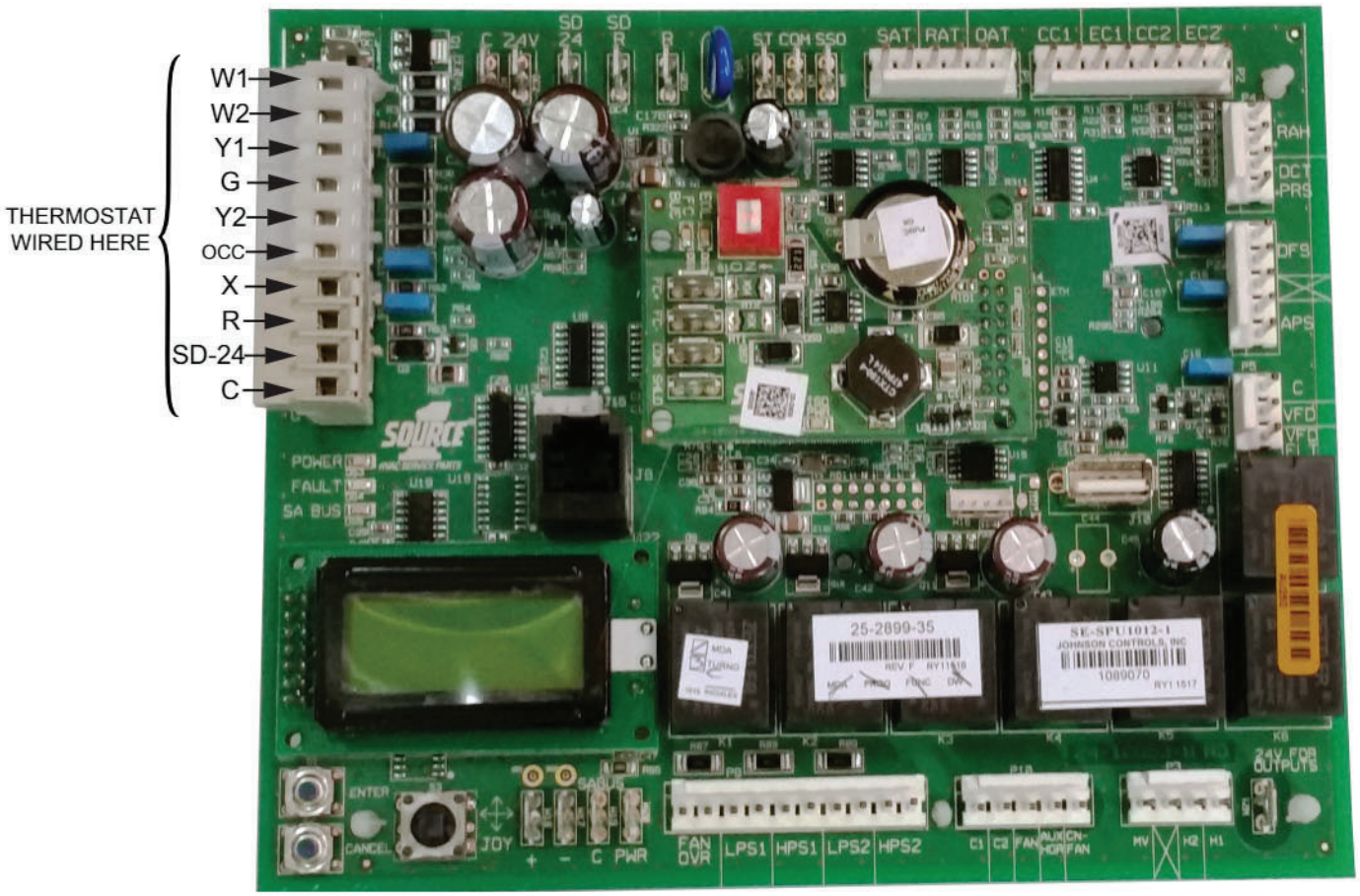


Figure 34: Unit Control Board

Table 30: Smart Equipment™ UCB Details

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

Table 30: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
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.
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.

Table 30: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
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
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

Table 30: Smart Equipment™ UCB Details (Continued)

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

Table 30: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
+	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
J15	Factory wired SA Bus connector	
Optional communication sub-board at center of UCB		
Terminal FC BUS[1] connections on left edge of the communication board		
FC+	FC ("Field Connected") BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts higher than –) FC bus BACnet MSTP communication circuit
FC–	FC ("Field Connected") BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts lower than +) FC bus BACnet MSTP communication circuit
COM	Common for the FC ("Field Connected") BUS BACnet MSTP communication circuit	Negative of the VDC FC bus BACnet MSTP communication circuit
SHLD	Shield for the FC ("Field Connected") BUS BACnet MSTP communication circuit	Earth ground reference of the cable to prevent interference on the FC bus BACnet MSTP communication circuit
Item Selector in red housing at left on top edge of the communication board		
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 31.

Table 31: 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.

Table 32: Ignition Control Flash Codes

Flashes	Fault Conditions	Check
STEADY ON	Control Failure	Control
HEARTBEAT	Normal Operation	
1	Not Applicable	
2	Pressure Switch Stuck Closed	Pressure Switch
3	Pressure Switch Failed To Close	Venter Pressure Switch Vent Blocked
4	Limit Switch Open	Main Limit AUX Limit
5	Flame Present With Gas Off First Stage Gas Valve Energized With W1 Off Second Stage Gas Valve Energized With First Stage Gas Valve Off	Gas Valve
6	Ignition Lockout	Gas Flow Gas Pressure Gas Valve Flame Sensor
STEADY OFF	No Power Or Control Failure	24VAC or Control

Start-Up Sheet

START-UP & SERVICE DATA INSTRUCTION

COMMERCIAL PACKAGE UNITS

3.0 To 50.0 TONS

START-UP CHECKLIST

Date: _____

Job Name: _____

Customer Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Model Number: _____ Serial Number: _____

Qualified Start-up Technician: _____ Signature: _____

HVAC Contractor: _____ Phone: _____

Address: _____

Contractor's E-mail Address: _____

Electrical Contractor: _____ Phone: _____

Distributor Name: _____ Phone: _____

WARRANTY STATEMENT

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

1034349-UCL-F-0318

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:

REFERENCE

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

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

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

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

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

Operating Measurements - Air Flow

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

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

Blower Motor HP _____FLA_____ RPM_____

Pulley Pitch Diameter _____Turns Out_____ Final Turns Out_____

Blower Pulley Pitch Diameter _____ Fixed Sheave_____

ELECTRICAL DATA

T1 - T2 _____ Volts T2 - T3 _____ Volts

Control Voltage _____ Volts T1 - T3 _____ Volts

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

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

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	☐	☐
Prove High Pressure Safety, All Systems	☐	☐
Prove Low Pressure Safety, All Systems	☐	☐

OPERATING MEASUREMENTS - GAS HEATING

Fuel Type: ☐ Natural Gas ☐ LP Gas

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

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

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

FINAL - INSPECTION

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

OBSERVED PRODUCT DEFICIENCIES & CONCERNS:

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6021977-UIM-B-1021
Supersedes:6021977-UIM-A-1120

York International Corporation
5005 York Drive
Norman, OK 73069

TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability

Installation Instructions

Part No. 24-10787-6, Rev. D
Issued November 2016

TEC3310-00-000, TEC3311-00-000, TEC3312-00-000, TEC3313-00-000,
TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, TEC3613-00-000

Refer to the QuickLIT website for the most up-to-date version of this document.

Applications

The TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers are stand-alone and field-selectable BACnet® Master-Slave/Token-Passing (MS/TP) or N2 networked devices provide control of the following:

- local hydronic reheat valves
- pressure-dependent variable air volume (VAV) equipment with or without local reheat
- two- or four-pipe fan coils
- cabinet unit heaters
- other zoning equipment using an on/off or floating control input

The networked models feature a field-selectable Building Automation System (BAS) BACnet MS/TP or N2 communication capability that enables remote monitoring and programming for efficient space temperature control. All models include a USB port configuration that reduces installation time by allowing simple backup and restore features from a USB drive, which enables rapid cloning of configuration between like units.

Some models have occupancy sensing capability built into the device. These thermostat controllers maximize up to 30% energy savings in high-energy usage commercial buildings, such as schools and hotels, during occupied times by using additional standby setpoints.

All models feature an intuitive onboard touchscreen UI with backlit display that makes setup and operation quick and easy. Multiple fan configurations are supported for fan coil equipment types:

- single-speed
- multi-speed (two or three discrete speeds)
- variable-speed/EC motors (0 to 10 VDC control)

Some models support dehumidification on two-pipe fan coil units with reheat, and four-pipe fan coil units with or without reheat. When no heating is required, the thermostat controller monitors space humidity and activates dehumidification control as necessary. Heat and/or reheat is used as required to maintain the space temperature. For optimal dehumidification performance, use a fan coil unit that has a multi-speed or variable-speed fan (VSF).

IMPORTANT: The TEC3000 Series Thermostat Controller is intended to provide an input to equipment under normal operating conditions. Where failure or malfunction of the thermostat controller could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the thermostat controller.

IMPORTANT : Le TEC3000 Series Thermostat Controller est destiné à transmettre des données entrantes à un équipement dans des conditions normales de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du thermostat controller risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du thermostat controller.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canada

This Class (B) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (B) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Installation

Parts Included

- one TEC3000 Series Thermostat Controller with integral mounting base
- one installation instructions sheet

Location Considerations

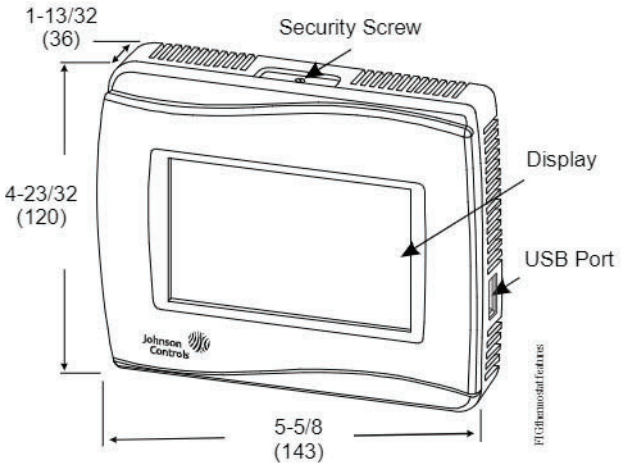
Locate the TEC3000 Series Thermostat Controller:

- on a partitioning wall, approximately 5 ft (1.5 m) above the floor in a location of average temperature, allowing for vertical air circulation to the TEC
- away from direct sunlight, radiant heat, outside walls, outside doors, air discharge grills, stairwells, and from behind doors
- away from steam or water pipes, warm air stacks, unconditioned areas (not heated or cooled), or sources of electrical interference

For integrated passive infrared (PIR) models, be sure that the thermostat controller is located centrally, where occupant movement is frequent.

Use insulating foam pads for installations where the wall temperature is different from the room temperature.

Figure 1: Thermostat Controller Shown without Occupancy Sensor, Dimensions, in. (mm)



Note: Allow for sufficient clearance to insert a USB drive into the USB port.

IMPORTANT: Only connect memory devices to the USB port. Do not use it for charging external devices.

Installing the Thermostat Controller

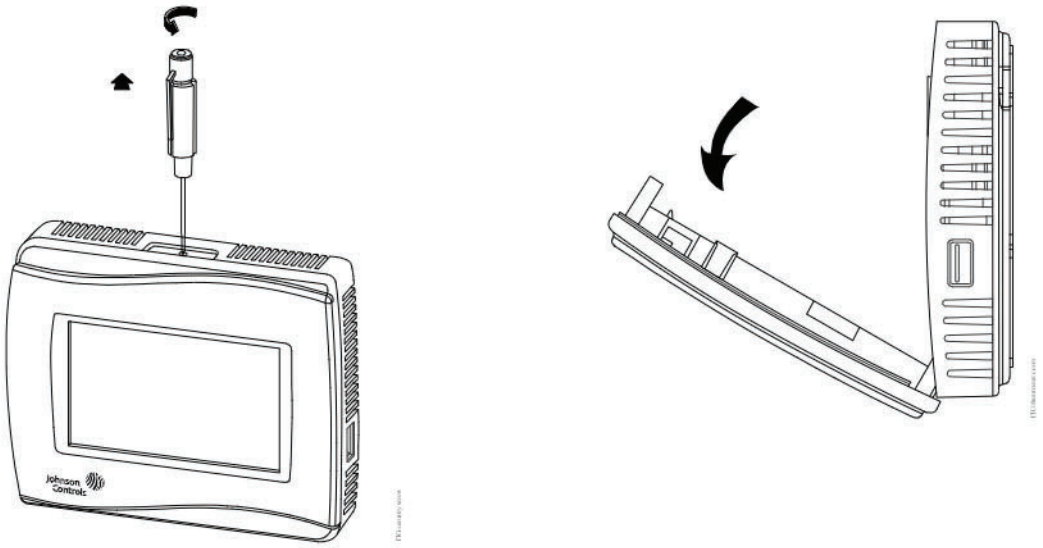
1. Use a 1/16 in. (1.5 mm) Allen wrench or Johnson Controls® T-4000-119 Allen-Head Adjustment Tool (order separately) to remove the security screw if it is installed on the top of the thermostat controller cover as illustrated in Figure 2.
2. Pull the top edge of the cover and open the thermostat controller as illustrated in Figure 2.

IMPORTANT: The cover is not secured on the bottom. Be careful not to drop the cover.

IMPORTANT: If you are installing more than one thermostat controller, keep track of which cover attaches to which base.

IMPORTANT: Use proper electrostatic discharge (ESD) precautions during installation and servicing to avoid damage to the electronic circuits of the thermostat controller.

Figure 2: Removing the Security Screw from the Thermostat Controller Cover (Shown without Occupancy Sensor) (Left) and Removing the Thermostat Controller Cover (Right)



3. Align the thermostat controller mounting base on the wall with the security screw on the top and use the base as a template to mark the two mounting hole locations. See Figure 3.

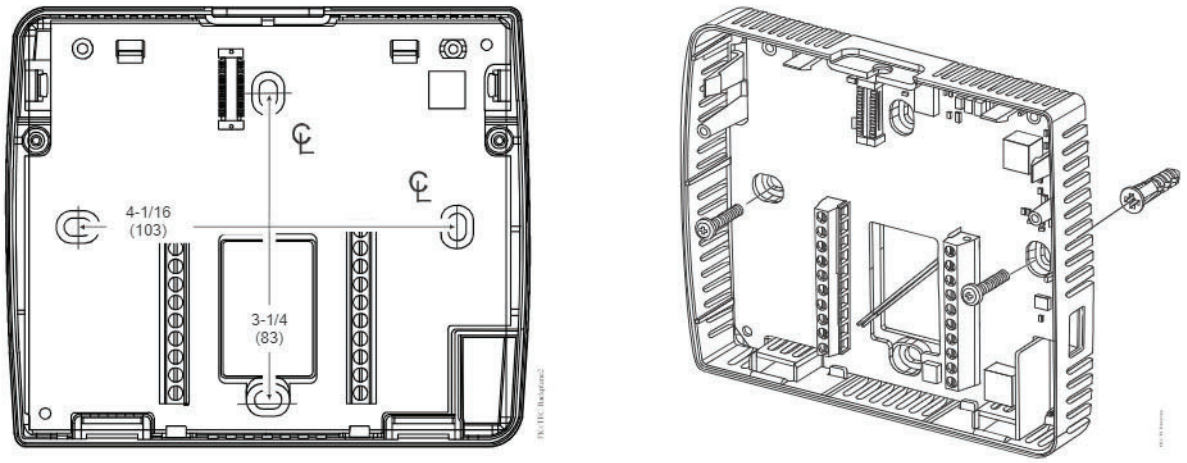
   Notes:

   - If you need to install the thermostat controller on an electrical junction box, use 2-1/2 x 4 in. (63 x 101 mm) square boxes with mud ring covers and avoid smaller 1-1/2 x 4 in. (38 x 101 mm) square or 3 x 2 in. (76 x 51 mm) boxes. This procedure ensures that you have enough space for cabling, if needed.
   - For surface-mounted applications, use durable mounting hardware, such as wall anchors, that cannot be easily pulled out of the mounting surface.

4. Pull approximately 6 in. (152 mm) of wire from the wall and insert the wire through the center hole in the thermostat controller mounting base. See Figure 3.
5. Secure the mounting base to the wall surface using two mounting screws (user supplied) as illustrated in Figure 3.

   Note: Be careful not to overtighten the mounting screws.

Figure 3: Mounting Hole Locations, Dimensions, in. (mm) (Left) and Securing the Thermostat Controller Mounting Base to the Wall (Right)



Wiring

When an existing thermostat controller is replaced, remove and label the wires to identify the terminal functions.

⚠ CAUTION

Risk of Electric Shock.
Disconnect the power supply before making electrical connections to avoid electric shock.

⚠ ATTENTION

Risque de décharge électrique.
Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.

NOTICE

Risk of Property Damage.
Do not apply power to the system before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

NOTICE

Risque de dégâts matériels.
Ne pas mettre le système sous tension avant d'avoir vérifié tous les raccords de câblage. Des fils formant un court-circuit ou connectés de façon incorrecte risquent d'endommager irrémédiablement l'équipement.

IMPORTANT: Make all wiring connections in accordance with local, national, and regional regulations. Do not exceed the electrical ratings of the TEC3000 Series Thermostat Controller.

IMPORTANT: Use proper electrostatic discharge (ESD) precautions during installation and servicing to avoid damage to the electronic circuits of the thermostat controller.

To wire the thermostat controller:

1. Strip the ends of each wire 1/4 in. (6 mm) and connect them to the appropriate screw terminals as indicated in Table 2 and Figure 6 or Figure 7.

   Note: For more details on wiring the MS/TP Communications Bus, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

2. Carefully push any excess wire back into the wall.

   Note: Seal the hole in the wall with fireproof material to prevent drafts from affecting the ambient temperature readings.

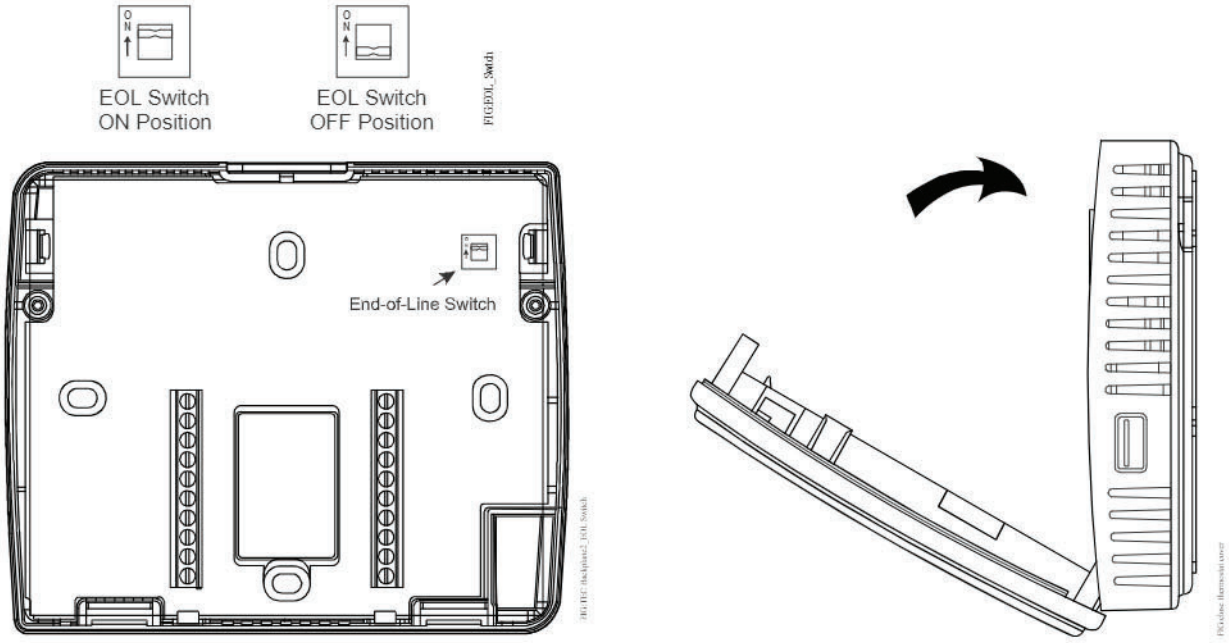
3. Reattach the communication wires to the terminal block.

   Note: If multiple wires are inserted into the terminals, be sure to properly twist the wires together before inserting them into the terminal connectors.

4. Set the bus end-of-line (EOL) termination switch to the desired location on the TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, and TEC3613-00-000 models only.

   The bus EOL termination switch allows you to designate the thermostat controller as the end of the Field Controller (FC) Bus and N2 Bus. The default position is OFF. If the thermostat controller is at the end of a daisy chain of devices on the FC Bus and N2 Bus, set the EOL switch to the ON position. See Figure 4.

Figure 4: EOL Switch Position (Left) and Installing the Thermostat Controller Cover (Right)



5. Reattach the thermostat controller cover to the mounting base (bottom side first).

IMPORTANT: Make sure you reattach the cover that corresponds to its correct base. The CPU board number needs to match the Base board number. Otherwise, an operation error occurs after you reattach a cover and base that do not belong together (as shown in Figure 5). See Table 1 on page 7 for TEC3000 model names and code numbers.

Figure 5: Error Code Indicating Mismatched Boards

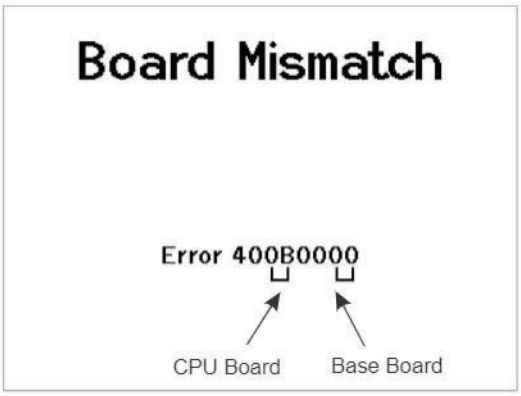


Table 1: TEC3000 Model Names and Code Numbers

Name	Code Number[1]	Name	Code Number[1]
TEC3310	00	**TEC3610**	0A
TEC3311	01	**TEC3611**	0B
TEC3312	02	**TEC3612**	0C
TEC3313	03	**TEC3613**	0D
TEC3320	04	**TEC3620**	0E
TEC3321	05	**TEC3621**	0F
TEC3322	06	**TEC3622**	10
TEC3323	07	**TEC3623**	11
TEC3330	08	**TEC3630**	12
TEC3331	09	**TEC3631**	13

1. The two-character code number is listed within the error code to indicate that the CPU board and base board do not belong together. However, if the same code number appears as both the CPU board and base board, there is no error. For example, if 0B is listed as the CPU board and the base board, the model is the TEC3611.

6. Use a 1/16 in. (1.5 mm) Allen wrench or Johnson Controls T-4000-119 Allen-Head Adjustment Tool (order separately) to reinstall the security screw on the top of the thermostat controller cover. See Figure 2 for security screw placement.
7. Remove the protective plastic cover sheet from the display.

IMPORTANT: If the display is dirty, **gently** wipe it clean with isopropyl alcohol or ethyl alcohol. Do not scrub hard as to avoid damaging the surface. Do not use other cleaners such as water, ketone, and aromatic solvents, since they may damage the polarizer.

Note: VAV and 2-pipe systems should connect their valve to the heating output.

Table 2: Terminal Identification (See Figure 6 and Figure 7 for Wiring Diagrams)

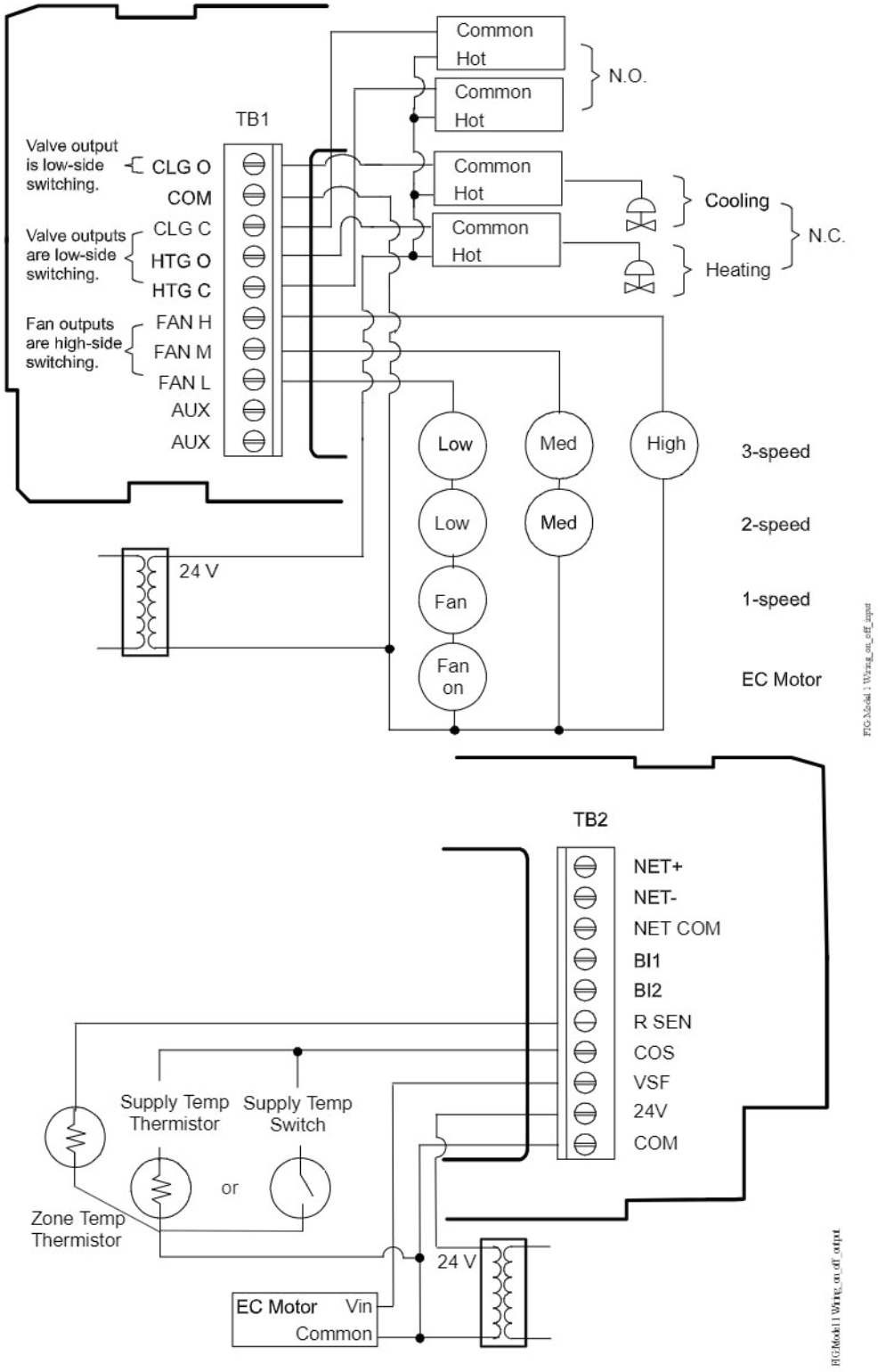
Terminal Label	Function	
	TEC3310, TEC3311, TEC3312, TEC3313 Floating FC/VAV and On/Off FC[1]	**TEC3610, TEC3611, TEC3612, TEC3613 Floating FC/VAV and On/Off FC[1]**
24 V	24 VAC hot from transformer	
FAN H	Fan high	
FAN M	Fan medium	
FAN L	Fan on (single-speed, variable speed), Fan low multi-speed)	
AUX	Auxiliary binary output	
AUX	Auxiliary power	
COM[2]	24 VAC common from transformer	
CLG O	Cool open (Floating), Cooling NC (On/Off), Triac	
CLG C	Cool close (Floating), Cooling NO (On/Off), Triac	
HTG O	Heat open (Floating), Heating NC (On/Off), Triac	
HTG C	Heat close (Floating), Heating NO (On/Off), Triac	
COM[2]	Common	
VSF	Variable speed fan command (configurable 0 to 10 V range)	
BI2	Configurable binary input 2	
BI1	Configurable binary input 1	
COS	Supply temperature sensor	
R SEN	Remote zone temperature sensor	
NET+	Not connected	Field bus+/N2+
NET-	Not connected	Field bus-/N2-
NET COM	Not connected	Isolated common for field bus

1. There is no support for an On and Off VAV.
2. The common terminals (do not include NET COM) are internally connected and can be used for all inputs and outputs.

Notes:

- VAV and 2-pipe systems should connect their valve to the heating output.
- Only one transformer is required for each TEC.

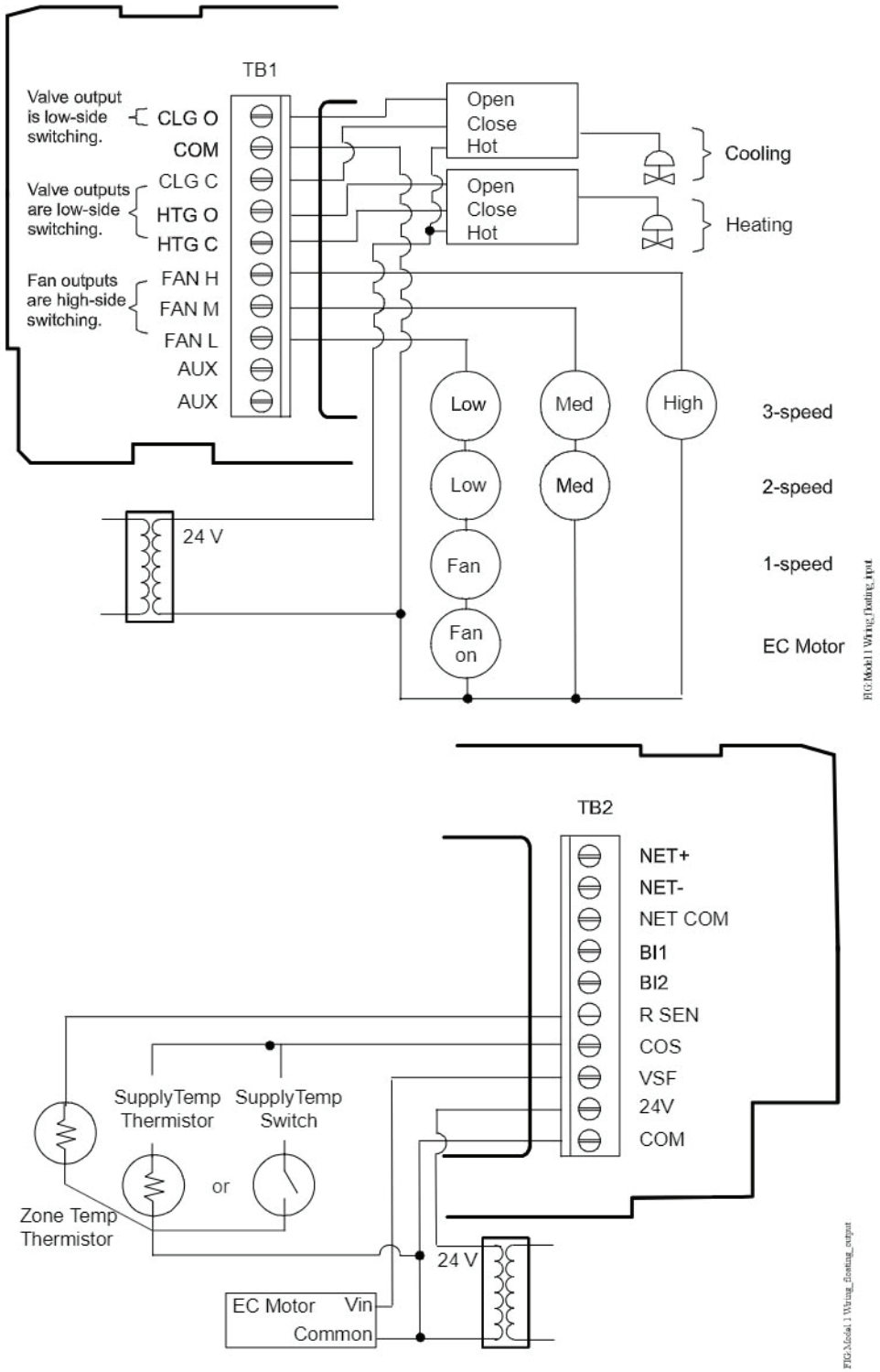
Figure 6: On/Off Wiring Diagram (See Table 2 for Terminal Identification)



Notes:

- For VAV and 2-pipe systems, connect the valve to the heating output.
- Only one transformer is required for each TEC.

Figure 7: Floating Wiring Diagram (See Table 2 for Terminal Identification)



Note: VAV and 2-pipe systems should connect their valve to the heating output.

Figure 8: Floating Control (Pressure-Dependent VAV)

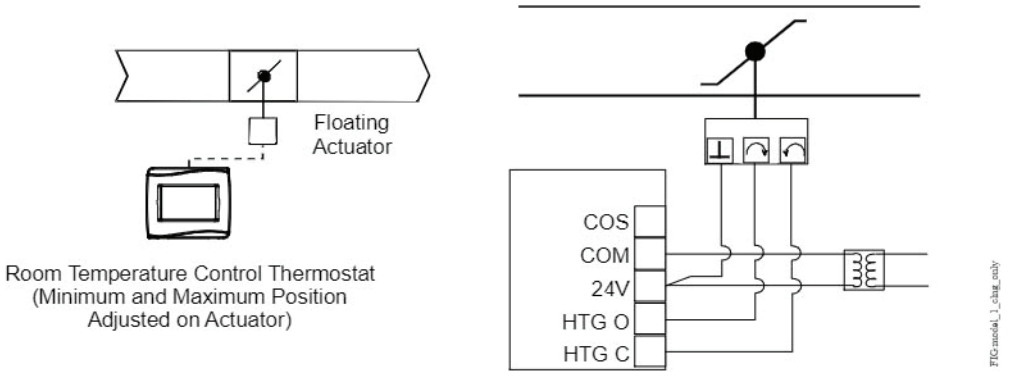


Figure 9: Floating Control (Pressure-Dependent VAV with Changeover Sensor/Switch)

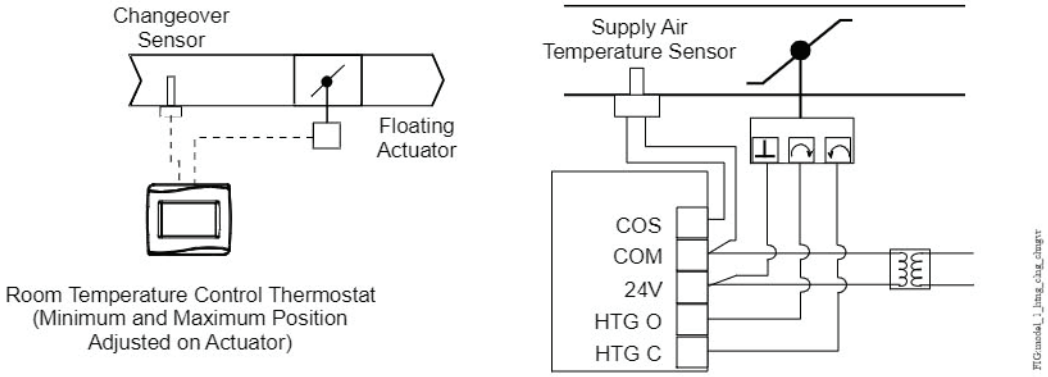
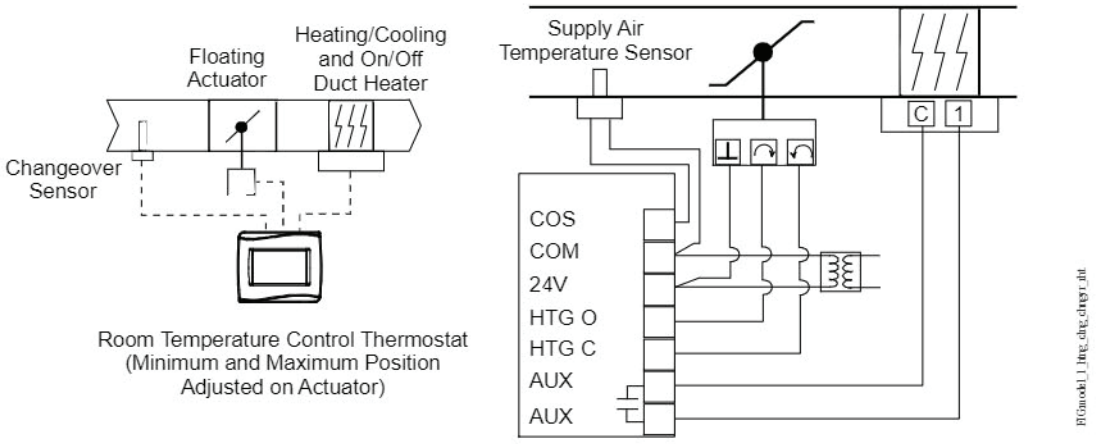


Figure 10: Floating Control (Pressure-Dependent VAV with Changeover Sensor/Switch and Reheat)



Note: Power to the AUX contact comes from the reheat coil.

Note: VAV and 2-pipe systems should connect their valve to the heating output.

Figure 11: Floating Control Two-Pipe Heating and Cooling Hydronic Valve Control Fan Coil Application

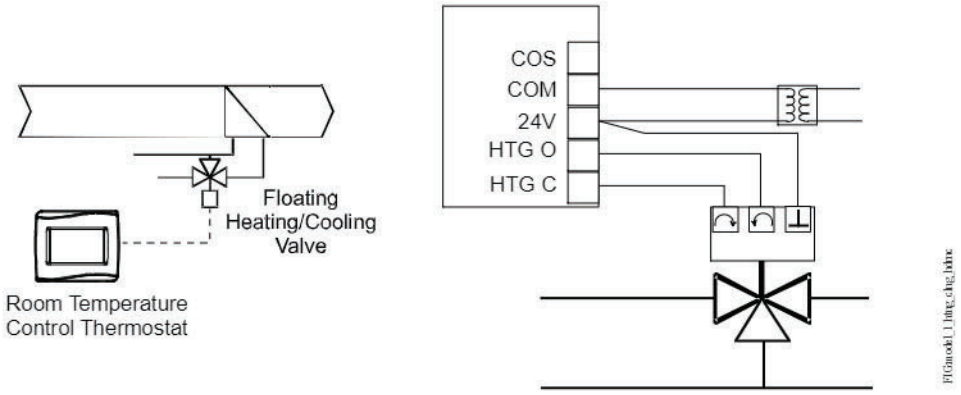


Figure 12: Floating Control Two-Pipe Heating and Cooling Hydronic Valve Control with Changeover Fan Coil Application

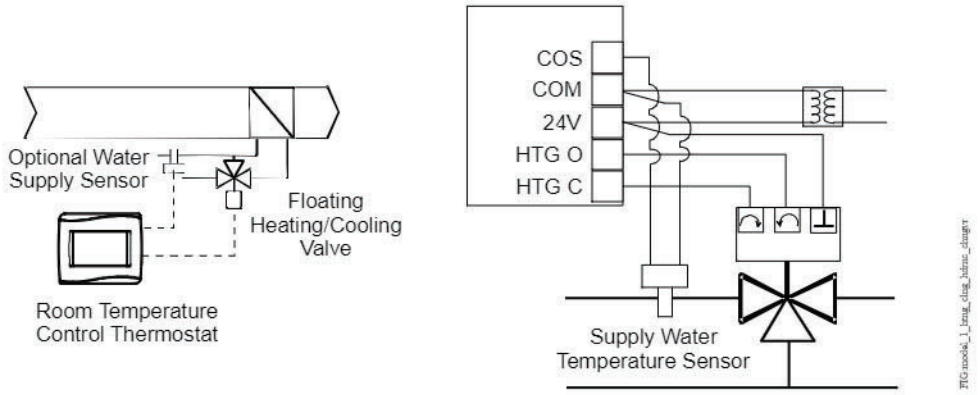
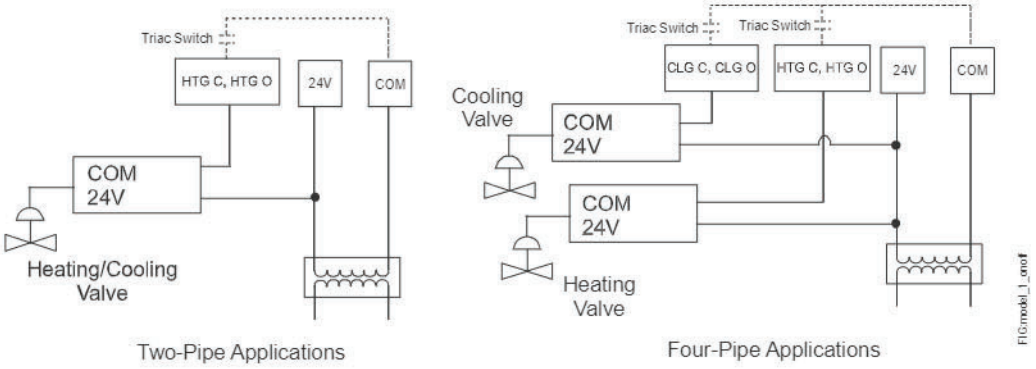


Figure 13: Floating Control (On/Off Two-Pipe and Four-Pipe Fan Coil Applications)



Note: VAV and 2-pipe systems should connect their valve to the heating output.

Figure 14: Floating Control (Floating Two-Pipe and Four-Pipe Fan Coil Applications)

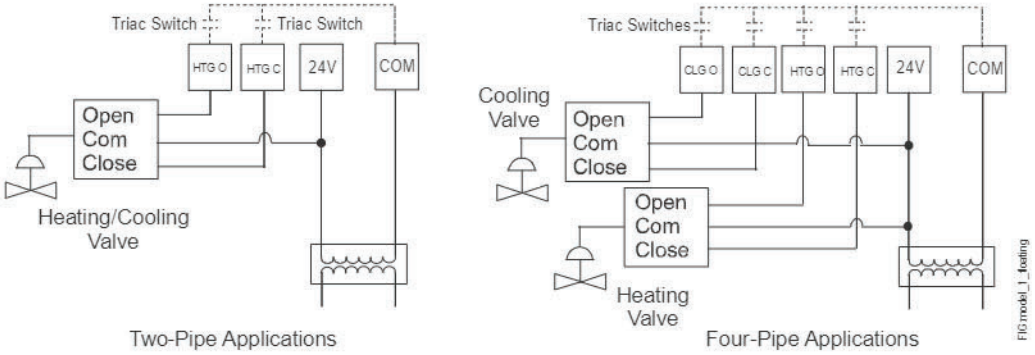


Figure 15: AUX Contact Wiring

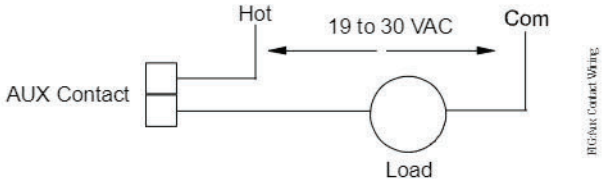
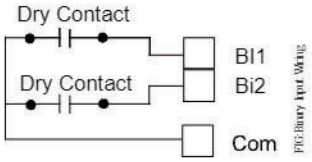


Figure 16: Binary Input Wiring



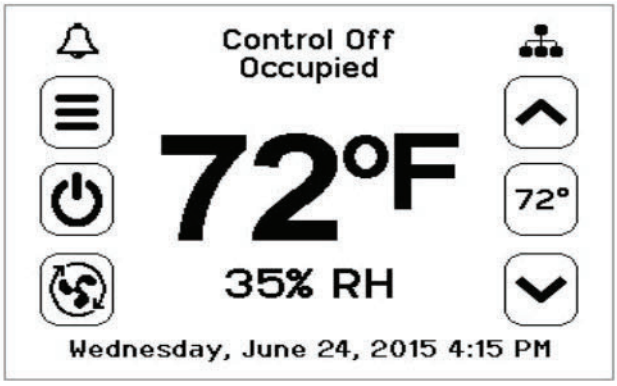
Setup and Adjustments

IMPORTANT: Table 7 provides a full list of TEC3000 menu settings. In the upcoming sections, step-by-step instructions are included on how to access and adjust the more commonly used menus.

Overview

Figure 17 shows the thermostat controller home screen. You can customize it to show or hide various elements from the occupant. See Table 3 for a listing of the touchscreen icons and Table 7 to identify the home screen settings under the Display Settings. When screen customization is used in conjunction with a passcode, the building owner can control which options the occupant can access and adjust.

Figure 17: Thermostat Controller Home Screen



The humidity level appears on the home screen if there is a humidity sensor in the unit, or if the thermostat controller has a network override written to it.

Customizing the Home Screen

Customizing the Home screen settings include:

- Brightness
- Enable Backlight
- Units
- Time
- Time Zone
- Time Format
- Date
- Date Format

You can also show or hide these items on the home screen:

- Fan Button
- Space Temperature
- Humidity
- Off Button
- Hold Button
- Setpoint
- Alarm Indication
- Occupancy Status
- Unit Status
- Date/Time

To customize the Home screen:

1. Press the Menu icon.
2. Press **Display Settings**.
3. Enable or disable elements of the home screen as appropriate for the building owner and occupants.
4. Set the passcode on the thermostat controller to prevent the occupants from changing settings that they should not have access to change.

UI Icons

Table 3 describes the home screen touchable icons. Press and release a UI icon to activate the TEC. Additional touchable icons appear based on the menu, and those icons are also described in Table 3.

Table 3: Touchscreen Icons (Part 1 of 2)

Icon	Icon Name	Description
	Menu	Displays the configuration screens where various settings may be adjusted.
	Alarm	Indicates that the thermostat controller has triggered an alarm.
 	Unit Power On Off	Powers the thermostat controller on or off. **Note:** This icon disables all equipment control, but does not physically power down the unit.
	Network Communication	Indicates that the thermostat controller detected a supervisory controller and both are online.
	Arrow	Increases or decreases a value depending on the configuration screen.

Table 3: Touchscreen Icons (Part 2 of 2)

Icon	Icon Name	Description
	Run/Hold	Displays the current setpoint. Hold mode is enabled by pressing the button.
	Hold/Hold	Displays the active setpoint. Hold mode is enabled. No Hold mode is enabled by pressing the button.
	Right Arrow	Proceeds to the next screen.
  	Fan Override On Auto Quiet	Adjusts the fan override between On, Auto, and Quiet.
	Home	Returns the display to the main home screen.
	Back	Returns to the previous screen.
	Save	Saves the current configuration and parameter settings.
	Delete	Deletes the scheduled event.
	Clear	Clears the password entry on the keypad screen.
	Wrench	Indicates that the value is editable.
	Checkmark	Indicates that an event or schedule is programmed for a specific day of the week.
	Exclamation Point	Indicates that an error has occurred.

Using the USB Port

The USB port allows you to quickly and easily load firmware upgrades, backup settings, and restore settings to the TEC3000 by using a USB drive. The TEC3000 can recognize eight configuration files or firmware package files. The USB drive format must be FAT or FAT32. The drive cannot be NTFS or USB 3.0. You must have access to the TEC3000 passcode, if a password has been set up, if you are upgrading firmware or copying configuration files. Do not remove the USB drive until the firmware upgrade is complete. The TEC3000 may restart and go offline to the NAE after a firmware upgrade. The upgrade takes approximately three minutes.

Configurations are copied, except for the Communication mode. See *Choosing the Communication Mode (TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, and TEC3613-00-000 Models)* to configure each device.

Loading the Firmware

1. Ensure that the TEC screen is on.
2. Insert the USB drive into the right side of the TEC.

   See Figure 1 for the USB port location.
3. Press the Menu icon.
4. Scroll down the menu and press **Update**.
5. Press **Load Firmware**.
6. Select the correct firmware version. The correct file name has the .pkg extension.
7. Press **Confirm** if you have the correct firmware version.

   The firmware is loaded from the USB drive into the TEC3000 operating system. The TEC3000 locates the new firmware only if the new firmware is on the root drive of the USB drive. See *Troubleshooting* if the firmware is not loaded correctly.
8. Remove the USB drive from the TEC3000 controller when the update is complete.

   The TEC3000 firmware update is complete when the TEC3000 restarts and returns to the home screen.

Backing Up the Settings

1. Ensure that the TEC screen is on.
2. Insert the USB drive into the right side of the TEC.

   See Figure 1 for the USB port location.
3. Press the Menu icon.
4. Scroll down the menu and press **Update**.
5. Press **Backup**.

   A message appears stating that the file is saved locally and on a USB drive.
6. Press **Confirm** if you have the correct firmware version.

   The setting files are named based on the TEC3000 model name, date, and time stamp (for example, TEC3311-00_2015-10-08T1). The files are saved locally and on the USB drive's root directory. See *Troubleshooting* if the settings are not backed up correctly.
7. After the settings are saved onto the USB drive, remove the USB drive from the TEC3000.

Restoring the Settings

1. Ensure that the TEC screen is on.
2. Insert the USB drive into the right side of the TEC.

   See Figure 1 for the USB port location.
3. Press the Menu icon.
4. Press **Update**.
5. Press **Restore**.
6. Select Local Storage or the correct configuration file created from a previous backup operation.

   The setting files are named based on the TEC3000 model name, date, and time stamp (for example, TEC3311-00_2015-10-08T1). The files are saved locally and on the USB drive's root directory.
7. Press **Confirm** if you have the correct file name.

The settings are loaded from the USB drive.

8. After the settings are loaded from the USB drive, remove the USB drive from the TEC3000.

Choosing the Communication Mode *(TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, and TEC3613-00-000 Models)*

1. Ensure the TEC screen is on.
2. Press the Menu icon.
3. Press **Network Setup**.
4. Press **FC Comm Mode**.
5. Select BACnet or N2 by pressing  .
6. Proceed to Step 7 to perform BACnet communication and Step 15 to perform N2 communication.
7. Press  to return to the previous screen.
8. Press **BACnet Instance ID**.
9. Enter the BACnet® instance ID using the keypad. This value should be different to the other controllers on the site.
10. Press **Save**.
11. Press  to return to the previous screen.
12. Press **BACnet Address**.
13. Enter the BACnet address through the keypad.
14. Press **Save**.
15. After selecting N2 in Step 5, press **Save**.
16. Press  to return to the previous screen.
17. Press **N2 Address**.
18. Enter the N2 address through the keypad.
19. Press **Save**.

Configuring the Thermostat Controller

Use the Menu icon on the home screen to access and change the basic operating parameters of the thermostat controller. During normal operation, press the Menu icon once to access the following parameters:

- Faults Status
- Setpoints
- Schedule
- Display Settings
- Control Setup
- Network Setup
- Equipment Setup
- System Status
- Control Status
- Controller Information
- Commissioning
- Update

Installer Configuration Menu

The thermostat controller comes from the factory with default settings for all configuration parameters. The UI menu navigation and default settings are shown in Table 7. Before any outputs turn on, the controller must be configured for the equipment connected to itself. You need to start from the home screen to perform any of the following tasks.

Screen Reset

The current screen returns to the home screen if the current screen is not touched for 3 minutes.

Selecting the Unit Type

There are three unit types. They are:

- 4-pipe – This unit type has both heating and cooling coils plus a supply fan. This configuration can also be used on configurations that are heating or cooling only.
- 2-pipe – This unit type has a single set of pipes that can serve hot or chilled water plus a supply fan. The Supply Temp Type allows for the connection of an analog sensor or an aquastat to a binary input. Based on the water temperature or aquastat state, the unit controls heating or cooling.
- VAV – This unit type is designed for a pressure-independent zone damper and the supply fan outputs are disabled. The TEC senses the supply air temperature coming from the unit. The Supply Temp Type setting allows for the connection of an analog sensor or binary duct thermostat. Based on the air temperature or duct thermostat state, the zone damper controls for heating or cooling. The TEC does not control the unit delivering the air. The logic needs to be part of another controller.

By default, the thermostat controller is configured for 4-pipe fan coil mode. To change to a 2-pipe or Pressure-Dependent VAV mode:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **General**.
4. Press **Unit Type** and select 2-pipe, 4-pipe, or VAV.
5. Press  to save and  to return to the previous screen.

Note: Selecting VAV reboots the controller in order to apply the change.

Selecting the Heating and Cooling Device Type

By default, the thermostat is configured for On-Off (2-position) control. This can be changed to Floating (Incremental) mode when the Unit Type is not set to VAV. For VAV mode, only floating actuators are supported and this option is unavailable. To change the Heating/Cooling Device Type:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **General.**
4. Press **Htg/Clg Device Type** and select On-Off or Floating. Changing this option reboots the controller in order to apply the change.
5. Press  to save and  to return to the previous screen.

When in Floating mode, the Actuator Stroke Time must also be set to match the equipment. To set the actuator stroke time:

1. Press the Menu icon.
2. Press **Equipment Setup.**
3. Press **General**.
4. Press **Actuator Stroke Time** and adjust accordingly.
5. Press  to save and  to return to the previous screen.

Configuring the Supply Fan - Fan Coil Only

On fan coil units (2-pipe or 4-pipe), three different types of supply fans are supported. These are single-speed fans, multi-speed fans (up to three discrete speeds), and VSF using a 0 to 10 V control signal and an optional binary on/off command. Note that fan control is not available when in VAV mode. To select the fan type:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **Supply Fan**.
4. Press **Supply Fan Type** and select Single Speed, Multi-Speed, or Variable Speed.
5. Press  to save and  to return to the previous screen.

For multi-speed fan control, you can adjust the point when the medium or high speed turns on. The fan speed is based on the load on the cooling/heating device, and is a percentage between 0 and 100. By default, the Med Speed On Cmd is 33% and the High Speed On Cmd is 66%. When only two fan speeds are used, you must set the High Speed On Cmd to 100% to disable the third speed and set the Med Speed On Cmd to 50%. To adjust these values:

1. Press the Menu icon.
2. Press **Equipment Setup.**
3. Press **Supply Fan**.
4. Press **Medium Speed On Cmd** and adjust accordingly.
5. Press **High Speed On Cmd** and adjust accordingly.
6. Press  to save and  to return to the previous screen.

For VSF control, the output is configurable for any range between 0 V and 10 V. The parameters are Start Voltage, Full Speed Voltage, and Minimum Command. Start Voltage is the voltage output at which the fan begins running, and Full Speed Voltage is the voltage output at which the fan reaches full speed. Minimum Command is the percentage of the range between the Start Voltage and the Full Speed Voltage. The fan does not go below the minimum command when the fan is turned on. By default, the Start Voltage is 2 V, the Full Speed Voltage is 10 V, and the Minimum Command is 20%.

When the variable speed fan is off, the FAN binary output is off and the voltage at the VSF output is 0 V. When the fan turns on, the FAN binary output turns on and the voltage at the VSF output begins controlling the fan. When the VSF is configured for reverse acting mode (Start Voltage is above Full Speed Voltage), the VSF output goes to the lesser of 10 V and 1 V above the Start Voltage when the fan is turned off.

To configure the variable speed parameters:

1. Press the Menu icon.
2. Press **Equipment Setup.**
3. Press **Supply Fan**.
4. Press **Start Voltage** and adjust accordingly.
5. Press **Full Speed Voltage** and adjust accordingly.
6. Press **Minimum Command** and adjust accordingly.
7. Press  to save and  to return to the previous screen.

Setting the Control Mode

The Control Mode informs the controller to run in Cooling only, Heating only, or Automatic mode, based on the temperature in the zone relative to the heating and cooling setpoints. Control Mode does not override equipment lockouts or changeover. To set the Control Mode:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Control Mode** and select Cooling, Heating, or Auto as desired.
5. Press  to save and  to return to the previous screen.

Setting the Fan Mode - Fan Coil Only

The Fan Mode informs the controller how to handle the fan. There are two options for fan configuration: a Fan Mode available to the installer through the menu system, and a fan override available as an option to the end-user. See *Customizing the Home Screen* for information on enabling and disabling end-user controls. The Fan Mode available to the installer provides the following options:

- On – fan is continuously on
- Auto – fan cycles on demand with the controller entering cooling, heating, or dehumidification modes
- Smart – fan cycles on demand with the controller entering cooling or heating modes during unoccupied periods but is continuously running during occupied and standby periods

The Fan Override icon on the previous screen provides the following options:

- On – overrides the fan to be continuously on
- Auto – follows the behavior set as Fan Mode
- Quiet – follows the behavior set as Fan Mode, but prevents the fan from ever going above minimum speed. The Quiet option has no effect on equipment with single-speed fans

To set the Fan Mode:

1. Press the Menu icon.
2. Press **Control Setup.**
3. Press **General**.
4. Press **Fan Mode** and select On, Auto, or Smart.
5. Press  to save and  to return to the previous screen.

Changeover

Pressure-Dependent VAV systems and 2-pipe fan coils require changeover detection in order to switch seasonal operation between heating and cooling modes. The TEC supports the following methods for changeover: automatic changeover using an analog sensor (thermistor), automatic changeover using a binary switch, or remote changeover from a BAS and manual changeover.

For automatic changeover, a supply temperature sensor or switch must be connected to the COS input of the TEC. Changeover Mode must be set to Auto, and Supply Temp Type must be set for Analog Sensor, Cooling N.C. (cooling when switch is closed), or Heating N.C. (heating when switch is closed). When an analog sensor is used, the changeover setpoint can be adjusted. The changeover logic applies a 10-degree Fahrenheit differential to the setpoint. The system switches to cooling mode when the temperature drops below the changeover setpoint and remains in cooling mode until the measured temperature has risen 10 degrees above the changeover setpoint.

To configure automatic changeover:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **Changeover**.
4. Press **Changeover Mode** and select Auto.
5. Press **Supply Temp Type** and select Analog Sensor, Cooling N.C., or Heating N.C.
6. Press  to save and  to return to the previous screen.

Additionally, the thermostat controller supports manual changeover. To configure manual changeover:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **General**.
4. Press **Changeover**.
5. Press **Changeover Mode** and select Heating or Cooling.
6. Press  to save and  to return to the previous screen.

You need to ensure that the Supply Temp type is set to Analog Sensor. The Changeover Mode is also exposed to the BAS through the CGOVR-MODE and can be commanded from the BAS.

On 2-pipe/VAV systems without an automatic changeover, or on 4-pipe systems, you can use COS as a monitor-only point for reading an analog sensor. By setting the controller in 4-pipe mode, or selecting Heating or Cooling for Changeover Mode, the controller defaults to monitor-only mode for the COS and exposes the value to the network as the supply temperature.

Dehumidification Control - Fan Coil Only

The TEC3000 controller support dehumidification control on fan coil devices under three configurations:

- 4-pipe fan coil
- 4-pipe fan coil with reheat
- 2-pipe fan coil (with changeover in cooling mode) with reheat

For optimal dehumidification performance, a 4-pipe unit with floating/incremental or 0 to 10 V control and a multi-speed or variable-speed fan is recommended.

Dehumidification operates when the zone humidity increases above the zone humidity setpoint and the controller is in the Idle or Cooling state. Dehumidification does not operate during heating and stops if the zone temperature drops below the heating setpoint. When dehumidification is active, the cooling device controls to the humidity setpoint, and the heating device reheats the zone in order to keep the temperature at the cooling setpoint. While in the dehumidification mode, a multi-speed or variable-speed fan runs at the lowest possible speed to maximize condensation and moisture removal across the cooling coil.

To enable dehumidification control:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Dehum Enable** and select Yes.

5. Press  to save and  to return to the previous screen.

This point is also exposed to the BAS through the point DEHUM-EN.

To adjust the dehumidification setpoint:

1. Press the Menu icon.
2. Press **Setpoints**.
3. Press **Dehumidification** and adjust accordingly.
4. Press  to save and  to return to the previous screen.

This point is also exposed to the BAS through the point DEHUM-SP.

Temperature Setpoints

The thermostat controller provides a flexible setpoint configuration to give power to the building owner while being easy to use by the occupant. In addition to a simple up/down offset adjustment on the home screen for the occupant, there are six temperature setpoints on the TEC. The six temperature setpoints are Cooling and Heating setpoints for Occupied, Unoccupied, and Standby modes. To set these setpoints:

1. Press the Menu icon.
2. Press **Setpoints**.
3. Select the setpoint to adjust and change as desired.
4. Press  to save and  to return to the previous screen.

Note: The TEC enforces a 2-degree deadband between heating and cooling setpoints. If a setpoint violates this standard (for example, cooling setpoint is set to 70 with a heating setpoint already set to 70), the opposing setpoint is modified to comply with this deadband (in the previous example, the heating setpoint would automatically change to 68).

The occupant has access to an up/down adjustment from the home screen. This adjustment applies a fixed offset (+/-) to the currently active setpoint, and this offset holds until the occupancy state of the controller changes. If the user taps the setpoint on the home screen, the icon inverts and displays white text on a black icon. The offset is held throughout all occupancy periods. For example, if the TEC is cooling in Occupied mode to an occupied cooling setpoint of 72 and you raise the setpoint 2 degrees to 74 from the home screen and then select hold, then the +2 degree offset persists through an occupancy change. If the occupancy then changes to unoccupied, with a setpoint of 80 degrees, the effective setpoint is 82 degrees. This allows the occupant to have a small amount of control over raising or lowering the temperature, but the building owner can still set back setpoints during standby and unoccupied periods. When the setpoint is in Hold mode, pressing the icon again releases the hold and immediately sets the setpoint offset back to 0.

Configuring Occupancy

The TEC3000 controller supports a wide variety of occupancy sources to adapt to nearly any application.

- Local stand-alone weekly scheduler
- Remote schedule from BAS
- Occupancy sensor (internal or remote)
- Occupancy binary input (configurable)
- Manual occupancy override
- Temporary occupancy (by interacting with screen while unoccupied)
- Temporary occupancy binary input

Occupancy is determined using a top-down decision matrix as shown in Table 4.

Enumerations may not match the *TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability Installation Instructions (Part No. 24-10787-6), TEC3000 Series Proportional Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability Installation Instructions (Part No. 24-10788-0), TEC3000 Series Single- or Two-Stage Economizer Thermostat Controllers Installation Instructions (Part No. 24-10789-5), and TEC3000 Series Field-Selectable BACnet MS/TP or N2 Networked Thermostat Controllers Technical Bulletin (LIT-12011956)* for NAE releases prior to 7.x.

Table 4: Occupancy Determination

Sequence of Operation (Highest to Lowest Priority)						
Occupancy Override Mode (OCCOVRD-MODE)	**Occupancy BI (BI1-S, BI2-S)[1]**	**Temporary Occupancy[2, 3]**	**Occupancy Schedule (External or Schedule) (OCC-CONFIG, NET-OCC)**	**Motion Sensor[4]**	**Effective Occupancy (EFF-OCC)**	**Occupancy Source (OCCSOURCE-S)**
Occupied	–	–	–	–	Occupied-Override	Occ Override
Unoccupied					Unoccupied-Override	
No Override	Closed[1]				Occupied	Occupancy BI
	Open[1]				Unoccupied	
	Not Configured[1]	True[2]	NOT Occupied		Temp Occupancy	Temp Occ
		True[3]	NOT Occupied		Temp Occupancy	Temp Occ BI
		False	Occupied	True	Occupied	Occupancy Sensor
				False	Standby	
				Disabled	Occupied	Occupancy Schedule
			Unoccupied	–	Unoccupied	
			Standby		Standby	
			Not Set[5]	True	Occupied	Occupancy Sensor
				False	Unoccupied	
				Disabled	Occupied	Occupancy Schedule

1. Not Configured means that neither BI1 Config nor BI2 Config is set to Occupancy BI. Open and Closed refer to the current state of the BI when configured as Occupancy.
2. True is triggered by interacting with the screen during a scheduled unoccupied period. A value of True can only occur when the schedule is not Occupied.
3. When triggered by a BI configured for Temp Occ, the input is ignored when the schedule is Occupied, the Manual Occupancy Mode is **not** No Override, or an Occupancy BI is configured.
4. Built-in occupancy sensing (PIR) or EI configured for Motion NO or Motion NC.
5. Not Set occurs when no events are scheduled through the local scheduler, or the schedule source is set to Schedule and the Schedule is writing Not Set as the schedule.

Selecting Schedule Source

Scheduling

The TEC3000 thermostat controller can operate as a stand-alone unit with an internal schedule or scheduled with an external schedule. The OCC-CONFIG object sets the method used for scheduling.

If the OCC-CONFIG is set to External, the NET-OCC object is used to control the unit externally.

If the OCC-CONFIG is set to Schedule, the internal schedule commands the LOCAL-OCC object, which sets the Occupancy Schedule command.

Note: If you do not have a schedule in the Schedule object and you have the OCC-CONFIG set to Schedule, you can control the unit with the LOCAL-OCC object externally; however, we do not recommend this method. See Table 5 for scheduling information.

Once the Occupancy Schedule command is set, the effective occupancy is determined by settings shown in the Occupancy Determination table. See Table 4.

Table 5: BAS Objects for Scheduling

BAS Objects for Scheduling			
OCC-CONFIG	**LOCAL-OCC (Commanded by Internal Schedule)**	**NET-OCC**	**Occupancy Schedule Command[1]**
External	Any State (Internal Schedule in Control)	Occupied	Occupied
		Unoccupied	Unoccupied
		Standby	Standby
		Not Set	Not Set
Schedule	Occupied	Not Applicable	Occupied
	Unoccupied		Unoccupied
	Standby		Standby
	Not Set		Not Set

1. The effective occupancy can be affected by other factors listed in Table 4.

The occupancy schedule comes from either the weekly scheduler built into the TEC or as an input from the BAS. The Schedule Source must be selected to tell the controller where to read the occupancy source from. To select the schedule source:

1. Press the Menu icon.
2. Press **Schedule**.
3. Press **Schedule Options**.
4. Press **Schedule Source** and select Schedule (Local) or External (BAS).
5. Press  to save and  to return to the previous screen.

