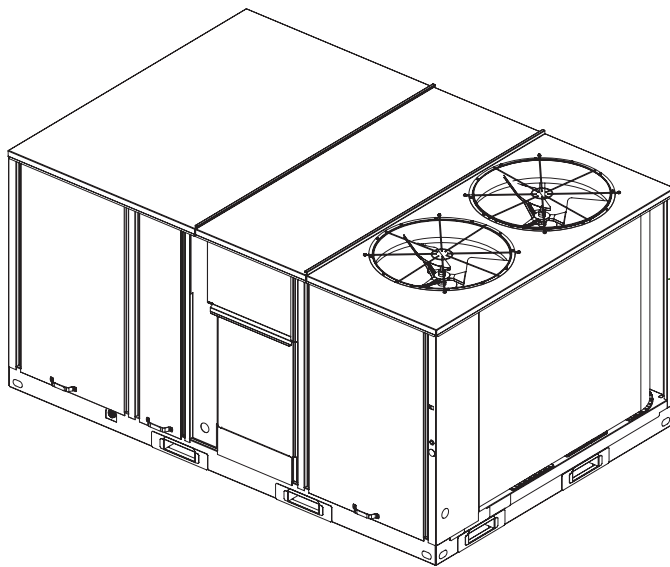


Installation, Operation, and Maintenance

Packaged Rooftop Air Conditioners Voyager™ – Electric/Electric 12.5 to 25 Tons, 60/50Hz



Model Number:

TS*150-301

TH*150-300

SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

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

⚠ CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ 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

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, **MUST** follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- Before installing/servicing this unit, technicians **MUST** put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). **ALWAYS** refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.
- When working with or around hazardous chemicals, **ALWAYS** refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.
- If there is a risk of energized electrical contact, arc, or flash, technicians **MUST** put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, **PRIOR** to servicing the unit. **NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- All Ingersoll Rand personnel must follow Ingersoll Rand Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. All policies can be found on the [BOS site](#). Where local regulations are more stringent than these policies, those regulations supersede these policies.
- Non-Ingersoll Rand personnel should always follow local regulations.

It is important that periodic maintenance be performed to help assure trouble free operation. A maintenance schedule is provided at the end of this manual.

Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

NOTICE:

Water Damage!

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

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Revision History

Updated Model Number Description, Unit Dimensions, Unit Weight, and Start-Up sections.

Overview of Manual

Note: *One copy of this document ships inside the control panel of each unit and is customer property. It must be retained by the unit's maintenance personnel.*

This booklet describes proper installation, operation, and maintenance procedures for air cooled systems.

By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized.

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Model Number Descriptions

T	S	D	1	5	0	G	3	R	0	A	A
1	2	3	4	5	6	7	8	9	10	11	12
<p>All products are identified by a multiple character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification code is provided. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, specific components, and other options for any specific unit.</p> <p>When ordering replacement parts or requesting service, be sure to refer to the specific model number and serial number printed on the unit nameplate.</p>											
Digit 1 — Unit Type			Digit 10 — Heating Capacity			Digit 11 — Minor Design Sequence			Digit 16 — Hinged Service Access / Filters		
T = Packaged Cooling, Electric Heat			0 = No Heat						0 = Standard Panels/Standard Filters ²²		
Digit 2 — Efficiency			G = 18 kW Electric Heat			Digit 12, 13 — Service Sequence			A = Hinged Access/Standard Filters ²²		
S = Standard Efficiency			K = 27 kW Electric Heat			00 = None			B = Standard Panels/MERV 8 Filters ⁶		
H = High Efficiency			N = 36 kW Electric Heat			01 = 18mm Microchannel Condenser Coil			C = Hinged Access/MERV 8 Filters ⁶		
Digit 3 — Airflow Configuration			Note: '01' only available on select models.			Digit 14 — Fresh Air Selection			Digit 17 — Condenser Coil Protection		
D = Downflow						0 = No Fresh Air			0 = Standard Coil		
H = Horizontal						D = Econ Dry Bulb w/ Barometric Relief ¹			1 = Standard Coil With Hail Guard		
Digit 4, 5, 6 — Nominal Gross Cooling Capacity (MBh)						F = Econ Reference Enthalpy w/ Barometric Relief ¹			4 = CompleteCoat™ Condenser Coil		
150 = 12½ Tons, 60Hz						H = Econ Comparative Enthalpy w/ Barometric Relief ¹			5 = CompleteCoat™ Condenser Coil with Hail Guard		
155 = 15 Tons, 50Hz						K = Low Leak Econ w/ Barometric Relief ¹			Digit 18 — Through The Base Provisions		
180 = 15 Tons, 60Hz						M = Low Leak Econ Reference Enthalpy w/ Barometric Relief ¹			0 = No Through The Base Provisions		
175 = 17½ Tons, 50Hz						P = Low Leak Econ Comparative Enthalpy w/ Barometric Relief ¹			A = Through The Base Electric ¹²		
210 = 17½ Tons, 60Hz DOE 2018						Digit 15 — Supply Fan/Drive Type/Motor			Digit 19 — Disconnect Switch/ Circuit Breaker¹¹		
211 = 17½ Tons, 60Hz						0 = Standard Motor			0 = No Disconnect/circuit break		
200 = 20 Tons, 50Hz						1 = Oversized Motor ⁶			1 = Unit Mounted Non-Fused Disconnect Switch		
240 = 20 Tons, 60Hz						3 = High Efficiency Motor ⁶			2 = Unit Mounted Circuit Breaker		
250 = 25 Tons, 50Hz						6 = Single Zone Variable Air Volume Standard Motor			Digit 20 — Convenience Outlet Option		
300 = 25 Tons, 60Hz DOE 2018						7 = Multi-Speed Standard Motor			0 = Without Convenience Outlet		
301 = 25 Tons, 60Hz						8 = Single Zone Variable Air Volume Oversized Motor			A = Unpowered Convenience Outlet ⁵		
Digit 7 — Major Design Sequence						9 = Multi-Speed Oversized Motor			B = Powered Convenience Outlet ⁵		
F = Microchannel Type Condenser Coils ²⁵						A = Single Zone Variable Air Volume Standard Motor w/ Shaft Grounding Ring			Digit 21 — Communications Options		
G = ASHRAE 90.1-2013 (Fan/ Compressor Staging) ¹³ or Microchannel Type Evaporator & Condenser Coils						B = Multi-Speed Standard Motor w/ Shaft Grounding Ring			0 = Without Communications Options		
Digit 8 — Voltage Selection						C = Single Zone Variable Air Volume Oversized Motor w/ Shaft Grounding Ring			1 = Trane Communications Interface ^{6, 15}		
3 = 208-230/60/3						D = Multi-Speed Oversized Motor w/ Shaft Grounding Ring			2 = Lontalk Communications Interface ⁶		
4 = 460/60/3						E = VAV Supply Air Temperature Control - Standard Motor			6 = Building Automation Control Network Communications Interface		
W = 575/60/3						F = VAV Supply Air Temperature Control - Oversized Motor			7 = Air-Fi™ Wireless Communications ²⁴		
K = 380/60/3						G = VAV Supply Air Temperature Control - Standard Motor w/ Shaft Grounding Ring			Digit 22 — Refrigeration System Option		
D = 380-415/50/3						H = VAV Supply Air Temperature Control - Oversized Motor w/ Shaft Grounding Ring			0 = Standard refrigeration system		
Digit 9 — Unit Controls									B = Dehumidification (Hot Gas Reheat) ^{4, 13}		
R = Reliatel									Digit 23 — Refrigeration Controls		
									0 = Without Refrigeration Controls		
									1 = Frostat ^{9, 18}		
									Digit 24 — Smoke Detector^{2, 10}		
									0 = Without Smoke Detector		
									A = Return Air Smoke Detector		
									B = Supply Air Smoke Detector		
									C = Return/Supply Air Smoke Detector		
									D = Plenum Smoke Detector ¹⁹		

Model Number Description

Digit 25 — System Monitoring Controls

- 0 = No Monitoring Controls
- 1 = Clogged Filter Switch⁹
- 2 = Fan Failure Switch⁹
- 3 = Discharge Air Sensing⁹
- 4 = Clogged Filter Switch and Fan Failure switch⁹
- 5 = Clogged Filter Switch and Discharge Air Sensing⁹
- 6 = Fan Failure Switch and Discharge Air Sensing⁹
- 7 = Clogged Filter Switch, Fan Failure Switch and Discharge Air Sensing⁹
- A = Condensate Drain Pan Overflow Switch
- B = Clogged Filter Switch and Condensate Drain Pan Overflow Switch⁹
- C = Fan Failure Switch and Condensate Drain Pan Overflow Switch⁹
- D = Discharge Air Sensing and Condensate Drain Pan Overflow Switch⁹
- E = Clogged Filter Switch, Fan Failure Switch and Condensate Drain Pan Overflow Switch⁹
- F = Clogged Filter Switch, Discharge Air Sensing Tube and Condensate Drain Pan Overflow Switch⁹
- G = Fan Failure Switch, Discharge Air Sensing Tube and Condensate Drain Pan Overflow Switch⁹
- H = Clogged Filter Switch, Fan Failure Switch, Discharge Air Sensing and Condensate Drain Pan Overflow Switch⁹

Digit 26 - System Monitoring Controls

- 0 = No Monitoring Controls
- A = Demand Control Ventilation (CO₂)¹⁷
- B = FDD (Fault Detection and Diagnostics)
- C = FDD (Fault Detection Diagnostics) & Demand Control Ventilation (CO₂)¹⁷

Digit 27 - Unit Hardware Enhancements

- 0 = No Enhancements
- 1 = Stainless Steel Drain Pan

Digit 28 - Short Circuit Current Rating

- 0 = Standard SCCR
- A = 65kA SCCR Option^{20, 21}

Digit 31 - Advanced Unit Controls

- 0 = Standard Unit Controls
- 1 = Human Interface²³

Note: Most Factory Installed Options available for Downflow Air Discharge units only. Please verify

with ordering system for availability.

Model Number Notes

1. Some field set up required.
2. Requires ReliaTel Options Module.
3. Requires Economizer.
4. All 22nd digit model numbers for reheat coil (B) require additional factory installed options: Froststat, and 2" pleated filters.
5. Must be ordered with Through-the-Base Electrical option or Horizontal-Side Access and either Unit Mounted Disconnect or Circuit Breaker.
6. Available factory installed on downflow AND horizontal units. Verify with ordering system.
7. Cannot be fused.
8. Must be factory installed when using Through-the-Base Options.
9. ReliaTel Options Module is required when ordering the following accessories: Clogged Filter Switch, Fan Fail Switch, Condensate Overflow Switch, Discharge Air Sensing Kit, Froststat, Ventilation Override, Smoke Detector, Dehumidification and Modulating Gas Heat Furnace.
10. Option cannot be ordered in conjunction with field installed economizer on downflow units. Must be factory installed. The return air smoke detector may not fit up or work properly on the Voyager units when used in conjunction with 3rd party accessories (such as bolt on heat wheels, economizers, and power exhaust). Do not order the return air smoke detectors when using this type of accessory.
11. Unit mounted disconnect and circuit breakers are mutually exclusive of each other.
12. Through-the-base electrical option or Horizontal-Side Access must be ordered with either unit mounted disconnect or circuit breaker.
13. Available on high efficiency units only.
14. All Factory Installed Options are Built-to-Order. Check order services for estimated production cycle.
15. TCI is for use with non-VariTrac systems and VariTrac systems.
16. For use with multi-speed and SZVAV units only.
17. Demand Control Ventilation Option includes wiring only. The CO₂ sensor is a field-installed only option.
18. Froststat is standard on VAV, and high efficiency units.
19. Supply and/or return smoke detector may not be used with the plenum smoke detector.
20. Only available where MOP is above 60A.
21. 575 VAC option is 25kA.
22. Standard filters are not available with Low Leak Economizers.
23. Human Interface is standard with FDD (Fault Detection Diagnostics).
24. Must be used with BACnet™ open protocol.
25. Apply to 50Hz units only.

General Information

Unit Description

Before shipment, each unit is leak tested, dehydrated, charged with refrigerant and compressor oil, and run tested for proper control operation.

For major design sequence F units, the condenser coils are microchannel type aluminum coils.

Direct-drive, vertical discharge condenser fans are provided with built-in thermal overload protection.

The ReliaTel™ Control Module is a microelectronic control system that is referred to as “Refrigeration Module” (RTRM). The acronym RTRM is used extensively throughout this document when referring to the control system network.

This module through Proportional/Integral control algorithms perform specific unit functions that governs unit operation in response to; zone temperature, supply air temperature, and/or humidity conditions depending on the application.

The stages of capacity control for these units are achieved by starting the Economizer Control Actuator (ECA).

The RTRM is mounted in the control panel and is factory wired to the respective internal components. The RTRM receives and interprets information from other unit modules, sensors, remote panels, and customer binary contacts to satisfy the applicable request for cooling.

