Installation

Foundation

⚠WARNING

Risk of Roof Collapsing!

Confirm with a structural engineer that the roof structure is strong enough to support the combined weight of the roofcurb and the unit. Refer to "Unit Weights," p. 17 for typical unit and curb weights. Failure to ensure proper structural roof support could cause the roof to collapse, which could result in death or serious injury and property damage.

NOTICE:

Water Damage!

Non-factory penetrations through the base of this unit are not allowed. Any penetration in the base of the unit may affect the water tight integrity of the unit and lead to water leaks into the conditioned space. Failure to follow instructions could result in equipment and property damage.

Horizontal Units

Notes:

- *For units with optional Condensate Overflow Switch (COF), the switch will not work properly if unit is not level or slightly sloped toward switch.*
- *To assure proper condensate flow during operation the unit and the curb must be level.*

If the unit is installed at ground level, elevate it above the snow line. Provide concrete footings at each support location with a "full perimeter" support structure or a slab foundation for support. Refer to Table 1, p. 17 and Table 2, p. 17 for the unit's operating and point loading weights when constructing a footing foundation.

If anchoring is required, anchor the unit to the slab using hold down bolts or isolators. Isolators should be installed to minimize the transmission of vibrations into the building.

For rooftop applications, if anchoring is required, anchor the unit to the roof with hold-down bolts or isolators.

Check with a roofing contractor for proper waterproofing procedures.

Ductwork

Elbows with turning vanes or splitters are recommended to minimize air noise due to turbulence and to reduce static pressure.

When attaching the ductwork to the unit, provide a water-tight flexible connector at the unit to prevent operating sounds from transmitting through the ductwork.

All outdoor ductwork between the unit and the structure should be weather proofed after installation is completed.

Note: *For sound consideration, cut only the holes in the roof deck for the ductwork penetrations. Do not cut out the entire roof deck within the curb perimeter.*

If a Curb Accessory Kit is not used:

a. The ductwork can be attached directly to the factory-provided flanges around the unit's supply and return air openings. Be sure to use flexible duct connections at the unit.

b. For "built-up" curbs supplied by others, gaskets must be installed around the curb perimeter flange and the supply and return air opening flanges.

General Unit Requirements

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

The checklist listed below is a summary of the steps required to successfully install a commercial unit. This checklist is intended to acquaint the installing personnel with what is required in the installation process. It does not replace the detailed instructions called out in the applicable sections of this manual.

- Check the unit for shipping damage and material shortage; file a freight claim and notify appropriate sales representative.
- Verify correct model, options and voltage from nameplate.
- Verify that the installation location of the unit will provide the required clearance for proper operation.
- Assemble and install the roof curb (if applicable). Refer to the latest edition of the curb installers guide that ships with each curb kit.
- Fabricate and install ductwork; secure ductwork to curb.
- Rigging the unit.
- Set the unit onto the curb; check for levelness.
- Ensure unit-to-curb seal is tight and without buckles or cracks.
- Install and connect a condensate drain line to the evaporator drain connection.

Factory Installed Economizer

- Ensure the standard economizer has been pulled out into the operating position. Refer to the economizer Installation Instructions for proper setup.

Note: *Low Leak Economizers do not pull out. Refer to Low Leak Economizers Installation Instructions for proper setup.*

- Install all access panels.

Main Electrical Power Requirements

- Verify that the power supply complies with the unit nameplate specifications.
- 208VAC units are factory wired for 230VAC. Line side wiring on TNS1 and TNS3 will need to be moved from 230V terminal to 208V terminal. Factory powered convenience outlets also need to be configured. Please see Powered Convenience Outlet Powered Option (FIYCOPO) section of this document.
- Inspect all control panel components; tighten any loose connections.
- Connect properly sized and protected power supply wiring to a field-supplied/ installed disconnect switch and to the main power terminal block (HTB1) in the unit control panel.
- Install proper grounding wires to an earth ground.

Note: *All field-installed wiring must comply with NEC and applicable local codes.*

Electric Heat Requirements

- Verify that the power supply complies with the electric heater specifications on the unit and heater nameplate.
- Inspect the heater junction box and control panel; tighten any loose connections.
- Check electric heat circuits for continuity.
- Low Voltage Wiring (AC and DC) Requirements
- Install the zone thermostat, with or without switching subbase.
- Connect properly sized control wiring to the proper termination points between the zone thermostat and the unit control panel.

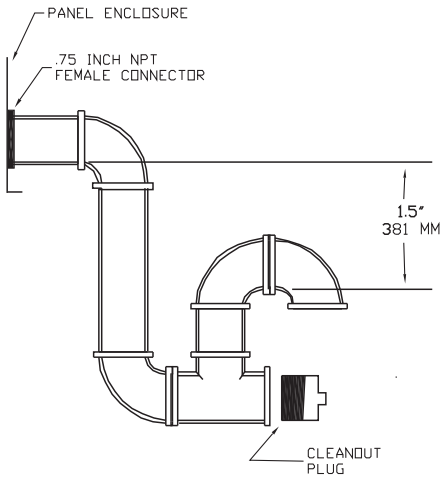
Condensate Drain Configuration

An evaporator condensate drain connection is provided on each unit. Refer to "Unit Dimensions," p. 12 for the appropriate drain location.

A condensate trap must be installed at the unit due to the drain connection being on the "negative pressure" side of the fan. Install the P-Trap using the guidelines in Figure 12.

A condensate drain line must be connected to the P-Trap. Pitch the drain lines at least ½-inch for every 10 feet of horizontal run to assure proper condensate flow. Do not allow the horizontal run to sag causing a possible double-trap condition which could result in condensate backup due to "air lock".

Figure 12. Condensate trap installation



Filter Installation

Each unit ships with 2-inch filters installed. The quantity of filters is determined by unit size. Access to the filters is obtained by removing the indoor fan access panel. If included, pull on filter removal tool to remove filters.

Refer to the unit Service Facts (shipped with each unit) for filter requirements.

Note: *Do not operate the unit without filters.*

Field Installed Power Wiring

An overall dimensional layout for the standard field installed wiring entrance into the unit is illustrated in "Unit Dimensions," p. 12. To insure that the unit's supply power wiring is properly sized and installed, follow the guidelines outlined below.

Note: *All field installed wiring must conform to NEC guidelines as well as state and Local codes.*

Verify that the power supply available is compatible with the unit's nameplate ratings. The available supply power must be within 10 percent of the rated voltage stamped on the nameplate. Use only copper conductors to connect the power supply to the unit.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

Note: *If the unit is not equipped with an optional factory installed nonfused disconnect switch or circuit breaker, a field supplied disconnect switch must be installed at or near the unit in accordance with the National Electrical Code (NEC latest edition).*

Main Unit Power

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

Standard Wiring

The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements.

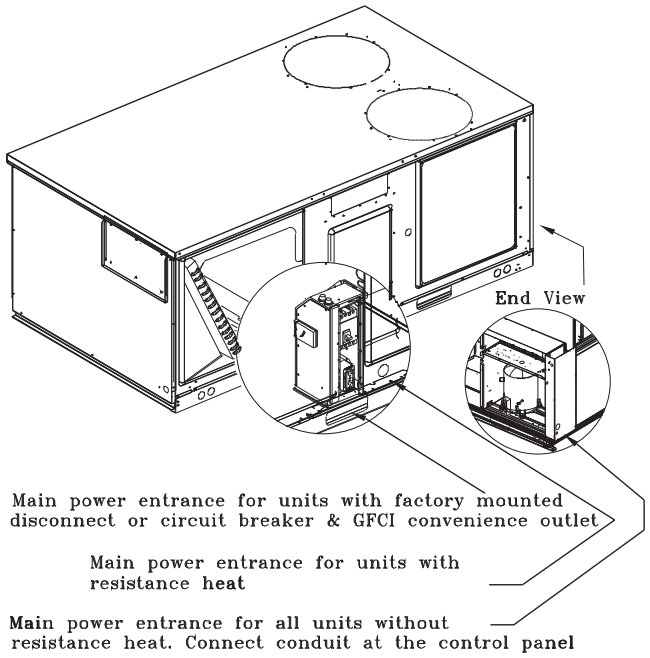
Protection devices must be sized according to the electrical data on the nameplate.

- If the unit is not equipped with an optional factory installed nonfused disconnect switch or circuit breaker, a field supplied disconnect switch must be installed at or near the unit in accordance with the National Electrical Code (NEC latest edition).
- Location of the applicable electrical service entrance is illustrated in "Unit Dimensions," p. 12. Complete the unit's power wiring connections onto either; the main terminal block HTB1 inside the unit control panel, the factory mounted nonfused disconnect switch (UCD) or circuit breaker (UCB), or the electric heat terminal block. Refer to the customer connection diagram that shipped with the unit for specific termination points.
- Provide proper grounding for the unit in accordance with local and national codes.

Optional TBUE Wiring (Through the Base Electrical Option)

- Location of the applicable electrical service is illustrated below. Refer to the customer connection diagram that is shipped with the unit for specific termination points. The termination points, depending on the customer option selected would be a factory mounted nonfused disconnect switch (UDC) or circuit breaker (UCB).
- Provide proper grounding for the unit in accordance with local and national codes.

Figure 13. Through the base electrical option



Field Installed Control Wiring

An overall layout of the various control options available with the required number of conductors for each control device is illustrated in Figure 18, p. 24.