This option is also exposed to the BAS through the point OCC-CONFIG. If BAS is configured as the occupancy source, map the point NET-OCC in and write to that point to control the schedule remotely. If the supervisor goes offline (as identified by the network icon going away on the home screen of the TEC), the control logic automatically falls back to the local schedule as the occupancy source. If that schedule is not set, the default occupancy is continuously occupied.

Setting the Local Schedule

A weekly occupancy schedule with up to four occupancy events for each day can be set locally on the TEC and operate independently of a supervisor. To set the schedule:

1. See *Selecting Schedule Source* to ensure the schedule source is set to Local.
2. Press the Menu icon.
3. Press **Schedule**.
4. Press **Set Schedule**.

5. Select the days to which the schedule should apply. Note that if events are already set for the selected days, they appear in the corresponding event box. If any events conflict between selected days, an asterisk appears in the event box. See Figure 18.

6. Select the event to be set. See Figure 18.

7. Set the Occupancy to Not Set, Occupied, Unoccupied, or Standby and press **Save**.

IMPORTANT: Internally, the TEC 3000 uses a BACnet schedule where daily schedules are independent of the previous and next days. The default occupancy of the TEC3000 from the factory is set to Occupied. As a result, a daily event at 12:00 AM must be scheduled if you do not want the controller to transition to Occupied Mode at midnight.

Figure 18: Selecting the Days (Left) and Selecting the Event (Right)

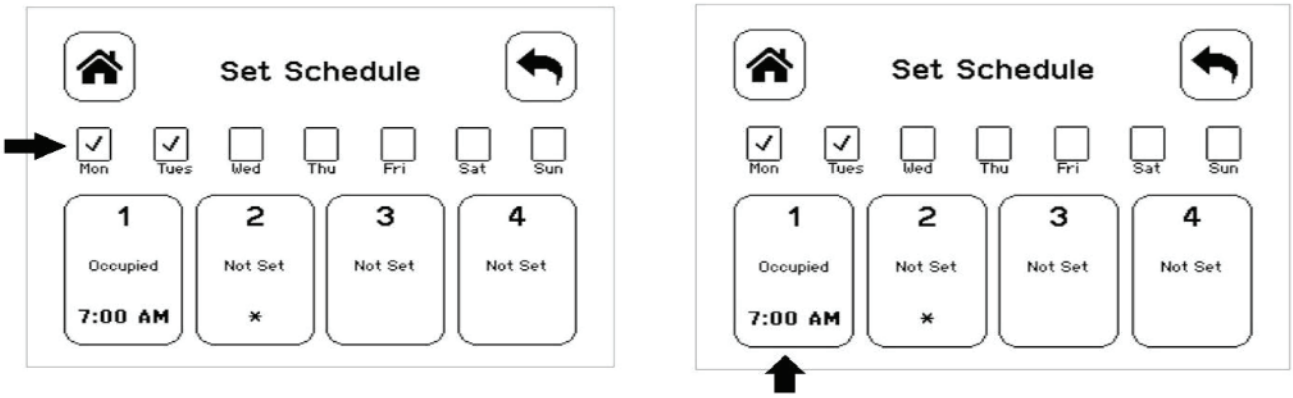
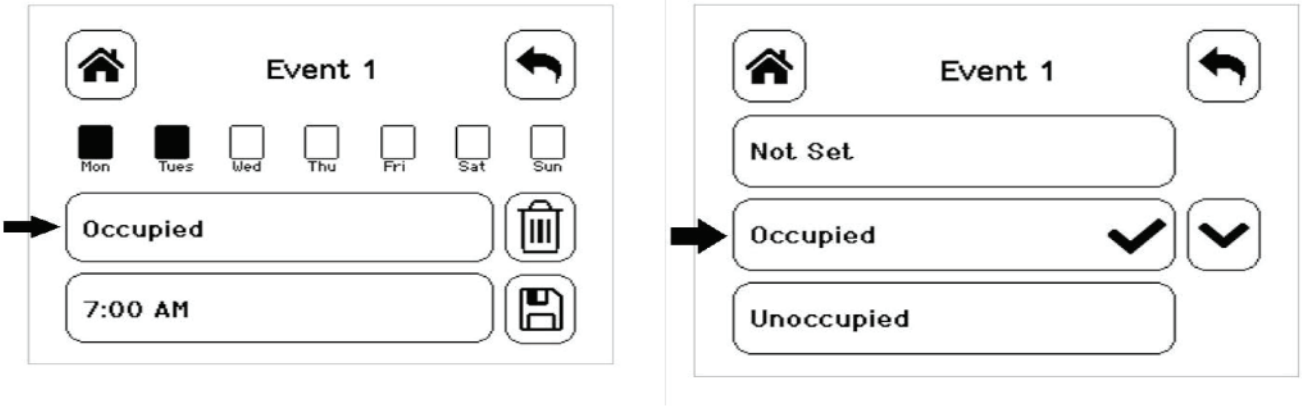
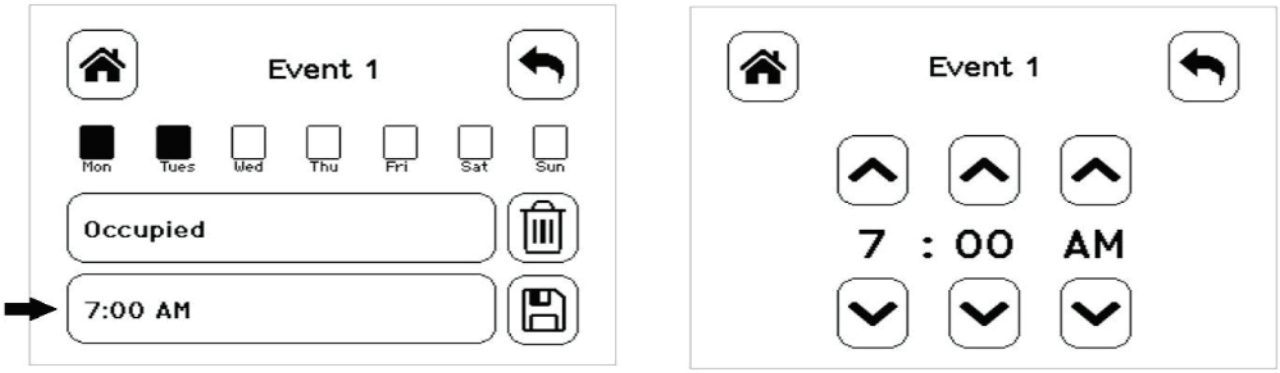


Figure 19: Setting the Room Occupancy (Left) and Setting the Occupancy Mode (Right)



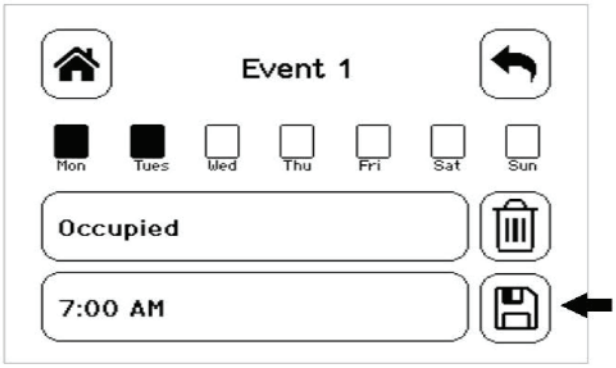
8. Set the time to the time at which the event should occur and press **Save**.

Figure 20: Setting the Event Time (Left) and Viewing the Event Time (Right)



9. Press **Save** to save the event and press the return icon to return to the main scheduler screen.

Figure 21: Returning to the Main Menu



10. Press  to save and  to return to the previous screen.

Overriding the Occupancy Mode

The TEC supports a manual override of all other schedule sources (for example, Schedule, Occupancy BI, and temporary occupancy). To override the Occupancy Mode:

1. Press the Menu icon.
2. Press **Schedule.**
3. Press **Schedule Options.**
4. Press **Manual Occupancy Mode** and select Occupied, Unoccupied, or No Override.
5. Press  to save and  to return to the previous screen.

This option is also exposed to the BAS through the point OCCOVRD-MODE.

Enabling Optimal Start

The TEC supports an advanced optimal start algorithm. The algorithm works in conjunction with a local schedule to pre-heat or pre-cool the zone before scheduled occupancy periods begin, in order to bring the zone to the desired occupied setpoint when the scheduled occupancy period begins. Occupant comfort is ensured while automatically minimizing energy usage. This algorithm creates a model of the zone being controlled and automatically determines when to start the equipment before the scheduled transition to Occupied. The start time automatically adjusts daily to minimize the time between reaching setpoint and entering Occupied state.

Note: Optimal Start does not work when the schedule source is set to External.

To enable this feature:

1. Press the Menu icon.
2. Press **Schedule.**
3. Press **Schedule Options.**
4. Press **Optimal Start Enable** and select Yes.
5. Press  to save and  to return to the previous screen.

Enabling the Motion Sensor (TEC3x11-00-000, TEC3x13-00-000 Models)

By default on models with integral motion sensing capability, the motion sensor is enabled with a default timeout of 15 minutes from the last detection of motion in the zone. On models without an integrated sensor, the default timeout is still 15 minutes, but it only is applied when one of the two configurable binary inputs is set to be a motion sensor (see *Configurable Binary Inputs* for information on configuring the binary inputs). To disable motion sensing capabilities, set the Motion Sensor Timeout to 0 minutes. See Table 4 to view the available setpoints. See Table 7 to view the setpoint values. To adjust the motion sensor timeout:

1. Press the Menu icon.
2. Press **Schedule.**
3. Press **Schedule Options**.
4. Press **Motion Sensor Timeout** and adjust accordingly.
5. Press  to save and  to return to the previous screen.

PID/PRAC+ Automatic Control Tuning

The TEC3000 features advanced proportional-integral-derivative (PID) control algorithms to maximize control performance while minimizing excessive cycling and wear on the equipment. PID is used in conjunction with a Multi-Stage Controller (MSC) for all occupied and standby control.

Additionally, the PID features Johnson Controls proprietary PRAC+ (Pattern Recognition Adaptive Control) automatic tuning, which continuously tunes the controller parameters to automatically optimize the control performance to match the equipment and zone. By default, PRAC+ is enabled and immediately begins to tune. To reset tuning at any time to the factory defaults:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Reset PID Tuning** and select Yes.
5. Press  to save and  to return to the previous screen.

PRAC+ automatic tuning can also be disabled. When disabled, the controller parameters remain at their last values until automatic tuning is re-enabled. To disable automatic tuning:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Auto PID Tuning Enable** and select No.
5. Press  to save and  to return to the previous screen.

Note: For more details on PID/PRAC+ Automatic Control Tuning, refer to the *Controller Tool Help (LIT-12011147)*.

Configurable Binary Inputs

The thermostat controller supports up to two configurable binary inputs (BIs) that can be used to add additional features to the system. Configurable Binary Inputs are accessed through **Settings > Control Setup > Inputs**. Both BIs can be configured to support the following options:

- Occupancy – Direct override of Occupied and Unoccupied
- Temp Occ – Trigger to place controller into Temporary Occupancy mode
- Motion NO – External motion sensor with an open contact output when no motion is detected
- Motion NC – External motion sensor with a closed contact output when no motion is detected
- Supply Fan Status – Input from the equipment to display a Supply Fan Fault. When Fan Alarm Action is set to Shutdown and the Supply Fan Fault is active, the TEC3000 disables the fan, heating, and cooling. When the Fan Alarm Action is set to Enable and the Supply Fan Fault is active, the TEC3000 allows the fan, heating, and cooling to operate during the Supply Fan Fault.
- Dirty Filter – Input from the equipment to display a dirty filter fault on the thermostat
- Service – Input from the equipment to display a service warning on the thermostat
- Fan Lock – Air Proof switch input to shut down control if no airflow is detected within 10 seconds of turning the fan on. Fan Lock must be manually reset from the Faults menu.
- Open Door – Works in conjunction with the Motion NO/Motion NC sensor to control occupancy
- Open Window – Sensor to shut down control if a window is opened. The controller disables control 60 seconds after detecting an opened window.
- Disabled – Sets the binary input to an unused state. When disabled, you can use the binary input for monitoring-only without affecting the thermostat functionality.

Setting both BIs to the same function is supported for all except Occupancy, Fan Lock, Open Door, and Open Window. If both BIs are set the same for those four, BI2 is ignored and only BI1 is used.

The Open Door option works in conjunction with a motion sensor, either built into the TEC or connected to another BI configured for Motion NO/NC mode.

When the door is open, motion detected by the sensor is ignored. Note that opening the door does not stop an Occupied period started by the motion sensor prior to opening the door.

The polarity of the inputs are provided in Table 6.

Table 6: Input Polarities

BI Configuration	Contact Open	Contact Closed
Occupancy	Unoccupied	Occupied
Temp Occ	No Trigger Active	Temporary Occupancy Trigger[1]
Motion NO	No Motion Detected, Standby	Motion Detected, Occupied[1]
Motion NC	Motion Detected, Occupied[1]	No Motion Detected, Standby
Dirty Filter	Dirty Filter Alarm Inactive	Dirty Filter Alarm[1]
Service	Service Alarm Inactive	Service Alarm[1]
Fan Lock	No Airflow	Airflow
Open Door	Door Open, Unoccupied	Door Closed, Occupied
Open Window	Window Open, Control Shut Down	Window Closed, Control Running
Supply Fan Status	Supply Fan Off	Supply Fan On

1. Configurations that support both BIs configured for the same feature of the action that occurs when either of the BIs enter that state.

Aux Control

The TEC has an auxiliary output that can be configured to operate in a few different ways. The Aux Mode supports seven different options:

- Not Used – Output is always off
- Occupied NO – Output is normally open, but closes when occupied
- Occupied NC – Output is normally closed, but opens when occupied
- Occupied Fan NO – Output is normally open, but is closed when occupied with the fan running
- Occupied Fan NC – Output is normally closed, but is open when occupied with the fan running
- On – Output is turned on (relay closed), used by a BAS to directly control the AUX output
- Off – Output is turned off (relay open), used by a BAS to directly control the AUX output

To set the Aux Mode:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Aux Mode** and set accordingly.
5. Press  to save and  to return to the previous screen.

This option is also exposed to the BAS through the point AUX-MODE.

When the Reheat installed parameter is set to True, the Aux output is used for Reheat Output. The setting for the Aux Mode is ignored when reheat is enabled.

Commissioning Mode

The thermostat controller has a built-in commissioning mode, which is designed to allow you to quickly test equipment wiring and functionality. Commissioning mode temporarily disables the control logic, and allows you to manually command any individual output. Commissioning is designed to be the last step of the installation process after configuring the controller for the equipment being controlled, and the available options in commissioning mode are dependent on the controller configuration. To enter commissioning mode:

1. Press the Menu icon.
2. Select Commissioning.
3. Confirm that the selection was intentional. (The control is overridden upon selecting Confirm).

Individual outputs can be commanded through this interface. For binary outputs, the options are Off or On; for analog outputs, they can be commanded from 0 to 100%. Whenever a control output is turned on, the fan is engaged for safety purposes. To command an output from the Commissioning menu:

1. Select the output to command. Adjust the value to the desired output and press **Save**. The output immediately changes to that value.
2. Restore the value to the original setting and press **Save** once again to complete testing that output.

Pressing the back icon from the main commissioning menu or allowing the menu system to time out and return to the home screen ends commissioning and puts the control logic back in control of the outputs.

Sensor Priority

The TEC3000 supports various sources of sensor data for use in control or display, including internal sensors, remote sensors (connected using an analog input), or network commanded sensors. The TEC uses the highest priority connected input (network commands followed by remote sensors and then internal sensors) for control and display. Not all sources are available for all sensors.

Network commands operate on a timeout basis. When a network point is written to by a supervisor, the point becomes the highest priority for 15 minutes. If a new update is written within 15 minutes, the timer is restarted for another 15 minutes.

Available Fault Diagnostics

- Supply Fan Faults – The TEC3000 supports a configurable Supply Fan Status feedback input that turns on when the Supply Fan Status does not match the Supply Fan Command, and can be configured to disable heating, cooling, and fan commands. The alarm delay is adjustable through the Fan Alarm delay setting. If the delay is set to 0 or the binary input is not defined, this feature becomes disabled.
- Supply Fan Runtime – The TEC3000 supports setting runtime limits on the supply fan command. When the limit is exceeded, an alarm turns on. This feature is intended to be used as a maintenance reminder. Setting the runtime limit to 0 disables this feature.
- Supply Air Temperature Diagnostics – The TEC3000 supports diagnostics when you have a Supply Air Temperature installed. The TEC3000 monitors the supply air. If you call for cooling or heating and the temperature does not fall or rise by at least the supply air temperature alarm offset value within the supply air temperature alarm delay, an alarm is generated. If the monitoring occurs while cooling, a cooling ineffective alarm is generated. If the monitoring occurs while heating, a heating ineffective alarm is generated. If you set the supply air temperature offset value set to 0, this alarm is disabled.
- Zone Temperature Alarm – When enabled, the user can set a low and high temperature alarm; and if the zone temperature rises or falls below those limits, an alarm is generated.
- Trends – Built-in trends exist for many of the inputs and outputs for the TEC3000. These trends are viewable at the TEC. The analog graph displays data in 15 minute increments over the previous 24 hours or a table with the last 25 data points. Binary trends display 25 samples taken at every change of state.

Menus and Submenus

In the following table, the * indicates that the menus depend on your configuration.

Table 7: Menus and Submenus (Part 1 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Setpoints	Occ Cooling Setpoint	72°F (22°C)	55 to 85°F (13 to 30°C)
	Occ Heating Setpoint	68°F (20°C)	55 to 85°F (13 to 30°C)
	Unocc Cooling Setpoint	80ºF (27°C)	55 to 85°F (13 to 30°C)
	Unocc Heating Setpoint	60°F (15°C)	55 to 85°F (13 to 30°C)
	Stby Cooling Setpoint	74°F (23°C)	55 to 85°F (13 to 30°C)
	Stby Heating Setpoint	66°F (19°C)	55 to 85°F (13 to 30°C)
	Humidity Setpoint*	50% RH	0 to 100% RH *Dehumidification Enable = True
Schedule	***Schedule Options***		
	Set Schedule		See *Scheduling*
	Optimal Start Enable	No	Yes or No
	Temp Occ Duration	120 minutes	0 to 300 minutes
	Motion Sensor Timeout	15 minutes	0 to 240 minutes 0 = PIR sensor disabled
	Manual Occupancy Mode	No Override	No Override, Occupied, Unoccupied
	Schedule Source	Schedule	Schedule or External
Display Settings	Passcode Enable	No	Yes or No
	Passcode*	NA	0000 to 9999 *Passcode Enable = Yes
	Brightness Setting	8	0 to 10 (most dim to brightest)
	Enable Backlight Timeout	Yes	Yes or No
	Units	IP	IP or SI
	Time	N/A	
	Time Zone	Central	All World Time Zones
	Set Time Format	24 hour	24 hour or 12 hour
	Date	N/A	
	Set Date Format	YYYY-MM-DD	YYYY-MM-DD, or Day, Month DD, YYYY, or MM-DD-YYYY
	Language	English	English, French, Spanish
	Show Fan Icon	Yes	Yes or No
	Show Temp	Yes	Yes or No
	Show Humidity	Yes	Yes or No
	Show Off Icon	Yes	Yes or No
	Show Hold Icon	Yes	Yes or No
	Show Setpoint	Yes	Yes or No
	Show Alarms	Yes	Yes or No
	Show Occ Status	Yes	Yes or No
	Show Unit Status	Yes	Yes or No
	Show Date/Time	Yes	Yes or No

Table 7: Menus and Submenus (Part 2 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Control Setup	**General**		
	Control Mode	Auto	Auto, Cooling, or Heating
	Unit Enable	Enable	Enable or Shutdown
	Fan Mode*	Smart	Not Used, On, Auto, Smart * Fan coil units only
	Max Setpoint Offset	3	0 to 20 degrees (°F or °C based on Units setting under Display Settings menu)
	Fan On Delay*	30 seconds	0 to 120 seconds * Fan coil units only
	Fan Off Delay*	30 seconds	0 to 120 seconds * Fan coil units only
	Frost Protection	Yes	Yes or No
	Reset PID Tuning*	No	Yes or No
	Auto PID Tuning Enable	Yes	Yes or No
	Dehumidification Enable*	No	Yes or No * Fan coil units with humidity sensor
	Aux Mode	Not Used	Not Used, Occupied NO, Occupied NC, Occupied Fan NO, Occupied Fan NC, On, Off
	Load Shed Rate Limit	0.066°F	0 to 1°F (0 to 0.5°C)
	Load Shed Adjust	4°F	0 to 8°F (0 to 4°C)
	Fan Alarm Delay	0 seconds	0 to 300 seconds
	Fan Alarm Action (when Fan Alarm Delay is greater than 0)	Enable	Enable or Shutdown
	Fan Alarm Reset (when Fan Alarm Delay is greater than 0)	No	Yes or No
	Fan Runtime Limit	0 hours	0 to 9,000 hours
	Fan Runtime Reset (when Fan Runtime Limit is greater than 0)	No	Yes or No
	Supply Air Temperature Alarm Offset	0°F	0 to 10°F (0 to 5.5°C)
	Supply Air Temperature Alarm Delay (when Supply Air Temp Alarm Offset is greater than 0)	300 seconds	300 to 3,600 seconds
	Inputs		
	BI1 Configuration	Disabled	Disabled, Occupancy, Occupancy Override, Remote PIR, Dirty Filter, Service, Fan Lock, Open Door, Open Window
	BI2 Configuration	Disabled	Disabled, Occupancy, Occupancy Override, Remote PIR, Dirty Filter, Service, Fan Lock, Open Door, Open Window
	Supply Temp Type	Analog Sensor	Analog Sensor, Heating NC, Cooling NC * Non four-pipe units only
	Supply Temp Sensor*	Nickel	Nickel, Platinum, A99B, 2.25k ohm negative temperature coefficient (NTC), 10k ohm NTC, 10k ohm NTC Type 3 * SAT Mode = Analog Sensor, non four-pipe

Table 7: Menus and Submenus (Part 3 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Control Setup (Cont.)	Supply Temp Offset*	0	-5 to 5 (°F or °C based on Units setting under Display Settings menu * Analog Sensor
	Zone Temp Sensor	Nickel	Nickel, Platinum, A99B, 2.25k ohm NTC, 10k ohm NTC, 10k ohm NTC Type 3
	Zone Temp Offset	0	-5 to 5 (°F or °C based on Units setting under Display Settings menu
	Humidity Offset	0% RH	-15% to 15% RH
	Reset Sensors	False	True or False
	Zone Temp Alarm Enabled	No	Yes or No
	Zone Temp Low Limit	55°F	32 to 150°F (0 to 65.56°C)
	Zone Temp High Limit	90°F	32 to 150°F (0 to 65.56°C)
Network Setup	FC Comm Mode	BACnet/MSTP	BACnet/MSTP, N2
	BACnet Instance ID*	1	0 to 4,194,302 * BACnet/MSTP communication mode
	N2 Device Address*	4	1 to 255 * N2 communication mode
	BACnet Device Address*	4	4 to 127 * BACnet/MSTP communication mode
	MSTP Baud Rate*	Auto	Auto, 1200, 9600, 19200, 38400, 76800 * BACnet/MSTP communication mode
	BACnet Encoding Type BACnet/MSTP Communication Mode	ISO 10646 (UCS-2)	ISO 10646 (UCS-2), ANSI X3.4 (US-ASCII)
Equipment Setup	**General**		
	Unit Type	4-Pipe	2-Pipe, 4-Pipe, VAV
	Heating/Cooling Device Type*	Floating	On/Off, Floating * Fan coil units only
	Actuator Stroke Time*	30 seconds	5 to 300 * Floating Heating/Cooling device type only
	Cooling Min On Time*	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Cooling Min Off Time*	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Heating Min On Time*	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Heating Min Off Time	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Supply Fan*		
	Supply Fan Type*	Single Speed	Single Speed, Multi-speed, Variable Speed * Fan coil units only
	Start Voltage*	2 VDC	0 to 10 VDC * Fan coil units only, variable speed fan

Table 7: Menus and Submenus (Part 4 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Equipment Setup (Cont.)	Full Speed Voltage*	10 VDC	0 to 10 VDC, proportional *Fan coil units only, variable speed fan
	Min Command*	20%	0 to 100% * Fan coil units only, variable speed fan
	Med Fan Speed On Cmd*	33%	0 to 100% * Fan coil units only, multi-speed fan
	High Fan Speed On Cmd*	66%	0 to 100% * Fan coil units only, multi-speed fan
	Reheat*		
	Reheat Installed	No	Yes (True) or No (False)
	Reheat Min Damper Position*	20%	0 to 100% * VAV units with reheat installed
	Reheat Fan Required*	No	Yes or No *Fan coil units with reheat installed
	Reheat Min On Time*	180 seconds	0 to 360 second * Reheat installed
	Reheat Min Off Time*	180 seconds	0 to 360 seconds * Reheat installed
	Changeover		
	Changeover Mode	Auto	Auto, Cooling, or Heating * Non 4-Pipe units
	Supply Temp Type	Analog Sensor	Analog Sensor, Heating NC, Cooling NC * Changeover Mode = Auto
	Changeover Setpoint	55°F	40 to 200°F (4 to 93°C) * Supply temp type = analog sensor
	Supply Temp Sensor	Nickel	Nickel, Platinum, A99B, 2.25k ohm NTC, 10k ohm NTC, 10k ohm NTC Type 3 * Supply temp type = analog sensor
	Supply Temp Offset	0°F	-5 to 5°F (-3 to 3°C) * Supply temp type = analog sensor

Table 7: Menus and Submenus (Part 5 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Trend	EFF-ZNT		-50 to 250°F (-45.56 to 121.11°C)
	EFF-SETPOINT		45 to 100°F (7.22 to 37.78°C)
	EFF-ZNH		0 to 100%RH
	B1 Status		On or Off
	B2 Status		On or Off
	EFF-OAT		-50 to 250°F (-45.56 to 121.11°C)
	EFF-SAT		-50 to 250°F (-45.56 to 121.11°C)
	FANSPD-S		On or Off
	CLG1-C		On or Off
	CLG2-C		On or Off
	HTG1-C		On or Off
	HTG2-C		On or Off
	OAD-O		0 to 100%
	HTG-O		0 to 100%
	CLG-O		0 to 100%
System Status	Occupancy Source	Local Schedule	Occupancy BI Temp Occ BI Temp Occ Occ Override Local Schedule BAS Schedule Occupancy Sensor
	Unit Status	Cooling	System Fault Airflow Fault Open Window Control Off Unreliable Temperature Dehumidification Idle Cooling Heating Cooling Unavailable Heating Unavailable Cooling Unavailable due to Changeover Cooling Unavailable due to OA Temp Cooling Unavailable due to Control Mode Heating Unavailable due to Changeover Heating Unavailable due to OA Temp Heating Unavailable due to Control Mode

Table 7: Menus and Submenus (Part 6 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
System Status (Cont.)	Supply Air Temperature	75°F	-50 to 250°F (-45 to 121°C)
	Changeover State	Supply Temperature Unreliable	Changeover Disabled Cooling Mode Heating Mode Supply Temperature Unreliable
	Zone Temp Source	Internal Sensor	Unreliable Internal Sensor Remote Sensor Network Override Input Not Installed
Control Status	Cooling % Command		0 to 100%
	Heating % Command		0 to 100%
	Reheat % Command		0 to 100%
	Cool Stage 1	Off	On or Off
	Heat Stage 1	Off	On or Off
	Reheat Stage 1	Off	On or Off
	Fan % Command	0%	0 to 100%
	Fan	On	On or Off
Controller Info	Model Name	TEC3x1x-xx	–
	Software Version	x.x.x.xxxx	–
	Unit Name	TECxxxxx	–
	Device Name		User-Supplied
	Device Description	TEC3000	–
Commissioning	Supply Air Temperature	Display Current Temperature	–
	Heat Command	0%	0 to 100%
	Cool Command	0%	0 to 100%
	Supply Fan	No	Yes or No
	Aux	No	Yes or No
Update	View Version	x.x.x.xxxx	Current Release of Software
	Load Firmware		File list from USB drive
	Restore		File list from USB drive or local storage[1]
	Backup		File list from USB drive or local storage[1]

1. Configuration can be backed up to the USB drive and restored to similar models to expedite the commissioning process.

Troubleshooting

Table 8: Fault List (Part 1 of 3)

Faults	Probable Causes	Solutions
Remote Zone Temp Fail	The External Zone Temperature sensor has been disconnected or has failed.	1. Check the wiring of the sensor. 2. If intentionally disconnected, reset sensors through the menu. 3. If the problem persists, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Supply Temp Fail	The External Supply Temperature sensor has been disconnected or has failed.	1. Check the wiring of the sensor. 2. If intentionally disconnected, result fault by entering the menu, enter Control Setup, and select Inputs to reset the sensors. 3. If the problem persists, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Internal Sensor Fail	An internal sensor has failed on the TEC.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Dehum Unavailable	Dehumidification is unavailable because the zone humidity sensor has failed or the humidity reading is not reliable.	1. If the source of zone humidity was a BAS, check the BAS to ensure that it is still online and is providing the TEC with the humidity reading. If removal of the BAS mapping was intentional, reset the sensors through the menu. 2. If the problem persists, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Service	Equipment connected to the BI configured for a Service alarm is triggering the alarm.	Service the equipment by way of the manufacturer's recommendation.
Dirty Filter	Equipment connected to the BI configured for a Dirty Filter alarm is triggering the alarm.	Replace the filter in the equipment as explained in the manufacturer's instructions.
Calibration Corrupt	Factory calibration data is lost or is not installed.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Changeover Fail	The Supply Temperature Sensor is not installed, has failed, or has been disconnected and the TEC can no longer detect changeover mode to cool or heat.	Follow the same steps as Supply Temp Fail alarm.
Zone Temp Unreliable	All sources of zone temperature are unreliable, including the onboard sensor.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Open Window	The switch connected to the BI configured for Open Window is sensing that the window is opened, and control has shut down.	1. Close the window to resume control. 2. Check sensor functionality with an ohmmeter, and verify the wiring to the TEC. 3. Order replacement units and return the affected devices to Johnson Controls under the RMA program.

Table 8: Fault List (Part 2 of 3)

Faults	Probable Causes	Solutions
Fan Lock	The switch connected to the BI configured for Fan Lock did not sense airflow within 10 seconds of starting the fan, and control has been shut down.	1. Inspect equipment to ensure fan functions. 2. Check sensor functionality with an ohmmeter, and verify wiring to the TEC. 3. Reset fault by entering the menu, selecting Fault Status, and selecting the Fan Lock. 4. Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Humidity Unreliable	The zone humidity reading was reliable and has now failed.	1. If the source of zone humidity was the onboard sensor, contact Johnson Controls product sales and support. 2. If the source of zone humidity was a BAS, check the BAS to ensure that it is still online and providing the TEC with the humidity reading. If removal of the BAS mapping was intentional, reset sensors through the menu.
Controller Fault	The controller has detected an internal fault that it cannot recover.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
	An unknown error has prevented the controller from turning on.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Touchscreen Unavailable	The touchscreen components have failed to initialize.	1. Reboot the controller. 2. If problems persist, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Board Mismatch	The baseboard and CPU board are paired incorrectly. An error message appears on the TEC indicating the model number of the baseboard and CPU board.	Match the baseboard to its corresponding CPU board. See *Repair Information* for information on ensuring that you have the CPU board and base board paired correctly.
USB Malfunction	A USB drive has malfunctioned and drawn more than the maximum allowed current.	1. Attempt to insert and use the USB drive again. 2. Try a new USB drive. 3. If problems persist, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Supply Fan Runtime Limit Extended	The Supply Fan Runtime has exceeded the configured Supply Fan Runtime Limit.	1. Service the Supply Fan. 2. Reset the Supply Fan runtime.
Heating Ineffective	The Supply Air Temperature has not increased above the configured Supply Air Temperature Alarm Offset while heating has been active for at least the Supply Air Temperature Alarm Delay.	Verify that the heating elements on the rooftop are functioning properly.
Cooling Ineffective	The Supply Air Temperature has not decreased below the configured Supply Air Temperature Alarm Offset while cooling has been active for at least the Supply Air Temperature Alarm Delay.	Verify that the cooling elements on the rooftop are functioning properly.
Supply Fan Fault	The Supply Fan Status configured for either BI1 or BI2 has not proved within the configured Fan Alarm Delay.	1. Verify that the Supply Fan is operating when turned on. 2. Verify that the Supply Fan Status wiring is connected correctly.

Table 8: Fault List (Part 3 of 3)

Faults	Probable Causes	Solutions
Zone Temperature Too Cold	The Zone Temperature has decreased below the configured Zone Temp Low Limit.	Verify that the TEC and the RTU heating are enabled and functioning.
Zone Temperature Too Hot	The Zone Temperature has increased above the configured Zone Temp High Limit.	Verify that the TEC and the RTU cooling are enabled and functioning.

Table 9: Troubleshooting Details[1] (Part 1 of 2)

Symptom	Probable Causes	Solutions
The controller displays **Idle** with a **Unit Status of Cooling Unavailable due to Changeover** despite being above cooling setpoint, or with a status of **Heating Unavailable due to Changeover** despite being below the setpoint.	The 2-pipe fan coil/VAV system does not have a changeover sensor and switch connected, or the sensor/switch has failed.	1. Check the wiring of the supply temperature sensor/switch. 2. Verify that the changeover is set up correctly for the type of sensor attached (sensor or switch).
	The changeover temperature is sensing a hot supply, but the controller is requesting cooling.	1. Verify that the supply is not in heating mode. If it is, nothing can be done from the TEC. 2. Check the wiring of the supply temperature sensor or switch. 3. Check the placement of the supply temperature sensor or switch. 4. Verify that the changeover is set up correctly for the type of sensor attached (sensor or switch).
	Changeover temperature is sensing a cold supply, but the controller is requesting heating.	1. Verify that the supply is not in cooling mode. If it is, nothing can be done from the TEC. 2. Check the wiring of the supply temperature sensor or switch. 3. Check the placement of supply temperature sensor or switch. 4. Verify that the changeover is set up correctly for the type of sensor attached (sensor or switch).
The controller displays **Idle** with a **Unit Status of Cooling Unavailable due to Control Mode** despite being above cooling setpoint, or with a status of **Heating Unavailable due to Control Mode** despite being below the setpoint.	The Control Mode is set to Cooling Mode, but the controller is requesting heating.	Change the Control Mode to Auto or Heating.
	The Control Mode is set to Heating Mode, but the controller is requesting cooling.	Change the Control Mode to Auto or Cooling.
The controller displays **Cooling** or **Heating,** but the staged equipment shuts off.	When in heating or cooling mode with staged equipment, the equipment cycles on and off during the cooling or heating operation in order to maintain setpoint.	Expected behavior.
The staged equipment shuts off above the cooling setpoint or below the heating setpoint.	The PID control algorithm minimizes overshoot and energy usage for the particular equipment and zone, and may cycle the equipment prior to reaching setpoint.	Expected behavior.

Table 9: Troubleshooting Details[1] (Part 2 of 2)

Symptom	Probable Causes	Solutions
The staged equipment cycles too rapidly or too slowly.	The control band around the setpoint is determined by the minimum on/off times and is set incorrectly for the equipment, zone, or user preference. There is a tradeoff between reduced control band size and increased energy usage and equipment wear from increased cycling.	1. To tighten the control band, reduce the minimum on and off time settings. Minimal control band is achieved with a 60-second minimum on/off time. 2. To loosen the control band, increase the minimum on and off time settings.
The controller provides an error when trying to upgrade firmware.	The USB drive is defective.	Try a different USB drive.
	The firmware package is corrupt.	Try re-downloading the firmware image onto the USB drive and retry the upgrade.
The controller provides an error when trying to back up settings.	The USB drive is defective.	Try a different USB drive.
The controller provides an error when trying to restore settings from a backup.	The USB drive is defective.	Try a different USB drive.
	The Restore file is corrupt.	Try restoring a different backup file.
	The Restore file is from an incompatible model TEC.	Ensure that the backup file being restored was from the same model TEC.
The controller is unable to access a USB drive.	The drive is formatted as NTFS or another unsupported format. The TEC supports FAT and FAT32 formats only.	Reformat the USB drive, or try a different USB drive with a supported format.
	The USB drive is defective.	Try a different USB drive.
The controller displays **Board Mismatch**.	The I/O board that the display board is currently attached to does not match the one that initially shipped with the display board.	Attach the display board to the correct I/O board.
	A hardware failure is causing the two boards to incorrectly identify themselves.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
The controller displays **Controller Fault**.	An internal fault was detected and the controller was unable to recover.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
The Bell icon is displayed on the TEC home page.	The fault has been detected on the TEC.	See Table 8 for TEC fault causes and resolution.
Partial Restore Complete is displayed when trying to restore settings from a backup file.	Not all of the items in the backup file have been restored. This error can be caused by a value being out of the minimum or maximum range in the backup file. It may also occur if there are inconsistencies in the reliability of a setting in the backup file and on the TEC device.	1. Create a Backup file on a USB drive for the TEC that is showing the issue. 2. Edit the backup file created in the previous step on a PC to reflect the desired settings. 3. Verify that the modified values are within minimum and maximum range in the backup file. 4. Restore the settings from the newly edited backup file on the TEC.
The temperature displayed is lower than the actual room temperature.	Cold air drafts are entering the back of the TEC.	Seal any holes behind the TEC to reduce drafts.
The Online icon does not appear for a networked controller.	There is improper field bus wiring.	Refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034).*

1. For common MS/TP troubleshooting information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034).*

Repair Information

If the TEC3000 Series Thermostat Controller fails to operate within its specifications, replace the unit. For a replacement thermostat controller, contact the nearest Johnson Controls representative.

Technical Specifications

TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability (Part 1 of 2)

Power Requirements		19 to 30 VAC, 50/60 Hz, 4 VA at 24 VAC nominal, Class 2 or safety extra-low voltage (SELV)
USB Port Power Rating		120 to 250 mA current draw supported
Relay Contact Rating	**On/Off or Floating Control**	19 to 30 VAC, 1.0 A maximum, 15 mA minimum, 3.0 A in-rush, Class 2 or SELV
Fan Relay Output Rating		19 to 30 VAC, 1.0 A maximum, 15 mA minimum, 3.0 A in-rush
Auxiliary Output Rating/Triac Output		19 to 30 VAC, 1.0 A maximum, 15 mA minimum, 3.0 A in-rush
Binary Inputs		Dry contact across terminal COM to terminals BI1, BI2, or COS
Analog Inputs		Nickel, platinum, A99B, 2.25k ohm NTC, 10k ohm NTC, 10k ohm NTC Type 3 across terminal COM to terminals R SEN or COS
Temperature Sensor Type		Local 1k ohm platinum sensor
Wire Size		18 AWG (1.0 mm diameter) maximum, 22 AWG (0.6 mm diameter) recommended
MS/TP Network Guidelines		Up to 100 devices maximum for each Network Automation Engine (NAE); 4,000 ft (1,219 m) maximum cable length
Temperature Range	**Backlit Display**	-40.0°F/-40.0°C to 122.0°F/50.0°C in 0.5° increments
	Heating Control	40.0°F/4.5°C to 90.0°F/32.0°C
	Cooling Control	54.0°F/12.0°C to 100.0°F/38.0°C
Accuracy	**Temperature**	±0.9F°/±0.5C° at 70.0°F/21.0°C typical calibrated
	Humidity	±5% RH from 20 to 80% RH at 50 to 90°F (10 to 32°C)
Minimum Deadband		2F°/1C° between heating and cooling
Occupancy Sensor Motion Detection (Occupancy Sensing Models)		Minimum of 94 angular degrees up to a distance of 15 ft (4.6 m); based on a clear line of sight
Ambient Conditions	**Operating**	32 to 122°F (0 to 50°C); 95% RH maximum, noncondensing
	Storage	-22 to 122°F (-30 to 50°C); 95% RH maximum, noncondensing
Compliance	**BACnet International**	BACnet Testing Laboratories™ (BTL) 135-2001 Listed BACnet Application Specific Controller (B-ASC)
	United States	UL Listed, File E27734, CCN XAPX, Under UL60730
		FCC Compliant to CFR 47, Part 15, Subpart B, Class B
	Canada	UL Listed, File E27734, CCN XAPX7, Under E60730
		Industry Canada, ICES-003
CE	**Europe**	CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and the RoHS Directive.
	Australia and New Zealand	RCM Mark, Australia/NZ Emissions Compliant

TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability (Part 2 of 2)

Shipping Weight	**Models without Occupancy Sensor**	0.75 lb (0.34 kg)
	Models with Occupancy Sensor	0.77 lb (0.35 kg)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

European Single Point of Contact:

JOHNSON CONTROLS
WESTENDHOF 3
45143 ESSEN
GERMANY

NA/SA Single Point of Contact:

JOHNSON CONTROLS
507 E MICHIGAN ST
MILWAUKEE WI 53202
USA

APAC Single Point of Contact:

JOHNSON CONTROLS
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NO. 22 BLOCK D NEW DISTRICT
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CONTRACTOR POC	JON DAVIS
DATE	1/31/2024
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INSTALLATION MANUAL

R-410A
ZT SERIES W/SMART EQUIPMENT™

3 - 5 Ton

60 Hertz



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General

York® ZT037-061 units are single package air conditioners with optional gas heating designed for outdoor installation on a rooftop or slab and for non-residential use. These units can be equipped with factory or field installed electric heaters for heating applications.

These 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, gas supply (where applicable), and duct connections. The electric heaters 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, service agency or the gas supplier.

⚠ 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.

⚠WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

a. Do not try to light any appliance.
b. Do not touch any electrical switch; do not use any phone in your building.
c. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
d. If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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.

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

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

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

Reference

Additional information is available in the following reference forms:

- Technical Guide - ZT037-061, 5167821
- General Installation - ZT037-061, 5167543
- Smart Equipment™ Control Quick Start Guide - 1136326
- Economizer Accessory -
  Downflow Factory Installed
  Downflow Field Installed
  Horizontal Field Installed
- Motorized Outdoor Air Damper
- Manual Outdoor Air Damper (0-100%)
- Manual Outdoor Air Damper (0-35%)
- Gas Heat Propane Conversion Kit
- Gas Heat High Altitude Kit (Natural Gas)
- Gas Heat High Altitude Kit (Propane)
- –60°F Gas Heat Kit
- Electric Heater Accessory

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

⚠ CAUTION

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

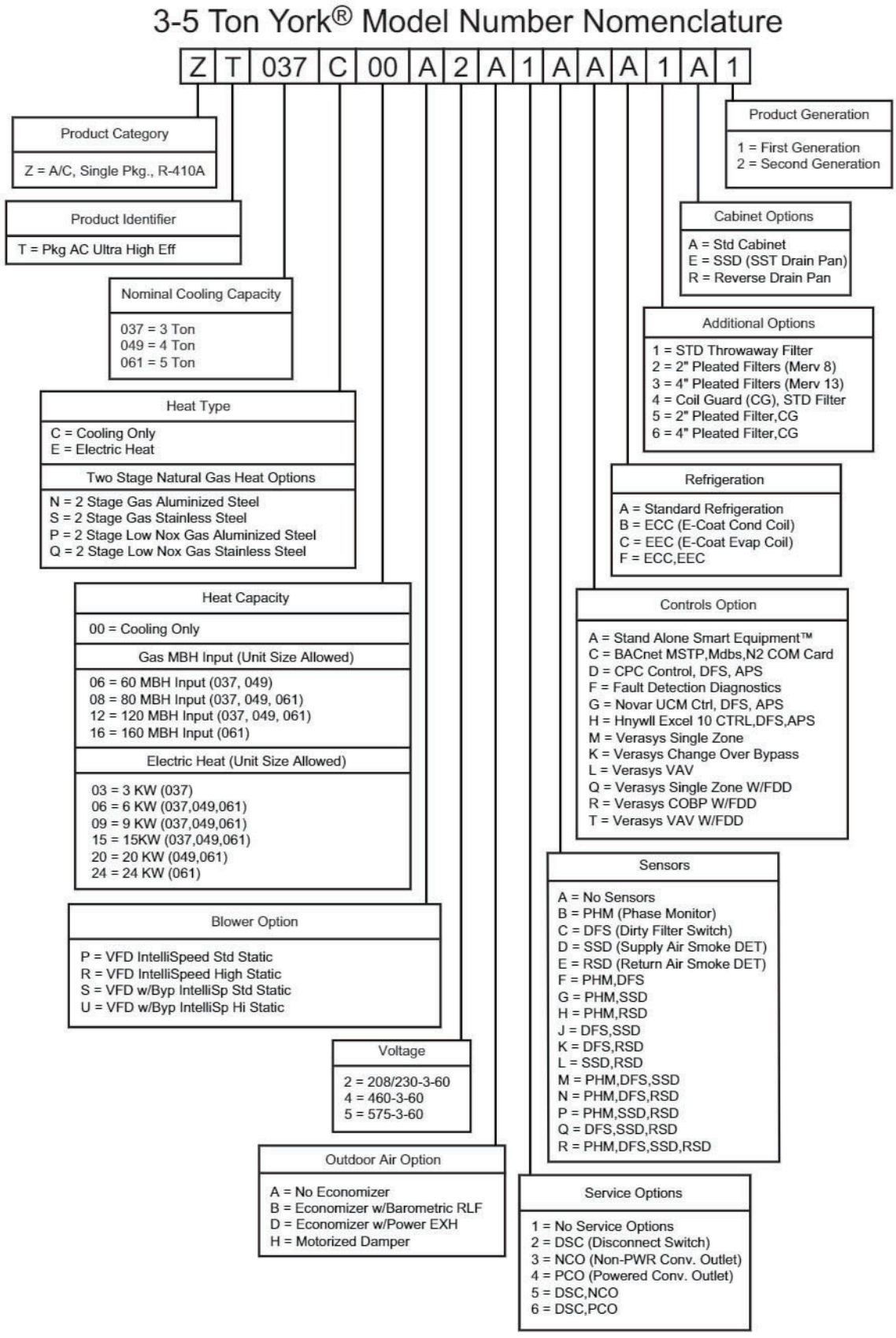
⚠WARNING

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

⚠ CAUTION

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

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. Refer to the unit rating plate for the approved type of gas for this product.
2. Install this unit only in a location and position as specified on Page 7 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 5, 27, 28 and 50 of these instructions.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 52 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

It is permitted to use the unit for heating and cooling of buildings or structures under construction where the application and use must comply with all manufacturer's installation instructions including:

- Proper installation of vent outlet air and combustion air intake hoods;
- Unit must be operated under thermostatic control;
- Return and supply air ducts must be sealed to the unit;
- Air filters in place;
- Unit furnace input rate and temperature rise must be set per rating plate marking;
- Return air temperature maintained between 55ºF (13ºC) and 80ºF (27ºC);
- Upon completion of the construction phase and prior to formal start up and commissioning, the unit, duct work and components should be thoroughly cleaned and inspected to assure that operation of the unit during construction has not contaminated the unit.

NOTE: Should the unit be used during the construction phase the standard limited warranty provisions go into effect once the unit is placed into operation.

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

Preceding Installation

1. Remove the two screws holding the brackets in the front, rear and compressor side fork-lift slots.



Figure 1: Unit Shipping Bracket

2. Turn each bracket toward the ground and the protective plywood covering will drop to the ground.
3. Remove the condenser coil external protective covering prior to operation.
4. Remove the toolless doorknobs and instruction packet prior to installation.

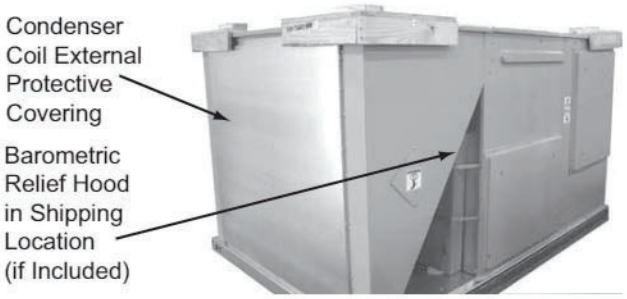


Figure 2: Condenser Covering

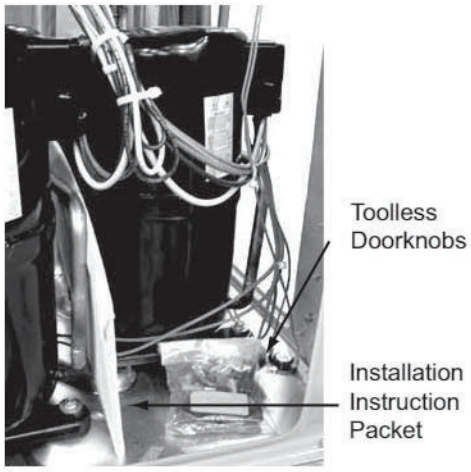


Figure 3: Compressor Section

5. If a factory option convenience outlet is installed, the weatherproof outlet cover must be field installed. The cover shall be located behind the filter access panel. 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 operation. 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. National Fuel Gas Code, ANSI Z223.1 - Latest Edition
3. Gas-Fired Central Furnace Standard, ANSI Z21.47a. - Latest Edition
4. Local building codes, and
5. Local gas 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.

After installation, gas fired units must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

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

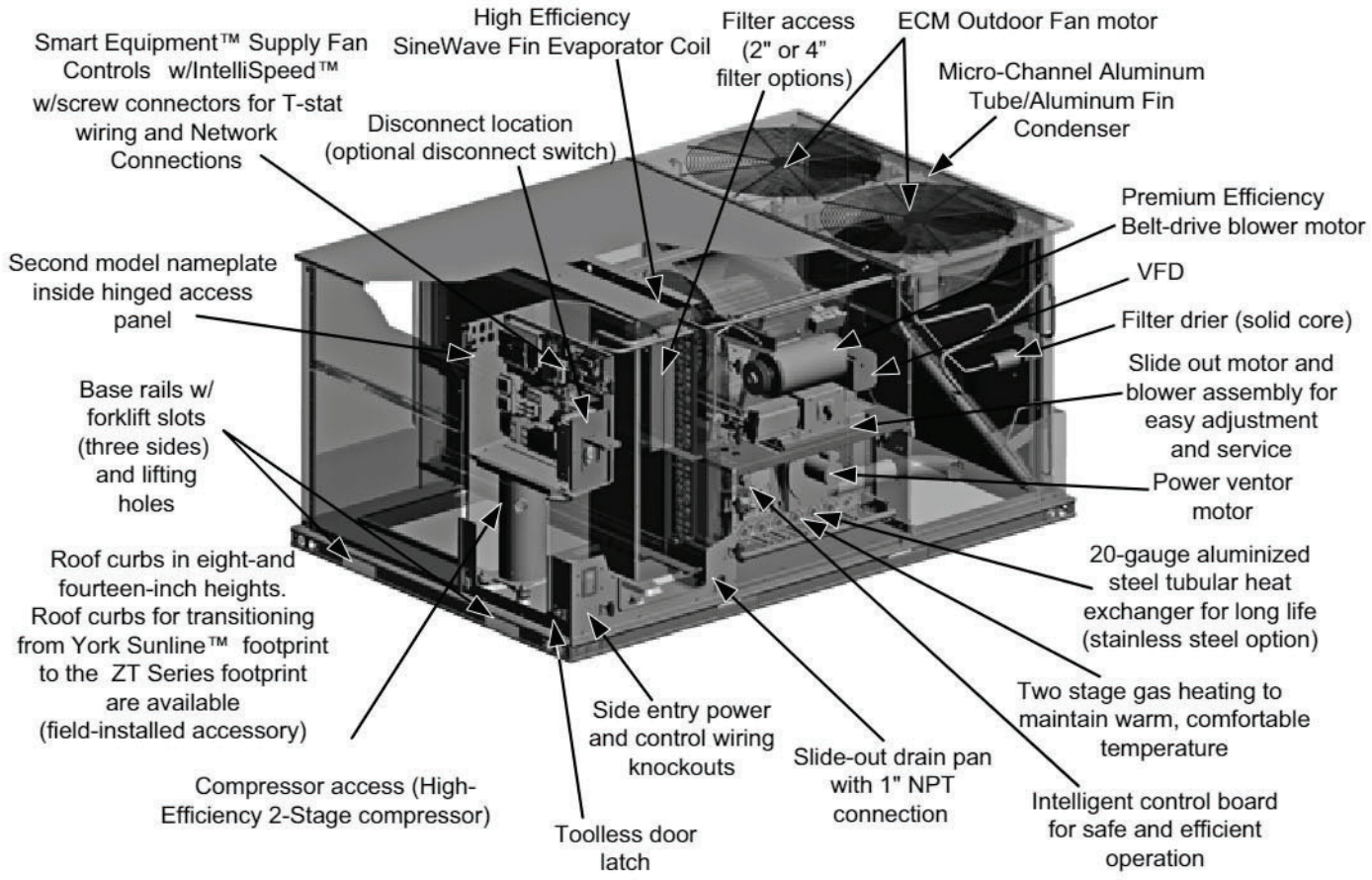


Figure 4: Component Location (ZT037 Shown)

Table 1: ZT037-061 Unit Limitations

Size (Tons)	Model	Unit Voltage	Unit Limitations		
			Applied Voltage		Outdoor DB Temp
			Min	Max	Max (°F)
037 (3.0)	ZT	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
049 (4.0)	ZT	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
061 (5.0)	ZT	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	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.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solution, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, anti static fabric softeners for clothes dryers, masonry acid washing materials.

Clearances

All units require particular clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with section 5.3 of Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 – Latest Edition (in U.S.A.), or Sections 7.2, 7.3, or 7.4 of Gas Installation Codes, CSA-B149.1 (in Canada) - Latest Edition, and/or applicable provisions of the local building codes. Refer to Table 5 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, combustion air inlet 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. Slotted openings in the base rails are provided for this purpose.

LENGTH OF FORKS MUST BE A MINIMUM OF 60 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.

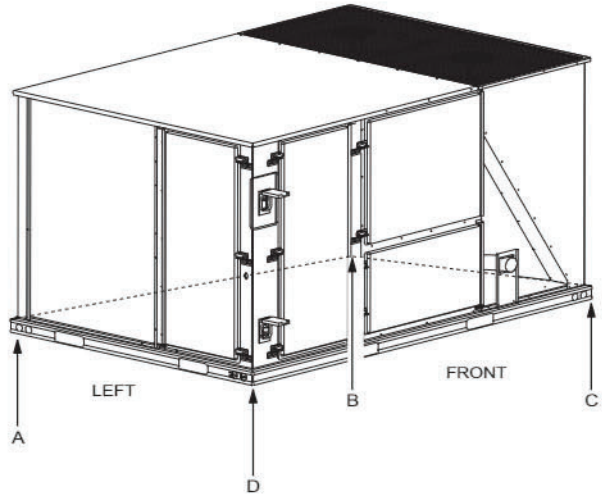


Figure 5: Unit 4 Point Load Weight

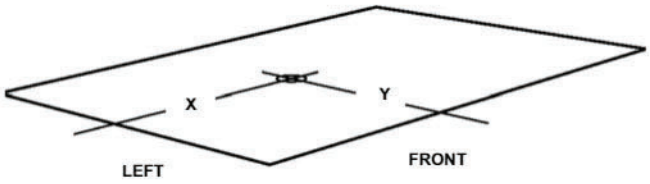


Figure 6: Center of Gravity

Table 2: Weights and Dimensions

Size (Tons)	Model	Weight (lbs.)		Center of Gravity		4 Point Load Location (lbs.)			
		Shipping	Operating	X	Y	A	B	C	D
037 (3)	ZT	927	922	42.4	24.7	202	184	255	281
049 (4)	ZT	965	960	42.5	25.5	217	198	260	285
061 5)	ZT	973	968	41.6	25.5	223	196	257	293

Table 3: ZT037-061 Unit Accessory Weights

Unit Accessory	Weight (lbs.)	
	Shipping	Operating
Economizer	90	85
Power Exhaust	40	35
Electric Heat[1]	49	49
Gas Heat[2]	110	110

1. Weight given is for the maximum heater size available (24KW).
2. Weight given is for the maximum number of tube heat exchangers available (8 tube).

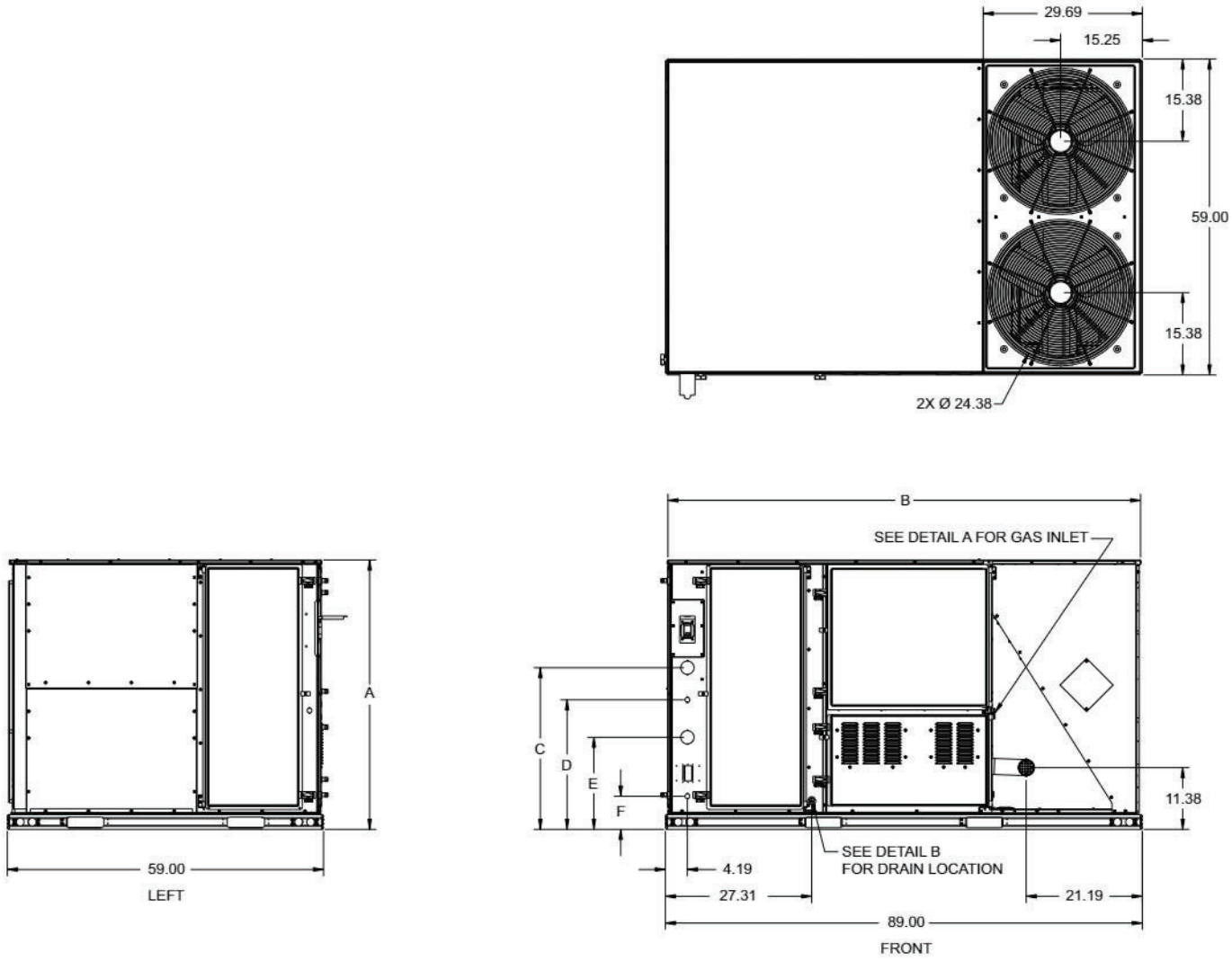
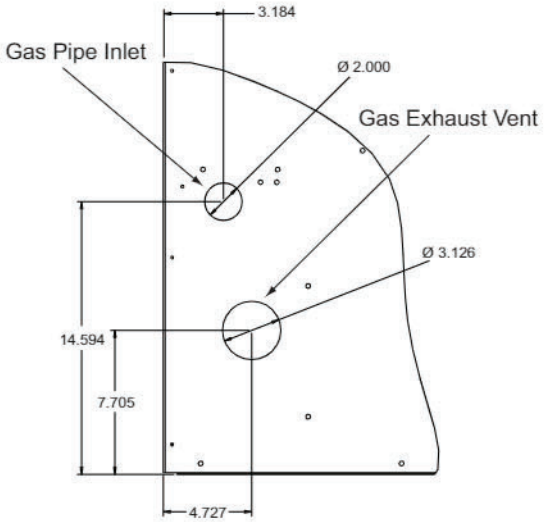


Figure 7: ZT037-061 Physical Dimensions

Table 4: ZT037-061 Unit Physical Dimensions

Unit Model Number	Dimension (in.)					
	A	B	C	D	E	F
ZT037	42	89	22 1/8	18 3/16	15 3/16	6 3/16
ZT049	42	89	22 1/8	18 3/16	15 3/16	6 3/16
ZT061	42	89	22 1/8	18 3/16	15 3/16	6 3/16

Detail A



42" CABINET

Detail B

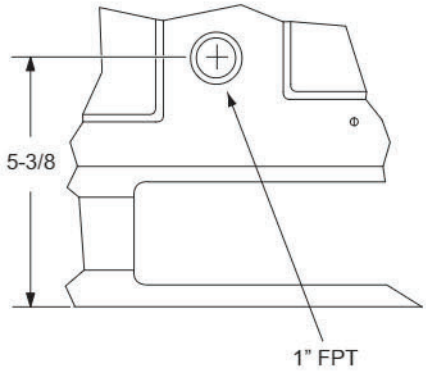


Table 5: ZT037-061 Unit Clearances

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

1. Units must be installed outdoors. Over hanging structure or shrubs should not obscure condenser air discharge outlet.
2. Units may be installed on combustable floors made from wood or class A, B or C roof covering materials.