Economizer Control Actuator ReliaTel™ Control

The ECA monitors the mixed air temperature, return air temperature, minimum position setpoint (local or remote), power exhaust setpoint, CO₂ setpoint, CO₂, and ambient dry bulb/ enthalpy sensor or comparative humidity (return air humidity against ambient humidity) sensors, if selected, to control dampers to an accuracy of ±5 percent of stroke. The actuator is spring returned to the closed position any time that power is lost to the unit. It is capable of delivering up to 25 in-lb of torque and is powered by 24 Vac.

RTCI—ReliaTel™ Trane Communication Interface (Optional)

This module is used when the application calls for an ICS™ building management type control system. It allows the control and monitoring of the system through an ICS panel. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installation instruction that ships with each kit when field installation is necessary.

RLCI—ReliaTel™ LonTalk Communication Interface (Optional)

This module is used when the application calls for an ICS™ building management type control system that is LonTalk. It allows the control and monitoring of the system through an ICS panel. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installation instruction that ships with each kit when field installation is necessary.

RBCI—ReliaTel BACnet™ Communication Interface (Optional)

This module is used when the application calls for an open BACnet protocol. It allows the control and monitoring of the system through an ICS panel. The module can be ordered from the factory or as a kit to be field installed. Follow the installation instructions that ships with each kit when field installation is necessary.

WCI—Trane Air-Fi™ Wireless Communication Interface (Optional)

The Trane Air-Fi Communication Interface allows for wireless communication between system controls, unit controls, and wireless sensors for Trane control products that use BACnet protocol. The WCI replaces the need for communications wire in all system applications.

RTOM—ReliaTel™ Options Module (Optional)

The RTOM monitors the supply fan proving, clogged filter, supply air temperature, exhaust fan setpoint, supply air tempering, Froststat™ and smoke detector. Refer to system input devices and functions for operation.

RTAM—ReliaTel™ Air Handler Module (Standard with Traditional VAV)

RTAM receives information from the supply duct static pressure transducer. Attached to the module are the supply air heating potentiometer, supply air cooling setpoint potentiometer, supply pressure setpoint potentiometer, static pressure deadband potentiometer, morning warm-up setpoint potentiometer, reset setpoint potentiometer, and 5 DIP switches.

System Input Devices & Functions

The RTRM must have a zone sensor or thermostat input in order to operate the unit. The flexibility of having several mode capabilities depends upon the type of zone sensor or thermostat selected to interface with the RTRM.

The descriptions of the following basic Input Devices used within the RTRM network are to acquaint the operator with their function as they interface with the various modules.

Refer to the unit's electrical schematic for the specific module connections. The following controls are available from the factory for field installation.

Supply Fan Failure Input (Optional)

The Fan Failure Switch (FFS) can be connected to sense indoor fan operation. If air flow through the unit is not proven by the differential pressure switch connected to the RTOM (factory set point 0.07" w.c.) within 40 seconds nominally, the RTRM will shut off all mechanical operations, lock the system out, send a diagnostic to ICS, and the SERVICE output will flash. The system will remain locked out until a reset is initiated either manually or through ICS.

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.

Clogged Filter Switch (Optional)

The unit mounted clogged filter switch monitors the pressure differential across the return air filters. It is mounted in the filter section and is connected to the RTOM. A diagnostic SERVICE signal is sent to the remote panel if the pressure differential across the filters is at least 0.5" w.c.

The contacts will automatically open when the pressure differential across the filters decreases to approximately 0.4" w.c.

The clogged filter output is energized when the supply fan is operating and the clogged filter switch has been closed for at least 2 minutes. The system will continue to operate regardless of the status of the filter switch.

Please note that on units equipped with factory installed MERV 13 filters, a clogged filter switch with different pressure settings will be installed. This switch will close when the differential pressure is approximately 0.8" w.c. and open when the differential falls to 0.7" w.c.

Compressor Disable (CPR1/2)

This input incorporates the low pressure control (LPC) of each refrigeration circuit and can be activated by opening a field supplied contact installed on the LTB.

If this circuit is open before the compressor is started, the compressor will not be allowed to operate. Anytime this circuit is opened for 1 continuous second during compressor operation, the compressor for that circuit is immediately turned "Off". The compressor will not be allowed to restart for a minimum of 3 minutes should the contacts close.

If four consecutive open conditions occur during the first three minutes of operation, the compressor for that circuit will be locked out, a diagnostic communicated to the remote panel (if installed), and a manual reset will be required to restart the compressor.

Phase Monitor

The Phase Monitor is a three-phase line monitor module that protects against phase loss, phase reversal and phase unbalance. It is intended to protect compressors from reverse rotation. It has an operating input voltage range of 190–600 Vac, and LED indicators for ON and FAULT. There are no field adjustments and the module will automatically reset from a fault condition.

Low Pressure Control ReliaTel Control

When the LPC is opened for 1 continuous second, the compressor for that circuit is turned off immediately. The compressor will not be allowed to restart for a minimum of 3 minutes.

If four consecutive open conditions occur during the first three minutes of operation, the compressor will be locked out, a diagnostic communicated to ICS™ if applicable, and a manual reset will be required to restart the compressor.

Discharge Line Thermostat ReliaTel Control

The high pressure controls and discharge line thermostats are wired in series between the compressor outputs on the RTRM and the compressor contactor coils. If the high pressure control switch or discharge line thermostat open, the RTRM senses a lack of current while calling for cooling and locks the compressor out. This is an auto reset lockout. If the circuit is open three consecutive times when the contactor coil should be on, the RTRM sets a manual lockout for that compressor.

Power Exhaust Control (Optional)

The power exhaust fan is started whenever the position of the economizer dampers meets or exceeds the power exhaust setpoint when the indoor fan is on.

The setpoint panel is located in the return air section and is factory set at 25 percent.

Lead/Lag Control (Dual Circuit Only)

Lead/Lag is a selectable input located on the RTRM. The RTRM is configured from the factory with the Lead/Lag control disabled. To activate the Lead/Lag function, simply cut the wire connected to J3-8 at the RTRM. When it is activated, each time the designated lead compressor is shut off due to the load being satisfied, the lead compressor or refrigeration circuit switches. When the RTRM is powered up, i.e. after a power failure, the control will default to the number one circuit compressor.

Evaporator Frost Control

This input incorporates the Froststat™ control (FOS) mounted in the indoor coil or on the suction line and can be activated by closing a field supplied contact installed in parallel with the FOS.

If this circuit is closed before the compressor is started, the compressor will not be allowed to operate. Anytime this circuit is closed for 1 continuous second during compressor operation, the compressor for that circuit is immediately turned "Off". The compressor will not be allowed to restart for a minimum of 3 minutes should the FOS open.

Sensors

Note: Zone sensor required for units configured for Single Zone VAV indoor fan system control to enable Single Zone VAV functionality.

Zone Sensor Module (ZSM) (BAYSENS106*)

This electronic sensor features three system switch settings (Heat, Cool, and Off) and two fan settings (On and Auto). It is a manual changeover control with single setpoint. (Cooling Setpoint Only.)

Zone Sensor Module (ZSM) (BAYSENS108*)

This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and Auto). It is a manual or auto changeover control with dual setpoint capability. It can be used with a remote zone temperature sensor BAYSENS075*.

Zone Sensor (BAYSENS110*)

This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and

Auto) with four system status LEDs. It is a manual or auto changeover control with dual setpoint capability. It can be used with a remote zone temperature sensor BAYSENS075*.

Programmable Zone Sensor (BAYSENS119*)

Programmable Night Setback: Auto or manual changeover with seven-day programming. Keyboard selection of Heat, Cool, Fan, Auto, or On. All programmable sensors have System On, Heat, Cool, Service LED/indicators as standard. Night Setback Sensors have one (1) Occupied, one (1) Un-occupied, and one (1) Override program per day.

Remote Zone Sensor (BAYSENS073*)

This electronic sensor features remote zone sensing and timed override with override cancellation. It is used with a Trane Integrated Comfort™ building management system.

Remote Zone Sensor (BAYSENS074*)

This electronic sensor features single setpoint capability and timed override with override cancellation. It is used with a Trane Integrated Comfort™ building management system.

Remote Zone Sensor (BAYSENS016*)

This bullet type temperature sensor can be used for outside air (ambient) sensing, return air temperature sensing, supply air temperature sensing, and remote temperature sensing (uncovered). Wiring procedures vary according to the particular application and equipment involved. Refer to the unit's wiring diagrams for proper connections.

Remote Zone Sensor (BAYSENS075*)

This electronic sensor can be used with BAYSENS119* Remote Panels. When this sensor is wired to a BAYSENS119* Remote Panel, wiring must be 18 AWG Shielded Twisted Pair (Belden 8760 or equivalent). Refer to the specific Remote Panel for wiring details.

Wireless Zone Sensor (BAYSENS050)

This electronic sensor features five system settings (Auto, Off, Cool, Heat, and Emergency Heat) and with On and Auto fan settings. It is a manual or auto changeover control with dual setpoint capability. Other features include a timed override function, lockable system settings, and Fahrenheit or Celsius temperature display. Included with the wireless zone sensor will be a receiver that is to be mounted inside the unit, a mounting bracket, and a wire harness.

General Information

High Temperature Sensor (BAYFRST003*)

This sensor connects to the RTRM Emergency Stop Input on the LTB and provides high limit “shutdown” of the unit. The sensor is used to detect high temperatures due to fire in the air conditioning or ventilation ducts. The sensor is designed to mount directly to the sheet metal duct. Each kit contains two sensors. The return air duct sensor (X1310004001) is set to open at 135°F.

The supply air duct sensor (X1310004002) is set to open at 240°F. The control can be reset after the temperature has been lowered approximately 25°F below the cutout setpoint.

Thermostat (BAYSTAT150)

This thermostat is a multi-stage 3 heat/2 cool, auto-changeover digital display thermostat. It is a programmable thermostat, and a 7-day programmable stat with night setback shall be available. In addition, it is wall mounted.

Thermostat (BAYSTAT151)

This thermostat is a single-stage 1 heat/1 cool, auto-changeover digital display thermostat. It is a non-programmable, wall-mounted thermostat.

Thermostat (BAYSTAT155)

This thermostat is a multi-stage 3 heat/2 cool, auto changeover digital display thermostat. It is a non-programmable, wall-mounted thermostat, and it can be used for Economizer Operation.

Smoke Detector Sensor (Optional)

This sensor is only applicable on units equipped with a RTOM. It provides high limit “shutdown” of the unit and requires a manual reset. The sensor is used to detect smoke due to fire in the air conditioning or ventilation ducts.

Notes:

- The supply and return air smoke detectors are designed to shut off the unit if smoke is sensed in the supply air stream or return air stream. This function is performed by sampling the airflow entering the unit at the return air opening. Follow the instructions provided below to assure that the airflow through the unit is sufficient for adequate sampling. Failure to follow these instructions will prevent the smoke detectors from performing it's design function.*
- Airflow through the unit is affected by the amount of dirt and debris accumulated on the indoor coil and filters. To insure that airflow through the unit is adequate for proper sampling by the return air smoke detector, complete adherence to the maintenance procedures, including recommended intervals between filter changes, and coil cleaning is required.*

- Periodic checks and maintenance procedures must be performed on the smoke detector to insure that it will function properly. For detailed instructions concerning these checks and procedures, refer to the appropriate section(s) of the smoke detector Installation and Maintenance Instructions provided with the literature package for this unit.*

In order for the supply air smoke detector or return air smoke detector to properly sense smoke in the supply air stream or return air stream, the air velocity entering the smoke detector 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.

Unit Model Number	Minimum Allowable Airflow with Return Air Smoke Detector
THD180	5300 cfm

Wall Mounted Relative Humidity Sensor (BAYSENS036*)

Field installed, wall mounted humidity sensor is used to control activation of the hot gas reheat dehumidification option.

Humidity set points can be selected for relative humidity levels between 40 percent and 60 percent by adjusting the DEHUMID setting on the ReliaTel Options Module; see [“RTOM—ReliaTel™ Options Module \(Optional\),” p. 7.](#)

Duct Mounted Relative Humidity Sensor (BAYSENS037*)

Field installed, duct mounted humidity sensor is used to control activation of the hot gas reheat dehumidification option.

Humidity set points can be selected for relative humidity levels between 40 percent and 60 percent by adjusting the DEHUMID setting on the ReliaTel Options Module; see [“RTOM—ReliaTel™ Options Module \(Optional\),” p. 7.](#)

Human Interface - 5 Inch Color Touchscreen (Optional)

The 5 inch Color Touchscreen Human Interface provides an intuitive user interface to the rooftop unit that speeds up unit commissioning, shortens unit troubleshooting times, and enhances preventative maintenance measures. The human interface includes several features including:

- Data trending capabilities by means of time series graphs
- Historical alarm messages
- Real-time sensor measurements
- On board system setpoints
- USB port that enables the downloading of component runtime information as well as trended historical sensor data
- Customized reports

Unit Inspection

As soon as the unit arrives at the job site:

- Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).
- Verify that the power supply complies with the unit nameplate specifications.
- Visually inspect the exterior of the unit, including the roof, for signs of shipping damage.
- Visually inspect the internal components for shipping damage as soon as possible after delivery and before it is stored. Do not walk on the sheet metal base pans.
- If concealed damage is discovered, notify the carrier's terminal of damage immediately by phone and by mail. Concealed damage must be reported within 15 days.
 - Request an immediate joint inspection of the damage by the carrier and the consignee.
 - Do not remove damaged material from the receiving location.
 - Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.
- Notify the appropriate sales representative before installing or repairing a damaged unit.