Note: *All field wiring must conform to NEC guidelines as well as state and local codes.*

Control Power Transformer

The 24-volt control power transformers are to be used only with the accessories called out in this manual. Transformers rated greater than 50 Vac are equipped with internal circuit breakers. If a circuit breaker trips, turn "Off" all power to the unit before attempting to reset it.

The transformer is located in the control panel. The circuit breaker is located on the left side of the transformer and can be reset by pressing in on the black reset button.

Controls using 24 Vac

Before installing any connecting wiring, refer to "Unit Dimensions," p. 12 for the electrical access locations provided on the unit and Table 3, p. 22 for AC conductor sizing guidelines.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

1. Use copper conductors unless otherwise specified.
2. Ensure that the AC control wiring between the controls and the unit's termination point does not exceed three (3) ohms/conductor for the length of the run.

Note: *Resistance in excess of 3 ohms per conductor could cause component failure due to insufficient AC voltage supply.*

3. Be sure to check all loads and conductors for grounds, shorts, and mis-wiring.
4. Do not run the AC low voltage wiring in the same conduit with the high voltage power wiring.
5. Route low voltage wiring per illustrations on the next page.

Table 3. Electromechanical thermostat 24 Vac conductors with ReliaTel™

Distance from Unit to Control	Recommended Wire Size
000–460 feet	18 gauge
000–140 m	0.75 mm^2
461–732 feet	16 gauge

Controls using DC Analog Input/Outputs (Standard Low Voltage Multiconductor Wire)

Before installing any connecting wiring between the unit and components utilizing a DC analog input\output signal, refer to "Unit Dimensions," p. 12 for the electrical access locations provided on the unit.

1. Table 4 lists the conductor sizing guidelines that must be followed when interconnecting the DC binary output devices and the system components utilizing a DC analog input\output signal to the unit.

Note: *Resistance in excess of 2.5 ohms per conductor can cause deviations in the accuracy of the controls.*

2. Ensure that the wiring between controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.
3. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires

Table 4. Zone sensor module wiring

Distance from Unit to Control	Recommended Wire Size
0–150 feet (0–45.7 m)	22 gauge (0.33 mm^2)
151–240 feet (46–73.1 m)	20 gauge (0.50 mm^2)
241–385 feet (73.5–117.3 m)	18 gauge (0.75 mm^2)
386–610 feet (117.7–185.9 m)	16 gauge (1.3 mm^2)
611–970 feet (186.2–295.7 m)	14 gauge (2.0 mm^2)

Figure 14. ReliaTel™ options module

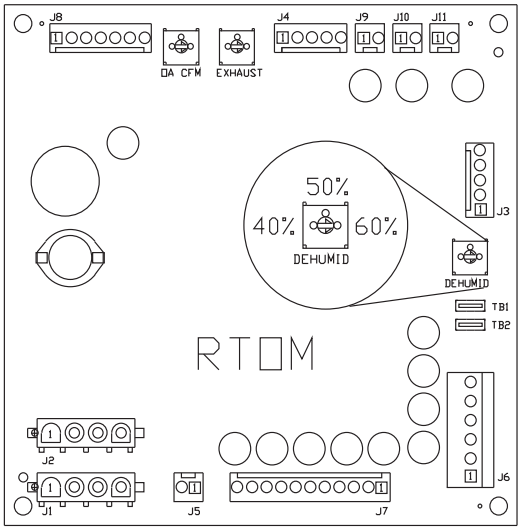


Figure 15. ReliaTel conventional thermostat field wiring diagram

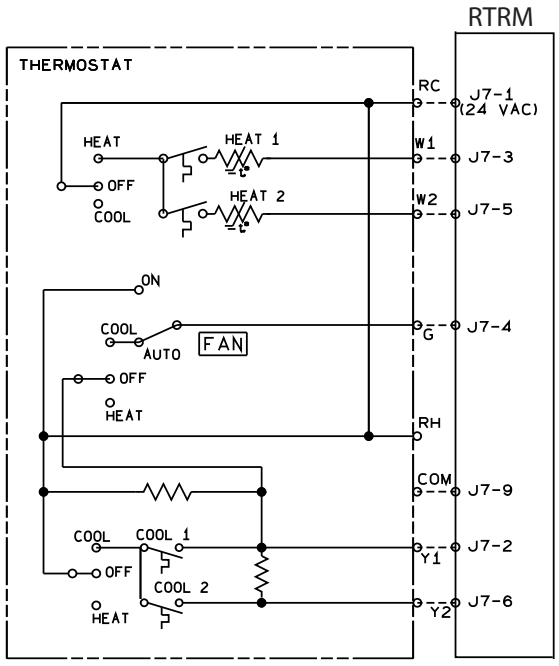


Figure 16. ReliaTel relative humidity sensor (dehumidification option)

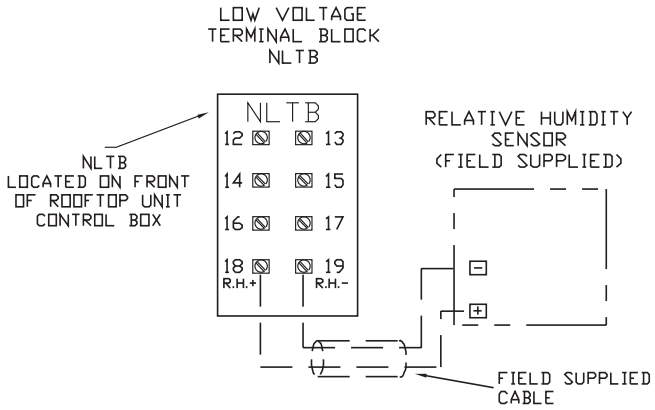


Figure 17. ReliaTel humidistat (dehumidification option)

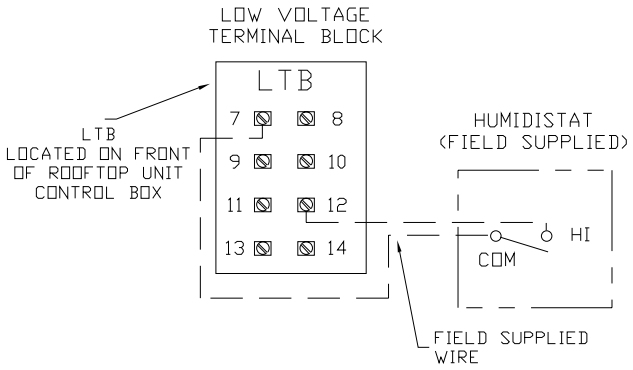
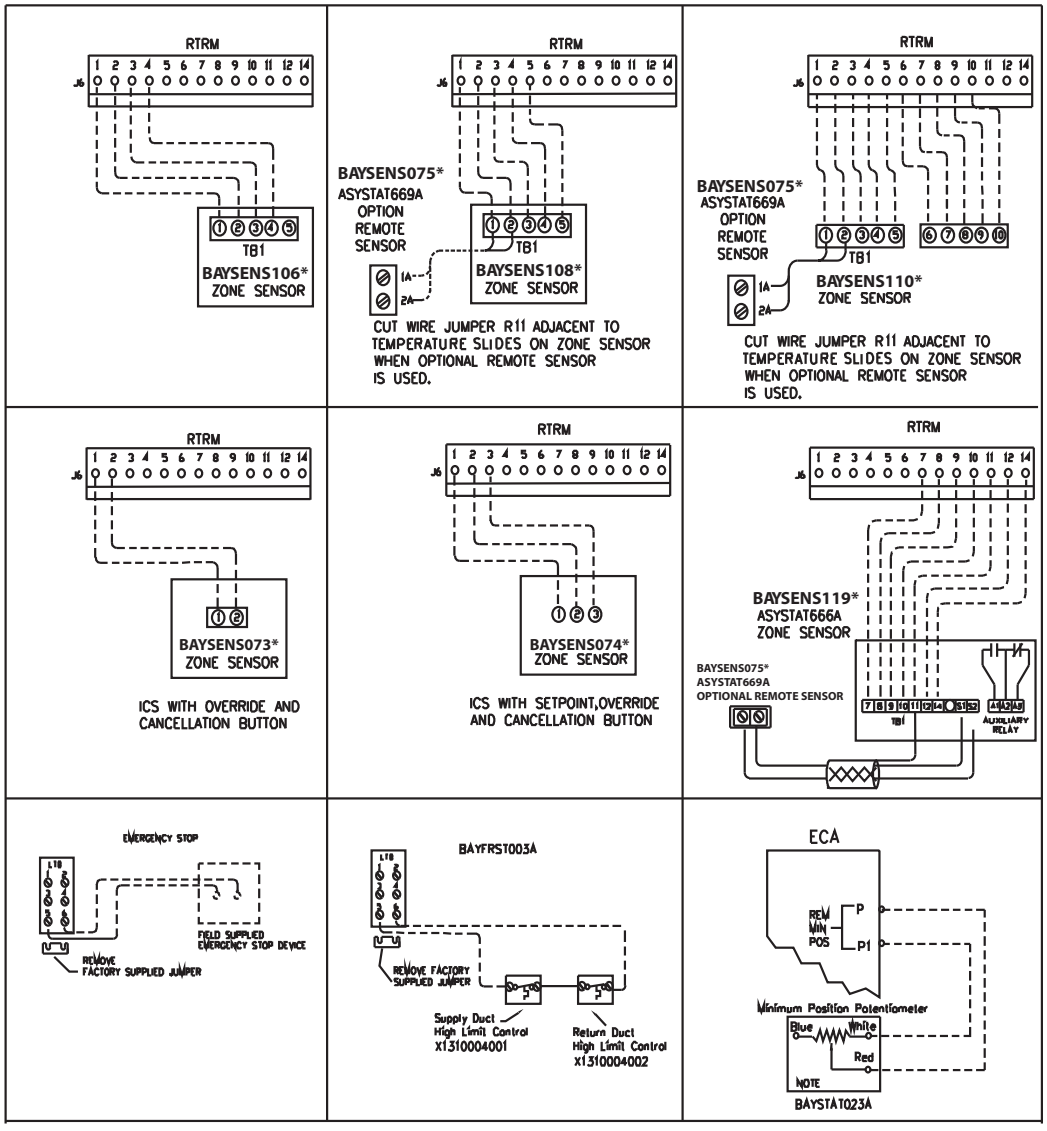
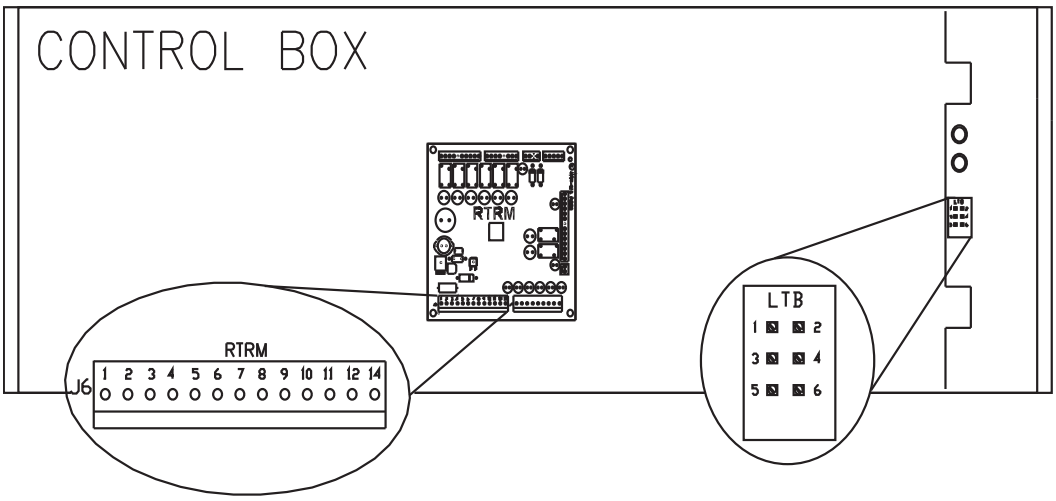