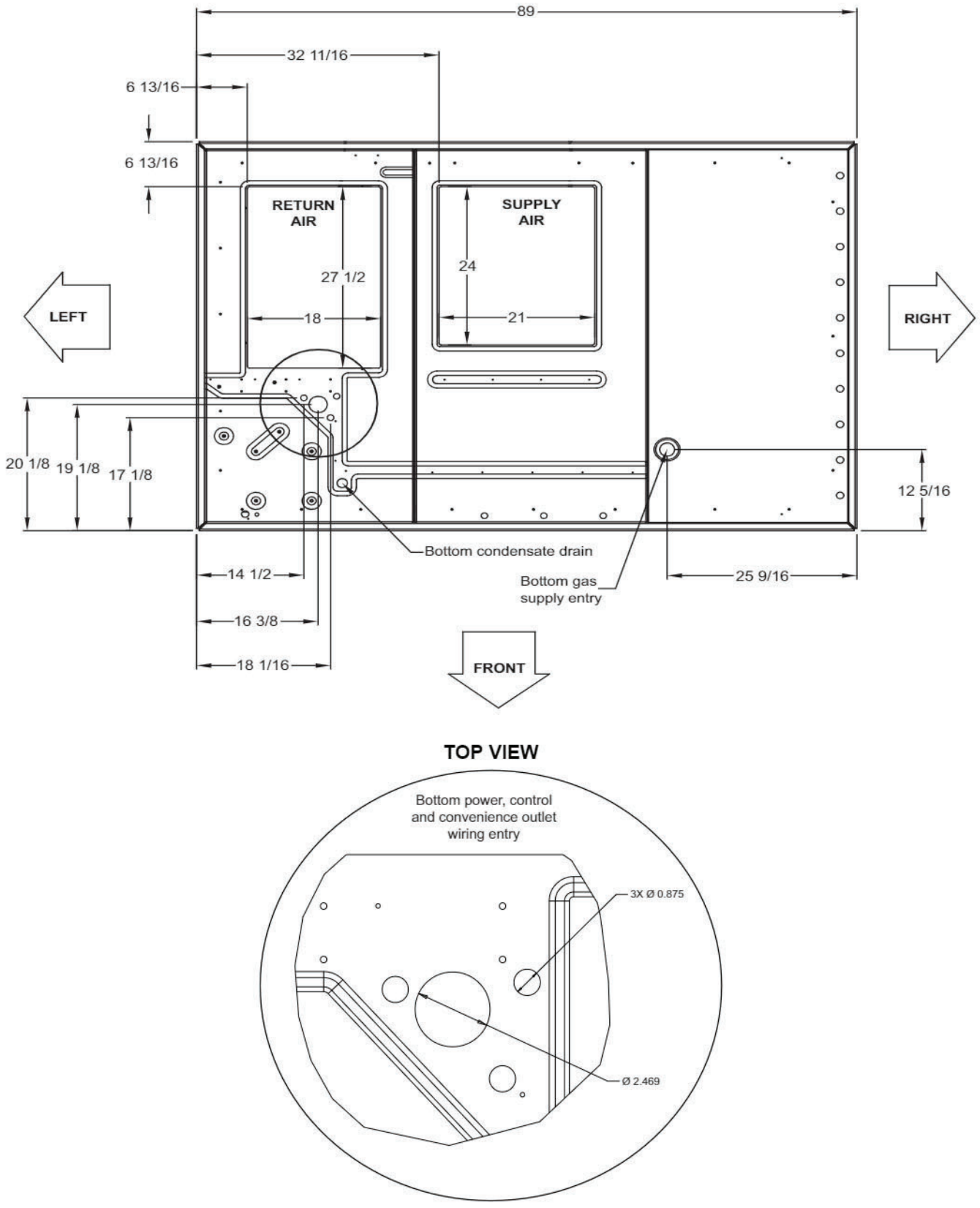


Figure 8: ZT037-061 Unit Bottom Duct Openings

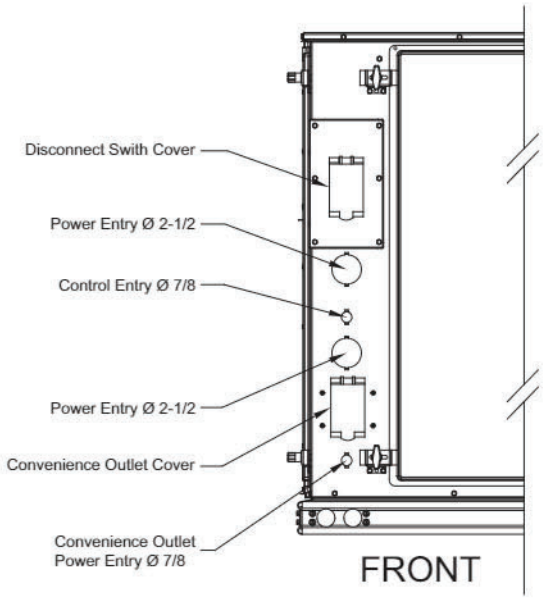


Figure 9: ZT037-061 Unit Electrical Entry

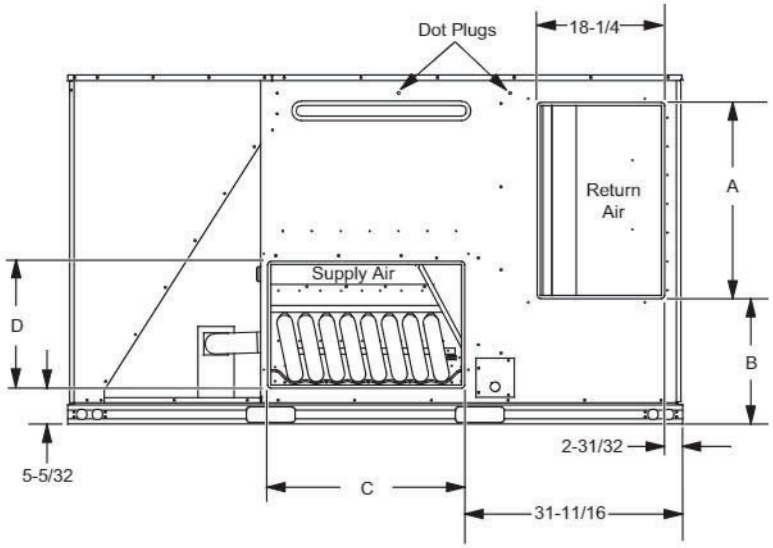


Figure 10: ZT037-061 Unit Side Duct Openings

Table 6: Side Duct Dimensions

Unit Model Number	Dimension (in.)			
	A	B	C	D
ZT037	27 3/4	12 1/16	27 1/2	16
ZT049	27 3/4	12 1/16	27 1/2	16
ZT061	27 3/4	12 1/16	27 1/2	16

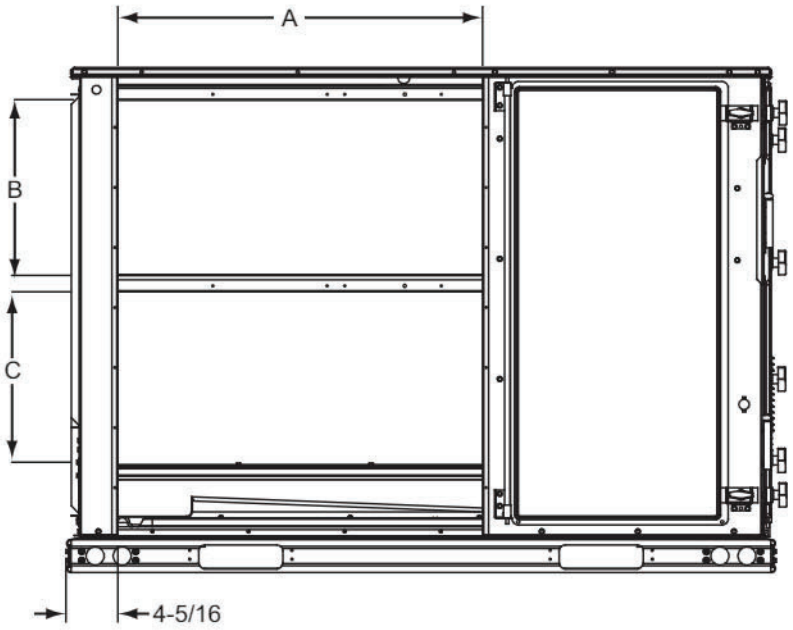


Figure 11: ZT037-061 Unit Left/End Duct Opening

Table 7: Left/End Duct Dimensions

Unit Model Number	Dimension (in.)		
	A	B	C
ZT037	30.357	13.365	22.516
ZT049	30.357	13.365	22.516
ZT061	30.357	13.365	22.516

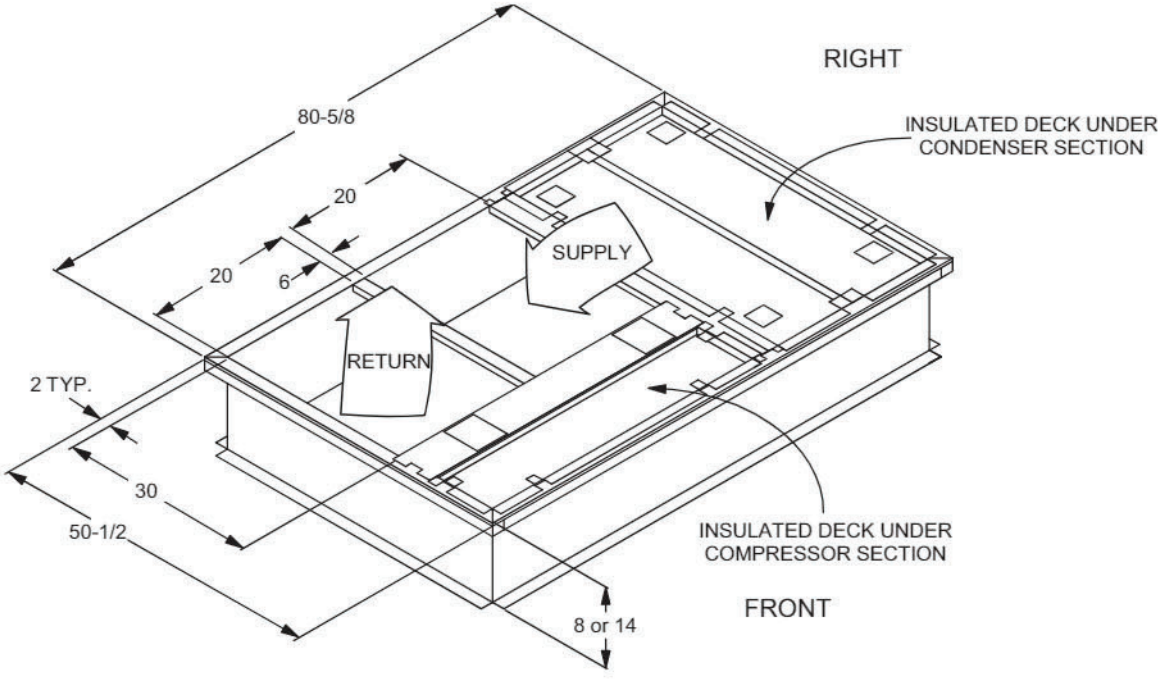


Figure 12: ZT037-061 Roof Curb

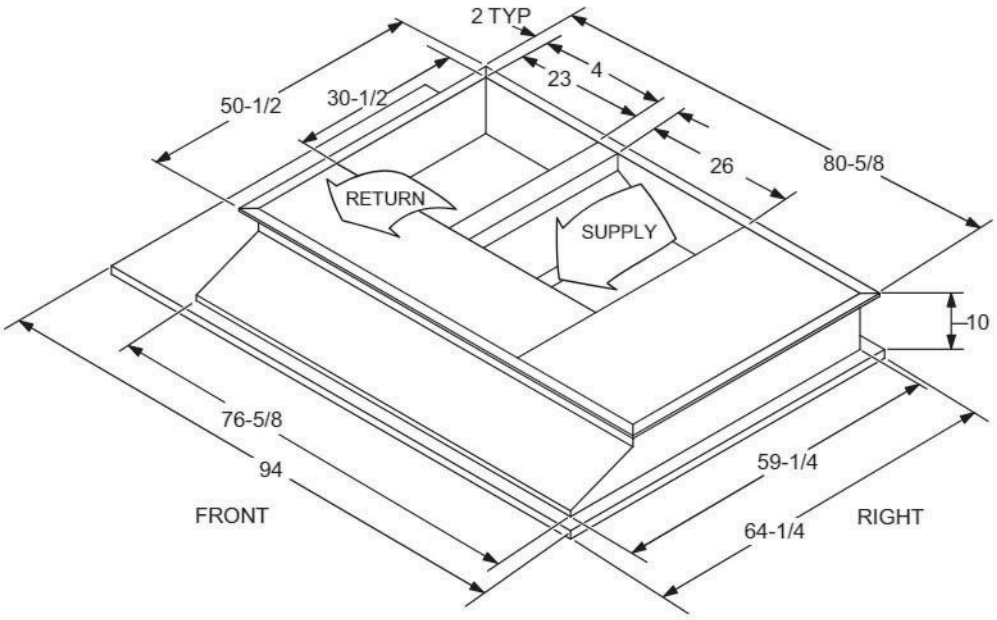


Figure 13: ZT037-061 Transition Roof Curb

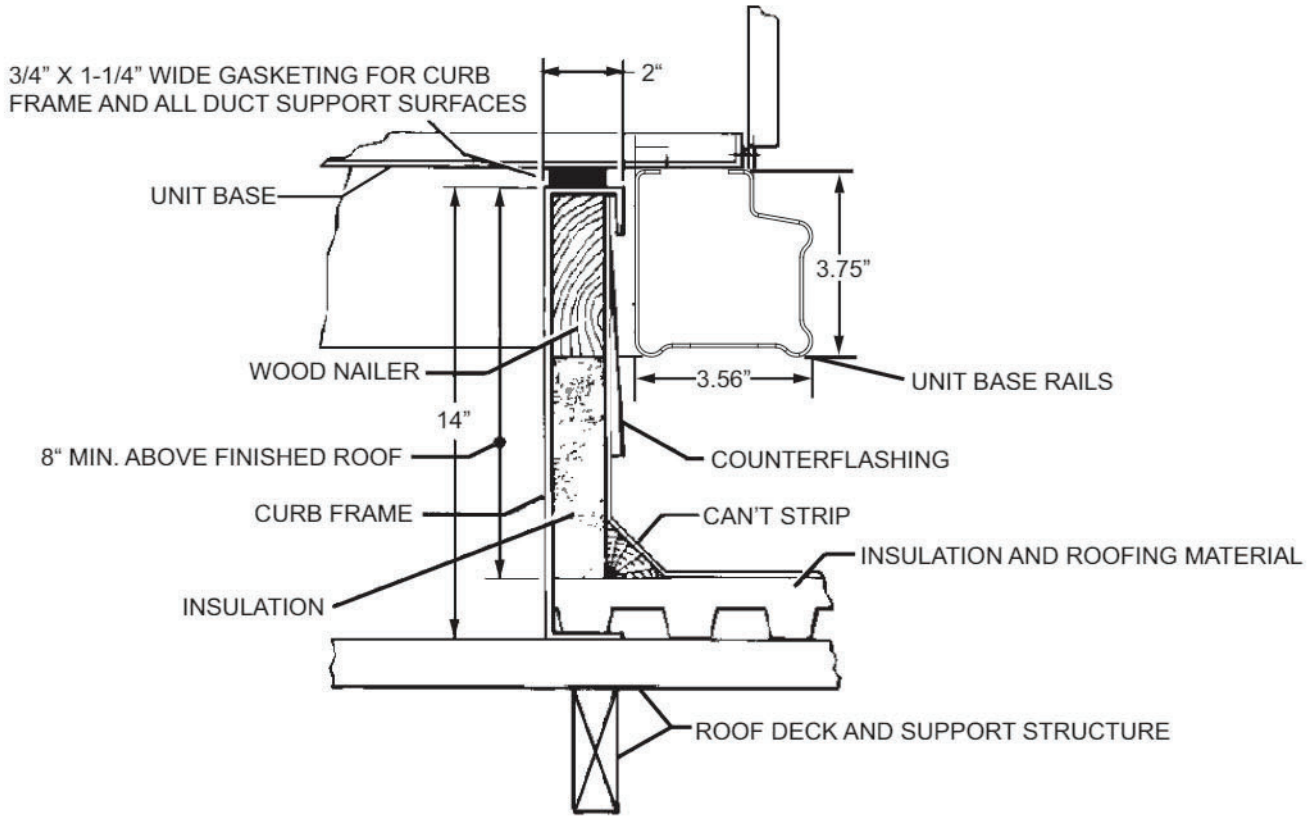


Figure 14: ZT037-061 Roof Curb Cutaway

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 Figure 8 for bottom air duct openings. Refer to Figures 10, 11 and Table 6 for side air duct openings.

Duct Covers

Units are shipped with the side duct openings covered and a covering over the bottom of the unit. For bottom duct application, no duct cover changes are necessary. For side duct application, remove the side duct covers and install over the bottom duct openings. The panels removed from the side duct connections are designed to be reused by securing each panel to its respective down flow opening. But keep in mind that the supply panel is installed with the painted surface UP, facing the heat exchanger, while the return panel is installed with the painted surface DOWN, facing the down flow duct opening. The supply panel is secured with the bracket (already in place from the factory) and two screws. It's a snug fit for the panel when sliding it between the heat exchanger and unit bottom, but there is room. The return panel is secured with four screws.

⚠ CAUTION

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and water-proofed.



Figure 15: Side Panels With Hole Plugs

NOTE: Orientation. Panel is "insulation" side up.



Figure 16: Return Downflow Plenum With Panel



Figure 17: Discharge Panel In Place

Side Panels

Units are shipped with side panels to cover the area where an economizer or motorized damper may be installed. These panels must be saved and used as tops for the Economizer rain hoods (See Figure 18)



Figure 18: Save Side Panels For Economizer Hood Tops

Condensate Drain

The side condensate drain is reversible and maybe re-oriented to the rear of the cabinet to facilitate condensate piping. A

condensate drain connection is available through the base pan for piping inside the roof curb. Trap the connection per Figure 19. The trap and drain lines should be protected from freezing.

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install condensate drain line from the 1 inch NPT female connection on the unit to an open drain.

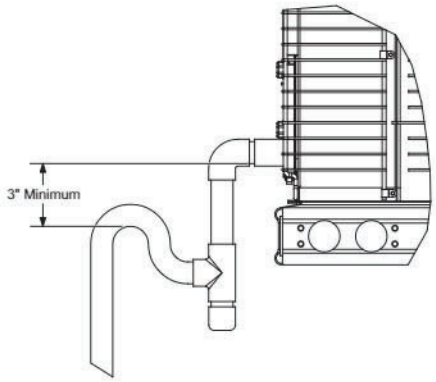


Figure 19: Condensate Drain

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. One-inch filters may be used with no modification to the filter racks. Filters must always be installed ahead of evaporator coil and must be kept clean or replaced with same size and type. Dirty filters reduce the capacity of the unit and result in frosted coils or safety shutdown. Refer to physical data tables, for the number and size of filters needed for the unit. The unit should not be operated without filters properly installed.

⚠ CAUTION

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

Power And Control Wiring

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

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.

⚠ CAUTION

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

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes 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 4 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 20 and 21 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.

Power Wiring Detail

Units are factory wired for the voltage shown on the unit nameplate. Refer to Electrical Data Table 9 to size power wiring, fuses, and disconnect switch.

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

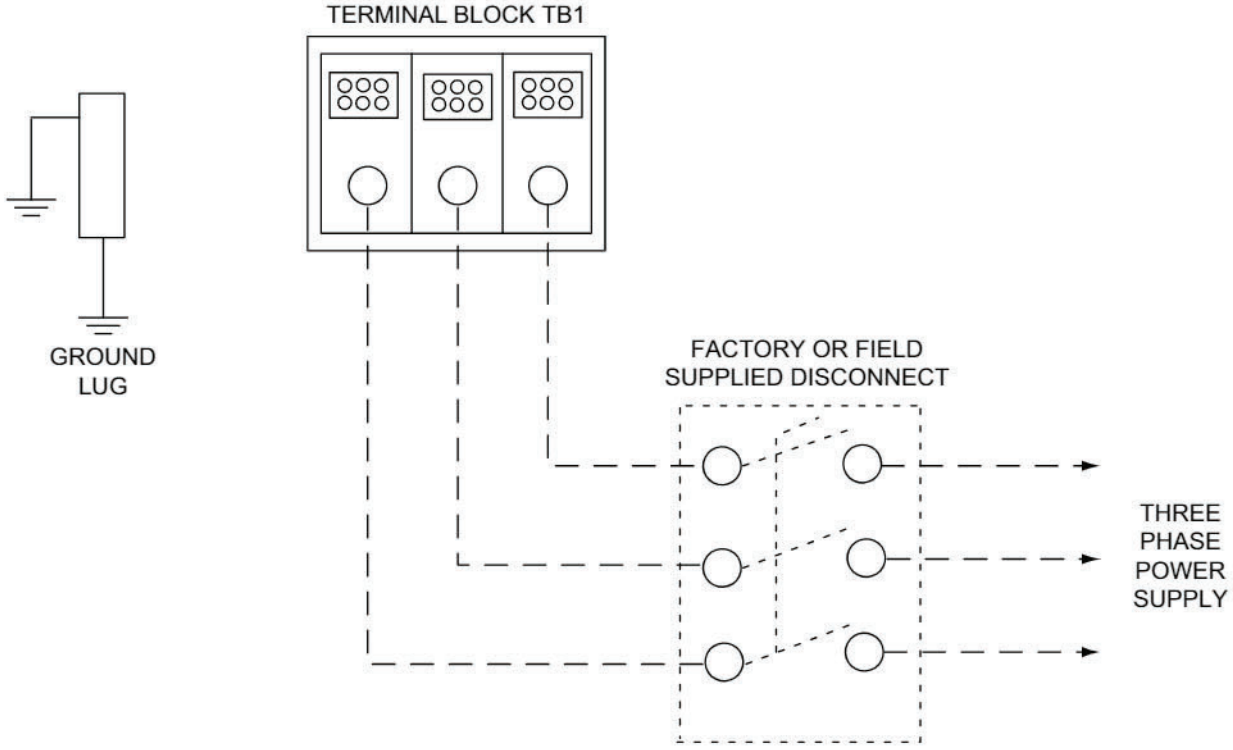


Figure 20: Field Wiring Disconnect

Thermostat Wiring

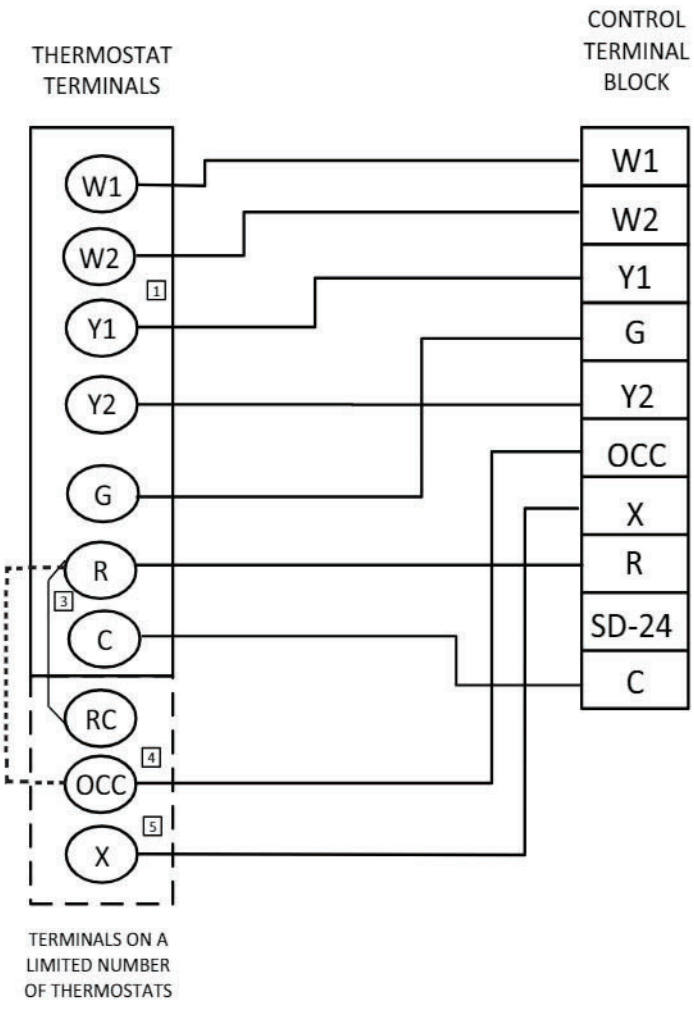
The thermostat should be located on an inside wall approximately 56 inch above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with thermostat for general installation procedure. Color-coded, insulated wires should be used to connect the thermostat to the unit. Refer to Table 8 for control wire sizing and maximum length.

Table 8: Control Wire Sizes

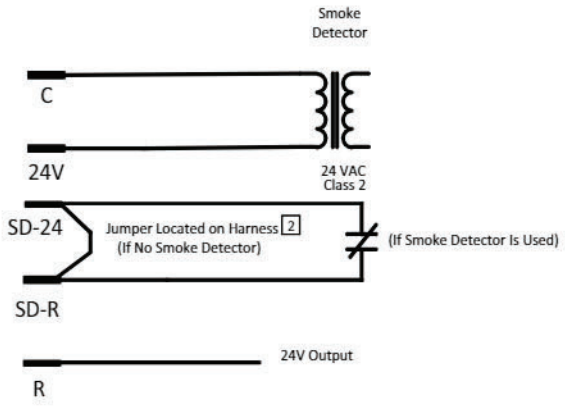
Wire Size	Maximum Length[1]
18 AWG	150 Feet

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

Typical Control Wiring Detail



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



1. Second stage heating not required on single stage heating units.
2. Jumper is required if there is no Smoke Detector circuit.
3. Jumper is required for any combination of R, RC, or RH.
4. OCC is an output from the thermostat to indicate the Occupied condition.
5. X is an input to the thermostat to display Error Status conditions.

Figure 21: Typical Control Wiring

Table 9: Electrical Data

ZT037-061 Standard Indoor Blower - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	11.6	73	18	3.5	4.3	5.5		None	-	-	-	25.8	31.3	35	40
									E03	2.3	1	6.4	25.8	31.3	35	40
									E06	4.5	1	12.5	25.8	31.3	35	40
									E08	6.8	1	18.9	29	35.9	35	40
									E15	11.3	2	31.4	44.6	51.5	45	60
	230	11.6	73	18	3.5	4.3	5.5		None	-	-	-	25.8	31.3	35	40
									E03	3	1	7.2	25.8	31.3	35	40
									E06	6	1	14.4	25.8	31.3	35	40
									E08	9	1	21.7	32.5	39.4	35	40
									E15	15	2	36.1	50.5	57.4	60	60
	460	5.7	38	9	1.6	2.1	2.2		None	-	-	-	12.4	14.6	15	20
									E03	3	1	3.6	12.4	14.6	15	20
									E06	6	1	7.2	12.4	14.6	15	20
									E08	9	1	10.8	16.1	18.9	20	20
									E15	15	2	18	25.1	27.9	30	30
	575	4.0	25.6	6.2	3.5	2.0	1.8	0.0	None	-	-	-	9.8	11.6	15	15
									E09	9.0	1	8.7	13.3	15.6	15	20
									E15	15.0	2	14.4	20.5	22.8	25	25
049 (4)	208	14.0	83.1	21.9	3.5	4.3	5.5	0.0	None	-	-	-	28.8	34.3	40	45
									E06	4.5	1	12.5	28.8	34.3	40	45
									E09	6.8	1	18.9	29.0	35.8	40	45
									E15	11.3	2	31.4	44.6	51.5	45	60
									E20	15.0	2	41.6	57.4	64.3	60	70
	230	14.0	83.1	21.9	3.5	4.3	5.5	0.0	None	-	-	-	28.8	34.3	40	45
									E06	6.0	1	14.4	28.8	34.3	40	45
									E09	9.0	1	21.7	32.4	39.3	40	45
									E15	15.0	2	36.1	50.5	57.4	60	60
									E20	20.0	2	48.1	65.5	72.4	70	80
	460	6.4	41.0	10.0	3.5	2.1	2.2	0.0	None	-	-	-	13.6	15.8	20	20
									E06	6.0	1	7.2	13.6	15.8	20	20
									E09	9.0	1	10.8	16.2	18.9	20	20
									E15	15.0	2	18.0	25.2	27.9	30	30
									E20	20.0	2	24.1	32.7	35.4	35	40
	575	4.6	33.0	7.1	3.5	2.0	1.8	0.0	None	-	-	-	10.6	12.4	15	15
									E09	9.0	1	8.7	13.3	15.6	15	20
									E15	15.0	2	14.4	20.5	22.8	25	25
									E20	20.0	2	19.2	26.6	28.8	30	30
061 (5)	208	16.5	110.0	25.8	3.5	4.3	5.5	0.0	None	-	-	-	31.9	37.4	40	50
									E06	4.5	1	12.5	31.9	37.4	40	50
									E09	6.8	1	18.9	31.9	37.4	40	50
									E15	11.3	2	31.4	44.6	51.5	45	60
									E20	15.0	2	41.6	57.4	64.3	60	70
									E24	18.0	2	50.0	67.8	74.7	70	80
	230	16.5	110.0	25.8	3.5	4.3	5.5	0.0	None	-	-	-	31.9	37.4	40	50
									E06	6.0	1	14.4	31.9	37.4	40	50
									E09	9.0	1	21.7	32.4	39.3	45	50
									E15	15.0	2	36.1	50.5	57.4	60	60
									E20	20.0	2	48.1	65.5	72.4	70	80
									E24	24.0	2	57.7	77.5	84.4	80	90
	460	7.2	52.0	11.3	3.5	2.1	2.2	0.0	None	-	-	-	14.6	16.8	20	20
									E06	6.0	1	7.2	14.6	16.8	20	20
									E09	9.0	1	10.8	16.2	18.9	20	20
									E15	15.0	2	18.0	25.2	27.9	30	30
									E20	20.0	2	24.1	32.7	35.4	35	40
									E24	24.0	2	28.9	38.7	41.5	40	45
	575	5.5	38.9	8.6	3.5	2.0	1.8	0.0	None	-	-	-	11.7	13.5	15	15
									E09	9.0	1	8.7	13.3	15.6	15	20
									E15	15.0	2	14.4	20.5	22.8	25	25
									E20	20.0	2	19.2	26.6	28.8	30	30
									E24	24.0	2	23.1	31.4	33.6	35	35

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

ZT037-061 Hi Static Indoor Blower - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	11.6	73	18	3.5	4.3	5.5		None	-	-	-	25.8	31.3	35	40
									E03	2.3	1	6.4	25.8	31.3	35	40
									E06	4.5	1	12.5	25.8	31.3	35	40
									E08	6.8	1	18.9	29	35.9	35	40
									E15	11.3	2	31.4	44.6	51.5	45	60
	230	11.6	73	18	3.5	4.3	5.5		None	-	-	-	25.8	31.3	35	40
									E03	3	1	7.2	25.8	31.3	35	40
									E06	6	1	14.4	25.8	31.3	35	40
									E08	9	1	21.7	32.5	39.4	35	40
									E15	15	2	36.1	50.5	57.4	60	60
	460	5.7	38	9	1.6	2.1	2.2		None	-	-	-	12.4	14.6	15	20
									E03	3	1	3.6	12.4	14.6	15	20
									E06	6	1	7.2	12.4	14.6	15	20
									E08	9	1	10.8	16.1	18.9	20	20
									E15	15	2	18	25.1	27.9	30	30
	575	4.0	25.6	6.2	3.5	2.0	1.8	0.0	None	-	-	-	9.8	11.6	15	15
									E09	9.0	1	8.7	13.3	15.6	15	20
									E15	15.0	2	14.4	20.5	22.8	25	25
049 (4)	208	14.0	83.1	21.9	3.5	4.3	5.5	0.0	None	-	-	-	28.8	34.3	40	45
									E06	4.5	1	12.5	28.8	34.3	40	45
									E09	6.8	1	18.9	29.0	35.8	40	45
									E15	11.3	2	31.4	44.6	51.5	45	60
									E20	15.0	2	41.6	57.4	64.3	60	70
	230	14.0	83.1	21.9	3.5	4.3	5.5	0.0	None	-	-	-	28.8	34.3	40	45
									E06	6.0	1	14.4	28.8	34.3	40	45
									E09	9.0	1	21.7	32.4	39.3	40	45
									E15	15.0	2	36.1	50.5	57.4	60	60
									E20	20.0	2	48.1	65.5	72.4	70	80
	460	6.4	41.0	10.0	3.5	2.1	2.2	0.0	None	-	-	-	13.6	15.8	20	20
									E06	6.0	1	7.2	13.6	15.8	20	20
									E09	9.0	1	10.8	16.2	18.9	20	20
									E15	15.0	2	18.0	25.2	27.9	30	30
									E20	20.0	2	24.1	32.7	35.4	35	40
	575	4.6	33.0	7.1	3.5	2.0	1.8	0.0	None	-	-	-	10.6	12.4	15	15
									E09	9.0	1	8.7	13.3	15.6	15	20
									E15	15.0	2	14.4	20.5	22.8	25	25
									E20	20.0	2	19.2	26.6	28.8	30	30
061 (5)	208	16.5	110.0	25.8	3.5	6.8	5.5	0.0	None	-	-	-	34.4	39.9	45	50
									E06	4.5	1	12.5	34.4	39.9	45	50
									E09	6.8	1	18.9	34.4	39.9	45	50
									E15	11.3	2	31.4	47.7	54.6	50	60
									E20	15.0	2	41.6	60.5	67.4	70	70
									E24	18.0	2	50.0	71.0	77.8	80	80
	230	16.5	110.0	25.8	3.5	6.8	5.5	0.0	None	-	-	-	34.4	39.9	45	50
									E06	6.0	1	14.4	34.4	39.9	45	50
									E09	9.0	1	21.7	35.6	42.4	45	50
									E15	15.0	2	36.1	53.6	60.5	60	70
									E20	20.0	2	48.1	68.6	75.5	70	80
									E24	24.0	2	57.7	80.7	87.5	90	90
	460	7.2	52.0	11.3	3.5	3.2	2.2	0.0	None	-	-	-	15.7	17.9	20	25
									E06	6.0	1	7.2	15.7	17.9	20	25
									E09	9.0	1	10.8	17.5	20.2	20	25
									E15	15.0	2	18.0	26.5	29.2	30	30
									E20	20.0	2	24.1	34.0	36.8	35	40
									E24	24.0	2	28.9	40.0	42.8	40	45
	575	5.5	38.9	8.6	3.5	2.2	1.8	0.0	None	-	-	-	11.9	13.7	15	15
									E09	9.0	1	8.7	13.6	15.9	15	20
									E15	15.0	2	14.4	20.8	23.0	25	25
									E20	20.0	2	19.2	26.8	29.0	30	30
									E24	24.0	2	23.1	31.6	33.9	35	35

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

ZT037-061 Standard Indoor Blower - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	11.6	73	18	3.5	4.3	5.5	20	None	-	-	-	35.8	41.3	45	50
									E03	2.3	1	6.4	35.8	41.3	45	50
									E06	4.5	1	12.5	35.8	41.3	45	50
									E08	6.8	1	18.9	41.5	48.4	45	50
									E15	11.3	2	31.4	57.1	64	60	70
	230	11.6	73	18	3.5	4.3	5.5	20	None	-	-	-	35.8	41.3	45	50
									E03	3	1	7.2	35.8	41.3	45	50
									E06	6	1	14.4	35.9	42.8	45	50
									E08	9	1	21.7	45	51.9	45	60
									E15	15	2	36.1	63	69.9	70	70
	460	5.7	38	9	1.6	2.1	2.2	20	None	-	-	-	17.4	19.6	20	25
									E03	3	1	3.6	17.4	19.6	20	25
									E06	6	1	7.2	17.9	20.6	20	25
									E08	9	1	10.8	22.4	25.1	25	30
									E15	15	2	18	31.4	34.1	35	35
	575	4.0	25.6	6.2	3.5	2.0	1.8	4.0	None	-	-	-	13.8	15.6	15	20
									E09	9.0	1	8.7	18.3	20.6	20	25
									E15	15.0	2	14.4	25.5	27.8	30	30
049 (4)	208	14.0	83.1	21.9	3.5	4.3	5.5	10.0	None	-	-	-	38.8	44.3	50	50
									E06	4.5	1	12.5	38.8	44.3	50	50
									E09	6.8	1	18.9	41.5	48.3	50	50
									E15	11.3	2	31.4	57.1	64.0	60	70
									E20	15.0	2	41.6	69.9	76.8	70	80
	230	14.0	83.1	21.9	3.5	4.3	5.5	10.0	None	-	-	-	38.8	44.3	50	50
									E06	6.0	1	14.4	38.8	44.3	50	50
									E09	9.0	1	21.7	44.9	51.8	50	60
									E15	15.0	2	36.1	63.0	69.9	70	70
									E20	20.0	2	48.1	78.0	84.9	80	90
	460	6.4	41.0	10.0	3.5	2.1	2.2	5.0	None	-	-	-	18.6	20.8	25	25
									E06	6.0	1	7.2	18.6	20.8	25	25
									E09	9.0	1	10.8	22.4	25.2	25	30
									E15	15.0	2	18.0	31.4	34.2	35	35
									E20	20.0	2	24.1	38.9	41.7	40	45
	575	4.6	33.0	7.1	3.5	2.0	1.8	4.0	None	-	-	-	14.6	16.4	15	20
									E09	9.0	1	8.7	18.3	20.6	20	25
									E15	15.0	2	14.4	25.5	27.8	30	30
									E20	20.0	2	19.2	31.6	33.8	35	35
061 (5)	208	16.5	110.0	25.8	3.5	4.3	5.5	10.0	None	-	-	-	41.9	47.4	50	60
									E06	4.5	1	12.5	41.9	47.4	50	60
									E09	6.8	1	18.9	41.9	48.3	50	60
									E15	11.3	2	31.4	57.1	64.0	60	70
									E20	15.0	2	41.6	69.9	76.8	70	80
									E24	18.0	2	50.0	80.3	87.2	90	90
	230	16.5	110.0	25.8	3.5	4.3	5.5	10.0	None	-	-	-	41.9	47.4	50	60
									E06	6.0	1	14.4	41.9	47.4	50	60
									E09	9.0	1	21.7	44.9	51.8	50	60
									E15	15.0	2	36.1	63.0	69.9	70	70
									E20	20.0	2	48.1	78.0	84.9	80	90
									E24	24.0	2	57.7	90.0	96.9	90	100
	460	7.2	52.0	11.3	3.5	2.1	2.2	5.0	None	-	-	-	19.6	21.8	25	25
									E06	6.0	1	7.2	19.6	21.8	25	25
									E09	9.0	1	10.8	22.4	25.2	25	30
									E15	15.0	2	18.0	31.4	34.2	35	35
									E20	20.0	2	24.1	38.9	41.7	40	45
									E24	24.0	2	28.9	45.0	47.7	45	50
	575	5.5	38.9	8.6	3.5	2.0	1.8	4.0	None	-	-	-	15.7	17.5	20	20
									E09	9.0	1	8.7	18.3	20.6	20	25
									E15	15.0	2	14.4	25.5	27.8	30	30
									E20	20.0	2	19.2	31.6	33.8	35	35
									E24	24.0	2	23.1	36.4	38.6	40	40

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

ZT037-061 Hi Static Blower - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	11.6	73	18	3.5	4.3	5.5	20	None	-	-	-	35.8	41.3	45	50
									E03	2.3	1	6.4	35.8	41.3	45	50
									E06	4.5	1	12.5	35.8	41.3	45	50
									E08	6.8	1	18.9	41.5	48.4	45	50
									E15	11.3	2	31.4	57.1	64	60	70
	230	11.6	73	18	3.5	4.3	5.5	20	None	-	-	-	35.8	41.3	45	50
									E03	3	1	7.2	35.8	41.3	45	50
									E06	6	1	14.4	35.9	42.8	45	50
									E08	9	1	21.7	45	51.9	45	60
									E15	15	2	36.1	63	69.9	70	70
	460	5.7	38	9	1.6	2.1	2.2	20	None	-	-	-	17.4	19.6	20	25
									E03	3	1	3.6	17.4	19.6	20	25
									E06	6	1	7.2	17.9	20.6	20	25
									E08	9	1	10.8	22.4	25.1	25	30
									E15	15	2	18	31.4	34.1	35	35
	575	4.0	25.6	6.2	3.5	2.0	1.8	4.0	None	-	-	-	13.8	15.6	15	20
									E09	9.0	1	8.7	18.3	20.6	20	25
									E15	15.0	2	14.4	25.5	27.8	30	30
049 (4)	208	14.0	83.1	21.9	3.5	4.3	5.5	10.0	None	-	-	-	38.8	44.3	50	50
									E06	4.5	1	12.5	38.8	44.3	50	50
									E09	6.8	1	18.9	41.5	48.3	50	50
									E15	11.3	2	31.4	57.1	64.0	60	70
									E20	15.0	2	41.6	69.9	76.8	70	80
	230	14.0	83.1	21.9	3.5	4.3	5.5	10.0	None	-	-	-	38.8	44.3	50	50
									E06	6.0	1	14.4	38.8	44.3	50	50
									E09	9.0	1	21.7	44.9	51.8	50	60
									E15	15.0	2	36.1	63.0	69.9	70	70
									E20	20.0	2	48.1	78.0	84.9	80	90
	460	6.4	41.0	10.0	3.5	2.1	2.2	5.0	None	-	-	-	18.6	20.8	25	25
									E06	6.0	1	7.2	18.6	20.8	25	25
									E09	9.0	1	10.8	22.4	25.2	25	30
									E15	15.0	2	18.0	31.4	34.2	35	35
									E20	20.0	2	24.1	38.9	41.7	40	45
	575	4.6	33.0	7.1	3.5	2.0	1.8	4.0	None	-	-	-	14.6	16.4	15	20
									E09	9.0	1	8.7	18.3	20.6	20	25
									E15	15.0	2	14.4	25.5	27.8	30	30
									E20	20.0	2	19.2	31.6	33.8	35	35
061 (5)	208	16.5	110.0	25.8	3.5	6.8	5.5	10.0	None	-	-	-	44.4	49.9	60	60
									E06	4.5	1	12.5	44.4	49.9	60	60
									E09	6.8	1	18.9	44.6	51.5	60	60
									E15	11.3	2	31.4	60.2	67.1	70	70
									E20	15.0	2	41.6	73.0	79.9	80	80
									E24	18.0	2	50.0	83.5	90.3	90	100
	230	16.5	110.0	25.8	3.5	6.8	5.5	10.0	None	-	-	-	44.4	49.9	60	60
									E06	6.0	1	14.4	44.4	49.9	60	60
									E09	9.0	1	21.7	48.1	54.9	60	60
									E15	15.0	2	36.1	66.1	73.0	70	80
									E20	20.0	2	48.1	81.1	88.0	90	90
									E24	24.0	2	57.7	93.2	100.0	100	100
	460	7.2	52.0	11.3	3.5	3.2	2.2	5.0	None	-	-	-	20.7	22.9	25	30
									E06	6.0	1	7.2	20.7	22.9	25	30
									E09	9.0	1	10.8	23.7	26.5	25	30
									E15	15.0	2	18.0	32.7	35.5	35	40
									E20	20.0	2	24.1	40.3	43.0	45	45
									E24	24.0	2	28.9	46.3	49.0	50	50
	575	5.5	38.9	8.6	3.5	2.2	1.8	4.0	None	-	-	-	15.9	17.7	20	20
									E09	9.0	1	8.7	18.6	20.9	20	25
									E15	15.0	2	14.4	25.8	28.0	30	30
									E20	20.0	2	19.2	31.8	34.0	35	35
									E24	24.0	2	23.1	36.6	38.9	40	40

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

Table 10: Physical Data
ZT037-061

Component	Models								
	ZT037			ZT049			ZT061		
Nominal Tonnage	**3.0**			**4.0**			**5.0**		
AHRI COOLING PERFORMANCE									
Gross Capacity @ AHRI A point (MBh)	38000			51200			61600		
AHRI net capacity (MBh)	37000			50000			60000		
EER	13.05			14.0			13.00		
SEER (208/230 & 460V)	17.0			17.5			16.3		
SEER (575V)	15.95			17.5			16.3		
Nominal CFM	1300			1600			1550		
System power (KW)	2.82			3.57			4.62		
Refrigerant type	R-410A			R-410A			R-410A		
Refrigerant charge (lb-oz)									
System 1 (208/230 & 460V)	10-5			13-2			12-7		
System 1 (575V)	9-12			13-2			12-7		
AHRI HEATING PERFORMANCE									
Heating model	N06	N08	N12	N06	N08	N12	N08	N12	N16
Heat input (K Btu)	60	80	120	60	80	120	80	120	160
Heat output (K Btu)	49	65	97	49	65	97	65	97	129
AFUE %	-		-	-		-	-		-
Steady state efficiency (%)	81.5	81	81	81.5	81	81	81	81	80.5
No. burners	4	4	6	4	4	6	4	6	8
No. stages	2^1	2^2	2^2	2^1	2^2	2^2	2^2	2^2	2^2
Temperature Rise Range (ºF)	20-50°F	25-65°F	50-80°F	20-50°F	25-65°F	50-80°F	25-65°F	35-65°F	45-75°F
Gas Limit Setting (ºF)	235	200	255	235	200	255	200	245	240
Gas piping connection (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
DIMENSIONS (inches)									
Length	89			89			89		
Width	59			59			59		
Height	42			42			42		
OPERATING WT. (lbs.)	922			960			968		
COMPRESSORS[3]									
Type	2-stage scroll			2-stage scroll			2-stage scroll		
Quantity	1			1			1		
Unit Capacity Steps (%)	67/100			67/100			67/100		
CONDENSER COIL DATA									
Face area (Sq. Ft.)	12.2			12.2			12.2		
Rows	1			1			1		
Fins per inch	23			23			23		
Tube diameter (in./MM)	.98/25			.98/25			.98/25		
Circuitry Type	2-pass Microchannel			2-pass Microchannel			2-pass Microchannel		
EVAPORATOR COIL DATA									
Face area (Sq. Ft.)	10.56			10.56			10.56		
Rows	3			4			4		
Fins per inch	15			15			15		
Tube diameter	0.375			0.375			0.375		
Refrigerant control	TXV			TXV			TXV		

ZT037-061 (Continued)

Component	Models								
	ZT037			ZT049			ZT061		
Nominal Tonnage	**3.0**			**4.0**			**5.0**		
CONDENSER FAN DATA									
Quantity of fans	2			2			2		
Fan diameter (Inch)	24			24			24		
Type	Prop			Prop			Prop		
Drive type	Direct ECM			Direct ECM			Direct ECM		
Quantity of motors	2			2			2		
Motor HP each	1/3			1/3			1/3		
No. speeds	Var.			Var.			Var.		
RPM	850			850			850		
Nominal total CFM	7000			7000			7000		
BELT DRIVE EVAP FAN DATA									
Quantity	1			1			1		
Fan Size (Inch)	12 x 9			12 x 9			12 x 9		
Type	Centrifugal			Centrifugal			Centrifugal		
Motor Sheave	1VL40		1VL40	1VL34		1VL44	1VL40		1VM50
Blower Sheave	AK79		AK61	AK64		AK69	AK61		AK64
Belt	A47		A45	A47		A47	A45		A47
Motor HP each	1-1/2		1-1/2	1-1/2		1-1/2	1-1/2		2
RPM	1725		1725	1725		1725	1725		1725
Frame size	56		56	56		56	56		56
FILTERS									
Quantity - Size	4 - (24 x 16 x 2)[4,5]			4 - (24 x 16 x 2)[4,5]			4 - (24 x 16 x 2)[4,5]		
	4 - (24 x 16 x 4)[6]			4 - (24 x 16 x 4)[6]			4 - (24 x 16 x 4)[6]		

1. 1st Stage Capacity is 75% of Full Capacity.
2. 1st Stage Capacity is 70% of Full Capacity.
3. ZT037, ZT049, ZT061 have crankcase heaters standard.
3. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.
4. 2 In. Pleated, Optional, MERV 8.
5. 4 In. Pleated, Optional, MERV 13.

Optional Electric Heat

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending in to the supply air chamber.

Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. refer to Table 11 for minimum CFM limitations and to Table 9 for electrical data.

Table 11: Electric Heat Minimum Supply Air

Size (Tons)	Model	Voltage	Minimum Supply Air (CFM)					
			Heater kW					
			3	6	9	15	20	24
037 (3)	ZT	208/230-3-60	960	960	1020	1000	-	-
		460-3-60	980	960	960	960	-	-
		600-3-60	-	-	960	960	-	-
049 (4)	ZT	208/230-3-60	-	1280	1420	1400	1400	-
		460-3-60	-	1400	1400	1400	1400	-
		600-3-60	-	-	1400	1400	1400	-
061 (5)	ZT	208/230-3-60	-	1600	1600	1600	1600	1600
		460-3-60	-	1600	1600	1600	1600	1600
		600-3-60	-	-	1600	1600	1600	1600

Optional Gas Heat

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

Gas Piping

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. "National Fuel Gas Code" Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 12. The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

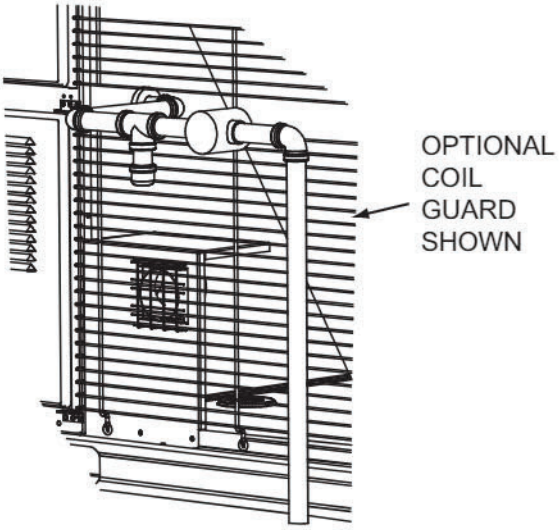


Figure 22: Side Entry Gas Piping

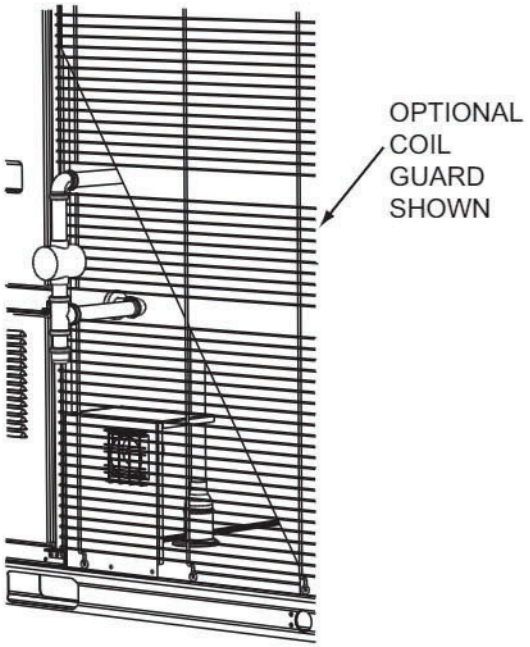


Figure 23: Bottom Entry Gas Piping

Table 12: Gas Pipe Sizing - Capacity of Pipe

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

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

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

Table 13: Gas Heat Minimum Supply Air

Size (Tons)	Model	Heat Size	Supply Air (CFM) Heating	
			Min	Max
037 (3)	ZT	N06	890	2220
		N08	915	2370
		N12	1130	1800
049 (4)	ZT	N06	890	2220
		N08	915	2370
		N12	1290	2250
061 (5)	ZT	N08	915	2370
		N12	1380	2570
		N16	1580	2630

Gas Connection

The gas supply line can be routed within the space and roof curb, exiting through the unit's basepan. Refer to Figures 22 and 23 for the gas piping inlet location. Typical supply piping arrangements are shown in Figures 22 and 23. All pipe nipples, fittings, and the gas cock are field supplied or may be purchased in Ducted Systems accessory kit #1GP0405.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.
2. Where required by local codes, a manual shut-off valve must be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe dope should be applied sparingly to male threads only.

⚠WARNING

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

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

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

⚠ CAUTION

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

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

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

⚠WARNING

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

LP Units, Tanks And Piping

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with LP gas with accessory kit model numbers 1NP0454 or 1NP0455.

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

For satisfactory operation, LP gas pressure must be 10.5 inch W.C. at the unit under full load. Maintaining proper gas pressure depends on three main factors:

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

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

⚠WARNING

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

Check all connections for leaks when piping is completed using a soap solution. **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

Vent And Combustion Air

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

Options/Accessories

Electric Heat

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

Smoke Detectors

⚠WARNING

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

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

⚠WARNING

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

⚠WARNING

To assure adequate airflow reaches the smoke detector's sensor, make sure that the holes of the sampling tube face into the air stream, and that the far-end of the sampling tube is sealed with the plastic end cap.

In addition, the unit's supply airflow must be adjusted to provide a pressure differential across the smoke detector's sampling and exhaust ports of at least 0.01 inches of water and no more than 1.11 inches of water, as measured by a manometer.

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

Motorized Outdoor Damper

The Motorized Outdoor Damper can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete

the assembly. Field installed Motorized Outdoor Damper accessories include complete instructions for installation.

Economizer

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

There are two Economizer options:

1. Down Flow, End Return Horizontal applications which include Fresh Air Hood, Exhaust Hood with Barometric Relief.
2. Horizontal Flow application (Field Installed Kit Only) that requires the purchase of a barometric relief hood.

NOTE: With the Down Flow, End Return Horizontal application it is required to save the two Side Panels for the economizer hood tops (See Figure 18).

Power Exhaust

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

The Power Exhaust factory installed option is for Down Flow application only.

There are two field installed Power Exhaust accessories:

1. Down Flow application.
2. Horizontal Flow application that requires the purchase of a barometric relief hood.

Rain Hood

All of the hood components, including the filters, the gasketing and the hardware for assembling, are packaged and located between the condenser coil section and the main unit cabinet, if the unit has factory installed options. If field installed accessories are being installed all parts necessary for the installation comes in the accessory.

Factory-installed VFD (Standard)

The factory-installed VFD is mounted in the blower access compartment. The drive comes wired from the factory to include both 3-phase power and control connections (run permit signal, speed reference signal & fault signal). All required drive parameters are pre-programmed at the factory, except in the case of 208-volt applications, in which the parameter that defines motor nameplate voltage must be changed to a value of 208.00 and the parameter that defines motor-rated current must be changed to the appropriate value appearing on the motor's nameplate. Refer to the enclosed drive material for instructions on changing parameter settings.

Manual Bypass

An optional, factory-installed manual bypass switch available with factory-installed VFD can be found in the Blower Motor Access compartment and has the following three positions:

- **DRIVE** - routes power through the VFD for modulating control of the indoor blower motor.
- **LINE (or BYPASS)** - routes power directly to the motor which provides full-speed motor operation and complete electrical isolation of the drive.
- **TEST** - routes power to the VFD but not to the motor to allow for drive programming and/or diagnostics.

If a drive failure occurs, the unit does not automatically switch to bypass mode. The LINE/DRIVE/TEST switch must be manually switched to the LINE (BYPASS) position. If there is a call for the fan, the indoor blower motor will run at full-speed while in the bypass mode.

⚠WARNING

Before beginning any service, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

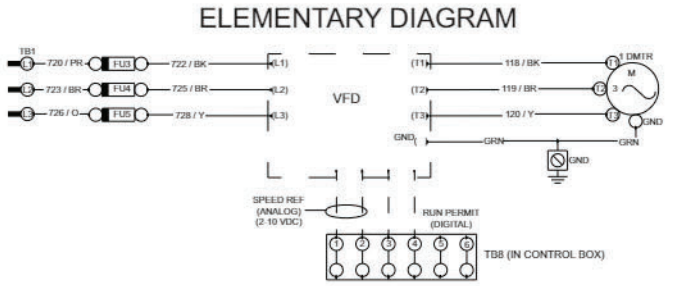


Figure 24: Simplified VFD Wiring

⚠ CAUTION

Do not connect AC power to the T1, T2, T3 drive terminals to prevent damage to the VFD.

⚠ CAUTION

The fuses (FU3, FU4, FU5) supplied with the unit are sized according to the electrical load of the blower motor, but may not provide adequate protection to the customer-installed drive, depending upon its specifications. Once a drive has been selected and installed, refer to the drive manufacturer's recommendations for proper fuse sizing.

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 +/- 1°F (default 55°F).

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

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

Sensor

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

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

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

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

a. 2-10 VDC from ECON on Economizer Expansion module
b. 24 VAC from EX-FAN to energize exhaust fan on Economizer Expansion module

Operation

Operation details include:

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



Figure 25: SE-ECO1001-0 Economizer Controller

Table 14: 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
		SA BUS[1] 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

Table 14: Smart Equipment™ Economizer Board Details (Continued)

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

Table 14: Smart Equipment™ Economizer Board Details (Continued)

Board Label	Cover Label	Description	Function & Comments
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
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.

Table 14: Smart Equipment™ Economizer Board Details (Continued)

Board Label	Cover Label	Description	Function & Comments
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 30.

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

Phasing

ZT037-061 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').

Table 15: Supply Air Limitations

Unit Size (Ton)	Minimum	Maximum
037 (3.0)	900	1500
049 (4.0)	1200	2000
061 (5.0)	1500	2500

Belt Tension

The tension on the belt should be adjusted as shown in Figure 26.

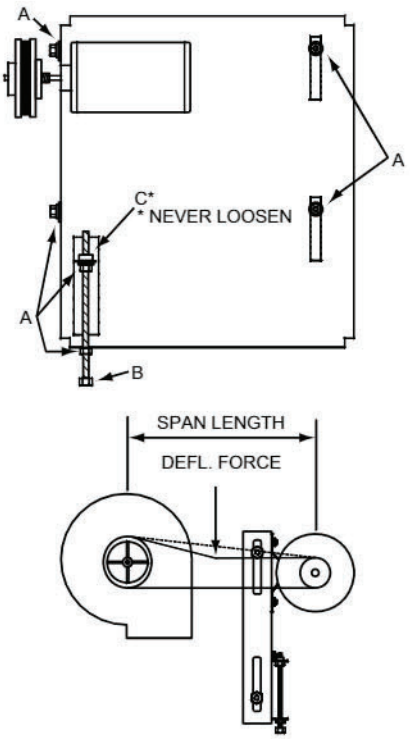


Figure 26: Belt Adjustment

⚠ CAUTION

Procedure for adjusting belt tension:

1. Loosen six 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 16 and Figure 27.

Table 16: 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

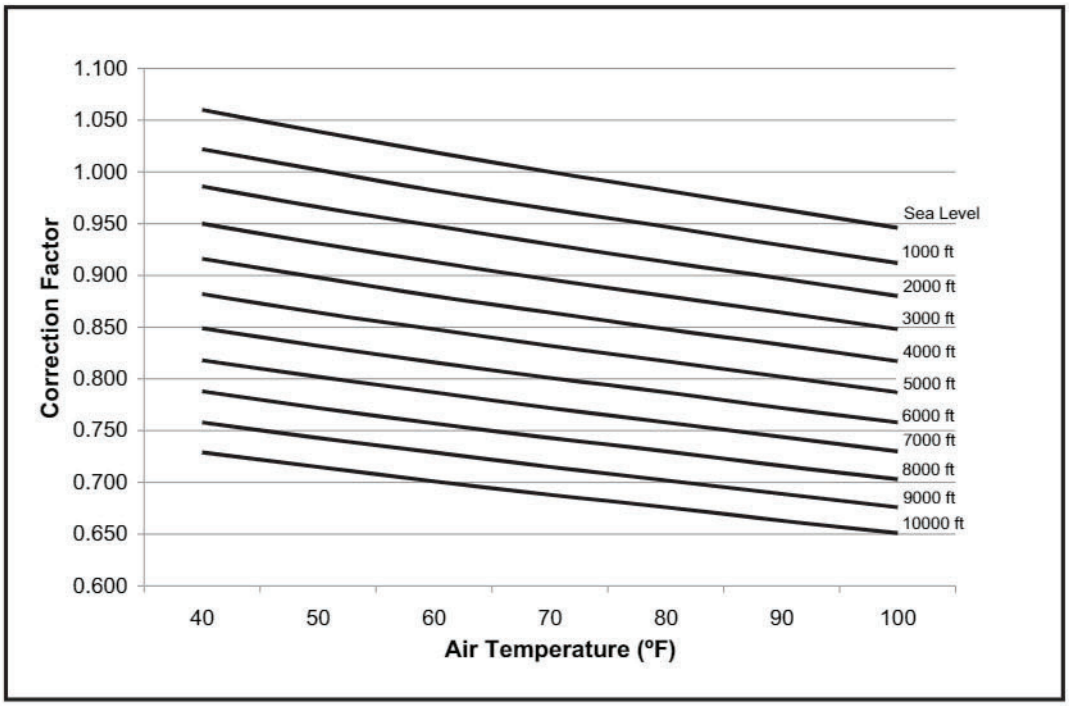


Figure 27: Altitude/Temperature Correction Factors

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 1,400 CFM, 0.6 IWC and 0.67 BHP?

Solution: At an elevation of 5,000 ft. the indoor blower will still deliver 1,400 CFM if the rpm is unchanged. However, Table 17 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 16 shows the correction factor to be 0.832.

Corrected static pressure = 0.6 x 0.832 = 0.499 IWC

Corrected BHP = 0.67 x 0.832 = 0.56

Example 2: A system, located at 5,000 feet of elevation, is to deliver 1,400 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.

Sea level static pressure = 0.6 / .832 = 0.72"

Enter the blower table at 1,400 sCFM and static pressure of 0.72". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 0.7. This value must be corrected for elevation.

BHP at 5,000 ft. = 0.7 x .832 = 0.58

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.
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. 2400 CFM
2. 1.6 IWC
3. Using the supply air blower performance table below, the following data point was located: 1230 RPM & 1.62 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 1.62 BHP exceeds the maximum continuous BHP rating of the 1.5 HP motor. The 2 HP motor is required.
6. 1230 RPM is within the range of the 2 HP drives.
7. Using the 2 HP motor and drive, .5 turns open will achieve 1230 RPM.

Example Supply Air Blower Performance

Air Flow (CFM)	Available External Static Pressure - IWG																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	1.5 HP & Field Supplied Drive						Standard 1.5 HP & Drive								Hi Static 2 HP & Drive					
2100	759	0.65	819	0.77	881	0.87	943	0.98	1005	1.08	1065	1.18	1121	1.28	1172	1.38	1217	1.48	1254	1.59
2200	778	0.73	838	0.84	900	1.95	962	1.05	1024	1.15	1083	1.25	1139	1.35	1191	1.45	1236	1.56	1273	1.66
2300	797	0.81	857	0.92	919	1.03	981	1.13	1043	1.23	1103	1.33	1159	1.43	1210	1.53	1255	1.64	1292	1.74
2400	817	1.90	877	1.01	939	1.12	1002	1.22	1063	1.32	1123	1.42	1179	1.52	1230	1.62	1275	1.73	1312	1.83

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	1.5	1.73	1VL40	AK61	N/A	787	847	908	968	1029	1089
		2	2.30	1VP56	AK74	N/A	1035	1084	1134	1183	1232	1281

Airflow Performance

Table 17: Airflow Performance - Side Duct Application

ZT037 (3.0 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]				Standard 1.5 Hp & Drive						High Static 1.5 Hp & Drive						FS[4]			
900	468	0.24	563	0.27	652	0.36	736	0.46	814	0.56	887	0.67	955	0.76	1017	0.87	1074	1.01	1126	1.09
1000	479	0.25	578	0.29	670	0.38	756	0.47	837	0.57	911	0.68	979	0.78	1041	0.89	1098	1.03	1148	1.11
1100	494	0.27	594	0.31	688	0.40	775	0.49	856	0.59	931	0.69	999	0.79	1061	0.90	1117	1.04	1167	1.13
1200	509	0.28	608	0.37	701	0.46	788	0.55	870	0.65	945	0.75	1015	0.85	1078	0.95	1136	1.06	1188	1.17
1300	524	0.30	623	0.39	716	0.48	804	0.58	886	0.68	961	0.78	1032	0.88	1096	0.99	1154	1.09	1207	1.20
1400	540	0.32	639	0.41	732	0.51	819	0.61	901	0.71	977	0.82	1048	0.92	1113	1.03	1172	1.14	1226	1.26
1500	562	0.34	660	0.44	753	0.54	840	0.65	921	0.75	998	0.85	1069	0.96	1135	1.07	1195	1.18	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive

ZT049 (4.0 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
			Standard 1.5 Hp & Drive						High Static 1.5 Hp & Drive								FS[4]			
1200	-	-	618	0.34	695	0.40	783	0.47	864	0.54	940	0.60	983	0.69	1073	0.76	1119	0.88	1178	0.94
1300	-	-	638	0.38	712	0.43	799	0.50	876	0.59	954	0.65	995	0.74	1080	0.81	1130	0.94	1188	1.00
1400	-	-	653	0.40	729	0.46	815	0.54	888	0.63	965	0.72	1007	0.78	1088	0.87	1140	1.00	1198	1.06
1500	574	0.36	666	0.42	747	0.50	831	0.59	900	0.68	975	0.78	1019	0.83	1096	0.92	1151	1.06	1207	1.11
1600	596	0.39	689	0.44	766	0.54	847	0.63	912	0.73	983	0.84	1031	0.88	1103	0.97	1162	1.13	1217	1.18
1700	619	0.43	711	0.49	786	0.58	863	0.68	925	0.79	991	0.89	1043	0.94	1112	1.04	1172	1.19	1227	1.25
1800	643	0.47	734	0.54	808	0.64	878	0.73	936	0.84	998	0.95	1055	1.00	1121	1.10	1183	1.27	1237	1.33
1900	669	0.52	757	0.61	831	0.71	894	0.79	948	0.91	1004	1.00	1067	1.06	1130	1.16	1194	1.35	-	-
2000	697	0.58	779	0.67	856	0.78	910	0.85	960	0.98	1010	1.05	1079	1.13	1140	1.23	-	-	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZT061 (5.0 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
			FS[4]				Standard 1.5 Hp & Drive								High Static 2.0 Hp & Drive					
1500	-	-	667	0.40	747	0.50	837	0.58	904	0.59	972	0.73	1039	0.88	1096	0.92	1151	1.06	1207	1.11
1600	-	-	689	0.44	766	0.54	844	0.60	917	0.65	982	0.79	1047	0.93	1103	0.97	1162	1.13	1217	1.18
1700	615	0.43	711	0.48	786	0.58	852	0.64	931	0.73	994	0.86	1057	1.00	1112	1.04	1172	1.19	1227	1.25
1800	641	0.48	734	0.53	808	0.64	863	0.68	945	0.80	1006	0.93	1067	1.06	1121	1.10	1183	1.27	1237	1.33
1900	666	0.52	757	0.59	831	0.71	878	0.76	959	0.87	1018	0.99	1077	1.12	1130	1.16	1194	1.35	1246	1.40
2000	692	0.58	781	0.65	842	0.73	914	0.82	973	0.94	1031	1.06	1089	1.19	1140	1.23	1204	1.43	1256	1.49
2100	718	0.64	806	0.73	863	0.75	934	0.88	987	1.01	1044	1.14	1101	1.26	1151	1.31	1215	1.53	1266	1.58
2200	744	0.71	832	0.81	886	0.83	954	0.95	1002	1.09	1059	1.22	1116	1.36	1164	1.40	1226	1.63	1276	1.67
2300	770	0.79	859	0.91	907	0.90	972	1.02	1017	1.16	1074	1.31	1131	1.45	1178	1.50	1236	1.72	1286	1.78
2400	796	0.87	887	1.03	927	0.98	990	1.09	1032	1.24	1091	1.40	1150	1.56	1195	1.62	1247	1.83	1295	1.87
2500	822	0.96	916	1.17	946	1.06	1006	1.17	1047	1.32	1112	1.52	1177	1.73	1219	1.79	1258	1.95	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

Table 18: Airflow Performance - Bottom Duct Application

ZT037 (3.0 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]				Standard 1.5 Hp & Drive						High Static 1.5 Hp & Drive						FS[4]			
900	469	0.26	580	0.34	682	0.43	775	0.52	860	0.60	936	0.69	1004	0.78	1063	0.87	1113	0.96	1155	1.05
1000	486	0.27	597	0.36	699	0.45	793	0.54	879	0.63	956	0.72	1024	0.81	1083	0.91	1135	1.00	1177	1.10
1100	504	0.29	613	0.38	714	0.47	807	0.56	892	0.66	969	0.75	1037	0.84	1098	0.93	1151	1.02	1196	1.12
1200	526	0.31	635	0.40	736	0.50	828	0.59	911	0.69	986	0.78	1053	0.87	1112	0.97	1162	1.06	1203	1.15
1300	552	0.33	657	0.42	755	0.52	844	0.62	926	0.71	1001	0.81	1067	0.90	1126	0.99	1177	1.08	1220	1.17
1400	577	0.35	679	0.46	774	0.56	862	0.65	943	0.75	1017	0.84	1084	0.93	1144	1.02	1198	1.11	-	-
1500	610	0.39	707	0.49	797	0.60	882	0.70	959	0.79	1031	0.89	1095	0.98	1154	1.07	1206	1.15	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZT049 (4.0 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 1.5 Hp & Drive								High Static 1.5 Hp & Drive								FS[4]			
1200	-	-	633	0.38	728	0.47	816	0.56	898	0.65	973	0.75	1042	0.85	1104	0.95	1159	1.05	1208	1.16
1300	-	-	656	0.41	748	0.50	834	0.59	914	0.68	988	0.77	1056	0.87	1118	0.96	1174	1.07	1224	1.17
1400	586	0.37	680	0.46	769	0.55	852	0.65	930	0.74	1003	0.84	1070	0.93	1132	1.02	1189	1.12	-	-
1500	612	0.40	703	0.50	790	0.59	871	0.69	948	0.78	1019	0.88	1086	0.97	1148	1.07	1205	1.17	-	-
1600	643	0.44	731	0.53	814	0.63	893	0.73	967	0.82	1037	0.92	1103	1.01	1164	1.11	1221	1.21	-	-
1700	671	0.47	756	0.57	837	0.67	914	0.77	987	0.87	1056	0.97	1121	1.07	1183	1.17	-	-	-	-
1800	699	0.53	781	0.63	860	0.73	935	0.84	1006	0.94	1074	1.04	1139	1.14	1199	1.24	-	-	-	-
1900	726	0.58	805	0.69	881	0.80	954	0.90	1024	1.01	1092	1.12	1157	1.22	1218	1.33	-	-	-	-
2000	755	0.64	831	0.75	905	0.86	977	0.97	1046	1.08	1113	1.19	1178	1.3	-	-	-	-	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZT061 (5.0 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]				Standard 1.5 Hp & Drive												High Static 2.0 Hp & Drive			
1500	616	0.39	696	0.50	771	0.60	841	0.71	907	0.81	968	0.91	1024	1.02	1075	1.12	1122	1.23	1164	1.33
1600	643	0.43	719	0.54	791	0.64	858	0.74	921	0.85	980	0.95	1034	1.06	1084	1.16	1130	1.26	1171	1.37
1700	671	0.47	746	0.58	817	0.68	884	0.78	947	0.88	1006	0.98	1062	1.09	1113	1.19	1160	1.29	1203	1.39
1800	698	0.52	771	0.62	840	0.72	905	0.83	967	0.93	1025	1.03	1080	1.13	1131	1.24	1178	1.34	1222	1.44
1900	725	0.57	796	0.67	864	0.77	929	0.88	990	0.98	1048	1.09	1102	1.19	1154	1.29	1202	1.40	1246	1.50
2000	753	0.62	822	0.73	888	0.83	952	0.94	1012	1.04	1069	1.15	1123	1.25	1174	1.36	1222	1.46	1267	1.57
2100	782	0.68	849	0.79	913	0.89	975	1.00	1033	1.11	1090	1.21	1143	1.32	1194	1.43	1243	1.54	1288	1.64
2200	809	0.74	874	0.85	936	0.96	997	1.07	1055	1.18	1110	1.29	1164	1.39	1215	1.50	1264	1.61	1310	1.72
2300	837	0.82	900	0.93	960	1.04	1019	1.15	1076	1.26	1132	1.37	1185	1.48	1236	1.59	1285	1.70	1333	1.81
2400	865	0.89	925	1.01	984	1.12	1042	1.23	1098	1.35	1152	1.46	1205	1.57	1256	1.69	1306	1.80	-	-
2500	893	0.98	952	1.09	1009	1.21	1065	1.33	1120	1.44	1173	1.56	1226	1.67	1277	1.79	1327	1.91	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

Table 19: RPM Selection

Size (Tons)	Model	Airflow Option	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
037 (3)	ZT	Field Supplied	1.5	1.5	1VL34	AK79	N/A	465	512	557	606	651	695
		Std.	1.5	1.5	1VL40	AK79	N/A	612	661	707	752	799	844
		H. Static	1.5	1.5	1VL40	AK61	N/A	782	846	906	968	1022	1085
		Field Supplied	1.5	1.5	1VL40	AK54	N/A	896	960	1030	1090	166	1238
049 (4)	ZT	Std.	1.5	1.5	1VL34	AK64	N/A	576	631	688	747	800	859
		H. Static	1.5	1.5	1VL44	AK69	N/A	792	844	892	944	996	1045
		Field Supplied	1.5	1.5	1VL44	AK59	N/A	915	989	1050	1113	1173	1238
061 (5)	ZT	Field Supplied	1.5	1.5	1VL40	AK79	N/A	609	656	703	746	792	839
		Std.	1.5	1.5	1VL40	AK61	N/A	782	846	906	968	1022	1085
		Field Supplied	2	2	1VL40	AK54	N/A	896	960	1030	1090	1166	1238
		H. Static	2	2	1VM50	AK64	N/A	1022	1079	1135	1190	1246	1297

Table 20: Indoor Blower Specifications

Size (Tons)	Model	Motor					Motor Sheave			Blower Sheave			Belt
		HP	RPM	Eff.	SF	Frame	Datum Dia. (in.)	Bore (in.)	Model	Datum Dia. (in.)	Bore (in.)	Model	
037 (3)	ZT	Std.	1-1/2	1725	0.86	1.15	56	2.4 - 3.4	7/8	1VL40	7.5	1	AK79
		H. Static	1-1/2	1725	0.86	1.15	56	2.4 - 3.4	7/8	1VL40	5.7	1	AK61
049 (4)	ZT	Std.	1-1/2	1725	0.86	1.15	56	1.9 - 2.9	7/8	1VL34	6	1	AK64
		H. Static	1-1/2	1725	0.86	1.15	56	2.8 - 3.8	7/8	1VL44	6.5	1	AK69
061 (5)	ZT	Std.	1-1/2	1725	0.86	1.15	56	2.4 - 3.4	7/8	1VL40	5.7	1	AK61
		H. Static	2	1725	0.86	1.15	56	3.4 - 4.4	7/8	1VM50	6	1	AK64

Table 21: Power Exhaust Specifications

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

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

Air Balance

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

⚠ CAUTION

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. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Checking Air Quantity

Method One

1. Remove the dot plugs from the duct panel (for location of the dot plugs see Figure 10).
2. Insert eight-inches of 1/4 inch metal tubing into the airflow 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. Use an Inclined Manometer or Magnehelic to determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil can vary greatly, measuring the pressure drop across a wet coil under field conditions could be inaccurate. To assure a dry coil, the compressors should be de-activated while the test is being run.