Precautionary Measures

⚠ WARNING

Fiberglass Wool!

Product contains fiberglass wool. 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. 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.

- 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.

Storage

Take precautions to prevent condensate from forming inside the unit's electrical compartments and motors if:

- The unit is stored before it is installed; or,
- The unit is set on the roof curb, and temporary heat is provided in the building. Isolate all side panel service entrances and base pan openings (e.g., conduit holes, S/A and R/ A openings, and flue openings) from the ambient air until the unit is ready for start-up.

Note: Do not use the unit's heater for temporary heat without first completing the start-up procedure detailed under *"Start Up," p. 36.*

The manufacturer will not assume any responsibility for equipment damage resulting from condensate accumulation on the unit's electrical and/or mechanical components.

Unit Clearances

Figure 1, p. 12 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.

Unit Dimensions

Figure 1. Typical installation clearance for single and multiple unit applications

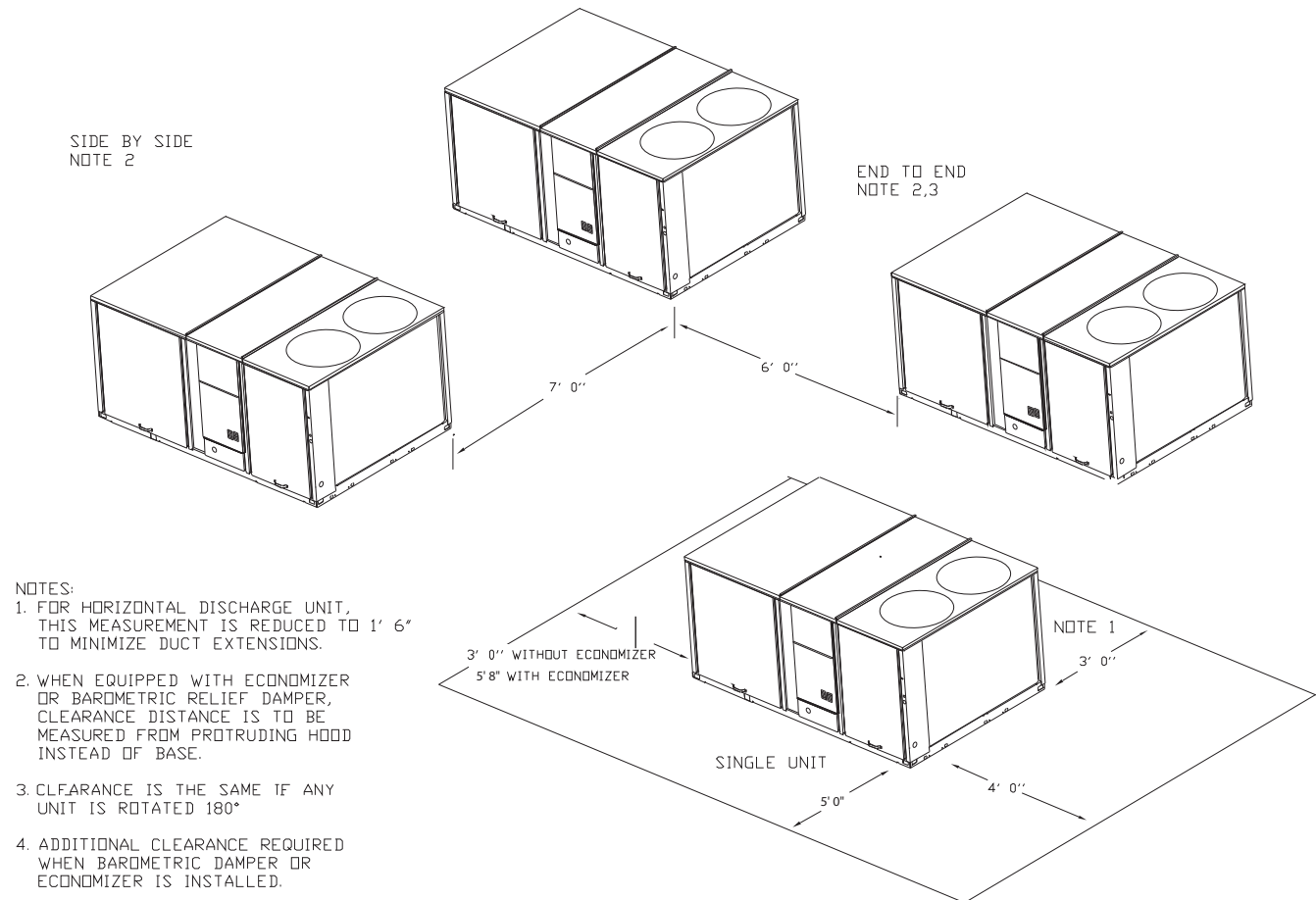
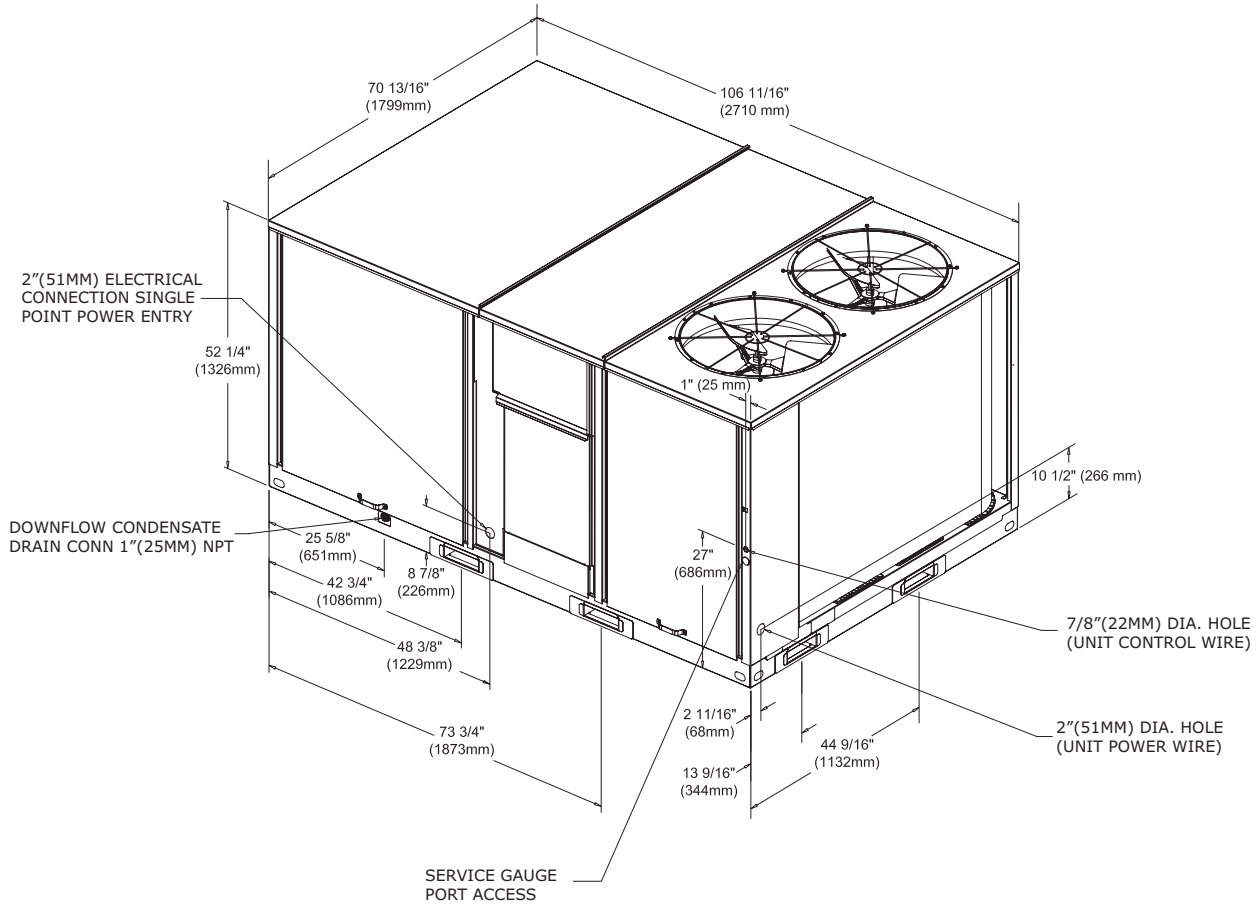
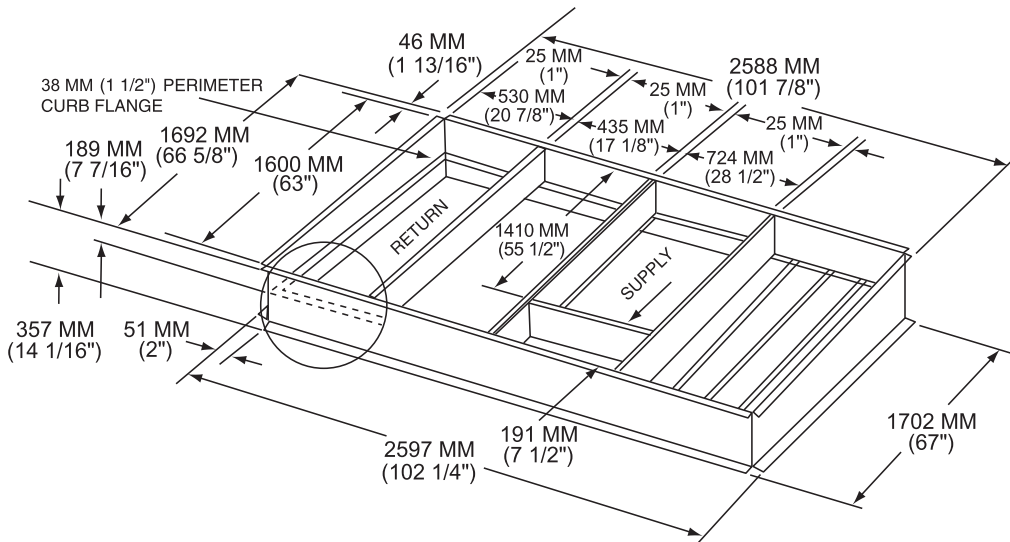


Figure 2. Unit dimensional data for 12½ tons standard efficiency units



Note: 51 mm(2") electrical connection: single point power when heat installed.

