Installation

Pre-Installation

⚠WARNING

Fiberglass Wool!

Exposition to glass wool fibers without all necessary PPE equipment could result in cancer, respiratory, skin or eye irritation, which could result in death or serious injury. Disturbing the insulation in this product during installation, maintenance or repair will expose you to airborne particles of glass wool fibers and ceramic fibers known to the state of California to cause cancer through inhalation. You MUST wear all necessary Personal Protective Equipment (PPE) including gloves, eye protection, a NIOSH approved dust/mist respirator, long sleeves and pants when working with products containing fiberglass wool.

Precautionary Measures

- Avoid breathing fiberglass dust.
- Use a NIOSH approved dust/mist respirator.
- Avoid contact with the skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves, and eye protection.
- Wash clothes separately from other clothing: rinse washer thoroughly.
- Operations such as sawing, blowing, tear-out, and spraying may generate fiber concentrations requiring additional respiratory protection. Use the appropriate NIOSH approved respiration in these situations.

First Aid Measures

Eye Contact - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.

Skin Contact - Wash affected areas gently with soap and warm water after handling.

⚠WARNING

Hazardous Voltage!

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

Remove power to the unit and gain access to the electric heat elements by removing the horizontal supply cover. Visually inspect the heater elements for the following:

1. Elements that are no longer secured to the white ceramic insulator.
2. Elements touching each other or touching metal.
3. Severely kinked, drooping, or broken elements.

If an element has detached from its ceramic insulator, carefully put it back into place.

Replace the heater elements if they present symptoms noted in item Step 2 or Step 3 above.

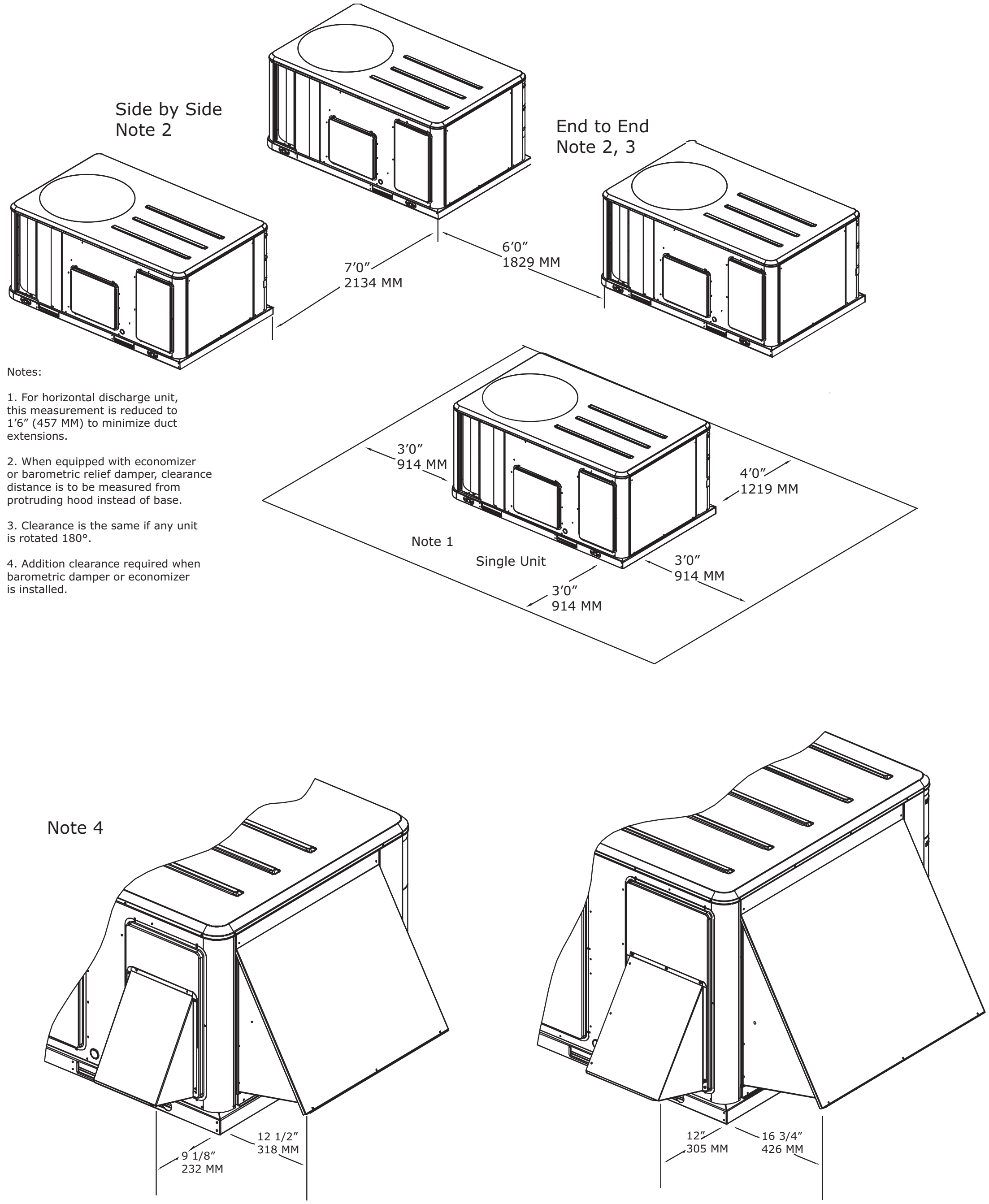
Dimensions and Weights

Unit Clearances

Figure 1, p. 18 illustrates the minimum operating and service clearances for either a single or multiple unit installation. These clearances are the minimum distances necessary to assure adequate serviceability, cataloged unit capacity, and peak operating efficiency.

Providing less than the recommended clearances may result in condenser coil starvation, "short-circuiting" of exhaust and economizer airflows, or recirculation of hot condenser air.

Figure 1. Typical installation clearances for single & multiple unit applications



TSC036-060G & THC036-THC037E Units

TSC072-120H, THC047-072E, THC048-120F Units

⚠WARNING

Heavy Objects!

Failure to follow instructions below or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

⚠WARNING

Improper Unit Lift!

Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.

Figure 2. Corner weights

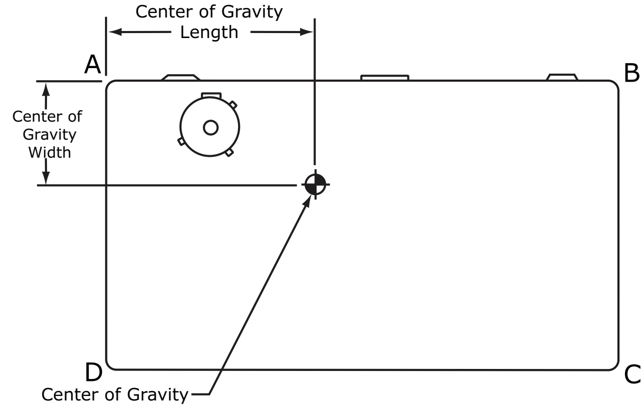


Table 3. Maximum unit & corner weights (lbs) and center of gravity dimensions (in.) - cooling models

	Unit	Maximum Model Weights(a)		Corner Weights(b)				Center of Gravity (in.)	
Tons	Model No.	Shipping	Net	A	B	C	D	Length	Width
3	TSC036G	537	431	201	155	25	50	29	8
4	TSC048G	557	452	213	159	27	53	29	8
5	TSC060G	603	498	218	140	50	90	27	12
6	TSC072H	762	667	218	186	131	132	44	21
7.5	TSC090H	772	679	186	217	106	170	34	21
7.5	TSC092H	940	797	249	235	163	149	46	21
8.5	TSC102H	938	837	273	222	183	159	47	22
10	TSC120H	1058	960	320	218	233	189	40	24
3	THC036E	555	481	157	122	95	107	31	19
4	THC048E	787	692	220	178	132	163	40	23
4	THC048F	737	642	208	177	128	130	44	22
5	THC060E	841	746	241	193	139	173	39	22
5	THC060F	774	679	219	189	135	137	43	21
6	THC072E	943	845	274	172	186	213	41	24
6	THC072F	883	740	228	219	155	138	47	21
6	THC074F	1016	918	309	207	223	178	40	24
7.5	THC092F	1026	928	315	209	224	180	40	24
8.5	THC102F	1035	937	316	212	227	181	49	24
10	THC120F	1326	1132	326	326	258	222	53	27

(a) Weights are approximate.
(b) Corner weights are given for information only.

Figure 3. Rigging and center of gravity

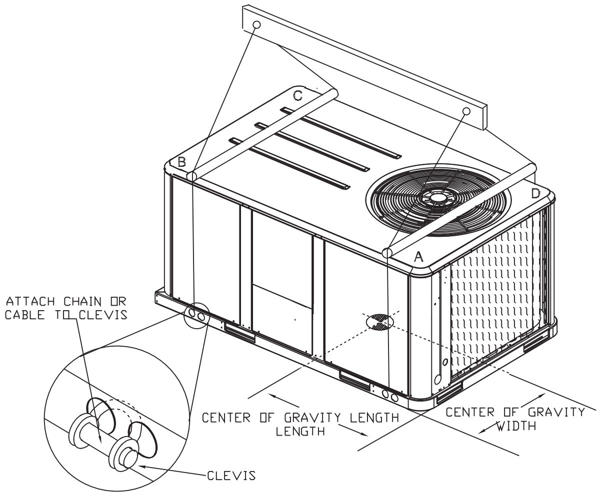
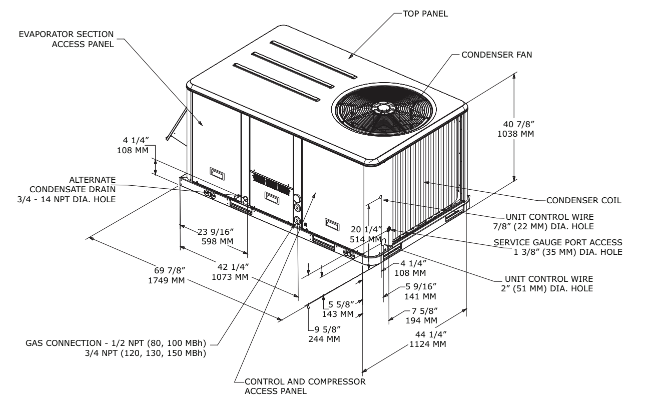


Table 4. Factory installed options (fiops)/accessory net weights (lbs)[(a),(b)]

Accessory	TSC036G-060G THC036E, THC037E Net Weight 3 to 5 Tons	THC047E-067E THC048E-060E THC048F-060F Net Weight 4 to 5 Tons	TSC072H-102H THC072E/F Net Weight 6 to 8.5 Tons	TSC120H THC074F-102F Net Weight 6, 7.5, 8.5, 10	THC120F Net Weight 10
Barometric Relief	7	10	10	10	10
Belt Drive Option (3 phase only)	31	31	—	—	—
Coil Guards	12	20	20	20	30
Economizer	26	36	36	36	36
Electric Heaters[(c)]	15	30	31	44	50
Hinged Doors	10	12	12	12	12
Low Leak Economizer	68	93	93	93	93
Manual Outside Air Damper	16	26	26	26	26
Motorized Outside Air Damper	20	30	30	30	30
Novar Control	8	8	8	8	8
Oversized Motor	5	8	8	—	—
Powered Convenience Outlet	38	38	38	38	50
Powered Exhaust	40	40	80	80	80
Reheat Coil	12[(d)]	14	15	20[(e)]	30
Roof Curb	61	78	78	78	89
Smoke Detector, Supply	5	5	5	5	5
Smoke Detector, Return	7	7	7	7	7
Through-the-Base Electrical	8	13	13	13	13
Through-the-Base Gas	5	5	5	5	5
Unit Mounted Circuit Breaker	5	5	5	5	5
Unit Mounted Disconnect	5	5	5	5	5
460V/575V[(f)]	29	29	—	—	—

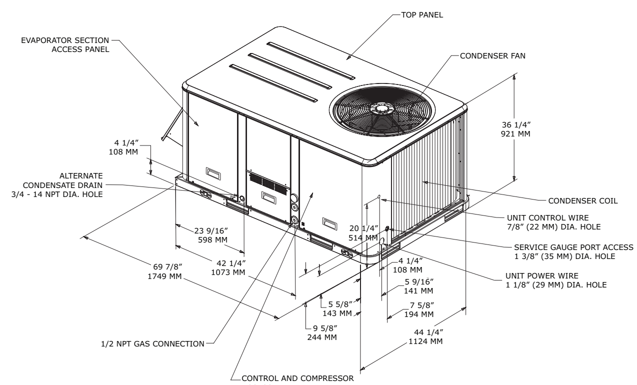
(a) Weights for options not listed are <5 lbs.
(b) Net weight should be added to unit weight when ordering factory-installed accessories.
(c) Applicable to cooling units only.
(d) Reheat weight here is only applicable to THC036E models.
(e) Reheat weight for this value only applicable to 7.5 and 8.5 Ton High Efficiency "F" models.
(f) Apply weight with all 460V and 575V 17 Plus Two-Stage Cooling units.

Figure 4. Cooling and gas/electric — 3 to 5 tons standard efficiency[(a),(b)]



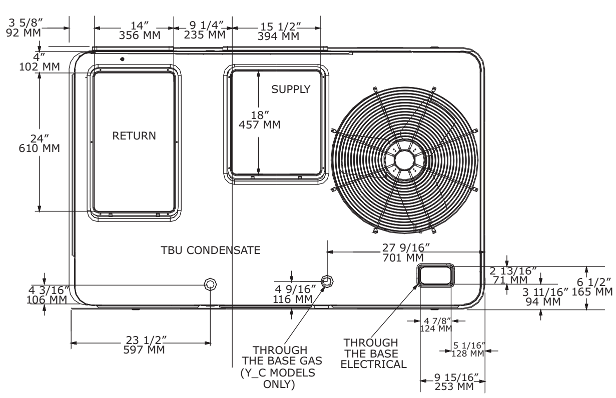
(a) All dimensions are in inches/millimeters.
(b) 1/2 NPT or 3/4 NPT gas connection = (Y_C models only); 2" electrical connection: single point power when heat installed (T_C models only)

Figure 5. Cooling and gas/electric - 3 tons high efficiency[(a),(b)]



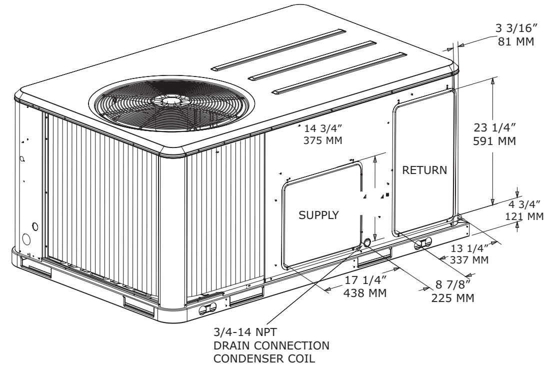
(a) All dimensions are in inches/millimeters.
(b) 1/2 NPT gas connection = (Y_C models only); 2" electrical connection: single point power when heat installed (T_C models only)

Figure 6. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency downflow airflow supply/return— through-the-base utilities[(a)]



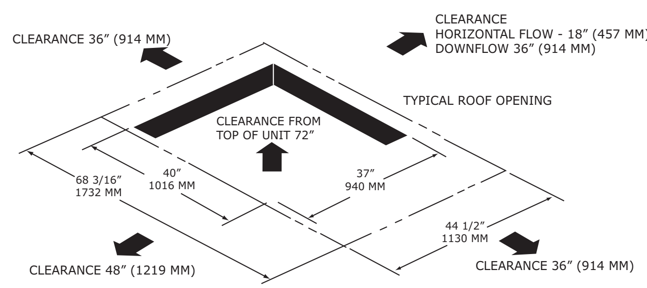
(a) All dimensions are in inches/millimeters.

Figure 7. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency— horizontal airflow supply/return[(a)]



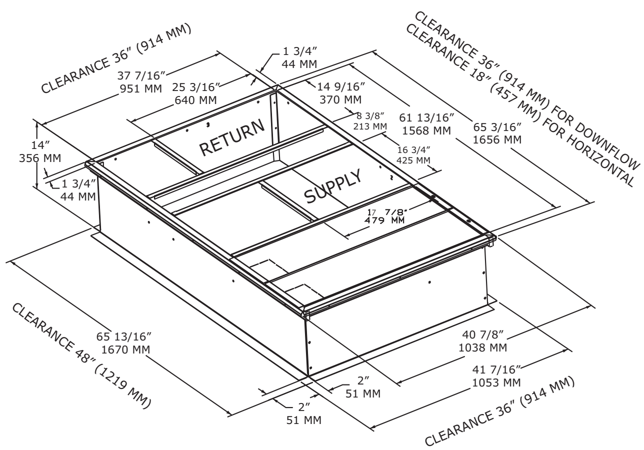
(a) All dimensions are in inches/millimeters.

Figure 8. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency— unit clearance and roof opening[(a)]



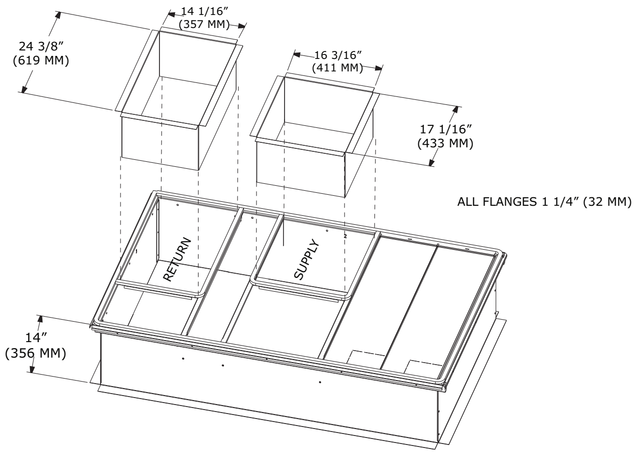
(a) All dimensions are in inches/millimeters.

Figure 9. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency— roof curb[(a)]



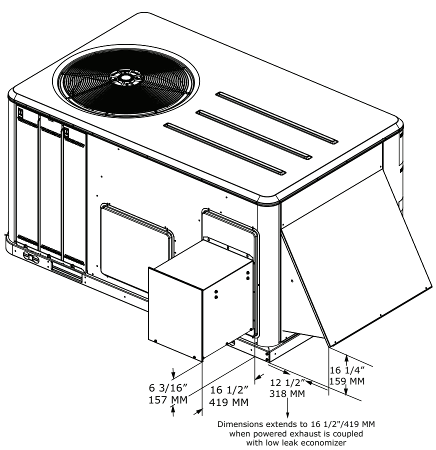
(a) All dimensions are in inches/millimeters.

Figure 10. Cooling and gas/electric —3 to 5 standard efficiency, 3 tons high efficiency — downflow duct connections, field fabricated[a]



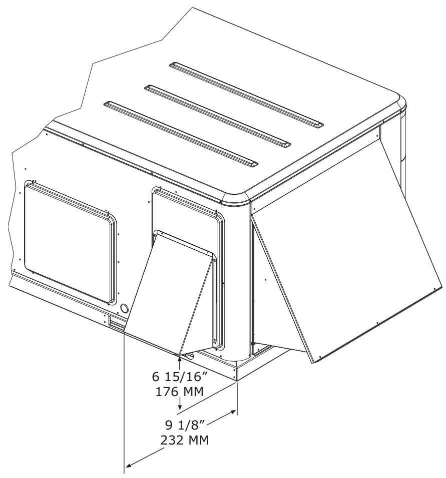
(a) All dimensions are in inches/millimeters.

Figure 11. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency— economizer, manual or motorized fresh air damper, power exhaust[a]



(a) All dimensions are in inches/millimeters.

Figure 12. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency— economizer & barometric relief damper hood[a]



(a) All dimensions are in inches/millimeters.