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

4. The CFM through the unit can be determined from the pressure drop indicated by the manometer by referring to Figure 28. In order to obtain an accurate measurement, be certain that the air filters are clean.
5. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.
6. After readings have been obtained, remove the tubes and replace the dot plugs.
7. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

⚠WARNING

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

Method Two

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

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

3. Use an Inclined Manometer or Magnehelic to determine the pressure drop across the unit. This is the External Static Pressure (ESP). In order to obtain an accurate measurement, be certain that the air filters are clean.
4. Determine the number of turns the variable motor sheave is open.
5. Select the correct blower performance table for the unit from Tables 17 and 18. Tables are presented for side and downflow configuration.
6. Determine the unit Measured CFM from the Blower Performance Table, External Static Pressure and the number of turns the variable motor sheave is open.
7. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.
8. After reading has been obtained, remove the tubes and seal holes.
9. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

NOTE: With the addition of field installed accessories repeat this procedure.

⚠WARNING

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

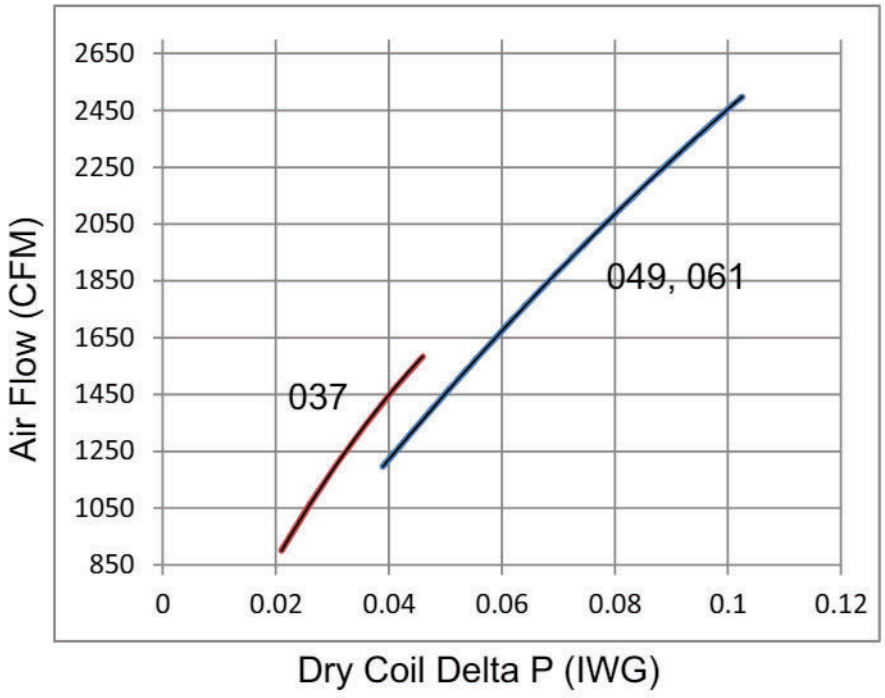


Figure 28: Dry Coil Delta P

Supply Air Drive Adjustment

⚠ CAUTION

Before making any blower speed changes review the installation for any installation errors, leaks or undesirable systems effects that can result in loss of airflow.

Even small changes in blower speed can result in substantial changes in static pressure and BHP. BHP and AMP draw of the blower motor will increase by the cube of the blower speed. Static pressure will increase by the square of the blower speed. Only qualified personnel should make blower speed changes, strictly adhering to the fan laws.

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

$$\left(\frac{1{,}700\ \text{CFM}}{1{,}400\ \text{CFM}}\right) \cdot 1.88\ \text{in.} = 2.28\ \text{in.}$$

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

EXAMPLE

A 4 ton unit was selected to deliver 1,700 CFM with a 1.5 HP motor, but the unit is delivering 1,400 CFM. The variable pitch motor sheave is set at 3 turns open.

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

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

Use Table 22 to locate the DD nearest to 2.28 in. Close the sheave to 2 turn open.

New BHP

= (Speed increase)^3 • BHP at 1,400 CFM

= (Speed increase)^3 • Original BHP

= New BHP

New motor Amps

= (Speed increase)^3 • Amps at 1,400 CFM

= (Speed increase)^3 • Original Amps

= New Amps

Table 22: Motor Sheave Datum Diameters

1VL34x7/8 (1-1/2 HP Motor)		1VL44x7/8 (1-1/2 HP Motor)		1VL40x7/8 (1-1/2 HP Motor)		1VM50x7/8 (2 HP Motor)	
Turns Open	Datum Diameter	Turns Open	Datum Diameter	Turns Open	Datum Diameter	Turns Open	Datum Diameter
0	2.9	0	4.0	0	3.6	0	4.4
1/2	2.8	1/2	3.9	1/2	3.5	1/2	4.3
1	2.7	1	3.8	1	3.4	1	4.2
1-1/2	2.6	1-1/2	3.7	1-1/2	3.3	1-1/2	4.1
2	2.3	2	3.6	2	3.2	2	4.0
2-1/2	2.4	2-1/2	3.5	2-1/2	3.1	2-1/2	3.9
3	2.3	3	3.4	3	3.0	3	3.8
3-1/2	2.2	3-1/2	3.3	3-1/2	2.9	3-1/2	3.7
4	2.1	4	3.2	4	2.8	4	3.6
4-1/2	2.0	4-1/2	3.1	4-1/2	2.7	4-1/2	3.5
5	1.9	5	3.0	5	2.6	5	3.4

⚠ 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. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Table 23: Additional Static Resistance

Size (Tons)	Model	CFM	Cooling Only[1]	Economizer[2] [3]	4" Pleated Filter[2]	Electric Heat kW[2]					
						3	6	9	15	20	24
037 (3)	ZT	900	0.05	-0.05	0.01	0.00	0.00	0.00	0.01	0.01	0.01
		1000	0.05	-0.03	0.02	0.00	0.00	0.00	0.02	0.02	0.02
		1100	0.04	-0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02
		1200	0.04	0.00	0.04	0.01	0.01	0.01	0.02	0.02	0.02
		1300	0.03	0.01	0.05	0.01	0.01	0.01	0.03	0.03	0.03
		1400	0.03	0.03	0.07	0.02	0.02	0.02	0.03	0.03	0.03
		1500	0.03	0.04	0.08	0.02	0.02	0.02	0.04	0.04	0.04
049 (4) 061 (5)	ZT	1200	-0.01	0.10	0.05	0.01	0.01	0.01	0.02	0.02	0.02
		1300	-0.01	0.11	0.06	0.01	0.01	0.01	0.03	0.03	0.03
		1400	-0.01	0.12	0.06	0.02	0.02	0.02	0.03	0.03	0.03
		1500	-0.01	0.13	0.07	0.02	0.02	0.02	0.04	0.04	0.04
		1600	-0.01	0.14	0.08	0.02	0.02	0.02	0.04	0.04	0.04
		1700	-0.01	0.15	0.08	0.03	0.03	0.03	0.05	0.05	0.05
		1800	-0.02	0.16	0.09	0.03	0.03	0.03	0.05	0.05	0.05
		1900	-0.02	0.17	0.10	0.04	0.04	0.04	0.06	0.06	0.06
		2000	-0.02	0.18	0.10	0.04	0.04	0.04	0.07	0.07	0.07
		2100	-0.03	0.19	0.11	0.05	0.05	0.05	0.07	0.07	0.07
		2200	-0.03	0.20	0.12	0.06	0.06	0.06	0.08	0.08	0.08
		2300	-0.04	0.21	0.12	0.06	0.06	0.06	0.09	0.09	0.09
		2400	-0.04	0.22	0.13	0.07	0.07	0.07	0.10	0.10	0.10
		2500	-0.05	0.23	0.14	0.08	0.08	0.08	0.11	0.11	0.11

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

Operation

Cooling Operation

- With a demand for first stage cooling either from a thermostat or space sensor, the low-voltage control circuit to "C1" and "G" is completed. For first stage cooling, the compressor is energized and the 1st stage operates (67% capacity). The UCB will energize the VFD equipped blower motor at low speed as set in the Smart Equipment™ control. When the thermostat calls for the second stage of cooling, the low-voltage control circuit to "C2" is completed. The control board energizes the 2nd stage of the compressor (100% capacity). If there is an initial call for both stages of cooling, the UCB will delay energizing the 2nd stage of the compressor by 30 seconds in order to avoid a power rush. Once the thermostat has been satisfied, it will de-energize C1 and C2. If the compressor has satisfied the minimum run time (3 min default), the compressors and condenser fans are de-energized. Otherwise, the unit operates until the minimum run has been completed. Upon the compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.
- To be available, a compressor must not be locked-out due to a high or low-pressure switch or freezestat trip and the Anti- Short Cycle Delay (5 min default) must have elapsed.

Free Cooling Operation with Economizer

- With a demand for first stage cooling either from a thermostat or space sensor and the outside air is suitable for free cooling, the dampers will be modulated to maintain supply air temperature to within +/- 1 degree of the Free Cooling SAT Upper Setpoint. If the output to the economizer actuator is at 10 vdc and the supply air temperature cannot be controlled to within 5 degrees of the Free Cooling SAT Upper Setpoint, one compressor will be energized. The economizer will then be modulated to maintain supply air temperature to within +/- 1 degree of the Free Cooling SAT Upper Setpoint.
- If a demand for second stage cooling occurs and the economizer is already modulating to maintain the supply air temperature to the Cooling SAT Upper Setpoint, the setpoint will be changed to the Free Cooling SAT Lower Setpoint. Any compressors that are energized will remain energized and the economizer dampers will be modulated to maintain supply air temperature to within +/- 1 degree of the Cooling SAT Lower Setpoint. If the output to the economizer actuator is at 10 vdc and the supply air temperature cannot be controlled to within 5 degrees of the Cooling SAT Lower Setpoint, compressor stage 2 will be energized. The economizer will then be modulated to maintain supply air temperature to within +/- 1 degree of the Cooling SAT Lower Setpoint.
- If the output to the economizer actuator is at minimum position and the supply air temperature drops more than 5 degrees below the current economizer SAT setpoint, the highest stage compressor will be de-energized as long as the minimum run time has elapsed.

Economizer With Single Enthalpy Sensor

When the room thermostat calls for cooling, the low voltage control circuit from “R” to “G” and “Y1” is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the “AUTO” position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (previously determined), “Y1” energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, “Y1” energizes the compressor and condenser fan motor only.

Once the thermostat has been satisfied, it will de-energize “Y1”. If the compressor has satisfied its minimum run time, the compressor and condenser fan are de-energized. Otherwise, the unit operates the cooling system until the minimum run times for the compressor has been completed. After the compressor de-energizes, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continues fan operation the economizer damper goes to the min. position.

Economizer With Dual Enthalpy Sensors

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

Economizer With Power Exhaust

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

Motorized Outdoor Air Dampers

This system operation is the same as the units with no outdoor air options with one exception. When the "R" to "G" circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the "R" to "G" circuit is opened, the damper spring returns fully closed.

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 compressor, initiate the ASCD (Anti-short cycle delay), and 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 compressor.

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 compressor, initiate the ASCD, and stop the condenser fans.

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 compressor, initiate the ASCD, and 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 compressor.

Evaporator Low Limit

During cooling operation, if the **Evaporator Low Limit Sensor (EC1)** (Located on the Suction Line at the Evaporator Coil.) detects a temperature below 26 Deg. F (default), the UCB will de-energize the compressor, initiate the ASCD, and 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)** falling below 26 Deg. F (default) three times within two hours of operation, the UCB will lock-out the compressor.

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 45ºF (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)** temperature below 26ºF will de-energize the compressor. If the call for cooling is still present at the end of the ASCD and the and the evaporator temperature sensor **(EC1)** 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)** (Located on the Suction Line at the Evaporator Coil.) to protect against low evaporator temperatures due to a low airflow or a low return air temperature, set at 26°F.
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 50 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace 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.

Electric Heating Sequence Of Operations

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

Two-stage heating:

a. Upon a call for first stage heat by the thermostat, the heater relay (RA) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor. If the second stage of heat is required, heater relay (RB) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

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.

Safety Controls

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

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the heater compartment and is set to open at the temperature indicated in the Electric Heat Limit Setting Tables 24. 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 24: Electric Heat Limit Setting

UNIT (TONS)	VOLTAGE	HEATER kW	LIMIT SWITCH OPENS °F
ZT037 (3)	208/230	3	155
		6	155
		9	170
		15	170
ZT049 (4)	208/230	6	155
		9	170
		15	170
		20	170
ZT061 (5)	208/230	6	155
		9	170
		15	170
		20	170
		24	170

Table 24: Electric Heat Limit Setting

UNIT (TONS)	VOLTAGE	HEATER kW	LIMIT SWITCH OPENS °F
ZT037 (3)	480	3	155
		6	155
		9	170
		15	170
ZT049 (4)	480	6	155
		9	170
		15	170
		20	170
ZT061 (5)	480	6	155
		9	170
		15	170
		20	170
		24	170
ZT037 (3)	600	9	170
		15	170
ZT049 (4)	600	9	170
		15	170
		20	170
ZT061 (5)	600	9	170
		15	170
		20	170
		24	170

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 25 for the required electric heat anticipator setting.

Table 25: Electric Heat Anticipator Setpoints

SETTING, AMPS	
W1	W2
0.13	0.1

Gas Heating Sequence Of Operations

When the thermostat calls for the first stage of heating, the low-voltage control circuit from “R” to “W1” is completed. A call for heat passes through the UCB to the **Ignition Control Board (ICB).** The UCB monitors the “W1” call and acts upon any call for heat by monitoring the **Gas Valve (GV).** Once voltage has been sensed at the GV, the UCB will initiate the fan on delay for heating, energizing the indoor blower the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately closed. The blower is de-

energized after the fan off delay for heating has elapsed. The draft motor performs a 30-second post purge.

Ignition Control Board

First Stage Of Heating

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

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

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

When “W1” is satisfied, both valves are closed.

Second Stage Of Heating

When the ICB receives a call for the second stage of heating, “W2,” the ICB conducts a complete first stage ignition sequence. If this sequence is satisfied, the second main valve of the GV is opened.

When “W2” is satisfied, the second main valve is closed.

Retry Operation

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

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

Recycle Operation

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

Gas Heating Operation Errors

Lock-Out

A one-hour lockout occurs following three retries or five recycles. During the one-hour lockout, flame detection, limit conditions, and main valves are tested. Any improper results will cause the appropriate action to occur. Recycling the low voltage power cancels the lock-out.

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 15-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

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

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

Flame Sense

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

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

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

Gas Valve

The UCB and ICB continuously monitor the GV.

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

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

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

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

Safety Controls

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

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the gas heat compartment and is set to open at the temperature indicated in Table 10. 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.

Auxiliary Limit Switch (ALS)

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

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

The control circuit includes the following safety controls:

Pressure Switch (PS)

Once the draft motor has reached full speed and closes the pressure switch during a normal ignition sequence, if the pressure switch opens for 2 seconds, the GV will be de-energized, the ignition cycle is aborted, and the ICB flashes the appropriate code. See Table 31 Ignition Control Flash Codes. The draft motor is energized until the pressure switch closes or “W1” is lost.

Roll-out Switch (ROS)

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

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

Internal Microprocessor Failure

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

Flash Codes

The ICB will initiate a flash code associated with errors within the system. Refer to IGNITION CONTROL FLASH CODES Table 31.

Resets

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

Gas Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 26 for the required gas heat anticipator setting.

Table 26: Gas Heat Anticipator Setpoints

SETTING, AMPS	
W1	**W2**
0.65	0.1

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.

NOTE: Prior to each cooling season, the crankcase heaters must be energized at least 10 hours before the system is put into operation.

2. Set the room thermostat setting 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.

Start-Up (Gas Heat)

Pre-Start Check List

Complete the following checks before starting the unit.

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

Operating Instructions

⚠ CAUTION

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

Lighting The Main Burners

1. Turn "OFF" electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve counter-clockwise to "ON" position (See Figure 30).
4. Turn "ON" electric power to unit.
5. If thermostat set temperature is above room temperature, the main burners will ignite. If a second stage of heat is called for, the main burners for second stage heat will ignite for the second stage heat.

Post Start Checklist

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

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

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

2. Check for correct manifold gas pressures. (See CHECKING GAS INPUT.)
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas pressure exceed 10.5 in. or the operating pressure drop below 4.5 in for natural gas units. If gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Shut Down

1. Set the thermostat to the lowest temperature setting.
2. Turn "OFF" all electric power to unit.
3. Open gas heat access panel.
4. Turn gas valve clockwise to "OFF" position (See Figure 30).

Checking Gas Heat Input

This unit has two stages of gas heat. The first stage is 70% of the full fire input and is considered the minimum input for the furnace. The intended input for each furnace is shown in Table 28. The table applies to units operating on 60 Hz power only.

To determine the rate of gas flow (Second Stage).

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for Second stage (100% input) heat.
3. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
4. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour. (See example below).
5. If necessary, adjust the high pressure regulator as discussed in the section "Manifold Gas Pressure Adjustment". **Be sure not to over-fire** the furnace on Second stage. If in doubt, it is better to leave the Second stage of the furnace slightly under-fired. Repeat Steps 1-5.

To determine the rate of gas flow (First Stage)

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for first stage (70% input) heat.
3. Even when the thermostat is calling for first stage heat, the unit will light on second stage and will run on Second stage for 1 minute. Allow this one-minute time period to expire and be certain the unit is running on first stage.
4. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
5. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour (See example below).

6. If necessary, adjust the low pressure regulator as discussed in the section “Manifold Gas Pressure Adjustment”. **Be sure not to under-fire** the furnace on first stage. If in doubt, it is better to leave the first stage of the furnace slightly over-fired (greater than 70% input). Repeat Steps 1-6.

Table 27: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

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

EXAMPLE

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

Manifold Gas Pressure Adjustment

This gas furnace has two heat stages. Therefore, the gas valve has two adjustment screws located under a plastic protective cover. The second stage (100% input) adjustment screw is adjacent to the “HI” marking on the valve and the first stage (60% input) adjustment screw is located adjacent to the “LO” marking on the valve (See Figure 30).

Manifold pressure adjustment procedure.

Adjust second stage (100% input) pressure first, then adjust first stage (70% input) pressure.

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

NOTE: When using natural gas, the manifold pressure for second stage (100% input) should be 3.5 IWG ± 0.3. The manifold pressure for first stage (60% input) when using natural gas should be 1.5 IWG ± 0.3.

Table 28: Gas Heat Stages

Unit		# of Burner Tubes	1st Stage Input (Mbh)	2nd Stage Input (Mbh)	Total Input (Mbh)
Size	Opt.				
037	N06	4	45	15	60
	N08	4	56	24	80
	N12	6	84	36	120
049	N06	4	45	15	60
	N08	4	56	24	80
	N12	6	84	36	120
061	N08	4	56	24	80
	N12	6	84	36	120
	N16	8	112	48	160

Adjustment Of Temperature Rise

The temperature rise (the difference of temperature between the return air and the heated air from the furnace) must lie within the range shown on the CSA rating plate and the data in Table 10.

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

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

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

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

Burners/Orifices Inspection/Servicing

Before checking or changing burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL POWER TO THE UNIT.

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

To service burners, complete step 4.

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

NOTE: Reverse the above procedure to replace the assemblies.

Make sure that burners are level and seat at the rear of the gas orifice.

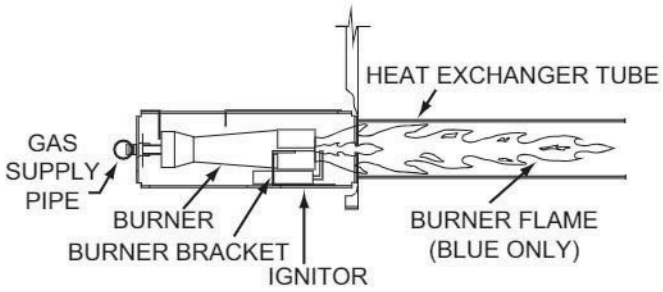


Figure 29: Typical Flame

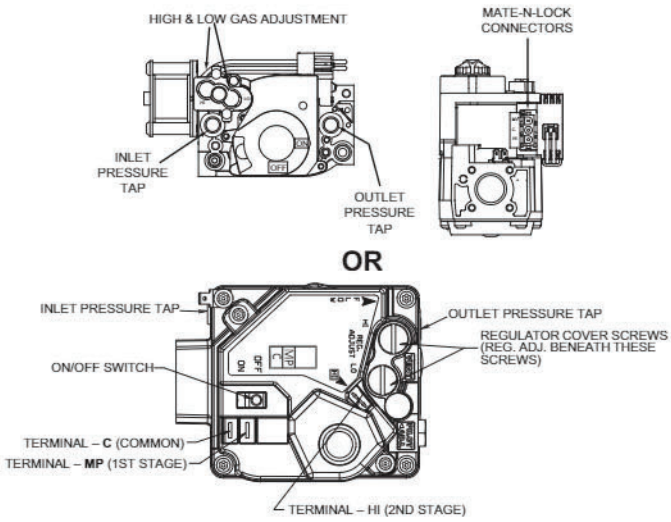


Figure 30: Typical Two Stage Gas Valve

Control Board Navigation Components

The following components are needed to access the control points in the Smart Equipment™ control. Installation and operation guides are available from your equipment dealer or distributor.

1. Local LCD on Unit Control Board.
2. Mobile Access Portal (MAP) Gateway (Portable).
   - Source 1 P/N S1-JC-MAP1810-OP
3. *MAP Gateway Quick Start Guide* P/N 24-10737-16
4. *MAP Gateway Instruction* P/N 24-10737-8

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

NOTE: For more in-depth sequence of operation of the Smart Equipment™ control, refer to the *Smart Equipment™ Controls Sequence of Operation Overview* LIT-12011950.

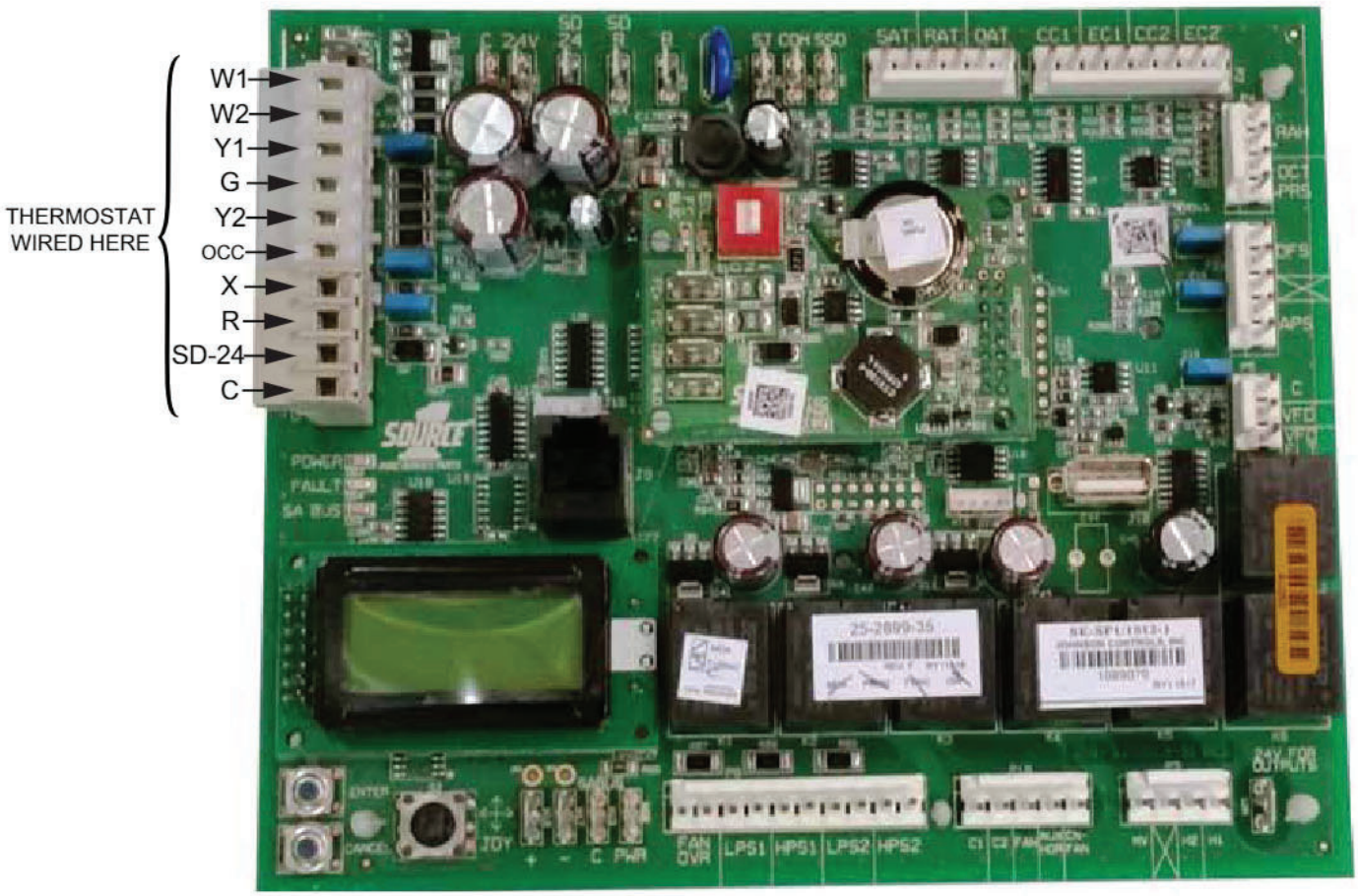


Figure 31: Unit Control Board

Table 29: Smart Equipment™ UCB Details

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

Table 29: 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 29: 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 29: 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 29: 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 BUS[1] connections on at left on lower edge and center of UCB		
PWR	Power for SA ("Sensor-Actuator") BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the 15 VDC (reading to C) circuit for powering an optional netstat and/or Multi Touch gateway
C	Common for SA BUS power and communication circuits	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Negative of the SA BUS circuits
–	Communication for SA BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts lower than +) SA BUS communication circuit to optional economizer board, 4-stage board, fault detection & diagnostics board, netstat and/or Multi Touch gateway
+	Communication for SA BUS devices	Also incorporated in the J8 6-pin phone jack connector at the left-center of the board. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts higher than –) SA BUS communication circuit to optional economizer board, 4-stage board, fault detection & diagnostics board, netstat and/or Multi Touch gateway
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 29: Smart Equipment™ UCB Details (Continued)

Description		Function & Comments
J15	Factory wired SA Bus connector	
Optional communication sub-board at center of UCB		
Terminal FC BUS[1] connections on left edge of the communication board		
FC+	FC ("Field Connected") BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts higher than –) FC bus BACnet MSTP communication circuit
FC–	FC ("Field Connected") BUS BACnet MSTP communication	Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to COM; at least 0.25 volts lower than +) FC bus BACnet MSTP communication circuit
COM	Common for the FC ("Field Connected") BUS BACnet MSTP communication circuit	Negative of the VDC FC bus BACnet MSTP communication circuit
SHLD	Shield for the FC ("Field Connected") BUS BACnet MSTP communication circuit	Earth ground reference of the cable to prevent interference on the FC bus BACnet MSTP communication circuit
Item Selector in red housing at left on top edge of the communication board		
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 30.

Table 30: 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.

Table 31: Ignition Control Flash Codes

Flashes	Fault Conditions	Check
Steady On	Control Failure	Control
Heartbeat	Normal Operation	
1	Not Applicable	
2	Pressure Switch Stuck Closed	Pressure Switch
3	Pressure Switch Failed To Close	Venter Pressure Switch Vent Blocked
4	Limit Switch Open	Main Limit AUX Limit
5	Flame Present With Gas Off First Stage Gas Valve Energized With W1 Off Second Stage Gas Valve Energized With First Stage Gas Valve Off	Gas Valve
6	Ignition Lockout	Gas Flow Gas Pressure Gas Valve Flame Sensor
Steady Off	No Power Or Control Failure	24VAC or Control

Charging The Unit

Charge unit by weight using name plate data or use charging tables.

Table 32: ZT037 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compressor Amps
300 Cfm/Ton 80/62	75	134	57	259	77	-25	7.6
	85	133	56	302	87	-26	8.1
	95	133	54	345	96	-26	8.6
300 Cfm/Ton 80/67	75	134	58	258	77	-25	7.6
	85	137	57	303	87	-24	8.0
	95	139	56	347	97	-23	8.5
300 Cfm/Ton 80/72	75	135	60	258	77	-25	7.5
	85	140	59	303	87	-23	8.0
	95	146	58	348	97	-20	8.4
300 Cfm/Ton 75/62	75	128	53	258	77	-23	7.6
	85	129	52	301	86	-22	8.1
	95	129	52	344	96	-22	8.6
400 Cfm/Ton 80/62	75	140	62	261	77	-23	7.9
	85	141	61	304	87	-23	8.3
	95	143	60	347	97	-22	8.8
400 Cfm/Ton 80/67	75	141	63	261	77	-23	7.8
	85	144	62	305	87	-22	8.3
	95	146	60	349	97	-21	8.8
400 Cfm/Ton 80/72	75	143	64	261	77	-22	7.8
	85	146	62	306	87	-20	8.3
	95	149	60	351	97	-19	8.7
400 Cfm/Ton 75/62	75	134	58	259	77	-21	7.8
	85	136	57	303	87	-20	8.3
	95	138	56	346	96	-19	8.8

Table 33: ZT049 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compressor Amps
300 Cfm/Ton 80/62	75	140	63	262	77	-27	9.8
	85	139	60	304	87	-27	10.5
	95	138	57	346	97	-28	11.2
300 Cfm/Ton 80/67	75	141	62	261	78	-26	9.9
	85	143	61	306	87	-25	10.6
	95	145	61	351	97	-25	11.3
300 Cfm/Ton 80/72	75	142	60	260	79	-26	10.0
	85	147	63	308	87	-24	10.7
	95	152	66	356	96	-22	11.4
300 Cfm/Ton 75/62	75	134	59	261	77	-24	9.8
	85	134	57	304	87	-24	10.5
	95	135	56	347	96	-24	11.2
400 Cfm/Ton 80/62	75	144	66	264	77	-24	10.2
	85	146	63	306	87	-24	10.9
	95	147	61	349	98	-24	11.6
400 Cfm/Ton 80/67	75	147	66	265	77	-23	10.3
	85	149	64	308	87	-22	11.0
	95	152	62	352	98	-22	11.7
400 Cfm/Ton 80/72	75	149	65	265	78	-22	10.4
	85	153	65	310	88	-21	11.1
	95	156	64	354	98	-20	11.8
400 Cfm/Ton 75/62	75	139	62	262	77	-22	10.2
	85	141	60	305	87	-21	10.9
	95	143	59	349	97	-20	11.6

Table 34: ZT061 Charging Table

Air Flow Indoor Db/Wb	Outdoor DB	Suction Pressure	Suction Temp.	Liquid Pressure	Liquid Temp.	Delta T Db	Compressor Amps
300 Cfm/Ton 80/62	75	139	60	271	79	-27	10.4
	85	137	57	316	88	-27	11.3
	95	135	54	361	96	-27	12.2
300 Cfm/Ton 80/67	75	139	59	274	79	-27	10.6
	85	141	59	320	88	-26	11.5
	95	143	59	366	97	-25	12.5
300 Cfm/Ton 80/72	75	139	59	277	80	-27	10.7
	85	145	62	324	89	-24	11.7
	95	151	65	371	97	-22	12.8
300 Cfm/Ton 75/62	75	133	56	270	78	-24	10.4
	85	133	55	317	87	-24	11.3
	95	133	54	363	96	-23	12.2
400 Cfm/Ton 80/62	75	143	63	272	79	-24	10.5
	85	144	61	318	89	-23	11.4
	95	145	59	364	98	-23	12.3
400 Cfm/Ton 80/67	75	145	62	275	79	-23	10.7
	85	147	61	322	88	-22	11.7
	95	149	61	369	97	-21	12.6
400 Cfm/Ton 80/72	75	147	61	279	79	-23	10.9
	85	150	62	326	88	-21	11.9
	95	153	62	374	96	-20	12.9
400 Cfm/Ton 75/62	75	138	59	272	79	-21	10.5
	85	139	58	319	88	-20	11.4
	95	140	57	365	97	-20	12.4

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

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:

1034349-UCL-F-0318

REFERENCE

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

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

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

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

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

Operating Measurements - Air Flow

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

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

Blower Motor HP _____FLA_____ RPM_____

Pulley Pitch Diameter _____Turns Out_____ Final Turns Out_____

Blower Pulley Pitch Diameter _____ Fixed Sheave_____

ELECTRICAL DATA

T1 - T2 _____ Volts T2 - T3 _____ Volts

Control Voltage _____ Volts T1 - T3 _____ Volts

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

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

1034349-UCL-F-0318

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	☐	☐
Prove High Pressure Safety, All Systems	☐	☐
Prove Low Pressure Safety, All Systems	☐	☐

OPERATING MEASUREMENTS - GAS HEATING

Fuel Type: ☐ Natural Gas ☐ LP Gas

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

1. $\frac{\text{Input X Eff. (BTU output)}}{\text{1.08 X Temp. Rise}}$

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

FINAL - INSPECTION

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

OBSERVED PRODUCT DEFICIENCIES & CONCERNS:

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5370596-YIM-D-1019
Supersedes: 5370596-YIM-C-0518

York International Corporation
5005 York Drive
Norman, OK 73069

TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability

Installation Instructions

Part No. 24-10787-6, Rev. D
Issued November 2016

TEC3310-00-000, TEC3311-00-000, TEC3312-00-000, TEC3313-00-000,
TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, TEC3613-00-000

Refer to the QuickLIT website for the most up-to-date version of this document.

Applications

The TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers are stand-alone and field-selectable BACnet® Master-Slave/Token-Passing (MS/TP) or N2 networked devices provide control of the following:

- local hydronic reheat valves
- pressure-dependent variable air volume (VAV) equipment with or without local reheat
- two- or four-pipe fan coils
- cabinet unit heaters
- other zoning equipment using an on/off or floating control input

The networked models feature a field-selectable Building Automation System (BAS) BACnet MS/TP or N2 communication capability that enables remote monitoring and programming for efficient space temperature control. All models include a USB port configuration that reduces installation time by allowing simple backup and restore features from a USB drive, which enables rapid cloning of configuration between like units.

Some models have occupancy sensing capability built into the device. These thermostat controllers maximize up to 30% energy savings in high-energy usage commercial buildings, such as schools and hotels, during occupied times by using additional standby setpoints.

All models feature an intuitive onboard touchscreen UI with backlit display that makes setup and operation quick and easy. Multiple fan configurations are supported for fan coil equipment types:

- single-speed
- multi-speed (two or three discrete speeds)
- variable-speed/EC motors (0 to 10 VDC control)

Some models support dehumidification on two-pipe fan coil units with reheat, and four-pipe fan coil units with or without reheat. When no heating is required, the thermostat controller monitors space humidity and activates dehumidification control as necessary. Heat and/or reheat is used as required to maintain the space temperature. For optimal dehumidification performance, use a fan coil unit that has a multi-speed or variable-speed fan (VSF).

IMPORTANT: The TEC3000 Series Thermostat Controller is intended to provide an input to equipment under normal operating conditions. Where failure or malfunction of the thermostat controller could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the thermostat controller.

IMPORTANT : Le TEC3000 Series Thermostat Controller est destiné à transmettre des données entrantes à un équipement dans des conditions normales de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du thermostat controller risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du thermostat controller.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canada

This Class (B) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (B) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Installation

Parts Included

- one TEC3000 Series Thermostat Controller with integral mounting base
- one installation instructions sheet

Location Considerations

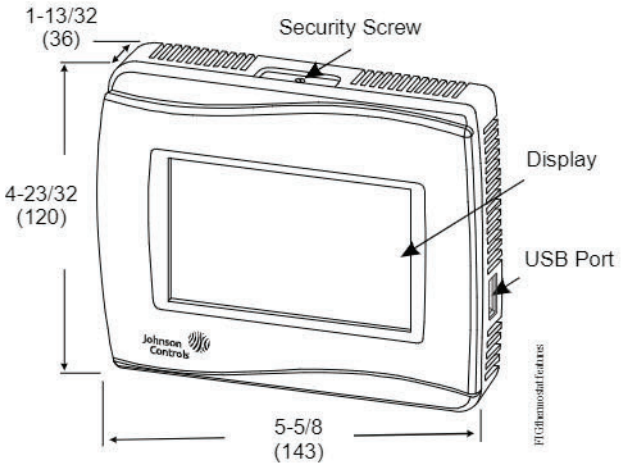
Locate the TEC3000 Series Thermostat Controller:

- on a partitioning wall, approximately 5 ft (1.5 m) above the floor in a location of average temperature, allowing for vertical air circulation to the TEC
- away from direct sunlight, radiant heat, outside walls, outside doors, air discharge grills, stairwells, and from behind doors
- away from steam or water pipes, warm air stacks, unconditioned areas (not heated or cooled), or sources of electrical interference

For integrated passive infrared (PIR) models, be sure that the thermostat controller is located centrally, where occupant movement is frequent.

Use insulating foam pads for installations where the wall temperature is different from the room temperature.

Figure 1: Thermostat Controller Shown without Occupancy Sensor, Dimensions, in. (mm)



Note: Allow for sufficient clearance to insert a USB drive into the USB port.

IMPORTANT: Only connect memory devices to the USB port. Do not use it for charging external devices.

Installing the Thermostat Controller

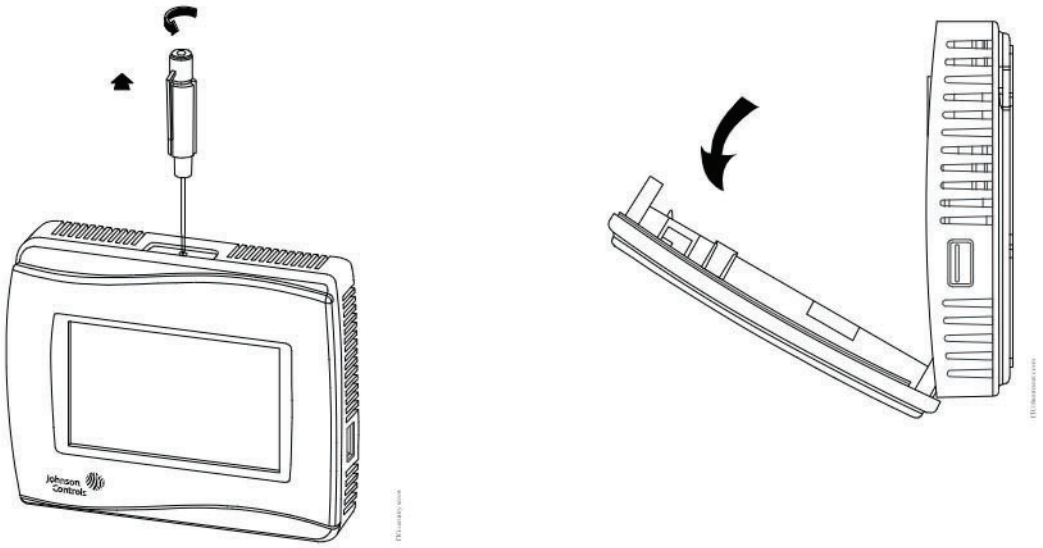
1. Use a 1/16 in. (1.5 mm) Allen wrench or Johnson Controls® T-4000-119 Allen-Head Adjustment Tool (order separately) to remove the security screw if it is installed on the top of the thermostat controller cover as illustrated in Figure 2.
2. Pull the top edge of the cover and open the thermostat controller as illustrated in Figure 2.

IMPORTANT: The cover is not secured on the bottom. Be careful not to drop the cover.

IMPORTANT: If you are installing more than one thermostat controller, keep track of which cover attaches to which base.

IMPORTANT: Use proper electrostatic discharge (ESD) precautions during installation and servicing to avoid damage to the electronic circuits of the thermostat controller.

Figure 2: Removing the Security Screw from the Thermostat Controller Cover (Shown without Occupancy Sensor) (Left) and Removing the Thermostat Controller Cover (Right)



3. Align the thermostat controller mounting base on the wall with the security screw on the top and use the base as a template to mark the two mounting hole locations. See Figure 3.

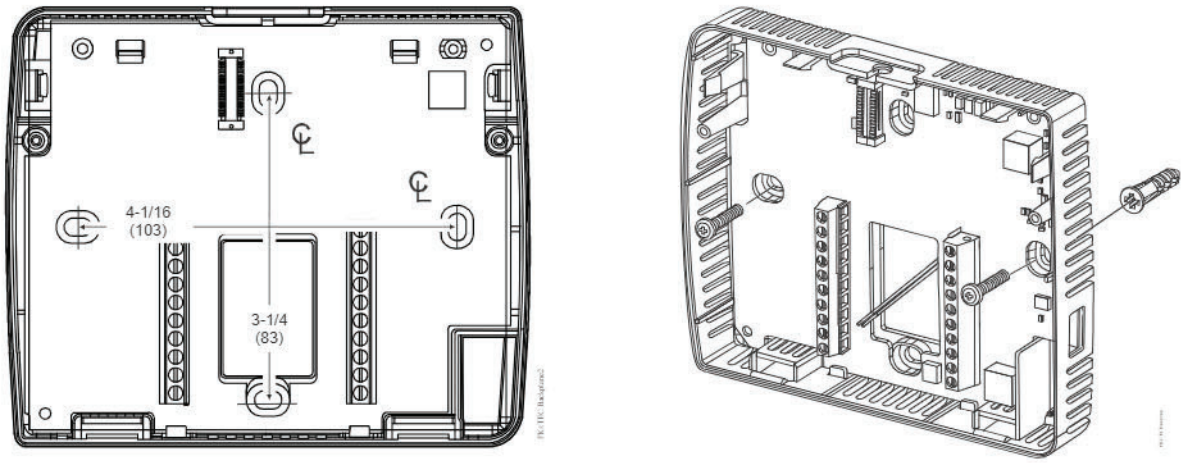
   Notes:

   - If you need to install the thermostat controller on an electrical junction box, use 2-1/2 x 4 in. (63 x 101 mm) square boxes with mud ring covers and avoid smaller 1-1/2 x 4 in. (38 x 101 mm) square or 3 x 2 in. (76 x 51 mm) boxes. This procedure ensures that you have enough space for cabling, if needed.
   - For surface-mounted applications, use durable mounting hardware, such as wall anchors, that cannot be easily pulled out of the mounting surface.

4. Pull approximately 6 in. (152 mm) of wire from the wall and insert the wire through the center hole in the thermostat controller mounting base. See Figure 3.
5. Secure the mounting base to the wall surface using two mounting screws (user supplied) as illustrated in Figure 3.

   Note: Be careful not to overtighten the mounting screws.

Figure 3: Mounting Hole Locations, Dimensions, in. (mm) (Left) and Securing the Thermostat Controller Mounting Base to the Wall (Right)



Wiring

When an existing thermostat controller is replaced, remove and label the wires to identify the terminal functions.

⚠ CAUTION

Risk of Electric Shock.
Disconnect the power supply before making electrical connections to avoid electric shock.

⚠ ATTENTION

Risque de décharge électrique.
Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.

NOTICE

Risk of Property Damage.
Do not apply power to the system before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

NOTICE

Risque de dégâts matériels.
Ne pas mettre le système sous tension avant d'avoir vérifié tous les raccords de câblage. Des fils formant un court-circuit ou connectés de façon incorrecte risquent d'endommager irrémédiablement l'équipement.

IMPORTANT: Make all wiring connections in accordance with local, national, and regional regulations. Do not exceed the electrical ratings of the TEC3000 Series Thermostat Controller.

IMPORTANT: Use proper electrostatic discharge (ESD) precautions during installation and servicing to avoid damage to the electronic circuits of the thermostat controller.

To wire the thermostat controller:

1. Strip the ends of each wire 1/4 in. (6 mm) and connect them to the appropriate screw terminals as indicated in Table 2 and Figure 6 or Figure 7.

   Note: For more details on wiring the MS/TP Communications Bus, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

2. Carefully push any excess wire back into the wall.

   Note: Seal the hole in the wall with fireproof material to prevent drafts from affecting the ambient temperature readings.

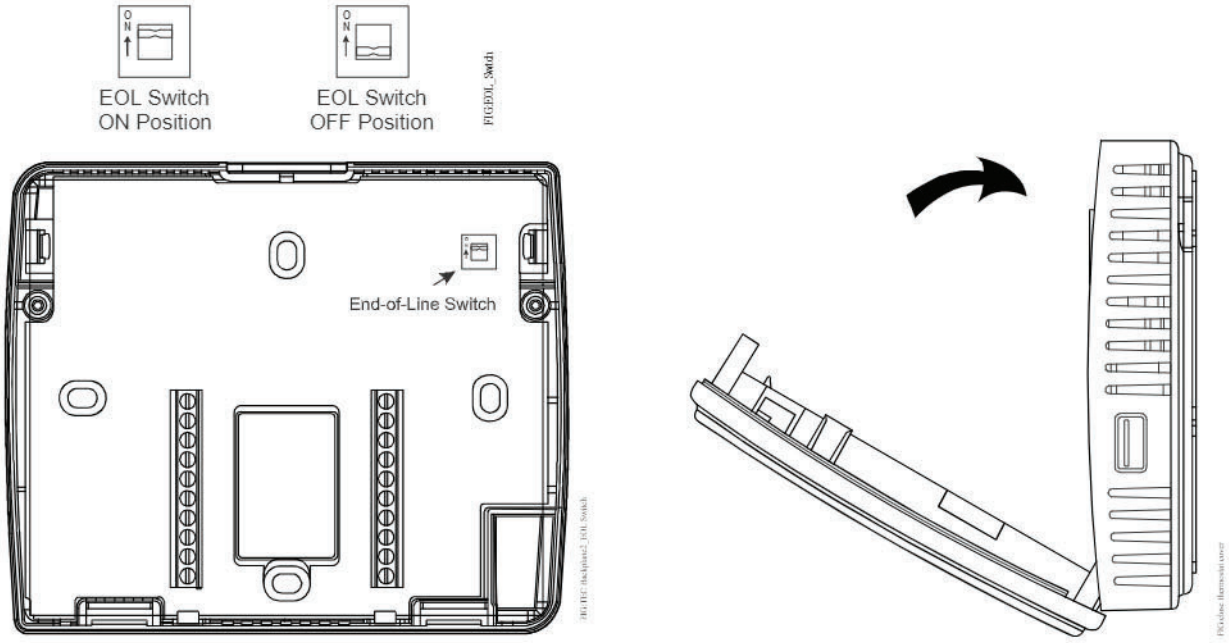
3. Reattach the communication wires to the terminal block.

   Note: If multiple wires are inserted into the terminals, be sure to properly twist the wires together before inserting them into the terminal connectors.

4. Set the bus end-of-line (EOL) termination switch to the desired location on the TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, and TEC3613-00-000 models only.

   The bus EOL termination switch allows you to designate the thermostat controller as the end of the Field Controller (FC) Bus and N2 Bus. The default position is OFF. If the thermostat controller is at the end of a daisy chain of devices on the FC Bus and N2 Bus, set the EOL switch to the ON position. See Figure 4.

Figure 4: EOL Switch Position (Left) and Installing the Thermostat Controller Cover (Right)



5. Reattach the thermostat controller cover to the mounting base (bottom side first).

IMPORTANT: Make sure you reattach the cover that corresponds to its correct base. The CPU board number needs to match the Base board number. Otherwise, an operation error occurs after you reattach a cover and base that do not belong together (as shown in Figure 5). See Table 1 on page 7 for TEC3000 model names and code numbers.

Figure 5: Error Code Indicating Mismatched Boards

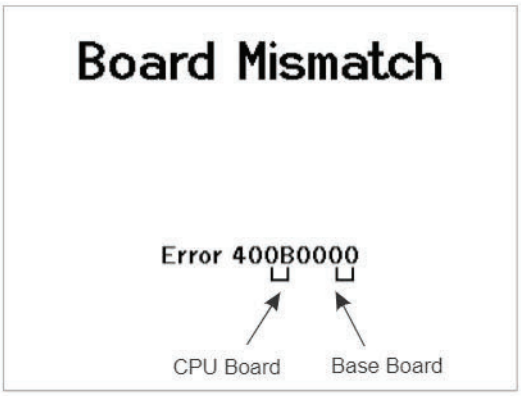


Table 1: TEC3000 Model Names and Code Numbers

Name	Code Number[1]	Name	Code Number[1]
TEC3310	00	**TEC3610**	0A
TEC3311	01	**TEC3611**	0B
TEC3312	02	**TEC3612**	0C
TEC3313	03	**TEC3613**	0D
TEC3320	04	**TEC3620**	0E
TEC3321	05	**TEC3621**	0F
TEC3322	06	**TEC3622**	10
TEC3323	07	**TEC3623**	11
TEC3330	08	**TEC3630**	12
TEC3331	09	**TEC3631**	13

1. The two-character code number is listed within the error code to indicate that the CPU board and base board do not belong together. However, if the same code number appears as both the CPU board and base board, there is no error. For example, if 0B is listed as the CPU board and the base board, the model is the TEC3611.

6. Use a 1/16 in. (1.5 mm) Allen wrench or Johnson Controls T-4000-119 Allen-Head Adjustment Tool (order separately) to reinstall the security screw on the top of the thermostat controller cover. See Figure 2 for security screw placement.
7. Remove the protective plastic cover sheet from the display.

IMPORTANT: If the display is dirty, **gently** wipe it clean with isopropyl alcohol or ethyl alcohol. Do not scrub hard as to avoid damaging the surface. Do not use other cleaners such as water, ketone, and aromatic solvents, since they may damage the polarizer.

Note: VAV and 2-pipe systems should connect their valve to the heating output.

Table 2: Terminal Identification (See Figure 6 and Figure 7 for Wiring Diagrams)

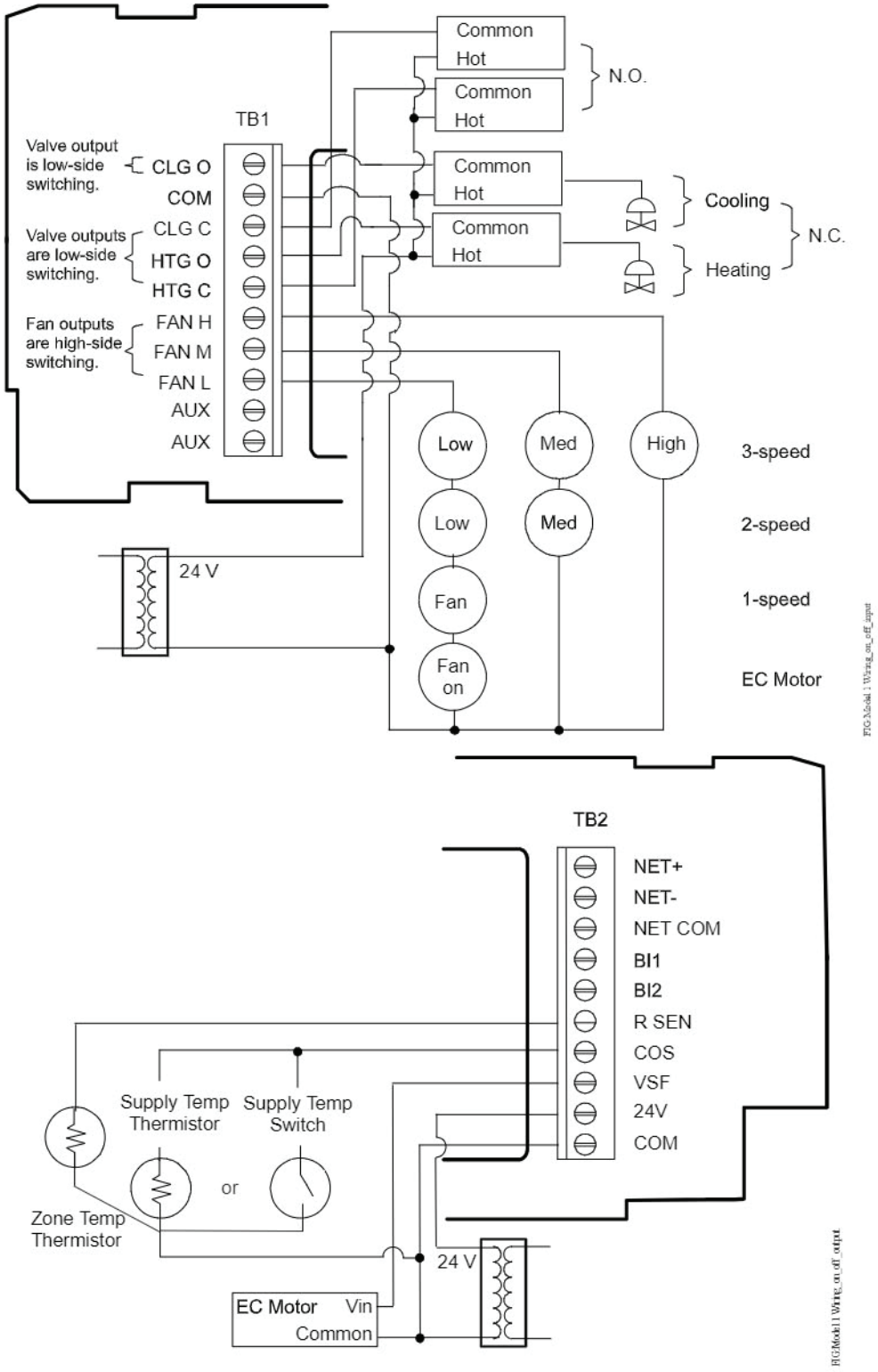
Terminal Label	Function	
	TEC3310, TEC3311, TEC3312, TEC3313 Floating FC/VAV and On/Off FC[1]	**TEC3610, TEC3611, TEC3612, TEC3613 Floating FC/VAV and On/Off FC[1]**
24 V	24 VAC hot from transformer	
FAN H	Fan high	
FAN M	Fan medium	
FAN L	Fan on (single-speed, variable speed), Fan low multi-speed)	
AUX	Auxiliary binary output	
AUX	Auxiliary power	
COM[2]	24 VAC common from transformer	
CLG O	Cool open (Floating), Cooling NC (On/Off), Triac	
CLG C	Cool close (Floating), Cooling NO (On/Off), Triac	
HTG O	Heat open (Floating), Heating NC (On/Off), Triac	
HTG C	Heat close (Floating), Heating NO (On/Off), Triac	
COM[2]	Common	
VSF	Variable speed fan command (configurable 0 to 10 V range)	
BI2	Configurable binary input 2	
BI1	Configurable binary input 1	
COS	Supply temperature sensor	
R SEN	Remote zone temperature sensor	
NET+	Not connected	Field bus+/N2+
NET-	Not connected	Field bus-/N2-
NET COM	Not connected	Isolated common for field bus

1. There is no support for an On and Off VAV.
2. The common terminals (do not include NET COM) are internally connected and can be used for all inputs and outputs.

Notes:

- VAV and 2-pipe systems should connect their valve to the heating output.
- Only one transformer is required for each TEC.

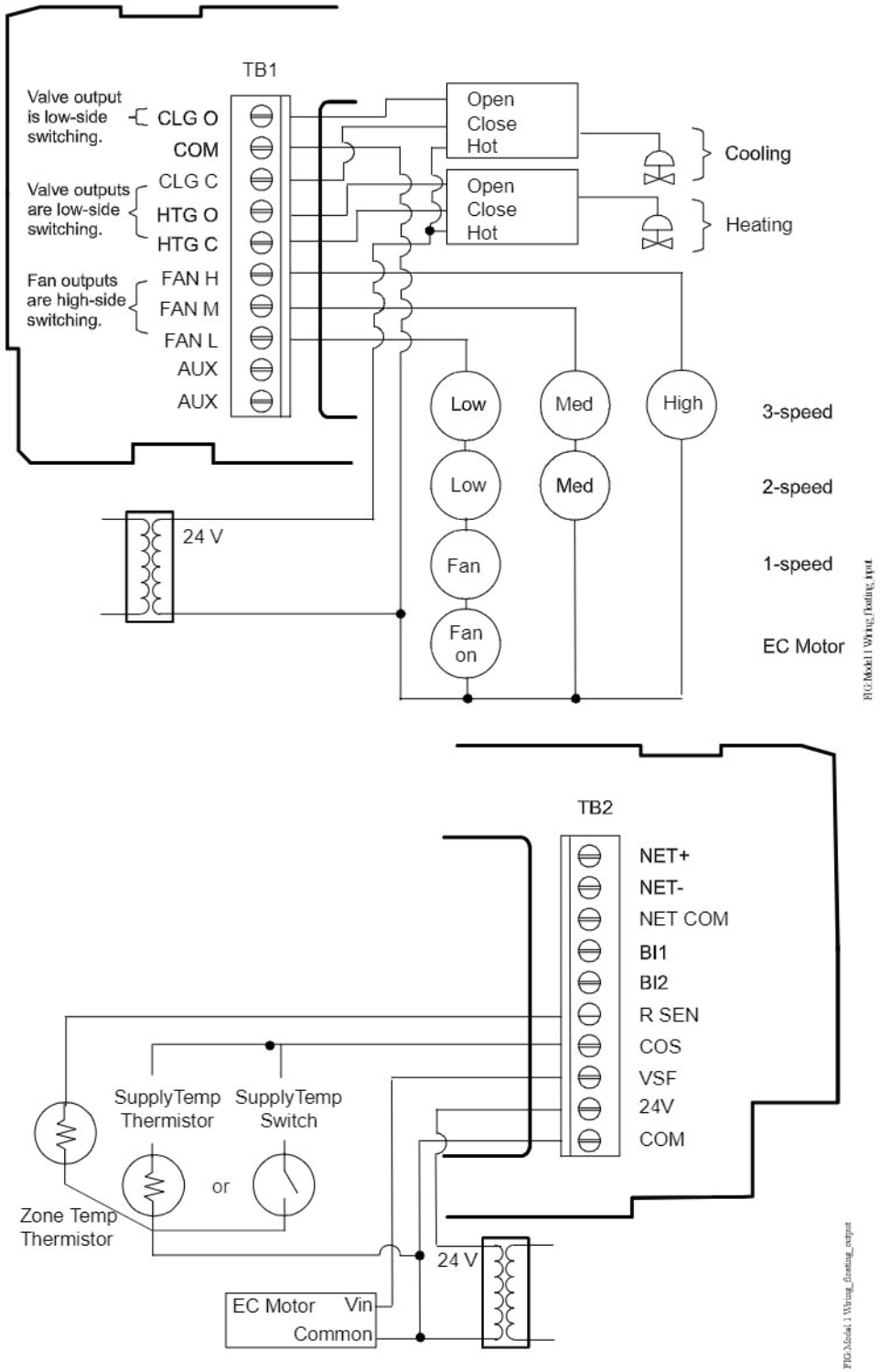
Figure 6: On/Off Wiring Diagram (See Table 2 for Terminal Identification)



Notes:

- For VAV and 2-pipe systems, connect the valve to the heating output.
- Only one transformer is required for each TEC.

Figure 7: Floating Wiring Diagram (See Table 2 for Terminal Identification)



Note: VAV and 2-pipe systems should connect their valve to the heating output.