Figure 18. Typical field wiring diagrams for optional controls (ReliaTel only)





Space Temperature Averaging

Space temperature averaging is accomplished by wiring a number of remote sensors in a series/parallel circuit.

Using the BAYSENS016* or BAYSENS077*, at least four sensors are required to accomplish space temperature averaging.

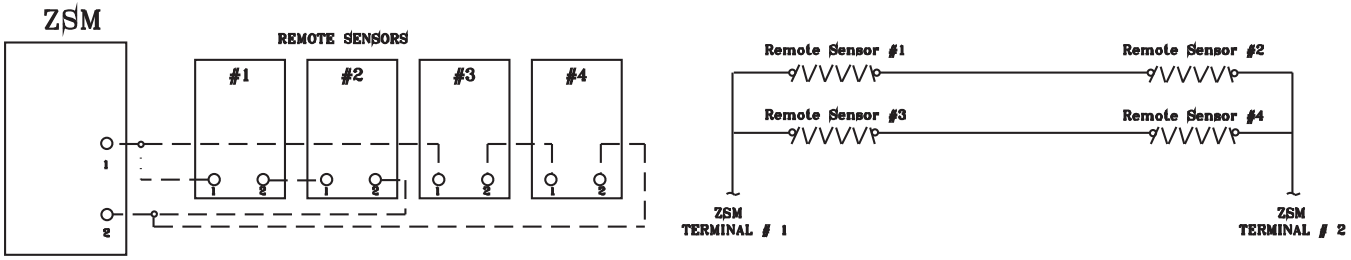
Example #1 illustrates two series circuits with two sensors in each circuit wired in parallel. The square of any number of remote sensors required. Example #2 illustrates three sensors squared in a series/parallel circuit. Example #3 illustrates the circuit required for this senor. Table 5 lists the temperature versus resistance coefficient for all sensing.

Table 5. Temperature vs. resistance

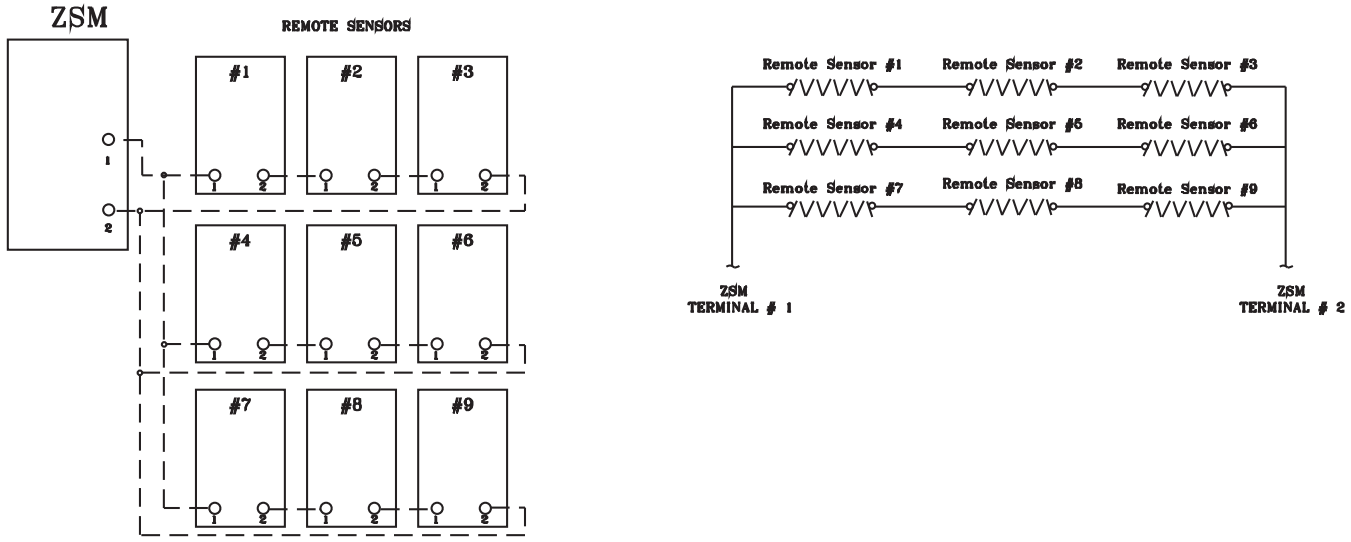
Degrees		Nominal Resistance (K-Ohms)
°F	°C	
-20	-28.9	170.1
-15	-26.1	143.5
-10	-23.3	121.4
-5	-20.6	103.0
0	-17.8	87.56
5	-15.0	74.65
10	-12.2	63.80
15	-9.4	54.66
20	-6.7	46.94
25	-3.8	40.40
30	-1.1	34.85
35	1.7	30.18
40	4.4	26.22
45	7.2	22.85
50	10.0	19.96
55	12.8	17.47
60	15.6	15.33
65	18.3	13.49
70	21.1	11.89
75	23.9	10.50
80	26.7	9.297
85	29.4	8.247
90	32.2	7.330
95	35.0	6.528
100	37.8	5.824

Table 6. Space temperature averaging examples

EXAMPLE #1



EXAMPLE #2



EXAMPLE #3

Table 7. Gas heater operating data

Heating Input Rate—Btu/h[a]	135,000	205,000
Minimum Supply Gas Pressure Natural/ LP	3.5" w.c./ 8.0" w.c.	
Manifold Gas Pressure[b]	-0.2" w.c	
Combustion Blower Suction Pressure (1st Stage)	-2.1 to -3.1" w.c.	-0.8 to -1.2" w.c.
(With Gas Valve Closed) (2nd Stage)	N/A -2.1 to	-3.1" w.c.
Minimum Flame Sensing Current [c]	5.0 Microamps D.C.	
Normal Sensing Current Range	8.0 to 16.0 Microamps D.C.	
Flue Gas Temperature Rise Above Ambient	400°F to 500°F	350°F to 475°F
Flue Gas Content - %CO_2	8.3 to 9.5	8.0 to 9.0
Natural LP	9.5 to 10.5	
Minimum Supply Air Temperature Across Heat Exchanger	40°F	

(a) For 50 Hertz applications, multiply rated Btu/h by 83 percent.
(b) Staged gas heat units have a negative pressure gas valve. Never adjust the staged gas pressure valve to a positive pressure.
(c) A voltage reading across pens (V+) & (V-) is equatable to the flame sensing current. One volt equals one micro amp.