Figure 13. Cooling and gas/electric —3 to 5 tons standard efficiency, 3 tons high efficiency— swing diameter for hinged door(s) option

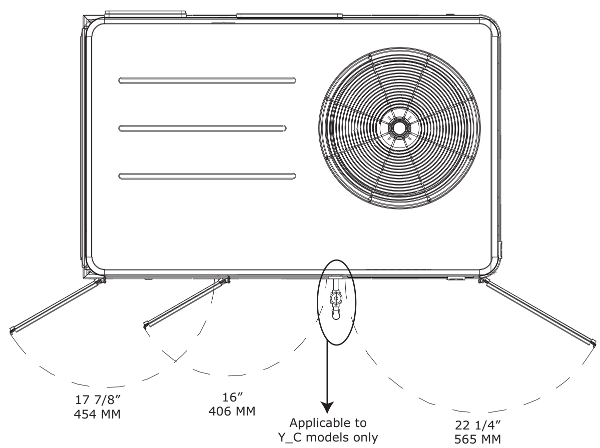
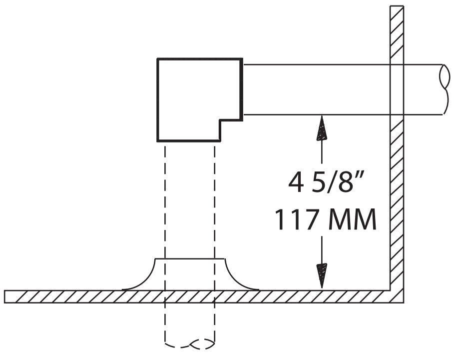
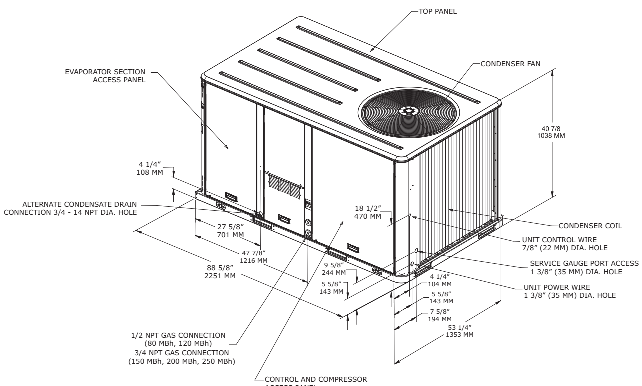


Figure 14. Gas/electric – 3 to 10 tons standard and high efficiency— gas pipe height (Y models only)[(a),(b)]



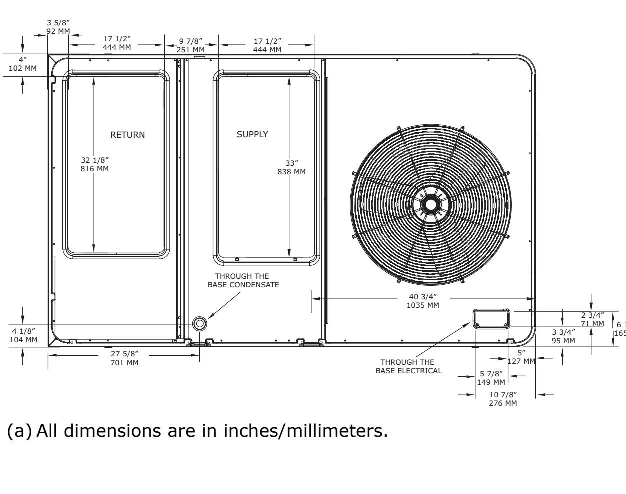
(a) All dimensions are in inches/millimeters.
(b) Height of gas pipe required from inside unit base to gas shut off assembly (factory provided)

Figure 15. Cooling and gas/electric —6, 7.5 (single) tons standard efficiency, 4 to 5 tons high efficiency[(a)]



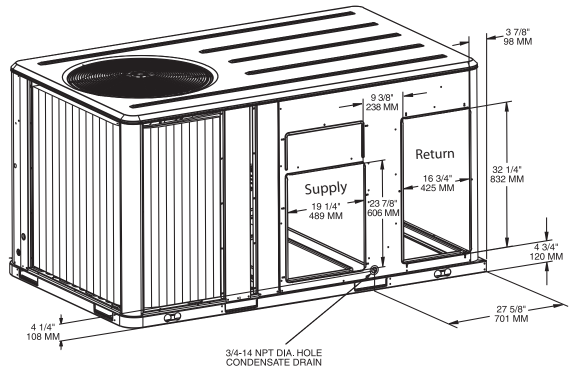
(a) All dimensions are in inches/millimeters.

Figure 16. Cooling and gas/electric — 6 to 10 tons standard efficiency, 4 to 8.5 tons high efficiency—downflow airflow supply/return, through-the-base utilities[(a)]



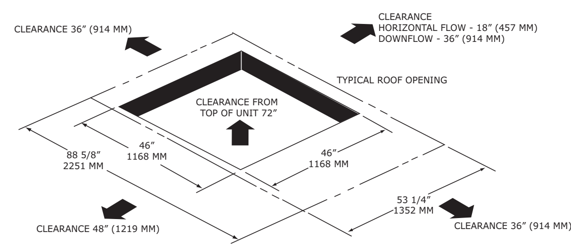
(a) All dimensions are in inches/millimeters.

Figure 17. Cooling and gas/electric — 6 to 10 ton standard efficiency units, 4 to 6 ton high efficiency units, 6(074)-8.5 (microchannel) high efficiency unit—horizontal airflow supply/return[(a)]



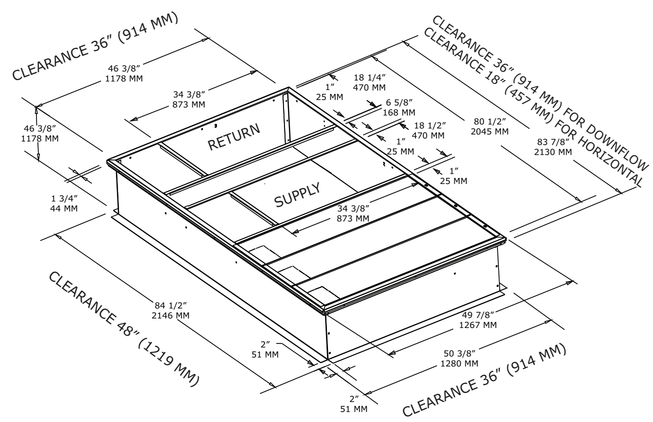
(a) All dimensions are in inches/millimeters.

Figure 18. Cooling and gas/electric —6 to 10 tons standard efficiency, 4 to 8.5 tons high efficiency— unit clearance and roof opening[(a)]



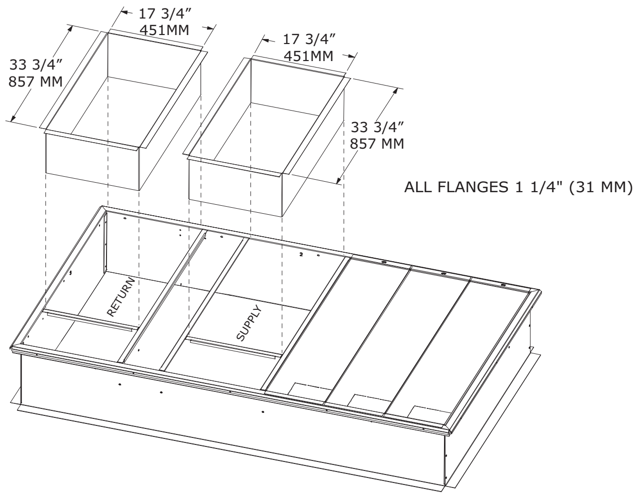
(a) All dimensions are in inches/millimeters.

Figure 19. Cooling and gas/electric —6 to 10 tons standard efficiency, 4 to 8.5 tons high efficiency— roof curb[(a)]



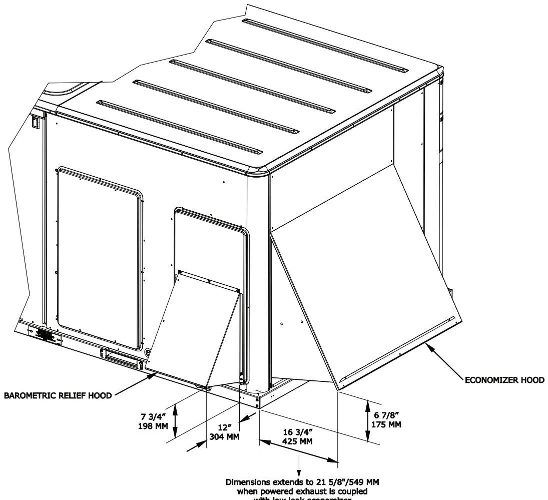
(a) All dimensions are in inches/millimeters.

Figure 20. Cooling and gas/electric —6 to 10 tons standard efficiency, 4 to 10 tons high efficiency— downflow duct connections, field fabricated[(a),(b),(c)]



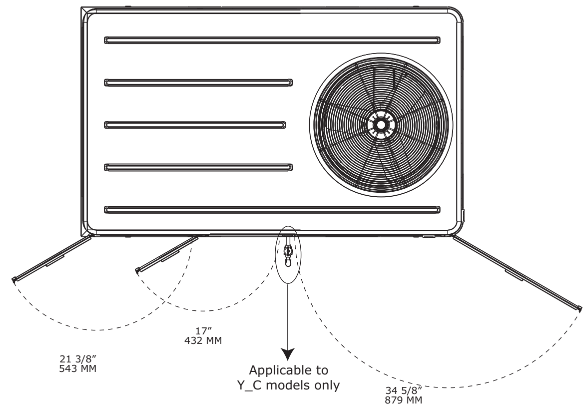
(a) All dimensions are in inches/millimeters.
(b) Reference duct clearance to combustible materials in this chapter.
(c) 1/2 or 3/4 NPT gas connection = (Y_C models only); 2" electrical connection: single point power when heat installed (T_C models only)

Figure 21. Cooling and gas/electric —6 to 10 tons standard efficiency, 4 to 10 tons high efficiency— economizer, manual or motorized fresh air damper[(a)]



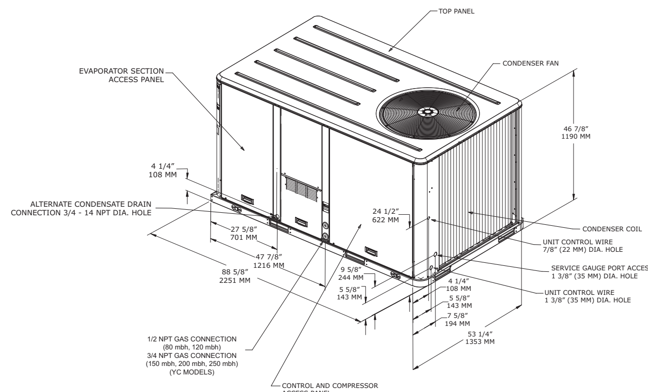
(a) All dimensions are in inches/millimeters.

Figure 22. Cooling and gas/electric —6 to 10 tons standard efficiency, 4 to 8.5 tons high efficiency— swing diameter for hinged door(s) option[(a)]



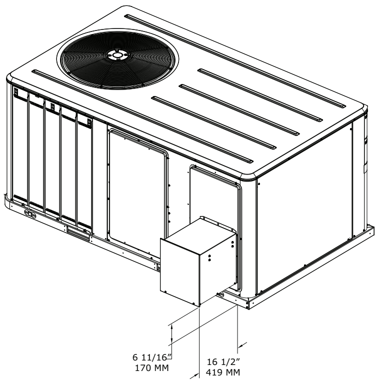
(a) All dimensions are in inches/millimeters.

Figure 23. Cooling and gas/electric —7.5 tons (dual compressor standard efficiency) to 10 tons standard efficiency, 6 to 8.5 tons high efficiency[(a)]



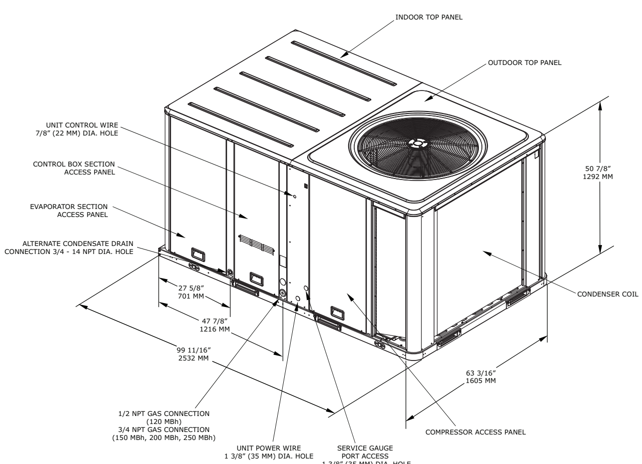
(a) All dimensions are in inches/millimeters.

Figure 24. Cooling and gas/electric —7.5 tons (dual compressor standard efficiency) to 10 tons standard efficiency, 6 to 8.5 tons high efficiency— power exhaust[(a)]



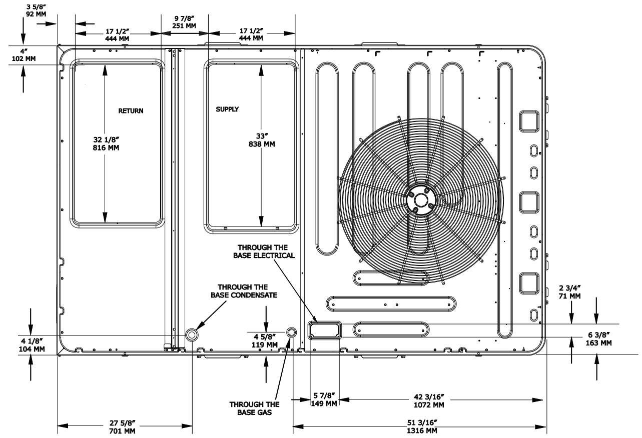
(a) All dimensions are in inches/millimeters.

Figure 25. Cooling and gas/electric —10 tons high efficiency[(a)]



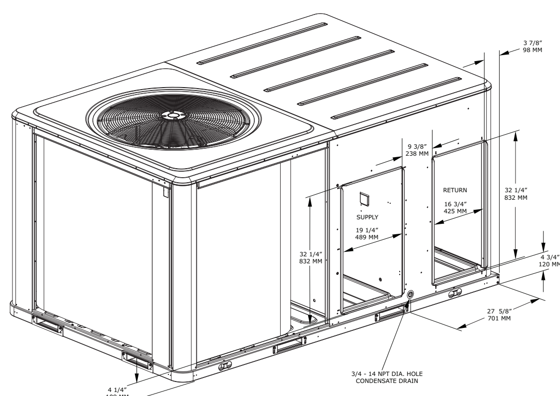
(a) All dimensions are in inches/millimeters.

Figure 26. Cooling and gas/electric —10 tons high efficiency— downflow airflow supply/return, through-the-base utilities[(a)]



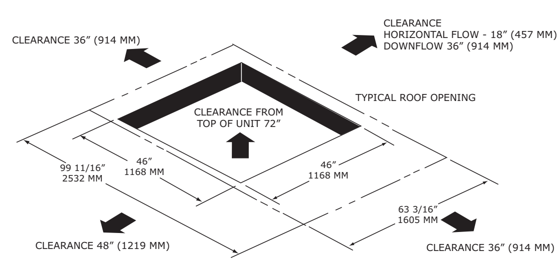
(a) All dimensions are in inches/millimeters.

Figure 27. Cooling and gas/electric —10 tons high efficiency— horizontal airflow, supply and return[(a)]



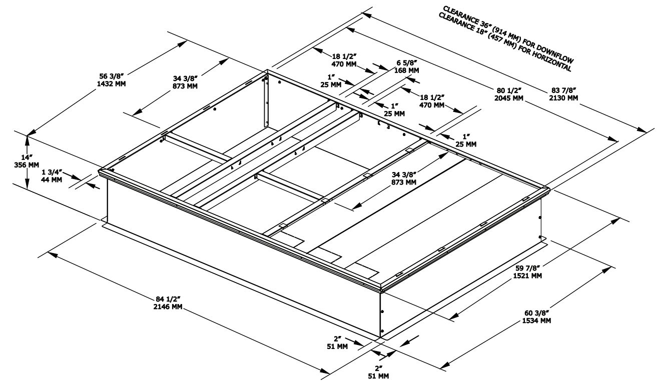
(a) All dimensions are in inches/millimeters.

Figure 28. Cooling and gas/electric —10 tons high efficiency— unit clearance and roof opening[(a)]



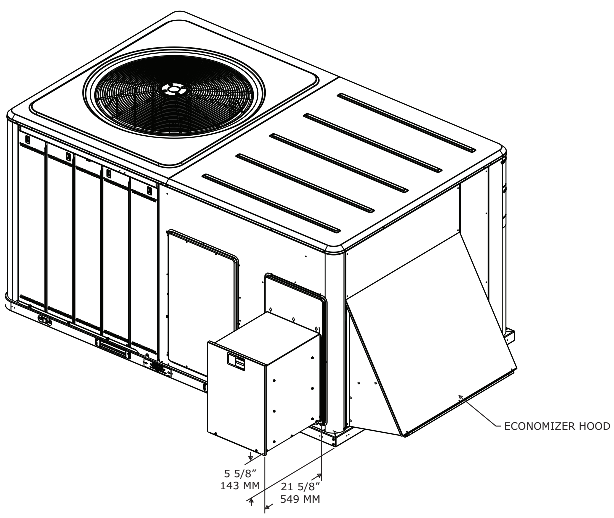
(a) All dimensions are in inches/millimeters.

Figure 29. Cooling and gas/electric —10 tons high efficiency— roof curb[a]



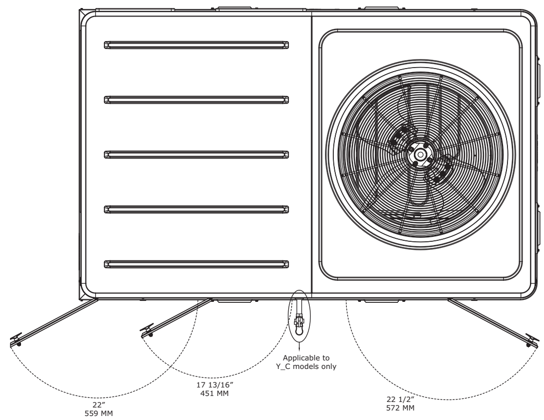
(a) All dimensions are in inches/millimeters.

Figure 30. Cooling and gas/electric —10 tons high efficiency— power exhaust[a]



(a) All dimensions are in inches/millimeters.

Figure 31. Cooling and gas/electric —10 tons high efficiency— swing diameter for hinged door(s) option[a]



(a) All dimensions are in inches/millimeters.

Installation

Foundation

⚠WARNING

Heavy Objects!

Failure to follow instructions below or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

Horizontal Units

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 the weights information in the Dimensions and Weights chapter 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.

⚠WARNING

Risk of Roof Collapsing!

Failure to ensure proper structural roof support could cause the roof to collapse, which could result in death or serious injury and property damage. 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 the weights section for typical unit and curb weights.

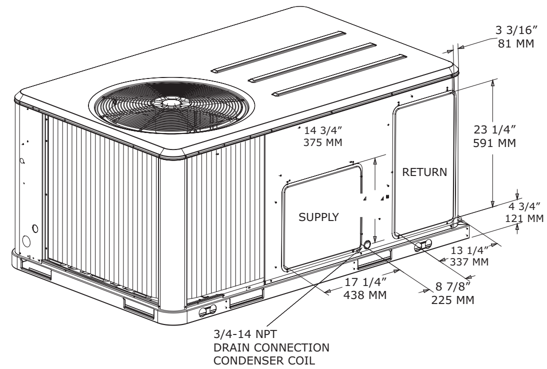
For rooftop applications, ensure the roof is strong enough to support the combined unit and support structural weight.Refer to maximum unit and corner weights (center of gravity) dimensions in the Dimensions and Weights section for the unit operating weights. If anchoring is required, anchor the unit to the roof with hold-down bolts or isolators.

Check with a roofing contractor for proper waterproofing procedures.