Figure 8: Floating Control (Pressure-Dependent VAV)

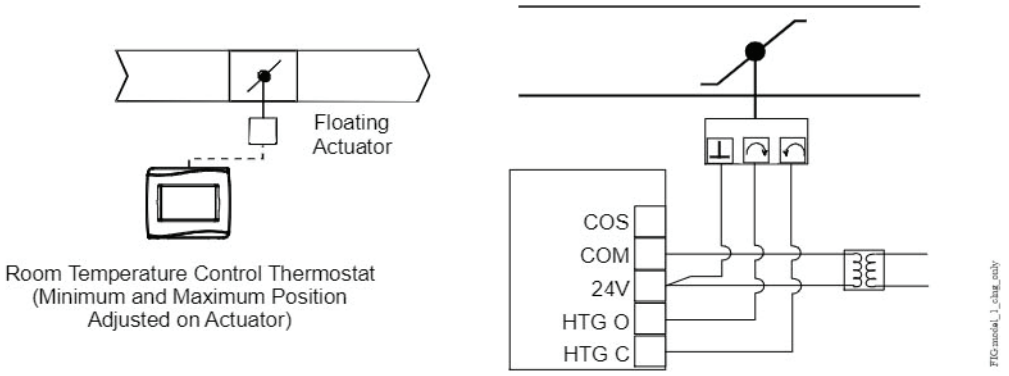


Figure 9: Floating Control (Pressure-Dependent VAV with Changeover Sensor/Switch)

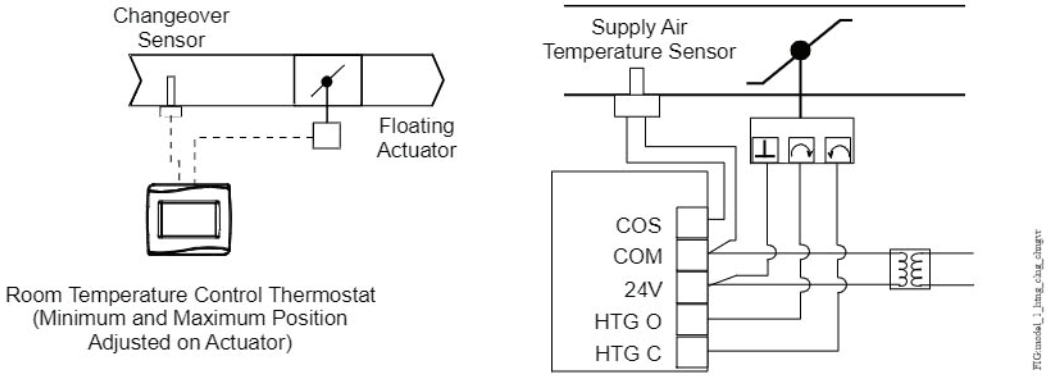
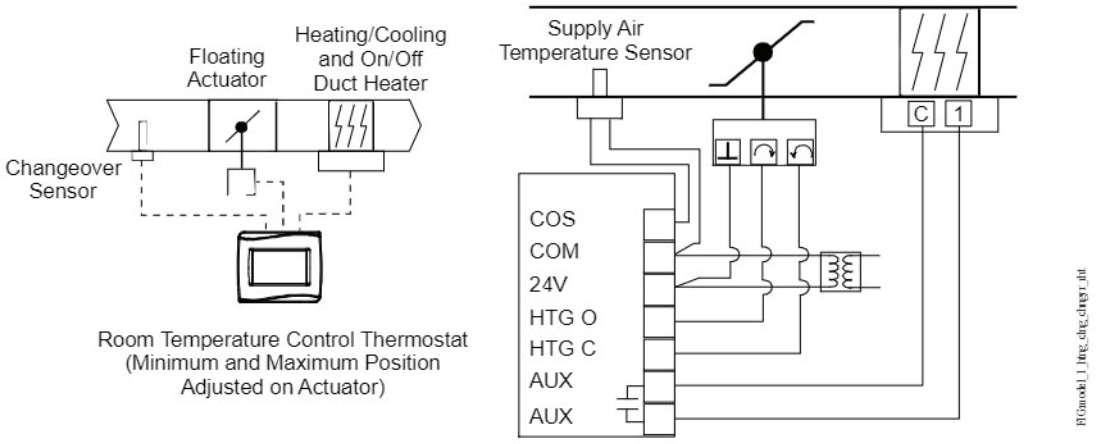


Figure 10: Floating Control (Pressure-Dependent VAV with Changeover Sensor/Switch and Reheat)



Note: Power to the AUX contact comes from the reheat coil.

Note: VAV and 2-pipe systems should connect their valve to the heating output.

Figure 11: Floating Control Two-Pipe Heating and Cooling Hydronic Valve Control Fan Coil Application

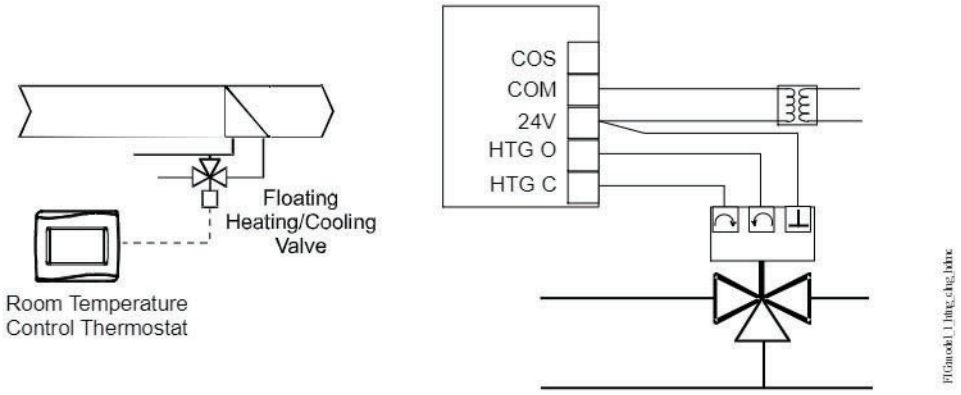


Figure 12: Floating Control Two-Pipe Heating and Cooling Hydronic Valve Control with Changeover Fan Coil Application

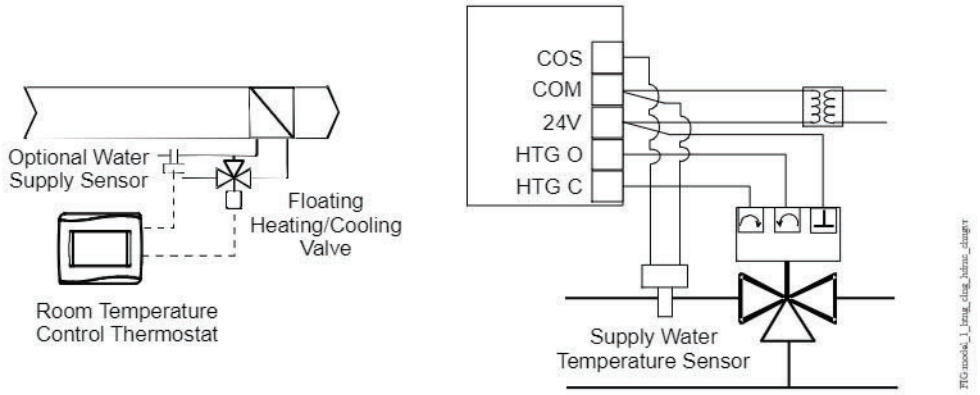
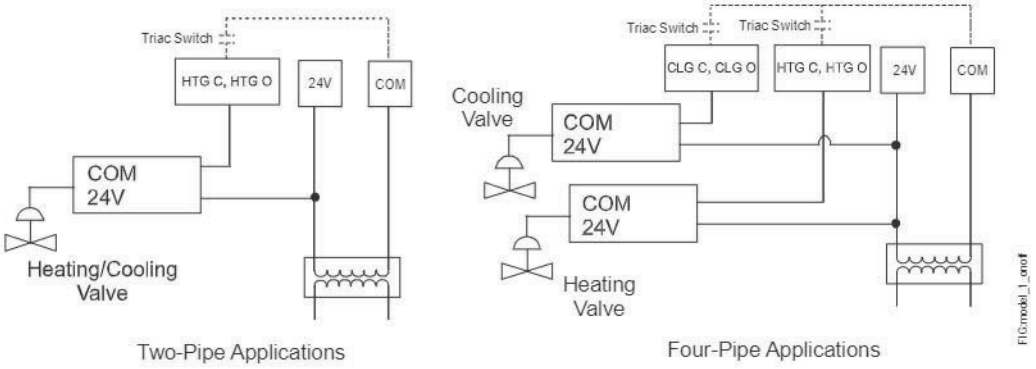


Figure 13: Floating Control (On/Off Two-Pipe and Four-Pipe Fan Coil Applications)



Note: VAV and 2-pipe systems should connect their valve to the heating output.

Figure 14: Floating Control (Floating Two-Pipe and Four-Pipe Fan Coil Applications)

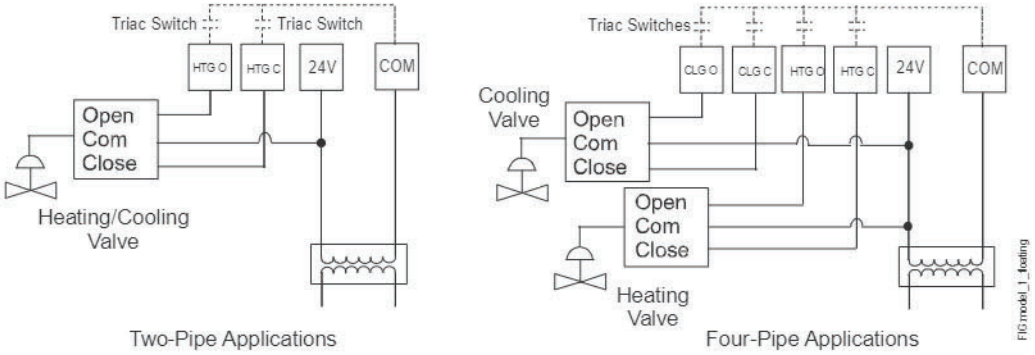


Figure 15: AUX Contact Wiring

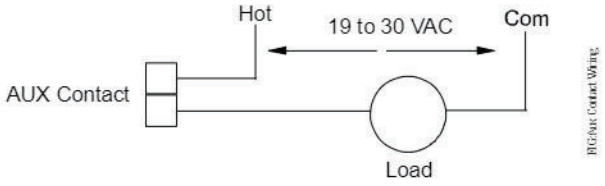
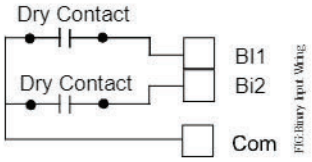


Figure 16: Binary Input Wiring



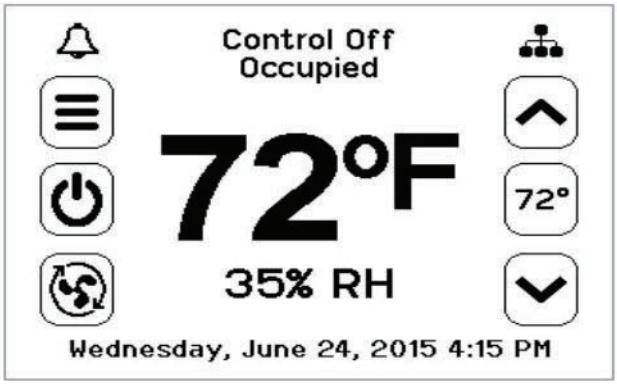
Setup and Adjustments

IMPORTANT: Table 7 provides a full list of TEC3000 menu settings. In the upcoming sections, step-by-step instructions are included on how to access and adjust the more commonly used menus.

Overview

Figure 17 shows the thermostat controller home screen. You can customize it to show or hide various elements from the occupant. See Table 3 for a listing of the touchscreen icons and Table 7 to identify the home screen settings under the Display Settings. When screen customization is used in conjunction with a passcode, the building owner can control which options the occupant can access and adjust.

Figure 17: Thermostat Controller Home Screen



The humidity level appears on the home screen if there is a humidity sensor in the unit, or if the thermostat controller has a network override written to it.

Customizing the Home Screen

Customizing the Home screen settings include:

- Brightness
- Enable Backlight
- Units
- Time
- Time Zone
- Time Format
- Date
- Date Format

You can also show or hide these items on the home screen:

- Fan Button
- Space Temperature
- Humidity
- Off Button
- Hold Button
- Setpoint
- Alarm Indication
- Occupancy Status
- Unit Status
- Date/Time

To customize the Home screen:

1. Press the Menu icon.
2. Press **Display Settings**.
3. Enable or disable elements of the home screen as appropriate for the building owner and occupants.
4. Set the passcode on the thermostat controller to prevent the occupants from changing settings that they should not have access to change.

UI Icons

Table 3 describes the home screen touchable icons. Press and release a UI icon to activate the TEC. Additional touchable icons appear based on the menu, and those icons are also described in Table 3.

Table 3: Touchscreen Icons (Part 1 of 2)

Icon	Icon Name	Description
	Menu	Displays the configuration screens where various settings may be adjusted.
	Alarm	Indicates that the thermostat controller has triggered an alarm.
 	Unit Power On Off	Powers the thermostat controller on or off. **Note:** This icon disables all equipment control, but does not physically power down the unit.
	Network Communication	Indicates that the thermostat controller detected a supervisory controller and both are online.
	Arrow	Increases or decreases a value depending on the configuration screen.

Table 3: Touchscreen Icons (Part 2 of 2)

Icon	Icon Name	Description
	Run/Hold	Displays the current setpoint. Hold mode is enabled by pressing the button.
	Hold/Hold	Displays the active setpoint. Hold mode is enabled. No Hold mode is enabled by pressing the button.
	Right Arrow	Proceeds to the next screen.
  	Fan Override On Auto Quiet	Adjusts the fan override between On, Auto, and Quiet.
	Home	Returns the display to the main home screen.
	Back	Returns to the previous screen.
	Save	Saves the current configuration and parameter settings.
	Delete	Deletes the scheduled event.
	Clear	Clears the password entry on the keypad screen.
	Wrench	Indicates that the value is editable.
	Checkmark	Indicates that an event or schedule is programmed for a specific day of the week.
	Exclamation Point	Indicates that an error has occurred.

Using the USB Port

The USB port allows you to quickly and easily load firmware upgrades, backup settings, and restore settings to the TEC3000 by using a USB drive. The TEC3000 can recognize eight configuration files or firmware package files. The USB drive format must be FAT or FAT32. The drive cannot be NTFS or USB 3.0. You must have access to the TEC3000 passcode, if a password has been set up, if you are upgrading firmware or copying configuration files. Do not remove the USB drive until the firmware upgrade is complete. The TEC3000 may restart and go offline to the NAE after a firmware upgrade. The upgrade takes approximately three minutes.

Configurations are copied, except for the Communication mode. See *Choosing the Communication Mode (TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, and TEC3613-00-000 Models)* to configure each device.

Loading the Firmware

1. Ensure that the TEC screen is on.
2. Insert the USB drive into the right side of the TEC.

   See Figure 1 for the USB port location.
3. Press the Menu icon.
4. Scroll down the menu and press **Update**.
5. Press **Load Firmware**.
6. Select the correct firmware version. The correct file name has the .pkg extension.
7. Press **Confirm** if you have the correct firmware version.

   The firmware is loaded from the USB drive into the TEC3000 operating system. The TEC3000 locates the new firmware only if the new firmware is on the root drive of the USB drive. See *Troubleshooting* if the firmware is not loaded correctly.
8. Remove the USB drive from the TEC3000 controller when the update is complete.

   The TEC3000 firmware update is complete when the TEC3000 restarts and returns to the home screen.

Backing Up the Settings

1. Ensure that the TEC screen is on.
2. Insert the USB drive into the right side of the TEC.

   See Figure 1 for the USB port location.
3. Press the Menu icon.
4. Scroll down the menu and press **Update**.
5. Press **Backup**.

   A message appears stating that the file is saved locally and on a USB drive.
6. Press **Confirm** if you have the correct firmware version.

   The setting files are named based on the TEC3000 model name, date, and time stamp (for example, TEC3311-00_2015-10-08T1). The files are saved locally and on the USB drive's root directory. See *Troubleshooting* if the settings are not backed up correctly.
7. After the settings are saved onto the USB drive, remove the USB drive from the TEC3000.

Restoring the Settings

1. Ensure that the TEC screen is on.
2. Insert the USB drive into the right side of the TEC.

   See Figure 1 for the USB port location.
3. Press the Menu icon.
4. Press **Update**.
5. Press **Restore**.
6. Select Local Storage or the correct configuration file created from a previous backup operation.

   The setting files are named based on the TEC3000 model name, date, and time stamp (for example, TEC3311-00_2015-10-08T1). The files are saved locally and on the USB drive's root directory.
7. Press **Confirm** if you have the correct file name.

The settings are loaded from the USB drive.

8. After the settings are loaded from the USB drive, remove the USB drive from the TEC3000.

Choosing the Communication Mode *(TEC3610-00-000, TEC3611-00-000, TEC3612-00-000, and TEC3613-00-000 Models)*

1. Ensure the TEC screen is on.
2. Press the Menu icon.
3. Press **Network Setup**.
4. Press **FC Comm Mode**.
5. Select BACnet or N2 by pressing  .
6. Proceed to Step 7 to perform BACnet communication and Step 15 to perform N2 communication.
7. Press  to return to the previous screen.
8. Press **BACnet Instance ID**.
9. Enter the BACnet® instance ID using the keypad. This value should be different to the other controllers on the site.
10. Press **Save**.
11. Press  to return to the previous screen.
12. Press **BACnet Address**.
13. Enter the BACnet address through the keypad.
14. Press **Save**.
15. After selecting N2 in Step 5, press **Save**.
16. Press  to return to the previous screen.
17. Press **N2 Address**.
18. Enter the N2 address through the keypad.
19. Press **Save**.

Configuring the Thermostat Controller

Use the Menu icon on the home screen to access and change the basic operating parameters of the thermostat controller. During normal operation, press the Menu icon once to access the following parameters:

- Faults Status
- Setpoints
- Schedule
- Display Settings
- Control Setup
- Network Setup
- Equipment Setup
- System Status
- Control Status
- Controller Information
- Commissioning
- Update

Installer Configuration Menu

The thermostat controller comes from the factory with default settings for all configuration parameters. The UI menu navigation and default settings are shown in Table 7. Before any outputs turn on, the controller must be configured for the equipment connected to itself. You need to start from the home screen to perform any of the following tasks.

Screen Reset

The current screen returns to the home screen if the current screen is not touched for 3 minutes.

Selecting the Unit Type

There are three unit types. They are:

- 4-pipe – This unit type has both heating and cooling coils plus a supply fan. This configuration can also be used on configurations that are heating or cooling only.
- 2-pipe – This unit type has a single set of pipes that can serve hot or chilled water plus a supply fan. The Supply Temp Type allows for the connection of an analog sensor or an aquastat to a binary input. Based on the water temperature or aquastat state, the unit controls heating or cooling.
- VAV – This unit type is designed for a pressure-independent zone damper and the supply fan outputs are disabled. The TEC senses the supply air temperature coming from the unit. The Supply Temp Type setting allows for the connection of an analog sensor or binary duct thermostat. Based on the air temperature or duct thermostat state, the zone damper controls for heating or cooling. The TEC does not control the unit delivering the air. The logic needs to be part of another controller.

By default, the thermostat controller is configured for 4-pipe fan coil mode. To change to a 2-pipe or Pressure-Dependent VAV mode:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **General**.
4. Press **Unit Type** and select 2-pipe, 4-pipe, or VAV.
5. Press  to save and  to return to the previous screen.

Note: Selecting VAV reboots the controller in order to apply the change.

Selecting the Heating and Cooling Device Type

By default, the thermostat is configured for On-Off (2-position) control. This can be changed to Floating (Incremental) mode when the Unit Type is not set to VAV. For VAV mode, only floating actuators are supported and this option is unavailable. To change the Heating/Cooling Device Type:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **General.**
4. Press **Htg/Clg Device Type** and select On-Off or Floating. Changing this option reboots the controller in order to apply the change.
5. Press  to save and  to return to the previous screen.

When in Floating mode, the Actuator Stroke Time must also be set to match the equipment. To set the actuator stroke time:

1. Press the Menu icon.
2. Press **Equipment Setup.**
3. Press **General**.
4. Press **Actuator Stroke Time** and adjust accordingly.
5. Press  to save and  to return to the previous screen.

Configuring the Supply Fan - Fan Coil Only

On fan coil units (2-pipe or 4-pipe), three different types of supply fans are supported. These are single-speed fans, multi-speed fans (up to three discrete speeds), and VSF using a 0 to 10 V control signal and an optional binary on/off command. Note that fan control is not available when in VAV mode. To select the fan type:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **Supply Fan**.
4. Press **Supply Fan Type** and select Single Speed, Multi-Speed, or Variable Speed.
5. Press  to save and  to return to the previous screen.

For multi-speed fan control, you can adjust the point when the medium or high speed turns on. The fan speed is based on the load on the cooling/heating device, and is a percentage between 0 and 100. By default, the Med Speed On Cmd is 33% and the High Speed On Cmd is 66%. When only two fan speeds are used, you must set the High Speed On Cmd to 100% to disable the third speed and set the Med Speed On Cmd to 50%. To adjust these values:

1. Press the Menu icon.
2. Press **Equipment Setup.**
3. Press **Supply Fan**.
4. Press **Medium Speed On Cmd** and adjust accordingly.
5. Press **High Speed On Cmd** and adjust accordingly.
6. Press  to save and  to return to the previous screen.

For VSF control, the output is configurable for any range between 0 V and 10 V. The parameters are Start Voltage, Full Speed Voltage, and Minimum Command. Start Voltage is the voltage output at which the fan begins running, and Full Speed Voltage is the voltage output at which the fan reaches full speed. Minimum Command is the percentage of the range between the Start Voltage and the Full Speed Voltage. The fan does not go below the minimum command when the fan is turned on. By default, the Start Voltage is 2 V, the Full Speed Voltage is 10 V, and the Minimum Command is 20%.

When the variable speed fan is off, the FAN binary output is off and the voltage at the VSF output is 0 V. When the fan turns on, the FAN binary output turns on and the voltage at the VSF output begins controlling the fan. When the VSF is configured for reverse acting mode (Start Voltage is above Full Speed Voltage), the VSF output goes to the lesser of 10 V and 1 V above the Start Voltage when the fan is turned off.

To configure the variable speed parameters:

1. Press the Menu icon.
2. Press **Equipment Setup.**
3. Press **Supply Fan**.
4. Press **Start Voltage** and adjust accordingly.
5. Press **Full Speed Voltage** and adjust accordingly.
6. Press **Minimum Command** and adjust accordingly.
7. Press  to save and  to return to the previous screen.

Setting the Control Mode

The Control Mode informs the controller to run in Cooling only, Heating only, or Automatic mode, based on the temperature in the zone relative to the heating and cooling setpoints. Control Mode does not override equipment lockouts or changeover. To set the Control Mode:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Control Mode** and select Cooling, Heating, or Auto as desired.
5. Press  to save and  to return to the previous screen.

Setting the Fan Mode - Fan Coil Only

The Fan Mode informs the controller how to handle the fan. There are two options for fan configuration: a Fan Mode available to the installer through the menu system, and a fan override available as an option to the end-user. See *Customizing the Home Screen* for information on enabling and disabling end-user controls. The Fan Mode available to the installer provides the following options:

- On – fan is continuously on
- Auto – fan cycles on demand with the controller entering cooling, heating, or dehumidification modes
- Smart – fan cycles on demand with the controller entering cooling or heating modes during unoccupied periods but is continuously running during occupied and standby periods

The Fan Override icon on the previous screen provides the following options:

- On – overrides the fan to be continuously on
- Auto – follows the behavior set as Fan Mode
- Quiet – follows the behavior set as Fan Mode, but prevents the fan from ever going above minimum speed. The Quiet option has no effect on equipment with single-speed fans

To set the Fan Mode:

1. Press the Menu icon.
2. Press **Control Setup.**
3. Press **General**.
4. Press **Fan Mode** and select On, Auto, or Smart.
5. Press  to save and  to return to the previous screen.

Changeover

Pressure-Dependent VAV systems and 2-pipe fan coils require changeover detection in order to switch seasonal operation between heating and cooling modes. The TEC supports the following methods for changeover: automatic changeover using an analog sensor (thermistor), automatic changeover using a binary switch, or remote changeover from a BAS and manual changeover.

For automatic changeover, a supply temperature sensor or switch must be connected to the COS input of the TEC. Changeover Mode must be set to Auto, and Supply Temp Type must be set for Analog Sensor, Cooling N.C. (cooling when switch is closed), or Heating N.C. (heating when switch is closed). When an analog sensor is used, the changeover setpoint can be adjusted. The changeover logic applies a 10-degree Fahrenheit differential to the setpoint. The system switches to cooling mode when the temperature drops below the changeover setpoint and remains in cooling mode until the measured temperature has risen 10 degrees above the changeover setpoint.

To configure automatic changeover:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **Changeover**.
4. Press **Changeover Mode** and select Auto.
5. Press **Supply Temp Type** and select Analog Sensor, Cooling N.C., or Heating N.C.
6. Press  to save and  to return to the previous screen.

Additionally, the thermostat controller supports manual changeover. To configure manual changeover:

1. Press the Menu icon.
2. Press **Equipment Setup**.
3. Press **General**.
4. Press **Changeover**.
5. Press **Changeover Mode** and select Heating or Cooling.
6. Press  to save and  to return to the previous screen.

You need to ensure that the Supply Temp type is set to Analog Sensor. The Changeover Mode is also exposed to the BAS through the CGOVR-MODE and can be commanded from the BAS.

On 2-pipe/VAV systems without an automatic changeover, or on 4-pipe systems, you can use COS as a monitor-only point for reading an analog sensor. By setting the controller in 4-pipe mode, or selecting Heating or Cooling for Changeover Mode, the controller defaults to monitor-only mode for the COS and exposes the value to the network as the supply temperature.

Dehumidification Control - Fan Coil Only

The TEC3000 controller support dehumidification control on fan coil devices under three configurations:

- 4-pipe fan coil
- 4-pipe fan coil with reheat
- 2-pipe fan coil (with changeover in cooling mode) with reheat

For optimal dehumidification performance, a 4-pipe unit with floating/incremental or 0 to 10 V control and a multi-speed or variable-speed fan is recommended.

Dehumidification operates when the zone humidity increases above the zone humidity setpoint and the controller is in the Idle or Cooling state. Dehumidification does not operate during heating and stops if the zone temperature drops below the heating setpoint. When dehumidification is active, the cooling device controls to the humidity setpoint, and the heating device reheats the zone in order to keep the temperature at the cooling setpoint. While in the dehumidification mode, a multi-speed or variable-speed fan runs at the lowest possible speed to maximize condensation and moisture removal across the cooling coil.

To enable dehumidification control:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Dehum Enable** and select Yes.

5. Press  to save and  to return to the previous screen.

This point is also exposed to the BAS through the point DEHUM-EN.

To adjust the dehumidification setpoint:

1. Press the Menu icon.
2. Press **Setpoints**.
3. Press **Dehumidification** and adjust accordingly.
4. Press  to save and  to return to the previous screen.

This point is also exposed to the BAS through the point DEHUM-SP.

Temperature Setpoints

The thermostat controller provides a flexible setpoint configuration to give power to the building owner while being easy to use by the occupant. In addition to a simple up/down offset adjustment on the home screen for the occupant, there are six temperature setpoints on the TEC. The six temperature setpoints are Cooling and Heating setpoints for Occupied, Unoccupied, and Standby modes. To set these setpoints:

1. Press the Menu icon.
2. Press **Setpoints**.
3. Select the setpoint to adjust and change as desired.
4. Press  to save and  to return to the previous screen.

Note: The TEC enforces a 2-degree deadband between heating and cooling setpoints. If a setpoint violates this standard (for example, cooling setpoint is set to 70 with a heating setpoint already set to 70), the opposing setpoint is modified to comply with this deadband (in the previous example, the heating setpoint would automatically change to 68).

The occupant has access to an up/down adjustment from the home screen. This adjustment applies a fixed offset (+/-) to the currently active setpoint, and this offset holds until the occupancy state of the controller changes. If the user taps the setpoint on the home screen, the icon inverts and displays white text on a black icon. The offset is held throughout all occupancy periods. For example, if the TEC is cooling in Occupied mode to an occupied cooling setpoint of 72 and you raise the setpoint 2 degrees to 74 from the home screen and then select hold, then the +2 degree offset persists through an occupancy change. If the occupancy then changes to unoccupied, with a setpoint of 80 degrees, the effective setpoint is 82 degrees. This allows the occupant to have a small amount of control over raising or lowering the temperature, but the building owner can still set back setpoints during standby and unoccupied periods. When the setpoint is in Hold mode, pressing the icon again releases the hold and immediately sets the setpoint offset back to 0.

Configuring Occupancy

The TEC3000 controller supports a wide variety of occupancy sources to adapt to nearly any application.

- Local stand-alone weekly scheduler
- Remote schedule from BAS
- Occupancy sensor (internal or remote)
- Occupancy binary input (configurable)
- Manual occupancy override
- Temporary occupancy (by interacting with screen while unoccupied)
- Temporary occupancy binary input

Occupancy is determined using a top-down decision matrix as shown in Table 4.

Enumerations may not match the *TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability Installation Instructions (Part No. 24-10787-6), TEC3000 Series Proportional Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability Installation Instructions (Part No. 24-10788-0), TEC3000 Series Single- or Two-Stage Economizer Thermostat Controllers Installation Instructions (Part No. 24-10789-5), and TEC3000 Series Field-Selectable BACnet MS/TP or N2 Networked Thermostat Controllers Technical Bulletin (LIT-12011956)* for NAE releases prior to 7.x.

Table 4: Occupancy Determination

Sequence of Operation (Highest to Lowest Priority)						
Occupancy Override Mode (OCCOVRD-MODE)	**Occupancy BI (BI1-S, BI2-S)[1]**	**Temporary Occupancy[2, 3]**	**Occupancy Schedule (External or Schedule) (OCC-CONFIG, NET-OCC)**	**Motion Sensor[4]**	**Effective Occupancy (EFF-OCC)**	**Occupancy Source (OCCSOURCE-S)**
Occupied	–	–	–	–	Occupied-Override	Occ Override
Unoccupied					Unoccupied-Override	
No Override	Closed[1]				Occupied	Occupancy BI
	Open[1]				Unoccupied	
	Not Configured[1]	True[2]	NOT Occupied		Temp Occupancy	Temp Occ
		True[3]	NOT Occupied		Temp Occupancy	Temp Occ BI
		False	Occupied	True	Occupied	Occupancy Sensor
				False	Standby	
				Disabled	Occupied	Occupancy Schedule
			Unoccupied	–	Unoccupied	
			Standby		Standby	
			Not Set[5]	True	Occupied	Occupancy Sensor
				False	Unoccupied	
				Disabled	Occupied	Occupancy Schedule

1. Not Configured means that neither BI1 Config nor BI2 Config is set to Occupancy BI. Open and Closed refer to the current state of the BI when configured as Occupancy.
2. True is triggered by interacting with the screen during a scheduled unoccupied period. A value of True can only occur when the schedule is not Occupied.
3. When triggered by a BI configured for Temp Occ, the input is ignored when the schedule is Occupied, the Manual Occupancy Mode is **not** No Override, or an Occupancy BI is configured.
4. Built-in occupancy sensing (PIR) or EI configured for Motion NO or Motion NC.
5. Not Set occurs when no events are scheduled through the local scheduler, or the schedule source is set to Schedule and the Schedule is writing Not Set as the schedule.

Selecting Schedule Source

Scheduling

The TEC3000 thermostat controller can operate as a stand-alone unit with an internal schedule or scheduled with an external schedule. The OCC-CONFIG object sets the method used for scheduling.

If the OCC-CONFIG is set to External, the NET-OCC object is used to control the unit externally.

If the OCC-CONFIG is set to Schedule, the internal schedule commands the LOCAL-OCC object, which sets the Occupancy Schedule command.

Note: If you do not have a schedule in the Schedule object and you have the OCC-CONFIG set to Schedule, you can control the unit with the LOCAL-OCC object externally; however, we do not recommend this method. See Table 5 for scheduling information.

Once the Occupancy Schedule command is set, the effective occupancy is determined by settings shown in the Occupancy Determination table. See Table 4.

Table 5: BAS Objects for Scheduling

BAS Objects for Scheduling			
OCC-CONFIG	**LOCAL-OCC (Commanded by Internal Schedule)**	**NET-OCC**	**Occupancy Schedule Command[1]**
External	Any State (Internal Schedule in Control)	Occupied	Occupied
		Unoccupied	Unoccupied
		Standby	Standby
		Not Set	Not Set
Schedule	Occupied	Not Applicable	Occupied
	Unoccupied		Unoccupied
	Standby		Standby
	Not Set		Not Set

1. The effective occupancy can be affected by other factors listed in Table 4.

The occupancy schedule comes from either the weekly scheduler built into the TEC or as an input from the BAS. The Schedule Source must be selected to tell the controller where to read the occupancy source from. To select the schedule source:

1. Press the Menu icon.
2. Press **Schedule**.
3. Press **Schedule Options**.
4. Press **Schedule Source** and select Schedule (Local) or External (BAS).
5. Press  to save and  to return to the previous screen.

This option is also exposed to the BAS through the point OCC-CONFIG. If BAS is configured as the occupancy source, map the point NET-OCC in and write to that point to control the schedule remotely. If the supervisor goes offline (as identified by the network icon going away on the home screen of the TEC), the control logic automatically falls back to the local schedule as the occupancy source. If that schedule is not set, the default occupancy is continuously occupied.

Setting the Local Schedule

A weekly occupancy schedule with up to four occupancy events for each day can be set locally on the TEC and operate independently of a supervisor. To set the schedule:

1. See *Selecting Schedule Source* to ensure the schedule source is set to Local.
2. Press the Menu icon.
3. Press **Schedule**.
4. Press **Set Schedule**.

5. Select the days to which the schedule should apply. Note that if events are already set for the selected days, they appear in the corresponding event box. If any events conflict between selected days, an asterisk appears in the event box. See Figure 18.

6. Select the event to be set. See Figure 18.

7. Set the Occupancy to Not Set, Occupied, Unoccupied, or Standby and press **Save**.

IMPORTANT: Internally, the TEC 3000 uses a BACnet schedule where daily schedules are independent of the previous and next days. The default occupancy of the TEC3000 from the factory is set to Occupied. As a result, a daily event at 12:00 AM must be scheduled if you do not want the controller to transition to Occupied Mode at midnight.

Figure 18: Selecting the Days (Left) and Selecting the Event (Right)

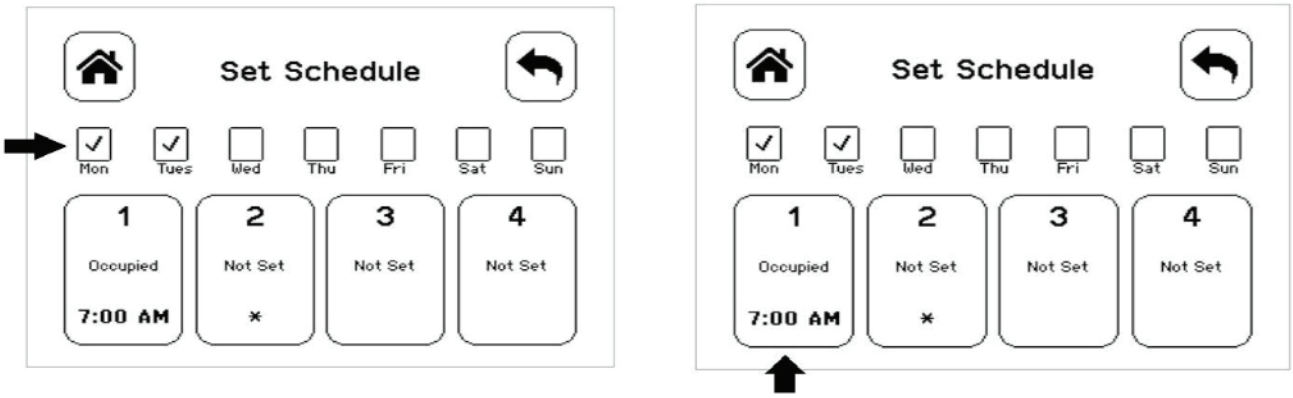
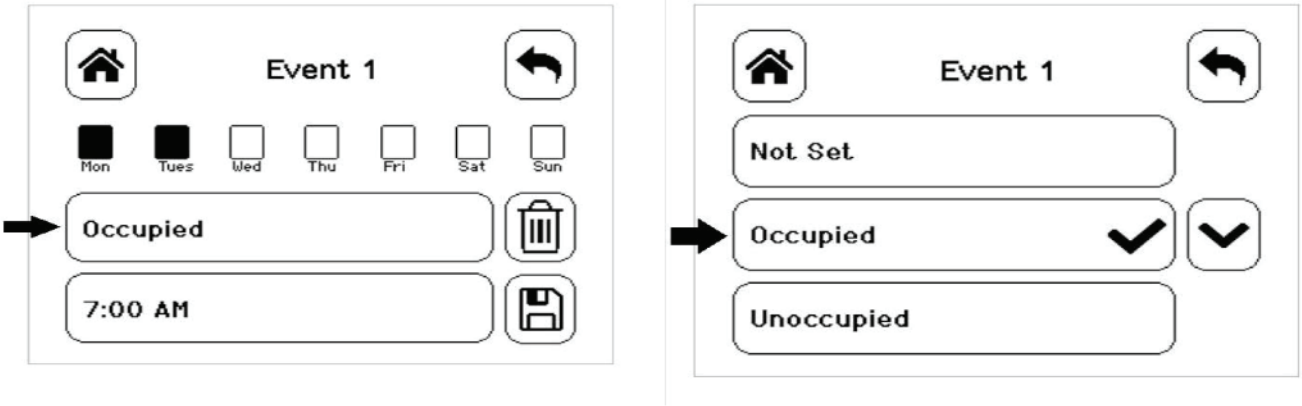
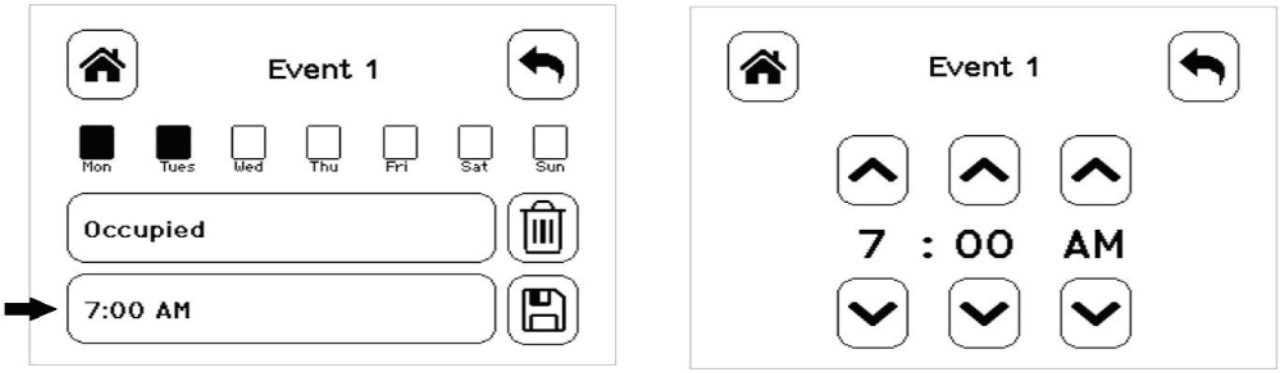


Figure 19: Setting the Room Occupancy (Left) and Setting the Occupancy Mode (Right)



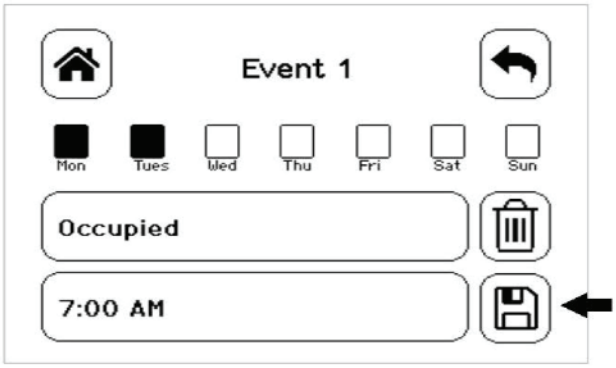
8. Set the time to the time at which the event should occur and press **Save**.

Figure 20: Setting the Event Time (Left) and Viewing the Event Time (Right)



9. Press **Save** to save the event and press the return icon to return to the main scheduler screen.

Figure 21: Returning to the Main Menu



10. Press  to save and  to return to the previous screen.

Overriding the Occupancy Mode

The TEC supports a manual override of all other schedule sources (for example, Schedule, Occupancy BI, and temporary occupancy). To override the Occupancy Mode:

1. Press the Menu icon.
2. Press **Schedule.**
3. Press **Schedule Options.**
4. Press **Manual Occupancy Mode** and select Occupied, Unoccupied, or No Override.
5. Press  to save and  to return to the previous screen.

This option is also exposed to the BAS through the point OCCOVRD-MODE.

Enabling Optimal Start

The TEC supports an advanced optimal start algorithm. The algorithm works in conjunction with a local schedule to pre-heat or pre-cool the zone before scheduled occupancy periods begin, in order to bring the zone to the desired occupied setpoint when the scheduled occupancy period begins. Occupant comfort is ensured while automatically minimizing energy usage. This algorithm creates a model of the zone being controlled and automatically determines when to start the equipment before the scheduled transition to Occupied. The start time automatically adjusts daily to minimize the time between reaching setpoint and entering Occupied state.

Note: Optimal Start does not work when the schedule source is set to External.

To enable this feature:

1. Press the Menu icon.
2. Press **Schedule.**
3. Press **Schedule Options.**
4. Press **Optimal Start Enable** and select Yes.
5. Press  to save and  to return to the previous screen.

Enabling the Motion Sensor (TEC3x11-00-000, TEC3x13-00-000 Models)

By default on models with integral motion sensing capability, the motion sensor is enabled with a default timeout of 15 minutes from the last detection of motion in the zone. On models without an integrated sensor, the default timeout is still 15 minutes, but it only is applied when one of the two configurable binary inputs is set to be a motion sensor (see *Configurable Binary Inputs* for information on configuring the binary inputs). To disable motion sensing capabilities, set the Motion Sensor Timeout to 0 minutes. See Table 4 to view the available setpoints. See Table 7 to view the setpoint values. To adjust the motion sensor timeout:

1. Press the Menu icon.
2. Press **Schedule.**
3. Press **Schedule Options**.
4. Press **Motion Sensor Timeout** and adjust accordingly.
5. Press  to save and  to return to the previous screen.

PID/PRAC+ Automatic Control Tuning

The TEC3000 features advanced proportional-integral-derivative (PID) control algorithms to maximize control performance while minimizing excessive cycling and wear on the equipment. PID is used in conjunction with a Multi-Stage Controller (MSC) for all occupied and standby control.

Additionally, the PID features Johnson Controls proprietary PRAC+ (Pattern Recognition Adaptive Control) automatic tuning, which continuously tunes the controller parameters to automatically optimize the control performance to match the equipment and zone. By default, PRAC+ is enabled and immediately begins to tune. To reset tuning at any time to the factory defaults:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Reset PID Tuning** and select Yes.
5. Press  to save and  to return to the previous screen.

PRAC+ automatic tuning can also be disabled. When disabled, the controller parameters remain at their last values until automatic tuning is re-enabled. To disable automatic tuning:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Auto PID Tuning Enable** and select No.
5. Press  to save and  to return to the previous screen.

Note: For more details on PID/PRAC+ Automatic Control Tuning, refer to the *Controller Tool Help (LIT-12011147)*.

Configurable Binary Inputs

The thermostat controller supports up to two configurable binary inputs (BIs) that can be used to add additional features to the system. Configurable Binary Inputs are accessed through **Settings > Control Setup > Inputs**. Both BIs can be configured to support the following options:

- Occupancy – Direct override of Occupied and Unoccupied
- Temp Occ – Trigger to place controller into Temporary Occupancy mode
- Motion NO – External motion sensor with an open contact output when no motion is detected
- Motion NC – External motion sensor with a closed contact output when no motion is detected
- Supply Fan Status – Input from the equipment to display a Supply Fan Fault. When Fan Alarm Action is set to Shutdown and the Supply Fan Fault is active, the TEC3000 disables the fan, heating, and cooling. When the Fan Alarm Action is set to Enable and the Supply Fan Fault is active, the TEC3000 allows the fan, heating, and cooling to operate during the Supply Fan Fault.
- Dirty Filter – Input from the equipment to display a dirty filter fault on the thermostat
- Service – Input from the equipment to display a service warning on the thermostat
- Fan Lock – Air Proof switch input to shut down control if no airflow is detected within 10 seconds of turning the fan on. Fan Lock must be manually reset from the Faults menu.
- Open Door – Works in conjunction with the Motion NO/Motion NC sensor to control occupancy
- Open Window – Sensor to shut down control if a window is opened. The controller disables control 60 seconds after detecting an opened window.
- Disabled – Sets the binary input to an unused state. When disabled, you can use the binary input for monitoring-only without affecting the thermostat functionality.

Setting both BIs to the same function is supported for all except Occupancy, Fan Lock, Open Door, and Open Window. If both BIs are set the same for those four, BI2 is ignored and only BI1 is used.

The Open Door option works in conjunction with a motion sensor, either built into the TEC or connected to another BI configured for Motion NO/NC mode.

When the door is open, motion detected by the sensor is ignored. Note that opening the door does not stop an Occupied period started by the motion sensor prior to opening the door.

The polarity of the inputs are provided in Table 6.

Table 6: Input Polarities

BI Configuration	Contact Open	Contact Closed
Occupancy	Unoccupied	Occupied
Temp Occ	No Trigger Active	Temporary Occupancy Trigger[1]
Motion NO	No Motion Detected, Standby	Motion Detected, Occupied[1]
Motion NC	Motion Detected, Occupied[1]	No Motion Detected, Standby
Dirty Filter	Dirty Filter Alarm Inactive	Dirty Filter Alarm[1]
Service	Service Alarm Inactive	Service Alarm[1]
Fan Lock	No Airflow	Airflow
Open Door	Door Open, Unoccupied	Door Closed, Occupied
Open Window	Window Open, Control Shut Down	Window Closed, Control Running
Supply Fan Status	Supply Fan Off	Supply Fan On

1. Configurations that support both BIs configured for the same feature of the action that occurs when either of the BIs enter that state.

Aux Control

The TEC has an auxiliary output that can be configured to operate in a few different ways. The Aux Mode supports seven different options:

- Not Used – Output is always off
- Occupied NO – Output is normally open, but closes when occupied
- Occupied NC – Output is normally closed, but opens when occupied
- Occupied Fan NO – Output is normally open, but is closed when occupied with the fan running
- Occupied Fan NC – Output is normally closed, but is open when occupied with the fan running
- On – Output is turned on (relay closed), used by a BAS to directly control the AUX output
- Off – Output is turned off (relay open), used by a BAS to directly control the AUX output

To set the Aux Mode:

1. Press the Menu icon.
2. Press **Control Setup**.
3. Press **General**.
4. Press **Aux Mode** and set accordingly.
5. Press  to save and  to return to the previous screen.

This option is also exposed to the BAS through the point AUX-MODE.

When the Reheat installed parameter is set to True, the Aux output is used for Reheat Output. The setting for the Aux Mode is ignored when reheat is enabled.

Commissioning Mode

The thermostat controller has a built-in commissioning mode, which is designed to allow you to quickly test equipment wiring and functionality. Commissioning mode temporarily disables the control logic, and allows you to manually command any individual output. Commissioning is designed to be the last step of the installation process after configuring the controller for the equipment being controlled, and the available options in commissioning mode are dependent on the controller configuration. To enter commissioning mode:

1. Press the Menu icon.
2. Select Commissioning.
3. Confirm that the selection was intentional. (The control is overridden upon selecting Confirm).

Individual outputs can be commanded through this interface. For binary outputs, the options are Off or On; for analog outputs, they can be commanded from 0 to 100%. Whenever a control output is turned on, the fan is engaged for safety purposes. To command an output from the Commissioning menu:

1. Select the output to command. Adjust the value to the desired output and press **Save**. The output immediately changes to that value.
2. Restore the value to the original setting and press **Save** once again to complete testing that output.

Pressing the back icon from the main commissioning menu or allowing the menu system to time out and return to the home screen ends commissioning and puts the control logic back in control of the outputs.

Sensor Priority

The TEC3000 supports various sources of sensor data for use in control or display, including internal sensors, remote sensors (connected using an analog input), or network commanded sensors. The TEC uses the highest priority connected input (network commands followed by remote sensors and then internal sensors) for control and display. Not all sources are available for all sensors.

Network commands operate on a timeout basis. When a network point is written to by a supervisor, the point becomes the highest priority for 15 minutes. If a new update is written within 15 minutes, the timer is restarted for another 15 minutes.

Available Fault Diagnostics

- Supply Fan Faults – The TEC3000 supports a configurable Supply Fan Status feedback input that turns on when the Supply Fan Status does not match the Supply Fan Command, and can be configured to disable heating, cooling, and fan commands. The alarm delay is adjustable through the Fan Alarm delay setting. If the delay is set to 0 or the binary input is not defined, this feature becomes disabled.
- Supply Fan Runtime – The TEC3000 supports setting runtime limits on the supply fan command. When the limit is exceeded, an alarm turns on. This feature is intended to be used as a maintenance reminder. Setting the runtime limit to 0 disables this feature.
- Supply Air Temperature Diagnostics – The TEC3000 supports diagnostics when you have a Supply Air Temperature installed. The TEC3000 monitors the supply air. If you call for cooling or heating and the temperature does not fall or rise by at least the supply air temperature alarm offset value within the supply air temperature alarm delay, an alarm is generated. If the monitoring occurs while cooling, a cooling ineffective alarm is generated. If the monitoring occurs while heating, a heating ineffective alarm is generated. If you set the supply air temperature offset value set to 0, this alarm is disabled.
- Zone Temperature Alarm – When enabled, the user can set a low and high temperature alarm; and if the zone temperature rises or falls below those limits, an alarm is generated.
- Trends – Built-in trends exist for many of the inputs and outputs for the TEC3000. These trends are viewable at the TEC. The analog graph displays data in 15 minute increments over the previous 24 hours or a table with the last 25 data points. Binary trends display 25 samples taken at every change of state.

Menus and Submenus

In the following table, the * indicates that the menus depend on your configuration.

Table 7: Menus and Submenus (Part 1 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Setpoints	Occ Cooling Setpoint	72°F (22°C)	55 to 85°F (13 to 30°C)
	Occ Heating Setpoint	68°F (20°C)	55 to 85°F (13 to 30°C)
	Unocc Cooling Setpoint	80ºF (27°C)	55 to 85°F (13 to 30°C)
	Unocc Heating Setpoint	60°F (15°C)	55 to 85°F (13 to 30°C)
	Stby Cooling Setpoint	74°F (23°C)	55 to 85°F (13 to 30°C)
	Stby Heating Setpoint	66°F (19°C)	55 to 85°F (13 to 30°C)
	Humidity Setpoint*	50% RH	0 to 100% RH *Dehumidification Enable = True
Schedule	***Schedule Options***		
	Set Schedule		See *Scheduling*
	Optimal Start Enable	No	Yes or No
	Temp Occ Duration	120 minutes	0 to 300 minutes
	Motion Sensor Timeout	15 minutes	0 to 240 minutes 0 = PIR sensor disabled
	Manual Occupancy Mode	No Override	No Override, Occupied, Unoccupied
	Schedule Source	Schedule	Schedule or External
Display Settings	Passcode Enable	No	Yes or No
	Passcode*	NA	0000 to 9999 *Passcode Enable = Yes
	Brightness Setting	8	0 to 10 (most dim to brightest)
	Enable Backlight Timeout	Yes	Yes or No
	Units	IP	IP or SI
	Time	N/A	
	Time Zone	Central	All World Time Zones
	Set Time Format	24 hour	24 hour or 12 hour
	Date	N/A	
	Set Date Format	YYYY-MM-DD	YYYY-MM-DD, or Day, Month DD, YYYY, or MM-DD-YYYY
	Language	English	English, French, Spanish
	Show Fan Icon	Yes	Yes or No
	Show Temp	Yes	Yes or No
	Show Humidity	Yes	Yes or No
	Show Off Icon	Yes	Yes or No
	Show Hold Icon	Yes	Yes or No
	Show Setpoint	Yes	Yes or No
	Show Alarms	Yes	Yes or No
	Show Occ Status	Yes	Yes or No
	Show Unit Status	Yes	Yes or No
	Show Date/Time	Yes	Yes or No

Table 7: Menus and Submenus (Part 2 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Control Setup	**General**		
	Control Mode	Auto	Auto, Cooling, or Heating
	Unit Enable	Enable	Enable or Shutdown
	Fan Mode*	Smart	Not Used, On, Auto, Smart * Fan coil units only
	Max Setpoint Offset	3	0 to 20 degrees (°F or °C based on Units setting under Display Settings menu)
	Fan On Delay*	30 seconds	0 to 120 seconds * Fan coil units only
	Fan Off Delay*	30 seconds	0 to 120 seconds * Fan coil units only
	Frost Protection	Yes	Yes or No
	Reset PID Tuning*	No	Yes or No
	Auto PID Tuning Enable	Yes	Yes or No
	Dehumidification Enable*	No	Yes or No * Fan coil units with humidity sensor
	Aux Mode	Not Used	Not Used, Occupied NO, Occupied NC, Occupied Fan NO, Occupied Fan NC, On, Off
	Load Shed Rate Limit	0.066°F	0 to 1°F (0 to 0.5°C)
	Load Shed Adjust	4°F	0 to 8°F (0 to 4°C)
	Fan Alarm Delay	0 seconds	0 to 300 seconds
	Fan Alarm Action (when Fan Alarm Delay is greater than 0)	Enable	Enable or Shutdown
	Fan Alarm Reset (when Fan Alarm Delay is greater than 0)	No	Yes or No
	Fan Runtime Limit	0 hours	0 to 9,000 hours
	Fan Runtime Reset (when Fan Runtime Limit is greater than 0)	No	Yes or No
	Supply Air Temperature Alarm Offset	0°F	0 to 10°F (0 to 5.5°C)
	Supply Air Temperature Alarm Delay (when Supply Air Temp Alarm Offset is greater than 0)	300 seconds	300 to 3,600 seconds
	Inputs		
	BI1 Configuration	Disabled	Disabled, Occupancy, Occupancy Override, Remote PIR, Dirty Filter, Service, Fan Lock, Open Door, Open Window
	BI2 Configuration	Disabled	Disabled, Occupancy, Occupancy Override, Remote PIR, Dirty Filter, Service, Fan Lock, Open Door, Open Window
	Supply Temp Type	Analog Sensor	Analog Sensor, Heating NC, Cooling NC * Non four-pipe units only
	Supply Temp Sensor*	Nickel	Nickel, Platinum, A99B, 2.25k ohm negative temperature coefficient (NTC), 10k ohm NTC, 10k ohm NTC Type 3 * SAT Mode = Analog Sensor, non four-pipe

Table 7: Menus and Submenus (Part 3 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Control Setup (Cont.)	Supply Temp Offset*	0	-5 to 5 (°F or °C based on Units setting under Display Settings menu * Analog Sensor
	Zone Temp Sensor	Nickel	Nickel, Platinum, A99B, 2.25k ohm NTC, 10k ohm NTC, 10k ohm NTC Type 3
	Zone Temp Offset	0	-5 to 5 (°F or °C based on Units setting under Display Settings menu
	Humidity Offset	0% RH	-15% to 15% RH
	Reset Sensors	False	True or False
	Zone Temp Alarm Enabled	No	Yes or No
	Zone Temp Low Limit	55°F	32 to 150°F (0 to 65.56°C)
	Zone Temp High Limit	90°F	32 to 150°F (0 to 65.56°C)
Network Setup	FC Comm Mode	BACnet/MSTP	BACnet/MSTP, N2
	BACnet Instance ID*	1	0 to 4,194,302 * BACnet/MSTP communication mode
	N2 Device Address*	4	1 to 255 * N2 communication mode
	BACnet Device Address*	4	4 to 127 * BACnet/MSTP communication mode
	MSTP Baud Rate*	Auto	Auto, 1200, 9600, 19200, 38400, 76800 * BACnet/MSTP communication mode
	BACnet Encoding Type BACnet/MSTP Communication Mode	ISO 10646 (UCS-2)	ISO 10646 (UCS-2), ANSI X3.4 (US-ASCII)
Equipment Setup	**General**		
	Unit Type	4-Pipe	2-Pipe, 4-Pipe, VAV
	Heating/Cooling Device Type*	Floating	On/Off, Floating * Fan coil units only
	Actuator Stroke Time*	30 seconds	5 to 300 * Floating Heating/Cooling device type only
	Cooling Min On Time*	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Cooling Min Off Time*	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Heating Min On Time*	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Heating Min Off Time	120 seconds	0 to 360 seconds * Fan coil on/off units only
	Supply Fan*		
	Supply Fan Type*	Single Speed	Single Speed, Multi-speed, Variable Speed * Fan coil units only
	Start Voltage*	2 VDC	0 to 10 VDC * Fan coil units only, variable speed fan

Table 7: Menus and Submenus (Part 4 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Equipment Setup (Cont.)	Full Speed Voltage*	10 VDC	0 to 10 VDC, proportional *Fan coil units only, variable speed fan
	Min Command*	20%	0 to 100% * Fan coil units only, variable speed fan
	Med Fan Speed On Cmd*	33%	0 to 100% * Fan coil units only, multi-speed fan
	High Fan Speed On Cmd*	66%	0 to 100% * Fan coil units only, multi-speed fan
	Reheat*		
	Reheat Installed	No	Yes (True) or No (False)
	Reheat Min Damper Position*	20%	0 to 100% * VAV units with reheat installed
	Reheat Fan Required*	No	Yes or No *Fan coil units with reheat installed
	Reheat Min On Time*	180 seconds	0 to 360 second * Reheat installed
	Reheat Min Off Time*	180 seconds	0 to 360 seconds * Reheat installed
	Changeover		
	Changeover Mode	Auto	Auto, Cooling, or Heating * Non 4-Pipe units
	Supply Temp Type	Analog Sensor	Analog Sensor, Heating NC, Cooling NC * Changeover Mode = Auto
	Changeover Setpoint	55°F	40 to 200°F (4 to 93°C) * Supply temp type = analog sensor
	Supply Temp Sensor	Nickel	Nickel, Platinum, A99B, 2.25k ohm NTC, 10k ohm NTC, 10k ohm NTC Type 3 * Supply temp type = analog sensor
	Supply Temp Offset	0°F	-5 to 5°F (-3 to 3°C) * Supply temp type = analog sensor

Table 7: Menus and Submenus (Part 5 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
Trend	EFF-ZNT		-50 to 250°F (-45.56 to 121.11°C)
	EFF-SETPOINT		45 to 100°F (7.22 to 37.78°C)
	EFF-ZNH		0 to 100%RH
	B1 Status		On or Off
	B2 Status		On or Off
	EFF-OAT		-50 to 250°F (-45.56 to 121.11°C)
	EFF-SAT		-50 to 250°F (-45.56 to 121.11°C)
	FANSPD-S		On or Off
	CLG1-C		On or Off
	CLG2-C		On or Off
	HTG1-C		On or Off
	HTG2-C		On or Off
	OAD-O		0 to 100%
	HTG-O		0 to 100%
	CLG-O		0 to 100%
System Status	Occupancy Source	Local Schedule	Occupancy BI Temp Occ BI Temp Occ Occ Override Local Schedule BAS Schedule Occupancy Sensor
	Unit Status	Cooling	System Fault Airflow Fault Open Window Control Off Unreliable Temperature Dehumidification Idle Cooling Heating Cooling Unavailable Heating Unavailable Cooling Unavailable due to Changeover Cooling Unavailable due to OA Temp Cooling Unavailable due to Control Mode Heating Unavailable due to Changeover Heating Unavailable due to OA Temp Heating Unavailable due to Control Mode

Table 7: Menus and Submenus (Part 6 of 6)

Level 1	Level 2 (LCD Screen Name)	Level 3 (Default Values)	Available Values
System Status (Cont.)	Supply Air Temperature	75°F	-50 to 250°F (-45 to 121°C)
	Changeover State	Supply Temperature Unreliable	Changeover Disabled Cooling Mode Heating Mode Supply Temperature Unreliable
	Zone Temp Source	Internal Sensor	Unreliable Internal Sensor Remote Sensor Network Override Input Not Installed
Control Status	Cooling % Command		0 to 100%
	Heating % Command		0 to 100%
	Reheat % Command		0 to 100%
	Cool Stage 1	Off	On or Off
	Heat Stage 1	Off	On or Off
	Reheat Stage 1	Off	On or Off
	Fan % Command	0%	0 to 100%
	Fan	On	On or Off
Controller Info	Model Name	TEC3x1x-xx	–
	Software Version	x.x.x.xxxx	–
	Unit Name	TECxxxxx	–
	Device Name		User-Supplied
	Device Description	TEC3000	–
Commissioning	Supply Air Temperature	Display Current Temperature	–
	Heat Command	0%	0 to 100%
	Cool Command	0%	0 to 100%
	Supply Fan	No	Yes or No
	Aux	No	Yes or No
Update	View Version	x.x.x.xxxx	Current Release of Software
	Load Firmware		File list from USB drive
	Restore		File list from USB drive or local storage[1]
	Backup		File list from USB drive or local storage[1]

1. Configuration can be backed up to the USB drive and restored to similar models to expedite the commissioning process.

Troubleshooting

Table 8: Fault List (Part 1 of 3)

Faults	Probable Causes	Solutions
Remote Zone Temp Fail	The External Zone Temperature sensor has been disconnected or has failed.	1. Check the wiring of the sensor. 2. If intentionally disconnected, reset sensors through the menu. 3. If the problem persists, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Supply Temp Fail	The External Supply Temperature sensor has been disconnected or has failed.	1. Check the wiring of the sensor. 2. If intentionally disconnected, result fault by entering the menu, enter Control Setup, and select Inputs to reset the sensors. 3. If the problem persists, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Internal Sensor Fail	An internal sensor has failed on the TEC.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Dehum Unavailable	Dehumidification is unavailable because the zone humidity sensor has failed or the humidity reading is not reliable.	1. If the source of zone humidity was a BAS, check the BAS to ensure that it is still online and is providing the TEC with the humidity reading. If removal of the BAS mapping was intentional, reset the sensors through the menu. 2. If the problem persists, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Service	Equipment connected to the BI configured for a Service alarm is triggering the alarm.	Service the equipment by way of the manufacturer's recommendation.
Dirty Filter	Equipment connected to the BI configured for a Dirty Filter alarm is triggering the alarm.	Replace the filter in the equipment as explained in the manufacturer's instructions.
Calibration Corrupt	Factory calibration data is lost or is not installed.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Changeover Fail	The Supply Temperature Sensor is not installed, has failed, or has been disconnected and the TEC can no longer detect changeover mode to cool or heat.	Follow the same steps as Supply Temp Fail alarm.
Zone Temp Unreliable	All sources of zone temperature are unreliable, including the onboard sensor.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Open Window	The switch connected to the BI configured for Open Window is sensing that the window is opened, and control has shut down.	1. Close the window to resume control. 2. Check sensor functionality with an ohmmeter, and verify the wiring to the TEC. 3. Order replacement units and return the affected devices to Johnson Controls under the RMA program.

Table 8: Fault List (Part 2 of 3)

Faults	Probable Causes	Solutions
Fan Lock	The switch connected to the BI configured for Fan Lock did not sense airflow within 10 seconds of starting the fan, and control has been shut down.	1. Inspect equipment to ensure fan functions. 2. Check sensor functionality with an ohmmeter, and verify wiring to the TEC. 3. Reset fault by entering the menu, selecting Fault Status, and selecting the Fan Lock. 4. Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Humidity Unreliable	The zone humidity reading was reliable and has now failed.	1. If the source of zone humidity was the onboard sensor, contact Johnson Controls product sales and support. 2. If the source of zone humidity was a BAS, check the BAS to ensure that it is still online and providing the TEC with the humidity reading. If removal of the BAS mapping was intentional, reset sensors through the menu.
Controller Fault	The controller has detected an internal fault that it cannot recover.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
	An unknown error has prevented the controller from turning on.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
Touchscreen Unavailable	The touchscreen components have failed to initialize.	1. Reboot the controller. 2. If problems persist, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Board Mismatch	The baseboard and CPU board are paired incorrectly. An error message appears on the TEC indicating the model number of the baseboard and CPU board.	Match the baseboard to its corresponding CPU board. See *Repair Information* for information on ensuring that you have the CPU board and base board paired correctly.
USB Malfunction	A USB drive has malfunctioned and drawn more than the maximum allowed current.	1. Attempt to insert and use the USB drive again. 2. Try a new USB drive. 3. If problems persist, order replacement units and return the affected devices to Johnson Controls under the RMA program.
Supply Fan Runtime Limit Extended	The Supply Fan Runtime has exceeded the configured Supply Fan Runtime Limit.	1. Service the Supply Fan. 2. Reset the Supply Fan runtime.
Heating Ineffective	The Supply Air Temperature has not increased above the configured Supply Air Temperature Alarm Offset while heating has been active for at least the Supply Air Temperature Alarm Delay.	Verify that the heating elements on the rooftop are functioning properly.
Cooling Ineffective	The Supply Air Temperature has not decreased below the configured Supply Air Temperature Alarm Offset while cooling has been active for at least the Supply Air Temperature Alarm Delay.	Verify that the cooling elements on the rooftop are functioning properly.
Supply Fan Fault	The Supply Fan Status configured for either BI1 or BI2 has not proved within the configured Fan Alarm Delay.	1. Verify that the Supply Fan is operating when turned on. 2. Verify that the Supply Fan Status wiring is connected correctly.

Table 8: Fault List (Part 3 of 3)

Faults	Probable Causes	Solutions
Zone Temperature Too Cold	The Zone Temperature has decreased below the configured Zone Temp Low Limit.	Verify that the TEC and the RTU heating are enabled and functioning.
Zone Temperature Too Hot	The Zone Temperature has increased above the configured Zone Temp High Limit.	Verify that the TEC and the RTU cooling are enabled and functioning.

Table 9: Troubleshooting Details[1] (Part 1 of 2)

Symptom	Probable Causes	Solutions
The controller displays **Idle** with a **Unit Status of Cooling Unavailable due to Changeover** despite being above cooling setpoint, or with a status of **Heating Unavailable due to Changeover** despite being below the setpoint.	The 2-pipe fan coil/VAV system does not have a changeover sensor and switch connected, or the sensor/switch has failed.	1. Check the wiring of the supply temperature sensor/switch. 2. Verify that the changeover is set up correctly for the type of sensor attached (sensor or switch).
	The changeover temperature is sensing a hot supply, but the controller is requesting cooling.	1. Verify that the supply is not in heating mode. If it is, nothing can be done from the TEC. 2. Check the wiring of the supply temperature sensor or switch. 3. Check the placement of the supply temperature sensor or switch. 4. Verify that the changeover is set up correctly for the type of sensor attached (sensor or switch).
	Changeover temperature is sensing a cold supply, but the controller is requesting heating.	1. Verify that the supply is not in cooling mode. If it is, nothing can be done from the TEC. 2. Check the wiring of the supply temperature sensor or switch. 3. Check the placement of supply temperature sensor or switch. 4. Verify that the changeover is set up correctly for the type of sensor attached (sensor or switch).
The controller displays **Idle** with a **Unit Status of Cooling Unavailable due to Control Mode** despite being above cooling setpoint, or with a status of **Heating Unavailable due to Control Mode** despite being below the setpoint.	The Control Mode is set to Cooling Mode, but the controller is requesting heating.	Change the Control Mode to Auto or Heating.
	The Control Mode is set to Heating Mode, but the controller is requesting cooling.	Change the Control Mode to Auto or Cooling.
The controller displays **Cooling** or **Heating,** but the staged equipment shuts off.	When in heating or cooling mode with staged equipment, the equipment cycles on and off during the cooling or heating operation in order to maintain setpoint.	Expected behavior.
The staged equipment shuts off above the cooling setpoint or below the heating setpoint.	The PID control algorithm minimizes overshoot and energy usage for the particular equipment and zone, and may cycle the equipment prior to reaching setpoint.	Expected behavior.