Table 8. Piping

Length of Pipe (ft)	Iron Pipe Size (IPS) Inches				
	½" Pipe	¾" Pipe	1" Pipe	1¼" Pipe	1½" Pipe
15	76	176	345	750	1220
30	52	120	241	535	850
45	43	99	199	435	700
60	38	86	173	380	610
75	-	77	155	345	545

Note: Capacity of Pipe of Different Diameters and Lengths in Cu. Ft. Per Hr. with Pressure Drop of 0.3" and Specific Gravity of 0.60

Table 9. Specific gravity multipliers

Specific Gravity	Multipliers
0.50	1.10
0.55	1.04
0.60	1.00
0.65	0.96

Figure 19. Schematic diagram for field gas piping to units

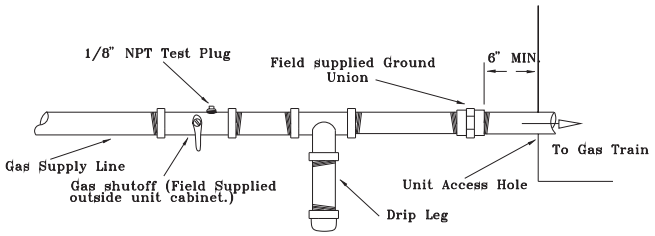
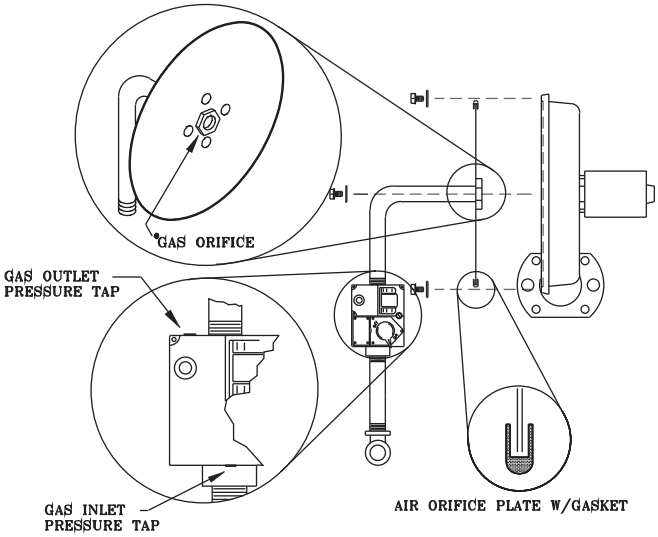


Figure 20. Typical unit gas train configuration



Use the following checklist in conjunction with the general checklist ("General Unit Requirements," p. 19) to ensure that the unit is properly installed and ready for operation.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

- Check all electrical connections for tightness and "point of termination" accuracy.
- Verify that the condenser airflow will be unobstructed.
- Verify that the condenser fan and indoor blower turn freely without rubbing and are properly tightened on the shafts.
- Check the supply fan belts for proper tension and the fan bearings for sufficient lubrication. If the belts require adjustment, or if the bearings need lubricating, refer to the maintenance section of this manual for instructions.
- Verify that a condensate trap is installed and the piping is properly sized and pitched.
- Verify that the correct size and number of filters are in place.
- Inspect the interior of the unit for tools and debris and install all panels in preparation for starting the unit.

Voltage Imbalance

Three phase electrical power to the unit must meet stringent requirements for the unit to operate properly. Measure each leg (phase-to-phase) of the power supply.

Each reading must fall within the utilization range stamped on the unit nameplate. If any of the readings do not fall within the proper tolerances, notify the power company to correct this situation before operating the unit.

Excessive three phase voltage imbalance between phases will cause motors to overheat and eventually fail.

The maximum allowable voltage imbalance is 2 percent. Measure and record the voltage between phases 1, 2, and 3 and calculate the amount of imbalance as follows:

% Voltage Imbalance =

$$\frac{100 \text{ X AV - VD}}{\text{AV}}$$ where;

AV (Average Voltage) =

$$\frac{\text{Volt 1 + Volt 2 + Volt 3}}{3}$$

- V1, V2, V3 = Line Voltage Readings
- VD = Line Voltage reading that deviates the farthest from the average voltage.

Example: If the voltage readings of the supply power measured 221, 230, and 227, the average volts would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ Avg.}$$

- VD (reading farthest from average) = 221
- The percentage of Imbalance equals:

$$\frac{100 \text{ X } 226 - 221}{226} = 2.2\%$$

The 2.2 percent imbalance in this example exceeds the maximum allowable imbalance of 2.0 percent. This much imbalance between phases can equal as much as a 20 percent current imbalance with a resulting increase in motor winding temperatures that will decrease motor life.

If the voltage imbalance is over 2 percent, notify the proper agencies to correct the voltage problem before operating this equipment.

Electrical Phasing (Three Phase Motors)

The compressor motor(s) and the supply fan motor are internally connected for the proper rotation when the incoming power supply is phased as A, B, C.

Proper electrical supply phasing can be quickly determined and corrected before starting the unit by using an instrument such as an Associated Research Model 45 Phase Sequence Indicator and following the steps below:

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

- Turn the field supplied disconnect switch that provides power to the main power terminal block or to the "Line" side of the optional factory mounted disconnect switch to the "Off" position.
- Connect the phase sequence indicator leads to the terminal block or to the "Line" side of the optional factory mounted disconnect switch as follows;

  Black (phase A) to L1

  Red (phase B) to L2

  Yellow (phase C) to L3
- Close the field supplied main power disconnect switch or circuit protector switch that provides the supply power to the unit.

⚠WARNING

Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

- Observe the ABC and CBA phase indicator lights on the face of the sequencer. The ABC indicator light will glow if the phase is ABC. If the CBA indicator light glows, open the disconnect switch or circuit protection switch and reverse any two power wires.
- Restore the main electrical power and recheck the phasing. If the phasing is correct, open the disconnect switch or circuit protection switch and remove the phase sequence indicator.

Compressor Crankcase Heaters

NOTICE:

Compressors Failure!

Unit must be powered and crankcase heaters energized at least 8 hours BEFORE compressors are started. This will protect the compressors from premature failure.

Each compressor can be equipped with a crankcase heater. The proper operation of the crankcase heater is important to maintain an elevated compressor oil

temperature during the "Off" cycle to reduce oil foaming during compressor starts. Oil foaming occurs when refrigerant condenses in the compressor and mixes with the oil. In lower ambient conditions, refrigerant migration to the compressor could increase.

When the compressor starts, the sudden reduction in crankcase pressure causes the liquid refrigerant to boil rapidly causing the oil to foam. This condition could damage compressor bearings due to reduced lubrication and could cause compressor mechanical failures.

Before starting the unit in the "Cooling" mode, set the system switch to the "Off" position and turn the main power disconnect to the "On" position and allow the crankcase heater to operate a minimum of 8 hours.

Before closing the main power disconnect switch, insure that the "System"selection switch is in the "Off" position and the "Fan" selection switch is in the "Auto" position.

Close the main power disconnect switch and the unit mounted disconnect switch, if applicable.

ReliaTel Controls

Upon power initialization, the RTRM performs self-diagnostic checks to insure that all internal controls are functional. It also checks the configuration parameters against the components connected to the system.

The Liteport LED located on the RTRM module is turned "On" within one second of power-up if internal operation is okay.

Use one of the following "Test" procedure to bypass some time delays and to start the unit at the control panel.

Each step of unit operation can be activated individually by temporarily shorting across the "Test" terminals for two to three seconds. The Liteport LED located on the RTRM module will blink when the test mode has been initiated.

The unit can be left in any "Test" step for up to one hour before it will automatically terminate, or it can be terminated by opening the main power disconnect switch. Once the test mode has been terminated, the Liteport LED will glow continuously and the unit will revert to the "System" control.

Three Stage Cooling

T/YH*150, 180, 210, and 240 models have the ability to utilize three stages of cooling when the unit is controlled by a zone sensor. To enable three stages of cooling, connect wires 36BY and 36BZ.

Important: *This is only intended for HIGH EFFICIENCY, SHORT-ORIFICE UNITS. Disconnecting these wires will disable three-stage cooling.*

4 Stages of Cooling (25 Tons)

25 tons high efficiency units have 4 stages of cooling with a single compressor and tandem set (similar to variable speed).

Modulating Gas Heat 5:1 Turndown (Optional)

The set-up required for equipment ordered with modulating gas heat varies based on the control system utilized. Zone sensors, LonTalk, and Comm3/4 do not require additional set-up.

24 volt control systems (thermostats) require setting the desired leaving air temperature. The heat exchanger will modulate to maintain this temperature. Use the following procedure for set-up:

1. Locate the RTOM
2. Locate the "Discharge Air SP" or "OA CFM SP"
3. Adjust the variable resistor to match the desired leaving temperature
   a. Range = 50°F–150°F
      i. Clockwise—Increase Temperature
      ii. Counterclockwise—Decrease Temperature

Factory-Mounted Unit Options

Circuit Breaker (FIYUCB) & Unit Disconnect (FIYUDC)

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

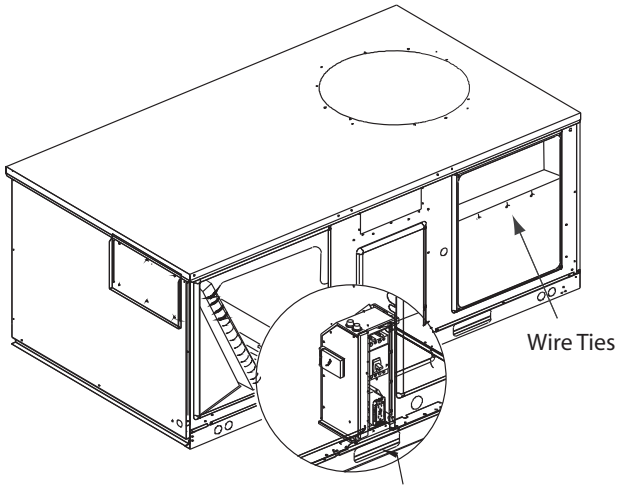
Important: *All phases of this installation must comply with NATIONAL, STATE, and LOCAL CODES. In addition to local codes, the installation must comply with National Electric Code - ANSI/NFPA NO. 70 LATEST REVISION.*

1. Field connections are made by first removing all access panels on the front of the unit. Unscrew the assembly around the outside of the disconnect switch or circuit breaker. This assembly is located between the evaporator and heat section of the unit (Figure 21, p. 30).

