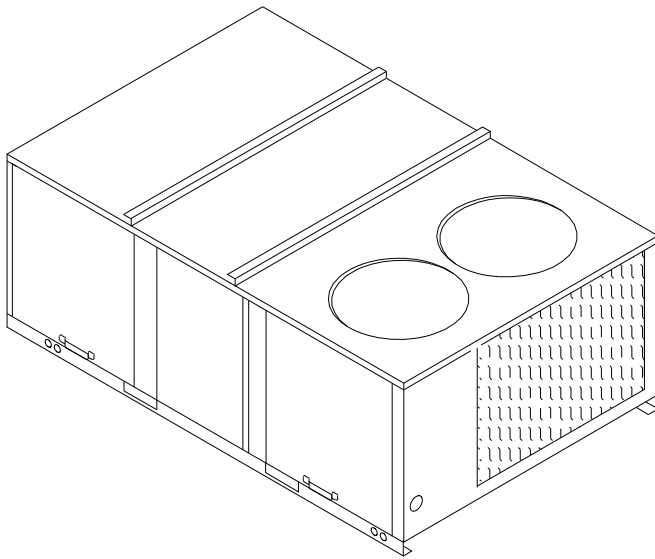


Installation, Operation, and Maintenance

Packaged Rooftop Air Conditioners Voyager™ – Electric/Electric 12½ – 25 Tons, 60/50Hz



Model Number:

TS*150-300

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.

January 2015

RT-SVX25J-EN

IR Ingersoll Rand

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.

ATTENTION: Warnings, Cautions and Notices appear at appropriate sections throughout this literature. Read these carefully:

⚠ 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

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.

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

Personal Protective Equipment (PPE) Required!

Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- 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.**

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

⚠ 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.

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.

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.

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.

Revision Summary

RT-SVX25J-EN (21 Jan 2015)

- Title 24 - ASHRAE 90.1-2013
- Updated Model Number Description, Startup, and Wiring Diagrams Sections

Table of Contents

Model Number Description	5	System Status Checkout Procedure	42
General Information	7	Resetting Cooling and Heating Lockouts ..	43
Unit Description	7	Zone Temperature Sensor (ZTS) Service Indi-	44
System Input Devices & Functions	7	cator	44
Sensors	9	Zone Temperature Sensor (ZTS) Test ...	44
Unit Inspection	11	Programmable & Digital Zone Sensor Test	45
Storage	11	Wiring Diagrams	47
Unit Clearances	11	Warranty	49
Unit Dimensions	12		
Unit Weights	17		
Rigging	18		
Installation	19		
Foundation	19		
General Unit Requirements	19		
Main Unit Power	21		
Space Temperature Averaging	25		
Factory-Mounted Unit Options	29		
Circuit Breaker (FIYUCB) & Unit Disconnect	29		
(FIYUDC)	29		
Powered and Unpowered Convenience ..	30		
Return Air Smoke Detector	31		
Pre Start	34		
Test Modes	34		
Verifying Proper Air Flow (Units with Belt	34		
Drive Indoor Fan)	34		
Start Up	35		
Economizer Start-Up	35		
Compressor Start-Up	35		
Dehumidification Option	36		
Heating Start-Up	36		
Variable Air Volume Applications (Multi-zone,	36		
Traditional VAV)	36		
Final System Set Up	38		
Maintenance	39		
Fan Belt Adjustment—Belt Drive Units ..	39		
Monthly Maintenance	40		
Final Process	41		
Troubleshooting	42		
ReliaTel Control	42		

Model Number Descriptions

T	S	D	1	5	0	F	3	R	0	A	A
1	2	3	4	5	6	7	8	9	10	11	12

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.

When ordering replacement parts or requesting service, be sure to refer to the specific model number and serial number printed on the unit nameplate.

Digit 1 – Unit Type

T = Packaged Cooling, Electric Heat

Digit 2 – Efficiency

S = Standard Efficiency
H = High Efficiency

Digit 3 – Airflow Configuration

D = Downflow
H = Horizontal

Digit 4, 5, 6 – Nominal Gross Cooling Capacity (MBh)

150 = 12½ Tons, 60Hz
155 = 15 Tons, 50Hz
180 = 15 Tons, 60Hz
175 = 17½ Tons, 50Hz
210 = 17½ Tons, 60Hz
200 = 20 Tons, 50Hz
240 = 20 Tons, 60Hz
250 = 25 Tons, 50Hz
300 = 25 Tons, 60Hz

Digit 7 – Major Design Sequence

F = Microchannel Type Condenser Coils
G = ASHRAE 90.1-2013 (Fan/Compressor Staging)¹⁴

Digit 8 – Voltage Selection

3 = 208-230/60/3
4 = 460/60/3
W = 575/60/3
K = 380/60/3
D = 380-415/50/3

Digit 9 – Unit Controls

R = Reliatel

Digit 10 – Heating Capacity

0 = No Heat
G = 18 kW Electric Heat
K = 27 kW Electric Heat
N = 36 kW Electric Heat

P = 54 kW Electric Heat
R = 72 kW Electric Heat

Digit 11 – Minor Design Sequence

Digit 12, 13 – Service Sequence

00 = None
01 = 18mm Microchannel Condenser Coil

Note: '01' only available on select models.

Digit 14 – Fresh Air Selection

0 = No Fresh Air
D = Econ Dry Bulb w/ Barometric Relief¹
F = Econ Reference Enthalpy w/ Barometric Relief¹
H = Econ Comparative Enthalpy w/ Barometric Relief¹
K = Low Leak Econ w/ Barometric Relief¹
M = Low Leak Econ Reference Enthalpy w/ Barometric Relief¹
P = Low Leak Econ Comparative Enthalpy w/ Barometric Relief¹

Digit 15 – Supply Fan/Drive Type/Motor

0 = Standard Motor
1 = Oversized Motor⁶
3 = High Efficiency Motor⁶
6 = Single Zone Variable Air Volume Standard Motor
7 = Multi-Speed Standard Motor
8 = Single Zone Variable Air Volume Oversized Motor
9 = Multi-Speed Oversized Motor
A = Single Zone Variable Air Volume Standard Motor w/ Shaft Grounding Ring
B = Multi-Speed Standard Motor w/ Shaft Grounding Ring
C = Single Zone Variable Air Volume Oversized Motor w/ Shaft Grounding Ring
D = Multi-Speed Oversized Motor w/ Shaft Grounding Ring
E = VAV Supply Air Temperature Control - Standard Motor
F = VAV Supply Air Temperature Control - Oversized Motor
G = VAV Supply Air Temperature Control - Standard Motor w/ Shaft Grounding Ring
H = VAV Supply Air Temperature Control - Oversized Motor w/ Shaft Grounding Ring

Digit 16 – Hinged Service Access / Filters

0 = Standard Panels/Standard Filters²⁵
A = Hinged Access/Standard Filters²⁵

B = Standard Panels/MERV 8 Filters⁶
C = Hinged Access/MERV 8 Filters⁶
D = Standard Panels/MERV 13 Filters⁶
E = Hinged Access/MERV 13 Filters⁶

Digit 17 – Condenser Coil Protection

0 = Standard Coil
1 = Standard Coil With Hail Guard
4 = CompleteCoat™ Condenser Coil
5 = CompleteCoat™ Condenser Coil with Hail Guard

Digit 18 – Through The Base Provisions

0 = No Through The Base Provisions
A = Through The Base Electric¹²

Digit 19 – Disconnect Switch/Circuit Breaker¹¹

0 = No Disconnect/circuit break
1 = Unit Mounted Non-Fused Disconnect Switch
2 = Unit Mounted Circuit Breaker

Digit 20 – Convenience Outlet Option

0 = Without Convenience Outlet
A = Unpowered Convenience Outlet⁵
B = Powered Convenience Outlet⁵

Digit 21 – Communications Options

0 = Without Communications Options
1 = Trane Communications Interface^{6, 17}
2 = Lontalk Communications Interface⁶
3 = Novar 2024 Controls Interface¹⁹
4 = Novar 3051 Controls Interface¹⁹
5 = Novar 3051 Communications Interface with Demand Control Ventilation¹⁹
6 = Building Automation Control Network Communications Interface

Digit 22 – Refrigeration System Option

0 = Standard refrigeration system
B = Dehumidification (Hot Gas Reheat)^{4, 14}

Digit 23 – Refrigeration Controls

0 = Without Refrigeration Controls
1 = Frostat^{9, 21}

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 Detector²²

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
- 8 = NOVAR Return Air Sensor (Novar 2024)^{13,19}
- 9 = NOVAR Zone Temp Sensor (Novar 3051)¹⁹
- 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)²⁰
- B = FDD (Fault Detection and Diagnostics)
- C = FDD (Fault Detection Diagnostics) & Demand Control Ventilation (CO₂)²⁰

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^{23, 24}

Digit 31 - Advanced Unit Controls

- 0 = Standard Unit Controls
- 1 = Human Interface²⁶

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. This option consists of the Novar return air sensor (Novar #WTS-10) that is wired and shipped in the return air section of the unit. The sensor ships with approximately 15' of extra wire for dropping down the return air duct (downflow only).
 14. Available on high efficiency units only.
 15. All Factory Installed Options are Built-to-Order. Check order services for estimated production cycle.
 16. The Novar control option includes the following factory installed and wired devices: Novar ETM-2024 or Novar 3051 rooftop controller, fan proving switch, clogged filter or unit shutdown switch, Cool 1, Cool 2, Heat switch and discharge air sensor (Novar 2024 is downflow only).
- Note:** Option cannot be ordered in conjunction with a factory installed smoke detector.
17. TCI is for use with non-VariTrac systems and VariTrac systems.
 18. For use with multi-speed and SZVAV units only.
 19. Novar is not available with SZ VAV products.
 20. Demand Control Ventilation Option includes wiring only. The CO₂ sensor is a field-installed only option.
 21. Froststat is standard on VAV, and high efficiency units.
 22. Supply and/or return smoke detector may not be used with the plenum smoke detector.
 23. Only available where MOP is above 60A.
 24. 575 VAC option is 25kA.
 25. Standard filters are not available with Low Leak Economizers.
 26. Human Interface is standard with FDD (Fault Detection Diagnostics).

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™ Communications 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.

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

General Information

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 exceed 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 Frostat™ control (FOS) mounted in the indoor coil 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.

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.

General Information

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 its 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. 35.