Table 9: Troubleshooting Details[1] (Part 2 of 2)

Symptom	Probable Causes	Solutions
The staged equipment cycles too rapidly or too slowly.	The control band around the setpoint is determined by the minimum on/off times and is set incorrectly for the equipment, zone, or user preference. There is a tradeoff between reduced control band size and increased energy usage and equipment wear from increased cycling.	1. To tighten the control band, reduce the minimum on and off time settings. Minimal control band is achieved with a 60-second minimum on/off time. 2. To loosen the control band, increase the minimum on and off time settings.
The controller provides an error when trying to upgrade firmware.	The USB drive is defective.	Try a different USB drive.
	The firmware package is corrupt.	Try re-downloading the firmware image onto the USB drive and retry the upgrade.
The controller provides an error when trying to back up settings.	The USB drive is defective.	Try a different USB drive.
The controller provides an error when trying to restore settings from a backup.	The USB drive is defective.	Try a different USB drive.
	The Restore file is corrupt.	Try restoring a different backup file.
	The Restore file is from an incompatible model TEC.	Ensure that the backup file being restored was from the same model TEC.
The controller is unable to access a USB drive.	The drive is formatted as NTFS or another unsupported format. The TEC supports FAT and FAT32 formats only.	Reformat the USB drive, or try a different USB drive with a supported format.
	The USB drive is defective.	Try a different USB drive.
The controller displays **Board Mismatch**.	The I/O board that the display board is currently attached to does not match the one that initially shipped with the display board.	Attach the display board to the correct I/O board.
	A hardware failure is causing the two boards to incorrectly identify themselves.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
The controller displays **Controller Fault**.	An internal fault was detected and the controller was unable to recover.	Order replacement units and return the affected devices to Johnson Controls under the RMA program.
The Bell icon is displayed on the TEC home page.	The fault has been detected on the TEC.	See Table 8 for TEC fault causes and resolution.
Partial Restore Complete is displayed when trying to restore settings from a backup file.	Not all of the items in the backup file have been restored. This error can be caused by a value being out of the minimum or maximum range in the backup file. It may also occur if there are inconsistencies in the reliability of a setting in the backup file and on the TEC device.	1. Create a Backup file on a USB drive for the TEC that is showing the issue. 2. Edit the backup file created in the previous step on a PC to reflect the desired settings. 3. Verify that the modified values are within minimum and maximum range in the backup file. 4. Restore the settings from the newly edited backup file on the TEC.
The temperature displayed is lower than the actual room temperature.	Cold air drafts are entering the back of the TEC.	Seal any holes behind the TEC to reduce drafts.
The Online icon does not appear for a networked controller.	There is improper field bus wiring.	Refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034).*

1. For common MS/TP troubleshooting information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034).*

Repair Information

If the TEC3000 Series Thermostat Controller fails to operate within its specifications, replace the unit. For a replacement thermostat controller, contact the nearest Johnson Controls representative.

Technical Specifications

TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability (Part 1 of 2)

Power Requirements		19 to 30 VAC, 50/60 Hz, 4 VA at 24 VAC nominal, Class 2 or safety extra-low voltage (SELV)
USB Port Power Rating		120 to 250 mA current draw supported
Relay Contact Rating	**On/Off or Floating Control**	19 to 30 VAC, 1.0 A maximum, 15 mA minimum, 3.0 A in-rush, Class 2 or SELV
Fan Relay Output Rating		19 to 30 VAC, 1.0 A maximum, 15 mA minimum, 3.0 A in-rush
Auxiliary Output Rating/Triac Output		19 to 30 VAC, 1.0 A maximum, 15 mA minimum, 3.0 A in-rush
Binary Inputs		Dry contact across terminal COM to terminals BI1, BI2, or COS
Analog Inputs		Nickel, platinum, A99B, 2.25k ohm NTC, 10k ohm NTC, 10k ohm NTC Type 3 across terminal COM to terminals R SEN or COS
Temperature Sensor Type		Local 1k ohm platinum sensor
Wire Size		18 AWG (1.0 mm diameter) maximum, 22 AWG (0.6 mm diameter) recommended
MS/TP Network Guidelines		Up to 100 devices maximum for each Network Automation Engine (NAE); 4,000 ft (1,219 m) maximum cable length
Temperature Range	**Backlit Display**	-40.0°F/-40.0°C to 122.0°F/50.0°C in 0.5° increments
	Heating Control	40.0°F/4.5°C to 90.0°F/32.0°C
	Cooling Control	54.0°F/12.0°C to 100.0°F/38.0°C
Accuracy	**Temperature**	±0.9F°/±0.5C° at 70.0°F/21.0°C typical calibrated
	Humidity	±5% RH from 20 to 80% RH at 50 to 90°F (10 to 32°C)
Minimum Deadband		2F°/1C° between heating and cooling
Occupancy Sensor Motion Detection (Occupancy Sensing Models)		Minimum of 94 angular degrees up to a distance of 15 ft (4.6 m); based on a clear line of sight
Ambient Conditions	**Operating**	32 to 122°F (0 to 50°C); 95% RH maximum, noncondensing
	Storage	-22 to 122°F (-30 to 50°C); 95% RH maximum, noncondensing
Compliance	**BACnet International**	BACnet Testing Laboratories™ (BTL) 135-2001 Listed BACnet Application Specific Controller (B-ASC)
	United States	UL Listed, File E27734, CCN XAPX, Under UL60730
		FCC Compliant to CFR 47, Part 15, Subpart B, Class B
	Canada	UL Listed, File E27734, CCN XAPX7, Under E60730
		Industry Canada, ICES-003
CE	**Europe**	CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and the RoHS Directive.
	Australia and New Zealand	RCM Mark, Australia/NZ Emissions Compliant

TEC3000 Series On/Off or Floating Fan Coil and Zoning Thermostat Controllers with Dehumidification Capability (Part 2 of 2)

Shipping Weight	**Models without Occupancy Sensor**	0.75 lb (0.34 kg)
	Models with Occupancy Sensor	0.77 lb (0.35 kg)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

European Single Point of Contact:

JOHNSON CONTROLS
WESTENDHOF 3
45143 ESSEN
GERMANY

NA/SA Single Point of Contact:

JOHNSON CONTROLS
507 E MICHIGAN ST
MILWAUKEE WI 53202
USA

APAC Single Point of Contact:

JOHNSON CONTROLS
C/O CONTROLS PRODUCT MANAGEMENT
NO. 22 BLOCK D NEW DISTRICT
WUXI JIANGSU PROVINCE 214142
CHINA

Building Technologies & Solutions
507 E. Michigan Street, Milwaukee, WI 53202

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Project Name: Farm Credit, Russellville, AR
Project Number: 02-23-2720
Transmitted To: Hight Jackson Associates
Specification: 23 75 34 -01 Variable Air Volume Package Product Data

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Construction Manager:

NABHOLZ CONSTRUCTION SERVICES
☐ Revise & Resubmit
☐ Reviewed & Amend As Noted
☒ Reviewed
By: Ann Miller Date: 06.05.2023

Design Review Comments:

☐ APPROVED
☐ APPROVED AS CORRECTED
☐ REVIEWED BY CONSULTANT
☑ REVISE AND RESUBMIT
☐ NOT APPROVED
☐ SUPPLEMENTAL HJ COMMENTS

Checking is only for conformance with the design concept of the Project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication process or to the techniques of construction; and for coordination of the work of all trades.

BY: Emerson Cochran
DATE: 06.26.23

Hight Jackson ASSOCIATES

CREATING CUSTOMERS FOR LIFE

POWERS

SUBMITTAL

PRODUCT	RTU-~~1 thru 9~~ 2, 4, 5, 6, 7, 8, & 9
SPECIFICATION	237534
MANUFACTURER	Tempmaster
JOB NAME	Farm Credit
LOCATION	Russellville, AR.
ENGINEER	HSA
CONTRACTOR	CSUSA
CONTRACTOR POC	Jon Davis
DATE	5/3/2023
SUBMITTED BY	Eric Blaylock

5440 Northshore Drive – North Little Rock, Arkansas 72118 – Tel: 501.374.5420 Fax: 501.370.9298

Johnson Controls

SUBMITTAL DATA

Order #: **Date:** 03/13/2023

Project: Farm Credit – Russellville, AR

Project #:

Submitter: Heda Behzadpour
POWERS MECHANICAL SERVICE COMP
5440 NORTHSHORE DRIVE,
North Little Rock, Arkansas 72118
(501) 398-4789

All gas pipe connections are 3/4"
All condensate connections are 1" NPT

Date
03/13/2023
Project Name
Farm Credit – Russellville, AR
Project Number
Client / Purchaser

Johnson Controls

Submittal Summary Page

Qty	Tag #	Model # / Material #	Description
1	RTU-1	ZB120N24G2D5NCD2A2	10 Ton, Three Stage Cooling, 12.0 EER, 240 MBH Input Aluminized Steel, Two Stage Gas Heat, 208/230-3-60 • VAV Controller with VFD • Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511). • 3 HP High Static Belt Drive Blower • 2" Pleated Filters (MERV 8) • Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card. • Non-Powered Convenience Outlet • HACR Circuit Breaker/Disconnect • Dirty Filter Switch • Return Air Smoke Detector (Bottom return only) • Phase Monitor • Composite Drain Pan - Front Connection • Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray • Hot Gas Bypass • Mod Option - VFD Grounding • Mod Option - Airflow Monitoring Station • Mod Option - OverFlow Drain Pan Switch
1	RTU-1	2LA04702412	Low Ambient Kit - ICM 333
1	RTU-1	2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
1	RTU-1	1FF0414	2" Only Metal Filter Frame Kit
1	RTU-1	1HG0411	Hail Guard Kit- Diamond Pattern
1	RTU-1	S1-TEC3631-14-000	7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO
1	RTU-2	ZJ150N24R2D5NCE2A2	A HUMIDITY SENSOR IS REQUIRED (PLEASE SEE THE ABOVE WARNING MESSAGE FOR A SOLUTION), 12.5 Ton, Single Packaged R-410A Air Conditioner, High Efficiency, Two Stage Cooling, 12.0 EER, 240 MBH Input Aluminized Steel, Two Stage Gas Heat, 208/230-3-60 • Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).

Qty	Tag #	Model # / Material #	Description
			• 5 HP High Static Belt Drive Blower • 2" Pleated Filters (MERV 8) • IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10) • Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card. • Non-Powered Convenience Outlet • HACR Circuit Breaker/Disconnect • Dirty Filter Switch • Return Air Smoke Detector (Bottom return only) • Phase Monitor • Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil • MagnaDry Reheat • Composite Drain Pan - Front Connection • Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray • Mod Option - VFD Grounding • Mod Option - Airflow Monitoring Station • Mod Option - OverFlow Drain Pan Switch
1	RTU-2	2LA04702424	Low Ambient Kit
1	RTU-2	2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
1	RTU-2	1FF0414	2" Only Metal Filter Frame Kit
1	RTU-2	1HG0434	Hail Guard Kit- Provent Style
1	RTU-2	S1-TEC3631-14-000	7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO
1	RTU-3	ZB090N18G2D5NCD2A2	7.5 Ton, Three Stage Cooling, 12.0 EER, 180 MBH Input Aluminized Steel, Two Stage Gas Heat, 208/230-3-60 • VAV Controller with VFD • Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511). • 3 HP High Static Belt Drive Blower • 2" Pleated Filters (MERV 8) • Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card. • Non-Powered Convenience Outlet • HACR Circuit Breaker/Disconnect • Dirty Filter Switch • Return Air Smoke Detector (Bottom return only) • Phase Monitor • Composite Drain Pan - Front Connection • Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray

Qty	Tag #	Model # / Material #	Description
			• Mod Option - VFD Grounding • Mod Option - Airflow Monitoring Station • Mod Option - OverFlow Drain Pan Switch
1	RTU-3	2LA04702412	Low Ambient Kit - ICM 333
1	RTU-3	2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
1	RTU-3	1FF0414	2" Only Metal Filter Frame Kit
1	RTU-3	1HG0411	Hail Guard Kit- Diamond Pattern
1	RTU-3	S1-TEC3631-14-000	7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO
3	RTU-4, 5, 6	ZJ102N18R2D5NCE2A3	A HUMIDITY SENSOR IS REQUIRED (PLEASE SEE THE ABOVE WARNING MESSAGE FOR A SOLUTION), 8.5 Ton, Single Packaged R-410A Air Conditioner, High Efficiency, Two Stage Cooling, 12.0 EER, 180 MBH Input Aluminized Steel, Two Stage Gas Heat, 208/230-3-60 • Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511). • 3 HP High Static Belt Drive Blower • 2" Pleated Filters (MERV 8) • IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10) • Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card. • Non-Powered Convenience Outlet • HACR Circuit Breaker/Disconnect • Dirty Filter Switch • Return Air Smoke Detector (Bottom return only) • Phase Monitor • Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil • MagnaDry Reheat • Composite Drain Pan - Front Connection • Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray • Mod Option - VFD Grounding • Mod Option - Airflow Monitoring Station • Mod Option - OverFlow Drain Pan Switch
3	RTU-4, 5, 6	2LA04702412	Low Ambient Kit - ICM 333
3	RTU-4, 5, 6	2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
3	RTU-4, 5, 6	1FF0414	2" Only Metal Filter Frame Kit
3	RTU-4, 5, 6	1HG0411	Hail Guard Kit- Diamond Pattern
3	RTU-4, 5, 6	S1-TEC3631-14-000	7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO

Qty	Tag #	Model # / Material #	Description
2	RTU-7, 8	ZT061N12P2D5NCE2A2	5 Ton, Single Packaged R-410A Ultra High Efficiency Air Conditioner, Two Stage Cooling, 16.3 SEER / 13.0 EER, 120 MBH Input Aluminized Steel, Two Stage Gas Heat, 208/230-3-60 • Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511). • VFD Standard • 1.5 HP Standard Static Belt Drive Blower • 2" Pleated Filters (MERV 8) • IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10) • Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card. • Non-Powered Convenience Outlet • HACR Circuit Breaker/Disconnect • Dirty Filter Switch • Return Air Smoke Detector (Bottom return only) • Phase Monitor • Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil • MagnaDry Reheat • Composite Drain Pan - Front Connection • Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray • Mod Option - VFD Grounding • Mod Option - Airflow Monitoring Station • Mod Option - OverFlow Drain Pan Switch
2	RTU-7, 8	1FF0415	2" Only metal Filter Frame Kit
2	RTU-7, 8	2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
2	RTU-7, 8	1HG0415	Hail Guard Kit- Diamond Pattern
2	RTU-7, 8	S1-TEC3631-14-000	7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO
1	RTU-9	ZT037N08R2D5NCE2A3	3 Ton, Single Packaged R-410A Ultra High Efficiency Air Conditioner, Two Stage Cooling, 80 MBH Input Aluminized Steel, Two Stage Gas Heat, 208/230-3-60 • Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511). • VFD Standard • 1.5 HP High Static Belt Drive Blower • 2" Pleated Filters (MERV 8) • IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10) • Smart Equipment Controller including Discharge Air, Return Air

Qty	Tag #	Model # / Material #	Description
			and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card. • Non-Powered Convenience Outlet • HACR Circuit Breaker/Disconnect • Dirty Filter Switch • Return Air Smoke Detector (Bottom return only) • Phase Monitor • Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil • MagnaDry Reheat • Composite Drain Pan - Front Connection • Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray • Mod Option - VFD Grounding • Mod Option - Airflow Monitoring Station • Mod Option - OverFlow Drain Pan Switch
1	RTU-9	1FF0415	2" Only metal Filter Frame Kit
1	RTU-9	2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
1	RTU-9	1HG0415	Hail Guard Kit- Diamond Pattern
1	RTU-9	S1-TEC3631-14-000	7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO

RESUBMIT RTU-1&3.
units shall be provided with inverter driven compressors and modulating gas heat per addendum #3. Systems shall meet requirements of spec section 23 75 34 as.

all units shall be provided with sloped factory roof curbs extending a minimum of 8" above roof line per addendum #3.

Curb weights shall be included in unit total weights for coordination with steel fabricator / structural as required for increased weights.

Equipment start-up and commissioning by a factory trained technician is recommended.
Contact your supplying distributor or sales representative for additional information & guidance.

⚠ WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2** System: **ZJ150N24R2D5NCE2A2**

Cooling Performance		
Total gross capacity	168.6	MBH
Sensible gross capacity	118.1	MBH
Total net capacity	155.2	MBH
Sensible net capacity	104.7	MBH
Efficiency (at ARI)	12.00	EER
Integrated eff. (at ARI)	15.20	IEER
Ambient DB temp.	95.0	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	57.2	°F
Leaving WB temp.	55.7	°F
Leaving air temp dew point	54.70	°F
Power input (w/o blower)	11.47	kW
Sound power	82	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	11 lbs	
Sys2	9 lbs	12 oz

Reheat Performance		
Total capacity	73.9	MBH
Sensible capacity	7.7	MBH
Ambient DB temp.	85	°F
Entering DB temp.	75	°F
Entering WB temp.	67	°F
Leaving DB temp.	73.5	°F
Leaving WB temp.	62.4	°F
Power input (w/o blower)	9.80	kW
Gallons of water per hour	7.55	GPM

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	194.0	MBH
Supply air	4800	CFM
Heating input capacity (Max)	240	MBH
Leaving DB temp.	97.4	°F
Air temp. rise	37.4	°F
SSE	81.0	%
Stages	2	

Supply Air Blower Performance		
Supply air	4800	CFM
Ext. static pressure	0.25	IWG
Addl. Unit Losses (Options/Accessories)	0.93	IWG
Blower speed	1359	HP
Max BHP of Motor (including service factor)	5.75	HP
Duct location	Bottom	
Motor rating	5.00	HP
Actual required BHP	4.23	HP
Power input	3.94	kW
Elevation	335	ft.
Drive type	BELT	
Requires field-supplied drive	true	

Outside/Mixed Air		
Outside Air CFM	300	CFM

Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	78.1	Amps
Unit max over-current protection	100	Amps

Dimensions & Weight					
Hgt 51 in.		Len 120 in.		Wth 59 in.	
Weight with factory installed options				1650	lbs

Clearances					
Right	12 in.	Front	12 in.	Rear	12 in.
Top	12 in.	Bottom	12 in.	Left	12 in.

Note: Please refer to the tech guide for listed maximum static pressures



12.5 Ton

- Tempmaster units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 240 MBH Input Aluminized Steel, Two Stage Gas Heat
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 750 Hours Salt Spray Test (ASTM B-117 Standards)
- Full perimeter base rails with built in rigging capabilities
- Scroll Compressor[s]
- Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- Slide-Out Blower/5 HP Belt Drive Motor Assembly
- Unit Ships with 2" Pleated Filters (MERV 8)
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 20"). Unit accepts 2" or 4" wide filters.
- Non-Powered Convenience Outlet
- Short Circuit Current: 5kA RMS Symmetrical
- Single Point Power Connection
- Through-the-Curb and Through-the-Base Utility Connections
- HACR Circuit Breaker/Disconnect
- Dirty Filter Switch
- Return Air Smoke Detector
- Micro-Channel "all-aluminum" conc evaporator coil
- MagnaDry Reheat
- Composite Drain Pan - Front Connection
- Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray

provide economizer with barometric relief only per addendum #3.

BAS Controller

- IntelliSpeed control of the VFD based on stages of cooling. Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10.
- Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 communication card.

Standard Unit Controller: Smart Equipment Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

coordinate increase in

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2** System: **ZJ150N24R2D5NCE2A2**

Additional Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	78.1	Amps
Unit max over-current protection	100	Amps
Min Voltage	187	V
Max Voltage	252	V
Comp #1 RLA	23.1	
Comp #1 LRA	160.0	
Comp #2 RLA	23.1	
Comp #2 LRA	160	
Indoor Mtr Voltage	208-3-60	
Indoor Mtr FLA	14	
Outdoor Mtr Qty	4	
Outdoor Fan Voltage	208-1-60	
OD Fan Mtr FLA (ea.)	1.65	
Power Ex Mtr Qty	1	
Powered Ex Voltage	208-1-60	
Power Ex Mtr FLA (ea)	5.5	
Combustion Mtr Qty	1	
Combustion Motor Voltage	208/230-1-60	
Combustion Mtr FLA (ea)	0.5	

coordinate change in electrical requirements with electrical contractor. any cost associated with changes shall be mechanical contractor or equipment suppliers responsibility.

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2** System: **ZJ150N24R2D5NCE2A2**

Factory Installed Options

ZJ150N24R2D5NCE2A2

Equipment Options		Option(s) Selected
Product Category:	**ZJ**	Single Packaged R-410A Air Conditioner, High Efficiency 12.0 EER
Nominal Cooling Capacity:	**150**	12.5 Ton Two Stage Cooling
Heat Type and Nominal Heat Capacity:	**N24**	240 MBH Input Aluminized Steel, Two Stage Gas Heat
Blower Option:	**R**	5 HP High Static Belt Drive Blower IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10)
Voltage:	**2**	208/230-3-60
Outside Air Option:	**D**	Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
Service Options:	**5**	Non-Powered Convenience Outlet HACR Circuit Breaker/Disconnect
Sensor Options:	**N**	Dirty Filter Switch Return Air Smoke Detector (Bottom return only)
Controls:	**C**	Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card.
Refrigeration:	**E**	Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil MagnaDry Reheat
Additional Options:	**2**	2" Pleated Filters (MERV 8) Phase Monitor
Cabinet Options:	**A**	Composite Drain Pan - Front Connection Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray
Product Generation:	**2**	

Field Installed Accessories

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2** System: **ZJ150N24R2D5NCE2A2**

- ○ 1CV0406 - Concentric Diffuser,Flush Mount,18X36
- ○ 1CV0413 - Concentric Diffuser,Side Discharge,18X28
- ○ 1CV0414 - Concentric Diffuser,Side Discharge,18X32
- ○ 1CV0415 - Concentric Diffuser,Side Discharge,18X36
- ○ 1CV0420 - Concentric Diffuser,Specialty,24X24
- ○ 1CV0421 - Concentric Diffuser,Specialty,28X28
- ○ 1CV0426 - Concentric Diffuser,Specialty,24X24
- ○ 1FE0412 - Flue Exhaust Extension Kit (14.0 lbs)
- ● 1FF0414 - 2" Only Metal Filter Frame Kit (16.0 lbs)
- ○ 1HA0425 - High Altitude Kit with Propane Conversion - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ○ 1HA0448 - High Altitude Kit for Natural Gas - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ● 1HG0434 - Hail Guard Kit-Provent Style (30.0 lbs)
- ○ 1HG0441 - Hail Guard Kit-Diamond Pattern (44.0 lbs)
- ○ 1NP0463 - Natural Gas to Propane Conversion Kit (2-Stage) (1.0 lbs)
- ○ 1RC0470 - Roof Curb - 8" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0471 - Roof Curb - 14" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0472 - Roof Curb, Transition-Sunline 7.5T thru 12.5T to Pro 3.0T thru 12.5T (Shipped Assembled) (200.0 lbs)
- ○ 1RC0476 - Roof Curb - 24" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 2AP0402 - Air Proving Switch (1.0 lbs)
- ○ 2AQ04700524 - CO^2 Space Sensor - Wall Mount Accessory (5.0 lbs)
- ○ 2AQ04700624 - CO^2 Unit Mount Accessory (4.6 lbs)
- ○ 2EC0401 - Kit, Single Enthalpy Field Installed (1.0 lbs)
- ● 2EC0402 - Kit, Dual Enthalpy Field Installed (Includes two humidity sensors) (1.0 lbs)
- ● 2LA04702424 - Low Ambient Kit (3.2 lbs)
- ○ 2SD04700824 - Smoke Detector Kit w/ Mounting Hardware for Supply Air (Horizontal/Downflow) Only (9.4 lbs)
- ○ S1-02812364700 - Blower Sheave for 12.5 Ton High Static Field Installed Drive (3.0 lbs)
- ○ S1-ADDWIRE - Add-a-Wire allows 5-wire thermostats to use only 4 wires. (0.3 lbs)
- ○ S1-CTSDTS - CTS Wired Temperature Sensor for thermostat | Duct *Also works for LX Series (0.3 lbs)
- ○ S1-CTSHTS - CTS Hardwired Temperature Sensor for CTS Thermostats *Works with LX series as well (0.2 lbs)
- ○ S1-CTSPLATE - Wall Plate for CTS Thermostats *Also works for new platform LX series models below (0.0 lbs)
- ○ S1-CTSWFTS - CTS Temperature Sensor with WiFi for CTS Thermostats *Also works with LX Series (0.1 lbs)
- ○ S1-LXLOCK - Locking Ring For LX-Series Thermostats (0.4 lbs)
- ○ S1-LXPLATE - Wall Plate For LX-Series Thermostats (0.0 lbs)
- ○ S1-LXWFM - For LX Series Thermostats - WiFi Communication (0.1 lbs)
- ○ S1-MP-PRTKIT-0P - MAP (Multiple Access Portal) Gateway Kit- Replacement MAP gateway protective case, lanyard and communication cable. Use only to replace worn or damaged components. (0.3 lbs)
- ○ S1-NSB8BHN041-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN043-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN141-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN143-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN240-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN241-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN243-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN240-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN241-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN243-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN041-0 - Wall Temperature Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN043-0 - Wall Temperature Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN141-0 - Wall Temperature Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2** System: **ZJ150N24R2D5NCE2A2**

- ○ S1-NSB8BTN143-0 - Wall Temperature Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN240-0 - Wall Temperature Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN241-0 - Wall Temperature Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN243-0 - Wall Temperature Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-TEC3030-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3030-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, AND FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3031-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3031-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3630-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3630-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ● S1-TEC3631-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3631-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-YK-MAP1810-0P - MAP (Multiple Access Portal) Gateway- For use with SimplicitySE Control. (0.2 lbs)
- ○ S1-YK-MAP1810-0S - Stationary MAP Gateway (Includes MAP Gateway, Field Bus Adapter, Mounting Bracket and 100 to 240 VAC Power Supply). US-compatible counties. (1.9 lbs)

provide thermostat less occupancy sensor.

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Consolidated Drawing

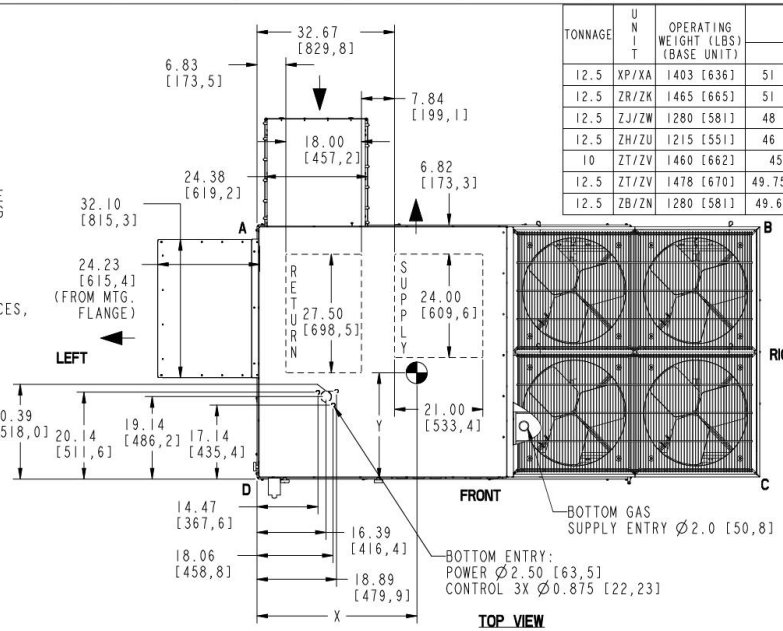
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   RIGHT SIDE: 12 [305]
   LEFT SIDE: 36 [915]
   FRONT: 36 [915]
   REAR: 36 [915]
   TOP: 72 [1830]
   BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAIN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF & FRESH AIR HOODS SHOWN.

⚠1 EXCEPT XP/XA (HEAT PUMP) UNITS.

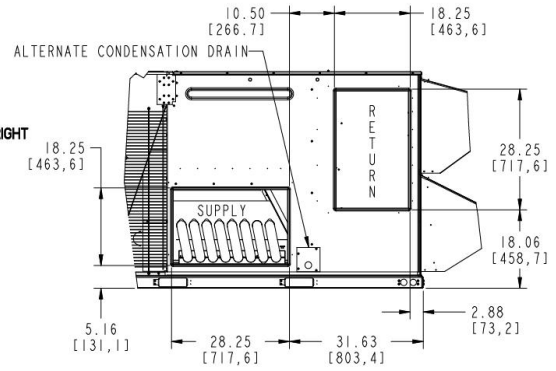
DIRECTION OF AIRFLOW

CENTER OF GRAVITY

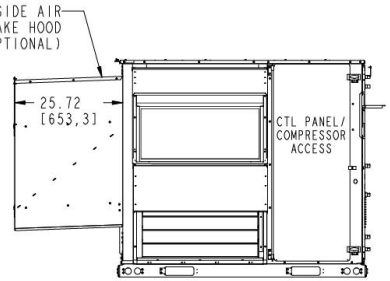
TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
12.5	XP/XA	1403 [636]	51 [1295,4]	25.5 [647,7]	259 [118]	347 [157]	456 [207]	340 [154]
12.5	ZR/ZK	1465 [665]	51 [1295,4]	25.5 [647,7]	270 [123]	363 [165]	477 [216]	355 [161]
12.5	ZJ/ZW	1280 [581]	48 [1219,2]	24 [609,6]	240 [109]	281 [128]	410 [186]	350 [159]
12.5	ZH/ZU	1215 [551]	46 [1168,4]	26 [660,4]	259 [118]	277 [126]	351 [159]	328 [149]
10	ZT/ZV	1460 [662]	45 [1143]	25.5 [647,7]	312 [142]	319 [145]	419 [190]	410 [186]
12.5	ZT/ZV	1478 [670]	49.75 [1263,7]	24.5 [622,3]	271 [123]	343 [156]	483 [219]	381 [173]
12.5	ZB/ZN	1280 [581]	49.6 [1259,8]	24.1 [612,1]	231 [105]	291 [132]	422 [191]	335 [152]



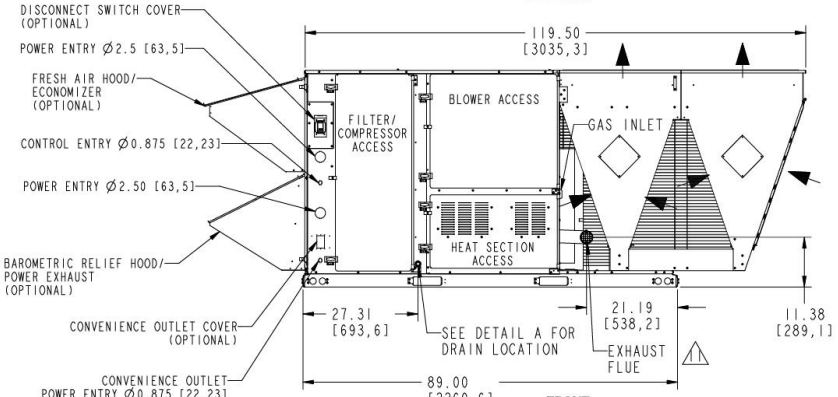
TOP VIEW



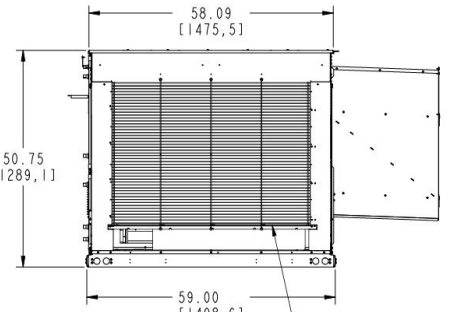
REAR (PARTIAL VIEW)
(INTAKE HOOD NOT SHOWN IN THIS VIEW)



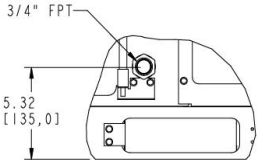
LEFT VIEW



FRONT
(OPTIONAL FRONT COIL GUARD NOT SHOWN IN THIS VIEW)



RIGHT VIEW



DETAIL A
SCALE 0.300

REV LEV	DATE	REVISION RECORD	EC NO	DR	CK	ENG
A	02-11-20	NEW DRAWING (FROM UST-PRED-W50H)	75768	LOP	RCH	SAA

THIRD ANGLE PROJECTION

NAME	DATE
DRN L. PACKARD	02-11-20
CHK R. HADDAD	02-11-20
ENG S. AYENI	02-11-20
MFG	

ALL PROPRIETARY RIGHTS IN THE SUBJECT MATTER HEREOF ARE RESERVED AND NO PERMISSION IS GRANTED TO REPRODUCE THIS PRINT IN WHOLE OR IN PART OR DISCLOSE ANY OF THE INFORMATION UPON IT TO OTHERS WITHOUT WRITTEN RELEASE BY JOHNSON CONTROLS

DRAWING PER ASME Y14.5-2009
TOLERANCES UNLESS OTHERWISE SPECIFIED:
ONE PLACE DECIMAL = ± .1
TWO PLACE DECIMAL = ± .03
THREE PLACE DECIMAL = ± .010
ANGLES = ± 2°
DIMENSIONS ARE IN INCHES

SUBMITTAL DWG, PRO W COIL, 50" CAB

JOHNSON CONTROLS
UNITARY PRODUCTS GROUP

SAFETY AND KEY CHARACTERISTICS PER BE-PDP-STD-01
MATERIAL
TYPE NOT APPLICABLE
ENG SPEC NOT APPLICABLE
SIZE
DWG NO. 5883790
REV A
PART NO.
NO 1 OF 1

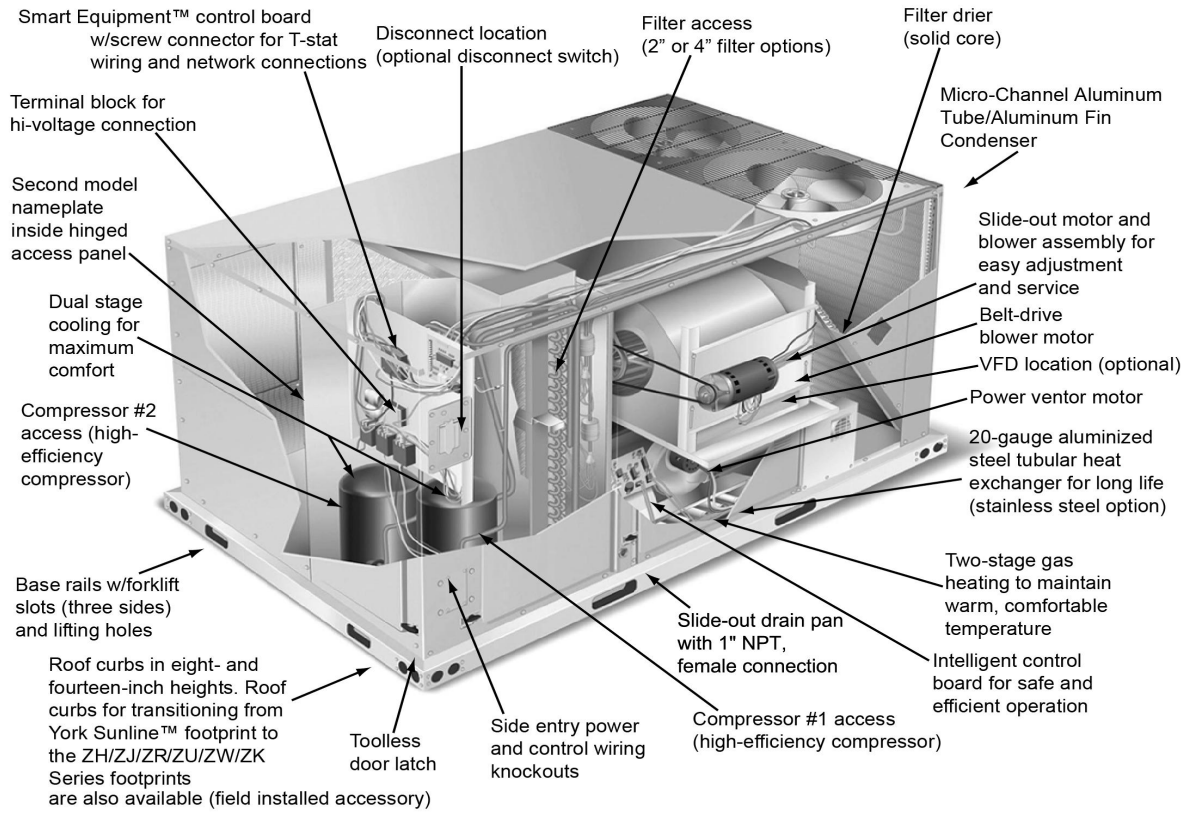
Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Component Locations

Cooling With Gas Heat (6.5 Through 10 Tons)



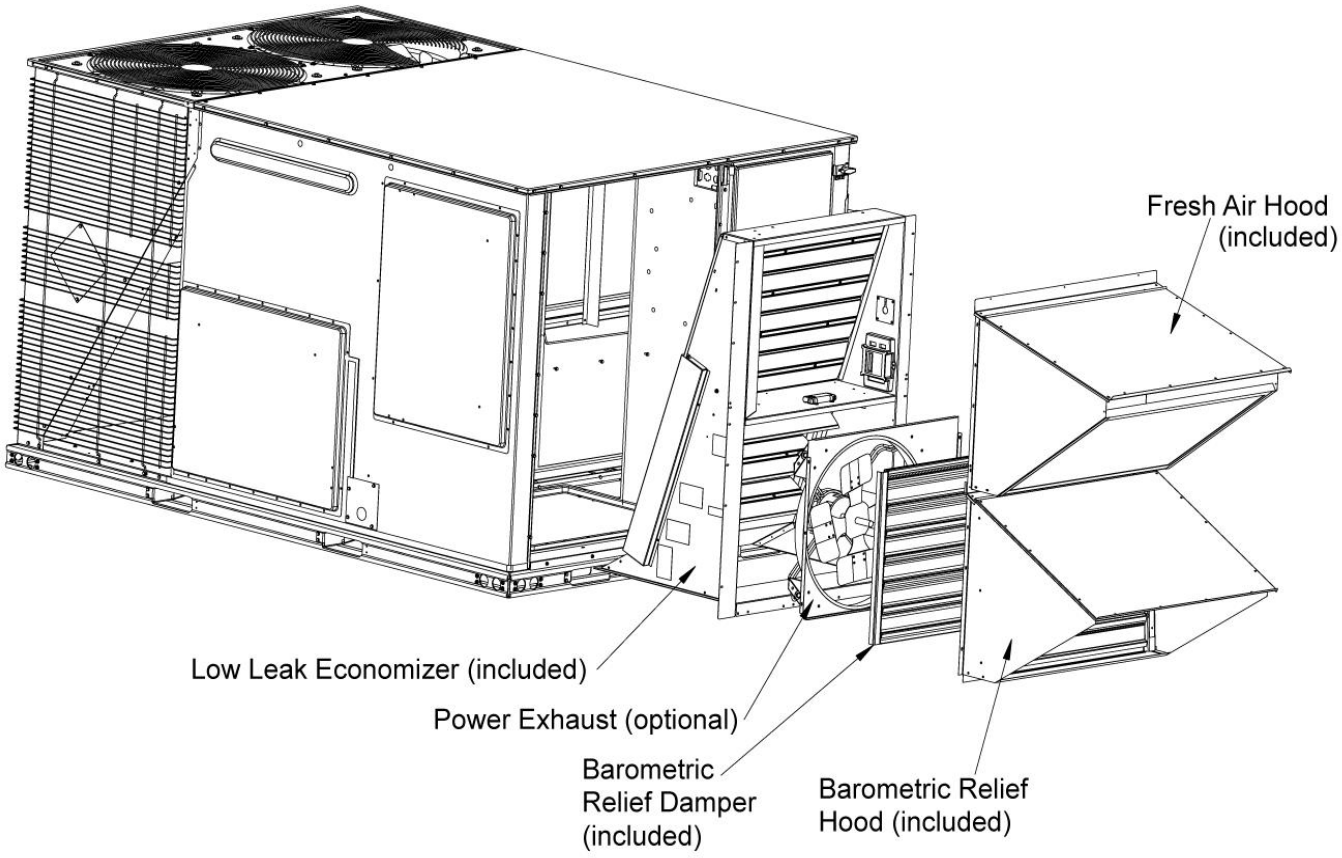
Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Low Leak Downflow Economizer

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

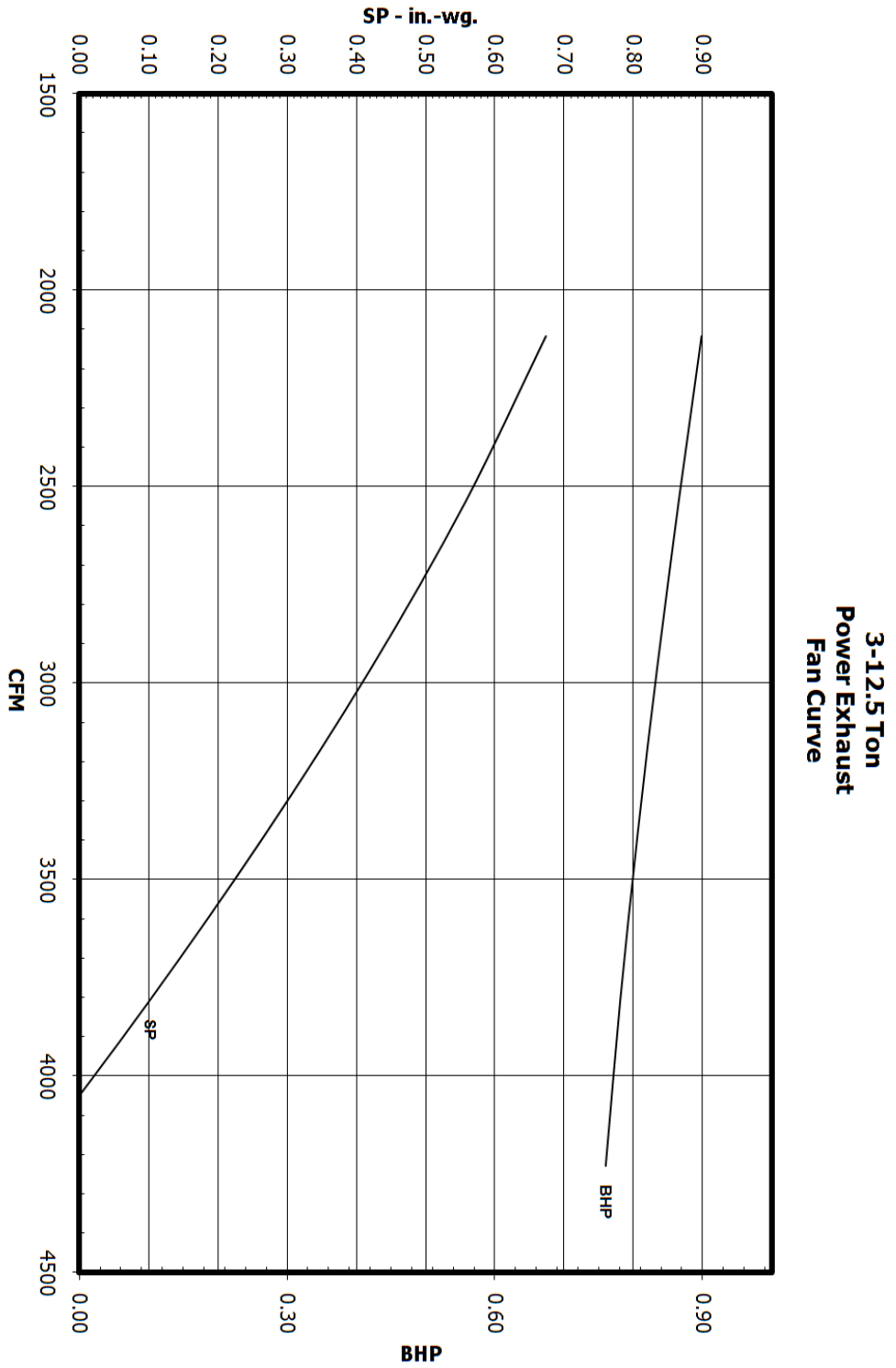
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Factory Installed Power Exhaust



Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP – 0213

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Johnson Controls Inc. (JCI)

Manufacturer's Technical Representative: Cameron Boyce, Engineer II

Mailing Address: 5005 Interstate Drive, Norman, OK, 73069

Telephone: (405) 419-6830 Email: cameron.w.boyce@jci.com

Product Information

Product Name: Predator Rooftop Air Conditioning Units

Product Type: Packaged Air Conditioning Units

Product Model Number: See attached
(List all unique product identification numbers and/or part numbers)

General Description: The units are enclosures with the following subcomponents: refrigerant compressors, outdoor fan motors, indoor coils, outdoor coils, reversing valve with coil, thermostatic expansion valves, standard indoor blower motor, Variable frequency drive indoor blower motor, exhaust fan motor, variable frequency drive, economizer, electric heater, heat cells, filters, and other miscellaneous items included in the subcomponent tables.

Mounting Description: Units are rigid curb and isolated curb base mounted

REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0213 Timothy J Piland Date: 09/06/2019 CALIFORNIA BUILDING CODE 2019

Applicant Information

Applicant Company Name: The VMC Group

Contact Person: John Giuliano

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: john.giuliano@thevmcgroup.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2016.

Signature of Applicant: Date: 8/28/19

Title: President Company Name: The VMC Group

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

California Licensed Structural Engineer Responsible for the Engineering and Test Report(s)

Company Name: The VMC Group

Name: Kenneth Tarlow California License Number: SE-2851

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: ken.tarlow@thevmcgroup.com

Supports and Attachments Preapproval

☐ Supports and attachments are preapproved under OPM- _____
(Separate application for OSHPD Preapproval of Manufacturer's Certification (OPM) of Supports and attachments is required)

☒ Supports and attachments are not preapproved

Certification Method

☒ Testing in accordance with: ☒ ICC-ES AC156

☐ Other (Please Specify): _____

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0213
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Testing Laboratory

Company Name: DCL Labs

Contact Name: Josh Sailer, Laboratory Manager

Mailing Address: 1315 Greg Street, Suite 109, Sparks, NV 89431

Telephone: (775) 358-5085 Email: josh@shaketest.com

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

Seismic Parameters

Design in accordance with ASCE 7-16 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = Rigid Curb = 1.5; Spring Isolated Curb = 4.5

S_{DS} (Design spectral response acceleration at short period, g) = 2.00

a_p (In-structure equipment or component amplification factor) = 2.5

R_p (Equipment or component response modification factor) = Rigid Curb = 6.0; Spring Isolated Curb = 2.0

Ω_0 (System overstrength factor) = 2.0

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1

Equipment or Component Natural Frequencies (Hz) = See attachment

Overall dimensions and weight (or range thereof) = See attachment

Equipment or Components @ grade designed in accordance with ASCE 7-16 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Design spectral response acceleration at short period, g) =

S_{D1} (Design spectral response acceleration at 1 second period, g) =

R (Response modification coefficient) =

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) =

I_p (Importance factor) = 1.5

Height to Center of Gravity above base =

Equipment or Component Natural Frequencies (Hz) =

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2015: ☐ Yes ☒ No

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0215
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

List of Attachments Supporting Special Seismic Certification

☒ Test Report(s) ☒ Drawings ☐ Calculations ☐ Manufacturer's Catalog

☐ Other(s) (Please Specify):

OSHPD Approval (For Office Use Only) – Approval Expires on December 31, 2025

Signature: Date: March 8, 2021

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to: S_{DS} (g) = 2.00 z/h = 1

Condition of Approval (if applicable):

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ150N24R2D5NCE2A2**

Quantity: **1** Tag #: **RTU-2**

Seismic Certification

Table 1 - Certified Components

Manufacturer: Johnson Controls and other Unitary Product Group brands (York, Coleman, Luxaire, Evcon, Fraser-Johnston and Ready Ship)

Product Line: JCI Packaged Rooftop Units

Product Construction: Cabinetis constructed of G90 galvanized 1,000 hour salt spray (per ASTM-B117) rated powder-coated 20 gage carbon steel wrapper and duct panel with integral corner posts, all attached atthe base to four (4) full perimeter 14 gage base rails with #10 sheet metal screws.

Options: 230-575 V, economizer, power exhaust, electric or gas heater, variable frequency drive

Mounting Description: Rigid or Flexible Curb Mounting

Product Line	Model Number[2]	Dimensions (inches)			Operating Weight (lb)	Nominal Cooling Capacity (Tons)	Sds (g), z/h=1	Unit
		Depth	Width	Height				
Predator Air Handling Units (Short)	ZH/ZU/JA3 037	89	59	42	860[1]	3	2.0	3
	ZJ/ZW/JA3 037	89	59	42	740	3		Interpolated
	ZR/ZK/JA3 037	89	59	42	980[1]	3		1
	ZT/ZV/JA3 037	89	59	42	922	3		Interpolated
	ZH/ZU/JA4 049	89	59	42	763	4		Interpolated
	ZJ/ZW/JA4 049	89	59	42	762	4		Interpolated
	ZR/ZK/JA4 049	89	59	42	880	4		Interpolated
	ZT/ZV/JA4 049	89	59	42	960	4		Interpolated
	ZH/ZU/JA5 061	89	59	42	772	5		Interpolated
	ZJ/ZW/JA5 061	89	59	42	1,070[1]	5		4
	ZR/ZK/JA5 061	89	59	42	1,070[1]	5		2
	ZT/ZV/JA5 061	89	59	42	968	5		Extrapolated
Predator Air Handling Units (Standard)	XP/XA/J06 078	89	59	42	970[1]	6.5	2.0	7
	ZF/ZS/J06 078	89	59	42	1,090[1]	6.5		10
	ZH/ZU/J06 078	89	59	42	910	6.5		Interpolated
	ZJ/ZW/J06 078	89	59	51	1030	6.5		Interpolated
	ZR/ZK/J06 078	89	59	51	1,060[1]	6.5		5
	ZF/ZS/J07 090	89	59	42	860	7.5		Interpolated
	ZH/ZU/J07 090	89	59	42	910	7.5		Interpolated
	ZJ/ZW/J07 090	89	59	51	1,081	7.5		Interpolated
	XP/XA/J07 090	89	59	42	920	7.5		Interpolated
	ZR/ZK/J07 090	89	59	42	965	7.5		Interpolated
	ZF/ZS/J08 102	89	59	51	1,020	8.5		Interpolated
	ZH/ZU/J08 102	89	59	51	1,030	8.5		Interpolated
	ZJ/ZW/J08 102	89	59	51	1,060	8.5		Interpolated
	XP/XA/J08 102	89	59	51	1,135	8.5		Interpolated
	ZR/ZK/J08 102	89	59	51	1,200	8.5		Interpolated
	ZF/ZS/J10 120	89	59	51	1,060	10		Interpolated
	ZH/ZU/J10 120	89	59	51	1,090	10		Interpolated
	ZJ/ZW/J10 120	89	59	51	1,070	10		Interpolated
	XP/XA/J10 120	89	59	51	1,135	10		Interpolated
	ZR/ZK/J10 120	89	59	51	1,200	10		Interpolated
	ZF/ZS/J12 150	119.5	59	51	1,253	12.5	2.0	Interpolated
	ZH/ZU/J12 150	119.5	59	51	1,250[1]	12.5		11
	XP/XA/J12 150	119.5	59	51	1,510[1]	12.5		8
	ZJ/ZW/J12 150	119.5	59	51	1,570[1]	12.5		9
	ZR/ZK/J12 150	119.5	59	51	1,600[1]	12.5		6
Predator Air Handling Units (Ultra High Efficiency)	ZT/ZV 120	119.5	59	51	1,470[1]	10	2.0	12
	ZT/ZV 078	119.5	59	51	1,550	6.5		Interpolated
	ZT/ZV 090	119.5	59	51	1,550	7.5		Interpolated
	ZT/ZV 102	119.5	59	51	1,575	8.5		Interpolated
	ZT/ZV 150	119.5	59	51	1,680[1]	12.5		13

1. Weights listed for tested units are actual, not approximate weights. The weights listed for interpolated units are maximum weights, assuming all optional features are included. Optional features are summarized in the table below.
2. Model numbers are generalized for each type of unit and the associated BTU tonnage thatthe unit can output.

Unit Accessory	Operating Weight (lbs.)
Economizer	85
Power Exhaust	35
Electric Heat	49
Gas Heat	110
Variable Frequency Drive	30

1. Weight given is for the maximum electric heater size available.
2. Weight given for the gas heater is for the maximum number oftube heat exchangers available (8 tube).
3. Weightincludes mounting hardware, controls and manual bypass option.

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0013
By:Timothy J Pilard
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

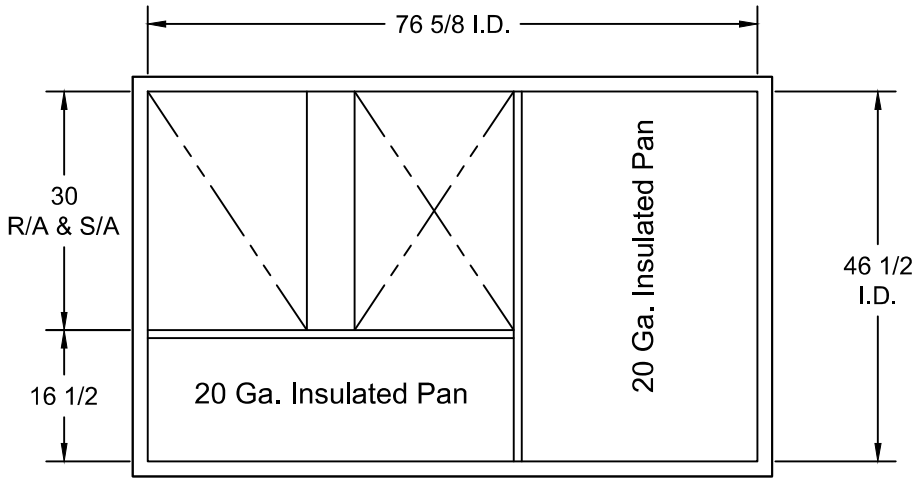
VERIFY ROOF PITCH AND DIRECTION

☐ APPROVED

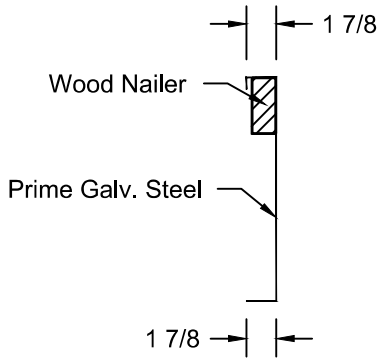
☐ APPROVED PENDING CHANGES

BY:

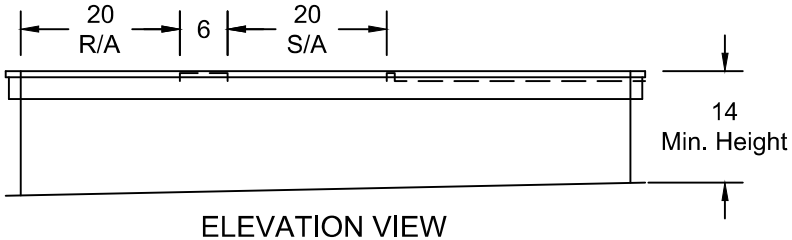
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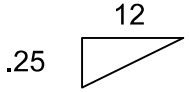
PLAN VIEW



TYPICAL SECTION



ELEVATION VIEW



PITCH

NOTE:
Top Duct Supports To Be Removable.

Rev.	Int.	Date	Description

REVISION HISTORY

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 9/27/23

TC-5 Uninsulated Roof Curb Top Duct Supports
New York ZJ150 (00488)

Powers Of Arkansas - North Little Rock, AR

Qty.: 1 | Job# :Q-26629

Tag: RTU-2

Drawn: JWhite

File: S20900-1 | Rev: ---

thybar CORPORATION
Thybar makes it right the first time, every time

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6** System: **ZJ102N18R2D5NCE2A3**

Cooling Performance		
Total gross capacity	105.2	MBH
Sensible gross capacity	73.4	MBH
Total net capacity	98.6	MBH
Sensible net capacity	66.8	MBH
Efficiency (at ARI)	12.00	EER
Integrated eff. (at ARI)	14.60	IEER
Ambient DB temp.	95.0	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	58.8	°F
Leaving WB temp.	56.5	°F
Leaving air temp dew point	55.00	°F
Power input (w/o blower)	6.75	kW
Sound power	88	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	7 lbs	4 oz
Sys2	7 lbs	8 oz

Reheat Performance		
Total capacity	42.7	MBH
Sensible capacity	11.7	MBH
Ambient DB temp.	85	°F
Entering DB temp.	75	°F
Entering WB temp.	67	°F
Leaving DB temp.	71.6	°F
Leaving WB temp.	63.1	°F
Power input (w/o blower)	5.55	kW
Gallons of water per hour	3.54	GPM

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	146.0	MBH
Supply air	3200	CFM
Heating input capacity (Max)	180	MBH
Leaving DB temp.	102.2	°F
Air temp. rise	42.2	°F
SSE	81.0	%
Stages	2	

Supply Air Blower Performance		
Supply air	3200	CFM
Ext. static pressure	0.7	IWG
Addl. Unit Losses (Options/Accessories)	0.39	IWG
Blower speed	998	HP
Max BHP of Motor (including service factor)	3.45	HP
Duct location	Bottom	
Motor rating	3.00	HP
Actual required BHP	2.09	HP
Power input	1.95	kW
Elevation	335	ft.
Drive type	BELT	

Outside/Mixed Air		
Outside Air CFM	300	CFM

Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	51.8	Amps
Unit max over-current protection	60	Amps

Dimensions & Weight					
Hgt 51 in.		Len 89 in.		Wth 59 in.	
Weight with factory installed options				1325	lbs

Clearances					
Right	12 in.	Front	12 in.	Rear	12 in.
Top	12 in.	Bottom	12 in.	Left	12 in.

Note: Please refer to the tech guide for listed maximum static pressures



8.5 Ton

- Tempmaster units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 180 MBH Input Aluminized Steel, Two Stage Gas Heat
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 750 Hours Salt Spray Test (ASTM B-117 Standards)
- Full perimeter base rails with built in rigging capabilities
- Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- Slide-out Blower/3 HP Belt Drive Motor Assembly
- Unit Ships with 2" Pleated Filters (MERV 8)
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 20"). Unit acc
- Non-Powered Convenience Outlet
- HACR Circuit Breaker/Disconnect
- Short Circuit Current: 5kA RMS Symmetrical
- Single Point Power Connection
- Through-the-Curb and Through-the-Base Utility Connections
- Dirty Filter Switch
- Return Air Smoke Detector
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- MagnaDry Reheat
- Composite Drain Pan - Front Connection
- Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray

provide economizer with barometric relief only per addendum #3.

BAS Controller

- IntelliSpeed control of the VFD based on stages of cooling. Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10.

Standard Unit Controller: Smart Equipment Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

coordinate increase in unit weight with steel fabricator and structural

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6** System: **ZJ102N18R2D5NCE2A3**

Additional Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	51.8	Amps
Unit max over-current protection	60	Amps
Min Voltage	187	V
Max Voltage	252	V
Comp #1 RLA	14.1	
Comp #1 LRA	120.4	
Comp #2 RLA	13.5	
Comp #2 LRA	120.4	
Indoor Mtr Voltage	208-3-60	
Indoor Mtr FLA	9.6	
Outdoor Mtr Qty	2	
Outdoor Fan Voltage	208-1-60	
OD Fan Mtr FLA (ea.)	2.8	
Power Ex Mtr Qty	1	
Powered Ex Voltage	208-1-60	
Power Ex Mtr FLA (ea)	5.5	
Combustion Mtr Qty	1	
Combustion Motor Voltage	208/230-1-60	
Combustion Mtr FLA (ea)	0.5	

coordinate change in electrical requirements with electrical contractor. any cost associated with changes shall be mechanical contractor or equipment suppliers responsibility.

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6** System: **ZJ102N18R2D5NCE2A3**

Factory Installed Options

ZJ102N18R2D5NCE2A3

Equipment Options		Option(s) Selected
Product Category:	**ZJ**	Single Packaged R-410A Air Conditioner, High Efficiency 12.0 EER
Nominal Cooling Capacity:	**102**	8.5 Ton Two Stage Cooling
Heat Type and Nominal Heat Capacity:	**N18**	180 MBH Input Aluminized Steel, Two Stage Gas Heat
Blower Option:	**R**	3 HP High Static Belt Drive Blower IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10)
Voltage:	**2**	208/230-3-60
Outside Air Option:	**D**	Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
Service Options:	**5**	Non-Powered Convenience Outlet HACR Circuit Breaker/Disconnect
Sensor Options:	**N**	Dirty Filter Switch Return Air Smoke Detector (Bottom return only)
Controls:	**C**	Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card.
Refrigeration:	**E**	Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil MagnaDry Reheat
Additional Options:	**2**	2" Pleated Filters (MERV 8) Phase Monitor
Cabinet Options:	**A**	Composite Drain Pan - Front Connection Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray
Product Generation:	**3**	

Field Installed Accessories

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6** System: **ZJ102N18R2D5NCE2A3**

- ○ 1CV0404 - Concentric Diffuser,Flush Mount,18X28
- ○ 1CV0412 - Concentric Diffuser,Side Discharge,20RD
- ○ 1CV0413 - Concentric Diffuser,Side Discharge,18X28
- ○ 1CV0420 - Concentric Diffuser,Specialty,24X24
- ○ 1CV0426 - Concentric Diffuser,Specialty,24X24
- ○ 1FE0412 - Flue Exhaust Extension Kit (14.0 lbs)
- ● 1FF0414 - 2" Only Metal Filter Frame Kit (16.0 lbs)
- ○ 1HA0425 - High Altitude Kit with Propane Conversion - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ○ 1HA0448 - High Altitude Kit for Natural Gas - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ● 1HG0411 - Hail Guard Kit-Diamond Pattern (37.0 lbs)
- ○ 1HG0432 - Hail Guard Kit-Provent Style (25.0 lbs)
- ○ 1NP0463 - Natural Gas to Propane Conversion Kit (2-Stage) (1.0 lbs)
- ○ 1RC0470 - Roof Curb - 8" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0471 - Roof Curb - 14" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0472 - Roof Curb, Transition-Sunline 7.5T thru 12.5T to Pro 3.0T thru 12.5T (Shipped Assembled) (200.0 lbs)
- ○ 1RC0476 - Roof Curb - 24" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1WC0412 - Wooden Crate (445.0 lbs)
- ○ 2AP0402 - Air Proving Switch (1.0 lbs)
- ○ 2AQ04700524 - CO^2 Space Sensor - Wall Mount Accessory (5.0 lbs)
- ○ 2AQ04700624 - CO^2 Unit Mount Accessory (4.6 lbs)
- ○ 2EC0401 - Kit, Single Enthalpy Field Installed (1.0 lbs)
- ● 2EC0402 - Kit, Dual Enthalpy Field Installed (Includes two humidity sensors) (1.0 lbs)
- ● 2LA04702412 - Low Ambient Kit - ICM 333 (2.2 lbs)
- ○ 2SD04700824 - Smoke Detector Kit w/ Mounting Hardware for Supply Air (Horizontal/Downflow) Only (9.4 lbs)
- ○ S1-02815208000 - Blower Sheave for 8.5 and 10 Ton High Static Field Installed Drive (2.8 lbs)
- ○ S1-ADDWIRE - Add-a-Wire allows 5-wire thermostats to use only 4 wires. (0.3 lbs)
- ○ S1-CTSDTS - CTS Wired Temperature Sensor for thermostat | Duct *Also works for LX Series (0.3 lbs)
- ○ S1-CTSHTS - CTS Hardwired Temperature Sensor for CTS Thermostats *Works with LX series as well (0.2 lbs)
- ○ S1-CTSPLATE - Wall Plate for CTS Thermostats *Also works for new platform LX series models below (0.0 lbs)
- ○ S1-CTSWFTS - CTS Temperature Sensor with WiFi for CTS Thermostats *Also works with LX Series (0.1 lbs)
- ○ S1-LXLOCK - Locking Ring For LX-Series Thermostats (0.4 lbs)
- ○ S1-LXPLATE - Wall Plate For LX-Series Thermostats (0.0 lbs)
- ○ S1-LXWFM - For LX Series Thermostats - WiFi Communication (0.1 lbs)
- ○ S1-MP-PRTKIT-0P - MAP (Multiple Access Portal) Gateway Kit- Replacement MAP gateway protective case, lanyard and communication cable. Use only to replace worn or damaged components. (0.3 lbs)
- ○ S1-NSB8BHN041-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN043-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN141-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN143-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN240-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN241-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN243-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN240-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN241-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN243-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN041-0 - Wall Temperature Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN043-0 - Wall Temperature Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN141-0 - Wall Temperature Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6** System: **ZJ102N18R2D5NCE2A3**

- ○ S1-NSB8BTN143-0 - Wall Temperature Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN240-0 - Wall Temperature Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN241-0 - Wall Temperature Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN243-0 - Wall Temperature Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-TEC3030-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3030-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, AND FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3031-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3031-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3630-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3630-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ● S1-TEC3631-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3631-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-YK-MAP1810-0P - MAP (Multiple Access Portal) Gateway- For use with SimplicitySE Control. (0.2 lbs)
- ○ S1-YK-MAP1810-0S - Stationary MAP Gateway (Includes MAP Gateway, Field Bus Adapter, Mounting Bracket and 100 to 240 VAC Power Supply). US-compatible counties. (1.9 lbs)

provide thermostat less occupancy sensor.