Ductwork

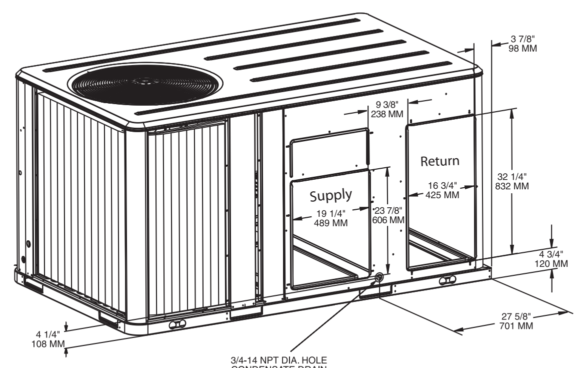
Supply and return air openings as viewed from the rear of the unit are shown in the following drawings.

Figure 32. Cooling and gas/electric — 3 to 5 tons standard efficiency, 3 tons high efficiency—horizontal airflow supply/return[(a)]



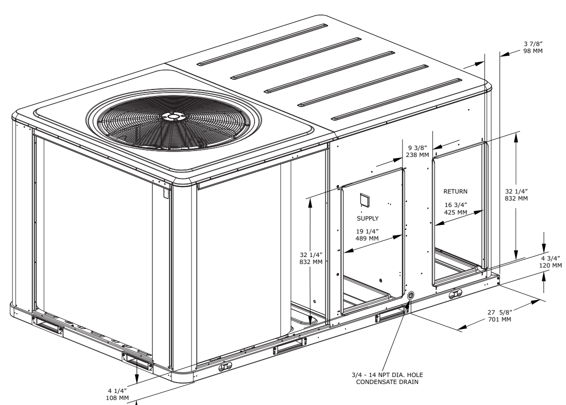
(a) All dimensions are in inches/millimeters.

Figure 33. Cooling and gas/electric — 6-10 ton standard efficiency units, 4 to 6 ton high efficiency units, 6(074)-8½ (Microchannel) high efficiency unit—horizontal airflow supply/return[(a)]



(a) All dimensions are in inches/millimeters.

Figure 34. Cooling and gas/electric —10 tons high efficiency— horizontal airflow, supply and return[(a)]



(a) All dimensions are in inches/millimeters.

Supply and return air openings as viewed from a downflow configuration are shown in the following drawings.

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.

Figure 35. 3 to 5 ton standard efficiency units & 3 ton high efficiency units - downflow supply & return air openings w/ through-the-base utilities

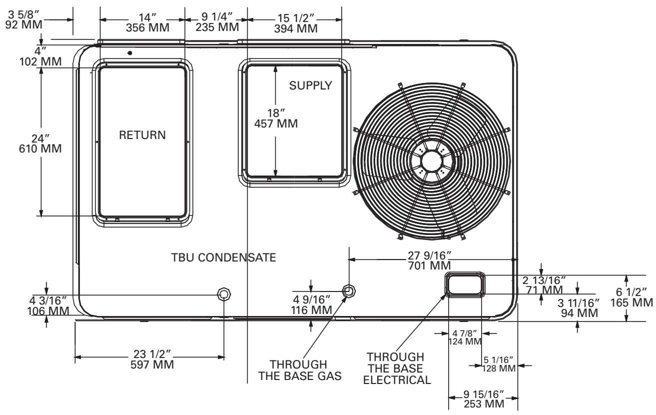


Figure 36. 4 to 6 ton high efficiency units, 6(074)-8.5 (Microchannel) high efficiency units and 6 to 10 ton standard efficiency units - down flow supply & return air openings w/ through-the-base utilities

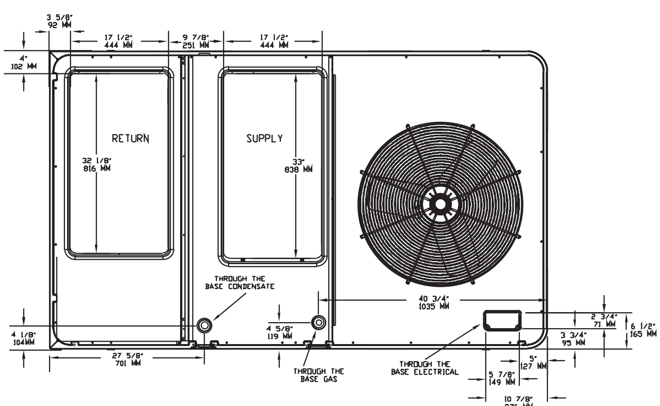


Figure 37. 10 ton high efficiency unit - downflow supply & return air openings w/ through-the-base utilities

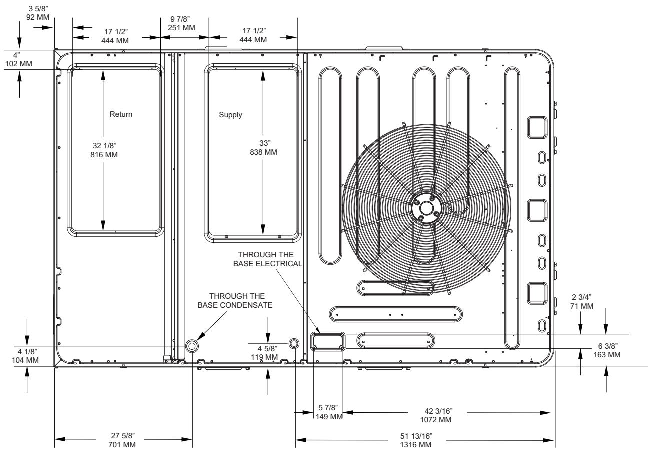


Table 5. Clearance required from duct to combustible surfaces

Model Number	Clearance required from duct to combustible surfaces (inches)
TSC0(36-60)G	0
THC036E,F	0
THC037-67E	0
TSC072H	0
THC072E/F	1
TSC090H	1
TSC092H	0
THC074F	1
THC092F	1
TSC102H	0
THC102F	1
TSC120H	1
THC120F	1

Roof Curb

The roof curbs for these units consists of a “full perimeter” enclosure to support the unit just inside of the unit base rail. The 10 ton high efficiency units contains a support base alignment rail and will extend past the end of the roof curb as shown in figures below and to the right.

Before installing any roof curb, verify;

- It is the correct curb for the unit,
- The includes the necessary gaskets and hardware,
- The purposed installation location provides the required clearance for proper operation,

- Insure that the curb is level and square. The top surface of the curb must be true to assure an adequate curb-to-unit seal.

⚠WARNING

Combustible Materials!

Failure to maintain proper clearance between the unit heat exchanger, vent surfaces and combustible materials could cause a fire which could result in death or serious injury or property damage. Refer to unit nameplate and installation instructions for proper clearances.

Verify that appropriate materials were used in the construction of roof and ductwork. Combustible materials should not be used in the construction of ductwork or roof curb that is in close proximity to heater elements or any hot surface. Any combustible material on the inside of the unit base should be removed and replaced with appropriate material.

Step-by-step curb assembly and installation instructions ship with each accessory roof curb kit. Follow the instructions carefully to assure proper fit-up when the unit is set into place.

Note: *To assure proper condensate flow during operation, the unit (and curb) must be level.*

If the unit is elevated, a field constructed catwalk around the unit is strongly recommended to provide easy access for unit maintenance and service.

Recommendations for installing the Supply Air and Return Air ductwork joining the roof curb are included in the curb instruction booklet. Curb ductwork must be fabricated and installed by the installing contractor before the unit is set into place.

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.*

Figure 38. View for base to roof curb alignment THC120F on 50" x 84" roof curb

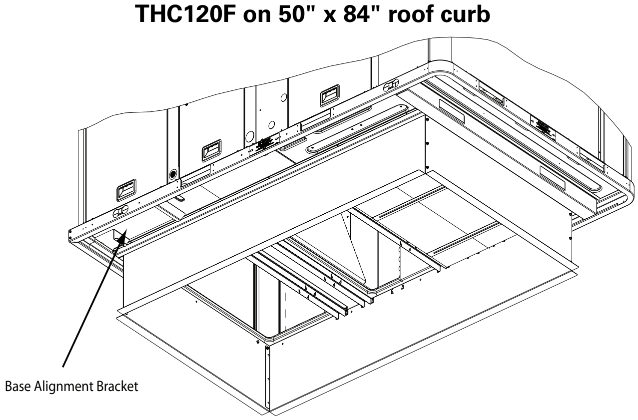
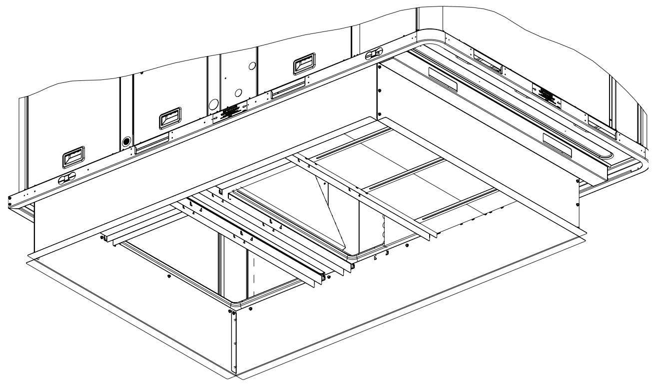


Figure 39. View for base to roof curb alignment THC120F on 60" x 84" roof curb



If a Curb Accessory Kit is not used:

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

Rigging

⚠WARNING

Heavy Objects!

Failure to follow instructions below or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

A rigging illustration and center-of-gravity dimensional data table is shown in the weights section. Refer to the typical unit operating weights table before proceeding.

1. Remove all drill screws fastening wood protection to metal base rail. Remove all screws securing wooden protection to wooden top crate.

   On 6-10 ton high efficiency units, remove wire ties from outdoor grill.
2. Remove Wooden Top Crate.

⚠WARNING

Improper Unit Lift!

Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.

3. Rig the unit as shown in the weights section. Attach adequate strength lifting slings to all four lifting brackets in the unit base rail. Do not use cables, chains, or slings except as shown.
4. Install a lifting bar, as shown in the weights section, to protect the unit and to facilitate a uniform lift. The minimum distance between the lifting hook and the top of the unit should be 7 feet.
5. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.

Figure 40. Fork pockets (all units except 10 ton high efficiency units)

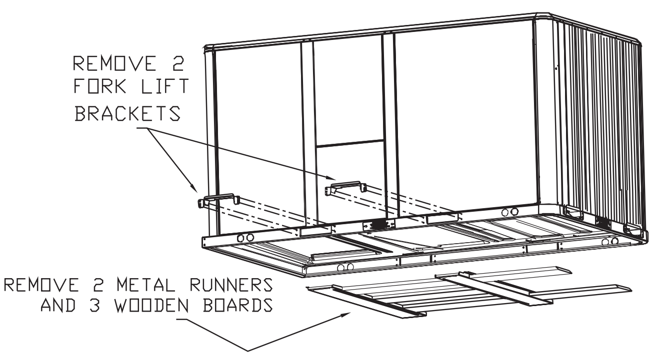
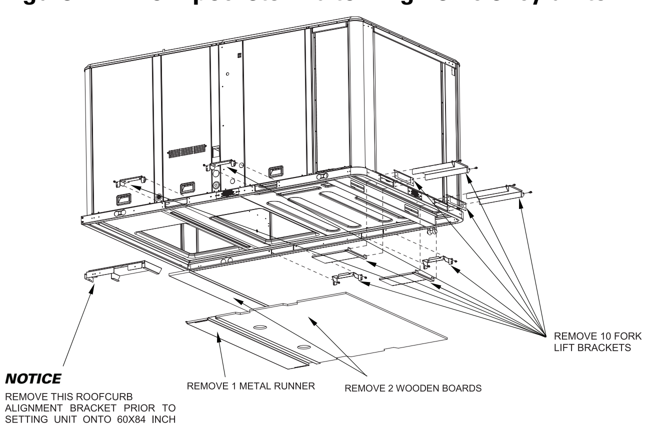


Figure 41. Fork pockets - 10 ton high efficiency units



6. Lift the unit enough to allow the removal of base fork pocket protection components as shown in the following figures.
7. When 10 ton high efficiency units are installed on smaller existing roof curb (50"x 84") for replacement applications, do not remove alignment bracket. This bracket helps assure proper alignment of duct openings.
8. Downflow units; align the base rail of the unit with the curb rail while lowering the unit onto the curb. Make sure that the gasket on the curb is not damaged while positioning the unit.

General Unit Requirements

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 unit 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.
- Install pitch pocket for power supply through building roof. (If applicable)
- 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 economizer has been pulled out into the operating position. Refer to the economizer installers guide for proper position and setup.
- Install all access panels.

Temperature Limit Switch Usage for Electric Heat Units

Units are factory shipped in the downflow discharge configuration but can be field converted to a horizontal discharge configuration. Some, but not all units require a different TCO-A limit switch, which is wire tied near the terminal block in the heater compartment if horizontal discharge configuration is used.

Horizontal Discharge Conversion (3 to 5 Ton Units)

Note: *3 to 5 ton units supply cover to supply opening and return cover to return opening.*

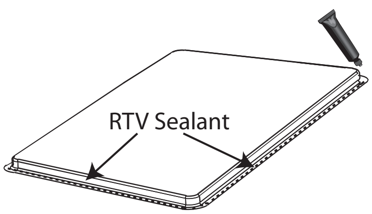
Supplies Needed by Installer for Conversion: 3 oz. tube of High Temperature RTV sealant. (500°F / 260°C: Similar to Dow Corning 736)

Note: *Failure to use recommended sealant could result in unit performance loss.*

If a unit is to be converted to a Horizontal discharge, the following conversion must be performed:

1. Remove RETURN and SUPPLY duct covers.
2. Locate supply cover. Apply ¼ in. (6mm.) continuous bead of 500°F RTV sealant to the flange as shown.

Figure 42. Supply duct cover



3. Position duct cover as shown, rotate 90 degrees to allow entrance into supply opening.
4. Slide duct covers into duct openings until inward edge of duct cover engages with the 2 retaining clips on the duct flanges. Secure the outward edge of each duct cover with 2 screws.
5. Slide RETURN DUCT COVER (insulation side up) into supply opening until inward edge of duct cover engages with the 2 retaining clips on the duct flange. Secure outward edge of the duct cover with two screws.

Note: *Certain unit/electric heater combinations require a limit switch change out for horizontal airflow applications. Refer to the following instructions to determine if this process is required for the unit undergoing installation.*

Horizontal Discharge Conversion (6 to 10 Ton Units)

Note: *6 to 10 ton units the supply cover to return opening & return cover to supply opening.*

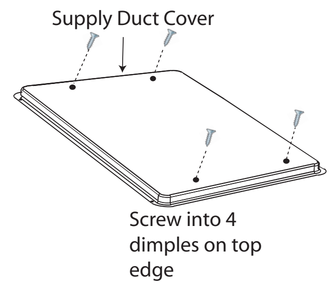
Supplies Needed by Installer for Conversion: 3 oz. tube of high Temperature RTV sealant. (500°F / 260°C: Similar to Dow Corning 736)

Note: *Failure to use recommended sealant could result in unit performance loss.*

If a unit is to be converted to a Horizontal discharge, the following conversion must be performed:

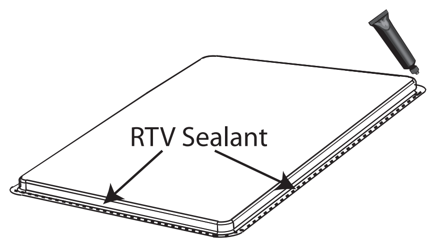
1. Remove RETURN and SUPPLY duct covers.
2. Place SUPPLY DUCT COVER over down-flow return opening. (insulation side down)
3. Using self-drilling screws, (or screws removed from duct cover), screw through dimples to attach DUCT COVER to base.

Figure 43. Supply duct cover



4. On original RETURN DUCT COVER, apply ¼”(6mm.) continuous bead of 500°F RTV sealant around flange (opposite insulation side), as shown.

Figure 44. Return duct cover

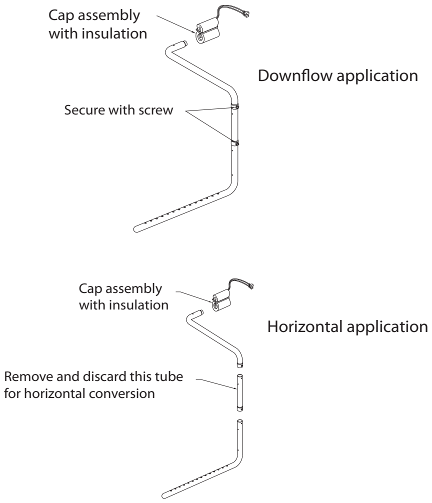


5. Slide RETURN DUCT COVER (insulation side up) into supply opening until inward edge of duct cover engages with the 2 retaining clips on the duct flange. Secure outward edge of the duct cover with two screws.

Note: *If unit is equipped with Return Air Smoke Detector, refer to field conversion instructions for horizontal discharge before installing return air duct.*

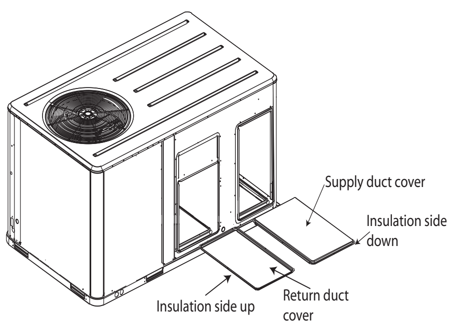
Note: *If unit is equipped with Discharge Air Sensing option refer to the following figure for proper tube positioning based on unit tonnage.*

Figure 45. Discharge air sensor



Note: *Certain unit/electric heater combinations require a limit switch change out for horizontal airflow applications. Refer to the following instructions to determine if this process is required for the unit undergoing installation.*

Figure 46. Supply & return openings



6. After completing installation of the duct covers for horizontal discharge, proceed to TCO-A instructions.

TCO-A Instructions

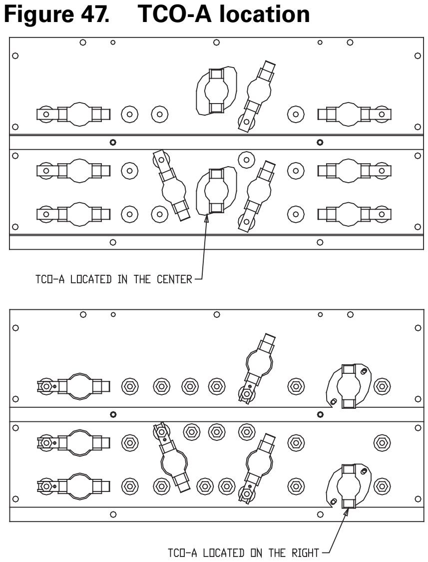
If the unit being installed is listed in the following table and is equipped with the corresponding model number of factory installed electric heater package in the table, the limit control TCO-A must be replaced with the extra limit control shipped in the heater compartment. Replace TCO-A following the instructions in steps 1 through 3 below. If the unit being installed does not have a factory installed electric heater package or is equipped with a factory installed electric heater model that does not correspond to any in this table, skip steps 1 through 3 and go on to next step in the installation process.

Table 6. TCO-A replaced for horizontal duct configuration

Unit Model Number	Electric Heater Model Number	TCO-A location
TSC120H4, THC074	BAYHTRA454	Right
TSC120H4, THC092-102F	BAYHTRA418, 427, 436, 454	Right
TSC120HW	BAYHTRAW18A, 36A, 54A	Right
THC072F4	BAYHTRU427, 436	Center
TSC090H4	BAYHTRW427, 436	Center
TSC090HW	BAYHTRWW27, W36	Center

1. Remove the heater section access panel and open the electric heater dead front panel.
2. TCO-A is the limit control located in the central part of the heater mounting plate and that is located on the bottom of the two heater element assemblies. See Figure 47, p. 32. To replace this device, first remove the two wires connected to the terminals. Next, remove the two screws which secure it to the heater element mounting plate. Once TCO-A has been removed form the heater element mounting plate, discard this device.
3. Obtain the replacement TCO-A which is secured by a wire tie near the electric heater terminal block in the heater compartment. Attach it to the heater element mounting plate with the two screws that were removed in step 2 above. Connect the two wires that were un-hooked in step 2 to the terminals on the new TCO-A. Refer to the heater package wiring diagram to assure that the wiring is connected properly.
4. Close the electric heater dead front panel and replace heat section access panel.