Figure 3. Unit dimensional data for 12½ tons standard efficiency units



Unit Dimensions

Figure 4. Horizontal duct dimensional data 12½ tons standard efficiency units

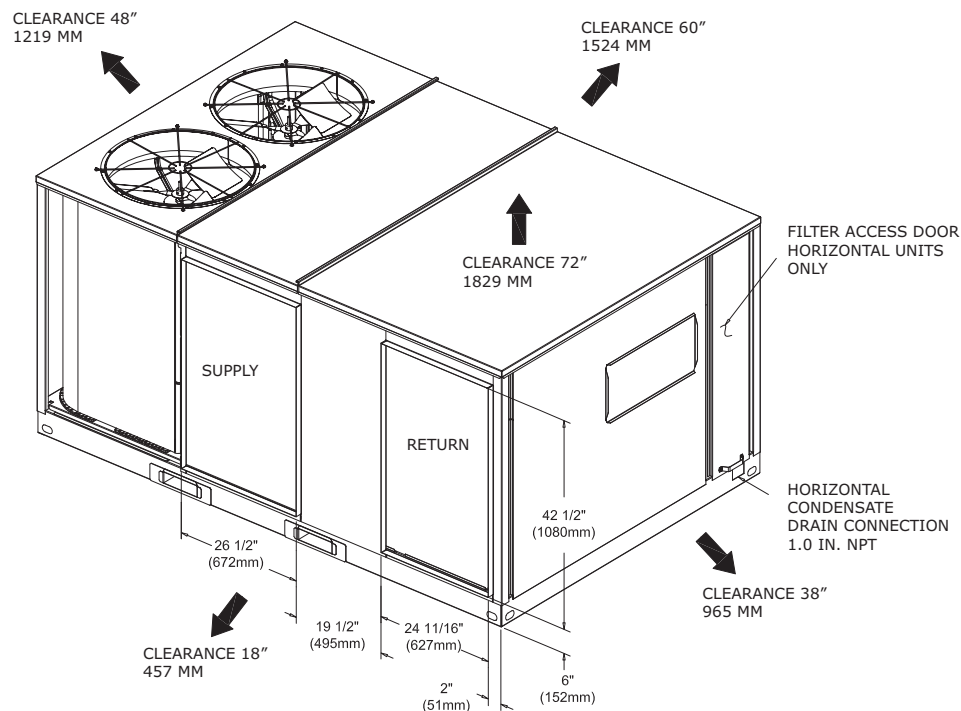
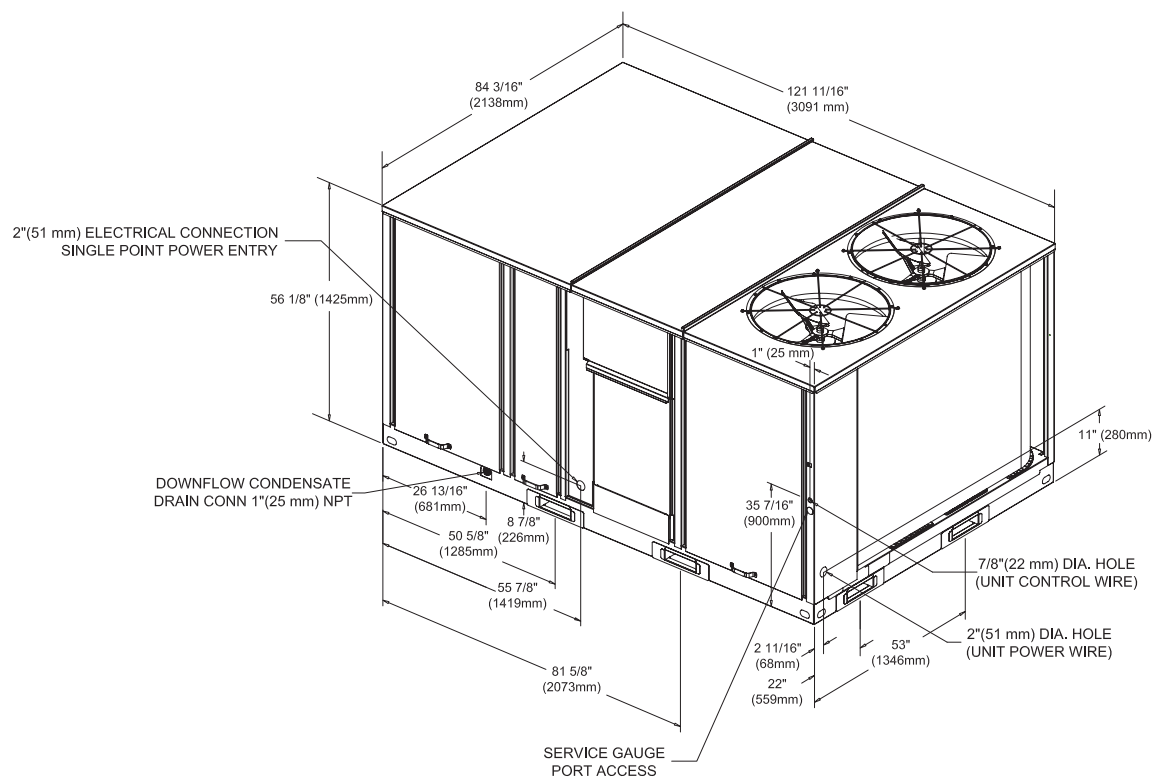
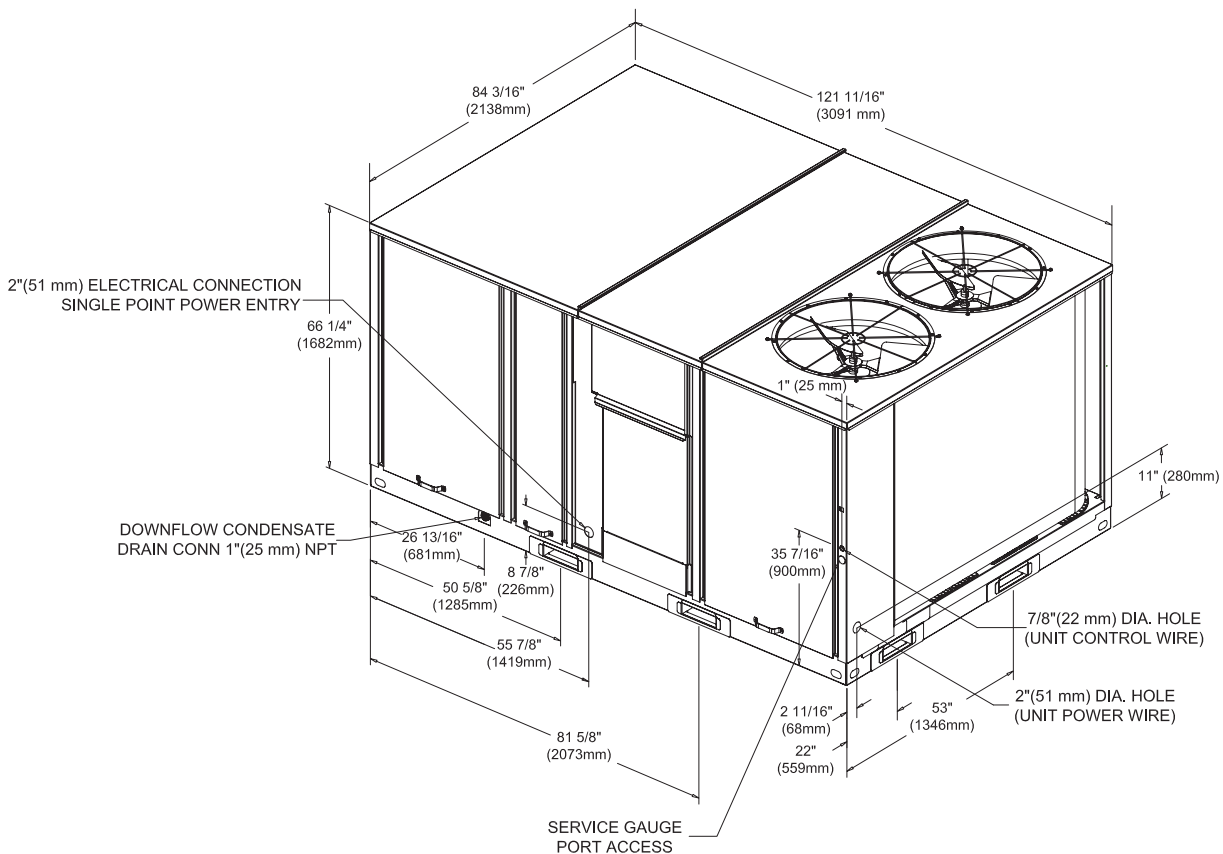


Figure 5. Unit dimensional data 15–25 tons standard efficiency & 12.5 tons high efficiency units



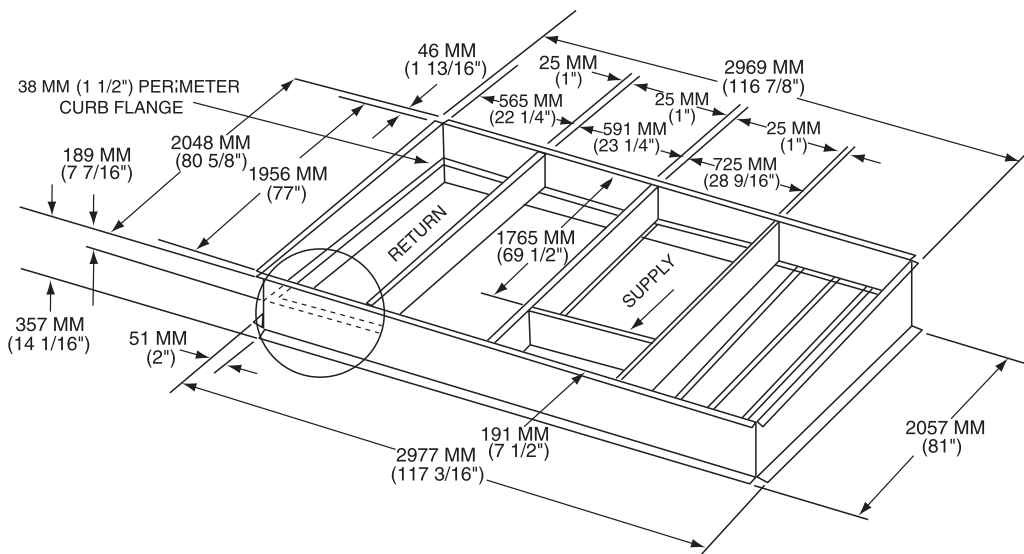
Note: 51 mm(2") electrical connection: single point power when heat installed.

Figure 6. Unit dimensional data 15–25 tons high efficiency units



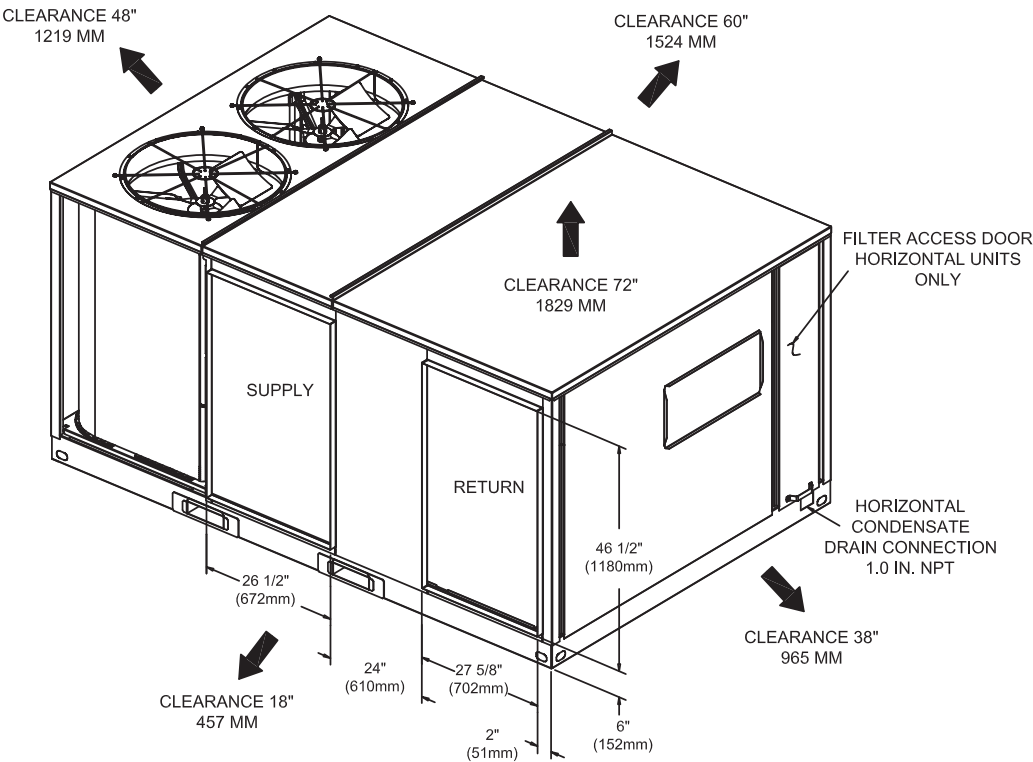
Note: 51 mm(2") Electrical Connection: Single Point Power When Heat Installed

Figure 7. Unit dimensional data 15–25 tons standard efficiency units, 12½–25 tons high efficiency units



Unit Dimensions

Figure 8. Horizontal duct dimensional data 15–25 tons standard efficiency units, 12½–25 tons high efficiency units



Unit Weights

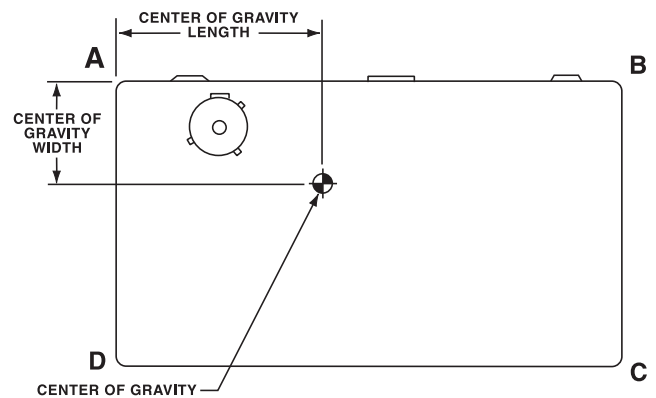
Table 1. Typical unit weights and point loading data (lb)

Unit Models	Net Weights	Corner Weights (lb)			
		A	B	C	D
TS*150G	1373	516	364	208	285
TH*150G	1868	632	503	345	391
THD150G Reheat unit	1959	693	470	337	458
TS*155F	1868	604	508	367	389
TS*180G	1763	575	480	338	370
TH*180G	2076	619	564	425	469
THD180G Reheat unit	2026	701	491	360	474
TS*175F	1909	605	520	381	401
TS*210/211G	1819	583	494	354	388
TH*210G	2037	622	542	399	474
THD210G Reheat unit	2071	736	495	360	480
TS*200F	1971	628	524	384	435
TS*240G	1902	615	498	357	433
TH*240G	2107	671	552	401	483
THD240G Reheat unit	2091	751	497	361	482
TS*250F	1924	609	520	381	415
TS*300/301G	1945	624	512	369	440
TH*300G	2108	672	556	400	481
THD300G Reheat Unit	2133	738	522	385	487

Table 2. Typical unit weights and point loading data (kg)

Unit Models	Net Weights	Corner Weights (kg)			
		A	B	C	D
TS*150G	624	234	165	94	130
TH*150G	848	287	228	156	177
THD150G Reheat unit	890	315	214	153	208
TS*155F	849	275	231	167	177
TS*180G	801	261	218	154	168
TH*180G	944	281	256	193	213
THD180G Reheat unit	921	319	223	164	215
TS*175F	868	275	236	173	182
TS*210/211G	827	265	224	161	177
TH*210G	926	283	246	181	215
THD210G Reheat unit	941	334	225	164	218
TS*200F	896	285	238	175	198
TS*240G	865	279	226	162	197
TH*240G	958	305	251	182	220
THD240G Reheat unit	951	341	226	164	219
TS*250F	875	277	236	173	189
TS*300/301G	884	283	233	168	200
TH*300G	958	305	253	182	219
THD300G Reheat Unit	970	336	237	175	222

Figure 9. Corner weights



Unit Weights

Rigging

⚠ WARNING

Heavy Objects!