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

Consolidated Drawing

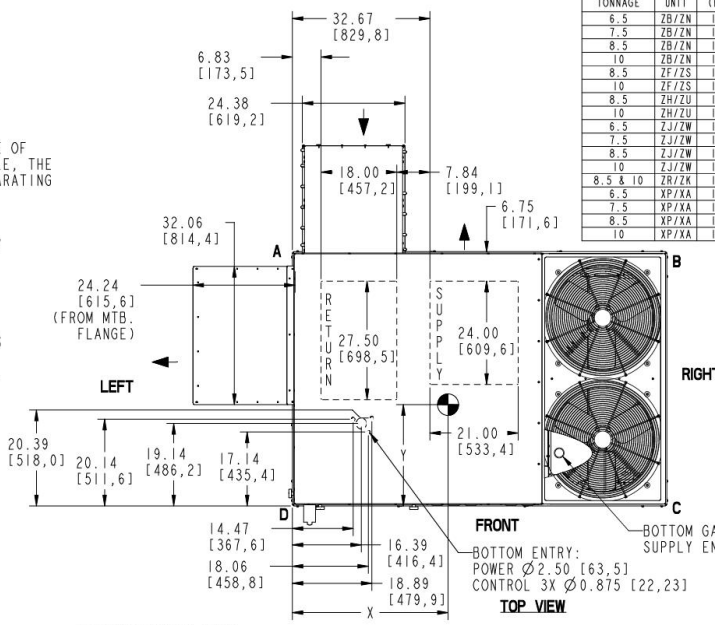
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   RIGHT SIDE: 12 [305]
   LEFT SIDE: 36 [915]
   FRONT: 36 [915]
   REAR: 36 [915]
   TOP: 72 [1830]
   BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF AND FRESH AIR HOODS SHOWN.

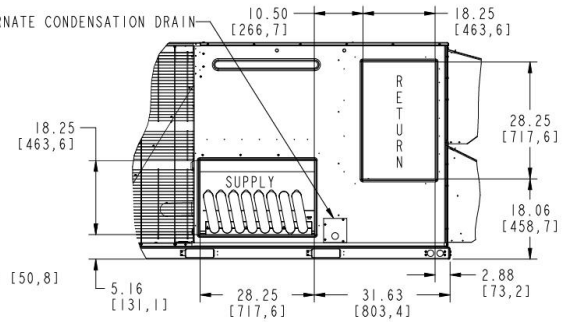
⚠ EXCEPT XP/XA (HEAT PUMP) UNITS.

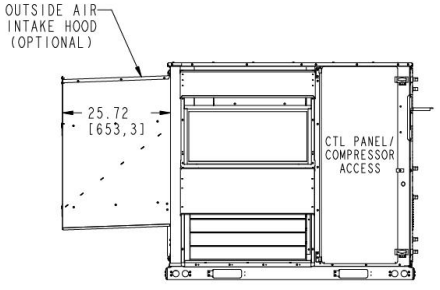
DIRECTION OF AIRFLOW

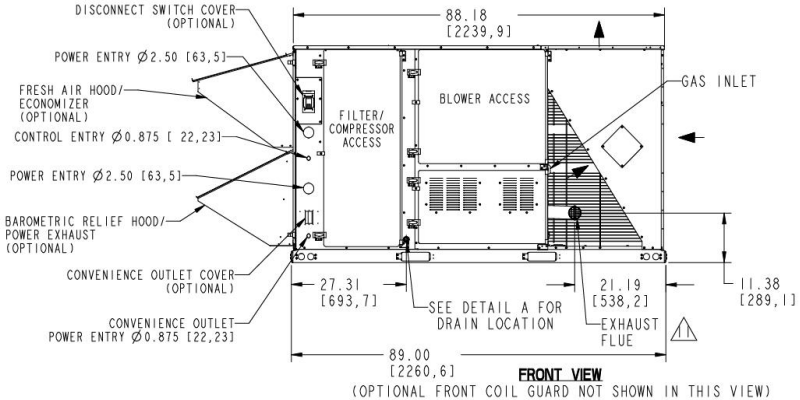
CENTER OF GRAVITY

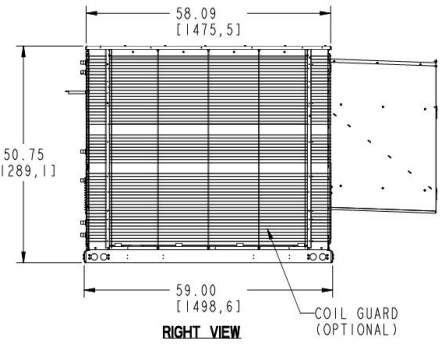
TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
6.5	ZB/ZN	1030 [467]	40 [1016]	25 [635]	245 [111]	197 [89]	262 [119]	327 [148]
7.5	ZB/ZN	1080 [490]	39 [990,6]	24 [609,6]	245 [111]	189 [86]	281 [128]	365 [166]
8.5	ZB/ZN	1084 [492]	38 [965,2]	24 [609,6]	255 [116]	193 [88]	274 [124]	361 [164]
10	ZB/ZN	1085 [492]	39 [990,6]	25 [635]	257 [117]	199 [90]	274 [124]	355 [161]
8.5	ZF/ZS	1007 [458]	38 [965,2]	24 [609,6]	235 [107]	175 [79]	255 [116]	342 [155]
10	ZF/ZS	1103 [501]	38 [965,2]	24 [609,6]	257 [117]	192 [87]	279 [127]	375 [170]
8.5	ZH/ZU	1030 [467]	38 [965,2]	24 [609,6]	240 [109]	179 [81]	261 [118]	350 [159]
10	ZH/ZU	1090 [494]	38 [965,2]	24 [609,6]	254 [115]	189 [86]	276 [125]	371 [168]
6.5	ZJ/ZW	1030 [467]	39 [990,6]	25 [635]	245 [111]	191 [87]	260 [118]	333 [151]
7.5	ZJ/ZW	1050 [476]	39 [990,6]	25 [635]	250 [113]	195 [89]	265 [120]	340 [154]
8.5	ZJ/ZW	1060 [481]	38 [965,2]	24 [609,6]	247 [112]	184 [84]	268 [122]	360 [163]
10	ZJ/ZW	1070 [485]	39 [990,6]	24 [609,6]	245 [111]	191 [87]	278 [126]	357 [162]
8.5 & 10	ZR/ZW	1200 [544]	38 [965,2]	25.5 [647,7]	297 [135]	221 [100]	291 [132]	390 [177]
6.5	XP/XA	1080 [490]	38 [965,2]	25 [635]	262 [119]	195 [89]	266 [121]	357 [162]
7.5	XP/XA	1090 [494]	38 [965,2]	23 [584,2]	243 [110]	181 [82]	284 [129]	381 [173]
8.5	XP/XA	1137 [516]	38 [965,2]	25.5 [647,7]	282 [128]	210 [95]	276 [125]	370 [168]
10	XP/XA	1135 [515]	38 [965,2]	25.5 [647,7]	281 [127]	209 [95]	275 [125]	369 [167]

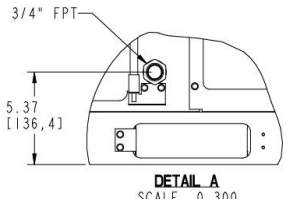












REV LEV	DATE	REVISION RECORD	EC NO	DR	CK	ENG
A	02-11-20	NEW DRAWING (FROM UST-PRED-F50H)	75768	LOP	RCH	SAA

THIRD ANGLE PROJECTION

NAME	DATE
DRN L. PACKARD	02-11-20
CHK R. HADDAD	02-11-20
ENG S. AYENI	02-11-20
MFG	

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DRAWING PER ASME Y14.5-2009

TOLERANCES UNLESS OTHERWISE SPECIFIED:
ONE PLACE DECIMAL = ± .1
TWO PLACE DECIMAL = ± .03
THREE PLACE DECIMAL = ± .010
ANGLES = ± 2°
DIMENSIONS ARE IN INCHES

SUBMITTAL DWG, PRO
STD FLAT COIL, 50" CAB

JOHNSON CONTROLS
UNITARY PRODUCTS GROUP

SAFETY AND KEY CHARACTERISTICS PER BE-PDP-STD-01

MATERIAL
TYPE NOT APPLICABLE
ENG SPEC NOT APPLICABLE
SIZE

DWG NO. 5883785 REV A
PART NO.
NO 1 OF 1

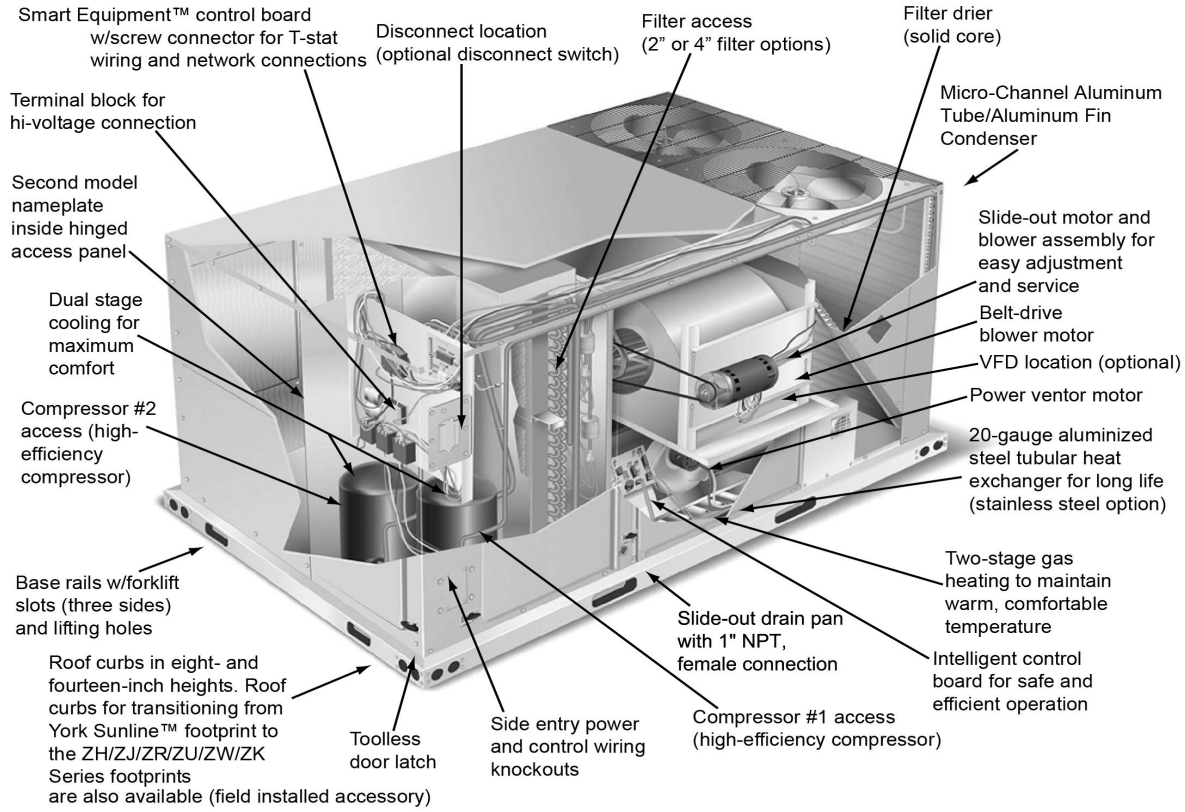
Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

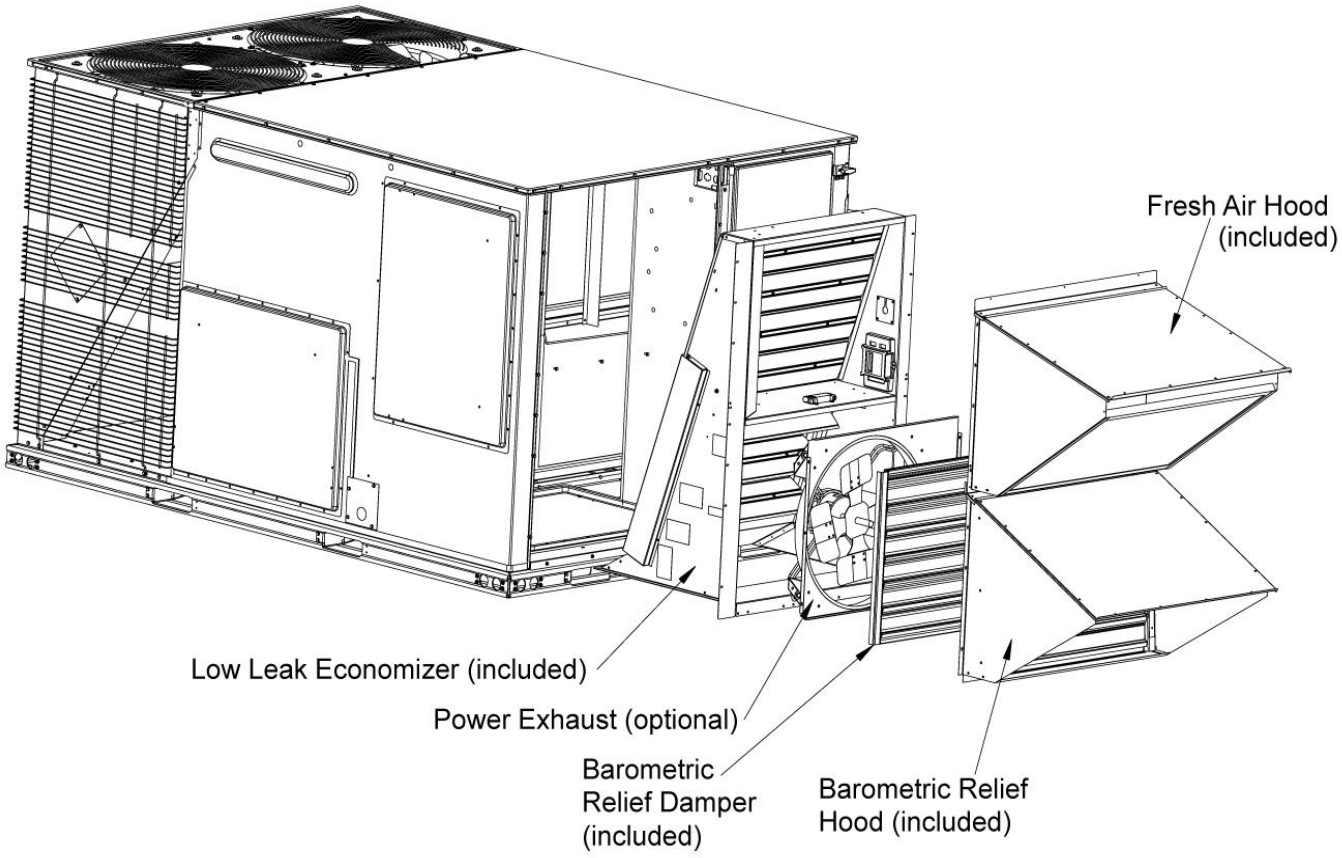
Component Locations

Cooling With Gas Heat (6.5 Through 10 Tons)



Low Leak Downflow Economizer

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

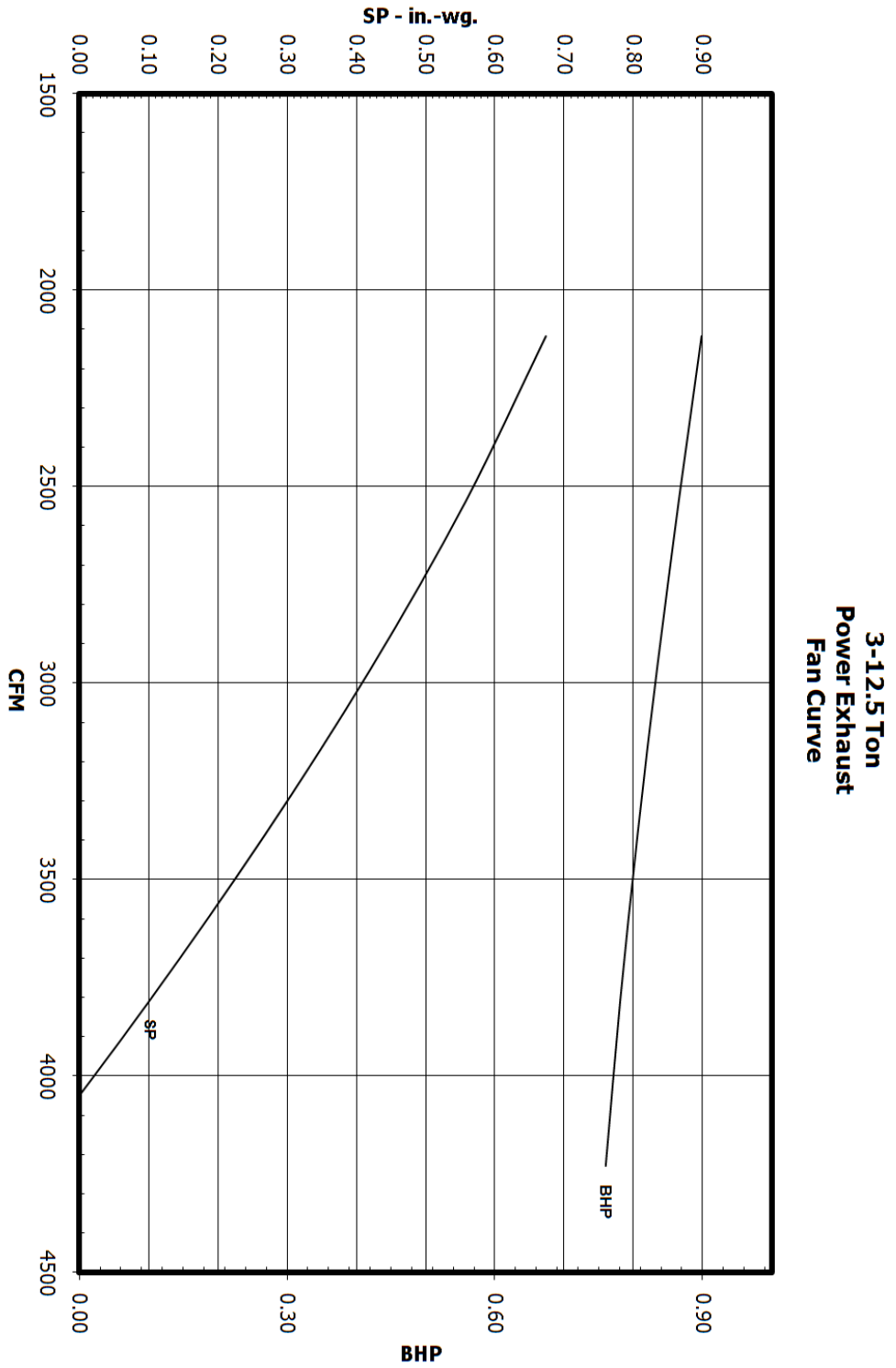
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

Factory Installed Power Exhaust



Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP – 0213

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Johnson Controls Inc. (JCI)

Manufacturer's Technical Representative: Cameron Boyce, Engineer II

Mailing Address: 5005 Interstate Drive, Norman, OK, 73069

Telephone: (405) 419-6830 Email: cameron.w.boyce@jci.com

Product Information

Product Name: Predator Rooftop Air Conditioning Units

Product Type: Packaged Air Conditioning Units

Product Model Number: See attached
(List all unique product identification numbers and/or part numbers)

General Description: The units are enclosures with the following subcomponents: refrigerant compressors, outdoor fan motors, indoor coils, outdoor coils, reversing valve with coil, thermostatic expansion valves, standard indoor blower motor, Variable frequency drive indoor blower motor, exhaust fan motor, variable frequency drive, economizer, electric heater, heat cells, filters, and other miscellaneous items included in the subcomponent tables.

Mounting Description: Units are rigid curb and isolated curb base mounted

REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0213 Timothy J Piland Date: 09/06/2019 CALIFORNIA BUILDING CODE 2019

Applicant Information

Applicant Company Name: The VMC Group

Contact Person: John Giuliano

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: john.giuliano@thevmcgroup.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2016.

Signature of Applicant: Date: 8/28/19

Title: President Company Name: The VMC Group

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

California Licensed Structural Engineer Responsible for the Engineering and Test Report(s)

Company Name: The VMC Group

Name: Kenneth Tarlow California License Number: SE-2851

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: ken.tarlow@thevmcgroup.com

Supports and Attachments Preapproval

☐ Supports and attachments are preapproved under OPM- _____
(Separate application for OSHPD Preapproval of Manufacturer's Certification (OPM) of Supports and attachments is required)

☒ Supports and attachments are not preapproved

Certification Method

☒ Testing in accordance with: ☒ ICC-ES AC156

☐ Other (Please Specify): _____

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0213
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Testing Laboratory

Company Name: DCL Labs

Contact Name: Josh Sailer, Laboratory Manager

Mailing Address: 1315 Greg Street, Suite 109, Sparks, NV 89431

Telephone: (775) 358-5085 Email: josh@shaketest.com

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

Seismic Parameters

Design in accordance with ASCE 7-16 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = Rigid Curb = 1.5; Spring Isolated Curb = 4.5

S_{DS} (Design spectral response acceleration at short period, g) = 2.00

a_p (In-structure equipment or component amplification factor) = 2.5

R_p (Equipment or component response modification factor) = Rigid Curb = 6.0; Spring Isolated Curb = 2.0

Ω_0 (System overstrength factor) = 2.0

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1

Equipment or Component Natural Frequencies (Hz) = See attachment

Overall dimensions and weight (or range thereof) = See attachment

Equipment or Components @ grade designed in accordance with ASCE 7-16 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Design spectral response acceleration at short period, g) =

S_{D1} (Design spectral response acceleration at 1 second period, g) =

R (Response modification coefficient) =

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) =

I_p (Importance factor) = 1.5

Height to Center of Gravity above base =

Equipment or Component Natural Frequencies (Hz) =

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2015: ☐ Yes ☒ No

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0215
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

List of Attachments Supporting Special Seismic Certification

☒ Test Report(s) ☒ Drawings ☐ Calculations ☐ Manufacturer's Catalog

☐ Other(s) (Please Specify):

OSHPD Approval (For Office Use Only) – Approval Expires on December 31, 2025

Signature: Date: March 8, 2021

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to: S_{DS} (g) = 2.00 z/h = 1

Condition of Approval (if applicable):

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZJ102N18R2D5NCE2A3**

Quantity: **3** Tag #: **RTU-4, 5, 6**

Seismic Certification

Table 1 - Certified Components

Manufacturer: Johnson Controls and other Unitary Product Group brands (York, Coleman, Luxaire, Evcon, Fraser-Johnston and Ready Ship)

Product Line: JCI Packaged Rooftop Units

Product Construction: Cabinetis constructed of G90 galvanized 1,000 hour salt spray (per ASTM-B117) rated powder-coated 20 gage carbon steel wrapper and duct panel with integral corner posts, all attached atthe base to four (4) full perimeter 14 gage base rails with #10 sheet metal screws.

Options: 230-575 V, economizer, power exhaust, electric or gas heater, variable frequency drive

Mounting Description: Rigid or Flexible Curb Mounting

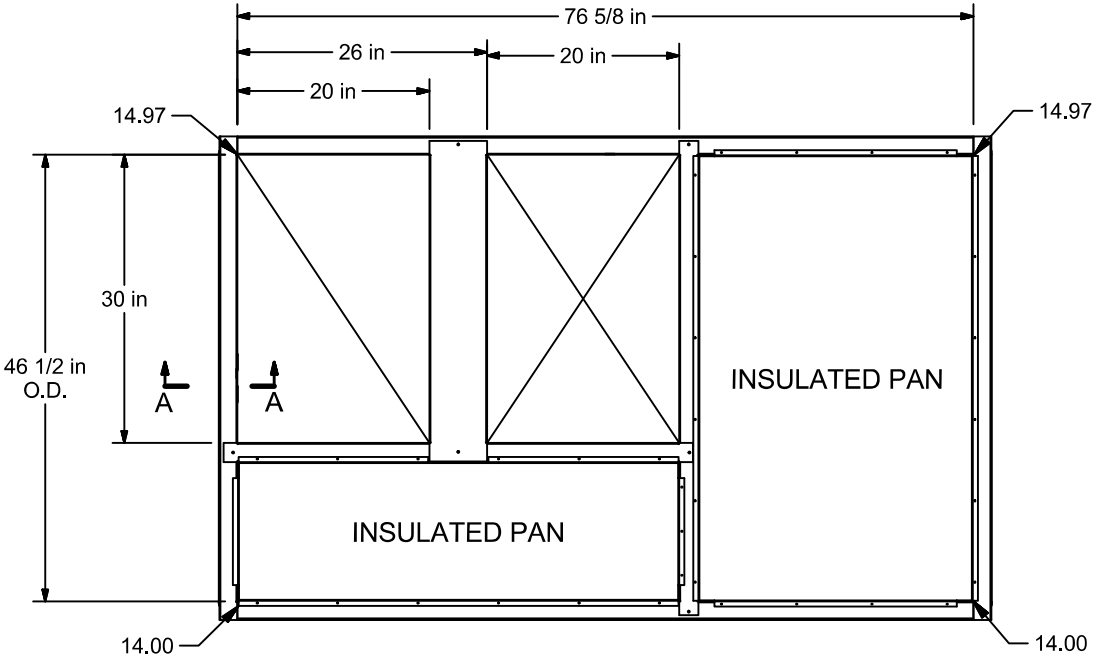
Product Line	Model Number[2]	Dimensions (inches)			Operating Weight (lb)	Nominal Cooling Capacity (Tons)	Sds (g), z/h=1	Unit
		Depth	Width	Height				
Predator Air Handling Units (Short)	ZH/ZU/JA3 037	89	59	42	860[1]	3	2.0	3
	ZJ/ZW/JA3 037	89	59	42	740	3		Interpolated
	ZR/ZK/JA3 037	89	59	42	980[1]	3		1
	ZT/ZV/JA3 037	89	59	42	922	3		Interpolated
	ZH/ZU/JA4 049	89	59	42	763	4		Interpolated
	ZJ/ZW/JA4 049	89	59	42	762	4		Interpolated
	ZR/ZK/JA4 049	89	59	42	880	4		Interpolated
	ZT/ZV/JA4 049	89	59	42	960	4		Interpolated
	ZH/ZU/JA5 061	89	59	42	772	5		Interpolated
	ZJ/ZW/JA5 061	89	59	42	1,070[1]	5		4
	ZR/ZK/JA5 061	89	59	42	1,070[1]	5		2
	ZT/ZV/JA5 061	89	59	42	968	5		Extrapolated
Predator Air Handling Units (Standard)	XP/XA/J06 078	89	59	42	970[1]	6.5	2.0	7
	ZF/ZS/J06 078	89	59	42	1,090[1]	6.5		10
	ZH/ZU/J06 078	89	59	42	910	6.5		Interpolated
	ZJ/ZW/J06 078	89	59	51	1030	6.5		Interpolated
	ZR/ZK/J06 078	89	59	51	1,060[1]	6.5		5
	ZF/ZS/J07 090	89	59	42	860	7.5		Interpolated
	ZH/ZU/J07 090	89	59	42	910	7.5		Interpolated
	ZJ/ZW/J07 090	89	59	51	1,081	7.5		Interpolated
	XP/XA/J07 090	89	59	42	920	7.5		Interpolated
	ZR/ZK/J07 090	89	59	42	965	7.5		Interpolated
	ZF/ZS/J08 102	89	59	51	1,020	8.5		Interpolated
	ZH/ZU/J08 102	89	59	51	1,030	8.5		Interpolated
	ZJ/ZW/J08 102	89	59	51	1,060	8.5		Interpolated
	XP/XA/J08 102	89	59	51	1,135	8.5		Interpolated
	ZR/ZK/J08 102	89	59	51	1,200	8.5		Interpolated
	ZF/ZS/J10 120	89	59	51	1,060	10		Interpolated
	ZH/ZU/J10 120	89	59	51	1,090	10		Interpolated
	ZJ/ZW/J10 120	89	59	51	1,070	10		Interpolated
	XP/XA/J10 120	89	59	51	1,135	10		Interpolated
	ZR/ZK/J10 120	89	59	51	1,200	10		Interpolated
	ZF/ZS/J12 150	119.5	59	51	1,253	12.5	2.0	Interpolated
	ZH/ZU/J12 150	119.5	59	51	1,250[1]	12.5		11
	XP/XA/J12 150	119.5	59	51	1,510[1]	12.5		8
	ZJ/ZW/J12 150	119.5	59	51	1,570[1]	12.5		9
	ZR/ZK/J12 150	119.5	59	51	1,600[1]	12.5		6
Predator Air Handling Units (Ultra High Efficiency)	ZT/ZV 120	119.5	59	51	1,470[1]	10	2.0	12
	ZT/ZV 078	119.5	59	51	1,550	6.5		Interpolated
	ZT/ZV 090	119.5	59	51	1,550	7.5		Interpolated
	ZT/ZV 102	119.5	59	51	1,575	8.5		Interpolated
	ZT/ZV 150	119.5	59	51	1,680[1]	12.5		13

1. Weights listed for tested units are actual, not approximate weights. The weights listed for interpolated units are maximum weights, assuming all optional features are included. Optional features are summarized in the table below.
2. Model numbers are generalized for each type of unit and the associated BTU tonnage thatthe unit can output.

Unit Accessory	Operating Weight (lbs.)
Economizer	85
Power Exhaust	35
Electric Heat	49
Gas Heat	110
Variable Frequency Drive	30

1. Weight given is for the maximum electric heater size available.
2. Weight given for the gas heater is for the maximum number oftube heat exchangers available (8 tube).
3. Weightincludes mounting hardware, controls and manual bypass option.

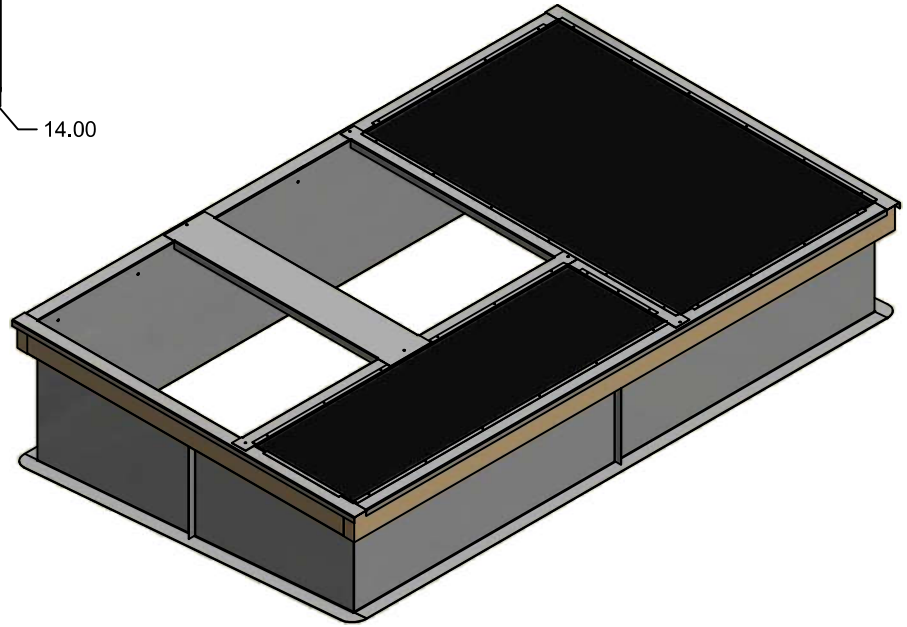
REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0013 By:Timothy J Pilard DATE: 03/08/2021 CALIFORNIA BUILDING CODE, 2019

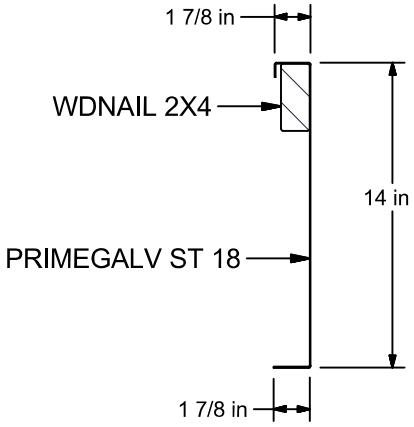


SUBMITTAL

Curb wall thickness and restraint requirements to be determined by seismic/windload calculations if required.

Verify roof pitch and direction





SECTION A-A

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are

± 1/16 ± 0.0625 ± 1°

Date: 1/3/2018

Non Insulated Roof Curbs Top Duct Supports
York ZT061 (00488)

Powers of Arkansas - North Little Rock, AR

Curb Weight
128 lbs.
Total Weight
128 lbs.

Qty.: 1 | Job # : 26629

Tag: RTU-4

Drawn: aaleman

File: ~~R5DSNYK0048814PC100N0~~ | Rev: B

thybar CORPORATION
Thybar makes it right the first time, every time

S20906-8

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SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

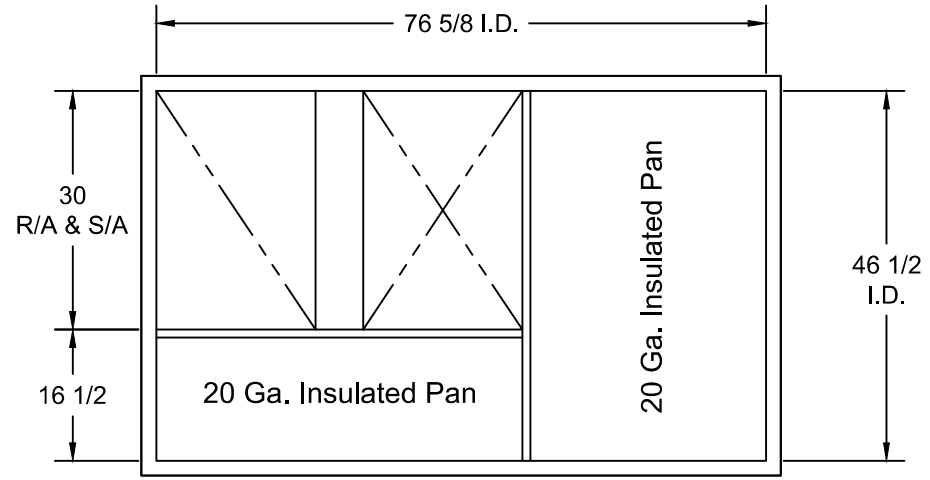
VERIFY ROOF PITCH AND DIRECTION

☐ APPROVED

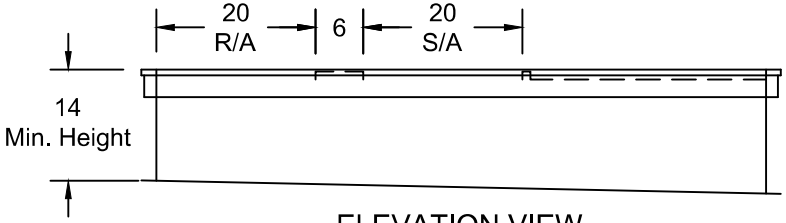
☐ APPROVED PENDING CHANGES

BY:

DATE: / /



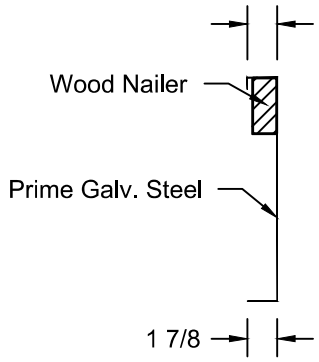
PLAN VIEW



ELEVATION VIEW



PITCH



TYPICAL SECTION

NOTE:
Top Duct Supports To Be Removable.

Rev.	Int.	Date	Description

REVISION HISTORY

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 9/27/23

TC-5 Uninsulated Roof Curb Top Duct Supports
New York ZJ102 (00488)

Powers Of Arkansas - North Little Rock, AR

Qty.: 1 | Job# :Q-26629

Tag: RTU-5

Drawn: JWhite

File: S20902-3 | Rev: ---

thybar CORPORATION
Thybar makes it right the first time, every time

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

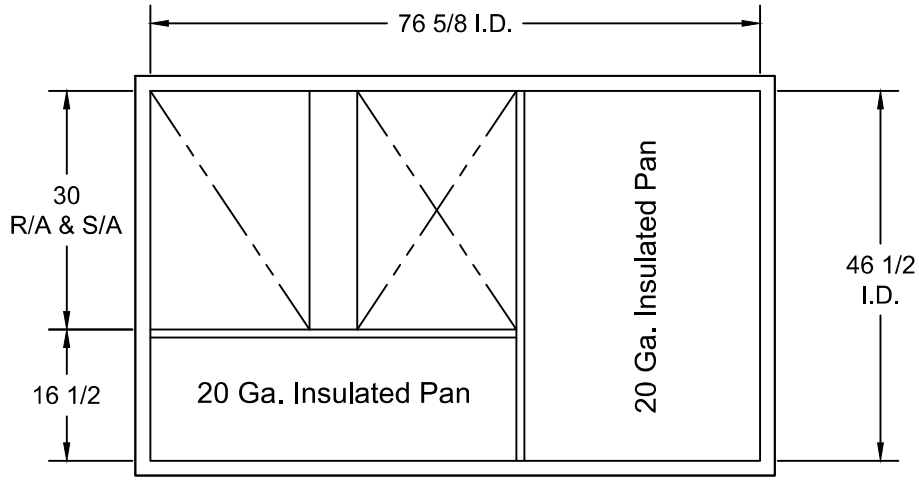
VERIFY ROOF PITCH AND DIRECTION

☐ APPROVED

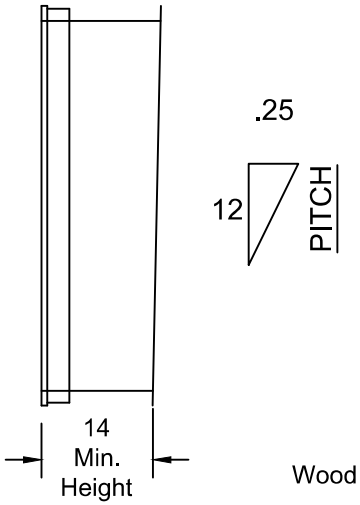
☐ APPROVED PENDING CHANGES

BY:

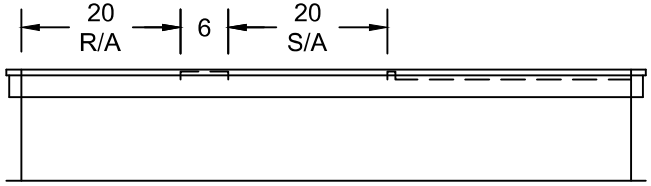
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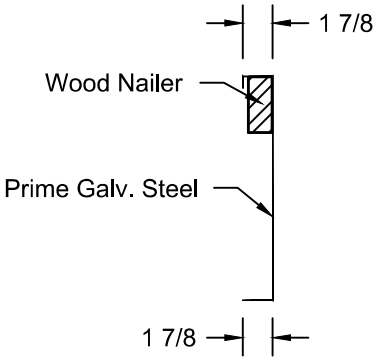
PLAN VIEW



END VIEW



ELEVATION VIEW



TYPICAL SECTION

NOTE:
Top Duct Supports To Be Removable.

Rev.	Int.	Date	Description

REVISION HISTORY

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 9/27/23

TC-5 Uninsulated Roof Curb Top Duct Supports
New York ZJ102 (00488)

Powers Of Arkansas - North Little Rock, AR

Qty.: 1 | Job# :Q-26629

Tag: RTU-6

Drawn: JWhite

File: S20905-7 | Rev: ---

thybar CORPORATION
Thybar makes it right the first time, every time

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8** System: **ZT061N12P2D5NCE2A2**

Cooling Performance		
Total gross capacity	63.3	MBH
Sensible gross capacity	46.5	MBH
Total net capacity	60.0	MBH
Sensible net capacity	43.2	MBH
Seasonal Efficiency (at ARI)	16.30	SEER
Efficiency (at ARI)	13.00	EER
Ambient DB temp.	95.0	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	58.5	°F
Leaving WB temp.	57.0	°F
Leaving air temp dew point	56.00	°F
Power input (w/o blower)	4.07	kW
Sound power	75	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	12 lbs	7 oz

Reheat Performance		
Total capacity	24.8	MBH
Sensible capacity	5.7	MBH
Ambient DB temp.	85	°F
Entering DB temp.	75	°F
Entering WB temp.	67	°F
Leaving DB temp.	72.4	°F
Leaving WB temp.	63.3	°F
Power input (w/o blower)	3.50	kW
Gallons of water per hour	2.18	GPM

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	97.0	MBH
Supply air	2000	CFM
Heating input capacity (Max)	120	MBH
Leaving DB temp.	104.9	°F
Air temp. rise	44.9	°F
SSE	81.0	%
Stages	2	

Supply Air Blower Performance		
Supply air	2000	CFM
Ext. static pressure	0.8	IWG
Addl. Unit Losses (Options/Accessories)	0.22	IWG
Blower speed	1017	HP
Max BHP of Motor (including service factor)	1.73	HP
Duct location	Bottom	
Motor rating	1.50	HP
Actual required BHP	1.05	HP
Power input	0.98	kW
Elevation	335	ft.
Drive type	BELT	

Outside/Mixed Air		
Outside Air CFM	250	CFM

Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	37.4	Amps
Unit max over-current protection	50	Amps

Dimensions & Weight					
Hgt 42 in.		Len 89 in.		Wth 59 in.	
Weight with factory installed options				1155	lbs

Clearances					
Right	12 in.	Front	12 in.	Rear	12 in.
Top	12 in.	Bottom	12 in.	Left	12 in.

Note: Please refer to the tech guide for listed maximum static pressures



5 Ton

- Tempmaster units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 120 MBH Input Aluminized Steel, Two Stage Gas Heat
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 750 Hours Salt Spray Test (ASTM B-117 Standards)
- Full perimeter base rails with built in rigging capabilities
- Scroll Compressor[s]
- Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- VFD Standard
- 1.5 HP Standard Static Belt Drive Blower
- Unit Ships with 2" Pleated Filters (MERV 8)
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 16"). U
- Non-Powered Convenience Outlet
- Single Point Power Connection
- HACR Circuit Breaker/Disconnect
- Through-the-Curb and Through-the-Base Utility Connections
- Short Circuit Current: 5kA RMS Symmetrical
- Dirty Filter Switch
- Return Air Smoke Detector
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- MagnaDry Reheat
- Composite Drain Pan - Front Connection
- Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray

provide economizer with barometric relief only per addendum #3.

BAS Controller

- IntelliSpeed control of the VFD based on stages of cooling. Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10.

Standard Unit Controller: Smart Equipment Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

coordinate increase in unit weight with steel

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8** System: **ZT061N12P2D5NCE2A2**

Additional Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	37.4	Amps
Unit max over-current protection	50	Amps
Min Voltage	187	V
Max Voltage	252	V
Comp #1 RLA	16.5	
Comp #1 LRA	110.0	
Indoor Mtr Voltage	208-3-60	
Indoor Mtr FLA	4.3	
Outdoor Mtr Qty	2	
Outdoor Fan Voltage	208-1-60	
OD Fan Mtr FLA (ea.)	3.5	
Power Ex Mtr Qty	1	
Powered Ex Voltage	208-1-60	
Power Ex Mtr FLA (ea)	5.5	
Combustion Mtr Qty	1	
Combustion Motor Voltage	208/230-1-60	
Combustion Mtr FLA (ea)	0.5	

coordinate change in electrical requirements with electrical contractor. any cost associated with changes shall be mechanical contractor or equipment suppliers responsibility.

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8** System: **ZT061N12P2D5NCE2A2**

Factory Installed Options

ZT061N12P2D5NCE2A2

Equipment Options		Option(s) Selected
Product Category:	**ZT**	Single Packaged R-410A Ultra High Efficiency Air Conditioner 16.3 SEER / 13.0 EER
Nominal Cooling Capacity:	**061**	5 Ton Two Stage Cooling
Heat Type and Nominal Heat Capacity:	**N12**	120 MBH Input Aluminized Steel, Two Stage Gas Heat
Blower Option:	**P**	VFD Standard 1.5 HP Standard Static Belt Drive Blower IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10)
Voltage:	**2**	208/230-3-60
Outside Air Option:	**D**	Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
Service Options:	**5**	Non-Powered Convenience Outlet HACR Circuit Breaker/Disconnect
Sensor Options:	**N**	Dirty Filter Switch Return Air Smoke Detector (Bottom return only)
Controls:	**C**	Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card.
Refrigeration:	**E**	Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil MagnaDry Reheat
Additional Options:	**2**	2" Pleated Filters (MERV 8) Phase Monitor
Cabinet Options:	**A**	Composite Drain Pan - Front Connection Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray
Product Generation:	**2**	

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8** System: **ZT061N12P2D5NCE2A2**

Field Installed Accessories

- ○ 1BD0408 - Burglar Bars (32.0 lbs)
- ○ 1CG0428 - Coil Guard (20.0 lbs)
- ○ 1CV0402 - Concentric Diffuser,Flush Mount,18RD
- ○ 1CV0411 - Concentric Diffuser,Side Discharge,18RD (55.0 lbs)
- ○ 1CV0419 - Concentric Diffuser,Specialty,18X18
- ○ 1FE0412 - Flue Exhaust Extension Kit (14.0 lbs)
- ● 1FF0415 - 2" Only metal Filter Frame Kit (16.0 lbs)
- ○ 1HA0424 - High Altitude Kit with Propane Conversion - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ○ 1HA0447 - High Altitude Kit for Natural Gas - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ● 1HG0415 - Hail Guard Kit-Diamond Pattern (50.0 lbs)
- ○ 1HG0431 - Hail Guard Kit-Provent Style (20.0 lbs)
- ○ 1NP0462 - Natural Gas to Propane Conversion Kit (1.0 lbs)
- ○ 1RC0470 - Roof Curb - 8" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0471 - Roof Curb - 14" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0476 - Roof Curb - 24" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1WC0412 - Wooden Crate (445.0 lbs)
- ○ 2AP0402 - Air Proving Switch (1.0 lbs)
- ○ 2AQ04700524 - CO^2 Space Sensor - Wall Mount Accessory (5.0 lbs)
- ○ 2AQ04700624 - CO^2 Unit Mount Accessory (4.6 lbs)
- ○ 2EC0401 - Kit, Single Enthalpy Field Installed (1.0 lbs)
- ● 2EC0402 - Kit, Dual Enthalpy Field Installed (Includes two humidity sensors) (1.0 lbs)
- ○ 2SD04700824 - Smoke Detector Kit w/ Mounting Hardware for Supply Air (Horizontal/Downflow) Only (9.4 lbs)
- ○ S1-02812496000 - Blower Sheave AK79 Field Installed Drive (4.0 lbs)
- ○ S1-ADDWIRE - Add-a-Wire allows 5-wire thermostats to use only 4 wires. (0.3 lbs)
- ○ S1-CTSDTS - CTS Wired Temperature Sensor for thermostat | Duct *Also works for LX Series (0.3 lbs)
- ○ S1-CTSHTS - CTS Hardwired Temperature Sensor for CTS Thermostats *Works with LX series as well (0.2 lbs)
- ○ S1-CTSPLATE - Wall Plate for CTS Thermostats *Also works for new platform LX series models below (0.0 lbs)
- ○ S1-CTSWFTS - CTS Temperature Sensor with WiFi for CTS Thermostats *Also works with LX Series (0.1 lbs)
- ○ S1-LXLOCK - Locking Ring For LX-Series Thermostats (0.4 lbs)
- ○ S1-LXPLATE - Wall Plate For LX-Series Thermostats (0.0 lbs)
- ○ S1-LXWFM - For LX Series Thermostats - WiFi Communication (0.1 lbs)
- ○ S1-MP-PRTKIT-0P - MAP (Multiple Access Portal) Gateway Kit- Replacement MAP gateway protective case, lanyard and communication cable. Use only to replace worn or damaged components. (0.3 lbs)
- ○ S1-NSB8BHN041-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN043-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN141-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN143-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN240-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN241-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN243-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN240-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN241-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN243-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN041-0 - Wall Temperature Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN043-0 - Wall Temperature Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN141-0 - Wall Temperature Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN143-0 - Wall Temperature Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8** System: **ZT061N12P2D5NCE2A2**

- ○ S1-NSB8BTN240-0 - Wall Temperature Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN241-0 - Wall Temperature Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN243-0 - Wall Temperature Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-TEC3030-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3030-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, AND FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3031-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3031-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3630-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3630-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ● S1-TEC3631-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3631-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-YK-MAP1810-0P - MAP (Multiple Access Portal) Gateway- For use with SimplicitySE Control. (0.2 lbs)
- ○ S1-YK-MAP1810-0S - Stationary MAP Gateway (Includes MAP Gateway, Field Bus Adapter, Mounting Bracket and 100 to 240 VAC Power Supply). US-compatible counties. (1.9 lbs)

provide thermostat less occupancy sensor.

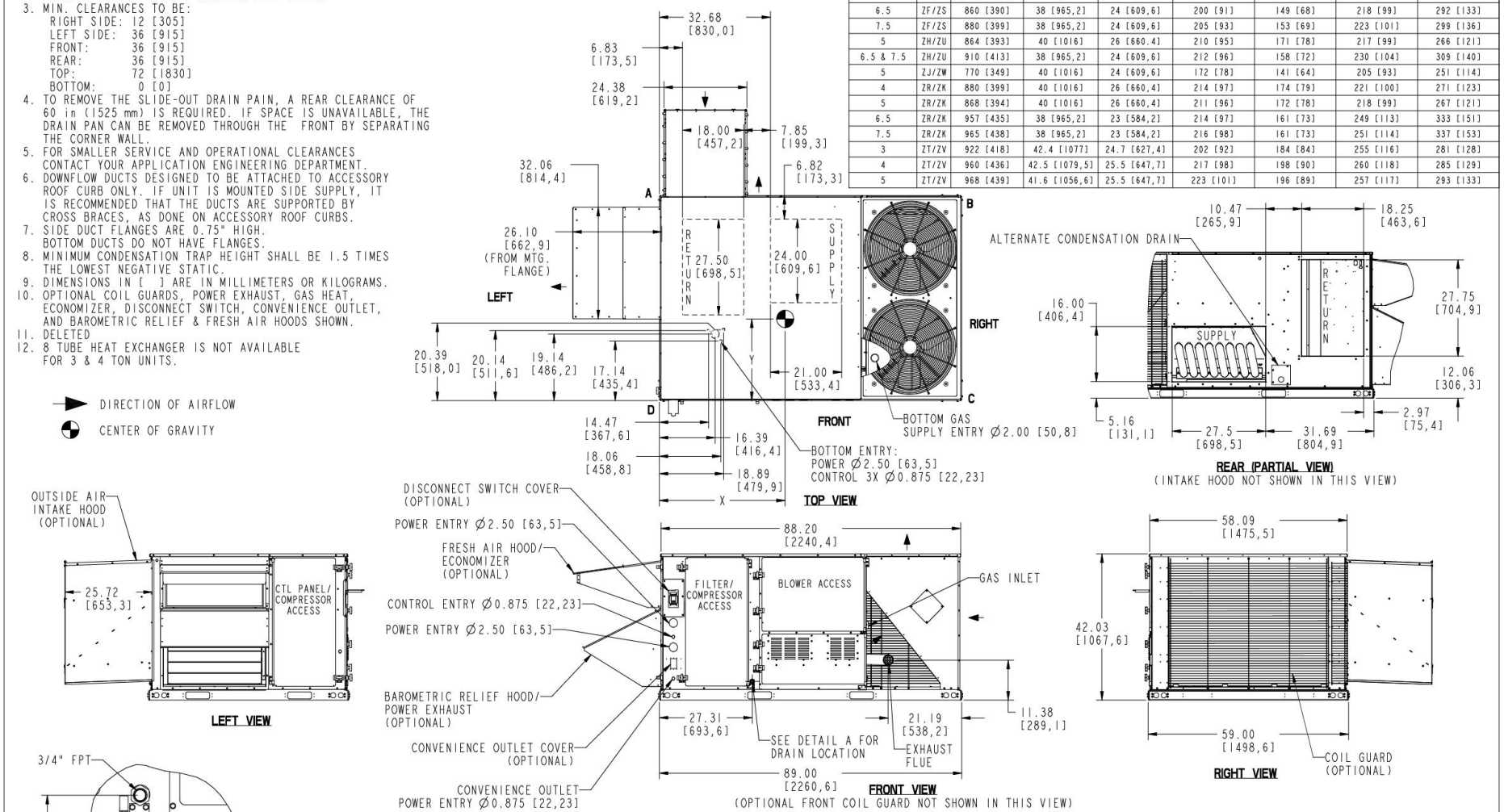
Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8**

Consolidated Drawing

NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   RIGHT SIDE: 12 [305]
   LEFT SIDE: 36 [915]
   FRONT: 36 [915]
   REAR: 36 [915]
   TOP: 72 [1830]
   BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAIN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF & FRESH AIR HOODS SHOWN.
11. DELETED
12. 8 TUBE HEAT EXCHANGER IS NOT AVAILABLE FOR 3 & 4 TON UNITS.

TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
6.5	ZF/ZS	860 [390]	38 [965,2]	24 [609,6]	200 [91]	149 [68]	218 [99]	292 [133]
7.5	ZF/ZS	880 [399]	38 [965,2]	24 [609,6]	205 [93]	153 [69]	223 [101]	299 [136]
5	ZH/ZU	864 [393]	40 [1016]	26 [660.4]	210 [95]	171 [78]	217 [99]	266 [121]
6.5 & 7.5	ZH/ZU	910 [413]	38 [965,2]	24 [609,6]	212 [96]	158 [72]	230 [104]	309 [140]
5	ZJ/ZW	770 [349]	40 [1016]	24 [609,6]	172 [78]	141 [64]	205 [93]	251 [114]
4	ZR/ZK	880 [399]	40 [1016]	26 [660,4]	214 [97]	174 [79]	221 [100]	271 [123]
5	ZR/ZK	868 [394]	40 [1016]	26 [660,4]	211 [96]	172 [78]	218 [99]	267 [121]
6.5	ZR/ZK	957 [435]	38 [965,2]	23 [584,2]	214 [97]	161 [73]	249 [113]	333 [151]
7.5	ZR/ZK	965 [438]	38 [965,2]	23 [584,2]	216 [98]	161 [73]	251 [114]	337 [153]
3	ZT/ZV	922 [418]	42.4 [1077]	24.7 [627,4]	202 [92]	184 [84]	255 [116]	281 [128]
4	ZT/ZV	960 [436]	42.5 [1079,5]	25.5 [647,7]	217 [98]	198 [90]	260 [118]	285 [129]
5	ZT/ZV	968 [439]	41.6 [1056,6]	25.5 [647,7]	223 [101]	196 [89]	257 [117]	293 [133]



REV LEV	DATE	REVISION RECORD	EC NO	DR	CK	ENG
A	02-11-20	NEW DRAWING (FROM UST-PRED-20DF42H)	75768	LOP	RCH	SAA

THIRD ANGLE PROJECTION

	NAME	DATE
DRN	L. PACKARD	02-11-20
CHK	R. HADDAD	02-11-20
ENG	S. AYENI	02-11-20
MFG		

ALL PROPRIETARY RIGHTS IN THE SUBJECT MATTER HEREOF ARE RESERVED AND NO PERMISSION IS GRANTED TO REPRODUCE THIS PRINT IN WHOLE OR IN PART OR DISCLOSE ANY OF THE INFORMATION UPON IT TO OTHERS WITHOUT WRITTEN RELEASE BY JOHNSON CONTROLS

DRAWING PER ASME Y14.5-2009
TOLERANCES UNLESS OTHERWISE SPECIFIED:
ONE PLACE DECIMAL = ± .1
TWO PLACE DECIMAL = ± .03
THREE PLACE DECIMAL = ± .010
ANGLES = ± 2°
DIMENSIONS ARE IN INCHES

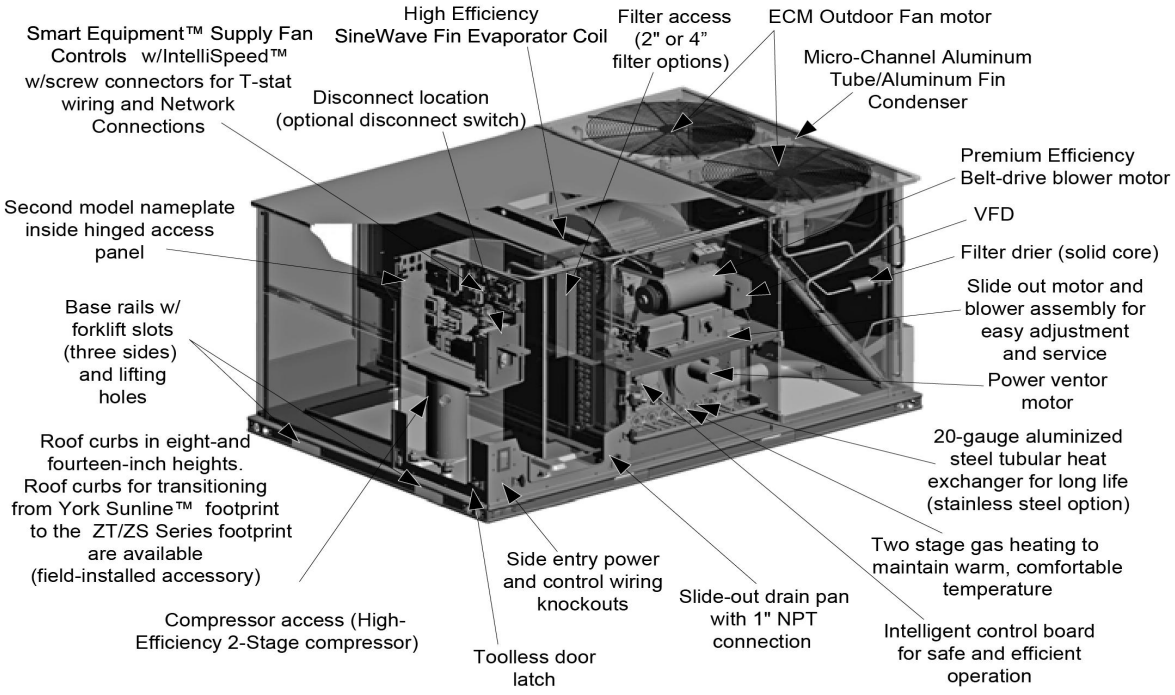
SUBMITTAL DWG, PRO
STD FLAT COIL, 2 ODF, 42" CAB

JOHNSON CONTROLS
UNITARY PRODUCTS GROUP

SAFETY AND KEY CHARACTERISTICS PER BE-PDP-STD-01
MATERIAL
TYPE NOT APPLICABLE
ENG SPEC NOT APPLICABLE
SIZE
DWG NO. 5883783
REV A
PART NO.
NO 1 OF 1

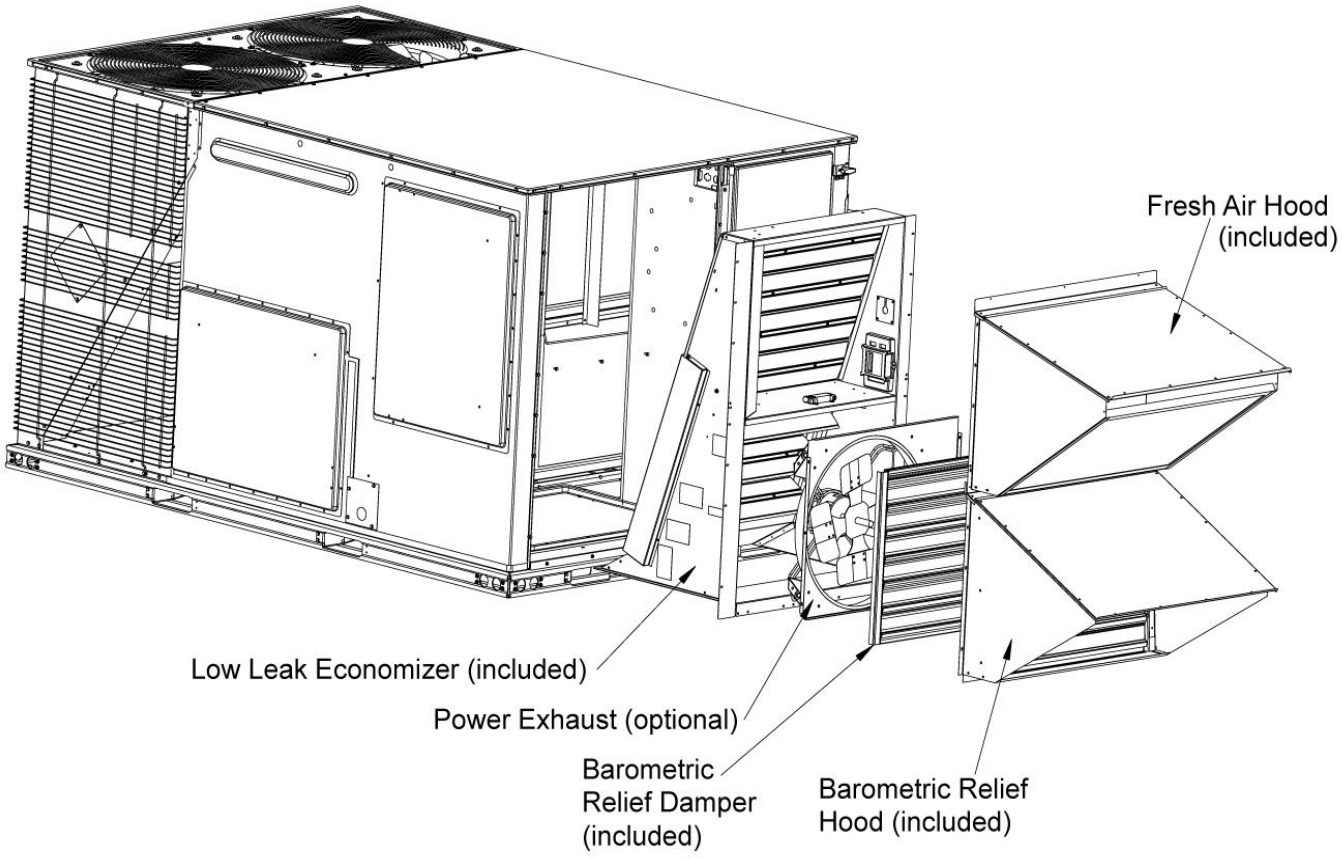
Component Location

Cooling With Gas Heat (3 Through 5 Ton)



Low Leak Downflow Economizer

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

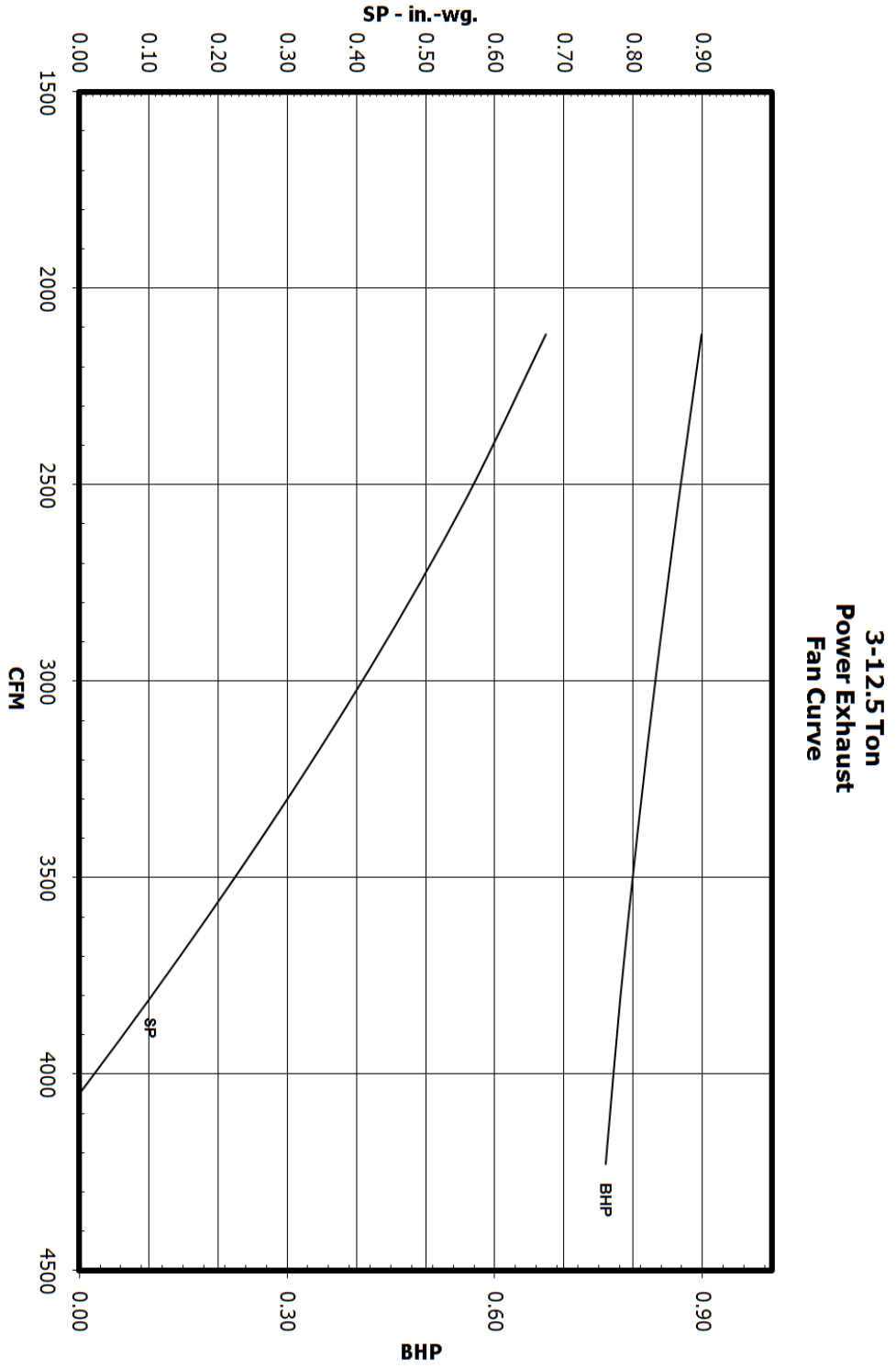
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8**

Factory Installed Power Exhaust



Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY	
APPLICATION #:	OSP – 0213

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Johnson Controls Inc. (JCI)

Manufacturer's Technical Representative: Cameron Boyce, Engineer II

Mailing Address: 5005 Interstate Drive, Norman, OK, 73069

Telephone: (405) 419-6830 Email: cameron.w.boyce@jci.com

Product Information

Product Name: Predator Rooftop Air Conditioning Units

Product Type: Packaged Air Conditioning Units

Product Model Number: See attached
(List all unique product identification numbers and/or part numbers)

General Description: The units are enclosures with the following subcomponents: refrigerant compressors, outdoor fan motors, indoor coils, outdoor coils, reversing valve with coil, thermostatic expansion valves, standard indoor blower motor, Variable frequency drive indoor blower motor, exhaust fan motor, variable frequency drive, economizer, electric heater, heat cells, filters, and other miscellaneous items included in the subcomponent tables.