Figure 47. TCO-A location



Return Air Smoke Detector

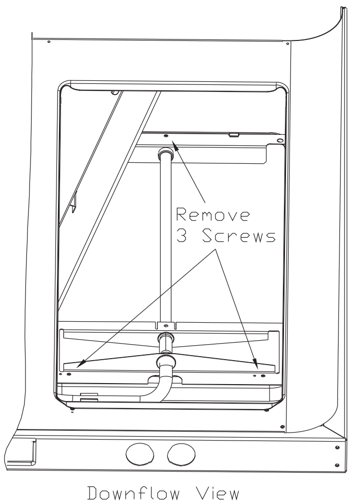
The factory installed Return Air Smoke Detector is installed in the downflow discharge position. No additional field setup is required.

If a unit is to be converted to horizontal discharge, the following conversion must be performed:

1. If the unit has an economizer, it must be pulled out in the operating position.
2. Remove the 3 screws from the mounting brackets.

Note: *Refer to downflow view for screw locations.*

Figure 48. Downflow view



3. Lift the tube and bracket from the downflow duct opening. Rotate the tube and bracket assembly 180 degrees ensuring that the holes on the copper sensing tube face away from the unit and face the return air ductwork.

Note: *Refer to horizontal views below.*

Figure 49. Horizontal view 1

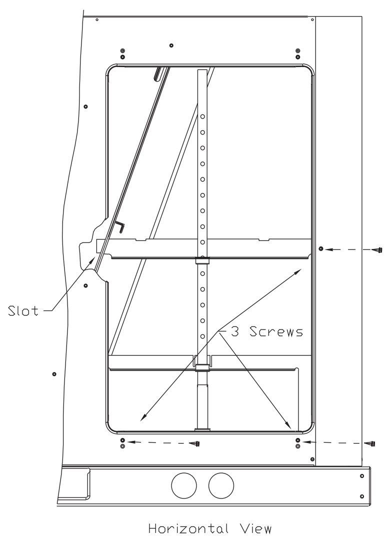
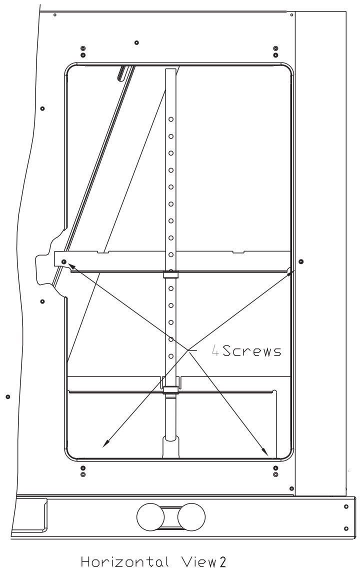


Figure 50. Horizontal view 2



Note: *Check to insure that the flexible tubing lies flat on the base pan surface.*

4. Slide the top bracket down the copper sensing tube. For TSC036G-060G, and THC036-037E units insert the tab on the left side into the slot on the indoor coil block off and secure the right side of the bracket with one of the 3 screws removed in step 2. Refer to Figure 49, p. 33. For THC047E-072E, THC048F-120F, and TSC072H-120H units secure the tab on left side to the indoor coil block off with one of the screws removed in step 2 and secure the right side of the bracket with one of the screws removed from the access panel. Refer to Figure 50, p. 33.
5. Using the remaining 2 screws removed in step 2, secure the bottom bracket. Refer to Figure 49, p. 33.

Note: *Larger diameter holes on bottom bracket line up with the dimples on the rear panel. The smaller diameter holes line up with the screw holes in the rear panel.*

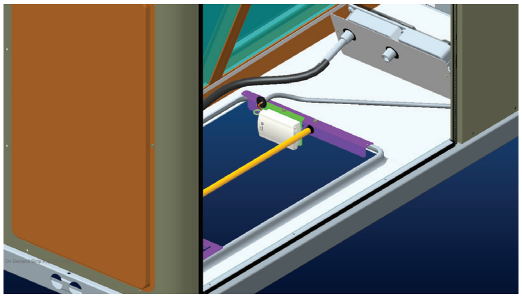
Air-Fi™ Wireless Communication Interface

The factory installed wireless communications interface is installed in the downflow discharge position.

If a unit is to be converted to horizontal discharge, the following conversion must be performed:

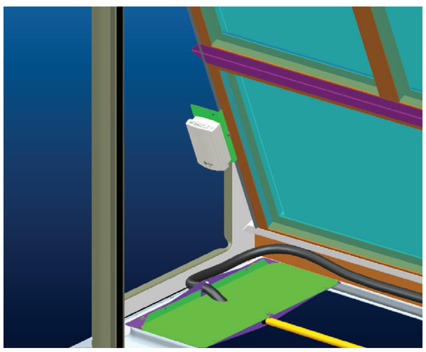
1. If the unit has an economizer, it must be pulled out in the operating position.
2. Remove the screw from the mounting bracket. Refer to downflow view for screw and bracket location.

Figure 51. Wireless communication interface - downflow



3. Mount the bracket in the horizontal discharge location. Refer to horizontal view for screw and bracket location.

Figure 52. Wireless communication interface - horizontal



Note: *Cable ties must be removed to allow the cable to extend to the horizontal mounting location.*

Main Electrical Power Requirements

⚠WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. 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.

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

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. 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.

- Verify that the power supply complies with the unit nameplate specifications.
- 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.

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 & 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

⚠WARNING

Hazardous Voltage!

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

An evaporator condensate drain connection is provided on each unit. Refer to the ductwork section in the Installation chapter for the appropriate drain location.

The condensate drain pan is factory installed to drain condensate to the back side of the unit. Refer to the ductwork section in the Installation chapter for the drawings. It can be converted to drain condensate out the front side of the unit or through the base.

To convert drain condensate out the front of unit:

1. Remove evaporator access panel and supply air access panels.
2. Remove the support panel that the condensate drain pan exits through.
3. Slide the condensate drain pan out of the unit and rotate 180°.
4. Slide the condensate drain pan back into the unit, align the drain with the grommeted opening in the rear support panel and push until the coupling is seated in the grommet.
5. Replace the front support panel by aligning the panel with tabs in the raceway. Align the condensate drain pan support in the grommeted hole as the panel is put in place.
6. Replace evaporator access panel and supply air access panels.

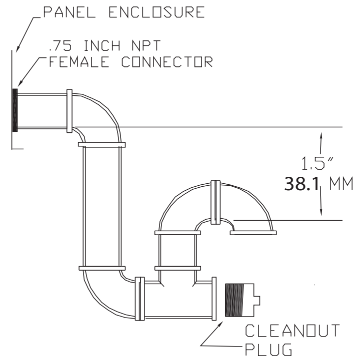
To convert drain condensate through the base of unit:

1. Remove evaporator access panel and supply air access panels.
2. Remove the support panel that the condensate drain pan exits through.
3. Slide the condensate drain pan out of the unit.
4. Place on a level surface in the position it was removed from the unit.
5. Remove the plug knockout in the bottom of the drainpan to convert it to through the base drainage.
6. Plug the original condensate drain opening with a field supplied 3/4” NPT plug.
7. Slide the condensate drain pan back into the unit, align the drain support with the grommeted opening in the rear support panel and push until the support is seated in the grommet.
8. Replace the front support panel by aligning the panel with tabs in the raceway. Align the plugged condensate drain pan coupling in the grommeted hole as the panel is put in place.
9. Replace evaporator access panel and supply air access panels.

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 53, p. 35.

A condensate drain line must be connected to the P-Trap. Pitch the drain lines at least 1/2 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 53. Condensate trap installation



Filter Installation

The quantity of filters is determined by unit size. Access to the filters is obtained by removing the filter access panel.

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

WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. 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.

An overall dimensional layout for the field installed wiring entrance into the unit is illustrated in the Dimensions and Weights chapter. To insure that the unit’s supply power wiring is properly sized and installed, follow the following guidelines.

Verify that the power supply available is compatible with the unit’s nameplate ratings. The available supply power must be within 10% 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!

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

Important: *If the unit is not equipped with an optional factory installed non-fused 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!

Failure to follow code could result in death or serious injury. 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.

⚠WARNING

Hazardous Voltage!

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

Standard Wiring

1. Location of the applicable electrical service entrance is illustrated in the Dimensions and Weights chapter. Complete the unit's power wiring connections at Compressor Contactor # 1 (CC1) inside the unit control panel. Refer to the customer connection diagram that is shipped with the unit for specific termination points
2. 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 non-fused disconnect switch (UDC) or circuit breaker (UCB). If neither a factory mounted non-fused disconnect switch (UDC) or circuit breaker (UCB) was factory mounted, field wiring connections should be terminated in the control box at Compressor Contactor # 1 (CC1).

Provide proper grounding for the unit in accordance with local and national codes.

Note: *Black Gasket is shipped from the factory and is located in the literature Ship With bag in the control box. Apply Black Gasket around conduit plate on all 4 sides after installation to prevent air leakage from the building entering the electrical enclosures.*

Note: *Seal between wiring and conduit with Black Gasket or weather proof sealer to prevent air leakage from the building entering the electrical enclosures. Also seal around conduit and wiring at all roof and curb penetrations.*

Figure 54. All units except 10 ton high efficiency with hot gas reheat dehumidification.

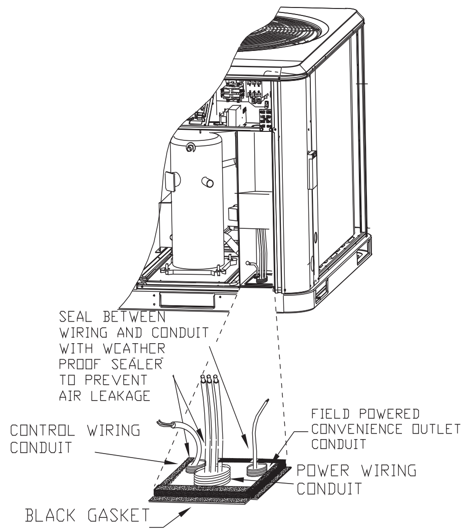
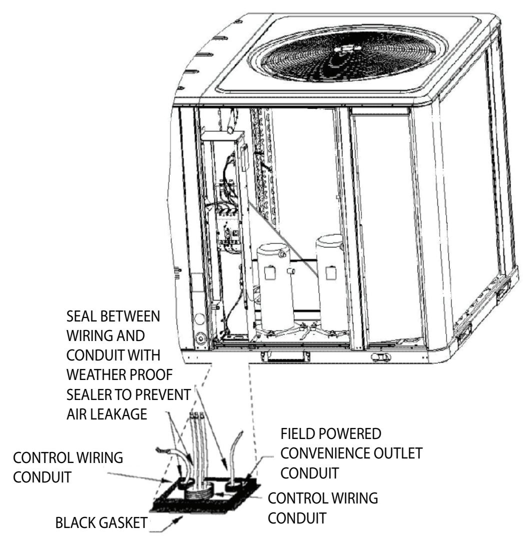


Figure 55. 10 ton high efficiency



Field Installed Control Wiring

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

> **⚠WARNING**
>
> **Proper Field Wiring and Grounding Required!**
>
> **Failure to follow code could result in death or serious injury. 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.**

An overall layout of the various control options available with the required number of conductors for each control device is illustrated in Figure 68, p. 44.

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 VA are equipped with internal circuit breakers. If a circuit breaker trips, turn "Off" all power to the unit before attempting to reset it.

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

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 the Dimensions and Weights chapter for the electrical access locations provided on the unit and Table 7, p. 37 or Table 8, p. 37 for AC conductor sizing guidelines, and;

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.

> ***NOTICE:***
>
> **Controls Using 24 VAC!**
>
> **Resistance in excess of 3 ohms per conductor could cause component failure due to insufficient AC voltage supply.**

Note: *Be sure to check all loads and conductors for grounds, shorts, and mis-wiring.*

3. Do not run the AC low voltage wiring in the same conduit with the high voltage power wiring.
4. Route low voltage wiring per illustrations on page Figure 61, p. 40.

Table 7. Electromechanical thermostat 24V AC conductors with ReliaTel™ units

Distance from Unit to Control	Recommended Wire Size
000 - 460 feet	18 gauge
000 - 140 m	.75 mm2
461 - 732 feet	16 gauge
141 - 223 m	1.3 mm2
733 - 1000 feet	14 gauge
224 - 305 m	2.0 mm2

Table 8. Electromechanical thermostat 24V AC conductors with Electromechanical unit

Distance from Unit to Control	Recommended Wire Size
0 - 30 feet	22 gauge
0 - 9.1 m	.33 m2
31 - 50 feet	20 gauge
9.5 - 15.2 m	.50m2
51 - 75 feet	18 gauge
15.5 - 22.9 m	.75 m2
76 - 125 feet	16 gauge
23.1 - 38.1 m	1.3 m2
126 - 200 feet	14 gauge
38.4 - 60.9 m	2.0 m2

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

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

- Table 9, p. 38 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.*

Note: *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.*

- Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.
- Route low voltage wiring per illustrations on page 40.

Note: *If digit 9 in the unit model number equals "E" (electromechanical control), accessory relay BAY24X042 is required if the thermostat does not energize the fan circuit in the heating mode.*

DC Conductors

Table 9. Zone sensor module wiring

Distance from Unit to Control	Recommended Wire Size
0 - 150 feet	22 gauge
0 - 45.7 m	.33 mm2
151 - 240 feet	20 gauge
46 - 73.1 m	.50 mm2
241 -385 feet	18 gauge
73.5 - 117.3 m	.75 mm2
386 - 610 feet	16 gauge
117.7 - 185.9 m	1.3 mm2
611 - 970 feet	14 gauge
186.2 - 295.7 m	2.0 mm2

Figure 56. ReliaTel™ conventional thermostat field wiring diagrams

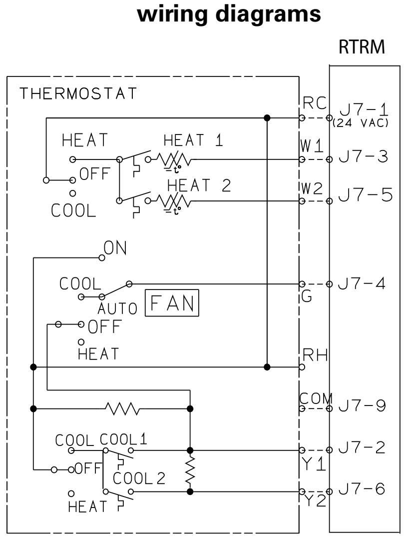


Figure 57. Typical field wiring diagrams for electromechanical thermostat

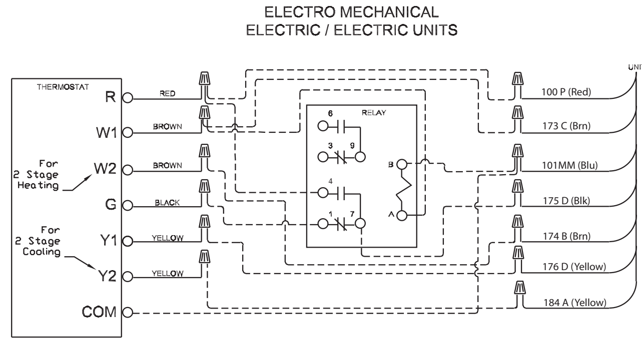


Figure 58. ReliaTel options module

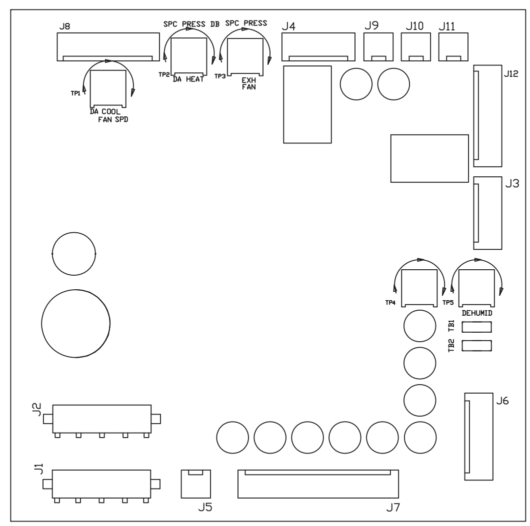


Figure 59. ReliaTel™ relative humidity sensor (dehumidification option)

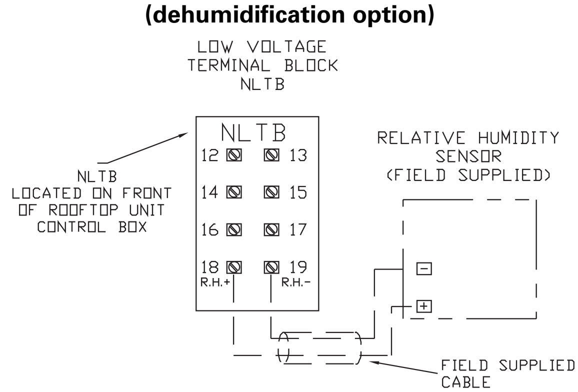


Figure 60. ReliaTel humidistat (dehumidification option)

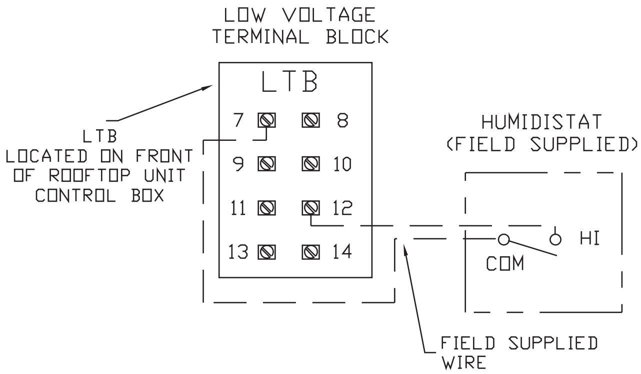


Figure 61. Electromechanical control customer low voltage routing (all units except 10 ton high efficiency)

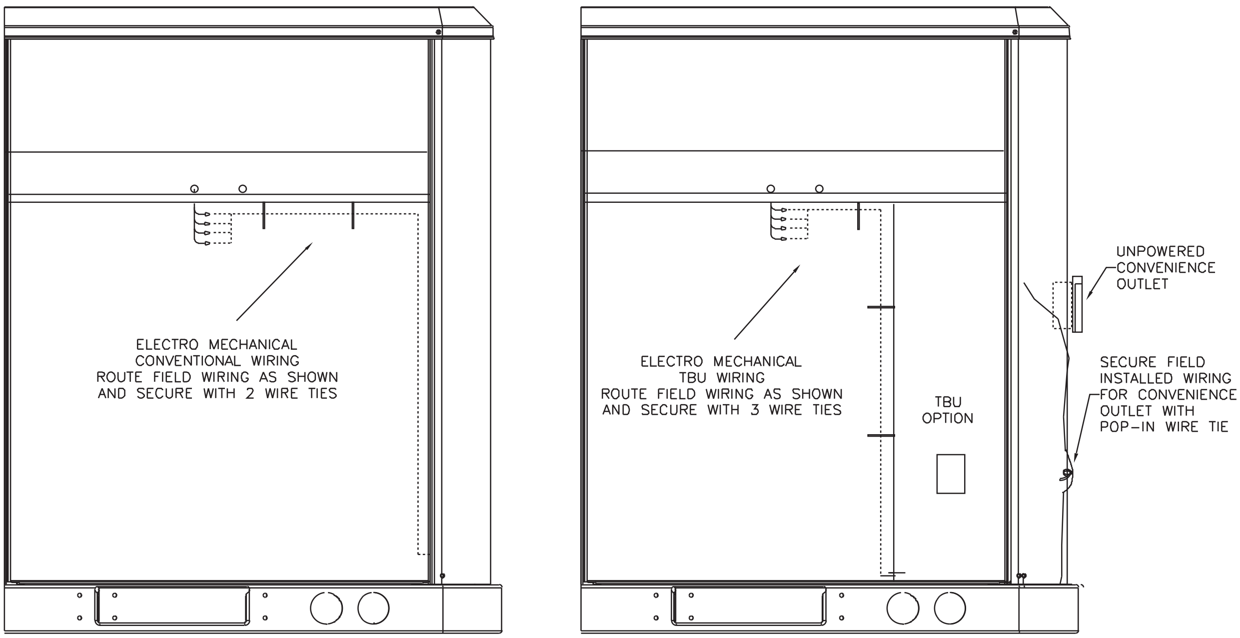


Figure 62. ReliaTel control customer low voltage routing (all units except 10 ton high efficiency)