   For downflow configurations, the hole in the base section is for both high and low voltage power wiring on down flow units. Horizontal units will route through the front plate located directly under the circuit breaker or disconnect panel. The hole is sized for 1 1/2" conduit. Horizontal units will use the front plate located directly under the circuit breaker panel.
2. If the conduit required for your application is larger, remove the termination plate and connect to the larger hole using field supplied reducing washers.
3. Route the power wires and ground conductor through conduit and into the bottom of the factory installed disconnect switch or circuit breaker. Connect the power conductors to the lugs provided. Connect the ground wire to the unit ground lug.

   Note: *Wire size for the length of run should be determined using the circuit ampacity found on the unit nameplate and the N.E.C.*
4. Route low voltage (class II), control wiring through hole in base of unit but not through high voltage conduit. Feed control wiring through bushing provided on side panel and into the flexible conduit provided in the heat section of the unit (Figure 21). Route wires through loose wire ties provided in unit as in Figure 21.
5. Tighten the wire ties. Secure the excess wire bundle under the wire ties in the outdoor section. Do not leave excess wire in the electrical enclosure. Use the unit wiring diagram to make the low voltage connections.

Figure 21. Main power entrance for units with factory mounted disconnect or circuit breaker



Main power entrance for units with factory mounted disconnect or circuit breaker

Powered and Unpowered Convenience

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

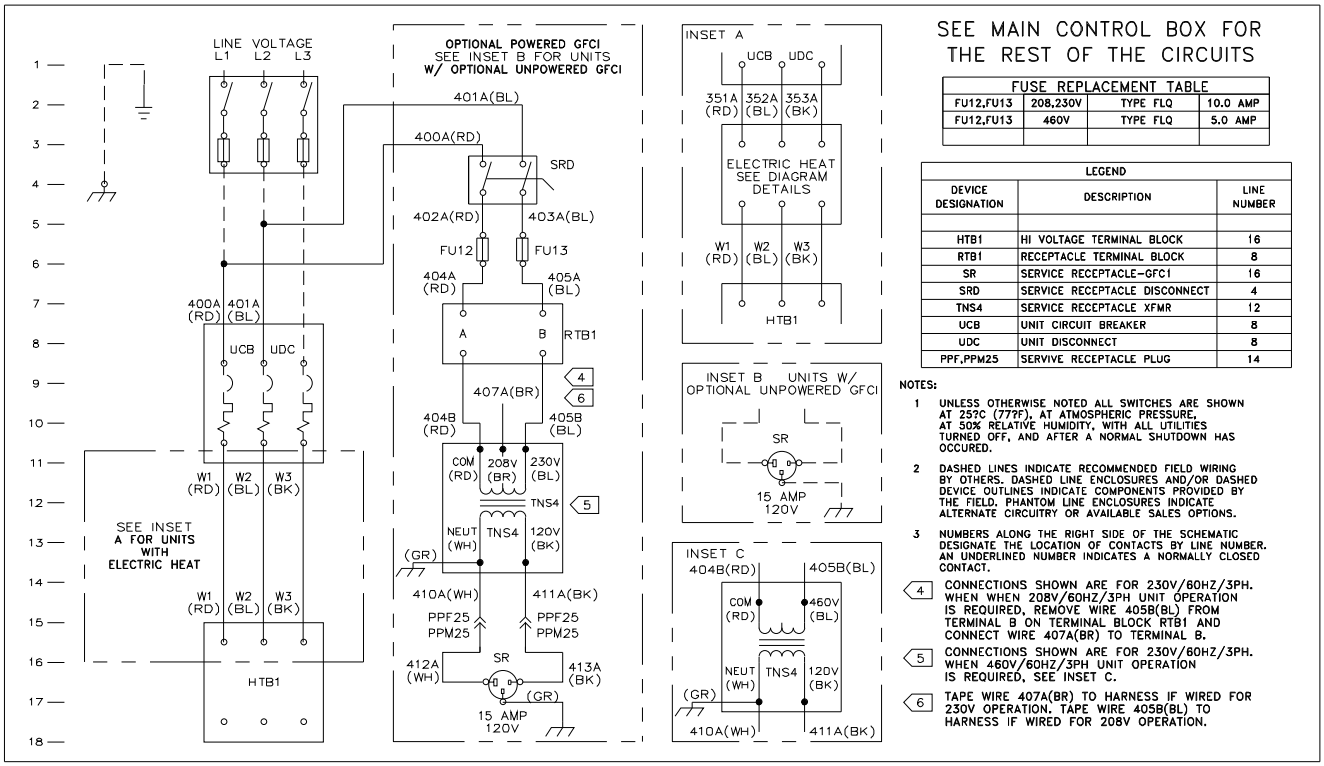
Powered Convenience Outlet Powered Option (FIYCOPO)

When the powered convenience outlet option is installed, the unit will include a dedicated transformer located in the evaporator section of the unit. Additionally, a service receptacle disconnect switch will be provided on the side wall of the evaporator section. The service receptacle switch is shipped in the OFF position.

The powered outlet comes completely wired from the factory except for 208 volt applications.

1. For 208 volt applications, disconnect and tape the blue 230 volt wire.
2. Then connect the brown 208 volt wire.

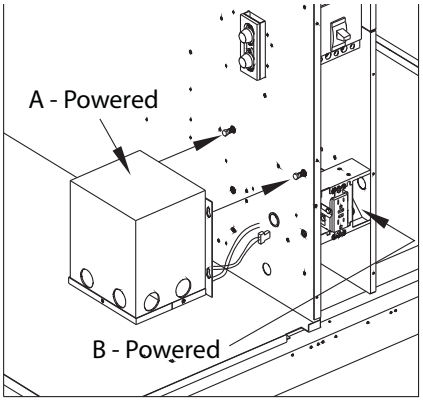
Figure 22. Wiring schematic 12½ through 25 ton options



Unpowered Convenience Outlet Unpowered Option (FIYCOUP)

1. When the unpowered convenience outlet option is installed, remove the receptacle.
2. The field wiring should be routed through the hole in the base for downflow applications or front panel for horizontal applications then through holes provided in the "J" box (bottom for EMT and top for flexible conduit).
3. Connect the three (3) wires to terminals inside outlet box.

Figure 23. Power options



Return Air Smoke Detector

Pre-Requisite

Note: *The following field installation instructions apply to downflow only. Horizontal return air smoke detectors require no field installation.*

When a unit is ordered with a downflow economizer and a return air smoke detector as factory installed options, the return air smoke detector cannot be completely installed because the economizer, when it is in the shipping position, is occupying the space where the return air smoke detector is to be installed.

The partial assembly and set-up required for each factory installed economizer must be completed up to the point where the barometric relief hood is to be installed into the unit. Prior to this operation, go to Step 5 of this instruction and perform the operations described there. After this is completed, the economizer installation is to be completed in its entirety as outlined in the installation guide.

Smoke Detector Installation

Important: *The shipping screw that holds the barometric relief damper must be removed before proceeding with the smoke detector installation.*

After completion of the economizer installation as outlined above, proceed with the installation of the return air smoke detector as follows:

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

1. Remove the smoke detector assembly from its shipping position in the indoor fan compartment. This assembly is attached with three screws to the indoor fan board near the top of the unit.
2. Remove and discard the shipping bracket from the smoke detector assembly. This is the angled piece of sheet metal that secured the smoke detector assembly to the interior parts of the unit during shipment.
3. Place the end of the smoke detector 16 inch metal exhaust tube provided into the bottom hole in the back of the smoke detector. Line up the tab in the exhaust tube with one of the slots in the detector and insert the tube until the tube can be rotated. Rotate the tube 45 degrees to lock it in place.