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. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury.

⚠ WARNING

Improper Unit Lift!

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. Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury and possible equipment or property-only damage.

Refer to [Figure 10, p. 18](#) and [Table 1, p. 17](#) and [Table 2, p. 17](#) for typical unit operating weights rigging before proceeding.

1. Remove the shipping crate from around the unit. Do not remove the crating from the top of the unit.
2. Rig the unit as shown in [Figure 10, p. 18](#). 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.
3. Install a lifting bar, as shown in [Figure 10, p. 18](#), 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.

NOTICE:

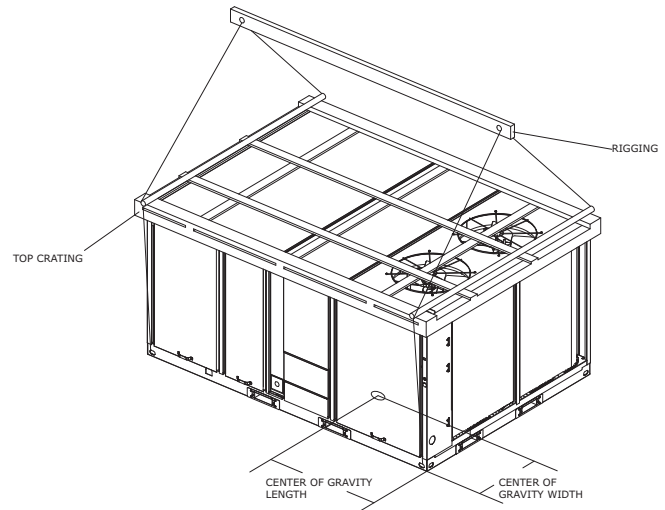
Unit Damage!

Unit damage will occur if fork lifting is attempted once the pallet has been removed.

4. Removal of the base pallet must be completed before unit can be set. Prior to lifting the unit, remove the 6 fork pockets from the base rails and 4 wood screws from the lifting lug corners. The unit will then separate from the pallet when lifted.
5. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
6. Lift the unit and position it into place.

7. 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.

Figure 10. Rigging and center of gravity data



Installation

Foundation

WARNING

Risk of Roof Collapsing!

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

NOTICE:

Water Damage!

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

Horizontal Units

Notes:

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

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

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

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

Check with a roofing contractor for proper waterproofing procedures.

Ductwork

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

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

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

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

If a Curb Accessory Kit is not used:

- a. The ductwork can be attached directly to the factory-provided flanges around the unit’s supply and return air openings. Be sure to use flexible duct connections at the unit.
- b. For “built-up” curbs supplied by others, gaskets must be installed around the curb perimeter flange and the supply and return air opening flanges.

General Unit Requirements

WARNING

Proper Field Wiring and Grounding Required!

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

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

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

Installation

Factory Installed Economizer

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

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

- Install all access panels.

Main Electrical Power Requirements

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

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

Electric Heat Requirements

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

Condensate Drain Configuration

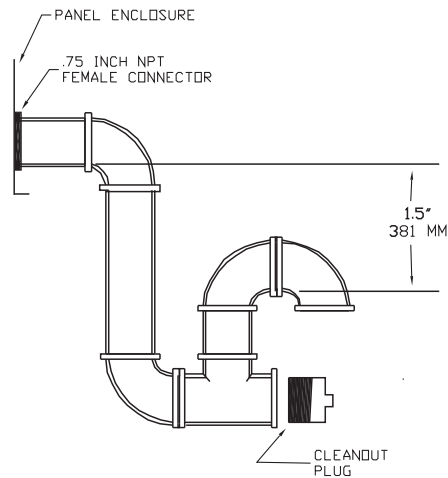
An evaporator condensate drain connection is provided on each unit. Refer to “Unit Dimensions,” p. 12 for the appropriate drain location.

A condensate trap must be installed at the unit due to the drain connection being on the “negative pressure” side of the fan. Install the P-Trap using the guidelines in Figure 11.

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 11. Condensate trap installation



Filter Installation

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

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

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

Field Installed Power Wiring

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

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

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

NOTICE:

Use Copper Conductors Only!

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

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

Main Unit Power

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

Standard Wiring

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

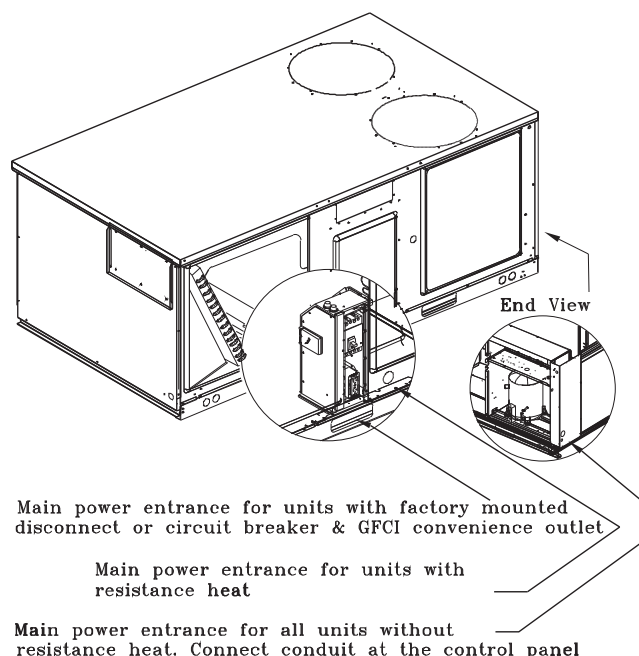
Protection devices must be sized according to the electrical data on the nameplate.

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

Optional TBUE Wiring (Through the Base Electrical Option)

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

Figure 12. Through the base electrical option



Field Installed Control Wiring

An overall layout of the various control options available with the required number of conductors for each control device is illustrated in [Figure 17, p. 24](#).

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

Control Power Transformer

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

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

Installation

Controls using 24 Vac

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

NOTICE:

Use Copper Conductors Only!

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

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

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

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

Table 3. Electromechanical thermostat 24 Vac conductors with ReliaTel™

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

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

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

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

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

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

Table 4. Zone sensor module wiring

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

Figure 13. ReliaTel™ options module

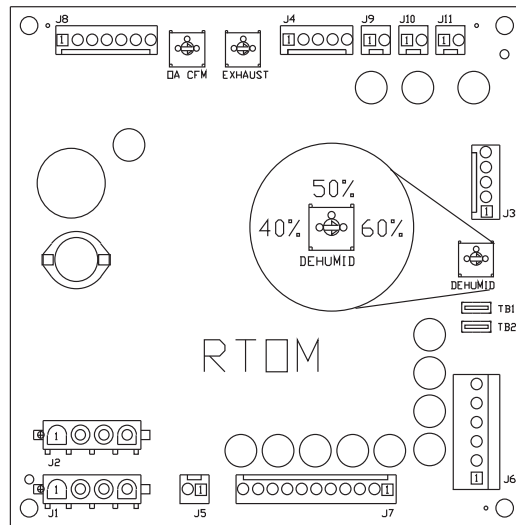


Figure 14. ReliaTel conventional thermostat field wiring diagram

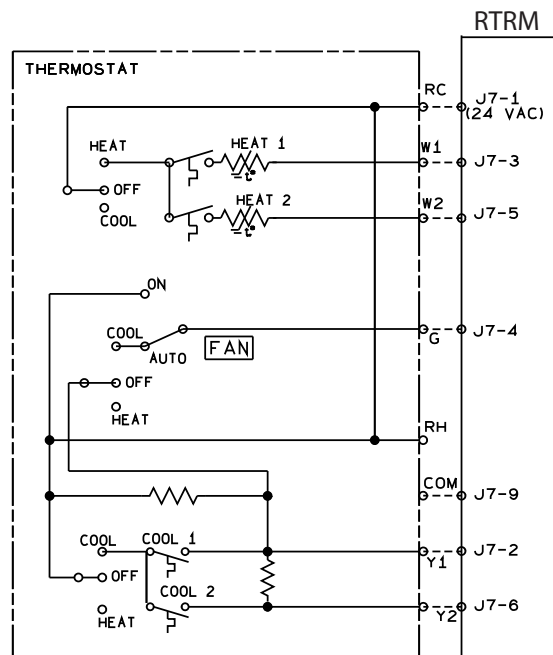


Figure 15. ReliaTel relative humidity sensor (dehumidification option)

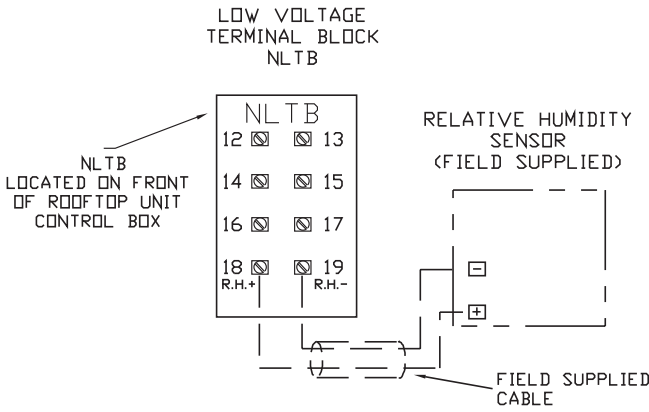
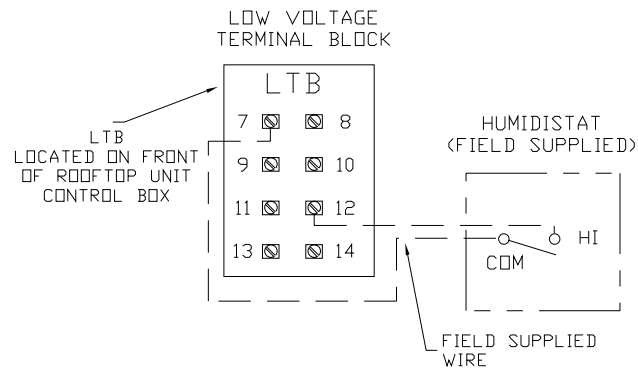
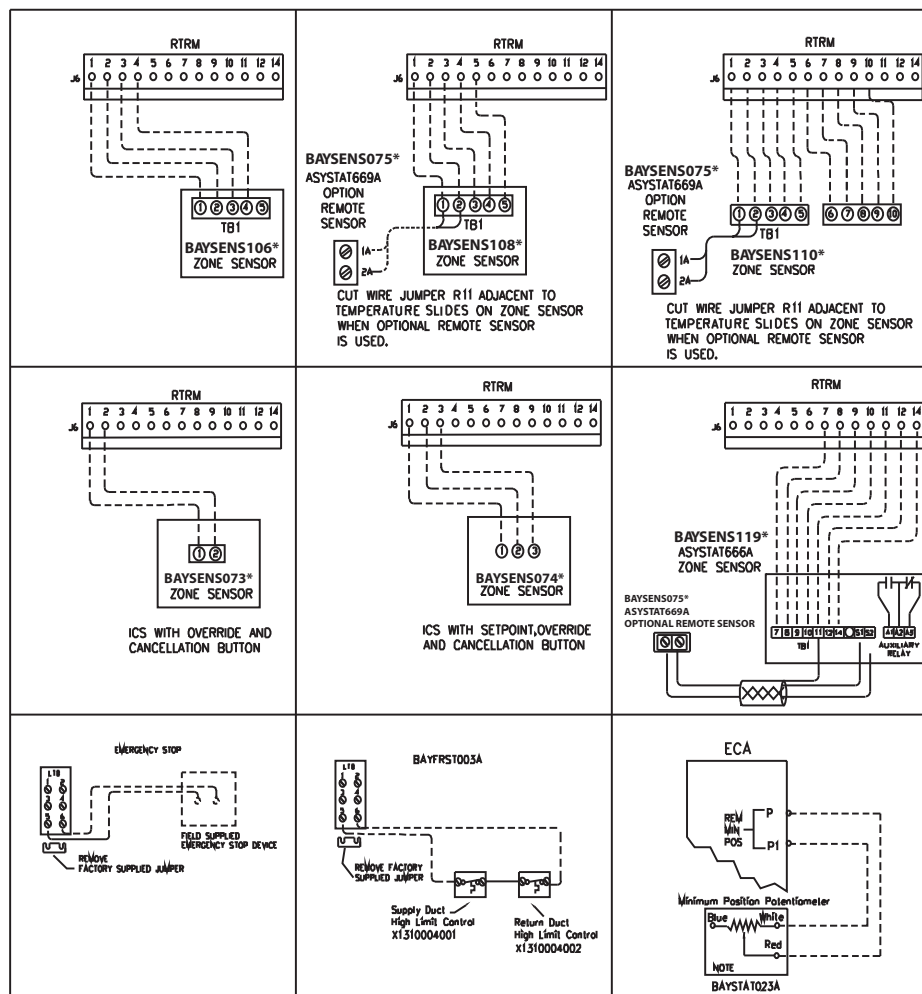


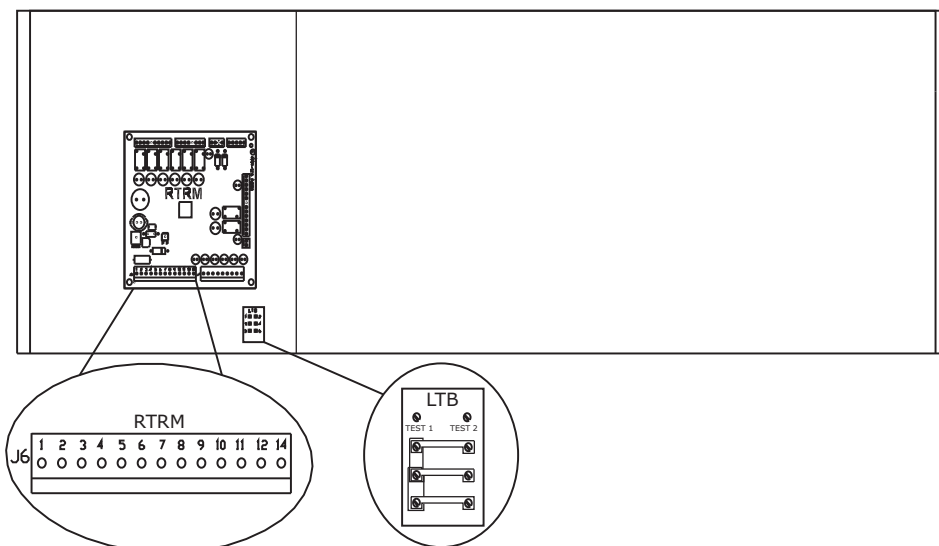
Figure 16. ReliaTel humidistat (dehumidification option)



0 0 0 0 0



CONTROL BOX



Space Temperature Averaging

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

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

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

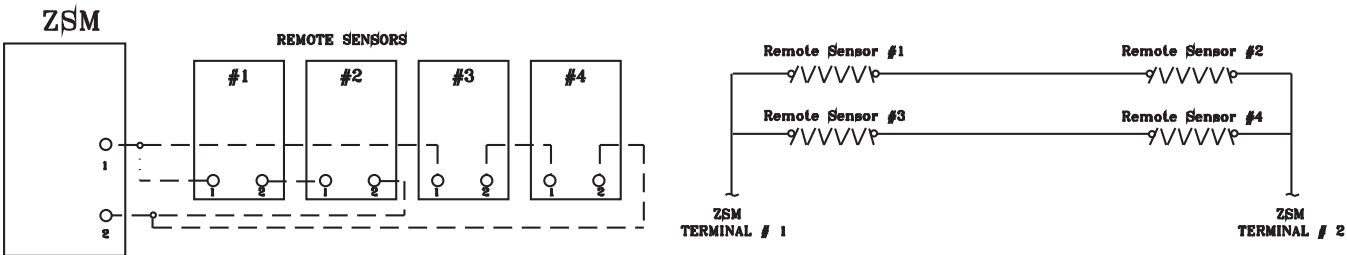
Table 5. Temperature vs. resistance

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

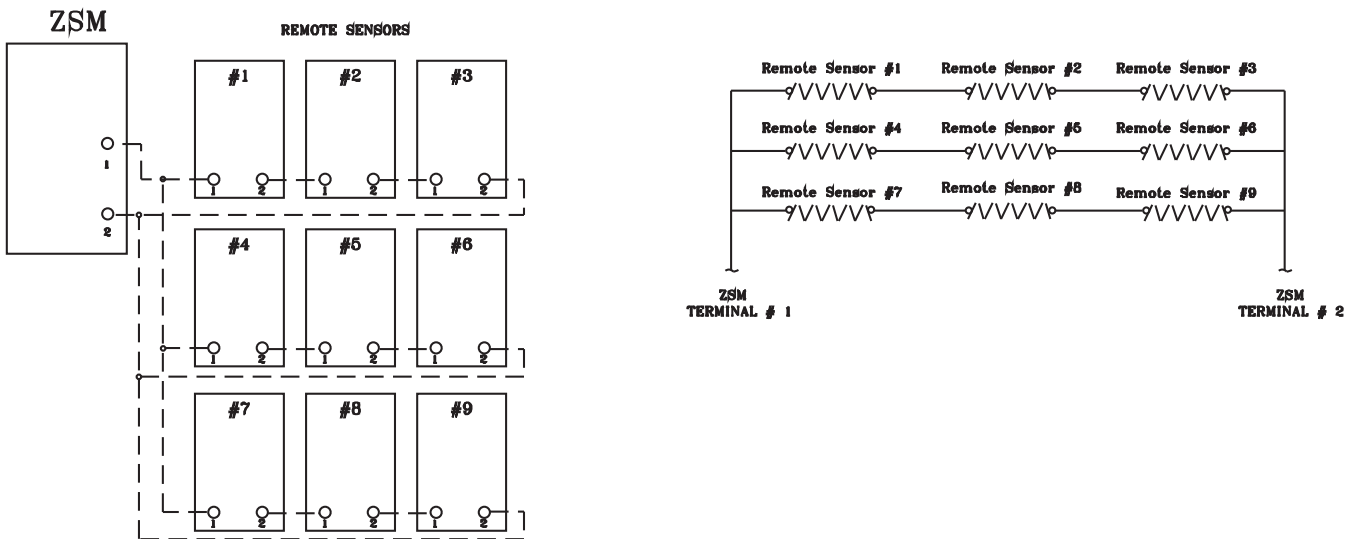
Installation

Table 6. Space temperature averaging examples

EXAMPLE #1



EXAMPLE #2



EXAMPLE #3



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

⚠ WARNING

Hazardous Voltage!

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

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

Voltage Imbalance

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

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

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

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

% Voltage Imbalance =

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

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

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

Electrical Phasing (Three Phase Motors)

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

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

⚠ WARNING

Hazardous Voltage!

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

- Turn the field supplied disconnect switch that provides power to the main power terminal block or to the "Line" side of the optional factory mounted disconnect switch to the "Off" position.
- Connect the phase sequence indicator leads to the terminal block or to the "Line" side of the optional factory mounted disconnect switch as follows:
Black (phase A) to L1
Red (phase B) to L2
Yellow (phase C) to L3
- Close the field supplied main power disconnect switch or circuit protector switch that provides the supply power to the unit.

WARNING

Live Electrical Components!

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

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

Compressor Crankcase Heaters

NOTICE:

Compressors Failure!

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

Each compressor can be equipped with a crankcase heater. The proper operation of the crankcase heater is important to maintain an elevated compressor oil temperature during the "Off" cycle to reduce oil foaming during compressor starts. Oil foaming occurs when refrigerant condenses in the compressor and mixes with the oil. In lower ambient conditions, refrigerant migration to the compressor could increase.

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

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

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

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

ReliaTel Controls

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

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

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

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

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

Three Stage Cooling

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

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

4 Stages of Cooling (25 Tons)

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

Factory-Mounted Unit Options

Circuit Breaker (FIYUCB) & Unit Disconnect (FIYUDC)

⚠ WARNING

Hazardous Voltage w/Capacitors!

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

For additional information regarding the safe discharge of capacitors, see PROD-SVB06*-EN

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

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

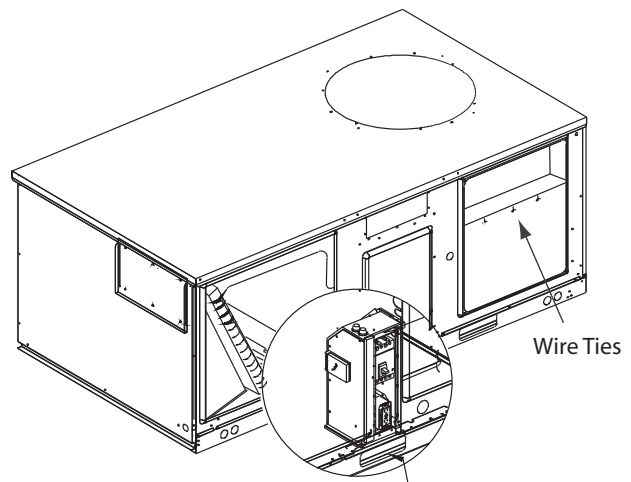
1. Field connections are made by first removing all access panels on the front of the unit. Unscrew the assembly around the outside of the disconnect switch or circuit breaker. This assembly is located between the evaporator and heat section of the unit (Figure 18, p. 29).
For downflow configurations, the hole in the base section is for both high and low voltage power wiring on down flow units. Horizontal units will route through the front plate located directly under the circuit breaker or disconnect panel. The hole is sized for 1 1/2" conduit. Horizontal units will use the front plate located directly under the circuit breaker panel.
2. If the conduit required for your application is larger, remove the termination plate and connect to the larger hole using field supplied reducing washers.
3. Route the power wires and ground conductor through conduit and into the bottom of the factory installed

disconnect switch or circuit breaker. Connect the power conductors to the lugs provided. Connect the ground wire to the unit ground lug.

Note: Wire size for the length of run should be determined using the circuit ampacity found on the unit nameplate and the N.E.C.

4. Route low voltage (class II), control wiring through hole in base of unit but not through high voltage conduit. Feed control wiring through bushing provided on side panel and into the flexible conduit provided in the heat section of the unit (Figure 18). Route wires through loose wire ties provided in unit as in Figure 18.
5. Tighten the wire ties. Secure the excess wire bundle under the wire ties in the outdoor section. Do not leave excess wire in the electrical enclosure. Use the unit wiring diagram to make the low voltage connections.

Figure 18. Main power entrance for units with factory mounted disconnect or circuit breaker



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

Powered and Unpowered Convenience

⚠ WARNING

Hazardous Voltage w/Capacitors!