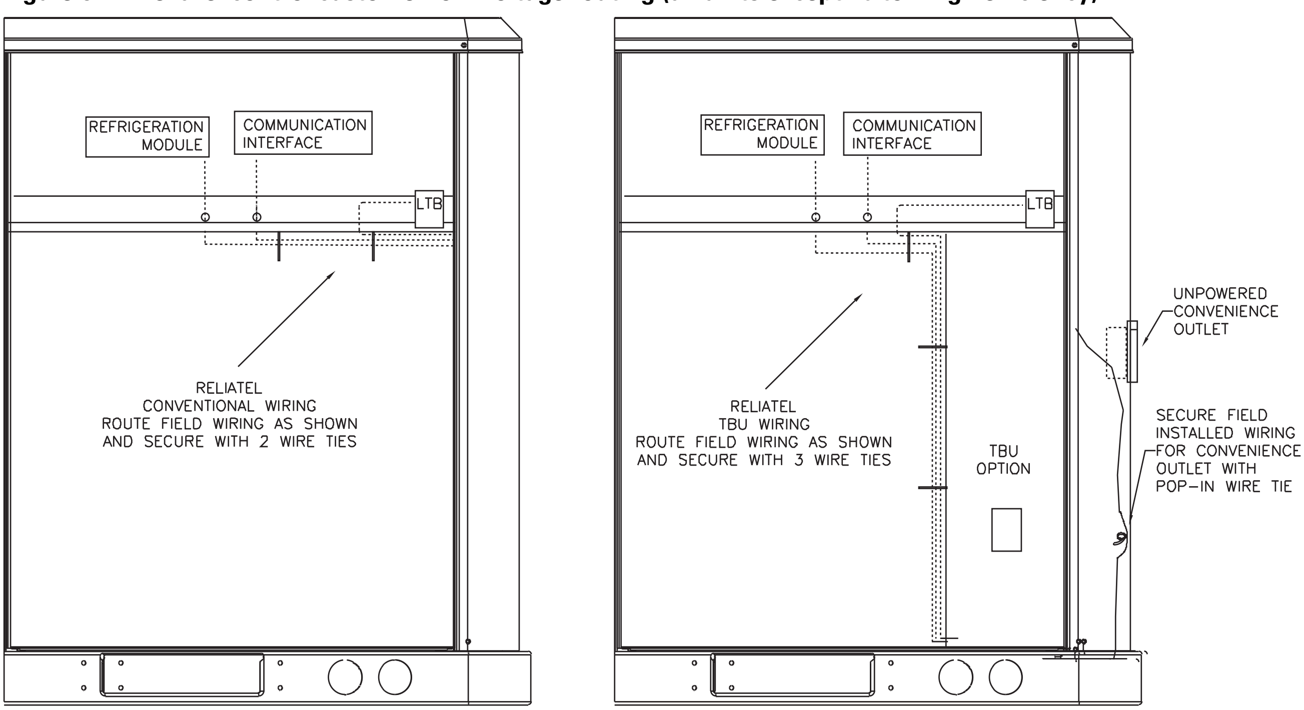


Figure 63. ReliaTel™ (without TBUE) control customer wire routing (10 ton high efficiency)

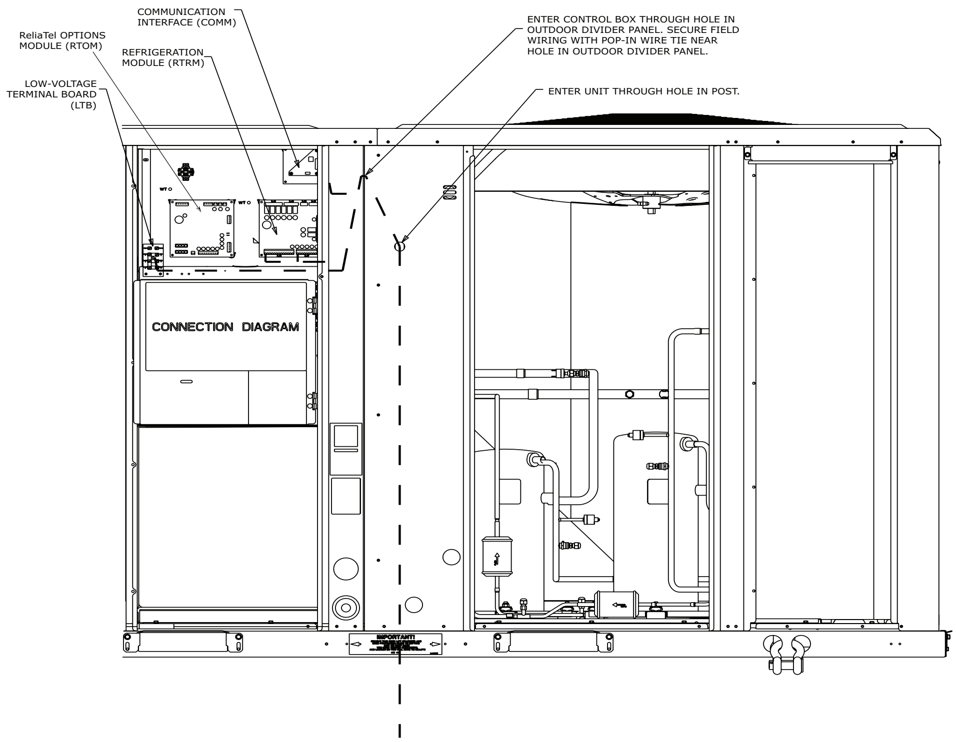


Figure 64. ReliaTel (with TBUE) control customer wire routing (10 ton high efficiency)

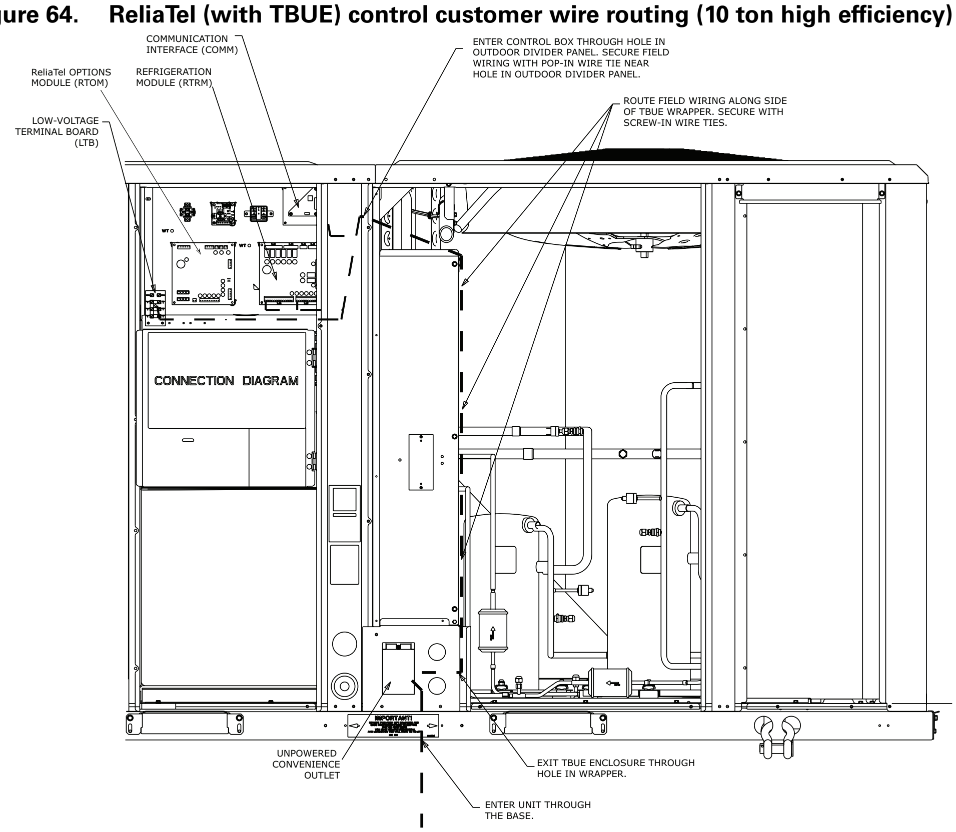


Figure 65. Electromechanical (without TBUE) control customer wire routing (10 ton high efficiency)

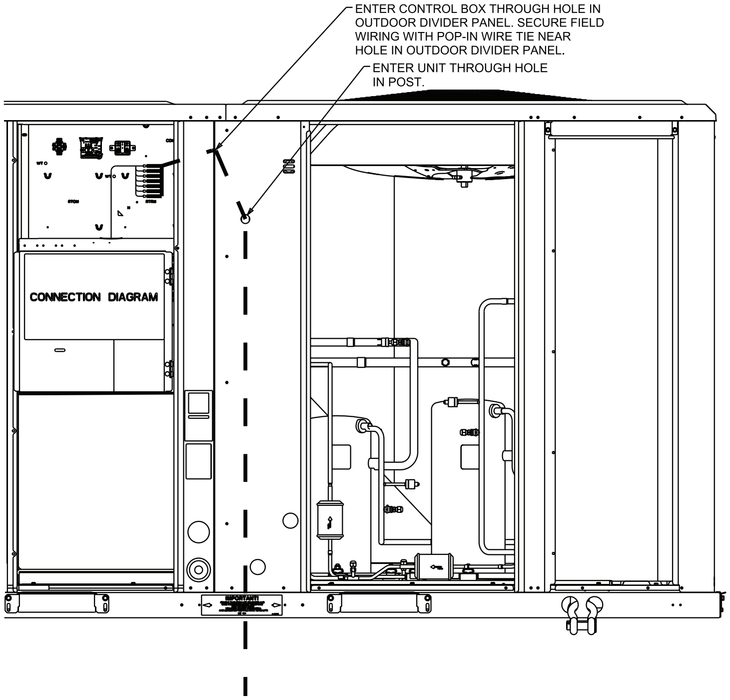
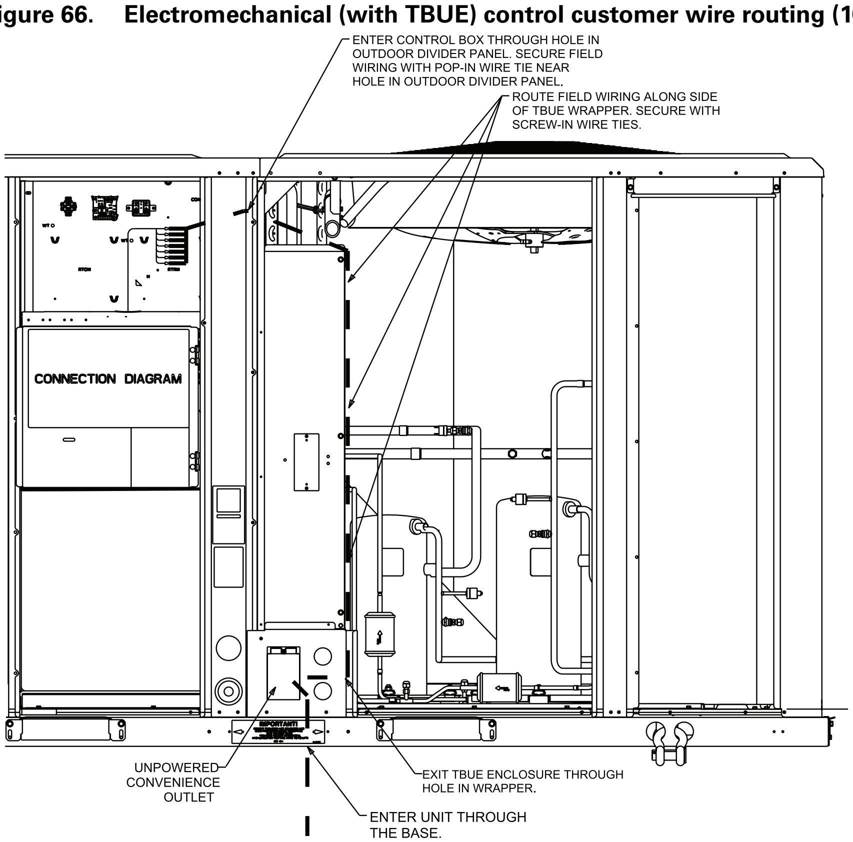


Figure 66. Electromechanical (with TBUE) control customer wire routing (10 ton high efficiency)



Space Temperature Averaging (ReliaTel™ only)

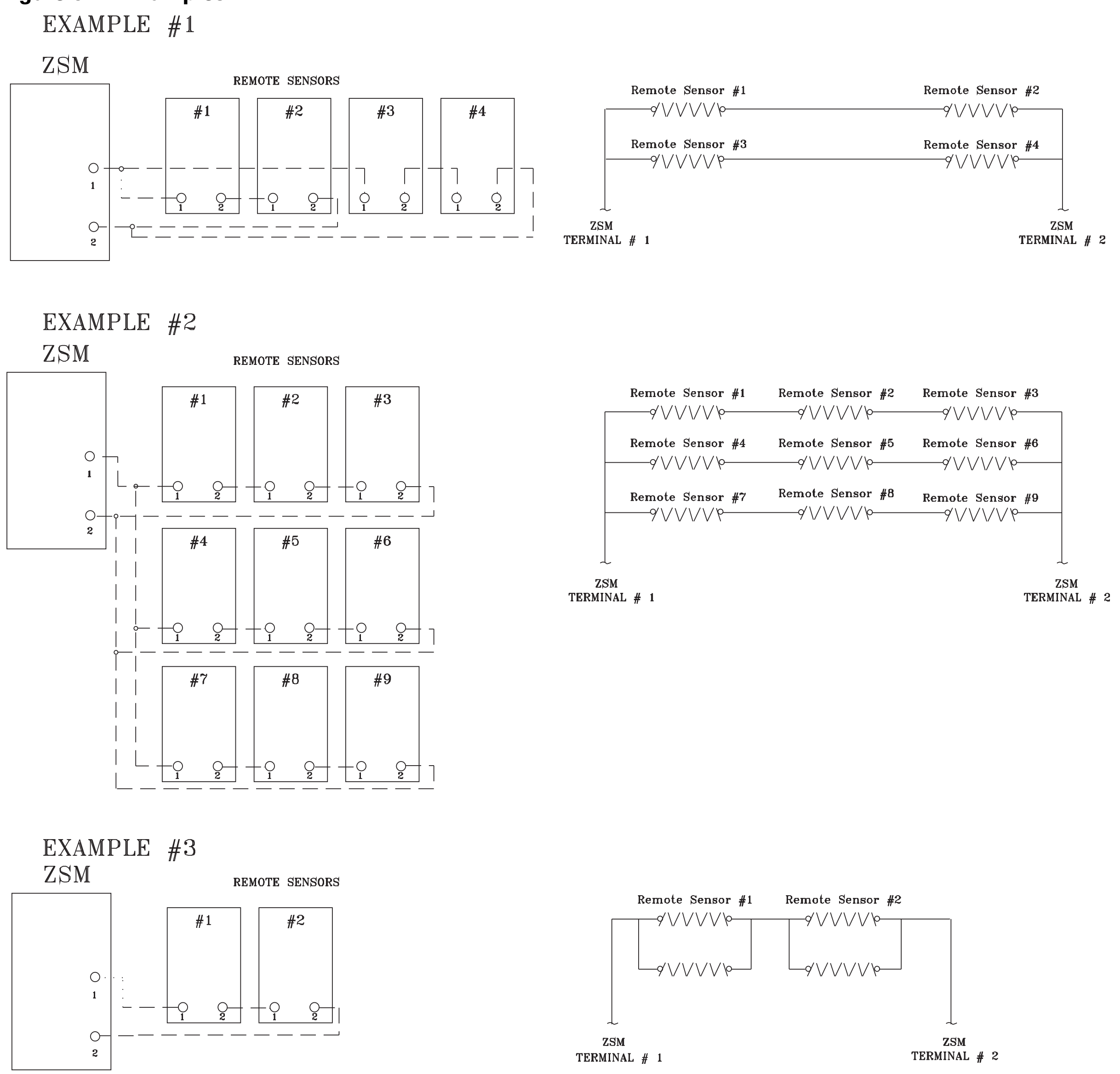
Space temperature averaging is accomplished by wiring a number of remote sensors in a series/parallel circuit.

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 is required.
- Example #2 illustrates three sensors squared in a series/parallel circuit. Using BAYSENS077*, two sensors are required to accomplish space temperature averaging.

Example #3 illustrates the circuit required for this sensor. Table 10, p. 45 lists the temperature versus resistance coefficient for all sensors.

Figure 67. Examples



Note: *Wiring pin numbers are for reference only. There are multiple smoke detector systems that could have differently numbered pins. For correct wiring details, please refer to the specific smoke detector literature that accompanied this unit.*

Figure 68. Typical field wiring diagrams for optional controls (ReliaTel™ only)

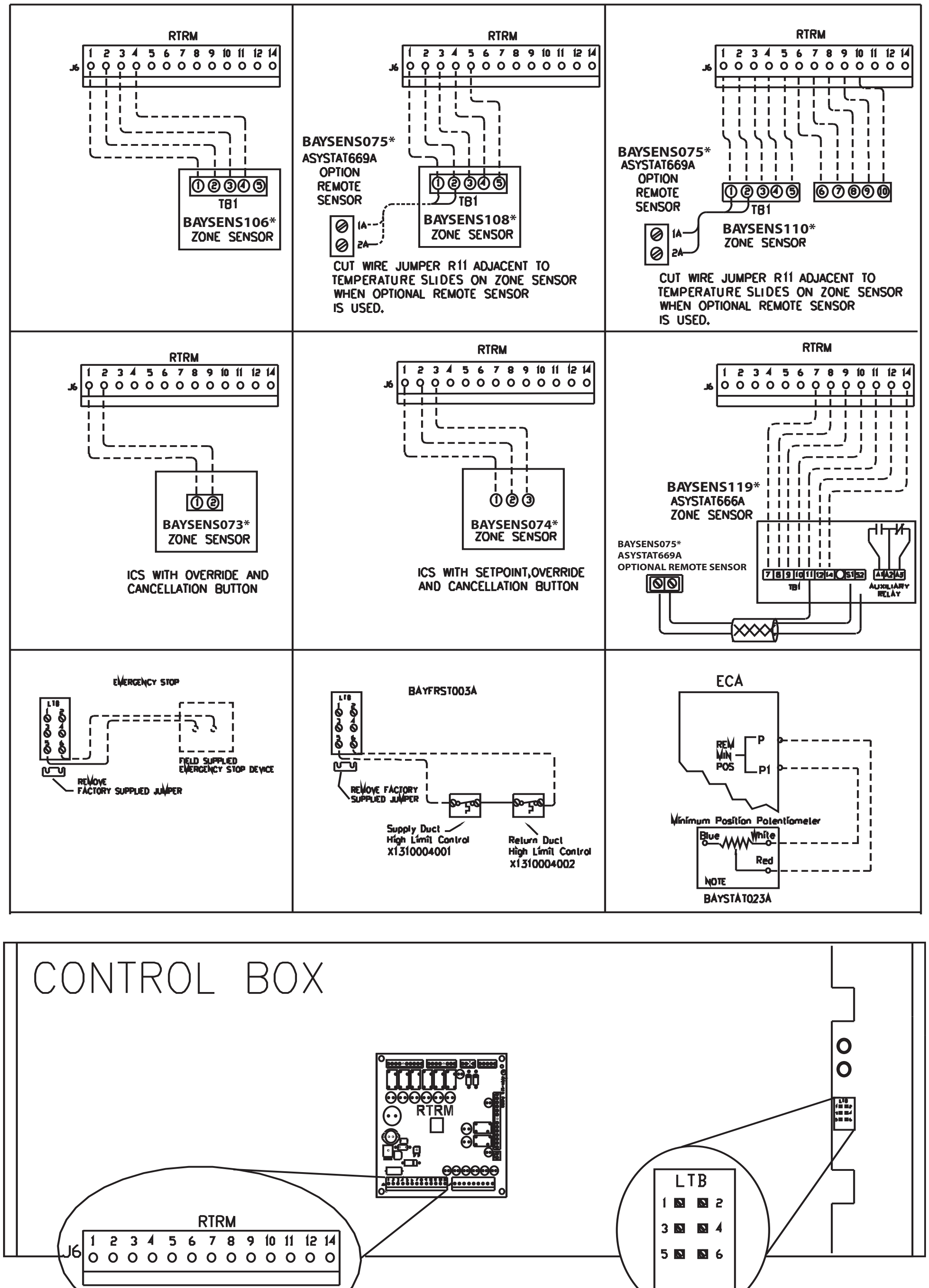


Table 10. Temperature vs. resistance

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

Pre-Start

Use the checklist provided below in conjunction with the "General Unit Requirements" checklist to ensure that the unit is properly installed and ready for operation.