Figure 24. Brackets

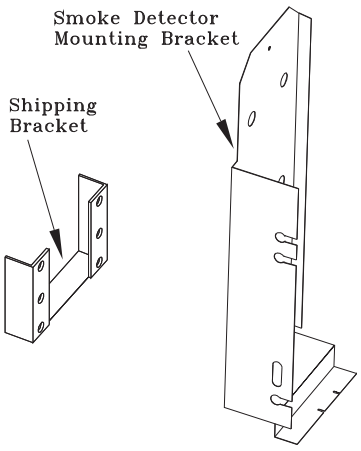
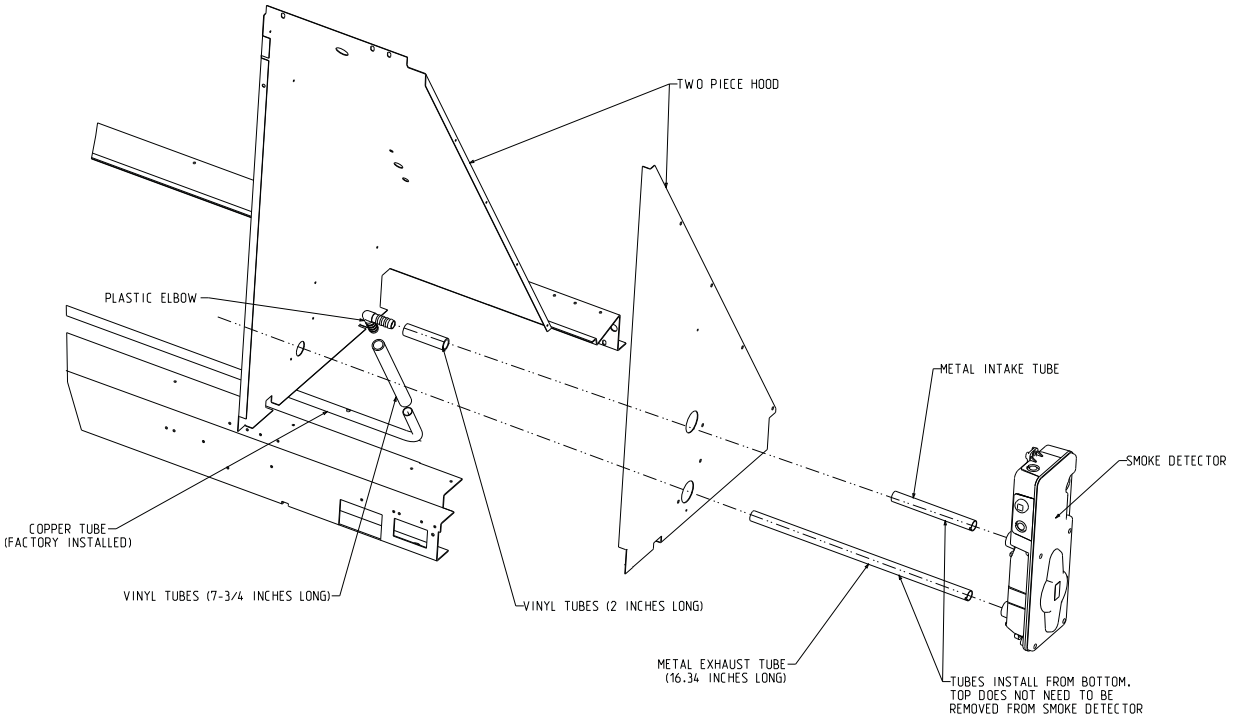


Figure 25. Return air smoke detector for downflow units



4. Slide one 2" piece of the vinyl tubing provided onto the short smoke detector inlet tube which protrudes out of the back side of the smoke detector. Push this piece of vinyl tubing onto the inlet tube until it contacts the end of the plastic extension on the backside of the smoke detector.
5. Slide the long piece of vinyl tubing provided onto one leg of the plastic barbed elbow provided. Slide the other end of this piece of vinyl tubing with the elbow attached approximately 1" onto the end of the copper sampling tube installed in the unit's return air opening. Position the leg of elbow without the vinyl tubing such that it points toward the front side of the unit (directly out of the unit toward the filter access panel).
6. Mount the smoke detector assembly into the unit. Align the smoke detector (exhaust tube down) with the holes in the outer panel of the barometric relief hood and position the smoke detector flush on the panel.

Note: *On all units there is a hole with a plastic snap bushing located on the inner vertical side of the barometric relief hood that the long exhaust tube must pass through. Be sure that the exhaust tube is aligned with this hole before positioning the smoke detector flush on the outer panel of the barometric relief hood.*

7. Secure the smoke detector to the hood with two #10-16 x 3/4' sheet metal screws provided.

Note: *In order to perform the last part of this operation, it will be necessary to remove the barometric relief filter, open the barometric relief damper, and reach inside through the barometric relief outlet to access and connect the copper exhaust elbow to the smoke detector exhaust tube.*

8. Connect the leg of the plastic elbow without the vinyl tubing attached that was installed in Step 5 to the smoke detector inlet tube pushing it onto the piece of vinyl tubing attached to the inlet tube.
9. Refer to Figure 26, p. 34 for wire connections of return air smoke detector to the unit wiring harness.
10. This completes the installation of the return air smoke detector. If the unit's air filter(s) and/or barometric relief filter were removed to ease installation of the smoke detector, they need to be replaced at this time.

Airflow & Sampling

Refer to the instructions provided below regarding unit airflow to assure that the return air smoke detector will function properly.

Important: *The return air smoke detector is designed to shut off the unit if smoke is sensed in the return air stream. This function is performed by sampling the airflow entering the unit at the return air opening. Observe the following instructions to assure the airflow through the unit is sufficient for adequate sampling. Failure to follow these instructions will prevent the smoke detector from performing its design function.*

In order for the return air smoke detector to properly sense smoke in the return air stream, the air velocity entering the unit must be between 500 and 4000 feet per minute. Most models of equipment covered by this instruction will develop an airflow velocity that falls within these limits over the entire airflow range specified in the evaporator fan performance tables.

Certain models, however, if operated at low airflow, will not develop an air velocity that falls within the required 500 to 4000 feet per minute range. For these models, the design airflow shall be greater than or equal to the minimum specified in Table 10.

Table 10. Minimum allowable airflow

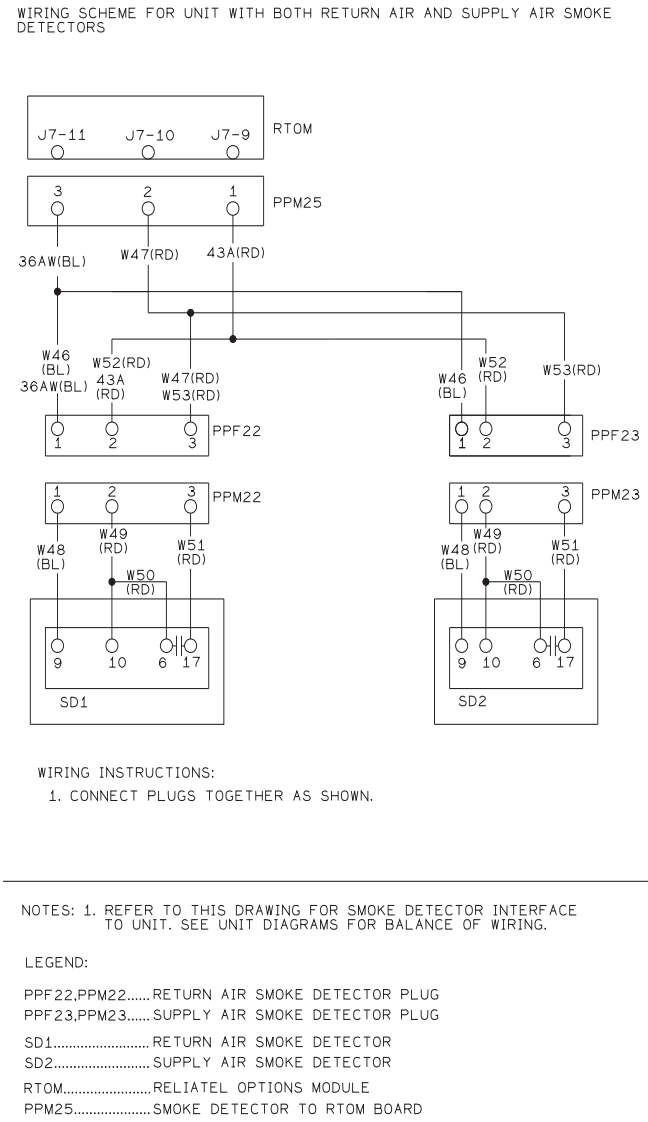
Unit Model Number	Minimum Allowable Airflow with Return Air Smoke Detector
YSD180, YHD180	5300 CFM

Notes:

- *Airflow through the unit is affected by the amount of dirt and debris accumulated on the indoor coil and filters. To insure that airflow through the unit is adequate for proper sampling by the return air smoke detector, complete adherence to the maintenance procedures, including recommended intervals between filter changes and coil cleaning, is required.*
- *Periodic checks and maintenance procedures must be performed on the smoke detector to insure that it will function properly. For detailed instructions concerning these checks and procedures, refer to the appropriate section(s) of the smoke detector Installation and Maintenance Instructions provided with the literature package for this unit.*

Important: *Refer to the service literature provided for testing and other information about the smoke detector or if problems are encountered.*

Figure 26. Smoke detector wiring scheme



Through the Base Gas Utility Option

This section contains the instructions for making field connections to the Through the Base Gas Utility Option. For gas piping, supply, and manifold pressure information see the unit installation, operation, and maintenance guide.

Field Installed Connections

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

Important: *All phases of this installation must comply with NATIONAL, STATE, and LOCAL CODES. In absence of local codes, the installation must conform with American National Standard-Z223.1a- National Fuel Gas Code Latest Revision.*

1. Field connections are made by first removing the access panel for the heat section on the front of the unit, Figure 28.
2. The gas piping assembly ships inside this section and includes the shut-off valve, a pressure tap for testing, and the necessary unions for field connection. For through the base access, remove the factory-provided cap from the base pan opening. See Figure 27.
3. Route field piping through this hole to the dimension shown in Table 11.

⚠WARNING

Outlet Pressure Check Required!

This unit uses a negative pressure gas valve. At start-up, the outlet pressure should be checked and adjusted if required to a negative -0.2 inches of water column. Never adjust the regulator to a positive pressure. Failure to follow instructions could result in death or serious injury or equipment damage.

4. Place the assembly through the cabinet opening as shown in Figure 28 and make the union connection to the field piping and to the gas train. Refer to the unit IOM for checkout procedures.