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

For additional information regarding the safe discharge of capacitors, see PROD-SVB06*-EN

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

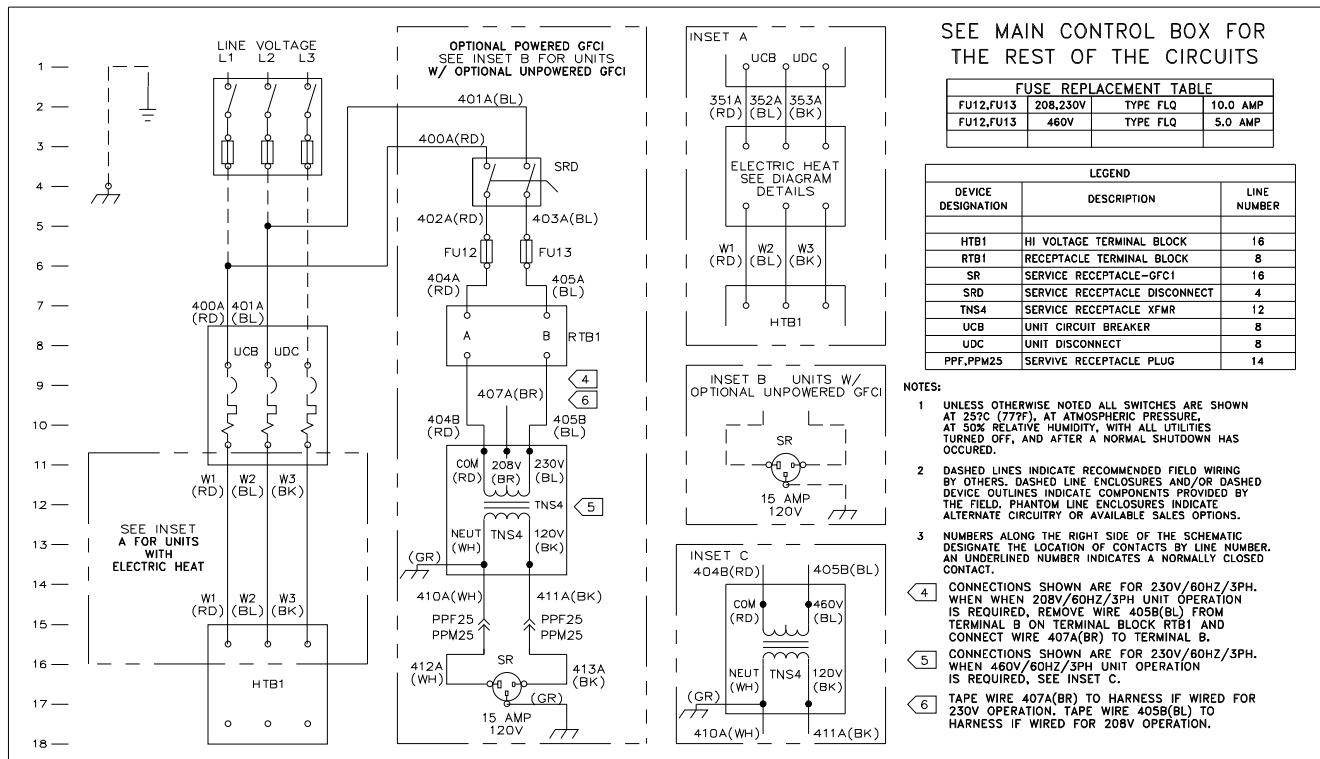
Powered Convenience Outlet Powered Option (FIYCOPO)

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

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

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

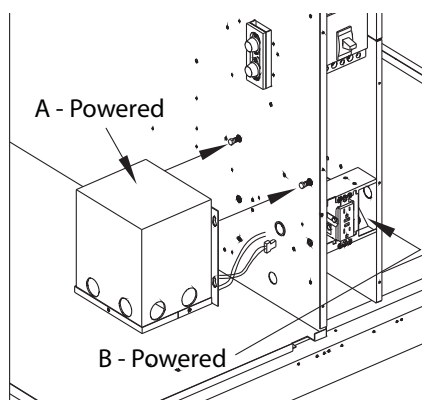
Figure 19. Wiring schematic 12½ through 25 ton options



Unpowered Convenience Outlet Unpowered Option (FIYCOUP)

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

Figure 20. Power options



Return Air Smoke Detector

Pre-Requisite

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

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

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

Smoke Detector Installation

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

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

⚠ WARNING

Hazardous Voltage w/Capacitors!

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

For additional information regarding the safe discharge of capacitors, see PROD-SVB06*-EN

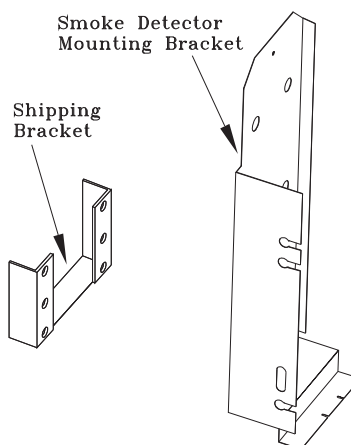
⚠ WARNING

Proper Field Wiring and Grounding Required!

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

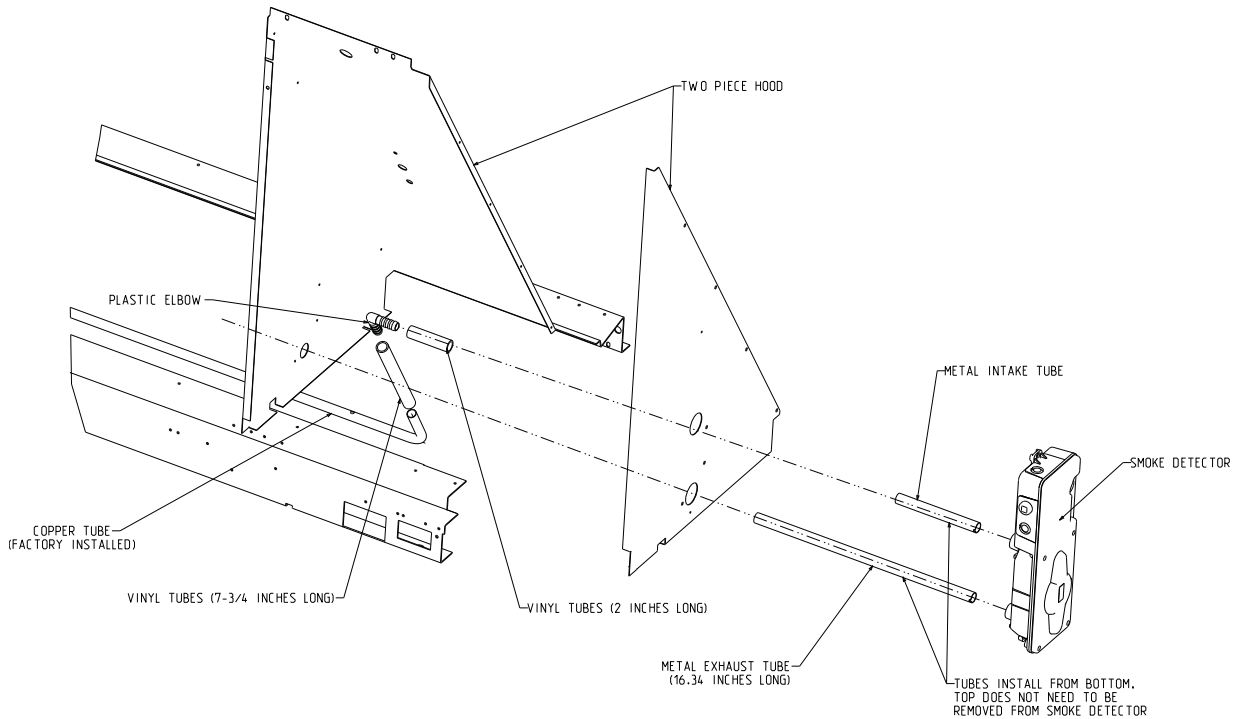
1. Remove the smoke detector assembly from its shipping position in the indoor fan compartment. This assembly is attached with three screws to the indoor fan board near the top of the unit.
2. Remove and discard the shipping bracket from the smoke detector assembly. This is the angled piece of sheet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

Figure 21. Brackets



Factory-Mounted Unit Options

Figure 22. Return air smoke detector for downflow units



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

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

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

Note: In order to perform the last part of this operation, it will be necessary to remove the barometric relief

filter, open the barometric relief damper, and reach inside through the barometric relief outlet to access and connect the copper exhaust elbow to the smoke detector exhaust tube.

8. Connect the leg of the plastic elbow without the vinyl tubing attached that was installed in [Step 5](#) to the smoke detector inlet tube pushing it onto the piece of vinyl tubing attached to the inlet tube.
9. Refer to [Figure 23, p. 33](#) for wire connections of return air smoke detector to the unit wiring harness.
10. This completes the installation of the return air smoke detector. If the unit's air filter(s) and/or barometric relief filter were removed to ease installation of the smoke detector, they need to be replaced at this time.

Airflow & Sampling

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

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

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

Certain models, however, if operated at low airflow, will not develop an air velocity that falls within the required 500 to 4000 feet per minute range. For these models, the design airflow shall be greater than or equal to the minimum specified in [Table 7](#).

Table 7. Minimum allowable airflow

Unit Model Number	Minimum Allowable Airflow with Return Air Smoke Detector
TSD180, THD180	5300 CFM

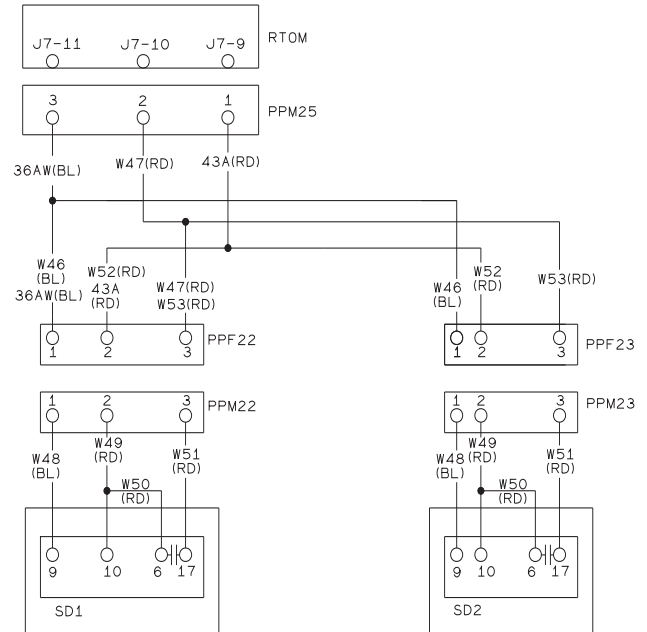
Notes:

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

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

Figure 23. Smoke detector wiring scheme

WIRING SCHEME FOR UNIT WITH BOTH RETURN AIR AND SUPPLY AIR SMOKE DETECTORS



WIRING INSTRUCTIONS:

1. CONNECT PLUGS TOGETHER AS SHOWN.

NOTES: 1. REFER TO THIS DRAWING FOR SMOKE DETECTOR INTERFACE TO UNIT. SEE UNIT DIAGRAMS FOR BALANCE OF WIRING.

LEGEND:

PPF22,PPM22.....RETURN AIR SMOKE DETECTOR PLUG
 PPF23,PPM23.....SUPPLY AIR SMOKE DETECTOR PLUG
 SD1.....RETURN AIR SMOKE DETECTOR
 SD2.....SUPPLY AIR SMOKE DETECTOR
 RTOM.....RELIA TEL OPTIONS MODULE
 PPM25.....SMOKE DETECTOR TO RTOM BOARD

Air-Fi™ Wireless Communication Interface (WCI)

When installed, the Trane Air-Fi Wireless Communication Interface is located in the evaporator section, near the return air ductwork. The exact mounting location is dependent on the airflow configuration, cabinet size, and fresh air selection. Refer to Figure 24 through Figure 28.

Refer to BAS-SVX40*-EN for instructions and troubleshooting procedures.

Figure 24. WCI mounting location - TSD150

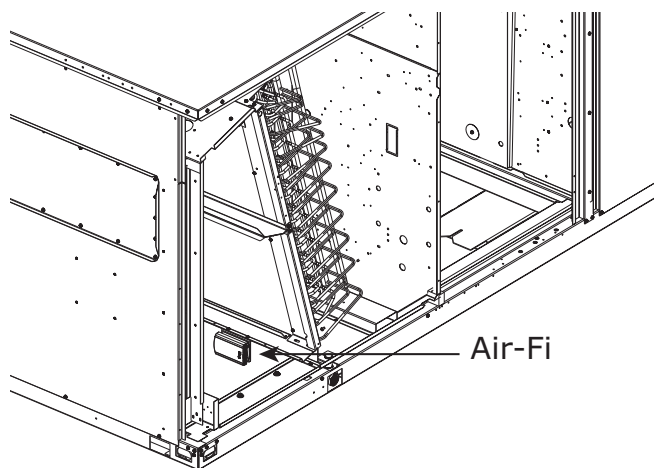


Figure 25. WCI mounting location - TSH150

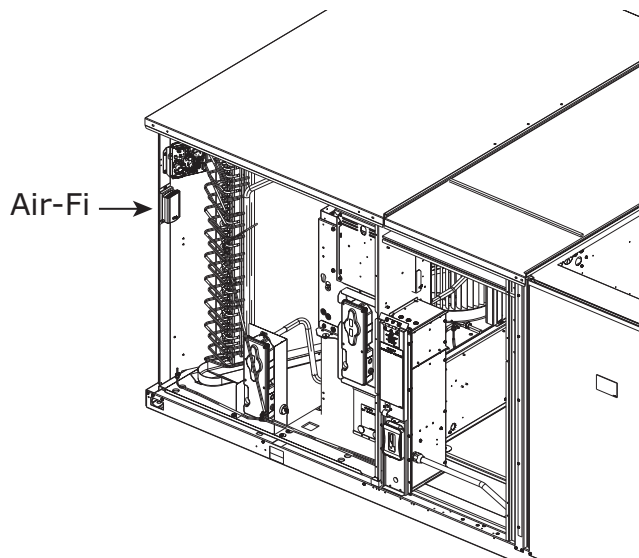


Figure 26. WCI mounting location - T*D180-300

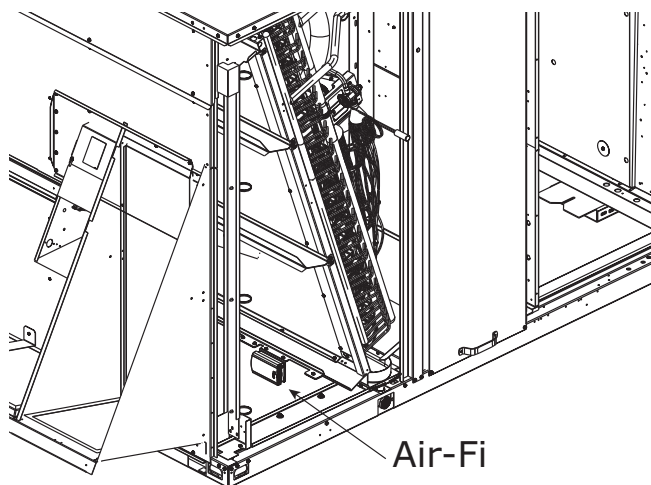


Figure 27. WCI mounting location - T*H180-300

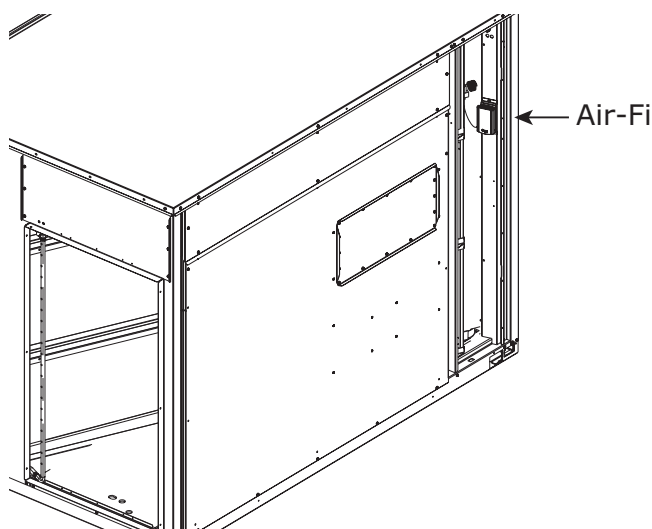
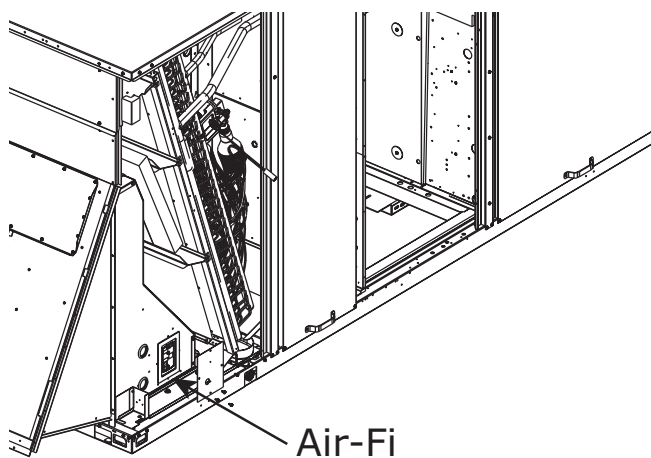


Figure 28. WCI mounting location - T*D150-300 - with low leak economizer



Pre Start

Test Modes

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

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

For unit test steps, test modes, and step resistance values to cycle the various components, refer to [Table 8](#).

Table 8. Service test guide for component operation

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

(a) The exhaust fan will turn on anytime the economizer damper position is equal

(b) The condenser fans will operate any time a compressor is “On.”

(c) Steps for optional accessories and non-applicable modes in unit will be skipped.

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

Much of the systems performance and reliability is closely associated with, and dependent upon having the proper airflow supplied both to the space that is being conditioned and across the evaporator coil.

The indoor fan speed is changed by opening or closing the adjustable motor sheave.

Before starting the SERVICE TEST, set the minimum position setpoint for the economizer to 0% using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel Control

Using the Service Test Guide in [Table 8](#), momentarily jump across the Test 1 and Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Once the supply fan has started, check for proper rotation. The direction of rotation is indicated by an arrow on the fan housing.

With the fan operating properly, determine the total system airflow (cfm):

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

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

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

Start Up

Economizer Start-Up

Using the Service Test Guide in [Table 8, p. 35](#), momentarily jump across the Test 1 and Test 2 terminals on LTB1 one-time to start the Minimum Ventilation Test.

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

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

The Exhaust Fan will start anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.

2. Verify that the dampers stroked to the minimum position.
3. Momentarily jump across the Test 1 and Test 2 terminals on LTB1 one additional time if continuing from previous component start-up or until the desired start-up component Test is started.
4. Verify that the dampers stroked to the full open position.
5. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Compressor Start-Up

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

Using the Service Test Guide in [Table 8, p. 35](#), continue the Service Test start-up procedure for each compressor circuit.

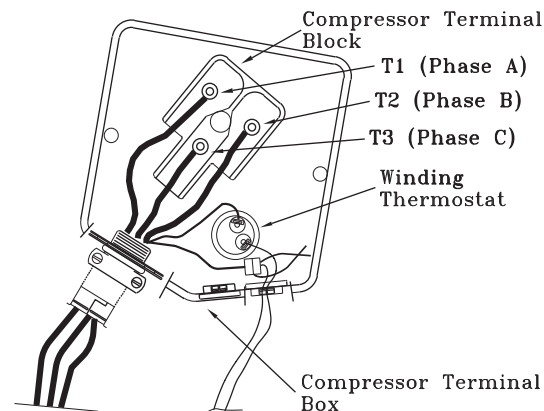
Momentarily jump across the Test 1 and Test 2 terminals on LTB1 one additional time if continuing from previous component start-up or until the desired startup component Test is started.

Scroll Compressors

- a. Once each compressor has started, verify that the rotation is correct. If wired correctly the suction pressure should drop and the discharge pressure should rise. If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed.
- b. If the electrical phasing is correct, before condemning a compressor, interchange any two leads (at the compressor Terminal block) to check the internal phasing. Refer to the following

illustration for the compressor terminal/phase identification. Do not allow the compressor to operate backwards for more than 5 seconds. Operation for a period of time longer than this will result in compressor damage. Copeland (Alliance) will experience failure also. If the compressor runs backward for an extended period, the motor winding can overheat and cause the motor winding thermostat to open.

Figure 29. Compressor terminal box



Note: The Copeland, SSA and SPA scroll compressors for R-410A units use Trane OIL00094. The correct oil for Trane CSHD is Trane OIL00079 or OIL00080. Compressor types are listed in [Table 9, p. 36](#). The appropriate oil charge is listed in [Table 10, p. 37](#).

Table 9. Compressor types

Tonnage	C1	C2
TS*150	ZP83KCE	ZP42K5E
TH*150	ZP91KCE	ZP38K5E
TH*150 Reheat	ZP67KCE	ZP67KCE
TS*155	CSHD105	SPA050
TS*180	CSHD110	ZP54K5E
TH*180	ZP104KCE	ZP49K5E
TH*180 Reheat	ZP83KCE	ZP83KCE
TS*175	CSHD120	SPA044
TS*210	CSHD110	ZP54K5E
TS*211	CSHD110	ZP54K5E
TH*210	ZP122KCE	ZP54K5E
TH*210 Reheat	CSHD089	ZP83KCE
TS*200	CSHD142	SSA083
TS*240	CSHD155	ZP76KCE
TH*240	CSHD142K*0M	ZP61KCE
TH*240 Reheat	CSHD120	CSHD120
TS*250	CSHD120	CSHD120
TS*300	CSHD161	ZP83KCE
TS*301	CSHD161	ZP83KCE
TH*300	ZPT122K5E	ZP122KCE

Table 10. POE Oil recharge amount (fl. oz.)

Model	C1 25mm/18mm	C2 25mm/18mm
TS*150	56	38
TH*150	56	38
TH*150 Reheat	56	56
TS*155	112/182.4	62 (62)/96
TS*180	112	38
TH*180	81	38
TH*180 Reheat	56	56
TSH210, TS*175	112/182.4	38 (62)/96
TS*175	112	38 (62)
TS*210	112	38
TS*211	112	38
TH*210	81	38
TH*210 Reheat	102	56
TS*240/200	112	56
TH*240	112	38
TH*240 Reheat	112	112
TS*250	112	106
TS*300	112	56
TS*301	112	56
TH*300	76 ^(a)	81

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

- 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.
- Check system subcooling. Follow the instruction listed on the subcooling charging curve in the Service Facts.
- Repeat [Step 1](#) through [Step 3](#) for each refrigerant circuit.
- To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure.
- Remove electro mechanical test mode connections (if applicable).

Dehumidification Option

Momentarily jump across the Test 1 and Test 2 terminals of the LTB1 until the unit enters test mode 7. ([Table 8, p. 35](#))

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

Heating Start-Up

- 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 8, p. 35](#), continue the SERVICE TEST start-up procedure for each compressor circuit.
Momentarily jump across the Test 1 and Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component test is started.
- Verify that the heater stage is operating properly.
- 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 8, p. 35](#), continue the SERVICE.
- TEST start-up procedure for each compressor circuit. Momentarily jump across the Test 1 and Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component test is started.
- Verify that the heater stage is operating properly.
- To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

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

Traditional VAV Standalone Operation

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

Supply Air Temperature Control - Occupied Cooling and Heating

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

The RTRM utilizes a proportional and integral control scheme with the integration occurring when the supply air

Start Up

temperature is outside the deadband. As long as the supply air temperature is within the setpoint deadband, the system is considered to be satisfied and no staging up or down will occur.

Supply Duct Static Pressure Control

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

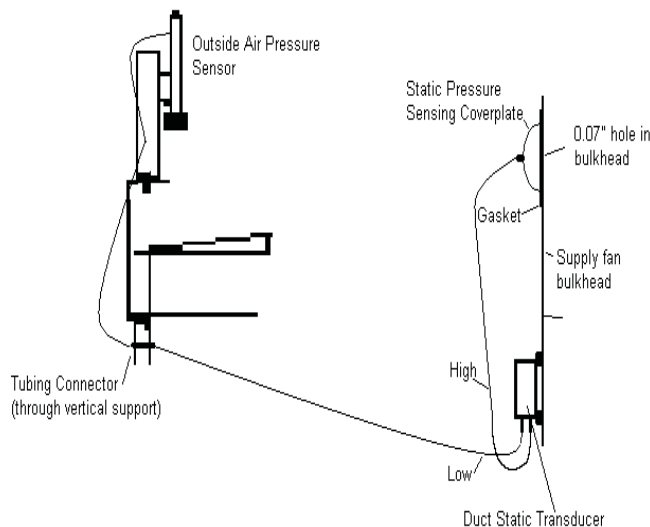
Example:

Supply Duct Static Setpoint = 2.0" w.c.

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

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

Figure 30. Supply duct static pressure control



VHR Relay Output

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

Figure 31. VHR relay output

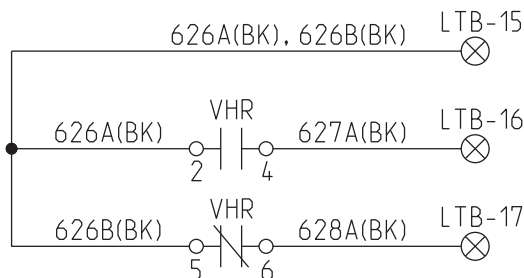


Table 11. Variable air volume mode operation

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

Notes:

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

To configure the proper potentiometer setpoints, connect a multi-meter across the customer connection header (J7) to the pins listed in [Table 12](#) below.

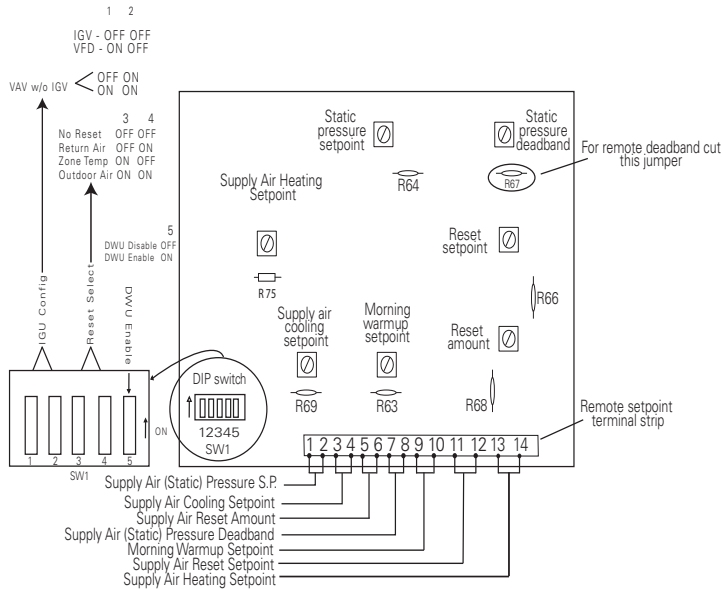
Table 12. VAV setpoints

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

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

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

Figure 32. RTAM module



Final System Set Up

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

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