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

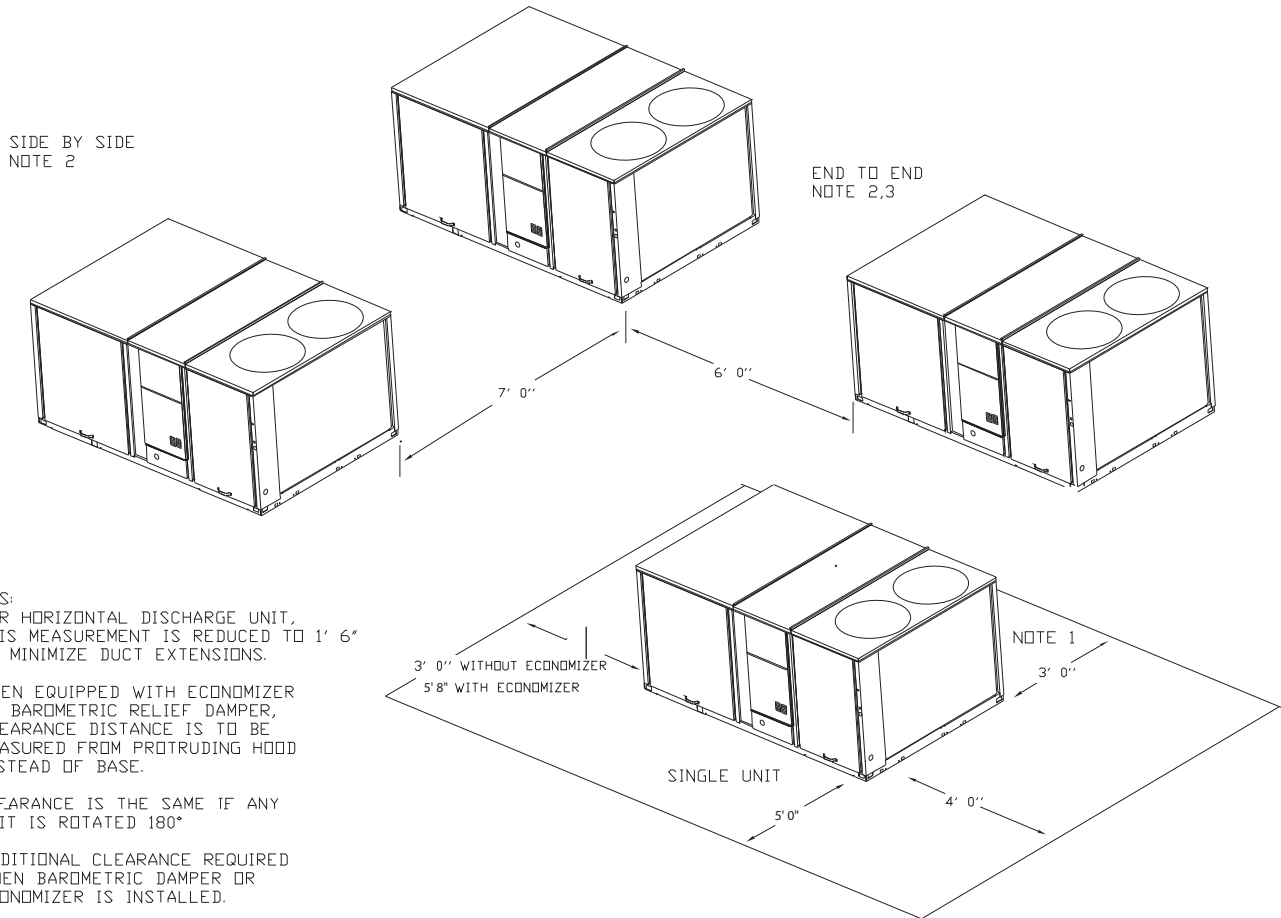
Unit Clearances

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

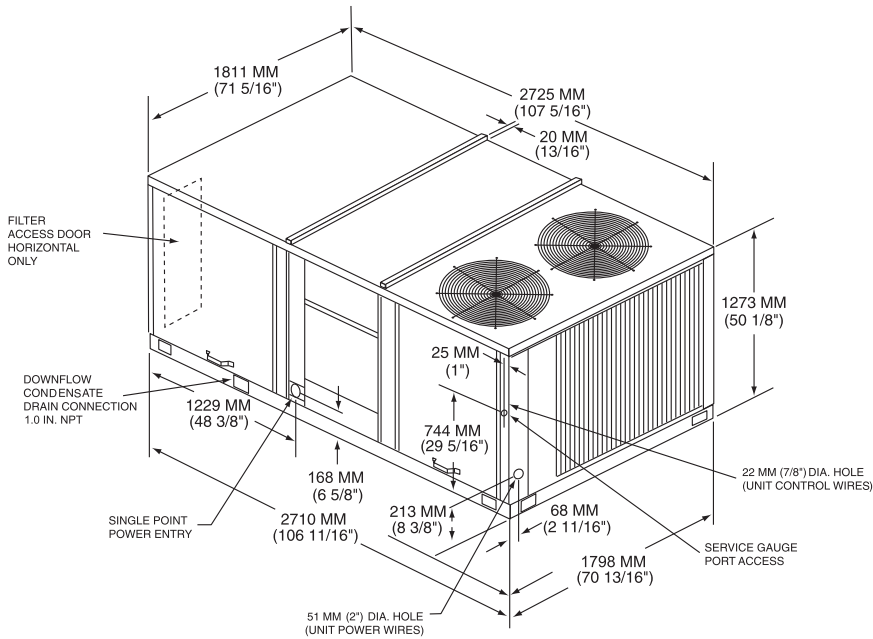
Figure 1. Typical installation clearance for single and multiple unit applications



NOTES:

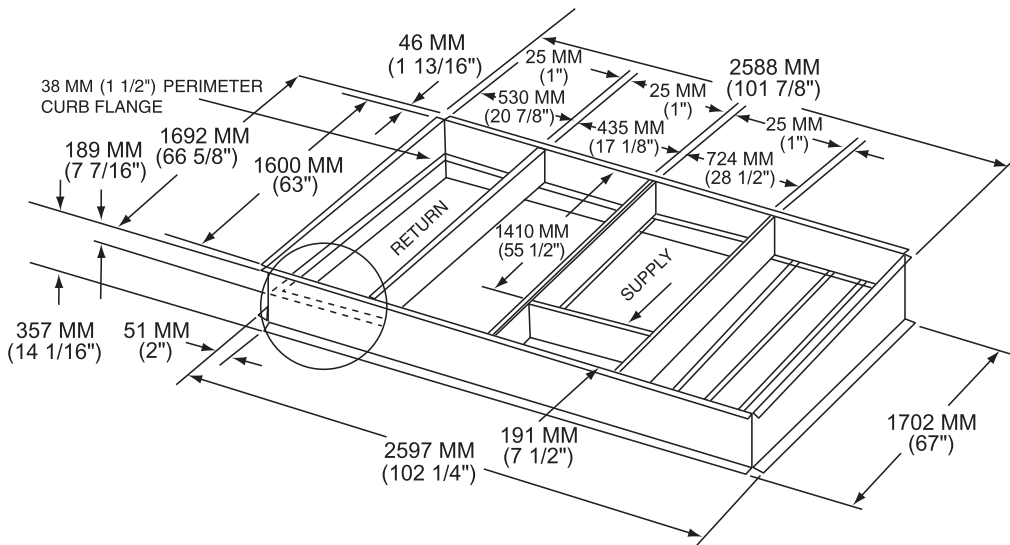
1. FOR HORIZONTAL DISCHARGE UNIT, THIS MEASUREMENT IS REDUCED TO 1' 6" TO MINIMIZE DUCT EXTENSIONS.
2. WHEN EQUIPPED WITH ECONOMIZER OR BAROMETRIC RELIEF DAMPER, CLEARANCE DISTANCE IS TO BE MEASURED FROM PROTRUDING HOOD INSTEAD OF BASE.
3. CLEARANCE IS THE SAME IF ANY UNIT IS ROTATED 180°
4. ADDITIONAL CLEARANCE REQUIRED WHEN BAROMETRIC DAMPER OR ECONOMIZER IS INSTALLED.

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

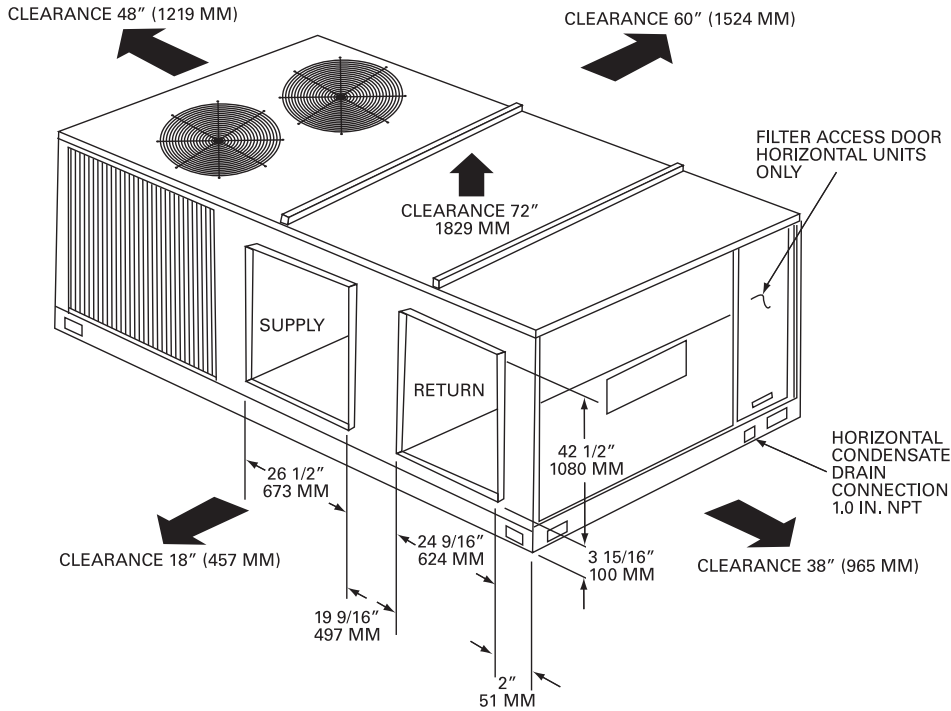
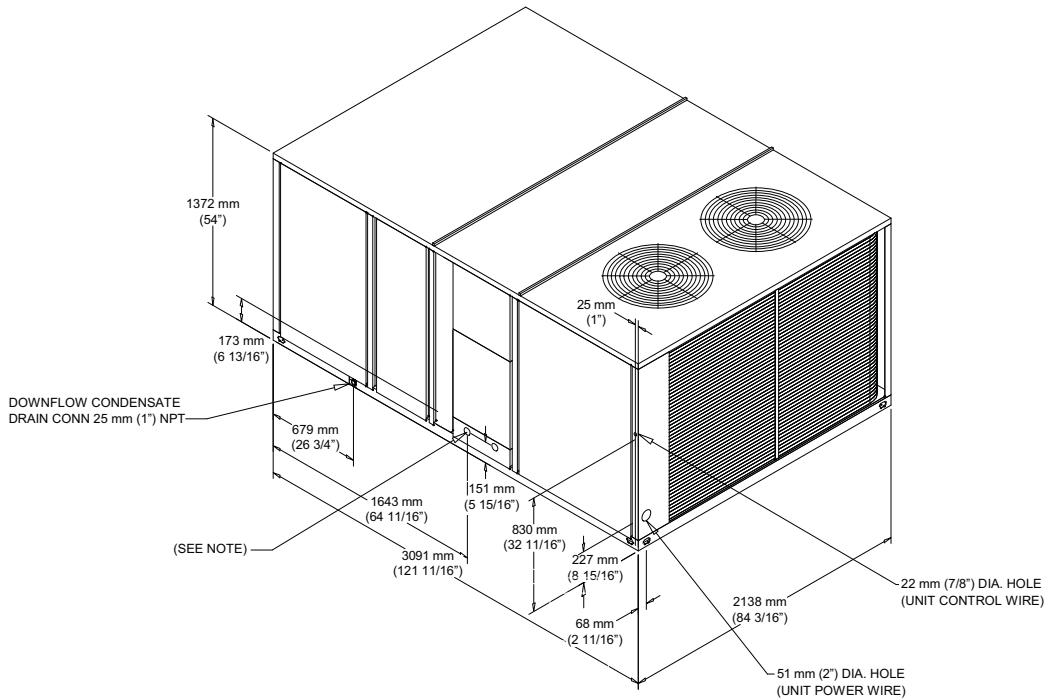
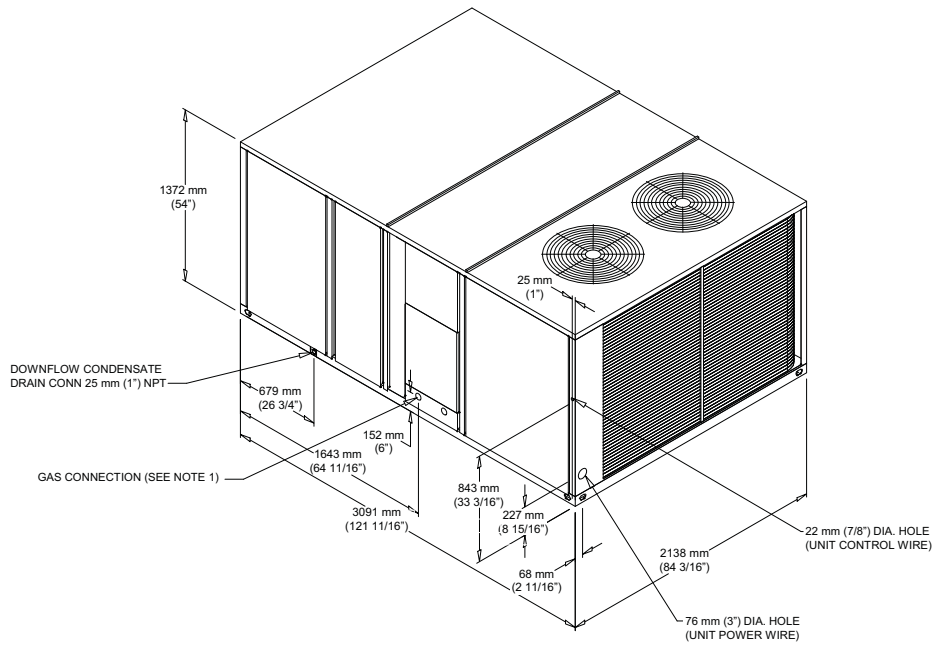


Figure 5. Unit dimensional data 15–25 tons standard efficiency units



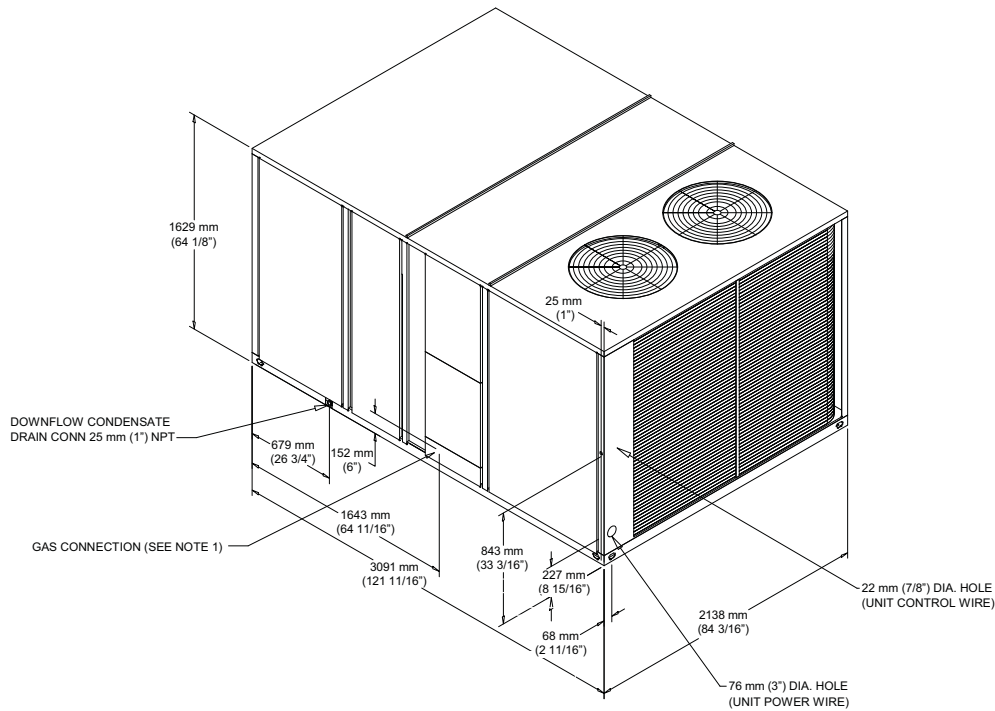
Note: 51 mm(2") Electrical Connection: Single Point Power When Heat Installed

Figure 6. Unit dimensional data 12½ ton high efficiency units



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

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



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

Unit Dimensions

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

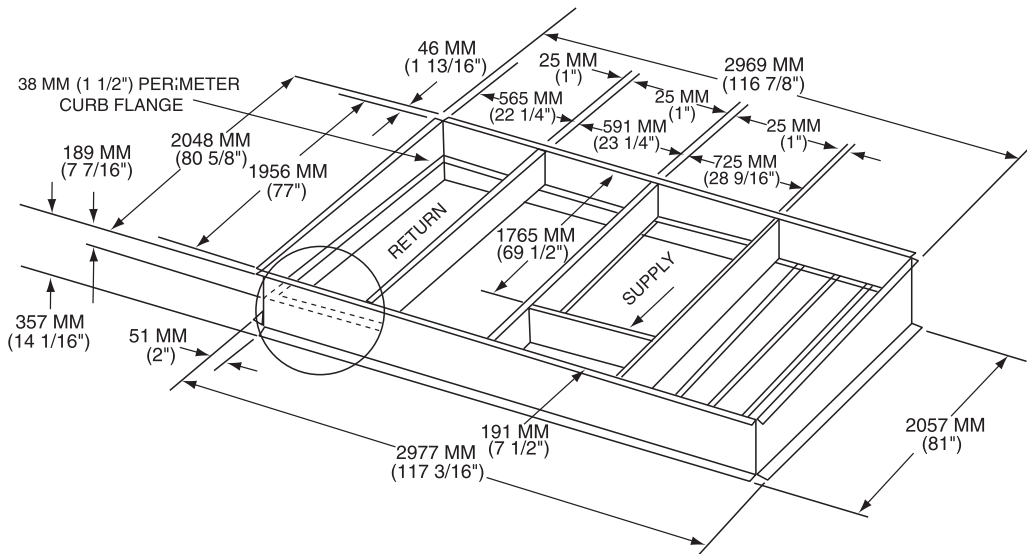
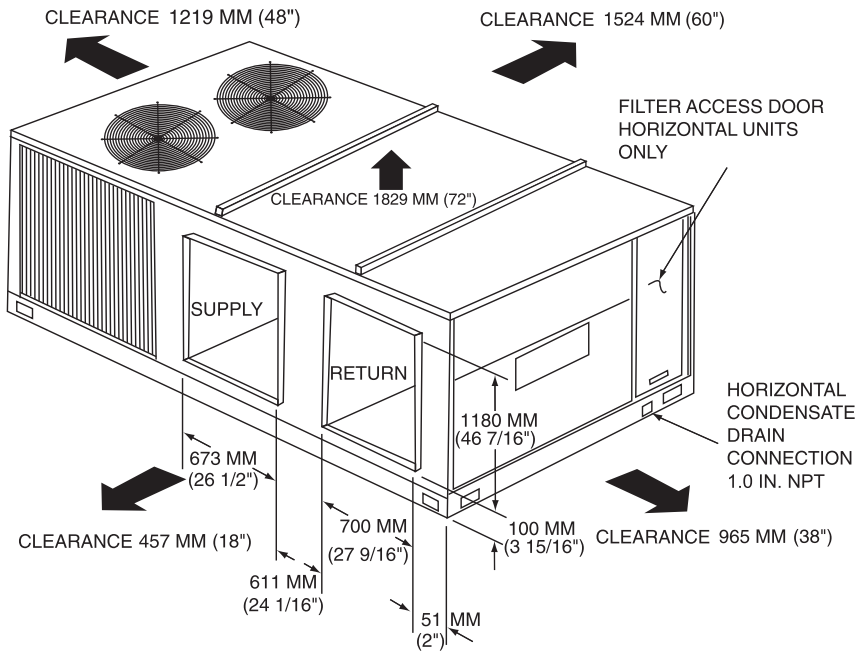


Figure 9. Horizontal duct dimensional data 15–25 tons standard efficiency units, 12½–25 tons high efficiency units



Unit Weights

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

Unit Models	Net Weights (25mm/18mm) ^(a)	Corner Weights (lb)			
		A	B	C	D
TS*150F	1413/1409	475/473	368/368	263/261	308/308
TH*150G	2062	640	550	409	462
TH*150G Reheat unit	2081	646	555	413	466
TS*155F	1822/1844	590/597	498/498	358/358	376/391
TS*180F ^(b)	1822/1844	618/618	493/493	336/334	378/378
TH*180G	2030	605	554	416	456
TH*180G Reheat unit	2048	611	559	419	460
TS*175F	1863/1887	591/598	510/510	372/374	388/403
TS*210F ^(b)	1863/1887	591/598	510/510	372/374	388/403
TH*210G	1991	608	532	390	461
TH*210G Reheat unit	2010	614	537	394	465
TS*200F	1925	614	514	375	422
TS*240F	1925	614	514	375	422
TH*240G	2061	657	542	392	470
TH*240G Reheat unit	2080	663	547	396	474
TS*250F	1878	595	510	372	402
TS*300F	1878	595	510	372	402
TH*300G	2062	658	546	391	468

(a) 25mm/18mm condenser coil

(b) 18mm condenser coil not used on TSD180F, TSD180F*(A,F), TSD210F, TSD210F*(A,F).

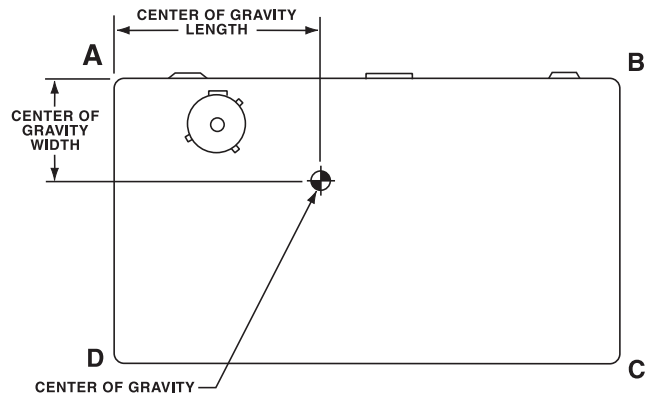
Table 2. Typical unit weights and point loading data (kg)

Unit Models	Net Weights (25mm/18mm) ^(a)	Corner Weights (kg)			
		A	B	C	D
TS*150F	641/639	215/215	167/167	119/118	140/140
TH*150G	937	291	250	186	210
TH*150G Reheat unit	946	294	252	188	212
TS*155F	826/836	268/271	226/226	162/162	171/177
TS*180F ^(b)	826/836	280/280	224/224	152/151	171/171
TH*180G	923	275	252	189	207
TH*180G Reheat unit	931	278	254	190	209
TS*175F	845/856	268/271	231/231	169/170	176/183
TS*210F ^(b)	845/856	268/271	231/231	169/170	176/183
TH*210G	905	276	242	177	210
TH*210G Reheat unit	912	278	244	179	211
TS*200F	873	279	233	170	191
TS*240F	873	279	233	170 </td <td>191</td>	191
TH*240G	937	299	246	178	214
TH*240G Reheat unit	944	301	248	180	215
TS*250F	852	270	231	169	182
TS*300F	852	270	231	169	182
TH*300G	937	299	248	178	213

(a) 25mm/18mm condenser coil

(b) 18mm condenser coil not used on TSD180F, TSD180F*(A,F), TSD210F, TSD210F*(A,F).

Figure 10. Corner 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

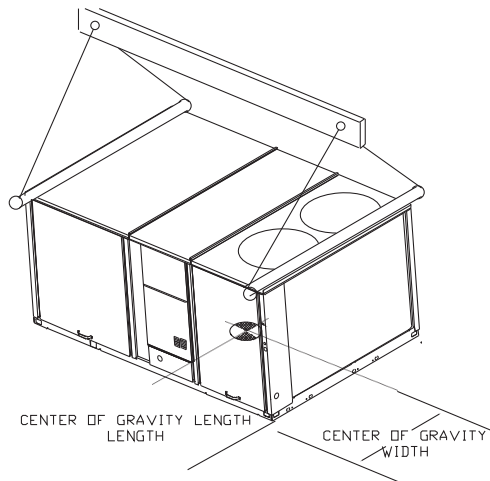
Improper Unit Lift!

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 11, 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 11, 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 11, 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.
4. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
5. Lift the unit and position it into place.
6. 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 11. 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 roof curb 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

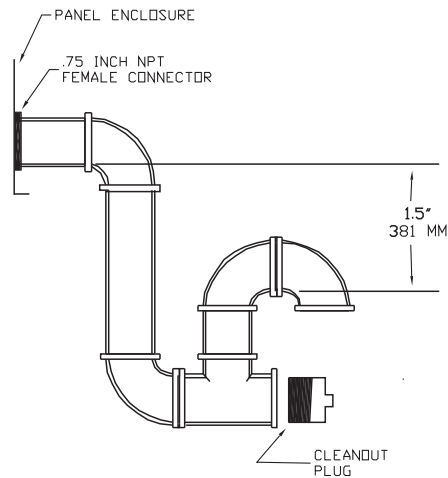
An evaporator condensate drain connection is provided on each unit. Refer to “Unit Dimensions,” p. 12 for the appropriate drain location.

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 12.

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 12. Condensate trap installation



Filter Installation

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

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

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

Field Installed Power Wiring

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

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

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

NOTICE:

Use Copper Conductors Only!

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

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

Main Unit Power

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

Standard Wiring

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

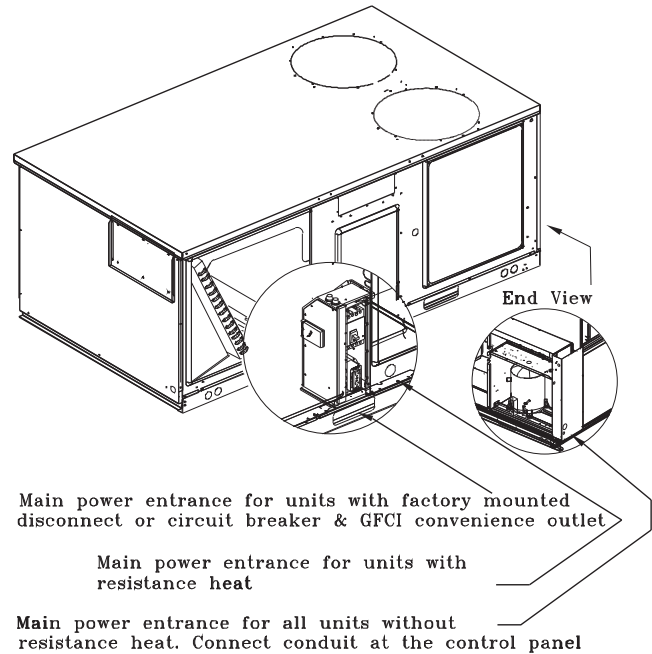
Protection devices must be sized according to the electrical data on the nameplate.

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

Optional TBUE Wiring (Through the Base Electrical Option)

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

Figure 13. Through the base electrical option



Field Installed Control Wiring

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

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

Control Power Transformer

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

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

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 14. ReliaTel™ options module

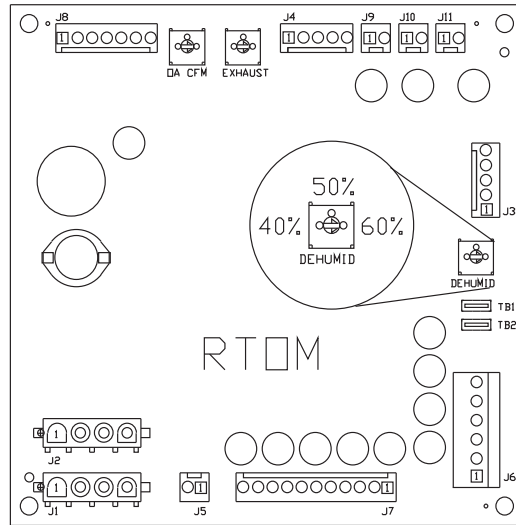


Figure 15. ReliaTel conventional thermostat field wiring diagram

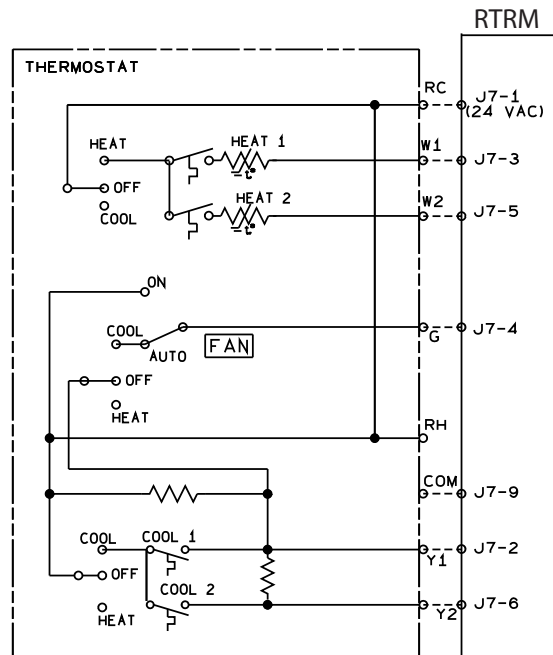


Figure 16. ReliaTel relative humidity sensor (dehumidification option)

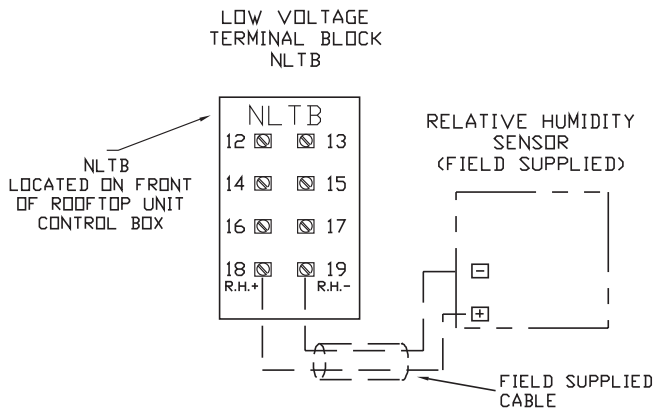
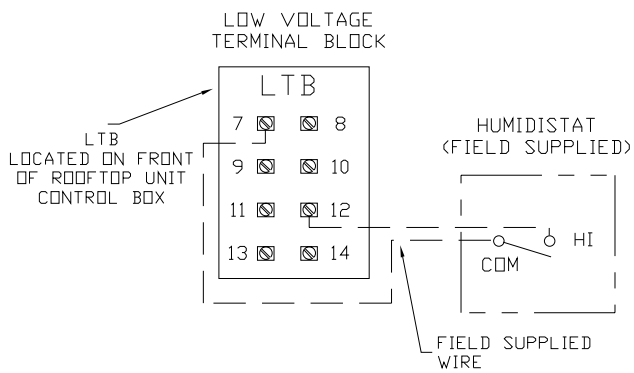
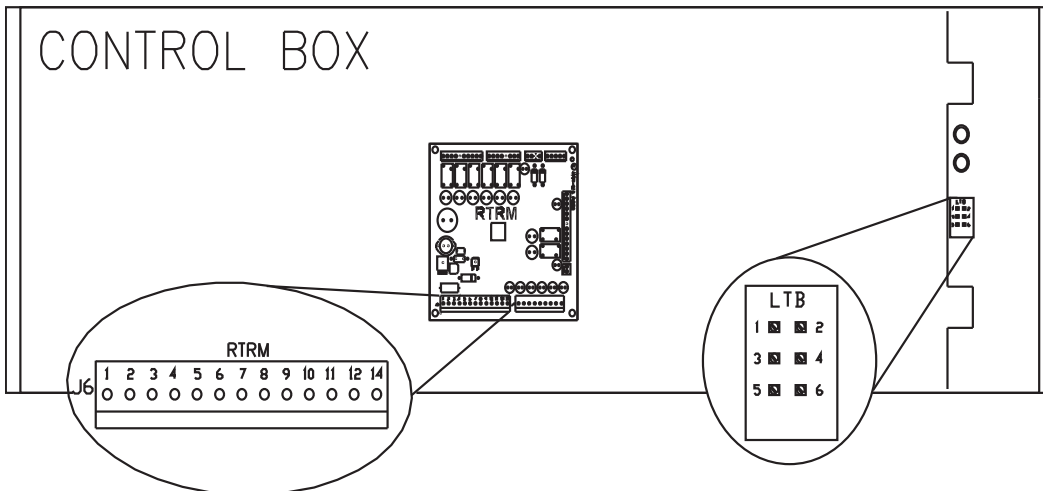
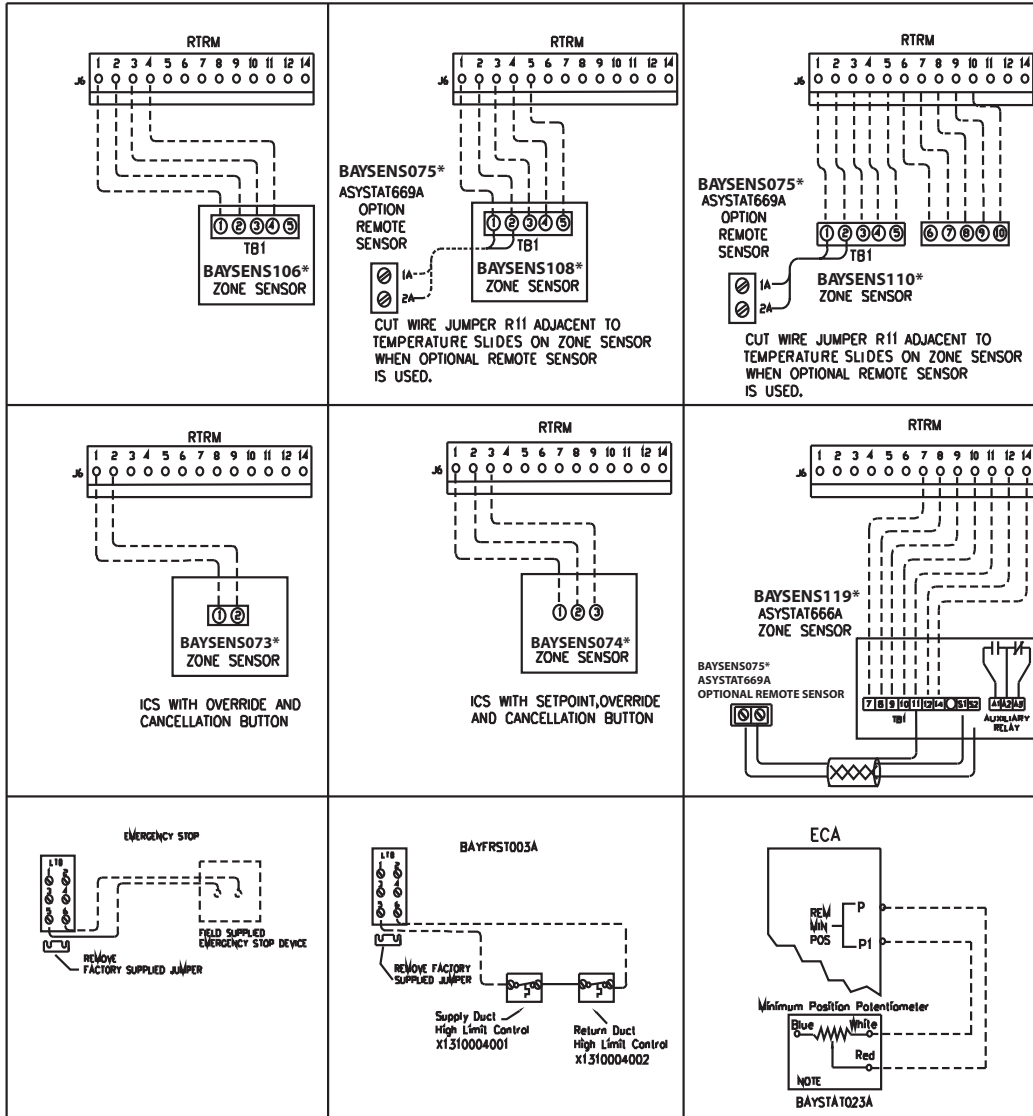


Figure 17. ReliaTel humidistat (dehumidification option)



Installation

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



Space Temperature Averaging

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

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

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

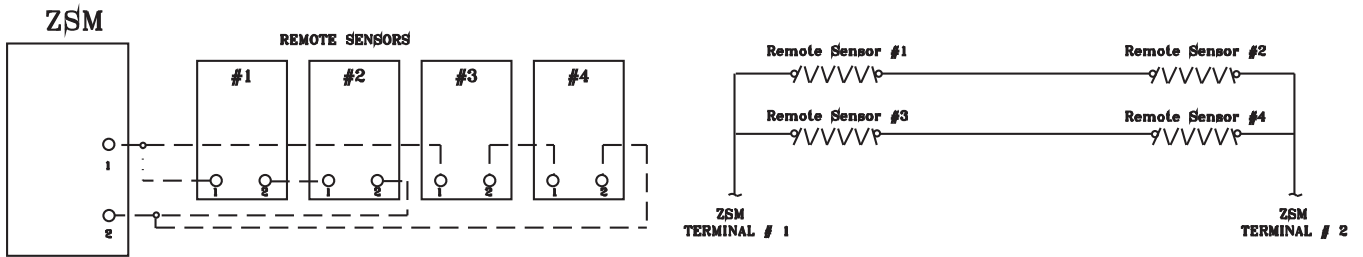
Table 5. Temperature vs. resistance

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

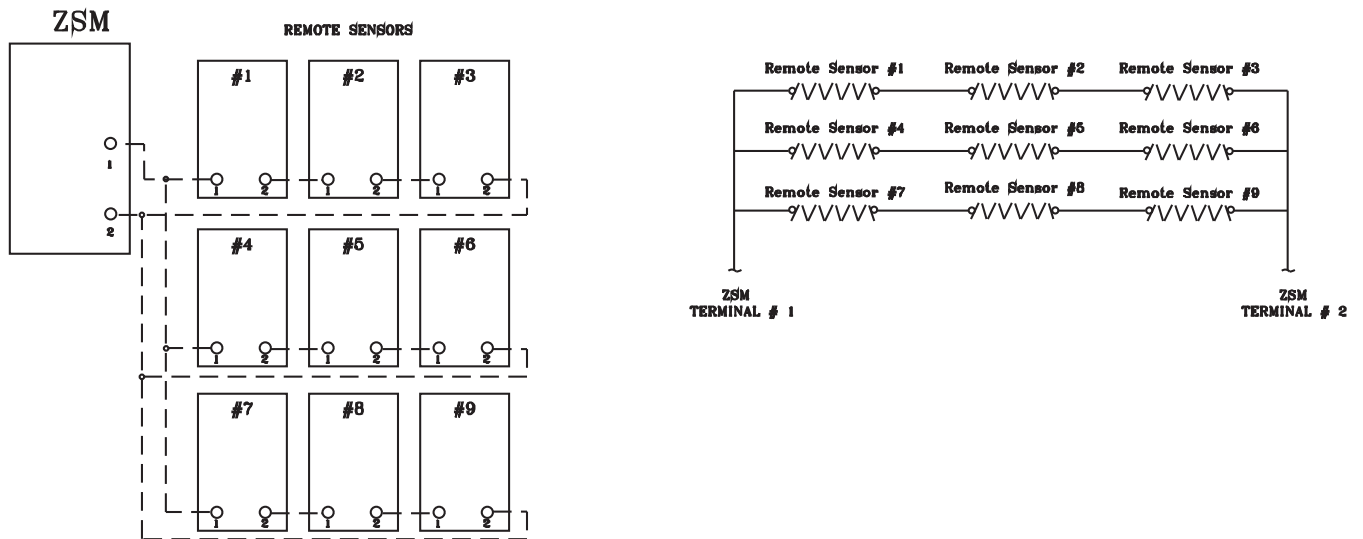
Installation

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.

Installation

⚠ 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-SVB06A-EN

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

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

1. Field connections are made by first removing all access panels on the front of the unit. Unscrew the assembly around the outside of the disconnect switch or circuit breaker. This assembly is located between the evaporator and heat section of the unit (Figure 19, 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.

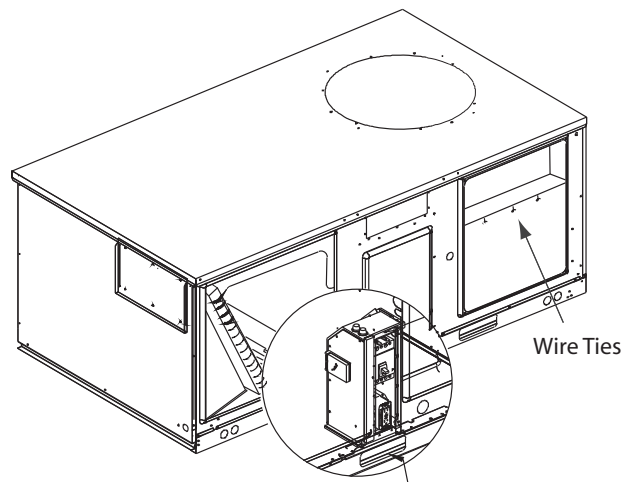
2. If the conduit required for your application is larger, remove the termination plate and connect to the larger hole using field supplied reducing washers.
3. Route the power wires and ground conductor through conduit and into the bottom of the factory installed

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 19). Route wires through loose wire ties provided in unit as in Figure 19.
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 19. Main power entrance for units with factory mounted disconnect or circuit breaker



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

Powered and Unpowered Convenience

⚠ WARNING

Hazardous Voltage w/Capacitors!

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

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

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

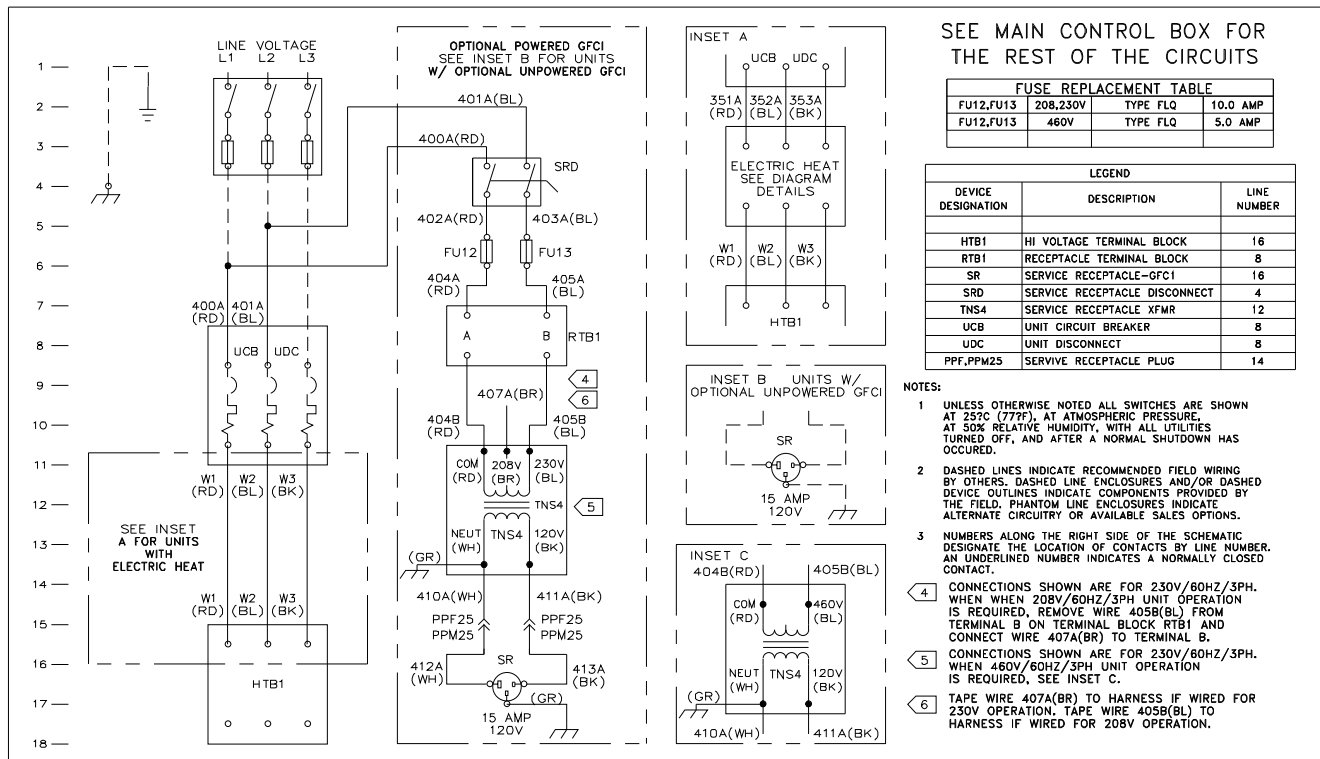
Powered Convenience Outlet Powered Option (FIYCOPO)

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

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

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

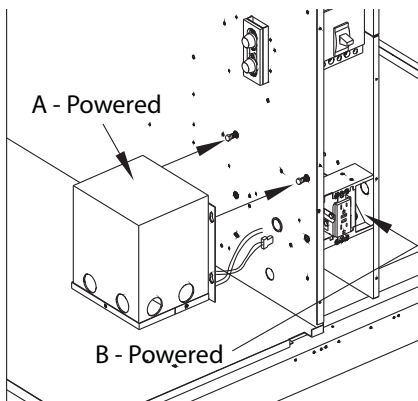
Figure 20. Wiring schematic 12½ through 25 ton options



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 21. Power options



Return Air Smoke Detector

Pre-Requirement

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

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

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

Smoke Detector Installation

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

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

⚠ WARNING

Hazardous Voltage w/Capacitors!

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

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

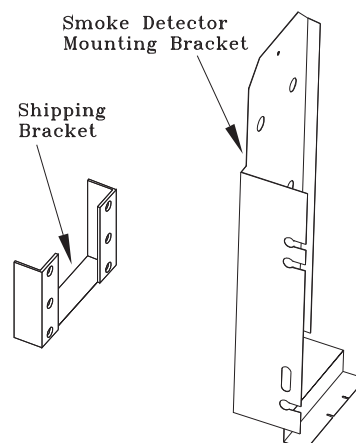
⚠ WARNING

Proper Field Wiring and Grounding Required!

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

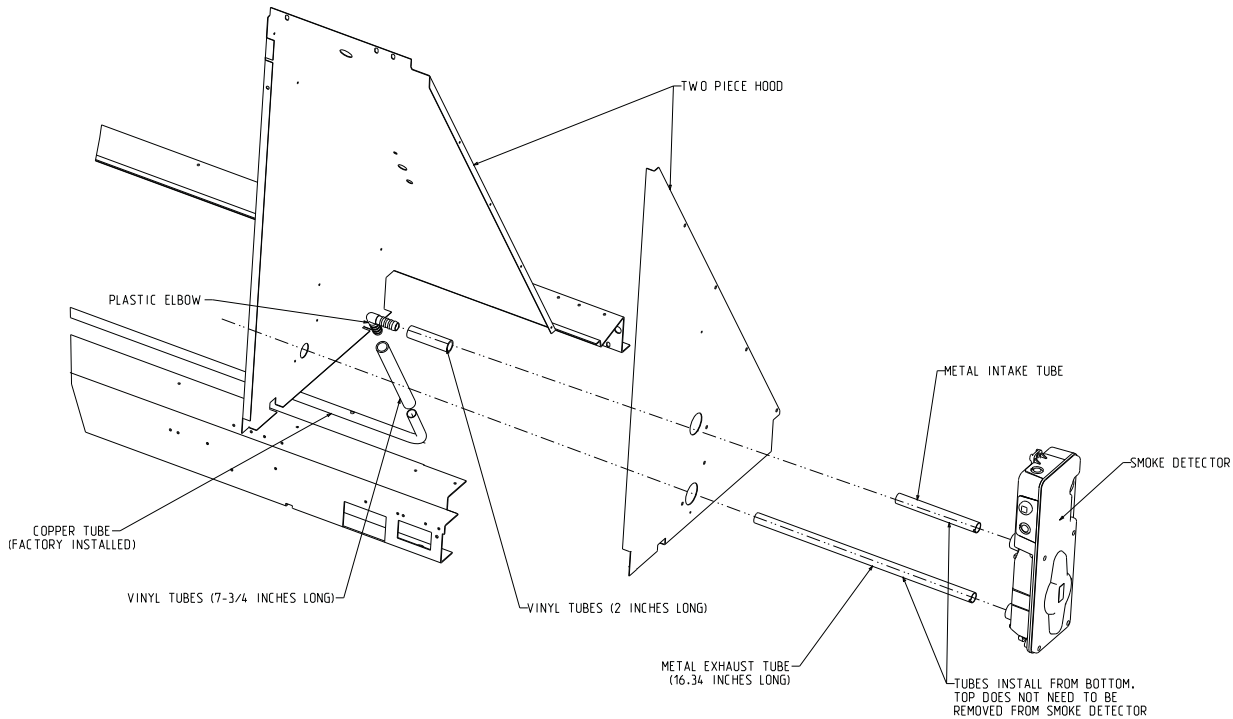
1. Remove the smoke detector assembly from its shipping position in the indoor fan compartment. This assembly is attached with three screws to the indoor fan board near the top of the unit.
2. Remove and discard the shipping bracket from the smoke detector assembly. This is the angled piece of sheet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

Figure 22. Brackets



Factory-Mounted Unit Options

Figure 23. Return air smoke detector for downflow units



- 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.
 - 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).
 - 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.
- 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.
- 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.
 - Refer to [Figure 24, p. 33](#) for wire connections of return air smoke detector to the unit wiring harness.
 - 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

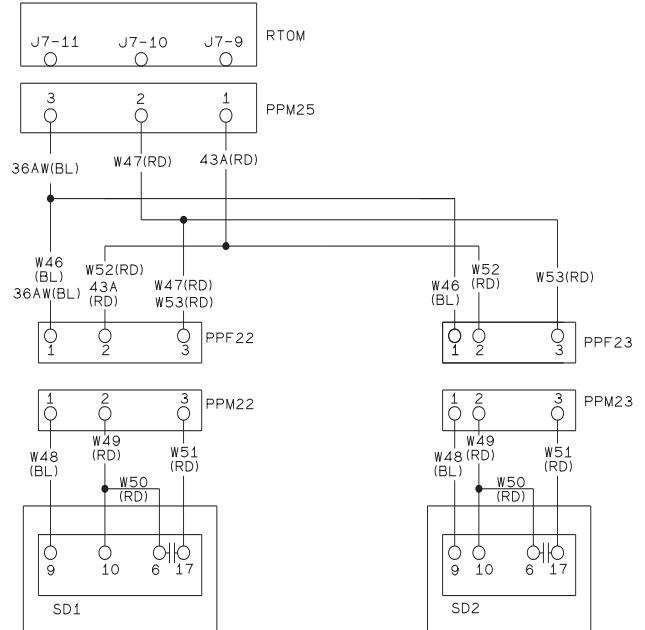
Notes:

- 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 24. 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..... RELIATEL OPTIONS MODULE
- PPM25..... SMOKE DETECTOR TO RTOM BOARD

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 Comp Heat Heat				Ohm
				1	2	1	2	
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. 34](#), momentarily jump across the Test 1 and Test 2 terminals on LTB1 one-time to start the Minimum Ventilation Test.

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

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

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

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

Compressor Start-Up

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

Using the Service Test Guide in [Table 8, p. 34](#), continue the Service Test start-up procedure for each compressor circuit.

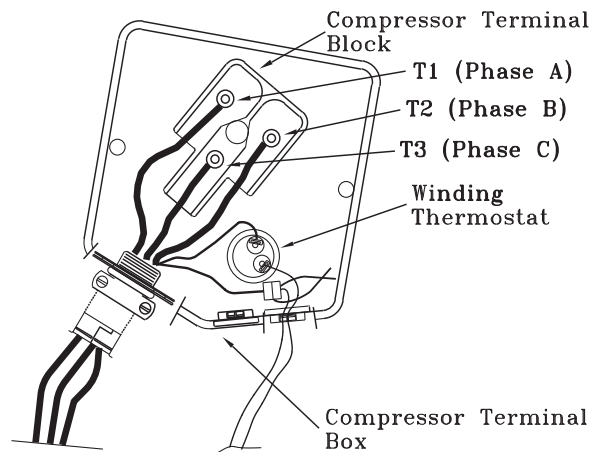
Momentarily jump across the Test 1 and Test 2 terminals on LTB1 one additional time if continuing from previous component start-up or until the desired startup component Test is started.

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 25. 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. 35](#). The appropriate oil charge is listed in [Table 10, p. 36](#).

Table 9. Compressor types

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

Start Up

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

Model	C1 25mm/18mm	C2 25mm/18mm
TS*150	56/105.6	62/99.2
TH*150	56	38
TH*150 Reheat	56	56
TS*180/155	112/182.4	62 (62)/96
TH*180	81	38
TH*180 Reheat	56	56
TSH210, TS*175	112/182.4	38 (62)/96
TS*210/175	112	38 (62)
TH*210	81	38
TH*210 Reheat	102	56
TS*240/200	112	56
TH*240	112	38
TH*240 Reheat	112	112
TS*300/250	112	106
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. 34](#))

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. 34](#), 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. 34](#), 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 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.

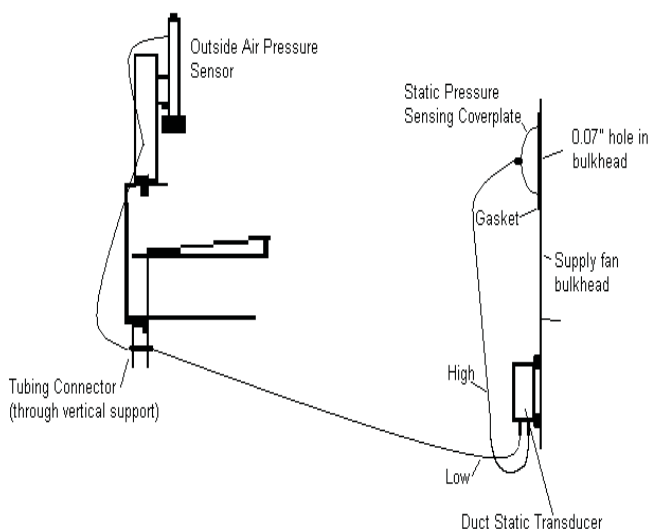
Example:

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 26. 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 27. VHR relay output

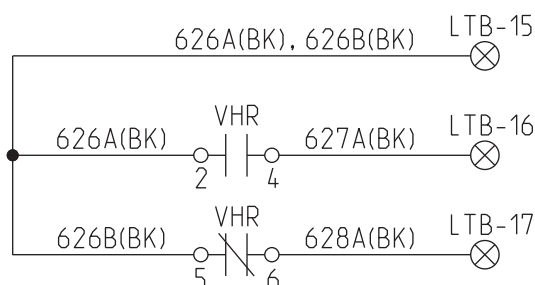


Table 11. Variable air volume mode operation

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

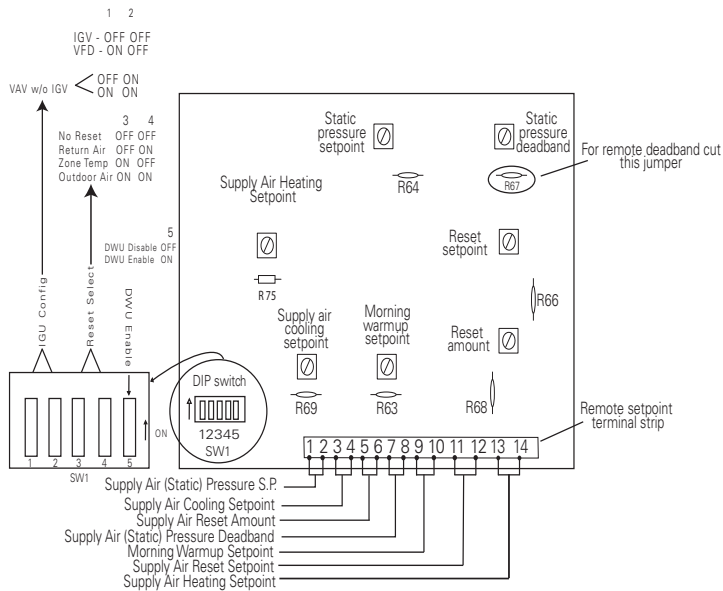
Resistance (Ohms)	DC volts	Supply Air Cooling Setpoint (J7-3,4)
		Deg F
240	0.97	50.37
280	1.09	52.30
320	1.21	54.24
360	1.32	56.09
410	1.45	58.18
450	1.55	59.80

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.

Start Up

Figure 28. 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.

Maintenance

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

Fan Belt Adjustment—Belt Drive Units

⚠ WARNING

Rotating Components!

The following procedure involves working with rotating components. 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 rotating components cutting and slashing technician which could result in death or serious injury.

The fan belts must be inspected periodically to assure proper unit operation.

Replacement is necessary if the belts appear frayed or worn. Units with dual belts require a matched set of belts to ensure equal belt length.

When removing or installing the new belts, do not stretch them over the sheaves. Loosen the belts using the belt tension adjustment bolts on the motor mounting base.

Once the new belts are installed, using a Browning or Gates tension gauge (or equivalent) illustrated in [Figure 29](#); adjust the belt tension as follows;

1. To determine the appropriate belt deflection;
 - a. Measure the center-to-center shaft distance (in inches) between the fan and motor sheaves.
 - b. Divide the distance measured in [Step 1a](#) by 64; the resulting value represents the amount of belt deflection that corresponds to the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in [Step 1b](#).
3. Set the small O-ring at zero on the force scale of the gauge plunger.
4. Place the large end of the gauge at the center of the belt span; then depress the gauge plunger until the large O-ring is even with the top of the next belt or even with a straightedge placed across the fan and motor sheaves.

Refer to [Table 13, p. 39](#).
5. Remove the belt tension gauge. The small O-ring now indicates a number other than zero on the plunger's force scale. This number represents the force (in pounds) required to give the needed deflection.

6. Compare the "force" scale reading ([Step 5](#)) with the appropriate "force" value listed in [Table 13, p. 39](#). If the "force" reading is outside the range, readjust the belt tension.
- Note:** Actual belt deflection "force" must not exceed the maximum "force" value shown in [Table 13, p. 39](#).
7. Recheck the belt tension at least twice during the first 2 to 3 days of operation. Belt tension may decrease until the new belts are "run in".

Figure 29. Belt tension gauge

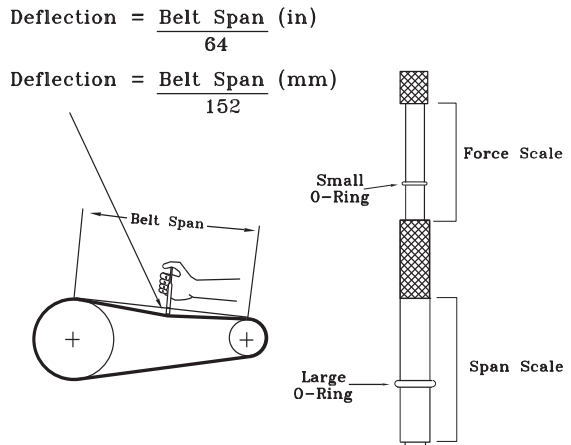


Table 13. Belt tension measurement and deflection ranges

Belts Cross Section	Small P.D Range (in.)	Deflection Force (lb)					
		Super Gripbelts (in.)		Gripnotch (in.)		Steel Cable Gripbelts (in.)	
		Min.	Max.	Min.	Max.	Min.	Max.
A	3.0–3.6	3	4 1/2	3 7/8	5 1/2	3 1/4	4
	3.8–4.8	3 1/2	5	4 1/2	6 1/4	3 3/4	4 3/4
	5.0–7.0	4	5 1/2	5	6 7/8	4 1/4	5 1/4
B	3.4–4.2	4	5 1/2	5 3/4	8	4 1/2	5 1/2
	4.4–5.6	5 1/8	7 1/8	6 1/2	9 1/8	5 3/4	7 1/4
	5.8–8.8	6 3/8	8 3/4	7 3/8	10 1/8	7	8 3/4

Belts Cross Section	Small P.D Range (mm)	Deflection Force (kg)					
		Super Gripbelts (mm)		Gripnotch (mm)		Steel Cable Gripbelts (mm)	
		Min.	Max.	Min.	Max.	Min.	Max.
A	13.3–16.0	13.3	20.0	17.2	24.5	14.5	17.8
	16.9–21.4	15.6	22.2	20.0	27.8	16.7	21.1
	22.0–31.1	17.8	24.5	22.2	30.6	18.9	23.4
B	15.1–18.7	17.8	24.5	25.6	35.6	20.0	24.5
	19.6–24.9	22.8	31.7	28.9	40.6	25.6	32.3
	25.8–39.1	28.4	38.9	32.8	45.0	31.1	38.9

Monthly Maintenance

Before completing the following checks, turn the unit OFF and lock the main power disconnect switch open.

⚠ 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.

Filters

Inspect the return air filters. Clean or replace them if necessary. Refer to the unit Service Facts for filter information.

Return Air Smoke Detector Maintenance

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.

Condensate Overflow Switch

During maintenance, the switch float (black ring) must be checked to ensure free movement up and down.

Cooling Season

- Check the unit's drain pans and condensate piping to ensure that there are no blockages.
- Inspect the evaporator and condenser coils for dirt, bent fins, etc. If the coils appear dirty, clean them according to the instructions described in "[Condenser Coil Cleaning](#)," p. 40.
- Manually rotate the condenser fan(s) to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.
- Inspect the F/A-R/A damper hinges and pins to ensure that all moving parts are securely mounted. Keep the blades clean as necessary.
- Verify that all damper linkages move freely; lubricate with white grease, if necessary.

- Check supply fan motor bearings; repair or replace the motor as necessary.
- Check the fan shaft bearings for wear. Replace the bearings as necessary.
- Check the supply fan belt. If the belt is frayed or worn, replace it. Refer to "[Fan Belt Adjustment—Belt Drive Units](#)," p. 39 for belt replacement and adjustments.
- Verify that all wire terminal connections are tight.
- Remove any corrosion present on the exterior surfaces of the unit and repaint these areas.
- Generally inspect the unit for unusual conditions (e.g., loose access panels, leaking piping connections, etc.).
- Make sure that all retaining screws are reinstalled in the unit access panels once these checks are complete.
- With the unit running, check and record the: ambient temperature; compressor suction and discharge pressures (each circuit); superheat (each circuit); Record this data on an "operator's maintenance log" like the one shown in [Table 14, p. 41](#). If the operating pressures indicate a refrigerant shortage, measure the system superheat. For guidelines, refer to "[Compressor Start-Up](#)," p. 35.

Note: Do NOT release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state and local laws.

Heating Season

- Inspect the unit's air filters. If necessary, clean or replace them.
- Check supply fan motor bearings; repair or replace the motor as necessary.
- Inspect both the main unit control panel and heat section control box for loose electrical components and terminal connections, as well as damaged wire insulation. Make any necessary repairs.
- Verify that the electric heat system operates properly.

Condenser Coil Cleaning

Regular coil maintenance, including annual cleaning, enhances the unit's operating efficiency by minimizing: compressor head pressure and amperage draw; evaporator water carryover; fan brake horsepower, due to increase static pressure losses; airflow reduction.

At least once each year, or more often if the unit is located in a "dirty" environment, clean the condenser coils using the instructions outlined below. Be sure to follow these instructions as closely as possible to avoid damaging the coils.

Microchannel (MCHE) Coils

NOTICE:

Coil Damage!
DO NOT use any detergents with microchannel condenser coils. Use pressurized water or air ONLY, with pressure no greater than 600psi. Failure to do so could result in coil damage.

For additional information regarding the proper microchannel coil cleaning procedure, refer to RT-SVB83-EN.*

Due to the soft material and thin walls of the MCHE coils, the traditional field maintenance method recommended for Round Tube Plate Fin (RTPF) coils does not apply to microchannel coils.

Moreover, chemical cleaners are a risk factor to MCHE due to the material of the coil. The manufacturer does not recommend the use of chemical cleaners to clean microchannel coils. Using chemical cleaners could lead to warranty claims being further evaluated for validity and failure analysis.

The recommended cleaning method for microchannel condenser coils is pressurized water or air with a non-pinpoint nozzle and an ECU of at least 180 with pressure no greater than 600 psi. To minimize the risk of coil damage, approach the cleaning of the coil with the pressure washer aimed perpendicular to the face of the coil during cleaning. Optimum clearance between the sprayer nozzle and the microchannel coil is 1"-3".

Final Process

For future reference, you may find it helpful to record the unit data requested below in the blanks provided.

(1) Complete Unit Model Number:

(2) Unit Serial Number:

(3) Wiring Diagram Numbers (from unit control panel)

– schematic(s)

– connection(s)

Table 14. Sample maintenance log

Date	Current Ambient Temp F/C	Refrigerant Circuit #1						Refrigerant Circuit #2					
		Compr. Oil Level	Suct. Press. Psig/kPa	Disch. Press. Psig/kPa	Liquid Press. Psig/kPa	Super-heat F/C	Sub-cool F/C	Compr. Oil Level	Suct. Press. Psig/kPa	Disch. Press. Psig/kPa	Liquid Press. Psig/kPa	Super-heat F/C	Sub-cool F/C
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					

Troubleshooting

⚠ WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

ReliaTel Control

The RTRM has the ability to provide the service personnel with some unit diagnostics and system status information.

Before turning the main power disconnect switch “Off”, follow the steps below to check the ReliaTel™ Refrigeration Module (RTRM). All diagnostics and system status information stored in the RTRM will be lost when the main power is turned “Off”.

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

1. Verify that the Liteport LED on the RTRM is burning continuously. If the LED is lit, go to [Step 3](#).
2. If the LED is not lit, verify that 24 Vac is presence between J1-1 and J1-2. If 24 Vac is present, proceed to [Step 3](#).

If 24 Vac is not present, check the unit main power supply, check transformer (TNS1). Proceed to [Step 3](#) if necessary.

3. Utilizing “Method 1” or “Method 2” in the “System Status Checkout Procedure, check the following:

System status

Heating status

Cooling status

If a System failure is indicated, proceed to [Step 4](#). If no failures are indicated, proceed to [Step 5](#).

4. If a System failure is indicated, recheck [Step 1](#) and [Step 2](#). If the LED is not lit in [Step 1](#), and 24 Vac is present in [Step 2](#), the RTRM has failed. Replace the RTRM.
5. If no failures are indicated, use one of the TEST mode procedures described in “Start Up,” p. 35 to start the

unit. This procedure will allow you to check all of the RTRM outputs, and all of the external controls (relays, contactors, etc.) that the RTRM outputs energize, for each respective mode. Proceed to [Step 6](#).

6. Step the system through all of the available modes, and verify operation of all outputs, controls, and modes. If a problem in operation is noted in any mode, you may leave the system in that mode for up to one hour while troubleshooting. Refer to the sequence of operations for each mode, to assist in verifying proper operation. Make the necessary repairs and proceed to [Step 7](#) and [Step 8](#).
7. If no abnormal operating conditions appear in the test mode, exit the test mode by turning the power “Off” at the main power disconnect switch.
8. Refer to the individual component test procedures if other microelectronic components are suspect.

System Status Checkout Procedure

“System Status” is checked by using one of the following two methods:

Method 1

If the Zone Sensor Module (ZSM) is equipped with a remote panel with LED status indication, you can check the unit within the space. If the ZSM does not have LEDs, use “Method 2,” p. 43.

BAYSENS110* and BAYSENS119* have the remote panel indication feature.

The LED descriptions are listed below.

- LED 1 (System)
 - “On” during normal operation.
 - “Off” if a system failure occurs or the LED fails.
 - “Flashing” indicates test mode.
- LED 2 (Heat)
 - “On” when the heat cycle is operating.
 - “Off” when the heat cycle terminates or the LED fails.
 - “Flashing” indicates a heating failure.
- LED 3 (Cool)
 - “On” when the cooling cycle is operating.
 - “Off” when the cooling cycle terminates or the LED fails.
 - “Flashing” indicates a cooling failure.
- LED 4 (Service)
 - “On” indicates a clogged filter.
 - “Off” during normal operation.

- “Flashing” indicates an evaporator fan failure or a Condenser Overflow Switch (COF) failure.

The following is the complete listing of indication causes:

System Failure

Check the voltage between terminals and 9 on J6, it should read approximately 32 Vdc. If no voltage is present, a System failure has occurred. Refer to [Step 4](#) in the previous section for the recommended troubleshooting procedure.

Cooling Failure

1. Cooling and heating set point (slide pot) on the zone sensor has failed. Refer to [“Zone Temperature Sensor \(ZTS\) Test,” p. 44.](#)
2. Zone temperature thermistor ZTEMP on ZTS failed. Refer to [“Zone Temperature Sensor \(ZTS\) Test,” p. 44.](#)
3. CC1 or CC2 24 Vac control circuit has opened, check CC1 and CC2 coils, and any of the controls below that apply to the unit (HPC1, HPC2).
4. LPC1 has opened during the three-minute minimum “on time” during consecutive compressor starts, check LPC1 or LPC2 by testing voltage between the J1-8 and J3-2 terminals on the RTRM and ground. If Vac is present, the LPCs has not tripped. If no voltage is present, LPCs has tripped.

Service Failure

1. If the supply fan proving switch has closed, the unit will not operate (when connected to RTOM), check the fan motor, belts, and proving switch.
2. If the clogged filter switch has closed, check the filters.

Simultaneous Heat and Cool Failure

- Emergency Stop is activated.

Method 2

The second method for determining system status is done by checking voltage readings at the RTRM (J6). The system indication descriptions and the approximate voltages are listed below.

System Failure

Measure the voltage between terminals J6-9 and J6-6.

- Normal Operation = approximately 32 Vdc
- System Failure = less than 1 Vdc, approximately 0.75 Vdc
- Test Mode = voltage alternates between 32 Vdc and 0.75 Vdc

Heat Failure

Measure the voltage between terminals J6-7 and J6-6.

- Heat Operating = approximately 32 Vdc
- Heat Off = less than 1 Vdc, approximately 0.75 Vdc

- Heating Failure = voltage alternates between 32 Vdc and 0.75 Vdc

Cool Failure

Measure the voltage between terminals J6-8 and J6-6.

- Cool Operating = approximately 32 Vdc
- Cool Off = less than 1 Vdc, approximately 0.75 Vdc
- Cooling Failure = voltage alternates between 32 Vdc and 0.75 Vdc

Service Failure

Measure the voltage between terminals J6-10 and J6-6.

- Clogged Filter = Approximately 32 Vdc.
- Normal = Less than 1 Vdc, approximately 0.75 Vdc
- Fan Failure = voltage alternates between 32 Vdc and 0.75 Vdc.

Note: If the Condensate Overflow Switch is closed, the unit will not operate. Check to make sure the float position is not in a tripped condition and verify an “open” between wires connecting to RTOM J6-1, J6-2.

To use LEDs for quick status information at the unit, purchase a BAYSENS110* ZSM and connect wires with alligator clamps to terminals 6 through 10. Connect each respective terminal wire (6 through 10) from the Zone Sensor to the unit J6 terminals 6 through 10.

Note: If the system is equipped with a programmable zone sensor, (BAYSENS119*), the LED indicators will not function while the BAYSENS110* is connected.

Resetting Cooling and Heating Lockouts

Cooling Failures and Heating Lockouts are reset in an identical manner.

“[Method 1,](#)” p. 43 explains resetting the system from the space; “[Method 2,](#)” p. 44 explains resetting the system at the unit.

Note: Before resetting Cooling Failures and Heating Lockouts check the Failure Status Diagnostics by the methods previously explained. Diagnostics will be lost when the power to the unit is disconnected.

Method 1

To reset the system from the space, turn the “Mode” selection switch at the zone sensor to the “Off” position. After approximately 30 seconds, turn the “Mode” selection switch to the desired mode, i.e. Heat, Cool or Auto.

Troubleshooting

Method 2

To reset the system at the unit, cycle the unit power by turning the disconnect switch "Off" and then "On".

Lockouts can be cleared through the building management system. Refer to the building management system instructions for more information.

Zone Temperature Sensor (ZTS) Service Indicator

The ZSM SERVICE LED is a generic indicator, that will signal the closing of a Normally Open switch at any time, providing the Indoor Motor (IDM) is operating.

This indicator is usually used to indicate a clogged filter, or an air side fan failure.

The RTRM will ignore the closing of this Normally Open switch for 2 (±1) minutes. This helps prevent nuisance SERVICE LED indications. The exception is the LED will flash 40 seconds after the fan is turned "On" if the Fan Proving Switch is not made.

Clogged Filter Switch

This LED will remain lit the entire time that the Normally Open switch is closed. The LED will be turned off immediately after resetting the switch (to the Normally Open position), or any time that the IDM is turned "Off".

If the switch remains closed, and the IDM is turned "On", the SERVICE LED will be turned "On" again after the 2 (±1) minute ignore delay.

This LED being turned "On", will have no other affect on unit operation. It is an indicator only.

Fan Failure Switch

When the "Fan Failure" switch is wired to the RTOM, the LED will remain flashing the entire time the fan proving switch is closed, indicating a fan failure, and it will shut the unit operations down.

Condensate Overflow Switch

When the condensate overflow switch is closed, a drain pan overflow condition is indicated and it will shut unit operations down.

Zone Temperature Sensor (ZTS) Test

Note: *These procedures are not for programmable or digital models and are conducted with the Zone Sensor Module electrically removed from the system.*

Test 1

Zone Temperature Thermistor (ZTEMP)

This component is tested by measuring the resistance between terminals 1 and 2 on the Zone Temperature Sensor. Below are some typical indoor temperatures, and corresponding resistive values.

Table 15. Temps and resistance values

Zone Temperature		Nominal ZTEMP Resistance (K-Ohms)	Nominal CSP or HSP Resistance (Ohms)
(°F)	(°C)		
50	10.0	19.9	889
55	12.8	17.47	812
60	15.6	15.3	695
65	18.3	13.49	597
70	21.1	11.9	500
75	23.9	10.50	403
80	26.7	9.3	305
85	29.4	8.25	208
90	32.2	7.3	110

Test 2

Cooling Set Point (CSP) and Heating Set Point (HSP) The resistance of these potentiometers are measured between the following ZSM terminals. Refer to [Table 15](#) for approximate resistances at the given setpoints.

Cool SP = Terminals 2 and 3

Range = 100 to 900 Ohms approximate

Heat SP = Terminals 2 and 5

Range = 100 to 900 Ohms approximate

Test 3

System Mode and Fan Selection

The combined resistance of the Mode selection switch and the Fan selection switch can be measured between terminals 2 and 4 on the Zone Sensor. The possible switch combinations are listed [Table 17, p. 45](#) with their corresponding resistance values.

Test 4

LED Indicator Test, (SYS ON, HEAT, COOL & SERVICE)

Method 1

Testing the LED using a meter with diode test function. Test both forward and reverse bias. Forward bias should measure a voltage drop of 1.5 to 2.5 volts, depending on your meter. Reverse bias will show an Over Load, or open circuit indication if LED is functional.

Method 2

Testing the LED with an analog Ohmmeter. Connect Ohmmeter across LED in one direction, then reverse the leads for the opposite direction. The LED should have at least 100 times more resistance in reverse direction, as compared with the forward direction. If high resistance in both directions, LED is open. If low in both directions, LED is shorted.

Method 3

To test LEDs with ZSM connected to unit, test voltages at LED terminals on ZSM. A measurement of 32 Vdc, across an unlit LED, means the LED has failed.