Table 11. Piping hole dimension

Model	Dimension
YS*150-300, YH*150-300	1 3/16"

Figure 27. Through the base opening

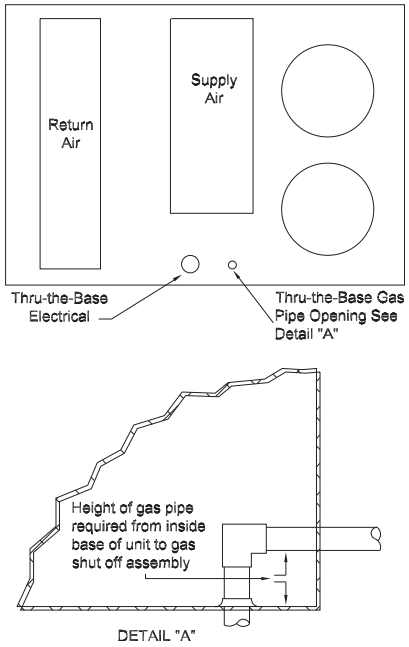
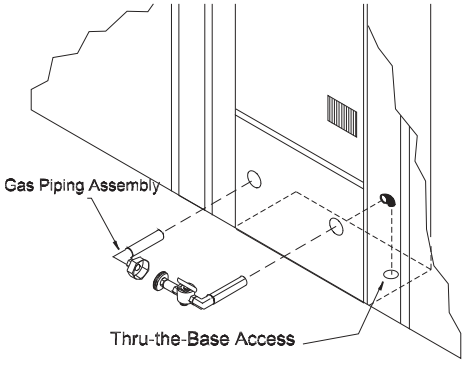


Figure 28. Gas piping



Pre Start

Test Modes

There are three methods in which the "Test" mode can be cycled at LTB-Test 1 and LTB-Test 2.

1. Step Test Mode—This method initiates the different components of the unit, one at a time, by temporarily shorting across the two test terminals for two to three seconds.
   For the initial start-up of the unit, this method allows the technician to cycle a component "On" and have up to one hour to complete the check.
2. Resistance Test Mode—This method can be used for start-up providing a decade box for variable resistance outputs is available. This method initiates the different components of the unit, one at a time, when a specific resistance value is placed across the two test terminals. The unit will remain in the specific test mode for approximately one hour even though the resistance is left on the test terminals.
3. Auto Test Mode—This method is not recommended for start-up due to the short timing between individual component steps. This method initiates the different components of the unit, one at a time, when a jumper is installed across the test terminals. The unit will start the first test step and change to the next step every 30 seconds. At the end of the test mode, control of the unit will automatically revert to the applied "System" control method.

For unit test steps, test modes, and step resistance values to cycle the various components, refer to Table 12.

Table 12. Service test guide for component operation

TEST STEP	MODE	Fan	Econ[a]	Comp 1	Comp 2	Heat 1	Heat 2	Ohm
1	Fan	On	Minimum Position Setpoint 0%	Off	Off	Off	Off	2.2K
	Minimum Ventilation	On	Select-able	Off	Off	Off	Off	
2	Economizer Test Open	On	Open	Off	Off	Off	Off	3.3K
3	Cool Stage 1	On	Minimum Position	On[b]	Off	Off	Off	4.7K
4[c]	Cool Stage 2	On	Minimum Position	On[b]	On[b]	Off	Off	6.8K
5[c]	Reheat	On	Minimum	On	On	Off	Off	33K
6[c]	Heat Stage 1	On	Minimum	Off	Off	On	Off	10K
7[c]	Heat Stage 2	On	Minimum	Off	Off	On	On	15K

(a) The exhaust fan will turn on anytime the economizer damper position is equal
(b) The condenser fans will operate any time a compressor is "On."
(c) Steps for optional accessories and non-applicable modes in unit will be skipped.

Verifying Proper Air Flow (Units with Belt Drive Indoor Fan)

Much of the systems performance and reliability is closely associated with, and dependent upon having the proper airflow supplied both to the space that is being conditioned and across the evaporator coil.
The indoor fan speed is changed by opening or closing the adjustable motor sheave.
Before starting the SERVICE TEST, set the minimum position setpoint for the economizer to 0% using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel Control

Using the Service Test Guide in Table 12, momentarily jump across the Test 1 and Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.
Once the supply fan has started, check for proper rotation. The direction of rotation is indicated by an arrow on the fan housing.
With the fan operating properly, determine the total system airflow (cfm):

1. Measure the actual rpm.
2. Measure the amperage at the supply fan contactor and compare it with the full load amp (FLA) rating stamped on the motor nameplate.
   a. Calculate the theoretical bhp:

$$\frac{\text{Actual Motor Amps}}{\text{Motor Nameplate Amps}} \text{ X Motor HP}$$

   b. Using the fan performance tables in the unit Service Facts, plot the actual rpm (Step 1) and the bhp (Step 2a) to obtain the operating cfm.
3. If the required cfm is too low, (external static pressure is high causing motor horsepower output to be below table value):
   a. Relieve supply and/or return duct static.
   b. Change indoor fan speed and repeat Step 1 and Step 2.
4. To increase fan rpm, loosen the pulley adjustment set screw and turn sheave clockwise.
5. To decrease fan rpm, loosen the pulley adjustment set screw and turn sheave counterclockwise.
6. If the required cfm is too high, (external static pressure is low causing motor horsepower output to be above table value), change indoor fan speed and repeat Step 1 and Step 2.
7. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Start Up

Economizer Start-Up

Using the Service Test Guide in Table 12, p. 36, momentarily jump across the Test 1 and Test 2 terminals on LTB1 one-time to start the Minimum Ventilation Test.

1. Set the minimum position setpoint for the economizer to the required percentage of minimum ventilation using the setpoint potentiometer located on the Economizer Control (ECA).

   The economizer will drive to its minimum position setpoint, exhaust fans (if applicable) may start at random, and the supply fan will start when the SERVICE TEST is initiated.

   The Exhaust Fan will start anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.
2. Verify that the dampers stroked to the minimum position.
3. Momentarily jump across the Test 1 and Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component Test is started.
4. Verify that the dampers stroked to the full open position.
5. To stop the SERVICE TEST, turn the main power disconnect switch to the “Off” position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Compressor Start-Up

1. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. Refer to the refrigerant circuit illustration in the Service Facts.

   Using the Service Test Guide in Table 12, p. 36, continue the Service Test start-up procedure for each compressor circuit.

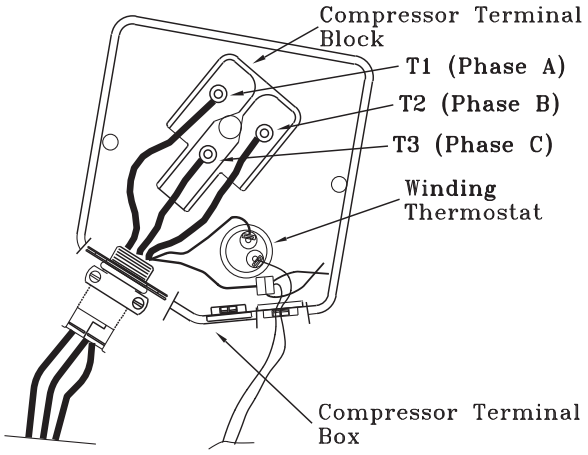
   Momentarily jump across the Test 1 and Test 2 terminals on LTB1 one additional time if continuing from previous component start-up or until the desired startup component Test is started.

   Scroll Compressors

   a. Once each compressor has started, verify that the rotation is correct. If wired correctly the suction pressure should drop and the discharge pressure should rise. If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed.

   b. If the electrical phasing is correct, before condemning a compressor, interchange any two leads (at the compressor Terminal block) to check the internal phasing. Refer to the following illustration for the compressor terminal/phase identification. Do not allow the compressor to operate backwards for more than 5 seconds. Operation for a period of time longer than this will result in compressor damage. Copeland (Alliance) will experience failure also. If the compressor runs backward for an extended period, the motor winding can overheat and cause the motor winding thermostat to open.

Figure 29. Compressor terminal box



Note: *The Copeland, SSA and SPA scroll compressors for R-410A units use Trane OIL00094. The correct oil for Trane CSHD is Trane OIL00079 or OIL00080. Compressor types are listed in Table 13, p. 37. The appropriate oil charge is listed in Table 14, p. 38.*

Table 13. Compressor types

Tonnage	C1	C2
YS*150	SSA067	SSA054
YH*150	ZP91KCE	ZP38K5E
YH*150 Reheat	ZP67KCE	ZP67KCE
YS*180/155	CSHD105	SPA050 (SPA054 on 380V/60Hz/ 3Ph units only)
YH*180	ZP104KCE	ZP49K5E
YH*180 Reheat	ZP83KCE	ZP83KCE
YS*210/175	CSHD120	SPA044 (SPA054 on 380V/60Hz/ 3Ph units only)
YH*210	ZP122KCE	ZP54K5E
YH*210 Reheat	CSHD089	ZP83KCE
YS*240/200	CSHD142	SSA083
YH*240	CSHD142K*0M	ZP61KCE
YH*240 Reheat	CSHD120	CSHD120
YS*300/250	CSHD120	CSHD120
YH*300	ZPT122K5E	ZP122KCE

Table 14. POE Oil recharge amount (fl. oz.)

Model	C1 25mm/18mm	C2 25mm/18mm
YS*150	56/105.6	62/99.2
YH*150	56	38
YH*150 Reheat	56	56
YS*180/155	112/182.4	62 (62)/96
YH*180	81	38
YH*180 Reheat	56	56
YSH210, YS*175	112/182.4	38 (62)/96
YS*210/175	112	38 (62)
YH*210	81	38
YH*210 Reheat	102	56
YS*240/200	112	56
YH*240	112	38
YH*240 Reheat	112	112
YS*300/250	112	106
YH*300	76[a]	81

(a) This is the total amount for both compressors (38oz per compressor).