⚠WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. 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.

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

- Check all electrical connections for tightness and "point of termination" accuracy.
- Verify that the condenser airflow will be unobstructed.

⚠WARNING

Rotating Components!

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

- 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%. Measure and record the voltage between phases 1, 2, and 3 and calculate the amount of imbalance as follows:

$$\% \text{ Voltage Imbalance} = \frac{100 \times AV - VD}{AV} \text{ where;}$$

$$AV \text{ (Average Voltage)} = \frac{\text{Volt 1} + \text{Volt 2} + \text{Volt 3}}{3}$$

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:

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

The 2.2% imbalance in this example exceeds the maximum allowable imbalance of 2.0%. This much imbalance between phases can equal as much as a 20% current imbalance with a resulting increase in motor winding temperatures that will decrease motor life. If the voltage imbalance is over 2%, 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 w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. 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.

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

- 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!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

- 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 (Optional)

Each compressor can be equipped with a crankcase heater (On some units the crankcase heater comes standard). 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.

Note: *Upon closing main power disconnect and the unit mounted disconnect switch or circuit breaker, the phase monitor will verify proper phasing. If LED on face of the monitor is red, correct supply power fault.*

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

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.

Table 11. Service test guide for component operation

Test Step	Mode	Fan	Econ [a]	Comp 1	Comp 2	Heat 1	Heat 2	Resistance	PWM Output[b]	Multi-Speed Fan Output
1	Fan	On	Minimum Position Setpoint 0%	Off	Off	Off	Off	2.2KΩ	50%	low
	Minimum Ventilation	On	Selectable	Off	Off	Off	Off			
2	Economizer Test Open	On	Open	Off	Off	Off	Off	3.3KΩ	50%[c]	low
3	Cool Stage 1	On	Minimum Position	On [d]	Off	Off	Off	4.7KΩ	82%	low
4 [e]	Cool Stage 2	On	Minimum Position	On [d]	On [d]	Off	Off	6.8KΩ	100%	High (2-step cooling) Low (3-step cooling)
5 [e]	Cool Stage 3	On	Minimum Position	On [d]	On [d]	Off	Off	8.2KΩ	100%	High
6 [e]	Reheat	On	Minimum	On	On	Off	Off	33KΩ	100%[f]	High
7 [e]	Heat Stage 1	On	Minimum	Off	Off	On	Off	10KΩ	100%	High
8 [e]	Heat Stage 2	On	Minimum	Off	Off	On	On	15KΩ	100%	High

(a) The exhaust fan will turn on anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.
(b) The PWM Output is in reference to the user selected maximum unit fan speed.
(c) Regardless of the Economizer Mode configuration, the unit will run the Supply Fan at the minimum speed during the Economizer step of the Service Test.
(d) The condenser fans will operate any time a compressor is 'On' providing the outdoor air temperatures are within the operating values.
(e) Steps for optional accessories and non-applicable modes in unit will be skipped.
(f) Units with Enhanced Dehumidification only will not perform this step during Service Test.

Test Modes

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

- 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.

- 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.

- 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 11, p. 48.

Electromechanical Controls Test Procedure

See unit schematic for correct wire numbers.

Fan Test and Minimum Ventilation

Connect red thermostat wire (R) to black thermostat wire (G).

Economizer Cooling

Connect a jumper wire across OTS on Economizer Control (ECA).

Connect red thermostat (R) wire to yellow thermostat wire (Y1).

Cool 1

Connect red thermostat wire (R) to yellow thermostat wire (Y1).

Cool 2

Connect red thermostat wire (R) to yellow thermostat wire (Y2).

Heat 1

Connect red thermostat wire (R) to brown thermostat wire (W1).

Heat 2

Connect red thermostat wire (R) to brown thermostat wire (W2).

Unit Start-Up

Sequence of Operation

Units are offered with two control options, electromechanical or ReliaTel™.

Note: *Refer to the unit nameplate: If the 9th digit of the model number = R, proceed with the ReliaTel™ Controls section within this chapter. If the 9th digit of the model number = E, proceed with the Electromechanical Controls section within this chapter.*

Note: *The optional condensate overflow switch (COF) will shut the unit down if the float is raised and the switch is closed.*

ReliaTel™ Controls

ReliaTel™ Controls - Constant Volume (CV)

ReliaTel™ control is a microelectronic control feature, which provides operating functions that are significantly different than conventional electromechanical units. The master module is the ReliaTel™ refrigeration module (RTRM).

The RTRM provides compressor anti-short cycle timing functions through minimum "Off" and "On" timing to increase reliability, performance and to maximize unit efficiency.

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

The LED located on the RTRM module is turned "On" within one second after power-up if all internal operations are okay.

ReliaTel™ Control Cooling without an Economizer

When the system switch is set to the "Cool" position and the zone temperature rises above the cooling setpoint control band, the RTRM energizes the (K9) relay coil located on the RTRM. When the K9 relay contacts close, the compressor contactor (CC1) coil is energized provided the low pressure control (LPC1), high pressure control (HPC1) and discharge line thermostat (TDL 1) are closed. When the CC1 contacts close, compressor (CPR1) and the outdoor fan motor (ODM) start to maintain the zone temperature to within ± 2°F of the sensor setpoint at the sensed location.

If the first stage of cooling can not satisfy the cooling requirement, the RTRM energizes the (K10) relay coil located on the RTRM. When the (K10) relay contacts close, the compressor contactor (CC2) coil is energized provided the low pressure control (LPC2), high pressure control (HPC2) and discharge line thermostat (TDL 2) are closed. When the CC2 contacts close, compressor (CPR2) starts to maintain the zone temperature to within ± 2°F of the sensor setpoint at the sensed location.

Three-Stages of Cooling

Note: *High efficiency units only.*

When the unit is configured for three-stage cooling, and the system switch is set to the cool position and the zone temperature rises above the cooling setpoint control band, the RTRM energizes the (K10) relay coil located on the RTRM. When the (K10) relay contacts close, compressor contactor (CC2) is energized. This is the smaller of the two compressors (CPR2). This staging order is opposite standard staging order.

If the first stage of cooling can not satisfy the cooling requirement, the RTRM energizes the (K9) relay coil and de-energizes the (K10) relay coil on the RTRM. Compressor contactor (CC1) is energized, bringing on the larger of the two compressors (CPR1). Compressor contactor (CC2) is de-energized, turning off the smaller compressor.

If the second stage of cooling can not satisfy the cooling requirement, the RTRM keeps the (K9) relay coil energized and energizes the (K10) relay coil. Compressor contactors (CC1) and (CC2) are energized, and both compressors (CPR1 and CPR2).

Lead/Lag is disabled with three-stage cooling. A unit configured for three-stage cooling and controlled with a thermostat will operate as a two-stage unit.

ReliaTel™ Control Evaporator Fan Operation (for Gas Units)

When the fan selection switch is set to the "Auto" position, the RTRM energizes the (K6) relay coil approximately 1 second after energizing the compressor contactor coil (CC1) in the cooling mode. In the heating mode, the RTRM energizes the (K6) relay coil approximately 45 second after gas ignition. Closing the (K6) contacts on the RTRM energizes the indoor fan relay (F) coil to start the indoor fan motor (IDM).

The RTRM de-energizes the fan relay (F) approximately 60 seconds after the cooling requirement has be satisfied to enhance unit efficiency. When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized approximately 90 seconds after the heating requirement.

When the fan selection switch is set to the "On" position, the RTRM keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

When the unit is equipped with the optional clogged filter switch, wired between terminals J7-3 and J7-4 on the ReliaTel™ options module (RTOM), the RTRM produces an analog output if the clogged filter switch (CFS) closes for two minutes after a request for fan operation. When the system is connected to a remote panel, the “SERVICE” LED will be turned on when this failure occurs.

ReliaTel™ Control Evaporator Fan Operation (for Cooling Only Units)

When the fan selection switch is set to the “Auto” position, the RTRM energizes the (K6) relay coil approximately 1 second after energizing the compressor contactor coil (CC1) in the cooling mode. In the heating mode, the RTRM energizes the (K6) relay coil approximately 1 second before energizing the electric heat contactors. Closing the (K6) contacts on the RTRM energizes the indoor fan relay (F) coil to start the indoor fan motor (IDM). The RTRM de-energizes the fan relay (F) approximately 60 seconds after the cooling requirement has be satisfied to enhance unit efficiency.

When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized at the same time as the heater contactors.

When the fan selection switch is set to the “On” position, the RTRM keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

When the unit is equipped with the optional clogged filter switch, wired between terminals J7-3and J7-4 on the ReliaTel™ options module (RTOM), the RTRM produces an analog output if the clogged filter switch (CFS) closes for two minutes after a request for fan operation.

When the system is connected to a remote panel, the “SERVICE” LED will be turned on when this failure occurs.

Low Ambient Operation

Note: *For ReliaTel™ units only*

During low ambient operation, outside air temperature below 55°F, the RTRM will cycle the compressor and outdoor fan motor “Off” for approximately 3 minutes after every 10 minutes of accumulated compressor run time. The indoor fan motor (IDM) will continue to operate during this evaporator defrost cycle (EDC) and the compressor and outdoor fan will return to normal operation once the defrost cycle has terminated and the compressor “Off” time delay has been satisfied.

Note: *Units with the dehumidification option - When in dehumidification mode, the unit will not cycle as described above. The unit will run continuously in dehumidification mode at all ambient conditions above 40°F. Dehumidification is disabled at ambient conditions below 40°F.*

Multi-Speed Indoor Motor

Note: *Multi-speed indoor fan available only on 6, 7.5 (dual compressor) & 8.5 tons high efficiency, and 10 ton products with ReliaTel™ controls.*

Note: *Multi-speed indoor fan standard for 17 Plus.*

Models configured for the multi-speed indoor motor will be controlled via the 0-10 Vdc or PWC indoor fan speed output located on the RTOM. R136 (DA COOL_FAN SPD) potentiometer on the RTOM sets the maximum motor speed. Note that the potentiometer voltage readings can be verified via 2-position harness connector located adjacent to the RTOM. The unit schematic will illustrate the exact location. Use a DC voltmeter to read the voltage between the two terminals. Provisions have been made in Service TEST Mode to allow for maximum motor speed adjustment. Motor may be adjusted using modes listed below. Reference the RPM table in the Performance Data section for fan speed.

1. TEST Mode Cool 2; 2-Step Cool applications only
2. TEST Mode Cool 3; 3-Step Cool applications only

Adjust R136 potentiometer clockwise to increase or counterclockwise to decrease motor speed.

Refer to the Fan Output% list below for supply fan output associated with each unit function:

Fan Output%

- Ventilation Only 50%
- Economizer Cooling 65%
- Cool 1 (C1 Energized) 65%
- Cool 2 (C1 + C2) 100% (2-Steps of Cooling)
- Cool 2 (C1 or C2) 65% (3-Steps of Cooling)
- Cool 3 (C1 + C2 Energized) 100%
- Dehumidification Fan Speeds and Enhanced 53%
- Heat 100%

Multi-Zone VAV Sequence of Operation

Supply Air Pressure Control

ReliaTel™ Option Module Control (RTOM)

Supply fan is driven by a pulse-width modulation (PWM) signal from the RTOM.

Note: *PWM = 3 to 5 tons*

A pressure transducer measures duct static pressure, and the supply fan is modulated to maintain the supply air static pressure within an adjustable user-defined range. The range is determined by the supply air pressure setpoint and supply air pressure deadband, which are set through a unit mounted potentiometer or remote panel. The RTOM provides supply fan motor speed modulation.

The supply fan will accelerate or decelerate as required to maintain the supply static pressure setpoint.

Supply Air Static Pressure Limit

The control of the supply fan and VAV boxes are coordinated, with respect to time, during unit start up and transition to/from Occupied/Unoccupied modes to prevent overpressurization of the supply air ductwork. However, if for any reason the supply air pressure exceeds the fixed supply air static pressure limit of 3.5" W.C., the supply fan is shut down and the VAV boxes are closed. The unit is then allowed to restart three times. If the overpressurization condition occurs on the fourth time, the unit is shut down and a manual reset diagnostic is set and displayed at any of the remote panels with LED status lights or communicated to the Integrated Comfort system.

Supply Air Temperature Controls

Cooling/Economizer

During occupied cooling mode of operation, the economizer (if available) and primary cooling are used to control the supply air temperature. The supply air temperature setpoint is user-defined at the unit mounted VAV Setpoint Potentiometer or at the remote panel. If the enthalpy of the outside air is appropriate to use “free cooling”, the economizer will be used first to attempt to satisfy the supply setpoint. On units with economizer, a call for cooling will modulate the fresh air dampers open. The rate of economizer modulation is based on deviation of the discharge temperature from setpoint, i.e., the further away from setpoint, the faster the fresh air damper will open. Note that the economizer is only allowed to function freely if ambient conditions are below the enthalpy control setting or below the return air enthalpy if unit has comparative enthalpy installed. If outside air is not suitable for “economizing”, the fresh air dampers drive to the minimum open position. A field adjustable potentiometer on the Economizer Actuator, or a remote potentiometer can provide the input to establish the minimum damper position. At outdoor air conditions above the enthalpy control setting, primary cooling only is used and the fresh air dampers remain at minimum position. If the unit does not include an economizer, primary cooling only is used to satisfy cooling requirements.

Supply Air Setpoint Reset

Supply air reset can be used to adjust the supply air temperature setpoint on the basis of a zone temperature, return air temperature, or on outdoor air temperature. Supply air reset adjustment is available on the unit mounted VAV setpoint potentiometer for supply air cooling control.

Reset Based on Outdoor Air Temperature

Outdoor air cooling reset is sometimes used in applications where the outdoor temperature has a large effect on building load. When the outside air temperature is low and the building cooling load is low, the supply air setpoint can be raised, thereby preventing subcooling of critical zones. This reset can lower usage of primary cooling and result in a reduction in primary cooling energy usage There are two user-defined parameters that are adjustable through the VAV Setpoint Potentiometer: reset temperature setpoint and reset amount. The amount of reset applied is dependent upon how far the outdoor air temperature is below the supply air reset setpoint. The amount is zero where they are equal and increases linearly toward the value set at the reset amount input. The maximum value is 20°F. If the outdoor air temperature is more than 20°F below the reset temperature setpoint the amount of reset is equal to the reset amount setpoint.

Reset Based on Zone or Return Temperature

Zone or return reset is applied to the zone(s) in a building that tends to overcool or overheat. The supply air temperature setpoint is adjusted based on the temperature of the critical zone(s) or the return air temperature. This can have the effect of improving comfort and/or lowering energy usage. The user-defined parameters are the same as for outdoor air reset. Logic for zone or return reset control is the same except that the origins of the temperature inputs are the zone sensor or return sensor respectively. The amount of reset applied is dependent upon how far the zone or return air temperature is below the supply air reset setpoint. The amount is zero where they are equal and increases linearly toward the value set at the reset amount potentiometer on the VAV setpoint potentiometer. The maximum value is 3°F. If the return or zone temperature is more than 3°F below the reset temperature setpoint the amount of reset is equal to the reset amount setpoint.

Zone Temperature Control

Unoccupied Zone Cooling

During unoccupied mode, the unit is operated as a CV unit. VAV boxes are driven full open and the supply fan is commanded to full speed. The unit controls zone temperature to the Unoccupied zone cooling setpoints.

Daytime Warm-up

During occupied mode, if the zone temperature falls to a temperature three degrees below the Morning Warm-up setpoint, Daytime Warm-up is initiated. The system changes to CV heating (full unit airflow), the VAV boxes are fully opened and the CV heating algorithm is in control until the Morning Warm-up setpoint is reached. The unit is then returned to VAV cooling mode. The Morning Warm-up setpoint is set at the unit mounted VAV Setpoint potentiometer or at a remote panel.

Morning Warm-up (MWU)

Morning warm-up control (MWU) is activated whenever the unit switches from unoccupied to occupied and the zone temperature is at least 1.5°F below the MWU setpoint. When MWU is activated the VAV box output will be energized for at least 6 minutes to drive all boxes open, the supply fan is commanded to full speed, and full heat (gas or electric) is energized. When MWU is activated the economizer damper is driven fully closed. When the zone temperature meets or exceeds the MWU setpoint minus 1.5°F, the heat will be turned or staged down. When the zone temperature meets or exceeds the MWU setpoint then MWU will be terminated and the unit will switch over to VAV cooling.

Variable Air Volume Applications (Single Zone VAV)

Supply Fan Output Control

Units configured for Single Zone VAV will be controlled via the 0-10Vdc Indoor Fan Speed output located on the RTOM. R136 (DA COOL_FAN SPD) potentiometer on the RTOM sets the maximum motor speed. Note that the potentiometer voltage readings can be verified via 2-position harness connector located adjacent to the RTOM. The unit schematic will illustrate the exact location. Use a DC voltmeter to read the voltage between the two terminals. Reference the RPM table in the Performance Data section for fan speed.

- Use Service TEST Mode to adjust maximum motor speed using modes listed below.

1. TEST Mode Cool 2; 2-Step Cool applications only
2. TEST Mode Cool 3; 3-Step Cool applications only

- Adjust DA COOL_FAN SPD potentiometer clockwise to increase or counterclockwise to decrease motor speed.
- The control will scale the 0-10Vdc output from the RTOM linearly to control between the 50%-100% controllable range based on the space cooling demand.

Minimum Supply Fan Output

- Refer to the table below for details on minimum supply fan output signals associated with each unit function.
- Minimum Fan Output%
- Ventilation Only 50%
- Economizer Cooling 65%
- Cool 1 (C1 Energized) 65%
- Cool 2 (C1 + C2) 82% (2-Steps of Cooling)
- Cool 2 (C1 or C2) 65% (3-Steps of Cooling)
- Cool 3 (C1 + C2 Energized) 82%
- Heat 100%

Discharge Air Cool Setpoint Adjustment

- Single Zone VAV units will require traditional zone heating (if heat installed) and cooling setpoints that are used on single speed units in addition to a new setpoint: Discharge Air Cool Setpoint limit. Discharge Air Cool Setpoints will be customer selectable via a potentiometer (DACR) adjacent to the RTOM with a range of 40- 70°F.
- The table below lists the discharge air cool setpoints on the DACR.

Note: *The recommended setting is 50°F.*

Table 12. Discharge air cool setpoints (DACR)

Setpoint (°F)	Voltage (Vdc)
40 - <0.1	55 - 1.65
41 - 0.2	56 - 1.7
42 - 0.3	57 - 1.75
43 - 0.45	58 - 1.83
44 - 0.55	59 - 1.9
45 - 0.7	60 - 1.95
46 - 0.8	61 - 2
47 - 0.95	62 - 2.05
48 - 1.05	63 - 2.1
49 - 1.15	64 - 2.13
50 - 1.25	65 - 2.17
51 - 1.3	66 - 2.21
52 - 1.35	67 - 2.27
53 - 1.45	68 - 2.3
54 - 1.55	69 - 2.35
70 - >2.4	

ReliaTel™ Control Cooling with an Economizer

The economizer is utilized to control the zone temperature providing the outside air conditions are suitable. Outside air is drawn into the unit through modulating dampers. When cooling is required and economizing is possible, the RTRM sends the cooling request to the unit economizer actuator (ECA) to open the economizer damper. The RTRM tries to cool the zone utilizing the economizer to slightly below the zone temperature setpoint. If the mixed air sensor (MAS) senses that the mixed air temperature is below 53°F, the damper modulates toward the closed position. If the zone temperature continues to rise above the zone temperature setpoint controlband and the economizer damper is full open, the RTRM energizes the compressor contactor (CC1). If the zone temperature continues to rise above the zone temperature setpoint controlband and the economizer damper is fully open, the RTRM energizes the compressor contactor (CC2).

Multi-Speed Fan

When economizing alone or with 1st stage cooling the indoor motor will operate at low speed. If economizing and 2nd stage cooling requested, the indoor motor will transition from low to high speed.

Single Zone VAV

The indoor motor will vary the indoor motor speed to optimize minimum fan speed for the cooling demand in all modes (Economizer Only, Economizer +1st Stage Cooling, or Economizer + 1st/2nd Stage Cooling).

The ECA continues to modulate the economizer damper open/closed to keep the mixed air temperature that is calculated by the RTRM.

If economizing is not possible, the ECA drives the damper to the minimum position setpoint when the indoor fan relay (F) is energized and allows mechanical cooling operation.

When the unit is equipped with the optional fan failure switch, wired between terminals J7-5 and J7-6 on the RTOM, the RTRM will stop all cooling functions and produce an analog output if the fan failure switch (FFS) does not open within 40 seconds after a request for fan operation. When the system is connected to a remote panel, the “SERVICE” LED will flash when this failure occurs.

ReliaTel™ Control Dehumidification

Single Compressor Units

On a call for dehumidification, the reheat valve is energized and the compressor is turned on. When the humidity control setpoint is satisfied, the valve is de-energized and the compressor is turned off. If there is a call for cooling or heating from the space temperature controller, i.e. zone sensor or thermostat, while in reheat, the reheat valve is de-energized and the compressor continues to run, or the heat is turned on. The 3 minute compressor on and off times are still active during compressor operation.

Dual Compressor Units

The dehumidification cycle is only permitted above 40°F and below 100°F and is not permitted during a heating cycle or during a demand for 2nd stage cooling. Otherwise, when an installed zone humidity sensor indicates a relative humidity equal to or greater than the RH set point as adjusted on the ReliaTel™ options module (RTOM), a dehumidification cycle is initiated. The sequence of operation for the dehumidification cycle is identical to that of the second stage ReliaTel™ cooling cycle, except that the hot gas reheat valve (RHV) is energized, allowing air from the evaporator to be reheated. Also, any installed fresh air damper is driven to minimum position.The dehumidification cycle is terminated by initiation of a heating cycle or a 2nd stage cooling cycle or when zone humidity is reduced to 5% below the R.H. set point. In the absence of a zone humidity sensor input, an on/off input from a zone humidistat is used to initiate/terminate the dehumidification cycle.

Dehumidification takes priority over a call for one-stage cooling.

Heating or two-stage cooling takes priority over dehumidification, and a relative humidity sensor takes priority over a humidistat.

Dehumidification Coil Purge Cycle

On multiple circuit units with dehumidification/reheat configured, a purge cycle will be active for compressor reliability. The purpose of this function is to properly distribute refrigerant and lubricant throughout the system by temporarily switching to the unused section of the coil for 3 minutes (purge cycle). The function operates as follows:

1. A purge cycle will be initiated after 90 minutes of accumulated compressor run time in only one mode: cooling or dehumidification, without transitioning to the other mode.
2. A purge cycle will consist of transitioning to the mode that hasn’t run in 90 minutes of total compressor operation. The cycle will last for a period of 3 minutes.
3. The 90-minute cycle count will be reset anytime there is a normal transition between cooling and dehumidification. Transitioning from one of these modes to any other mode (off or heat) will not reset the counter.
4. If the purge cycle is a cooling cycle, only the first circuit will be activated. If it is a dehumidification cycle then the normal 2-compressor dehumidification mode cycle will be used.
5. The purge cycle will ignore the low ambient dehumidification lockout feature.
6. A purge cycle takes priority over normal cooling or dehumidification requests, but will discontinue for all high priority lockouts and alarms.

ReliaTel™ Control Cooling with an Economizer

The economizer is utilized to control the zone temperature providing the outside air conditions are suitable. Outside air is drawn into the unit through modulating dampers. When cooling is required and economizing is possible, the RTRM sends the cooling request to the unit economizer actuator (ECA) to open the economizer damper. The RTRM tries to cool the zone utilizing the economizer to slightly below the zone temperature setpoint. If the mixed air sensor (MAS) senses that the mixed air temperature is below 53°F, the damper modulates toward the closed position. If the zone temperature continues to rise above the zone temperature setpoint control band and the economizer damper is full open for 5 minutes, the RTRM energizes the compressor contactor (CC1). If the zone temperature continues to rise above the zone temperature setpoint control band and the economizer damper is fully open, the RTRM energizes the compressor contactor (CC2).

The ECA continues to modulate the economizer damper open/closed to keep the mixed air temperature that is calculated by the RTRM.

If economizing is not possible, the ECA drives the damper to the minimum position setpoint when the indoor fan relay (F) is energized and allows mechanical cooling operation.

When the unit is equipped with the optional fan failure switch, wired between terminals J7-5 and J7-6 on the RTOM, the RTRM will stop all cooling functions and produce an analog output if the fan failure switch (FFS) does not open within 40 seconds after a request for fan operation. When the system is connected to a remote panel, the "SERVICE" LED will flash when this failure occurs.

Note: *For units equipped with the dehumidification option, if the unit is economizing, the damper resets to minimum position while in dehumidification mode.*

Economizer Set-Up

Adjusting the minimum position potentiometer located on the unit economizer actuator (ECA) sets the required amount of ventilation air.

Two of the three methods for determining the suitability of the outside air can be selected utilizing the enthalpy potentiometer on the ECA, as described below:

1. Ambient temperature - controlling the economizing cycle by sensing the outside air dry bulb temperature. The following table lists the selectable dry bulb values by potentiometer setting.
2. Reference enthalpy - controlling the economizer cycle by sensing the outdoor air humidity. The following table lists the selectable enthalpy values by potentiometer setting. If the outside air enthalpy value is less than the selected value, the economizer is allowed to operate.
3. Comparative enthalpy - utilizing a humidity sensor and a temperature sensor in both the return air stream and the outdoor air stream, the unit control processor (RTRM) will be able to establish which conditions are best suited for maintaining the zone temperature, i.e. indoor conditions or outdoor conditions. The potentiometer located on the ECA is non-functional when both the temperature and humidity sensors are installed.

Table 13. Potentiometer settings

Potentiometer Setting	Dry Bulb	Reference Enthalpy
A	73°F (22.8ºC)	27 Btu/lb (63 kJ/kg)
B	70°F (21.1ºC)	25 Btu/lb (58 kJ/kg)
C	67°F[a] (19.4ºC)	23 Btu/lb (53 kJ/kg)
D	63°F (17.2ºC)	22 Btu/lb (51 kJ/kg)
E	55ºF (12.8ºC)	19 Btu/lb (44 kJ/kg)

(a) Factory settings

ReliaTel™ Control Heating Operation (for Cooling Only Units)

When the system switch is set to the "Heat" position and the zone temperature falls below the heating setpoint control band, the RTRM energizes (K1) relay coil. When the (K1) relay contacts close, located on the RTRM, the first stage electric heat contactor (AH or AH & CH) is energized.

If the first stage of electric heat can not satisfy the heating requirement, the RTRM energizes (K2) relay coil. When the (K2) relay contacts close, located on the RTRM, the second stage electric heat contactor (BH) is energized, if applicable. The RTRM cycles both the first and second stages of heat "On" and "Off" as required to maintain the zone temperature setpoint.

ReliaTel™ Control Heating Operation (for Gas Units)

When the system switch is set to the "Heat" position and the zone temperature falls below the heating setpoint control band, a heat cycle is initiated when the RTRM communicates ignition information to the Ignition module (IGN).

Ignition Module

Two-stage (IGN) runs self-check (including verification that the gas valve is de-energized). (IGN) checks the high-limit switches (TC01 & TC02) for normally closed contacts, the pressure switch (PS) for normally open contacts, and the flame rollout (FR) switch for continuity. (IGN) energizes inducer blower on high speed to check pressure switch closure. If the pressure switch is closed, the inducer blower starts a 20-second pre-purge (15 seconds on high speed followed by 5 seconds on low speed). If the pressure switch (PS) is still open, the inducer blower will continue to be energized on high speed until pressure switch closure. After pre-purge completes, the (IGN) energizes the first stage of the gas valve, initiates spark for 2 seconds minimum, 7 seconds maximum (ignition trial) and detects flame and de-energizes spark. From this point, a fixed 45 second indoor blower delay on timing starts. After the indoor blower delay on is completed, the (IGN) energizes the indoor blower. The (IGN) enters a normal operating loop where all inputs are continuously monitored. If the first stage of gas heat can not satisfy the heating requirement, the thermostat closes W2. The (IGN) energizes the second stage of the gas valve and the second stage of inducer blower. When the zone thermostat is satisfied, the (IGN) de-energizes the gas valve. The (IGN) senses loss of flame. The (IGN) initiates a 5 second inducer blower post purge. The (RTRM) initiates a second indoor blower delay off.

If the burner fails to ignite, the ignition module will attempt two retries before locking out. The green LED will indicate a lock out by two fast flashes. An ignition lockout can be reset by;

1. Opening for 3 seconds and closing the main power disconnect switch.
2. Switching the “Mode” switch on the zone sensor to “OFF” and then to the desired position.
3. Allowing the ignition control module to reset automatically after one hour. Refer to the “Ignition Control Module Diagnostics” section for the LED diagnostic definitions.

When the fan selection switch is set to the “Auto” position, the RTRM energizes the indoor fan relay (F) coil approximately 30 second after initiating the heating cycle to start the indoor fan motor (IDM).

Table 14. Ignition module diagnostics

Steady light	Module is powered up, but no active call for heat.
Blinking at continuous steady rate	Active call for heat.
One blink	Loss of communication.
Two blinks	System lockout (failure to ignite, no spark, low/no gas pressure, etc.)
Three blinks	Pressure switch (no vent air flow, bad CBM, closed at initial call for heat). Auto reset.
Four blinks	High limit (excessive heat in combustion chamber, low airflow). Auto reset.
Five blinks	Flame sensed and gas valve not energized or flame sensed and no call for heat.
Six blinks	Flame rollout (CBM failure, incorrect gas pressure, incorrect primary air). Requires manual reset of the switch.
Seven blinks	ReliaTel™ module will communicate a heat fail diagnostic back to the RTRM.

Drain Pan Condensate Overflow Switch (Optional)

This input incorporates the condensate overflow switch (COF) mounted on the drain pan and the ReliaTel™ options module (RTOM). When the condensate level reaches the trip point for 6 continuous seconds, the RTOM will shut down all unit function until the overflow condition has cleared. The unit will return to normal operation after 6 continuous seconds with the COF in a non-tripped condition. If the condensate level causes the unit to shutdown more than 2 times in a 3 day period, the unit will be locked-out of operation. A manual reset of the diagnostic system through the zone sensor or Building Automation System (BAS) will be required. Cycling unit power will also clear the fault.

Electromechanical Controls

These units are offered with two control options, electromechanical and ReliaTel™ controls. The ReliaTel™ controls is a microelectronic control feature, which provides operating functions that are significantly different than conventional electromechanical units.

Electromechanical Control Cooling without an Economizer

When the thermostat switch is set to the “Cool” position and the zone temperature rises above the cooling setpoint, the thermostat Y contacts close. The compressor contactor (CC1) coil is energized provided the low pressure control (LPC1), high pressure control (HPC1) and discharge line thermostat (TDL 1) are closed. When the (CC1) contacts close, compressor (CPR1) and the outdoor fan motor (ODM) start. If the first stage of cooling can not satisfy the cooling requirement, the thermostat closes Y2. The compressor contactor (CC2) coil is energized provided the low pressure control (LPC2), high pressure control (HPC2) and discharge line thermostat (TDL 2) are closed.

When the (CC2) contacts close, compressor (CPR2) starts.

Electromechanical Control Evaporator Fan Operation (for Gas Units)

When the thermostat fan selection switch is set to the “Auto” position, the Ignition Module (IGN) energizes the indoor fan relay (F) approximately 1 second after energizing the compressor contactor coil (CC1) in the cooling mode. In the heating mode, the Ignition Module (IGN) energizes the indoor fan relay (F) coil approximately 45 second after gas ignition. Closing indoor fan relay (F) coil starts the indoor fan motor (IDM). The (IGN) de-energizes the fan relay (F) approximately 80 seconds after the cooling requirement has been satisfied to enhance unit efficiency.

When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized approximately 90 seconds after the heating requirement.

When the thermostat fan selection switch is set to the “On” position, the (IGN) keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

Electromechanical Evaporator Fan Operation (for Cooling Only Units)

When the thermostat fan selection switch is set to the “Auto” position, the thermostat energizes the indoor fan relay coil (F) to start the indoor fan motor (IDM). The fan relay (F) de-energizes after the cooling requirement has been satisfied. When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized with heater contactors.

When the thermostat fan selection switch is set to the “On” position, the thermostat keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

Economizer Set-Up

Adjusting the minimum position potentiometer located on the unit economizer actuator (ECA) sets the required amount of ventilation air.

Ambient temperature is controlling the economizing cycle by sensing the outside air dry bulb temperature. The following table lists the selectable dry bulb values by potentiometer setting.

Table 15. Potentiometer settings

Potentiometer Setting	Dry Bulb	Reference Enthalpy
A	73°F (22.8ºC)	27 Btu/lb (63 kJ/kg)
B	70°F (21.1ºC)	25 Btu/lb (58 kJ/kg)
C	67°F[(a)] (19.4ºC)	23 Btu/lb (53 kJ/kg)
D	63°F (17.2ºC)	22 Btu/lb (51 kJ/kg)
E	55ºF (12.8ºC)	19 Btu/lb (44 kJ/kg)

(a) Factory settings

Electromechanical Control Cooling with an Economizer

The economizer is utilized to control the zone temperature providing the outside air conditions are suitable. Outside air is drawn into the unit through modulating dampers.

When cooling is required and economizing is possible, the unit economizer actuator (ECA) opens the economizer damper. The ECA continues to modulate the economizer damper open/closed to keep the mixed air temperature in the 50ºF to 55ºF range.

The thermostat will close the Y2 contacts to turn on contactor (CC1) if mechanical cooling is required.

If economizing is not possible, the ECA drives the damper to the minimum position setpoint when the indoor fan relay (F) is energized and allows mechanical cooling operation.

Electromechanical Control Heating Operation (for Cooling Only Units)

When the system switch is set to the "Heat" position and the zone temperature falls below the heating setpoint, the thermostat closes W1 contacts the first stage electric heat contactor (AH or AH & CH) is energized. If the first stage of electric heat can not satisfy the heating requirement, the thermostat closes W2.
When the W2 contacts close, the second stage electric heat contactor (BH) is energized, if applicable. The thermostat cycles both the first and second stages of heat "On" and "Off" as required to maintain the zone temperature setpoint.

Electromechanical Control Heating Operation (for Gas Units)

When the system switch is set to the "Heat" position and the zone temperature falls below the heating setpoint, the Ignition module (IGN) initiates a heat cycle.

Ignition Module Low, Medium and High Heat

Two-stage (IGN) runs self-check (including verification that the gas valve is de-energized). (IGN) checks the high-limit switches (TC01 & TC02) for normally closed contacts, the pressure switch (PS) for normally open contacts, and the flame rollout (FR) switch for continuity. (IGN) energizes inducer blower on high speed to check pressure switch closure.

If the pressure switch is closed, the inducer blower starts a 20 second pre-purge (15 seconds on high speed followed by 5 seconds on low speed).

If the pressure switch (PS) is still open, the inducer blower will continue to be energized on high speed until pressure switch closure.

After pre-purge completes, the (IGN) energizes the first stage of the gas valve, initiates spark for 2 seconds minimum, 7 seconds maximum (ignition trial) and detects flame and de-energizes spark. From this point, a fixed 45 second indoor blower delay on timing starts.

After the indoor blower delay on is completed, the (IGN) energizes the indoor blower. The (IGN) enters a normal operating loop where all inputs are continuously monitored. If the first stage of gas heat can not satisfy the heating requirement, the thermostat closes W2. The (IGN) energizes the second stage of the gas valve and the second stage of inducer blower.

When the zone thermostat is satisfied, the (IGN) de-energizes the gas valve. The (IGN) senses loss of flame. The (IGN) initiates a 5 second inducer blower post purge and 90 second indoor blower delay off at current speed. The (IGN) de-energizes the inducer blower at the end of the post purge. The (IGN) de-energizes the indoor blower at the end of the selected indoor blower delay off.

Table 16. Ignition module diagnostics

Steady light	Module is powered up, but no active call for heat.
Blinking at continuous steady rate	Active call for heat.
One blink	Loss of communication.
Two blinks	System lockout (failure to ignite, no spark, low/no gas pressure, etc.)
Three blinks	Pressure switch (no vent air flow, bad CBM, closed at initial call for heat). Auto reset.
Four blinks	High limit (excessive heat in combustion chamber, low airflow). Auto reset.

Table 16. Ignition module diagnostics

Five blinks	Flame sensed and gas valve not energized or flame sensed and no call for heat.
Six blinks	Flame rollout (CBM failure, incorrect gas pressure, incorrect primary air). Requires manual reset of the switch.
Seven blinks	W1& W2 swapped (electromechanical 3-10 tons units).

Drain Pan Condensate Overflow Switch (Optional)

The condensate overflow switch (COF) is utilized to prevent water overflow from the drain pan. The float switch is installed on the corner lip of the drain pan. When the condensate level reaches the trip point, the COF relay energizes and opens the 24VAC control circuit which disables the unit. Once the 24VAC control circuit is opened, a delay timer will prevent unit start-up for three minutes.

Verifying Proper Air Flow

WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

Units with 5-Tap Direct 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 motor is factory wired to operate on speed tap 1 in the cooling and heating mode for electric/electric units. For Gas/Electric units, the motor is factory wired to operate on speed tap 1 during cooling. For 3 & 4 ton Gas/ Electric units operating in heat mode, the minimum setting is Tap 4.

For these units, a separate tap terminal is provided to change speeds automatically between heating and cooling. The motor can be rewired for different speed settings should the application require it. Refer to the wiring diagram that shipped in the unit and the unit fan performance tables in the Service Facts.

The indoor fan motors are specifically designed to operate within the BHP parameters listed in the fan performance tables of the unit Service Facts.

When verifying direct drive fan performance, the tables must be used somewhat differently than those of belt driven fans. Fan performance diagnostics can be easily recognized when these tables are used correctly.

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 11, p. 48, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Electromechanical Control:

Using the Service Test Guide perform the proper test mode connections.

With the fan operating properly, determine the total system external static pressure (inches w.c.) by the following method (ReliaTel/Electromechanical):

1. Measure the supply and return duct static pressure and sum the resulting absolute values,
2. Use the accessory pressure drop table in the Service Facts, to calculate the total static pressure drop for all of the accessories installed on the unit; i.e., curb, economizer, etc.

Note: *Accessory static pressure drop is based on desired CFM and may not be actual static pressure drop.*

3. Add the total accessory static pressure drop (step 2) to the duct external static pressure (step 1). The sum of these two values represents the total system external static pressure.

Using the Fan Performance Tables in the Service Facts, look up the selected speed tap setting and match the measured ESP to determine the approximate CFM.

If the required CFM is too low, (external static pressure is high) do one or both of the following and repeat procedure:

a. Relieve supply and/or return duct static.
b. Change indoor fan speed tap to a higher value

If the required CFM is too high, (external static pressure is low), do one or both of the following and repeat procedure:

c. Increase supply and/or return duct static.
d. Change indoor fan speed tap to a lower value.

Note: *Minimum setting for units with gas or electric heat is 320 CFM per ton. For 3 & 4 ton gas Heat units operating in heating mode the heat speed set cannot be lower than speed Set 4.*

4. To stop the SERVICE TEST, turn the main power disconnect switch to the “Off” position or proceed to the next component start-up procedure.

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 11, p. 48, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Electromechanical Control:

Using the Service Test Guide perform the proper test mode connections.

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) by (ReliaTel™/Electromechanical):

1. Measuring 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 using (Actual Motor Amps/ Motor Nameplate Amps) 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 HP 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.
   - To Increase Fan RPM; Loosen the pulley adjustment set screw and turn sheave clockwise.
   - To Decrease Fan RPM; Loosen the pulley adjustment set screw and turn sheave counterclockwise.
   - If the required CFM is too high, (external static pressure is low causing motor HP output to be above table value), change indoor fan speed and repeat Step 1 and Step 2.
   - To stop the SERVICE TEST, turn the main power disconnect switch to the “Off” position or proceed to the next component start-up procedure.

Units with Direct Drive Indoor Fan - Electromechanical Control

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 adjusting the output voltage from the MMC/ECM board to the direct drive fan. Before starting the SERVICE TEST, set the minimum position setpoint for the economizer to 0 percent using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel™ Units with Direct Drive Indoor Fan (10 Ton Standard Efficiency, 6(074) to 10 Ton High Efficiency, and optional 7.5 (092) to 8.5 Ton Standard Efficiency)

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 adjusting the voltage from the RTOM Indoor Fan Speed output to the direct drive plenum fan. If installed, before starting the SERVICE TEST disable the Economizer by disconnecting the 4 pin power connector located at the base of the Economizer Control (ECA).

Using the Service Test Guide in Table 11, p. 48, momentarily jump across the Test 1 & Test 2 terminals on LTB1. Repeat process until Service Test Mode is at Cool 2 (2-Steps of Cooling Applications Only) or Cool 3 (3-Steps of Cooling applications). The indoor motor shall be operating @ 100%, to verify turn DA COOL_FAN SPD potentiometer full clockwise, voltage should read ~7.5 Vdc across harness test terminals. The Unit schematic illustrates location for measuring the indoor motor speed voltage.

Table 17. Direct drive plenum fan settings (rpm vs. voltage)

Potentiometer Voltage	Motor RPM
1	N/A
1.25	N/A
1.5	N/A
1.75	N/A
2	N/A
2.25	325
2.5	402
2.75	465
3	544
3.25	630
3.5	716
3.75	775
4	845
4.25	912

Table 17. Direct drive plenum fan settings (rpm vs. voltage) (continued)

Potentiometer Voltage	Motor RPM
4.5	976
4.75	1044
5	1115
5.25	1203
5.5	1253
5.75	1312
6	1368
6.25	1425
6.5	1475
6.75	1533
7	1581
7.25	1615
7.5	1615

Once the supply fan has started, determine the total system airflow (CFM)

1. Measure the DC voltage across harness test terminals. Using the fan rpm table shown above, determine RPM correlated to measured voltage.
2. If the required CFM is too low, (external static pressure is high causing motor HP 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.

- To Increase/Decrease Fan RPM turn DA COOL_FAN SPD on the RTOM clockwise/counter-clockwise.

3. If the required CFM is too high, (external static pressure is low causing motor HP output to be above table value), change indoor fan speed and repeat repeat Step 1 and Step 2.

- Stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position and reconnect Economizer 4-pin power connector if disconnected for this procedure.

Proceed to the next component start-up procedure.

Electromechanical Control:

Using the Service Test Guide perform the proper test mode connections.

Once the supply fan has started, determine the total system airflow (CFM) by (ReliaTel™/Electromechanical):

4. Measure the amperage at the supply fan contactor and compare it with the full load amp (FLA) rating for the evaporator motor stamped on the unit nameplate.
   a. Calculate the theoretical BHP using (Actual Motor Amps/Motor Nameplate Amps) 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.
5. If the required CFM is too low, (external static pressure is high causing motor HP output to be below table value),
   a. Relieve supply and/or return duct static.
   b. Change indoor fan speed and repeat steps 1 and 2.

- For ECM board: To Increase/Decrease Fan RPM:
  a. Push and hold the SET button for 3 sec. Board will display Motor 1 parameter name: Hi 1.
  b. Slow push SET again to display the parameter's current value =7.50 volts.
  c. Push on + or – button to adjust parameter to desired value = XXX volts.
  d. Push and hold SET button for 3 sec to "save" the value. After save is complete, Hi 1 will show again.
  e. After the voltage Hi 1 is successfully changed, the display sequence will be:

MTR 1---> XXX -----> MTR2 -----> 0.00----->FST1---->ON/OFF----->FST2------>ON/OFF------->EhEn-- --->ON/OFF

The motor will ramp up or down to adjust to the input signal. Using the fan rpm table above, determine RPM correlated to displayed voltage.

- If the required CFM is too high, (external static pressure is low causing motor HP output to be above table value), change indoor fan speed and repeat steps 1 and 2.
- To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure.

Units with Constant CFM Direct 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 provides a constant CFM base on voltage output for the potentiometer on the RTOM board. Before starting the SERVICE TEST, set the minimum position setpoint for the economizer to 0 percent using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel Control

Using the Service Test Guide in Table 11, p. 48, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Once the supply fan has started, determine the total system airflow (CFM) by:

1. Measure the DC voltage across pins TP1 and ground (screw on corner of RTOM board). Lookup desired CFM using the voltage CFM table shown on the access panel

label or in the unit Service Facts; record corresponding voltage. Adjust potentiometer until output voltage across TP1 and ground achieves desired CFM setpoint.

2. To increase voltage/CFM, turn potentiometer clockwise.
3. To decrease voltage/CFM, turn potentiometer counter-clockwise.

Note: *With ID fan access panel removed, fan will operate at lower RPM due to the decrease in pressure. Once panel is installed, RPM will increase.*

17 Plus units with the constant CFM direct drive indoor fan

Proper airflow is critical to unit operation. All 17 Plus Precedent units (037, 047, and 067 units) use an indoor fan that provides a constant CFM. There are two different types of 17 Plus Precedent units: Single Zone VAV units and Multi Speed units. Both types of units use the same type of indoor motor and the same airflow adjustment procedure.

To adjust airflow on a 17 Plus unit the Service Test mode must be used for accurate results. Additionally, airflow adjustments should be made in either “Cool Stage 2” or any stage of heat because the fan is driven to its maximum setting during these stages. Only the maximum fan setting requires adjustment, all other fan speeds follow the maximum adjustment and do not require any adjustment.

Using the Service Test Guide in Table 11, p. 48, enter the unit into either “Cool Stage 2" or any stage of heat by using either the “Step Test Mode” or “Resistance Test Mode”.

Once the unit is in either “Cool Stage 2” or any stage of heat, system airflow (CFM) is determined by:

1. In the indoor fan compartment, locate the R136 potentiometer on the RTOM circuit board (also designated “DA COOL - FAN SPD”). Also, locate the TP1 test pin loop next to the R136 potentiometer.
2. Measure the DC Voltage across the test pin TP1 and unit chassis ground. Compare DC voltage to the CFM chart shown in Table 18, p. 61. Table 18, p. 61 shows what DC voltage corresponds to CFM per ton of unit cooling.

   Note: *If 1200 cfm is required from a 3 ton unit (037) the R136 potentiometer should be adjusted so that the DC voltage measured at TP1 to ground reads 1.65 volts DC.*

3. To increase the TP1 voltage, turn the R136 potentiometer clockwise.
4. To decrease the TP1 voltage, turn the R136 potentiometer counter-clockwise.

Note: *With the indoor fan access panel removed, the fan will operate at a lower RPM because static pressure is reduced with the door open. Once the panel is returned the RPM of the indoor fan will increase.*

Table 18. Cfm vs. vdc

PWM% value	Potentiometer Voltage (vdc)	CFM/Ton
70	<0.1	320
75	0.7	347
80	1.25	373
85	1.65	400
90	1.95	427
95	2.17	453
100	>2.4	480

Variable Air Volume Applications (Traditional VAV)

Supply Air Temperature Control - Occupied Cooling and Heating

The RTRM is designed to maintain a selectable supply air temperature of 40°F to 90°F with a +/- 3.5°F deadband. In cooling, if supply air temperature is more than 3.5 degrees warmer than the selected temperature, a stage of cooling will be turned “On” (if available). Then if the supply air temperature is more than 3.5° cooler than the selected temperature, a stage of cooling will be turned “Off”. At very low airflows the unit may cycle stages “On” and “Off” to maintain an average discharge air temperature outside the 7° deadband. During low load 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.

Note: *The RTRM is designed to maintain a selectable supply air temperature of 40°F to 90°F with a +/- 3.5°F deadband. However, to reduce the risk of evaporator coil freeze-up in Precedent and Voyager Light Commercial applications, supply air temperature should not be set below 50° F.*

Supply Air Temperature Control with an Economizer

The economizer is utilized to control the supply air cooling at +1.5°F around the supply air temperature setpoint range of 40°F and 90°F providing the outside air conditions are suitable. To reduce the risk of evaporator coil freeze-up supply air temperature should not be set below 50° F. While economizing, the mechanical cooling is disabled until the economizer dampers have been fully open for three minutes. If the economizer is disabled due to unsuitable conditions, the mechanical cooling will cycle as though the unit had no economizer.

Note: *The RTRM is designed to maintain a selectable supply air temperature of 40°F to 90°F with a +/- 3.5°F deadband. However, to reduce the risk of evaporator coil freeze-up in Precedent and Voyager*

Light Commercial applications, supply air temperature should not be set below 50°F.

VHR Relay Output

During unoccupied mode, daytime warm-up (DWU), morning warm-up (MWU) and heating mode the Supply Fan will operate at 100% of user set maximum airflow. All VAV boxes must be opened through an ICS program or by the VHR wired to the VAV boxes. The RTRM will delay 100% fan operation approximately 6.5 minutes when switching from occupied cooling mode to a heating mode.

Zone Temperature Control without a Night Setback Panel or ICS - Unoccupied Cooling

When a field supplied occupied/unoccupied switching device is connected between RTRM J6-11 and RTRM J6-12, both the economizer and the mechanical cooling will be disabled.

Zone Temperature Control without a Night Setback Panel or ICS - Unoccupied Heating

When a field supplied occupied/unoccupied switching device is connected between RTRM J6-11 and J6-12 and DWU is enabled, the zone temperature will be controlled at 10°F below the Morning Warm-up setpoint, but not less than 50°F, by cycling one or two stages of either gas or electric heat, whichever is applicable.

Morning Warm-up (MWU) Control

Morning Warm-up is activated if the zone temperature is at least 1.5°F below the MWU setpoint whenever the system switches from Unoccupied to Occupied status. The MWU setpoint may be set from the unit mounted potentiometer or a remotely mounted potentiometer. The setpoint ranges are from 50°F to 90°F. When the zone temperature meets or exceeds the MWU setpoint, the unit will switch to the “Cooling” mode. The economizer will be held closed during the morning warm-up cycle.

Daytime Warm-up (DWU) Control

Daytime Warm-up is applicable during occupied status and when the zone temperature is below the initiation temperature. It can be activated or deactivated through ICS or a night setback zone sensor. If ICS or a night setback zone sensor is not utilized, DWU can be activated by setting the DWU enable DIP switch (RTAM) to ON and supplying a valid morning warm-up setpoint.

The unit is shipped with a Morning Warm-up setpoint configured and the Daytime Warm-up function is activated (switch on). Opening the DWU enable switch will disable this function.

If the system control is local, the DWU initiation setpoint is 3°F below the Morning Warm-up setpoint. The termination setpoint is equal to the Morning Warm-up setpoint.

If the system control is remote (Tracer™), the DWU setpoint is equal to the Tracer Occupied heating setpoint.

The initiation and termination setpoints are selectable setpoints designated by Tracer.

When the zone temperature meets or exceeds the termination setpoint while the unit is in an Occupied, “Auto” Mode or switched to the “Cooling” Mode, the unit will revert to the cooling operation.

If an Occupied “Heating” Mode is selected, the unit will only function within the DWU perimeters until the system is switched from the “Heat” Mode or enters an Unoccupied status.

Note: *When a LCI is installed on a VAV unit, the MWU setpoint located on the RTAM board is ignored. The MWU and DWU setpoints come from the higher priority LCI-R DAC.*

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.

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.

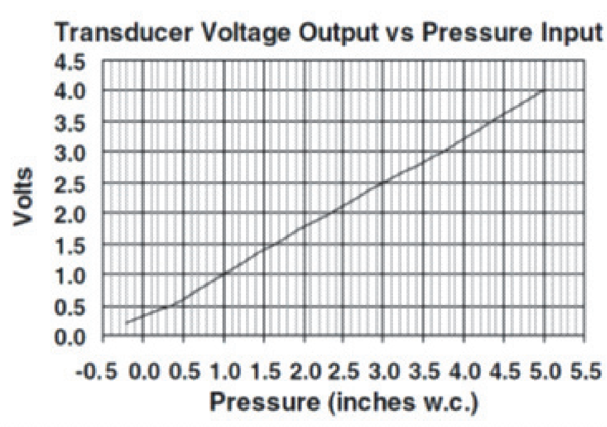
Example:

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 69. Transducer voltage output vs. pressure input



Supply Air Temperature Reset

The supply air temperature can be reset by using one of four DIP switch configurations on the RTAM or through ICS when a valid supply air reset setpoint with a supply air reset amount is given. A selectable reset amount of 0° F to 20°F via RTAM potentiometer or ICS is permissible for each type of reset.

The amount of change applied to the supply air temperature setpoint depends on how far the return air, zone, or outdoor air temperature falls below the reset temperature setpoint. If the return air, zone, or outdoor air temperature is equal to or greater than the reset temperature setpoint, the amount of change is zero.

If the return air, or zone temperature falls 3°F below the reset temperature setpoint, the amount of reset applied to the supply air temperature will equal the maximum amount of reset selected.

If the outdoor air temperature falls 20°F below the reset temperature setpoint, the amount of reset applied to the supply air temperature will equal the maximum amount of reset selected. The four DIP switch configurations are as follows:

1. None - When RTAM DIP Switch #3 and #4 are in the "Off" position, no reset will be allowed.
2. Reset based on Return Air Temperature - When RTAM DIP Switch #3 is "Off" and Switch #4 is "On", a selectable supply air reset setpoint of 50°F to 90°F via a unit mounted potentiometer or Tracer™ is permissible.
3. Reset based on Zone Temperature - When RTAM DIP Switch #3 is "On" and Switch #4 is "Off", a selectable supply air reset setpoint of 50°F to 90°F via RTAM potentiometer or Tracer is permissible.
4. Reset based on Outdoor Air Temperature - When DIP Switch #3 and #4 are "On", a selectable supply air reset setpoint of 0°F to 100°F via RTAM potentiometer or Tracer is permissible.

Return Air Smoke Detector

The return air smoke detector is designed to shut off the unit if smoke is sensed in the return air stream. Sampling the airflow entering the unit at the return air opening performs this function.

In order for the 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. Equipment covered in this manual will develop an airflow velocity that falls within these limits over the entire airflow range specified in the evaporator fan performance tables.

There are certain models however, if operated at low airflow, will not develop an airflow 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 CFM specified in the table provided below. Failure to follow these instructions will prevent the smoke detector from performing its design function.

Economizer Start-Up

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

Minimum Position Setting for 17 Plus, 6 to 10 Ton with Multi-Speed, or Single Zone VAV

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

1. Apply power to the unit
2. Using the Service Test Guide on unit access panel, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start indoor fan.
3. Turn the MIN POS - DCV potentiometer on the RTEM clockwise to open or counter-clockwise to close. The damper will open to this setting for low speed fan operation. When adjusting minimum position, the damper may move to the new setting in several small steps. Wait at least 15 seconds for the damper to settle at the new position. Range of damper for this setting is 0-100%.
4. Momentarily jump across the Test 1 & Test 2 terminals on LTB1, to cycle through test modes to Cool 1.
5. Turn the DCV SETPOINT - LL potentiometer on the RTEM clockwise to open or counter-clockwise to close. This will set the minimum damper position at an intermediate point of fan operation range of damper for this setting is 0-75%.
6. Momentarily jump across the Test 1 & Test 2 terminals on LTB1, to cycle through test modes to Cool 2.
7. Turn the MIN POS - DESIGN potentiometer on the RTEM clockwise to open or counter-clockwise to close. This will set the minimum damper position at maximum fan speed. Range of damper for this setting is 0-50%.
8. The economizer minimum damper position for all fan speeds is complete. The RTEM will control minimum damper position along an imaginary line between the

3 damper minimum positions based on fan speed. Note: The RTEM will limit intermediate minimum damper position to ensure proper ventilation based upon the low fan speed minimum damper position set in Step 3.

9. Replace the filter access panel. The damper will close when the blower circuit is de-energized.

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

ReliaTel™ Control:

Using the Service Test Guide in Table 11, p. 48, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test below.

Electromechanical Control:

Using the Service Test Guide perform the proper test mode connections.

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.

⚠WARNING

Rotating Components!

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

   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.

ReliaTel™ Control

Momentarily jump across the Test 1 & 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.

Electromechanical Control

Using the Service Test Guide perform the proper test mode connections.

3. Verify that the dampers stroked to the full open position.

4. 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 electromechanical test mode connections (if applicable).

Compressor Start-Up

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

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.

ReliaTel™ Control

Momentarily jump across the Test 1 & 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.

Electromechanical Control

Using the Service Test Guide perform the proper test mode connections.

Scroll Compressors

a. Once each compressor has started, verify that the rotation is correct. 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. If the compressor runs backward for an extended period (15 to 30 minutes), the motor winding can overheat and cause the motor winding thermostat to open.

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 superheat. Follow the instruction listed on the superheat charging curve in the Service Facts.

   Superheat should be within ±5°F of the superheat chart value.

4. Repeat steps 1 through 4 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 procedure. Remove electromechanical test mode connections (if applicable).

Dehumidification Option

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

Momentarily jump across the Test 1 and Test 2 terminals of the LTB1 until the unit enters test mode 7. (See Table 11, p. 48). Once the unit is in the reheat test mode, verify that the 3 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. If the unit has a 2 speed outdoor fan and if the outdoor air temperature is below 70°F, verify that the OD fan is in low speed.

1. Clamp an amp meter around one of 1st stage heater power wires at the heater contactor.

ReliaTel™ Control

Using the Service Test Guide in Table 11, p. 48, continue the SERVICE TEST start-up procedure for each compressor circuit.

Momentarily jump across the Test 1 & 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.

Electromechanical Control

Using the Service Test Guide perform the proper test mode connections;

2. Verify that the heater stage is operating properly.

3. Clamp an amp meter around one of 2nd stage heater power wires at the heater contactor (if applicable).

ReliaTel™ Control

Using the Service Test Guide in Table 11, p. 48, continue the SERVICE TEST start-up procedure for each compressor circuit. Momentarily jump across the Test 1 & 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.

Electromechanical Control

Using the Service Test Guide (Table 11, p. 48) perform the proper test mode connections;

4. Verify that the heater stage is operating properly

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 electromechanical test mode connections (if applicable).

Final System Setup

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 & 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.

Make sure all personnel are standing clear of the unit before proceeding. The system components will start when the power is applied.