Table 16. Default operation for mechanical ZSM (CV only)

J6 Input/Connection	If no input/connection this happens
J6-7 ^(a) - Heat indication	LED will not come on while heating LED will not flash during heat fail
J6-8 ^(a) - Cool indication	LED will not come on while cooling LED will not flash during cool fail ^(a)
J6-9 ^(a) - System indication (sys on)	LED will not come on while unit has power
J6-10 ^(a) - Service indication	LED will not come on when CFS or FFS trips

(a) these connections are only on certain model ZSMs

Note: Measurements should be made from LED common (ZSM terminal 6 to respective LED terminal). Refer to [Table 16, p. 45](#).

Table 17. System mode and fan selection

Resistance Valves (K-Ohms)	Zone Sensor Unit/Fan Mode	Local Unit Mode	Local Fan Mode
2.32	Off/Auto	Off	Auto
4.87	Cool/Auto	Cool	Auto
7.68	Auto/Auto	Auto	Auto
10.77	Off/On	Off	On
13.32	Cool/On	Cool	On
16.13	Auto/On	Auto	On
19.48	Heat/Auto	Heat	Auto
27.93	Heat/On	Heat	On
35.0	Emergency Heat/Auto	Emergency Heat	Auto
43.45	Emergency Heat/On	Emergency Heat	On
Out of Range (Short)	INVALID/Short	Invalid (CV), Auto (VAV)	Invalid
Out of Range (Open)	INVALID/Open	Invalid (CV), Off (VAV)	Invalid

Programmable & Digital Zone Sensor Test

Testing Serial Communication Voltage

1. Verify 24 Vac is present between terminals J6-14 and J6-11.
2. Disconnect wires from J6-11 and J6-12. Measure the voltage between J6-11 and J6-12, should be about 32 Vdc.
3. Reconnect wires to terminals J6-11 and J6-12. Measure voltage again between J6-11 and J6-12, voltage should flash high and low every 0.5 seconds. The voltage on the low end will measure about 19 Vdc, while the voltage on the high end will measure from approximately 24 to 38 Vdc.
4. Verify all modes of operation, by running the unit through all of the steps in the "Test Modes" section discussed in ["Start Up," p. 35"](#).
5. After verifying proper unit operation, exit the test mode. Turn the fan on continuously at the ZSM, by pressing the button with the fan symbol. If the fan comes on and runs continuously, the ZSM is good. If you are not able to turn the fan on, the ZSM is defective.

ReliaTel Refrigeration Module (RTRM) Default Chart

If the RTCL loses input from the building management system, the RTRM will control in the default mode after approximately 15 minutes. If the RTRM loses the Heating and Cooling setpoint input, the RTRM will control in the default mode instantaneously.

The temperature sensing thermistor in the Zone Sensor Module is the only component required for the "Default Mode" to operate.

Unit Operation Without a Zone Sensor

This procedure is for temporary operation only. The economizer and condenser fan cycling functions are disabled.

⚠ 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.

1. Open and Lock the unit disconnect switch.
2. Remove the Outside Air Sensor (OAS) from the condenser section of unit.
3. Use two (2) wire nuts, to individually cap the wires.

Troubleshooting

4. Locate the RTRM (J6). Connect two (2) wires to terminals J6-1 and 2.
5. Connect the sensor (OAS) using two wire nuts to the two (2) field supplied wires that were connected to terminals 1 and 2 on J6.

Unit Economizer Control (ECA) Troubleshooting ReliaTel Control

Verify Economizer Status by Economizer Actuator (ECA) LED indicator:

- OFF: No Power or Failure
- ON: Normal, OK to Economize
- Slow Flash: Normal, Not OK to Economize
- Fast Flash - 1/4 Second On / 2 Seconds Off:
 - Error Code: Communications Failure
- Pulse Flash: 1/30 Second On / 1/4 Second Off: (2 Seconds between pulse sequences)

Error Code:

- 1 Flash: Actuator Fault
- 2 Flashes: CO₂ Sensor
- 3 Flashes: RA Humidity Sensor
- 4 Flashes: RA Temp Sensor
- 5 Flashes: OA Quality Sensor
- 6 Flashes: OA Humidity Sensor
- 7 Flashes: OA Temp Sensor
- 8 Flashes: MA Temp Sensor
- 9 Flashes: RAM Fault
- 10 Flashes: ROM Fault
- 11 Flashes: EEPROM Fault

Wiring Diagrams

Note: Wiring diagrams can be accessed via e-Library by entering the diagram number in the literature order number search field or by contacting technical support.

Table 18. Wiring diagrams

Type of Airflow	Schematic Type	Voltage	Diagram Number	Description	
Constant Volume	Power	200-575	2313-1478	TS*150-300 50/60HZ, Cooling Only with or without Electric Heat	
			1213-1001	TH*150-300 50/60HZ Cooling Only with or without Electric Heat	
	Control	200-575	2313-1487	TS*150-300 Cooling Only with or without Electric Heat, with or without Dehumidification	
			2313-1495	TS*150-300 with or without Dehumidification, Option Modules	
			2313-1008	TH*150-300, Cooling Only with or without Electric Heat, with or without Dehumidification	
			1213-1015	TH*150-300, with or without Dehumidification, Option Modules	
	Raceway Connection	200-575	2313-1514	TS*150-300,Cooling Only, with or without Dehumidification	
			1213-1037	TH*150-300,Cooling Only, with or without Dehumidification	
	Control Box Connections	208-230	2313-1497	TS*150-300,50/60HZ, Cooling Only, with or without Dehumidification	
		200-575	1213-1017	TH*150-240,50/60HZ, Cooling Only, with or without Dehumidification	
		380-575	2313-1498	TS*150-300 50/60HZ, Cooling Only, with or without Dehumidification	
		200-575	1213-1047	TH*300 Cooling Only with or without Electric Heat	
	Module Connections	200-575	1213-1027	TH*150-300, Cooling Only with or without Electric Heat	
	Variable Air Volume/ Multi-speed Fans/Single Zone Variable Air Volume	Power	208-575	2313-1482	TS*150-300 50/60HZ, Cooling Only with or without Electric Heat,
				1213-1001	TH*150-300 50/60HZ Cooling Only with or without Electric Heat
Control		208-575	2313-1491	TS*150-300 Cooling Only with or without Electric Heat, with or without Dehumidification	
			2313-1008	TH*150-300, Cooling Only with or without Electric Heat, with or without Dehumidification	
			2313-1495	TS*150-300 with or without Dehumidification, Option Modules	
			1213-1015	TH*150-300, with or without Dehumidification, Option Modules	
Raceway Connection		208-575	2313-1518	TS*150-300 Cooling Only, with or without Dehumidification	
			1213-1037	TH*150-300,Cooling Only, with or without Dehumidification	
Control Box Connections		208-230	2313-1505	TS*150-300 50/60HZ, Cooling Only, with or without Dehumidification	
		200-575	1213-1250	TH*150-240,50/60HZ, Cooling Only, with or without Dehumidification	
		460-575	2313-1506	TS*150-300 50/60HZ, Cooling Only, with or without Dehumidification	
		200-575	1213-1254	TH*300 Cooling Only with or without Electric Heat	
Module Connections		200-575	1213-1027	TH*150-300, Cooling Only with or without Electric Heat	

Wiring Diagrams

Table 19. Wiring diagrams for units with High Short Circuit Rating (SCCR)

Type of Airflow	Schematic Type	Voltage	Diagram Number	Description
Constant Volume	Power	208-575	2313-1578	TS*150-300 Cooling Only with or without Electric Heat
			1213-1004	TH*150-300 Cooling Only with or without Electric Heat
	Control	208-575	2313-1582	TS*150-300 Cooling Only with or without Electric Heat
			1213-1012	TH*150-300 Cooling Only with or without Electric Heat
			2313-1590	TS*150-300 TH*150-300, Cooling Only with or without Electric Heat, Options Modules
			1213-1015	TH*150-300 with or without Dehumidification, Option Modules
	Raceway Connection	208-575	2313-2019	TS*150-300 Cooling Only with or without Electric Heat
			1213-1042	TH*150-300 Cooling Only with or without Electric Heat
	Control Box Connections	208-575	2313-2002	TS*150-300 TH*150-300, Cooling Only with or without Electric Heat
			1213-1022	TH*150-240 Cooling Only with or without Electric Heat
	Module Connections	208-575	2313-2048	TS*150-300 Cooling Only with or without Electric Heat
			1213-1027	TH*150-300 Cooling Only with or without Electric Heat
Multi-zone Variable Air Volume/ Multi-speed Fans/Single Zone Variable Air Volume	Power	208-575	2313-1578	TS*150-300 Cooling Only with or without Electric Heat
			1213-1004	TH*150-300 Cooling Only with or without Electric Heat
	Control	208-575	2313-1586	TS*150-300 Cooling Only with or without Electric Heat
			1213-1012	TH*150-300 Cooling Only with or without Electric Heat
			2313-1590	TS*180-300 Cooling Only with or without Electric Heat, Options Modules
			1213-1015	TH*150-300 with or without Dehumidification, Option Modules
	Raceway Connection	208-575	2313-2023	TS*180-300 Cooling Only with or without Electric Heat
			1213-1042	TH*150-300 Cooling Only with or without Electric Heat
	Control Box Connections	208-575	2313-2006	TS*180-300 Cooling Only with or without Electric Heat
			1213-1257	TH*150-240 Cooling Only with or without Electric Heat
			1213-1261	TH*300 Cooling Only with or without Electric Heat
	Module Connections	208-575	2313-2052	TS*180-300 Cooling Only with or without Electric Heat
1213-1027			TH*150-300 Cooling Only with or without Electric Heat	

Warranty

TSD, TSH, THD, and THH (Parts Only) Models Less than 20 Tons for Commercial Use*

This warranty is extended by Trane, to the original purchaser and to any succeeding owner of the real property to which the Air Conditioner is originally affixed, and applies to products purchased and retained for use within the U.S.A. and Canada. There is no warranty against corrosion, erosion or deterioration.

If any part of your air conditioner fails because of a manufacturing defect within one year from the date of the original purchase, Warrantor will furnish without charge the required replacement part.

In addition, if the sealed motor-compressor fails because of a manufacturing defect within the second through fifth year from the date of original purchase, Warrantor will furnish without charge the required replacement compressor.

Warrantor's obligations and liabilities under this warranty are limited to furnishing F.O.B. Warrantor factory or warehouse replacement parts for Warrantor's products covered under this warranty.

Warrantor shall not be obligated to pay for the cost of lost refrigerant.

No liability shall attach to Warrantor until products have been paid for and then liability shall be limited solely to the purchase price of the equipment under warranty shown to be defective.

THE WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING BUT NOT SPECIFICALLY LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR USE, AND IN NO EVENT SHALL WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Trane
2701 Wilma Rudolph Blvd.
Clarksville, TN 37040-1008
Attention: Manager, Product Service
GW-602-4800

Models 20 Tons and Greater for Commercial Use*

The Company warrants for a period of 12 months from initial start-up or 18 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion or deterioration.

In addition, if the sealed motor-compressor fails because of a manufacturing defect within the second through fifth year from the date of original purchase, Warrantor will furnish without charge the required replacement compressor.

The Company's obligations and liabilities under this warranty are limited to furnishing f.o.b. factory or warehouse at Company designated shipping point, freight allowed to Buyer's city (or port of export for shipment outside the conterminous United States) replacement equipment (or at the option of the Company parts therefore) for all Company products not conforming to this warranty and which have been returned to the manufacturer.

The Company shall not be obligated to pay for the cost of lost refrigerant.

No liability whatsoever shall attach to the Company until said products have been paid for and then said liability shall be limited to the purchase price of the equipment shown to be defective.

The Company makes certain further warranty protection available on an optional extra-cost basis. Any further warranty must be in writing, signed by an officer of the Company.

The warranty and liability set forth herein are in lieu of all other warranties and liabilities, whether in contract or in negligence, express or implied, in law or in fact, including implied warranties of merchantability and fitness for particular use.

In no event shall the Company be liable for any incidental or consequential damages.

Trane
2701 Wilma Rudolph Blvd.
Clarksville, TN 37040-1008
Attention: Manager, Product Service

* This warranty is for commercial usage of said equipment and not applicable when the equipment is used for a residential application. Commercial use is any application where the end purchaser uses the product for other than personal, family or household purposes.

*A 5 year limited warranty is provided for the optional Low Leak Economizer, when combined with the optional FDD (Fault Detection & Diagnostics) option.

The manufacturer optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, the manufacturer offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.IRCO.com.

The manufacturer has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.