2. After the compressor and condenser fan have started and operated for approximately 30 minutes, observe the operating pressures. Compare the operating pressures to the operating pressure curve in the Service Facts.
3. Check system subcooling. Follow the instruction listed on the subcooling charging curve in the Service Facts.
4. Repeat Step 1 through Step 3 for each refrigerant circuit.
5. To stop the SERVICE TEST, turn the main power disconnect switch to the “Off” position or proceed to the next component start-up proc
6. edure. Remove electro mechanical test mode connections (if applicable).

Dehumidification Option

Momentarily jump across the Test 1 and Test 2 terminals of the LTB1 until the unit enters test mode 7. (Table 12, p. 36)

Once the unit is in the reheat test mode, verify that the three-way valve has shifted to the reheat position and that the supply temperature rises 10°F more than when in cooling mode stage 2. Monitor the suction pressure for 15 minutes. The suction pressure should remain within 5 psi of normal cooling operation.

Heating Start-Up

Open the main disconnect switch to shut the unit off and to reset the RTRM.

Follow the Test Guide in Table 12, p. 36 to start the unit in the heating mode. ReliaTel Control Momentarily jump across the Test 1 and Test 2 terminals on LTB1 one additional time if continuing from previous component start-up or until the desired start-up component Test is started.

Note: *At initial start-up modulating gas heat exchangers can produce a resonance that will subside after the break-in period.*

Variable Air Volume Applications (Multi-zone, Traditional VAV)

Traditional VAV Standalone Operation

If a traditional VAV unit is required to operate without ICS, BAS, or other “front end” controller, a jumper must be placed between J6-2 and J6-4 of the RTRM to allow local standalone control.

Supply Air Temperature Control - Occupied Cooling and Heating

The RTRM is designed to maintain a selectable supply air temperature of 40°F to 80°F with a +/- 3.5°F deadband. To reduce the risk of coil freezing, it is not recommended to set the supply air temperature below 50°F. In cooling mode, if the supply air temperature is more than 3.5°F warmer than the selected temperature, a stage of cooling will be turned ‘on’ (if available). Also, if the supply air temperature is more than 3.5°F cooler than the selected temperature, a stage of cooling will be turned ‘off’. At very low airflow, the unit may cycle stages ‘on’ and ‘off’ to maintain an average discharge air temperature outside the 7 degrees deadband.

If the unit has modulating gas heat, it can be made to discharge heating with VAV control. This is done by placing a contact closure across the ‘Changeover Input’ on the RTAM. While in the mode, the unit will heat to the Supply Air Heating Setpoint +/- 3.5°F. During low loads, or low airflow conditions, the actual temperature swing of the discharge air will likely be greater.

The RTRM utilizes a proportional and integral control scheme with the integration occurring when the supply air temperature is outside the deadband. As long as the supply air temperature is within the setpoint deadband, the system is considered to be satisfied and no staging up or down will occur.

Supply Duct Static Pressure Control

The supply duct static pressure is measured by a transducer with a 0.25 to 2.125 Vdc proportional output which corresponds to an adjustable supply duct static pressure of 0.3" w.c. to 2.5" w.c. respectively with a deadband adjustment range from 0.2" w.c. to 1.0" w.c. The setpoint is adjustable on the RTAM Static Pressure Setpoint potentiometer or through ICS.

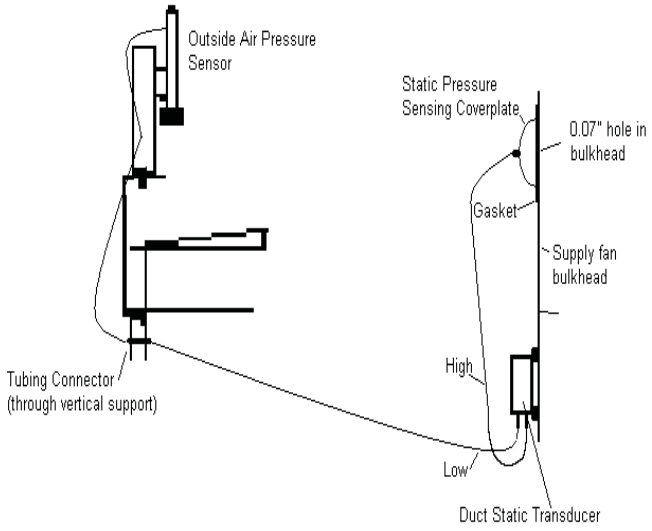
Example:

Supply Duct Static Setpoint = 2.0" w.c.

(RTAM) deadband = 0.2" w.c. (RTAM)

Duct Static Control Range = 1.9" w.c. to 2.1" w.c.

Figure 30. Supply duct static pressure control



VHR Relay Output

For standalone VAV unit operation, the VHR output should be wired to drive VAV boxes to maximum position during all heating modes and unoccupied periods. The VHR contacts are shown in the de-energized position and will switch (energize) during the above mentioned operating modes.

Figure 31. VHR relay output

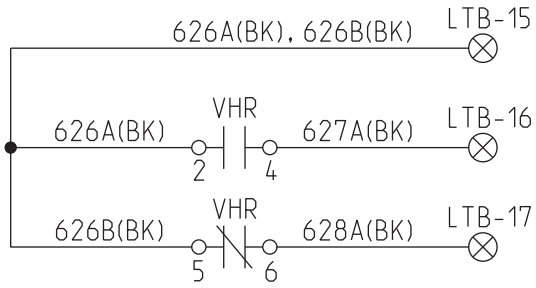


Table 15. Variable air volume mode operation

System Mode		Fan "Auto"	Fan "On"
Heat	DWU Active DWU Off	DWU[2] Off[4]	DWU[2] VAV Heating[4]
Cool		VAV Cooling[1]	VAV Cooling[1]
Auto	DWU Active DWU Off	DWU or Cooling[1,2,3,4] VAV Cooling[1]	DWU or Cooling[1,2,3,4] VAV Cooling or Heating[1]
Off		Off[4]	Off[4]

Notes:
1. If Cooling is selected the supply fan will run continuously. If VAV Heating is activated the supply fan will run continuously.
2. If Daytime Warmup is Activated, the supply fan will run continuously.
3. Auto changeover between Cooling and Daytime Warmup depends upon the DWU initiate setpoint.
4. The fan will be Off any time the system selection switch is "Off".

To configure the proper potentiometer setpoints, connect a multi-meter across the customer connection header (J7) to the pins listed in Table 16 below.

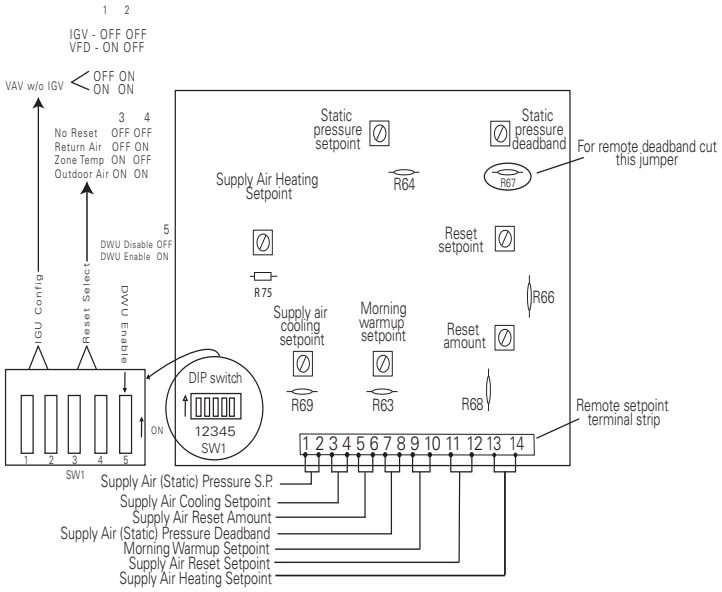
Table 16. VAV setpoints

		Supply Air Cooling Setpoint (J7-3,4)
Resistance (Ohms)	**DC volts**	**Deg F**
240	0.97	50.37
280	1.09	52.30
320	1.21	54.24
360	1.32	56.09
410	1.45	58.18
450	1.55	59.80

		Supply Air Pressure Setpoint (J7-1,2)
Resistance (Ohms)	**DC volts**	**"WC**
100	0.45	0.30
350	1.30	0.98
540	1.75	1.49
730	2.11	2.00
>900	>2.38	2.5

Note: To reduce the risk of coil freezing, it is not recommended to set the supply air temperature setpoint below 50°F.

Figure 32. RTAM module



Final System Set Up

After completing all of the pre-start and start-up procedures outlined in the previous sections (i.e., operating the unit in each of its modes through all available stages of cooling and heating), perform these final checks before leaving the unit:

- Program the Night Setback (NSB) panel (if applicable) for proper unoccupied operation. Refer to the programming instructions for the specific panel.
- Verify that the Remote panel “System” selection switch, “Fan” selection switch, and “Zone Temperature” settings for automatic operation are correct.
- Inspect the unit for misplaced tools, hardware, and debris.
- Verify that all exterior panels including the control panel doors and condenser grilles are secured in place.
- Close the main disconnect switch or circuit protector switch that provides the supply power to the unit’s terminal block or the unit mounted disconnect switch.