Mounting Description: Units are rigid curb and isolated curb base mounted

REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0213 Timothy J Piland Date: 09/06/2019 CALIFORNIA BUILDING CODE 2019

Applicant Information

Applicant Company Name: The VMC Group

Contact Person: John Giuliano

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: john.giuliano@thevmcgroup.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2016.

Signature of Applicant: Date: 8/28/19

Title: President Company Name: The VMC Group

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

California Licensed Structural Engineer Responsible for the Engineering and Test Report(s)

Company Name: The VMC Group

Name: Kenneth Tarlow California License Number: SE-2851

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: ken.tarlow@thevmcgroup.com

Supports and Attachments Preapproval

☐ Supports and attachments are preapproved under OPM- _____
(Separate application for OSHPD Preapproval of Manufacturer's Certification (OPM) of Supports and attachments is required)

☒ Supports and attachments are not preapproved

Certification Method

☒ Testing in accordance with: ☒ ICC-ES AC156

☐ Other (Please Specify): _____

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0213
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Testing Laboratory

Company Name: DCL Labs

Contact Name: Josh Sailer, Laboratory Manager

Mailing Address: 1315 Greg Street, Suite 109, Sparks, NV 89431

Telephone: (775) 358-5085 Email: josh@shaketest.com

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

Seismic Parameters

Design in accordance with ASCE 7-16 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = Rigid Curb = 1.5; Spring Isolated Curb = 4.5

S_{DS} (Design spectral response acceleration at short period, g) = 2.00

a_p (In-structure equipment or component amplification factor) = 2.5

R_p (Equipment or component response modification factor) = Rigid Curb = 6.0; Spring Isolated Curb = 2.0

Ω_0 (System overstrength factor) = 2.0

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1

Equipment or Component Natural Frequencies (Hz) = See attachment

Overall dimensions and weight (or range thereof) = See attachment

Equipment or Components @ grade designed in accordance with ASCE 7-16 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Design spectral response acceleration at short period, g) =

S_{D1} (Design spectral response acceleration at 1 second period, g) =

R (Response modification coefficient) =

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) =

I_p (Importance factor) = 1.5

Height to Center of Gravity above base =

Equipment or Component Natural Frequencies (Hz) =

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2015: ☐ Yes ☒ No

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0215
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

List of Attachments Supporting Special Seismic Certification

☒ Test Report(s) ☒ Drawings ☐ Calculations ☐ Manufacturer's Catalog

☐ Other(s) (Please Specify):

OSHPD Approval (For Office Use Only) – Approval Expires on December 31, 2025

Signature: _____ Date: March 8, 2021

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to: S_{DS} (g) = 2.00 z/h = 1

Condition of Approval (if applicable):

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT061N12P2D5NCE2A2**

Quantity: **2** Tag #: **RTU-7, 8**

Seismic Certification

Table 1 - Certified Components

Manufacturer: Johnson Controls and other Unitary Product Group brands (York, Coleman, Luxaire, Evcon, Fraser-Johnston and Ready Ship)

Product Line: JCI Packaged Rooftop Units

Product Construction: Cabinetis constructed of G90 galvanized 1,000 hour salt spray (per ASTM-B117) rated powder-coated 20 gage carbon steel wrapper and duct panel with integral corner posts, all attached atthe base to four (4) full perimeter 14 gage base rails with #10 sheet metal screws.

Options: 230-575 V, economizer, power exhaust, electric or gas heater, variable frequency drive

Mounting Description: Rigid or Flexible Curb Mounting

Product Line	Model Number[2]	Dimensions (inches)			Operating Weight (lb)	Nominal Cooling Capacity (Tons)	Sds (g), z/h=1	Unit
		Depth	Width	Height				
Predator Air Handling Units (Short)	ZH/ZU/JA3 037	89	59	42	860[1]	3	2.0	3
	ZJ/ZW/JA3 037	89	59	42	740	3		Interpolated
	ZR/ZK/JA3 037	89	59	42	980[1]	3		1
	ZT/ZV/JA3 037	89	59	42	922	3		Interpolated
	ZH/ZU/JA4 049	89	59	42	763	4		Interpolated
	ZJ/ZW/JA4 049	89	59	42	762	4		Interpolated
	ZR/ZK/JA4 049	89	59	42	880	4		Interpolated
	ZT/ZV/JA4 049	89	59	42	960	4		Interpolated
	ZH/ZU/JA5 061	89	59	42	772	5		Interpolated
	ZJ/ZW/JA5 061	89	59	42	1,070[1]	5		4
	ZR/ZK/JA5 061	89	59	42	1,070[1]	5		2
	ZT/ZV/JA5 061	89	59	42	968	5		Extrapolated
Predator Air Handling Units (Standard)	XP/XA/J06 078	89	59	42	970[1]	6.5	2.0	7
	ZF/ZS/J06 078	89	59	42	1,090[1]	6.5		10
	ZH/ZU/J06 078	89	59	42	910	6.5		Interpolated
	ZJ/ZW/J06 078	89	59	51	1030	6.5		Interpolated
	ZR/ZK/J06 078	89	59	51	1,060[1]	6.5		5
	ZF/ZS/J07 090	89	59	42	860	7.5		Interpolated
	ZH/ZU/J07 090	89	59	42	910	7.5		Interpolated
	ZJ/ZW/J07 090	89	59	51	1,081	7.5		Interpolated
	XP/XA/J07 090	89	59	42	920	7.5		Interpolated
	ZR/ZK/J07 090	89	59	42	965	7.5		Interpolated
	ZF/ZS/J08 102	89	59	51	1,020	8.5		Interpolated
	ZH/ZU/J08 102	89	59	51	1,030	8.5		Interpolated
	ZJ/ZW/J08 102	89	59	51	1,060	8.5		Interpolated
	XP/XA/J08 102	89	59	51	1,135	8.5		Interpolated
	ZR/ZK/J08 102	89	59	51	1,200	8.5		Interpolated
	ZF/ZS/J10 120	89	59	51	1,060	10		Interpolated
	ZH/ZU/J10 120	89	59	51	1,090	10		Interpolated
	ZJ/ZW/J10 120	89	59	51	1,070	10		Interpolated
	XP/XA/J10 120	89	59	51	1,135	10		Interpolated
	ZR/ZK/J10 120	89	59	51	1,200	10		Interpolated
	ZF/ZS/J12 150	119.5	59	51	1,253	12.5	2.0	Interpolated
	ZH/ZU/J12 150	119.5	59	51	1,250[1]	12.5		11
	XP/XA/J12 150	119.5	59	51	1,510[1]	12.5		8
	ZJ/ZW/J12 150	119.5	59	51	1,570[1]	12.5		9
	ZR/ZK/J12 150	119.5	59	51	1,600[1]	12.5		6
Predator Air Handling Units (Ultra High Efficiency)	ZT/ZV 120	119.5	59	51	1,470[1]	10	2.0	12
	ZT/ZV 078	119.5	59	51	1,550	6.5		Interpolated
	ZT/ZV 090	119.5	59	51	1,550	7.5		Interpolated
	ZT/ZV 102	119.5	59	51	1,575	8.5		Interpolated
	ZT/ZV 150	119.5	59	51	1,680[1]	12.5		13

1. Weights listed for tested units are actual, not approximate weights. The weights listed for interpolated units are maximum weights, assuming all optional features are included. Optional features are summarized in the table below.
2. Model numbers are generalized for each type of unit and the associated BTU tonnage thatthe unit can output.

Unit Accessory	Operating Weight (lbs.)
Economizer	85
Power Exhaust	35
Electric Heat	49
Gas Heat	110
Variable Frequency Drive	30

1. Weight given is for the maximum electric heater size available.
2. Weight given for the gas heater is for the maximum number oftube heat exchangers available (8 tube).
3. Weightincludes mounting hardware, controls and manual bypass option.

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0013
By:Timothy J Pilard
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

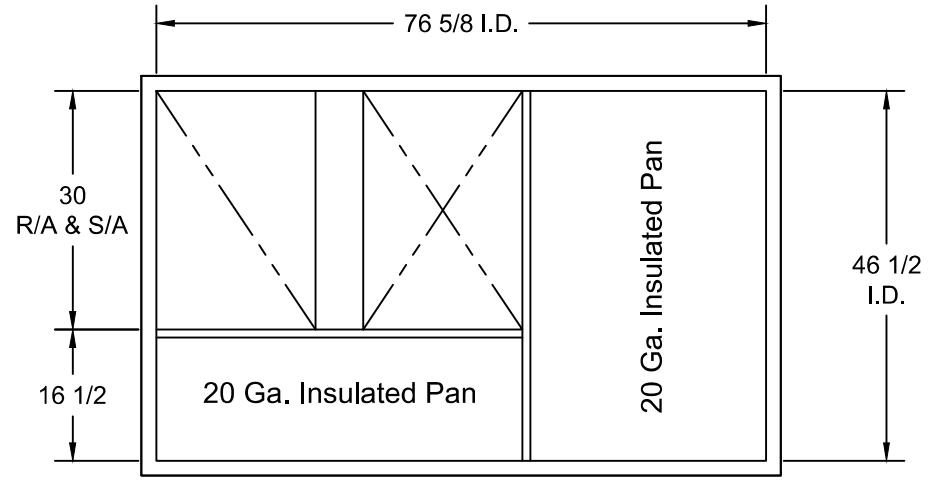
VERIFY ROOF PITCH AND DIRECTION

☐ APPROVED

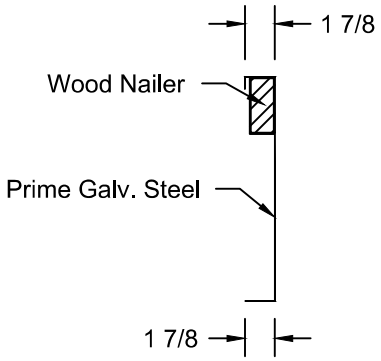
☐ APPROVED PENDING CHANGES

BY:

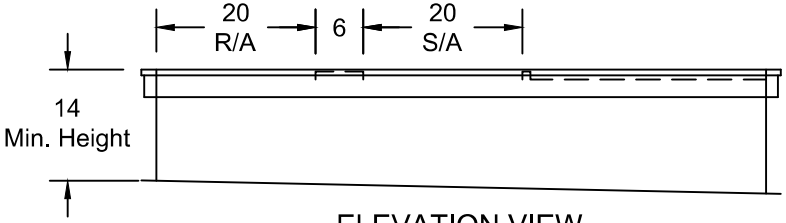
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PLAN VIEW



TYPICAL SECTION



ELEVATION VIEW



PITCH

NOTE:
Top Duct Supports To Be Removable.

Rev.	Int.	Date	Description

REVISION HISTORY

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 9/27/23

TC-5 Uninsulated Roof Curb Top Duct Supports
New York ZT061 (00488)

Powers Of Arkansas - North Little Rock, AR

Qty.: 1 | Job# :Q-26629

Tag: RTU-7

Drawn: JWhite

File: S20906-8 | Rev: ---

thybar CORPORATION
Thybar makes it right the first time, every time

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

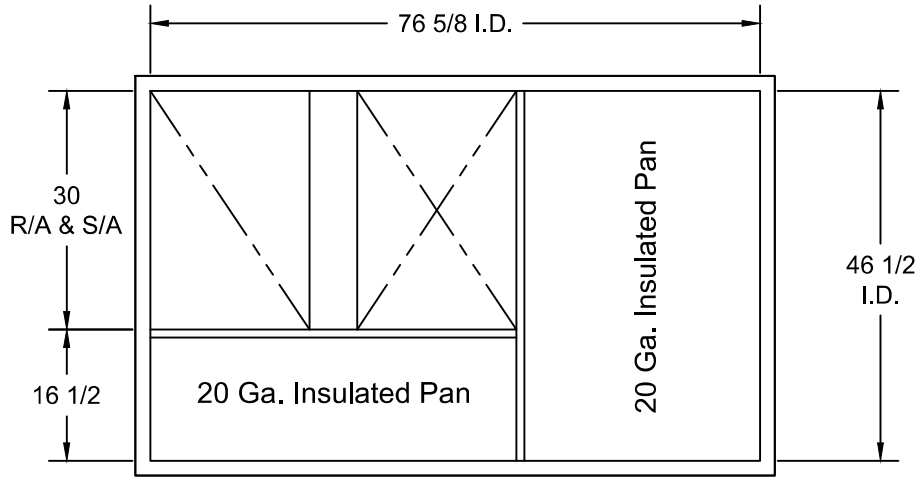
VERIFY ROOF PITCH AND DIRECTION

☐ APPROVED

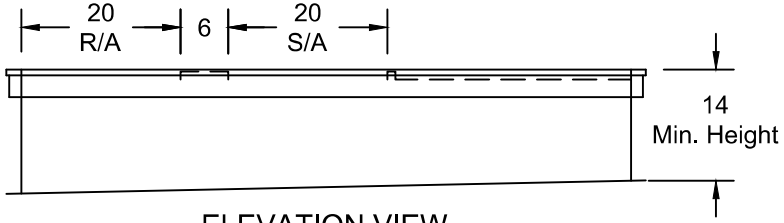
☐ APPROVED PENDING CHANGES

BY:

DATE: / /



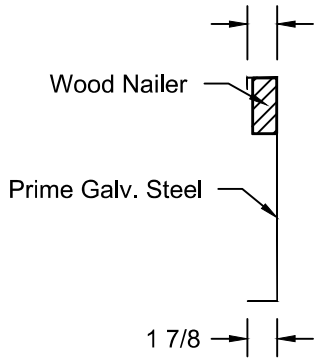
PLAN VIEW



ELEVATION VIEW



PITCH



TYPICAL SECTION

NOTE:
Top Duct Supports To Be Removable.

Rev.	Int.	Date	Description

REVISION HISTORY

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 9/27/23

TC-5 Uninsulated Roof Curb Top Duct Supports
New York ZJ102 (00488)

Powers Of Arkansas - North Little Rock, AR

Qty.: 1 | Job# :Q-26629

Tag: RTU-8

Drawn: JWhite

File: S20903-5 | Rev: ---

thybar CORPORATION
Thybar makes it right the first time, every time

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9** System: **ZT037N08R2D5NCE2A3**

Cooling Performance		
Total gross capacity	40.0	MBH
Sensible gross capacity	27.3	MBH
Total net capacity	37.7	MBH
Sensible net capacity	25.0	MBH
Seasonal Efficiency (at ARI)	17.00	SEER
Efficiency (at ARI)	13.05	EER
Ambient DB temp.	95.0	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	58.9	°F
Leaving WB temp.	56.4	°F
Leaving air temp dew point	54.80	°F
Power input (w/o blower)	2.38	kW
Sound power	75	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	10 lbs	6 oz

Reheat Performance		
Total capacity	18.8	MBH
Sensible capacity	7.4	MBH
Ambient DB temp.	85	°F
Entering DB temp.	75	°F
Entering WB temp.	67	°F
Leaving DB temp.	69.3	°F
Leaving WB temp.	62.3	°F
Power input (w/o blower)	2.00	kW
Gallons of water per hour	1.30	GPM

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	65.0	MBH
Supply air	1200	CFM
Heating input capacity (Max)	80	MBH
Leaving DB temp.	110.2	°F
Air temp. rise	50.2	°F
SSE	81.0	%
Stages	2	

Supply Air Blower Performance		
Supply air	1200	CFM
Ext. static pressure	1.1	IWG
Blower speed	948	HP
Max BHP of Motor (including service factor)	1.73	HP
Duct location	Bottom	
Motor rating	1.50	HP
Actual required BHP	0.74	HP
Power input	0.69	kW
Elevation	335	ft.
Drive type	BELT	

Outside/Mixed Air		
Outside Air CFM	200	CFM

Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	31.3	Amps
Unit max over-current protection	40	Amps

Dimensions & Weight			
Hgt 42 in.	Len 89 in.	Wth 59 in.	
Weight with factory installed options		1120	lbs

Clearances					
Right	12 in.	Front	12 in.	Rear	12 in.
Top	12 in.	Bottom	12 in.	Left	12 in.

Note: Please refer to the tech guide for listed maximum static pressures



3 Ton

- Tempmaster units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 80 MBH Input Aluminized Steel, Two Stage Gas Heat
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 750 Hours Salt Spray Test (ASTM B-117 Standards)
- Full perimeter base rails with built in rigging capabilities
- Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- VFD Standard
- Slide-Out Blower/1.5 HP Belt Drive Motor Assembly
- Unit Ships with 2" Pleated Filters (MERV 8)
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 16"). Unit accepts 2" or 4" wide filters
- Non-Powered Convenience Outlet
- HACR Circuit Breaker/Disconnect
- Short Circuit Current: 5kA RMS Sym
- Single Point Power Connection
- Through-the-Curb and Through-the-Base Utility Connections
- Dirty Filter Switch
- Return Air Smoke Detector
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- MagnaDry Reheat
- Composite Drain Pan - Front Connection
- Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray

provide economizer with barometric relief only per addendum #3.

BAS Controller

- IntelliSpeed control of the VFD based on stages of cooling. Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10.

Standard Unit Controller: Smart Equipment Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

coordinate increase in unit weight with steel

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9** System: **ZT037N08R2D5NCE2A3**

Additional Electrical Data		
Power supply	208-3-60	
Unit min circuit ampacity	31.3	Amps
Unit max over-current protection	40	Amps
Min Voltage	187	V
Max Voltage	252	V
Comp #1 RLA	11.6	
Comp #1 LRA	73.0	
Indoor Mtr Voltage	208-3-60	
Indoor Mtr FLA	4.3	
Outdoor Mtr Qty	2	
Outdoor Fan Voltage	208-1-60	
OD Fan Mtr FLA (ea.)	3.5	
Power Ex Mtr Qty	1	
Powered Ex Voltage	208-1-60	
Power Ex Mtr FLA (ea)	5.5	
Combustion Mtr Qty	1	
Combustion Motor Voltage	208/230-1-60	
Combustion Mtr FLA (ea)	0.5	

coordinate change in electrical requirements with electrical contractor. any cost associated with changes shall be mechanical contractor or equipment suppliers responsibility.

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9** System: **ZT037N08R2D5NCE2A3**

Factory Installed Options

ZT037N08R2D5NCE2A3

Equipment Options		Option(s) Selected
Product Category:	**ZT**	Single Packaged R-410A Ultra High Efficiency Air Conditioner
Nominal Cooling Capacity:	**037**	3 Ton Two Stage Cooling
Heat Type and Nominal Heat Capacity:	**N08**	80 MBH Input Aluminized Steel, Two Stage Gas Heat
Blower Option:	**R**	VFD Standard 1.5 HP High Static Belt Drive Blower IntelliSpeed control of the VFD based on stages of cooling (Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10)
Voltage:	**2**	208/230-3-60
Outside Air Option:	**D**	Dry Bulb Low Leak Economizer w/Barometric Relief and Power Exhaust and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
Service Options:	**5**	Non-Powered Convenience Outlet HACR Circuit Breaker/Disconnect
Sensor Options:	**N**	Dirty Filter Switch Return Air Smoke Detector (Bottom return only)
Controls:	**C**	Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. BACNet MS/TP, Modbus and N2 Communication Card.
Refrigeration:	**E**	Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil MagnaDry Reheat
Additional Options:	**2**	2" Pleated Filters (MERV 8) Phase Monitor
Cabinet Options:	**A**	Composite Drain Pan - Front Connection Tool-free maintenance with features like hinged doors for all-access panels, slide-out blower and blower motor tray
Product Generation:	**3**	

no smoke detector for RTU-9

Field Installed Accessories

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9** System: **ZT037N08R2D5NCE2A3**

- ○ 1CV0402 - Concentric Diffuser,Flush Mount,18RD
- ○ 1CV0411 - Concentric Diffuser,Side Discharge,18RD (55.0 lbs)
- ○ 1CV0419 - Concentric Diffuser,Specialty,18X18
- ○ 1FE0412 - Flue Exhaust Extension Kit (14.0 lbs)
- ● 1FF0415 - 2" Only metal Filter Frame Kit (16.0 lbs)
- ○ 1HA0424 - High Altitude Kit with Propane Conversion - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ○ 1HA0447 - High Altitude Kit for Natural Gas - For applications between 2000 and 6000 feet altitude (1.0 lbs)
- ● 1HG0415 - Hail Guard Kit-Diamond Pattern (50.0 lbs)
- ○ 1HG0431 - Hail Guard Kit-Provent Style (20.0 lbs)
- ○ 1NP0462 - Natural Gas to Propane Conversion Kit (1.0 lbs)
- ○ 1RC0470 - Roof Curb - 8" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0471 - Roof Curb - 14" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1RC0476 - Roof Curb - 24" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (135.0 lbs)
- ○ 1WC0412 - Wooden Crate (445.0 lbs)
- ○ 2AP0402 - Air Proving Switch (1.0 lbs)
- ○ 2AQ04700524 - CO^2 Space Sensor - Wall Mount Accessory (5.0 lbs)
- ○ 2AQ04700624 - CO^2 Unit Mount Accessory (4.6 lbs)
- ○ 2EC0401 - Kit, Single Enthalpy Field Installed (1.0 lbs)
- ● 2EC0402 - Kit, Dual Enthalpy Field Installed (Includes two humidity sensors) (1.0 lbs)
- ○ 2SD04700824 - Smoke Detector Kit w/ Mounting Hardware for Supply Air (Horizontal/Downflow) Only (9.4 lbs)
- ○ S1-02812384700 - Blower Sheave
- ○ S1-ADDWIRE - Add-a-Wire allows 5-wire thermostats to use only 4 wires. (0.3 lbs)
- ○ S1-CTSDTS - CTS Wired Temperature Sensor for thermostat | Duct *Also works for LX Series (0.3 lbs)
- ○ S1-CTSHTS - CTS Hardwired Temperature Sensor for CTS Thermostats *Works with LX series as well (0.2 lbs)
- ○ S1-CTSPLATE - Wall Plate for CTS Thermostats *Also works for new platform LX series models below (0.0 lbs)
- ○ S1-CTSWFTS - CTS Temperature Sensor with WiFi for CTS Thermostats *Also works with LX Series (0.1 lbs)
- ○ S1-LXLOCK - Locking Ring For LX-Series Thermostats (0.4 lbs)
- ○ S1-LXPLATE - Wall Plate For LX-Series Thermostats (0.0 lbs)
- ○ S1-LXWFM - For LX Series Thermostats - WiFi Communication (0.1 lbs)
- ○ S1-MP-PRTKIT-0P - MAP (Multiple Access Portal) Gateway Kit- Replacement MAP gateway protective case, lanyard and communication cable. Use only to replace worn or damaged components. (0.3 lbs)
- ○ S1-NSB8BHN041-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN043-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN141-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN143-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN240-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN241-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN243-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN240-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN241-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN243-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN041-0 - Wall Temperature Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN043-0 - Wall Temperature Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN141-0 - Wall Temperature Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN143-0 - Wall Temperature Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN240-0 - Wall Temperature Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN241-0 - Wall Temperature Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)

Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9** System: **ZT037N08R2D5NCE2A3**

- ○ S1-NSB8BTN243-0 - Wall Temperature Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-TEC3030-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3030-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, AND FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3031-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3031-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3630-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3630-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ● S1-TEC3631-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3631-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-YK-MAP1810-0P - MAP (Multiple Access Portal) Gateway- For use with SimplicitySE Control. (0.2 lbs)
- ○ S1-YK-MAP1810-0S - Stationary MAP Gateway (Includes MAP Gateway, Field Bus Adapter, Mounting Bracket and 100 to 240 VAC Power Supply). US-compatible counties. (1.9 lbs)

provide thermostat less occupancy sensor.

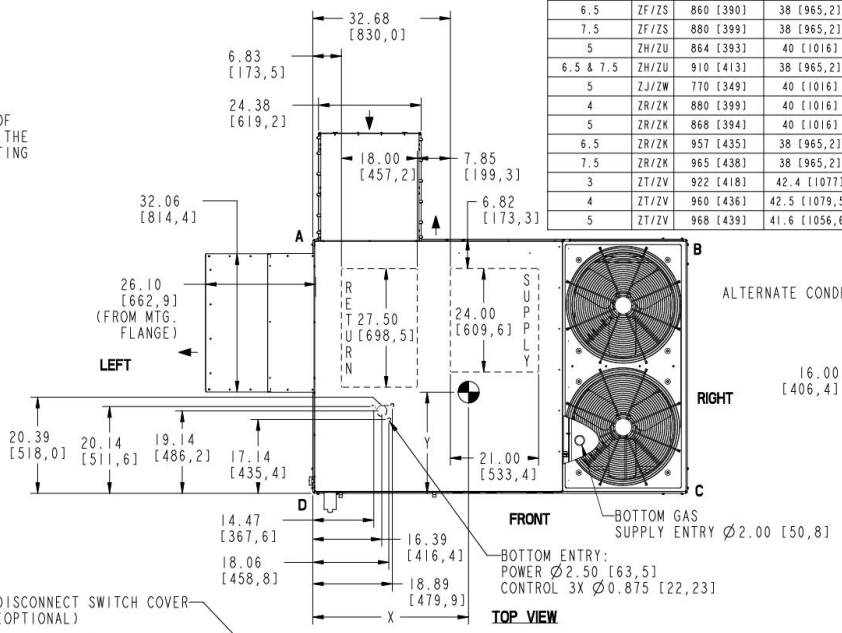
Project Name: **Farm Credit – Russellville, AR** Unit Model #: **ZT037N08R2D5NCE2A3**

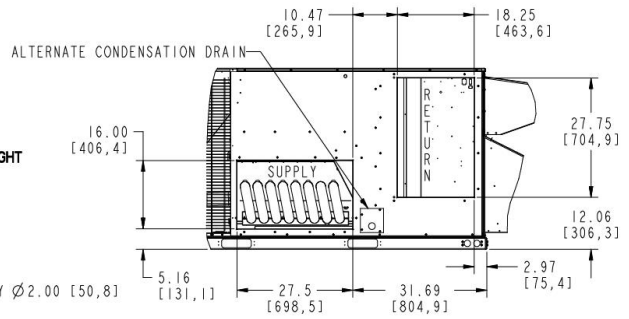
Quantity: **1** Tag #: **RTU-9**

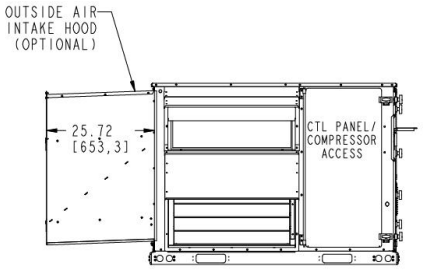
Consolidated Drawing

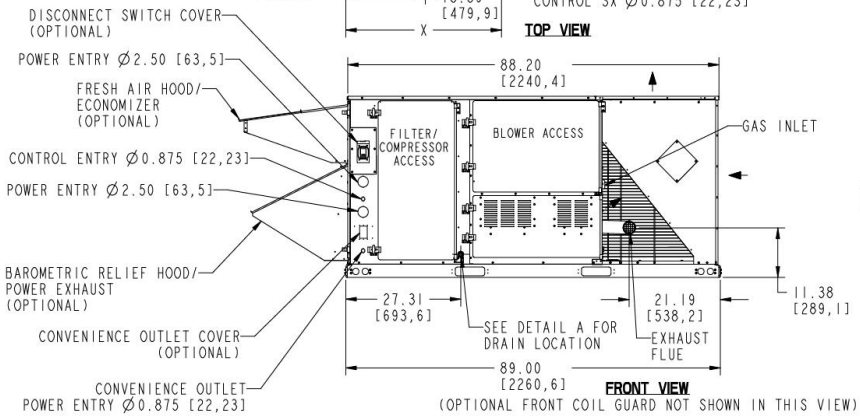
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   RIGHT SIDE: 12 [305]
   LEFT SIDE: 36 [915]
   FRONT: 36 [915]
   REAR: 36 [915]
   TOP: 72 [1830]
   BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAIN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF & FRESH AIR HOODS SHOWN.
11. DELETED
12. 8 TUBE HEAT EXCHANGER IS NOT AVAILABLE FOR 3 & 4 TON UNITS.

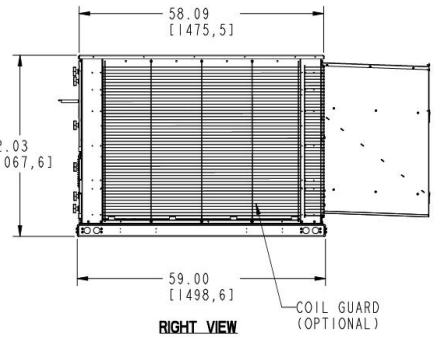
TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
6.5	ZF/ZS	860 [390]	38 [965,2]	24 [609,6]	200 [91]	149 [68]	218 [99]	292 [133]
7.5	ZF/ZS	880 [399]	38 [965,2]	24 [609,6]	205 [93]	153 [69]	223 [101]	299 [136]
5	ZH/ZU	864 [393]	40 [1016]	26 [660.4]	210 [95]	171 [78]	217 [99]	266 [121]
6.5 & 7.5	ZH/ZU	910 [413]	38 [965,2]	24 [609,6]	212 [96]	158 [72]	230 [104]	309 [140]
5	ZJ/ZW	770 [349]	40 [1016]	24 [609,6]	172 [78]	141 [64]	205 [93]	251 [114]
4	ZR/ZK	880 [399]	40 [1016]	26 [660,4]	214 [97]	174 [79]	221 [100]	271 [123]
5	ZR/ZK	868 [394]	40 [1016]	26 [660,4]	211 [96]	172 [78]	218 [99]	267 [121]
6.5	ZR/ZK	957 [435]	38 [965,2]	23 [584,2]	214 [97]	161 [73]	249 [113]	333 [151]
7.5	ZR/ZK	965 [438]	38 [965,2]	23 [584,2]	216 [98]	161 [73]	251 [114]	337 [153]
3	ZT/ZV	922 [418]	42.4 [1077]	24.7 [627,4]	202 [92]	184 [84]	255 [116]	281 [128]
4	ZT/ZV	960 [436]	42.5 [1079,5]	25.5 [647,7]	217 [98]	198 [90]	260 [118]	285 [129]
5	ZT/ZV	968 [439]	41.6 [1056,6]	25.5 [647,7]	223 [101]	196 [89]	257 [117]	293 [133]

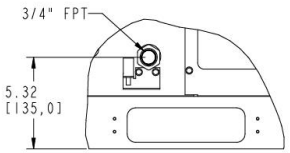












REV LEV	DATE	REVISION RECORD	EC NO	DR	CK	ENG
A	02-11-20	NEW DRAWING (FROM UST-PRED-20DF42H)	75768	LOP	RCH	SAA

THIRD ANGLE PROJECTION

NAME	DATE
DRN L. PACKARD	02-11-20
CHK R. HADDAD	02-11-20
ENG S. AYENI	02-11-20
MFG	

ALL PROPRIETARY RIGHTS IN THE SUBJECT MATTER HEREOF ARE RESERVED AND NO PERMISSION IS GRANTED TO REPRODUCE THIS PRINT IN WHOLE OR IN PART OR DISCLOSE ANY OF THE INFORMATION UPON IT TO OTHERS WITHOUT WRITTEN RELEASE BY JOHNSON CONTROLS

DRAWING PER ASME Y14.5-2009
TOLERANCES UNLESS OTHERWISE SPECIFIED:
ONE PLACE DECIMAL = ± .1
TWO PLACE DECIMAL = ± .03
THREE PLACE DECIMAL = ± .010
ANGLES = ± 2°
DIMENSIONS ARE IN INCHES

SUBMITTAL DWG, PRO
STD FLAT COIL, 2 ODF, 42" CAB

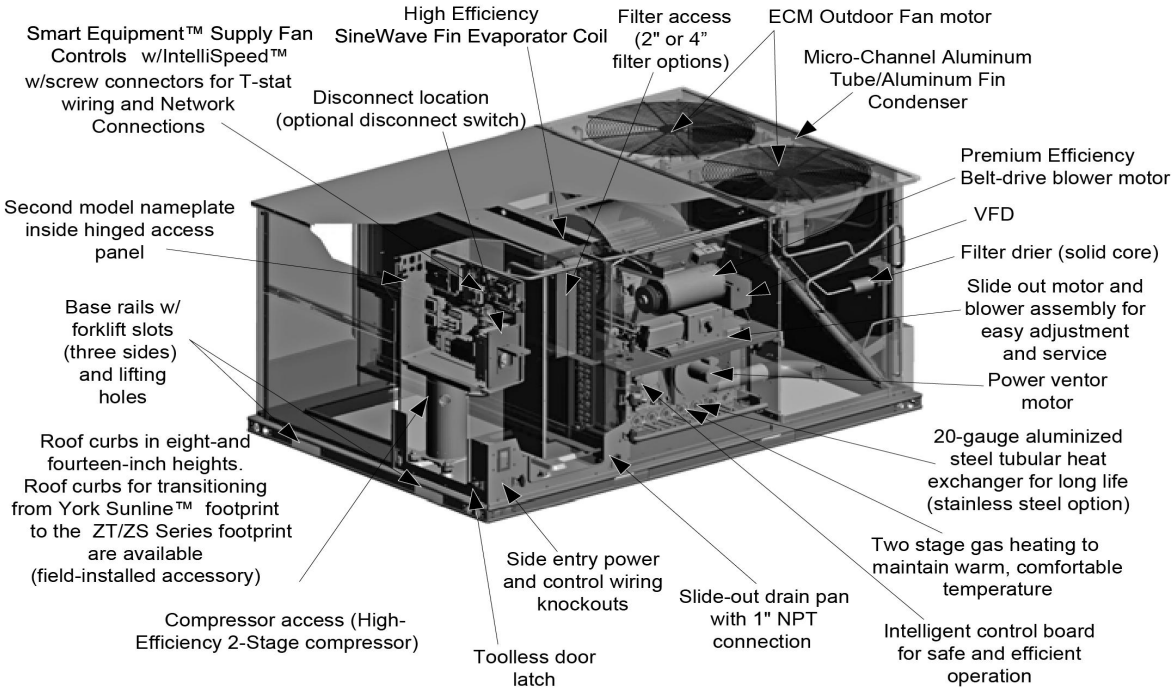
JOHNSON CONTROLS
UNITARY PRODUCTS GROUP

SAFETY AND KEY CHARACTERISTICS PER BE-PDP-STD-01
MATERIAL
TYPE NOT APPLICABLE
ENG SPEC NOT APPLICABLE
SIZE
DWG NO. 5883783
REV A
PART NO.
NO 1 OF 1

Component Locations

Component Location

Cooling With Gas Heat (3 Through 5 Ton)

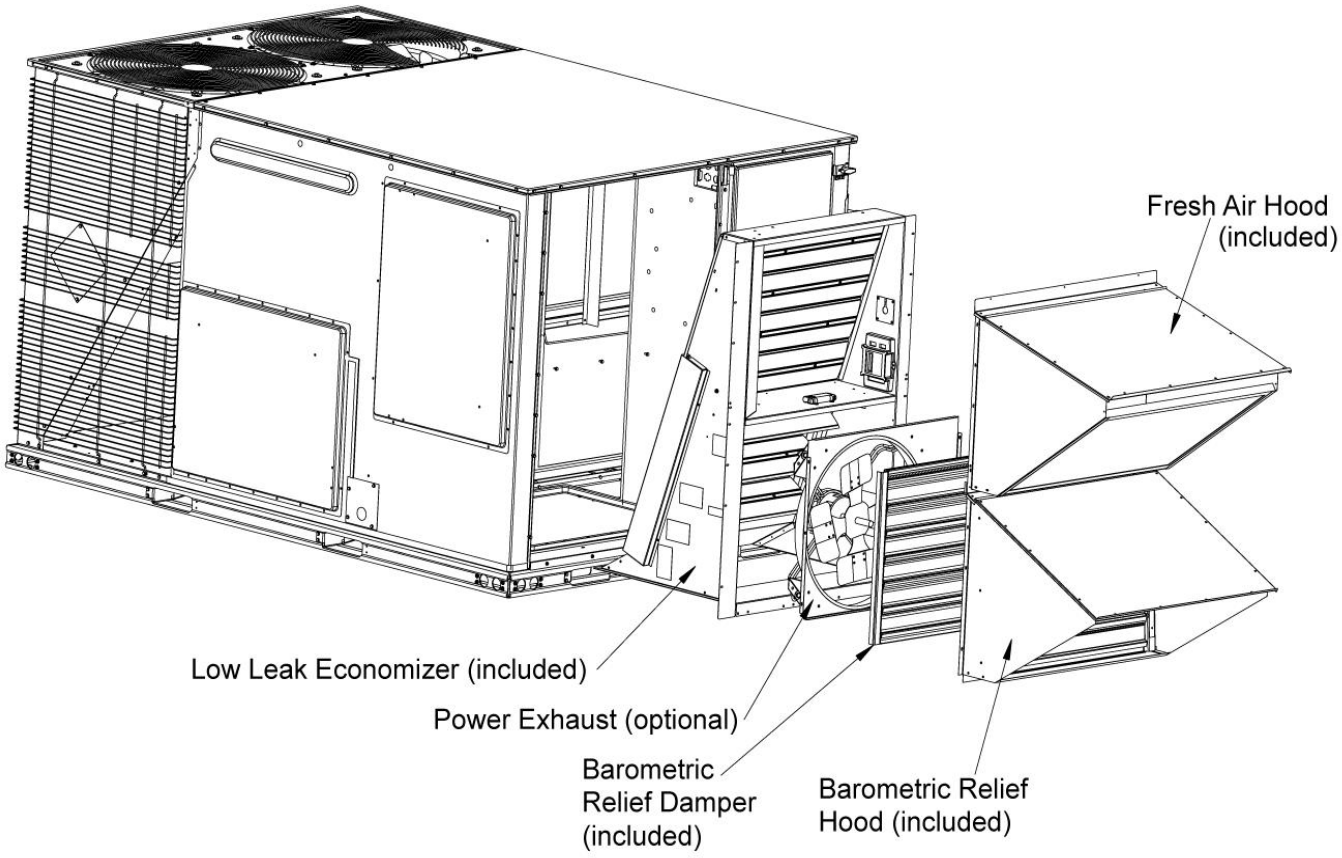


Project Name: **Farm Credit – Russellville, AR**
Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9**

Low Leak Downflow Economizer

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1” of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

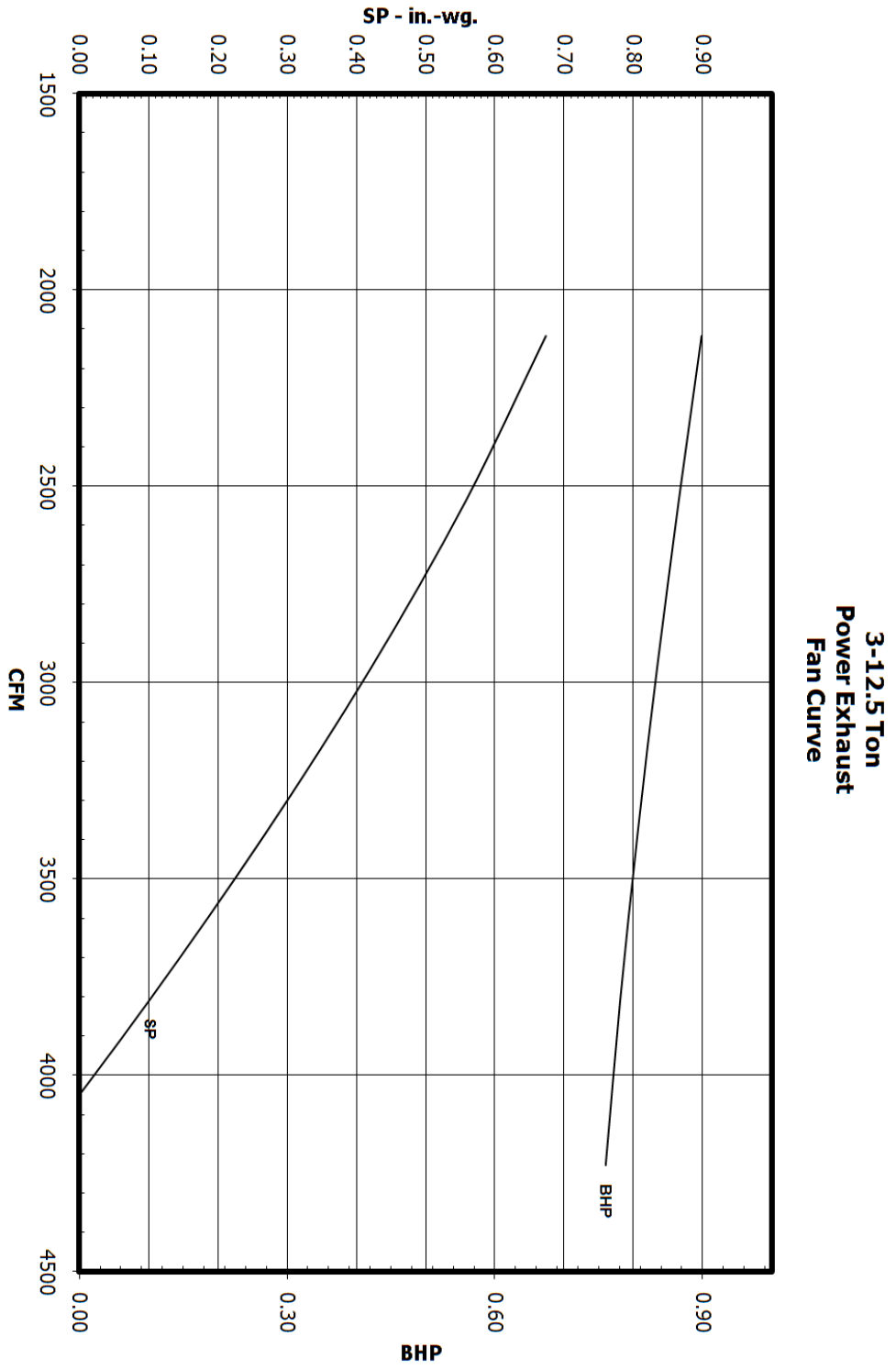
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9**

Factory Installed Power Exhaust



Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP – 0213

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Johnson Controls Inc. (JCI)

Manufacturer's Technical Representative: Cameron Boyce, Engineer II

Mailing Address: 5005 Interstate Drive, Norman, OK, 73069

Telephone: (405) 419-6830 Email: cameron.w.boyce@jci.com

Product Information

Product Name: Predator Rooftop Air Conditioning Units

Product Type: Packaged Air Conditioning Units

Product Model Number: See attached
(List all unique product identification numbers and/or part numbers)

General Description: The units are enclosures with the following subcomponents: refrigerant compressors, outdoor fan motors, indoor coils, outdoor coils, reversing valve with coil, thermostatic expansion valves, standard indoor blower motor, Variable frequency drive indoor blower motor, exhaust fan motor, variable frequency drive, economizer, electric heater, heat cells, filters, and other miscellaneous items included in the subcomponent tables.

Mounting Description: Units are rigid curb and isolated curb base mounted

Applicant Information

Applicant Company Name: The VMC Group

Contact Person: John Giuliano

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: john.giuliano@thevmcgroup.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2016.

Signature of Applicant: Date: 8/28/19

Title: President Company Name: The VMC Group

REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0213 Timothy J Piland Date: 09/06/2019 CALIFORNIA BUILDING CODE 2019

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

California Licensed Structural Engineer Responsible for the Engineering and Test Report(s)

Company Name: The VMC Group

Name: Kenneth Tarlow California License Number: SE-2851

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: ken.tarlow@thevmcgroup.com

Supports and Attachments Preapproval

☐ Supports and attachments are preapproved under OPM- _____
(Separate application for OSHPD Preapproval of Manufacturer's Certification (OPM) of Supports and attachments is required)

☒ Supports and attachments are not preapproved

Certification Method

☒ Testing in accordance with: ☒ ICC-ES AC156

☐ Other (Please Specify): _____

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0213
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Testing Laboratory

Company Name: DCL Labs

Contact Name: Josh Sailer, Laboratory Manager

Mailing Address: 1315 Greg Street, Suite 109, Sparks, NV 89431

Telephone: (775) 358-5085 Email: josh@shaketest.com

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9**

Seismic Certification

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

Seismic Parameters

Design in accordance with ASCE 7-16 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = Rigid Curb = 1.5; Spring Isolated Curb = 4.5

S_{DS} (Design spectral response acceleration at short period, g) = 2.00

a_p (In-structure equipment or component amplification factor) = 2.5

R_p (Equipment or component response modification factor) = Rigid Curb = 6.0; Spring Isolated Curb = 2.0

Ω_0 (System overstrength factor) = 2.0

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1

Equipment or Component Natural Frequencies (Hz) = See attachment

Overall dimensions and weight (or range thereof) = See attachment

Equipment or Components @ grade designed in accordance with ASCE 7-16 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Design spectral response acceleration at short period, g) =

S_{D1} (Design spectral response acceleration at 1 second period, g) =

R (Response modification coefficient) =

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) =

I_p (Importance factor) = 1.5

Height to Center of Gravity above base =

Equipment or Component Natural Frequencies (Hz) =

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2015: ☐ Yes ☒ No

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0215
BY: Timothy J Piland
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

List of Attachments Supporting Special Seismic Certification

☒ Test Report(s) ☒ Drawings ☐ Calculations ☐ Manufacturer's Catalog

☐ Other(s) (Please Specify):

OSHPD Approval (For Office Use Only) – Approval Expires on December 31, 2025

Signature: Date: March 8, 2021

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to: S_{DS} (g) = 2.00 z/h = 1

Condition of Approval (if applicable):

Project Name: **Farm Credit – Russellville, AR**

Unit Model #: **ZT037N08R2D5NCE2A3**

Quantity: **1** Tag #: **RTU-9**

Seismic Certification

Table 1 - Certified Components

Manufacturer: Johnson Controls and other Unitary Product Group brands (York, Coleman, Luxaire, Evcon, Fraser-Johnston and Ready Ship)

Product Line: JCI Packaged Rooftop Units

Product Construction: Cabinetis constructed of G90 galvanized 1,000 hour salt spray (per ASTM-B117) rated powder-coated 20 gage carbon steel wrapper and duct panel with integral corner posts, all attached atthe base to four (4) full perimeter 14 gage base rails with #10 sheet metal screws.

Options: 230-575 V, economizer, power exhaust, electric or gas heater, variable frequency drive

Mounting Description: Rigid or Flexible Curb Mounting

Product Line	Model Number[2]	Dimensions (inches)			Operating Weight (lb)	Nominal Cooling Capacity (Tons)	Sds (g), z/h=1	Unit
		Depth	Width	Height				
Predator Air Handling Units (Short)	ZH/ZU/JA3 037	89	59	42	860[1]	3	2.0	3
	ZJ/ZW/JA3 037	89	59	42	740	3		Interpolated
	ZR/ZK/JA3 037	89	59	42	980[1]	3		1
	ZT/ZV/JA3 037	89	59	42	922	3		Interpolated
	ZH/ZU/JA4 049	89	59	42	763	4		Interpolated
	ZJ/ZW/JA4 049	89	59	42	762	4		Interpolated
	ZR/ZK/JA4 049	89	59	42	880	4		Interpolated
	ZT/ZV/JA4 049	89	59	42	960	4		Interpolated
	ZH/ZU/JA5 061	89	59	42	772	5		Interpolated
	ZJ/ZW/JA5 061	89	59	42	1,070[1]	5		4
	ZR/ZK/JA5 061	89	59	42	1,070[1]	5		2
	ZT/ZV/JA5 061	89	59	42	968	5		Extrapolated
Predator Air Handling Units (Standard)	XP/XA/J06 078	89	59	42	970[1]	6.5	2.0	7
	ZF/ZS/J06 078	89	59	42	1,090[1]	6.5		10
	ZH/ZU/J06 078	89	59	42	910	6.5		Interpolated
	ZJ/ZW/J06 078	89	59	51	1030	6.5		Interpolated
	ZR/ZK/J06 078	89	59	51	1,060[1]	6.5		5
	ZF/ZS/J07 090	89	59	42	860	7.5		Interpolated
	ZH/ZU/J07 090	89	59	42	910	7.5		Interpolated
	ZJ/ZW/J07 090	89	59	51	1,081	7.5		Interpolated
	XP/XA/J07 090	89	59	42	920	7.5		Interpolated
	ZR/ZK/J07 090	89	59	42	965	7.5		Interpolated
	ZF/ZS/J08 102	89	59	51	1,020	8.5		Interpolated
	ZH/ZU/J08 102	89	59	51	1,030	8.5		Interpolated
	ZJ/ZW/J08 102	89	59	51	1,060	8.5		Interpolated
	XP/XA/J08 102	89	59	51	1,135	8.5		Interpolated
	ZR/ZK/J08 102	89	59	51	1,200	8.5		Interpolated
	ZF/ZS/J10 120	89	59	51	1,060	10		Interpolated
	ZH/ZU/J10 120	89	59	51	1,090	10		Interpolated
	ZJ/ZW/J10 120	89	59	51	1,070	10		Interpolated
	XP/XA/J10 120	89	59	51	1,135	10		Interpolated
	ZR/ZK/J10 120	89	59	51	1,200	10		Interpolated
	ZF/ZS/J12 150	119.5	59	51	1,253	12.5	2.0	Interpolated
	ZH/ZU/J12 150	119.5	59	51	1,250[1]	12.5		11
	XP/XA/J12 150	119.5	59	51	1,510[1]	12.5		8
	ZJ/ZW/J12 150	119.5	59	51	1,570[1]	12.5		9
	ZR/ZK/J12 150	119.5	59	51	1,600[1]	12.5		6
Predator Air Handling Units (Ultra High Efficiency)	ZT/ZV 120	119.5	59	51	1,470[1]	10	2.0	12
	ZT/ZV 078	119.5	59	51	1,550	6.5		Interpolated
	ZT/ZV 090	119.5	59	51	1,550	7.5		Interpolated
	ZT/ZV 102	119.5	59	51	1,575	8.5		Interpolated
	ZT/ZV 150	119.5	59	51	1,680[1]	12.5		13

1. Weights listed for tested units are actual, not approximate weights. The weights listed for interpolated units are maximum weights, assuming all optional features are included. Optional features are summarized in the table below.
2. Model numbers are generalized for each type of unit and the associated BTU tonnage thatthe unit can output.

Unit Accessory	Operating Weight (lbs.)
Economizer	85
Power Exhaust	35
Electric Heat	49
Gas Heat	110
Variable Frequency Drive	30

1. Weight given is for the maximum electric heater size available.
2. Weight given for the gas heater is for the maximum number oftube heat exchangers available (8 tube).
3. Weightincludes mounting hardware, controls and manual bypass option.

REVIEWED FOR CODE COMPLIANCE
OSHPD
OSP-0013
By:Timothy J Pilard
DATE: 03/08/2021
CALIFORNIA BUILDING CODE, 2019

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

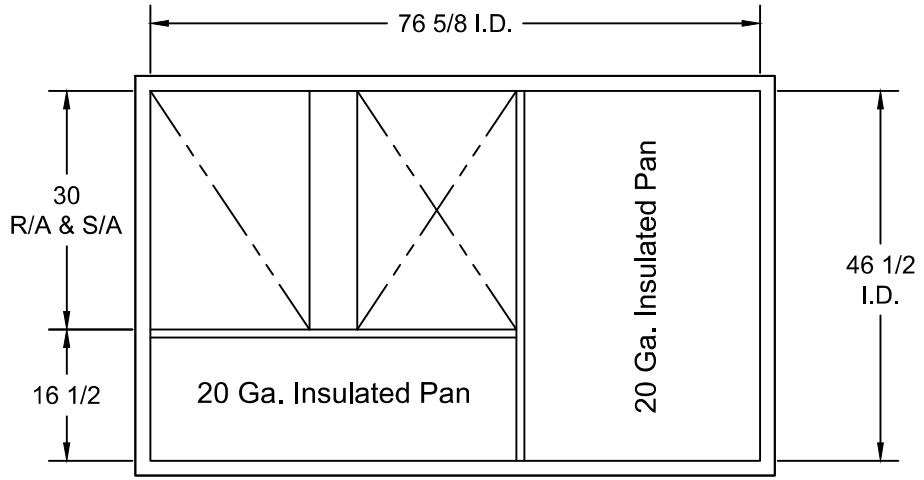
VERIFY ROOF PITCH AND DIRECTION

☐ APPROVED

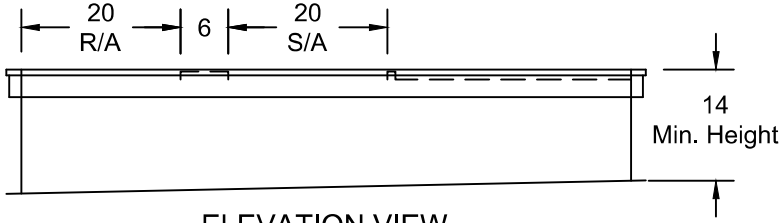
☐ APPROVED PENDING CHANGES

BY:

DATE: / /



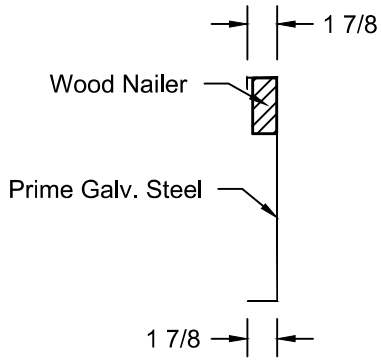
PLAN VIEW



ELEVATION VIEW



PITCH



TYPICAL SECTION

NOTE:
Top Duct Supports To Be Removable.

Rev.	Int.	Date	Description

REVISION HISTORY

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 9/27/23

TC-5 Uninsulated Roof Curb Top Duct Supports
New York ZT037 (00488)

Powers Of Arkansas - North Little Rock, AR

Qty.: 1 | Job# :Q-26629

Tag: RTU-9

Drawn: JWhite

File: S20904-6 | Rev: ---

thybar CORPORATION
Thybar makes it right the first time, every time

Date
03/13/2023
Project Name
Farm Credit – Russellville, AR
Project Number
Client / Purchaser

Johnson Controls

Guide Specification Summary Page

Product Series	Models and Unit Tags	
3-12.5 TempMaster® Omni™ Pro	ZB120N24G2D5NCD2A2	RTU-1
	ZJ150N24R2D5NCE2A2	RTU-2
	ZB090N18G2D5NCD2A2	RTU-3
	ZJ102N18R2D5NCE2A3	RTU-4, 5, 6
	ZT061N12P2D5NCE2A2	RTU-7, 8
	ZT037N08R2D5NCE2A3	RTU-9

GENERAL

units are convertible single packages with a common footprint cabinet and common roof curb for all 3 through 12-1/2 ton models. All 6-1/2 through 12-1/2 ton have two compressors with independent R-410A refrigeration circuits to provide 2 stages of cooling. The units were designed for light commercial applications and can be easily installed on a roof curb, slab, or frame. All units are self contained and assembled on rigid full perimeter base rails allowing for 3-way forklift access and overhead rigging. Every unit is completely charged with R-410A, wired, piped, and tested at the factory to provide a quick and easy field installation. All units are convertible between side and down airflow. Independent economizer designs are used on side and down discharge applications, as well as all tonnage sizes. Predator® units are available in the following configurations: cooling only, cooling with electric heat, cooling with gas heat, reheat only, reheat with electric heat and reheat with gas heat. Electric heaters are available as factory-installed options or field-installed accessories.

DESCRIPTION

Units shall be factory assembled, single package, (Elec/Elec, Gas/ Elec), designed for outdoor installation. They shall have built in field convertible duct connections for down discharge supply/return or horizontal discharge supply/return and be available with factory installed options or field installed accessories. The units shall be factory wired, piped and charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. The cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA certified to ANSI Z21.47 and UL 1995/CAN/CSA No. 236-M90 standards.

UNIT CABINET

Unit cabinet shall be constructed of galvanized steel with exterior surfaces coated with a non-chalking, powder paint finish, certified at a 750-hour salt spray test per ASTM-B117 standards. Indoor blower sections shall be insulated with up to 1” thick insulation coated on the airside. Either aluminum foil faced or elastometric rubber insulation shall be used in the unit’s compartments and be fastened to prevent insulation from entering the air stream. Cabinet doors shall be hinged with toolless access for easy servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging, fork truck access and proper sealing on roof curb applications. Disposable 2” filters shall be furnished as standard and be accessible through hinged access door. Fan performance measuring ports shall be provided on the outside of the cabinet to allow accurate air removing panels or creating bypass of the coils. Condensate pan shall be slide out design, constructed of a non corrosive material, internally sloped and conforming to ASHRAE 62-B9 standards. Condensate connection shall be a minimum of ¾” I.D. female and be rigid mount connection.

INDOOR (EVAPORATOR) FAN ASSEMBLY

Fan shall be a belt drive assembly and include an adjustable pitch motor pulley. Job site selected brake horsepower shall not exceed the motors nameplate horsepower rating plus the service factor. Units shall be designed to operate within the service factor. Fan wheel shall be double inlet type with forward curve blades, dynamically balanced to operate smoothly throughout the entire range of operation. Airflow design shall be constant volume. Bearings shall be sealed and permanently lubricated for longer life and no maintenance. Entire blower assembly and motor shall be slide out design.

OUTDOOR (CONDENSER) FAN ASSEMBLY

The outdoor fans shall be of the direct drive type, discharge air vertically, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The outdoor fan motors shall have permanently lubricated bearings internally protected against overload conditions and staged independently. A cleaning window shall be provided on two sides of the units for coil cleaning.

REFRIGERANT COMPONENTS

Compressors:

a. Shall be fully hermetic type, direct drive, internally protected with internal high-pressure relief and over temperature protection. The hermetic motor shall be suction gas cooled and have a voltage range of + or – 10% of the unit nameplate voltage.
b. Shall have internal spring isolation and sound muffling to minimize vibration and noise, and be externally isolated on a dedicated, independent mounting.

Coils:

a. Evaporator coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option.
b. Evaporator coils shall be of the direct expansion, draw-thru design.
c. Condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed or Micro-Channel aluminum tube, aluminum fins.
d. Condenser coils shall be of the draw-thru design.

Refrigerant Circuit and Refrigerant Safety Components shall include:

a. Independent fixed-orifice or thermally operated expansion devices.
b. Solid core filter drier/strainer to eliminate any moisture or foreign matter.
c. Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.
d. The 6-1/2 through 12-1/2 ton unit shall have two independent refrigerant circuits, equally split in 50% capacity increments.

Unit Controls:

a. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side.
b. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor:
   - Loss-of-charge/Low-pressure switch.
   - High-pressure switch.
   - Freeze condition sensor on evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.
c. Unit shall incorporate “AUTO RESET” compressor over temperature, over current protection.
d. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
e. Unit control board shall have on-board diagnostics and fault message display.
f. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to a selectable value as low as 0 ºF.
g. Control board shall monitor each refrigerant safety switch independently.

GAS HEATING SECTION

Heat exchanger and exhaust system shall be constructed of aluminized steel, and be designed with induced draft combustion with post purge logic, energy saving direct spark ignition, and redundant main gas valve. The heat exchanger shall be of the tubular type, constructed of T1-40 aluminized steel for corrosion resistance and allowing minimum mixed air entering temperature of 40 ºF. Burners shall be of the in-shot type, constructed of aluminum-coated steel. All gas piping shall enter the unit cabinet at a single location, through either the side or bottom, without any field modifications. An integrated control board shall provide timed control of evaporator fan functioning and burner ignition. Heating section shall be provided with the following minimum protection:

a. Primary and auxiliary high-temperature limit switches.
b. Induced draft pressure sensor.
c. Flame roll out switch (manual reset).
d. Flame proving controls.
e. All two stage gas units shall have two independent stages of capacity (70% or 75% 1st stage, 100% 2nd stage) 3 through 5 ton and (60% 1st stage, 100% 2nd stage) 6-1/2 through 12-1/2 ton.

UNIT OPERATING CHARACTERISTICS

Unit shall be capable of starting and running at 125 ºF outdoor temperature, exceeding maximum load criteria of AHRI Standard 340/360. The compressor, with standard controls, shall be capable of operation down to 0 ºF outdoor temperature. Unit shall be provided with fan time delay to prevent cold air delivery before heat exchanger warms up. (Gas heat only)

ELECTRICAL REQUIREMENTS - All unit power wiring shall enter unit cabinet at a single factory provided location and be capable of side or bottom entry to minimize roof penetrations and avoid unit field modifications. Separate side and bottom openings shall be provided for the control wiring.

STANDARD LIMITED WARRANTIES - Compressor – 5 Years, Heat Exchanger – 10 Years, Elect. Heat Elem. – 5 Years, Parts – 1 Year.

FACTORY INSTALLED OPTIONAL OUTDOOR AIR (Shall be made available by either/or):

ADDITIONAL FACTORY INSTALLED OPTIONS

- **Alternate Indoor Blower Motor** – For applications with high restrictions, units are available with optional indoor blower motors that provide higher static output and/or higher airflow.

- **Variable Air Volume (VAV)** – The VAV option using a variable frequency drive (VFD) shall be available on 6-1/2 through 12-1/2 ton models for applications requiring a constant supply-duct static pressure. Units equipped for VAV shall be controlled by a duct pressure transducer with a 0 - 5" WC pressure range. The pressure transducer shall provide a 0 - 5 VDC output signal to a VAV control board which, in turn shall provide a 2 - 10 VDC speed reference signal to the VFD. The VAV control board shall operate using factory-installed Supply Air, Return Air and Outside Air Temperature Sensors with a nominal resistance of 10,000 Ohms. Units equipped with VFD's shall have factory-installed manual bypass as an option.
- **IntelliSpeed™ Supply Fan Control Option (ASHRAE 90.1 compliant, section 6.4.3.10)** – Units configured with the IntelliSpeed™ Supply Fan Option will contain a VFD for variable volume supply fan operation. This option allows the supply fan RPM to vary based on the number of compressors or heating stages energized. The economizer's minimum position will also be configurable to vary based on the supply fan VFD frequency output.
- **Non-Powered Convenience Outlet** – Unit is provided with a non-powered 120VAC GFCI outlet with cover on the corner of the unit housing the compressors.
- **BAS Controls** – Include supply air sensor, return air sensor, dirty filter indicator and air proving switch.
- **Dirty Filter Switch** – This kit includes a differential pressure switch that energizes the fault light on the unit thermostat, indicating that there is an abnormally high-pressure drop across the filters.
- **Smoke Detector** – A smoke detector can be factory mounted and wired in the supply and/or return air compartments.

FIELD INSTALLED OPTIONS

- **Hail Guard** - This kit includes a sloped hood which installs over the outside condenser coil and prevents damage to the coil fins from hail strikes.
- **Metal Frame Filter Kit** – Metal frame with polyester filter medium.

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/UPG 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/UPG 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 current standard warranty policy and warranty manual found on UPGnet for details.

In the event that communication with Johnson Controls/UPG 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/UPG
Technical Services Department
5005 York Drive
Norman, OK 73069

SAFETY WARNINGS

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

⚠WARNING

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

⚠WARNING

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

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

DESIGN APPLICATION INFORMATION

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

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

Design Outdoor Air CFM At Minimum Position: _____

Total External Static Pressure: _____

Supply Static Pressure: _____

Return Static Pressure: _____

Design Building Static Pressure: _____

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

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

ADDITIONAL APPLICATION NOTES FROM SPECIFYING ENGINEER:

REFERENCE

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

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

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

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

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

Operating Measurements - Air Flow

Fan operates with proper rotation	ID Fans ☐	Exh. Fans ☐	Cond. Fans ☐
Pressure drop across dry evaporator coil (At maximum design CFM) [1]			IWC
External Static Pressure			IWC
Return Static Pressure			IWC
Supply Static Pressure			IWC
Supply Air CFM Using Dry Coil Chart			CFM
Final Adjusted Supply Air CFM[2]			CFM

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

Blower Motor HP _____ FLA_____ RPM_____

Pulley Pitch Diameter _____Turns Out_____ Final Turns Out_____

Blower Pulley Pitch Diameter _____ Fixed Sheave_____

ELECTRICAL DATA

T1 - T2 _____ Volts T2 - T3 _____ Volts

Control Voltage _____ Volts T1 - T3 _____ Volts

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

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

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	☐	☐
Prove High Pressure Safety, All Systems	☐	☐
Prove Low Pressure Safety, All Systems	☐	☐

OPERATING MEASUREMENTS - GAS HEATING

Fuel Type: ☐ Natural Gas ☐ LP Gas

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

1. $\frac{\text{Input X Eff. (BTU output)}}{\text{1.08 X Temp. Rise}}$

OPERATIONAL MEASUREMENTS - STAGING CONTROLS

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

FINAL - INSPECTION

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

OBSERVED PRODUCT DIFFICIENCIES & CONCERNS: