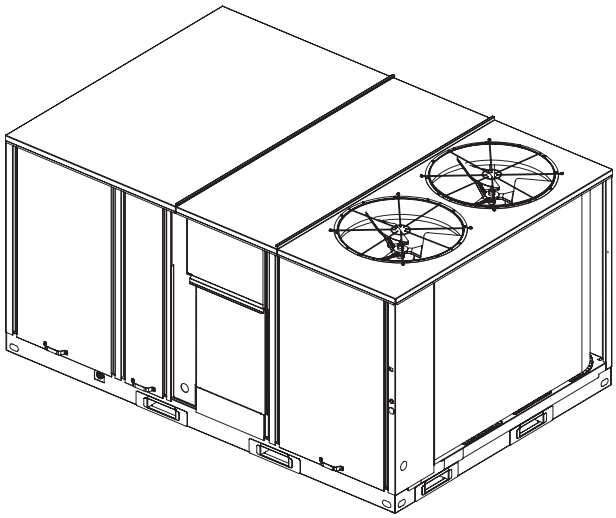
Installation, Operation, and Maintenance

Packaged Rooftop Air Conditioners
Voyager™ – Heat Pump
12.5 to 20 Tons, 60/50 Hz



Model Numbers
WS*150-240

⚠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.

February 2017 **RT-SVX33G-EN**

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.

The three types of advisories are defined as follows:

⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

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

Important Responsible Refrigerant Practices

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

⚠WARNING

Proper Field Wiring and Grounding Required!

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

⚠WARNING

Personal Protective Equipment (PPE) Required!

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

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

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⚠WARNING

Follow EHS Policies!

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

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

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Revision History

Updated Features & Benefits, Model Number Description, General Data, Electrical Data, Dimensional Data, Weights, and Mechanical Specifications sections.

Table of Contents

Model Number Description

W	S	D		1	5	0		E		3		R		G		B		*	*
1	2	3		4	5	6		7		8		9		10		11		12	13

Digit 1 — Unit Type

W = Packaged Cooling, Electric Heat

Digit 2 — Efficiency

S = Standard 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
200 = 20 Ton, 50Hz
240 = 20 Tons, 60Hz

Digit 7 — Major Design Sequence

E = R-410A Refrigerant

Digit 8 — Voltage Selection

3 = 208-230/60/3
4 = 460/60/3
W = 575/60/3
T = 200/50/1
D = 380-415/50/3

Digit 9 — Unit Controls

R = Reliatel

Digit 10 — Heating Capacity

Note: *(Applicable to Digit 1 W models only)*

0 = No Heat
G = 18 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

Digit 14 — Fresh Air Selection

0 = No Fresh Air
D = Econ Dry Bulb w/ Barometric Relief[1]
F = Econ Reference Enthaply w/ Barometric Relief[1]
H = Econ Comparative Enthaply w/ Barometric Relief[1]
K = Low Leak Econ w/ Barometric Relief[1]
M = Low Leak Econ Reference Enthalpy w/ Barometric Relief[1]
P = Low Leak Econ Comparative Enthalpy w/ Barometric Relief[1]

Digit 15 — Supply Fan/Drive Type/Motor

0 = Standard Motor
1 = Oversized Motor[2]
3 = High Efficiency Motor[2]
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 Ground Ring
B = Multi-Speed Standard Motor w/ Shaft Ground Ring
C = Single Zone Variable Air Volume Oversized Motor w/ Shaft Ground Ring
D = Multi-Speed Oversized Motor w/ Shaft Ground Ring

Digit 16 — Hinged Service Access / Filters

0 = Standard Panels/Standard Filters[13]
A = Hinged Access/Standard Filters[13]
B = Standard Panels / 2" MERV 8 Filters[2]
C = Hinged Access / 2" MERV 8 Filters[2]
D = Standard Panels / MERV 13 Filters[2]
E = Hinged Access / MERV 13 Filters[2]

Digit 17 — Condenser Coil Protection

0 = Standard Coil
1 = Standard Coil With Hail Guard
2 = Black Epoxy Pre-Coated Coil
3 = Black Epoxy Pre-Coated Coil with Hail Guard

Digit 18 — Through The Base Provisions

0 = No Through The Base Provisions
A = Through The Base Electric[3]
D = Through The Base Utilities Access

Digit 19 — Disconnect Switch/ Circuit Breaker[4]

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 Outlet[5]
B = Powered Convenience Outlet[5]

Digit 21 — Communications Options

0 = Without Communications Options
1 = Trane Communications Interface
2 = Lontalk Communications Interface
6 = Building Automation Control Network Communications Interface
7 = Air-Fi™ Wireless Communications[15]

Digit 22 — Refrigeration System Option

0 = Standard refrigeration system

Digit 23 — Refrigeration Controls

0 = Without Refrigeration Controls
1 = Frostat[6]

Digit 24 — Smoke Detector[7, 8]

0 = Without Smoke Detector
A = Return Air Smoke Detector
B = Supply Air Smoke Detector
C = Return/Supply Air Smoke Detector
D = Plenum Smoke Detector[9]

Digit 25 — System Monitoring Controls[6]

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

Sensing Tube and Condensate Drain Pan Overflow Switch

H = Clogged Filter Switch, Fan Failure Switch, Discharge Air Sensing and Condensate Drain Pan Overflow Switch

Digit 26 - System Monitoring Controls

0 = No Monitoring Controls
A = Demand Control Ventilation (CO_2)[10]
B = FDD (Fault Detection and Diagnostics)
C = FDD (Fault Detection Diagnostics) & Demand Control Ventilation (CO_2)[10]

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[11, 12]

Digit 31 - Advanced Unit Controls

0 = Standard Unit Controls
1 = Human Interface[14]

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. Available factory installed on downflow AND horizontal units. Verify with ordering system.
3. Through-the-base electrical option or Horizontal-Side Access must be ordered with either unit mounted disconnect or circuit breaker.
4. Unit mounted disconnect and circuit breakers are mutually exclusive of each other.
5. Must be ordered with Through-the-Base Electrical option or Horizontal-Side Access and either Unit Mounted Disconnect or Circuit Breaker.
6. ReliaTel Options Module is required when ordering the following accessories: Clogged Filter Switch, Fan Fail Switch, Condensate Overflow Switch, Discharge Air Sensing Kit, Frostat, Ventilation Override, Smoke Detector, Dehumidification and Modulating Gas Heat Furnace.
7. Requires ReliaTel Options Module.
8. 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.
9. Supply and/or return smoke detector may not be used with the plenum smoke detector.
10. Demand Control Ventilation Option includes wiring only. The $C0_2$ sensor is a field-installed only option.
11. Only available where MOP is above 60A.
12. 575 VAC option is 25kA.
13. Standard filters are not available with Low Leak Economizers.
14. Human Interface is standard with FDD (Fault Detection Diagnostics).
15. Must be used with BACnet™ open protocol.

General Information

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.

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.

⚠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, mask, 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.

Precautionary Measures

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

First Aid Measures

- Eye Contact - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.
- Skin Contact - Wash affected areas gently with soap and warm water after handling.

Storage

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

16. The unit is stored before it is installed; or,
17. 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 Description

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

The condenser coils are aluminum fin, mechanically bonded to copper tubing.

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 and stopping the compressors.

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.

ReliaTel™ Control

Economizer Control Actuator

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% 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 inch pounds 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.

RTOM – ReliaTel™ Options Module (Optional)

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

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

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

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 schematics for the specific module connections.

Note: *The following controls are available from the factory for field installation.*

Supply Fan Failure Input (Optional)

The Fan Failure Switch can be connected to sense indoor fan operation:

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

Drain Pan Condensate Overflow Switch (Optional)

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

Clogged Filter Switch (Optional)

The unit mounted clogged filter switch monitors the pressure differential across the return air filters. It is mounted in the filter section and is connected to the RTOM. A diagnostic SERVICE signal is sent to the remote panel if the pressure differential across the filters is at least 0.5" w.c. The contacts will automatically open when the pressure differential across the filters decreases to approximately 0.4" w.c. The clogged filter output is energized when the supply fan is operating and the clogged filter switch has been closed for at least 2 minutes. The system will continue to operate regardless of the status of the filter switch.
Please note that on units equipped with factory installed MERV 13 filters, a clogged filter switch with different pressure settings will be installed. This switch will close when the differential pressure is approximately 0.8' w.c. and open when the differential falls to 0.7" w.c.

Compressor Disable (CPR1/2)

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

If this circuit is open before the compressor is started, the compressor will not be allowed to operate. Anytime this circuit is opened for 1 continuous second during compressor operation, the compressor for that circuit is immediately turned "Off". The compressor will not be allowed to restart for a minimum of 3 minutes should the contacts close.
If four consecutive open conditions occur during the first three minutes of operation, the compressor for that circuit will be locked out, a diagnostic communicated to the remote panel (if installed), and a manual reset will be required to restart the compressor.

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.

High Pressure Control (Optional)

ReliaTel Control

The high pressure controls are wired in series between the compressor outputs on the RTRM and the compressor contactor coils. If the high pressure control switch opens, the RTRM senses a lack of current while calling for cooling and locks the compressor out.
On dual circuit units, if the high pressure control opens, the compressor on the affected circuit is locked out. A manual reset for the affected circuit is required.

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%.

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.

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.
The supply and return air smoke detectors are designed to shut off the unit if smoke is sensed in the supply air stream or return air stream. This function is performed by sampling the airflow entering the unit at the return air opening. Follow the instructions provided below to assure that the airflow through the unit is sufficient for adequate sampling. Failure to follow these instructions will prevent the smoke detectors from performing it's design function.

Important: *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.

Zone 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) (BAYSENS107*)

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 (BAYSENS109*)

This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and Auto) with four system status LED's. 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, 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 BAYSENS106*, 108*, 110*, 109* Remote Panels. When this sensor is wired to a BAYSENS109* 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.

Thermostat (BAYSTAT150)

This thermostat is a multi-stage 3 heat/2 cool, auto-changeover digital display thermostat. It is a

programmable thermostat, and a 7-day programmable stat with night setback shall be available. In addition, it is wall mounted.

Thermostat (BAYSTAT151)

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

Thermostat (BAYSTAT155)

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

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 Dimensions

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

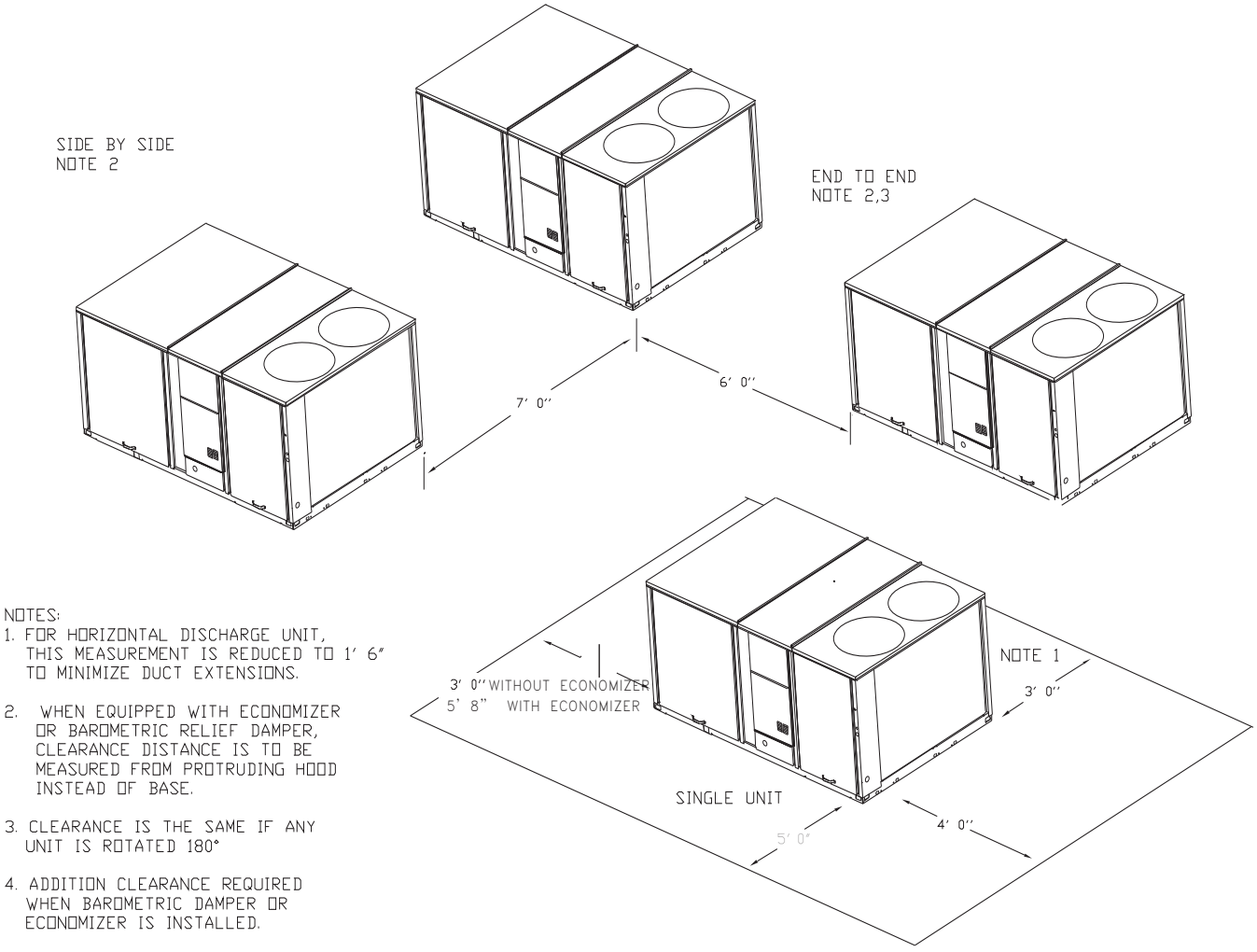
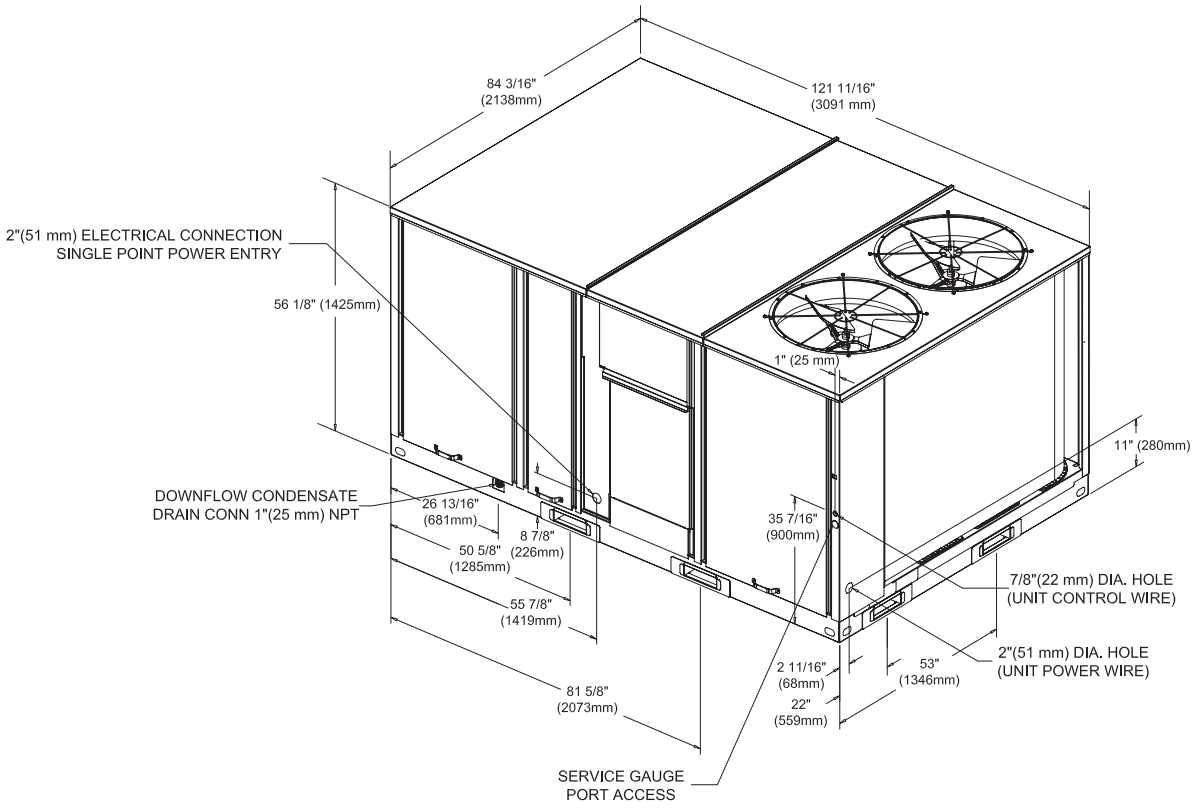
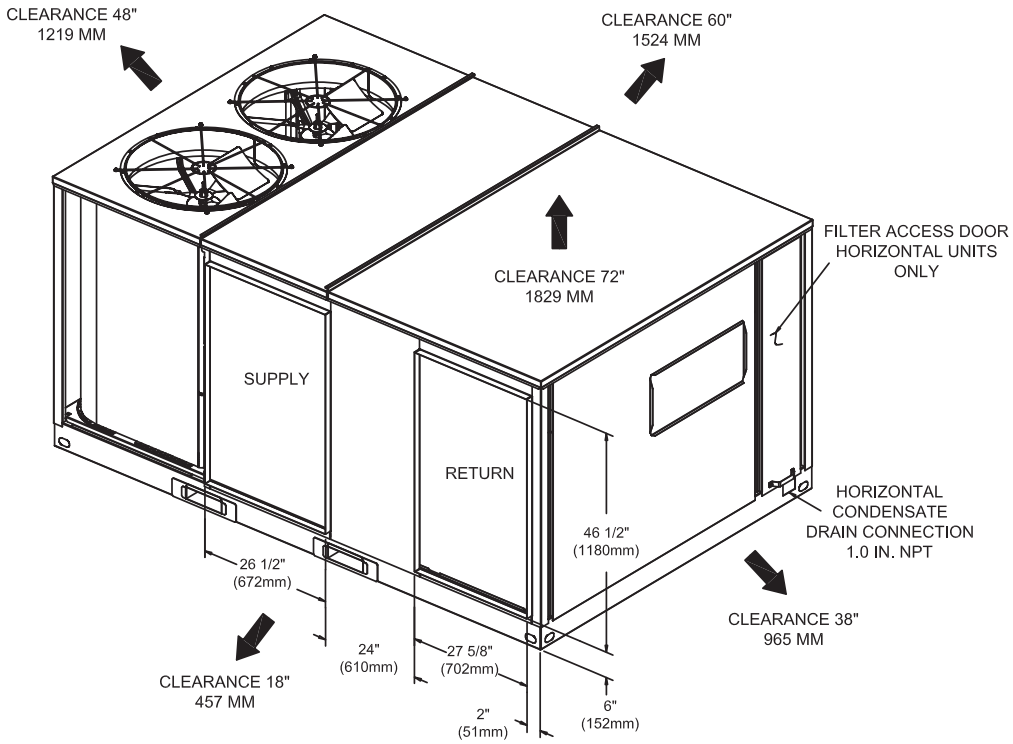


Figure 2. Heat pump models - 12½ - 15 tons



* All dimensions are in inches/millimeters.

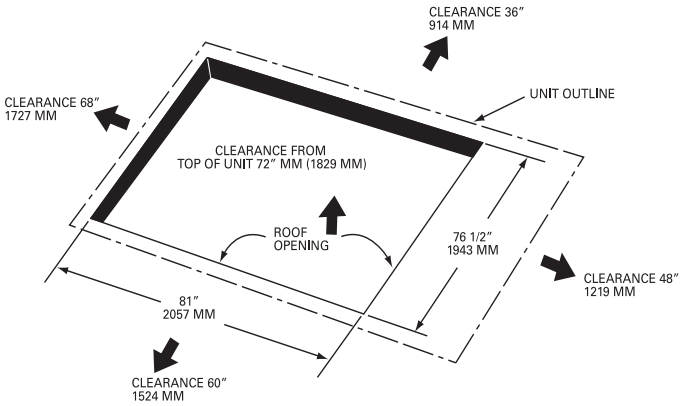
Figure 3. Horizontal duct dimensional data heat pump models - 12½ - 20 tons



* All dimensions are in inches/millimeters.

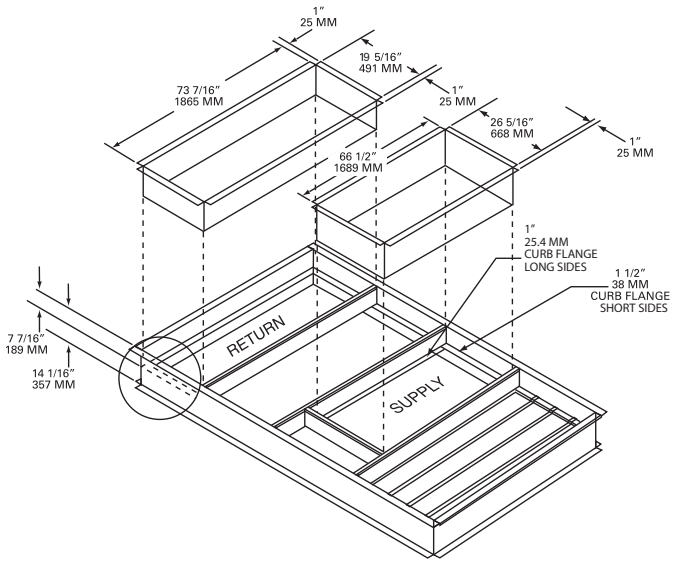
Unit Dimensions

Figure 4. Heat pump models - 12½ - 15 tons



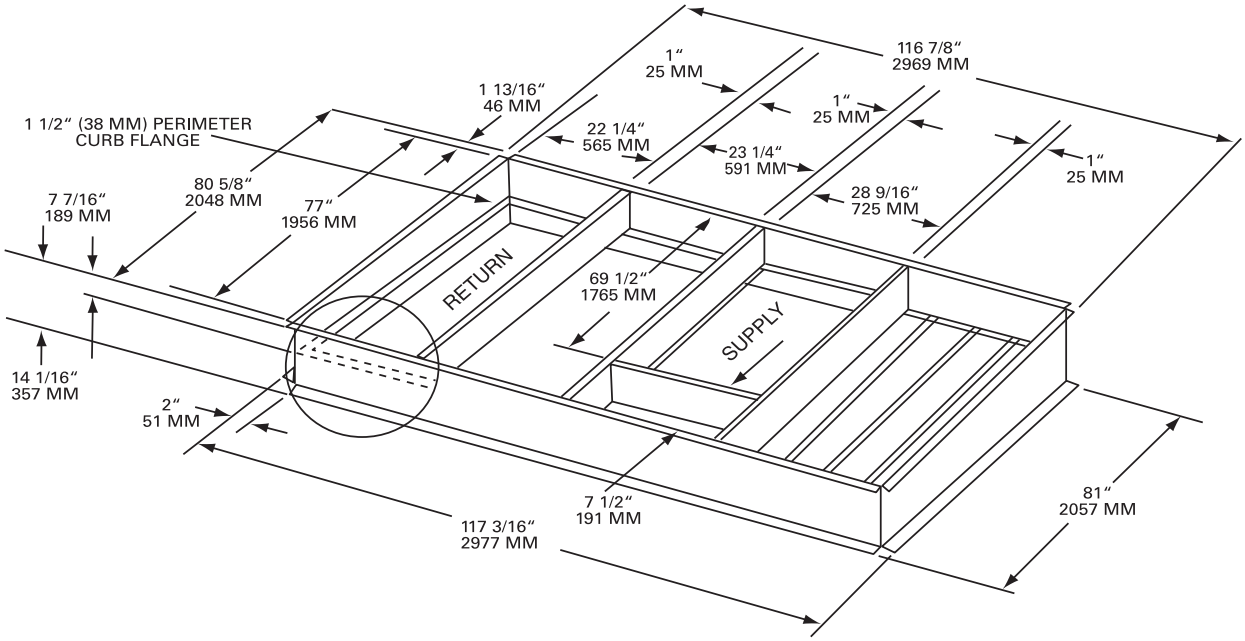
* All dimensions are in inches/millimeters.

Figure 5. Heat pump models - 12½ - 15 tons



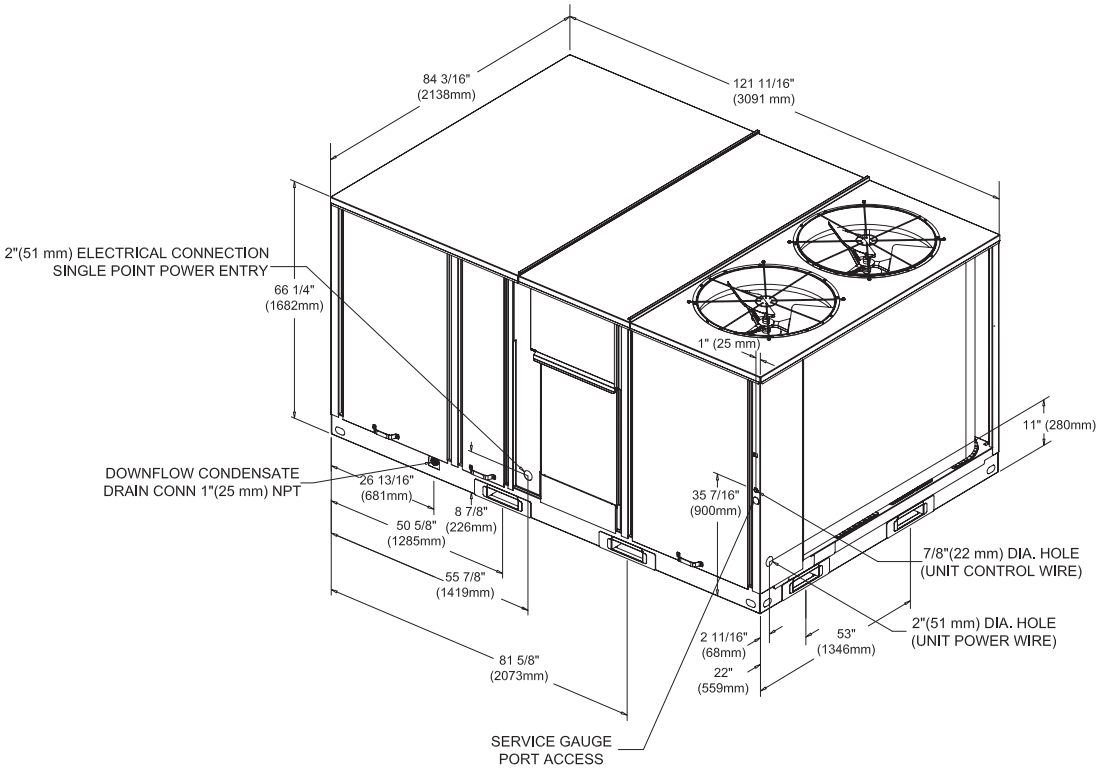
* Duct flanges mount 7-7/16" down inside the curb on the 1-1½ curb flanges. Roofcurb is intended for downflow use only.
* All dimensions are in inches/millimeters.

Figure 6. Heat pump models - 12½ - 15 tons



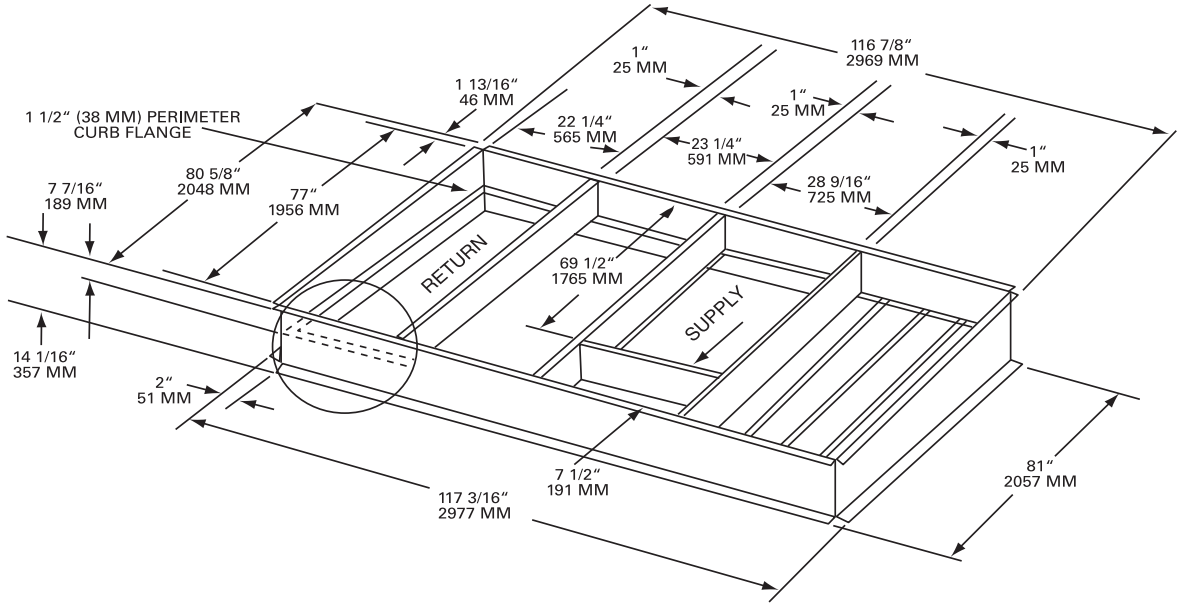
* All dimensions are in inches/millimeters.

Figure 7. Heat pump models - 20 tons



* All dimensions are in inches/millimeters.

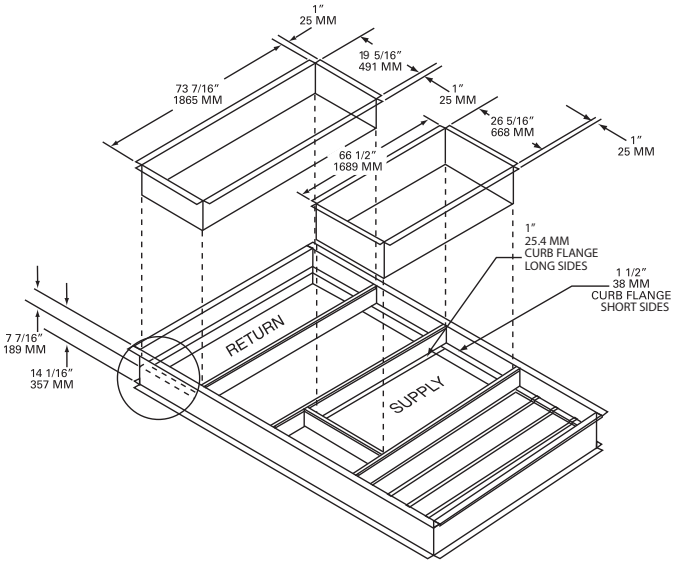
Figure 8. Heat pump models - 20 tons



* All dimensions are in inches/millimeters.

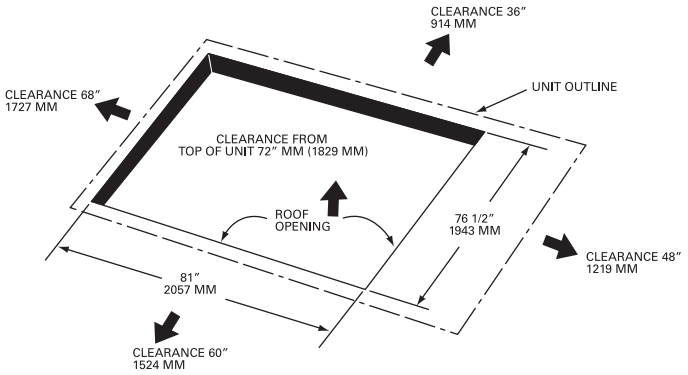
Unit Dimensions

Figure 9. Heat pump models - 20 tons



* Duct flanges mount 7-7/16" down inside the curb on the 1-1½ curb flanges. Roofcurb is intended for downflow use only.
* All dimensions are in inches/millimeters.

Figure 10. Heat pump models - 20 tons



* All dimensions are in inches/millimeters.

Figure 11. Downflow & horizontal condensate locations

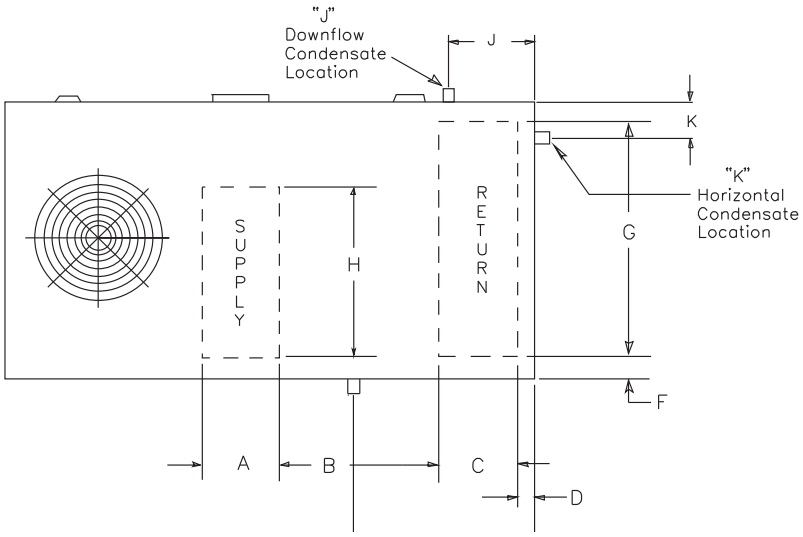


Table 1. Unit dimensions

Tons	Downflow Only							Condensate Drain Size	Condensate Drain Location			
									Downflow		Horizontal	
	A	B	C	D	F	G	H		E	J	E	K
12½, 15, 20	26 7/16	28 3/4	19 15/16	4 1/4	4 1/4	76 5/16	68 11/16	1 NPT	-	26 3/4	-	5 3/8

Figure 12. Through the base utility locations and access panel swing clearances

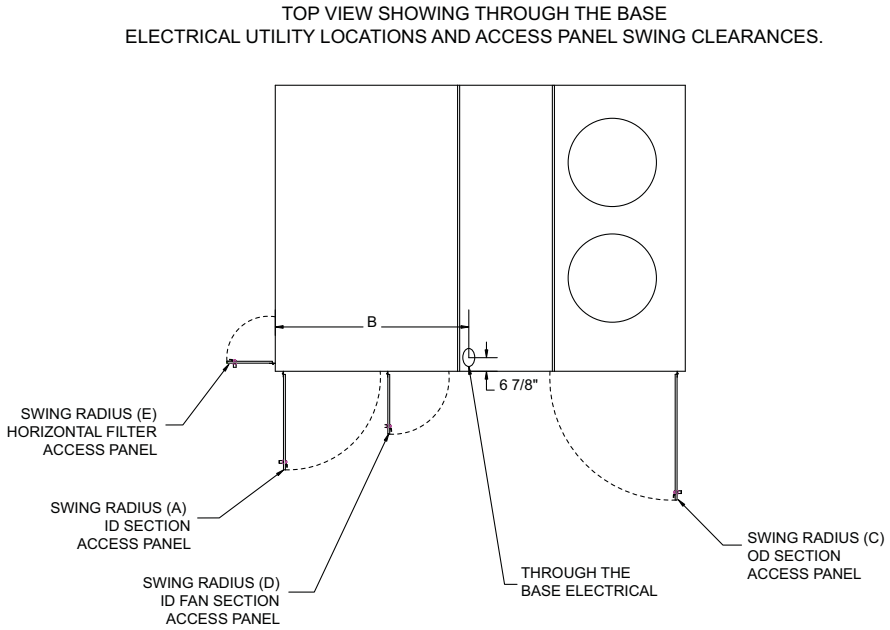


Table 2. Swing clearances

Unit Model #	A	B	C	D	E
WSD150-180	42 3/8	48 3/8	31	N/A	N/A
WSD240	29 1/2	56	38 1/2	18 1/2	N/A
WSH150-180	42 3/8	N/A	31	N/A	12
WSH240	29 1/2	N/A	38 1/2	18 1/2	14

Note: All dimensions are in inches.

Unit Weights

Table 3. Typical unit weights and point loading data

Unit Description	Net Weight	Corner Weights (lbs.)				Center of Gravity (in.)	
		A	B	C	D	Length	Width
WS*150	2024	647	524	385	468	55	35
WS*155	2028	648	525	386	469	55	35
WS*180	2028	648	525	386	469	55	35
WS*200	2198	717	575	403	502	54	35
WS*240	2198	717	575	403	502	54	35

Note: Corner weights are given for information only. Unit is to be supported continuously by a curb or equivalent frame support.

Rigging

Refer to Figure 13 and Table 3 for typical unit operating weights rigging before proceeding.

⚠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.

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 13. 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 13, to protect the unit and to facilitate a uniform lift. The minimum distance between the lifting hook and the top of the unit should be 7 feet.

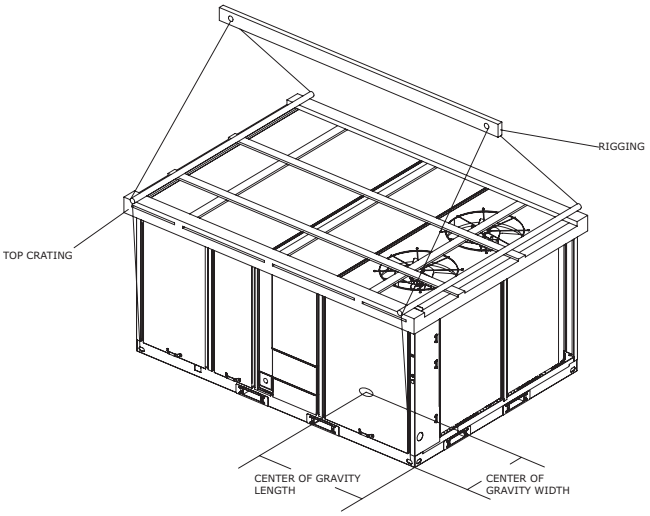
NOTICE:

Unit Damage!

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

4. Removal of the base pallet must be completed before unit can be set. Prior to lifting the unit, remove the 6 fork pockets from the base rails and 4 wood screws from the lifting lug corners. The unit will then separate from the pallet when lifted.
5. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
6. Lift the unit and position it into place.
7. Downflow units; align the base rail of the unit with the curb rail while lowering the unit onto the curb. Make sure that the gasket on the curb is not damaged while positioning the unit.

Figure 13. Rigging and center of gravity data



Installation

Foundation

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.

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 3, p. 18 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, ensure the roof is strong enough to support the combined unit and support structural weight.

⚠WARNING

Risk of Roof Collapsing!

Confirm with a structural engineer that the roof structure is strong enough to support the combined weight of the roofcurb and the unit. Refer to Table 3, p. 18 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.

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:

1. 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.
2. 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

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

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

Factory Installed Economizer

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

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

- Install all access panels.

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.

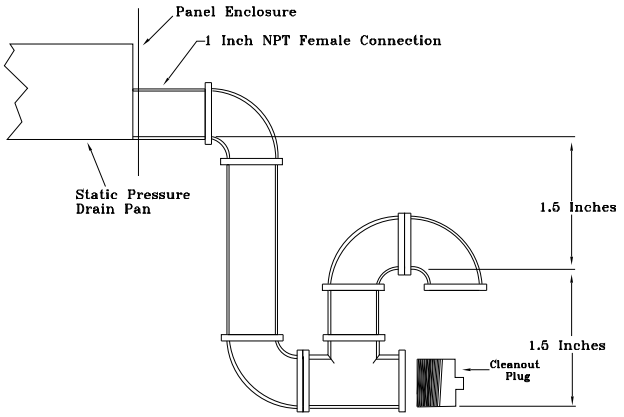
Condensate Drain Configuration

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 14, p. 20.

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 14. 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, filters are removed by pulling the filter removal tool.

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

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

Electrical 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.

Main Electrical Power Requirements

- Verify that the power supply complies with the unit nameplate specifications.
- Inspect all control panel components; tighten any loose connections.
- Connect properly sized and protected power supply wiring to a field-supplied/installed disconnect switch and to the main power terminal block (HTB1) in the unit control panel.
- Install proper grounding wires to an earth ground.

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

Low Voltage Wiring (AC & DC) Requirements

- Install the zone thermostat, with or without switching subbase.
- Connect properly sized control wiring to the proper termination points between the zone thermostat and the unit control panel.

Field Installed Power Wiring

An overall dimensional layout for the standard field installed wiring entrance into the unit is illustrated in the Unit Dimensions section. 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% 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

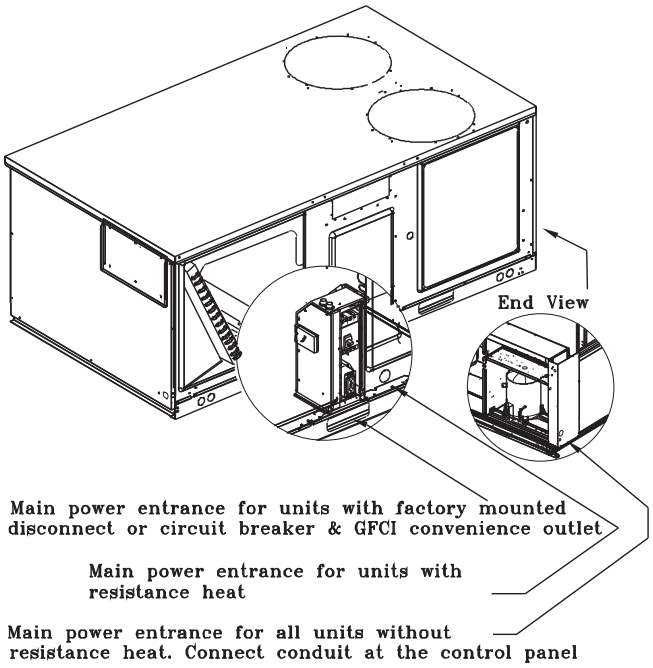
The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements. Protection devices must be sized according to the electrical data on the nameplate.

1. 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).
2. Location of the applicable electrical service entrance is illustrated in the Unit Dimensions section. 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.
3. Provide proper grounding for the unit in accordance with local and national codes.

Optional TBUE Wiring (Through the Base Electrical Option)

1. Location of the applicable electrical service is illustrated in the following illustration. 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).
2. Provide proper grounding for the unit in accordance with local and national codes.

Figure 15. Through the base electrical option



Field Installed Control Wiring

An overall layout of the various control options available with the required number of conductors for each control device is illustrated in Figure 17, p. 23.

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.

⚠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.

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

Controls Using 24 VAC

Before installing any connecting wiring, refer to "Unit Dimensions," p. 12 for the electrical access locations provided on the unit and Table 4, p. 22 for AC conductor sizing guidelines, and;

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

NOTICE:

Component Failure!

Resistance in excess of 3 ohms per conductor could result in 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 Figure 16, p. 22.

Table 4. Electromechanical thermostat 24 Vac conductors with ReliaTel™

Distance from Unit to Control	Recommended Wire Size
000 - 460 feet (000 - 140 m)	18 gauge (0.75 mm^2)
461 - 732 feet (141 - 223 m)	16 gauge (1.3 mm^2)
733 - 1000 feet (224 - 305 m)	14 gauge (2.0 mm^2)

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 5, p. 22 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 5. DC conductors 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 16. Reliatel conventional thermostat field wiring diagram

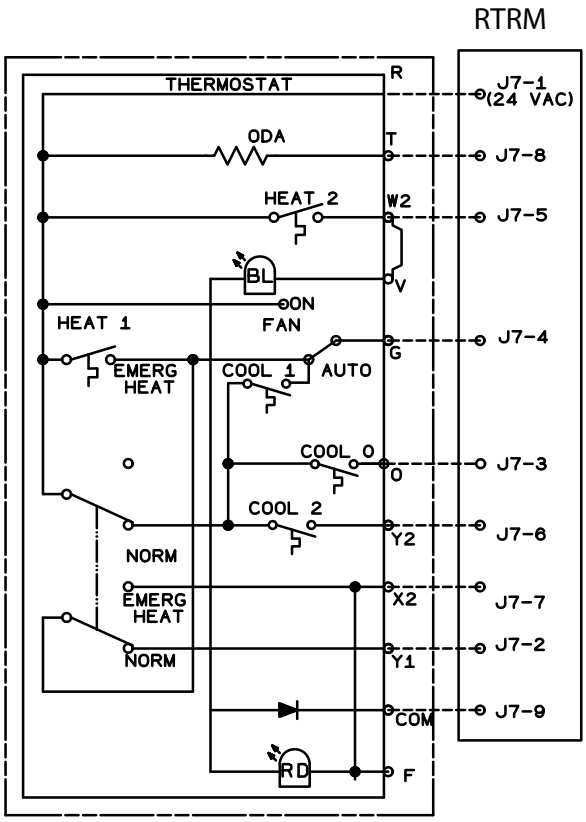
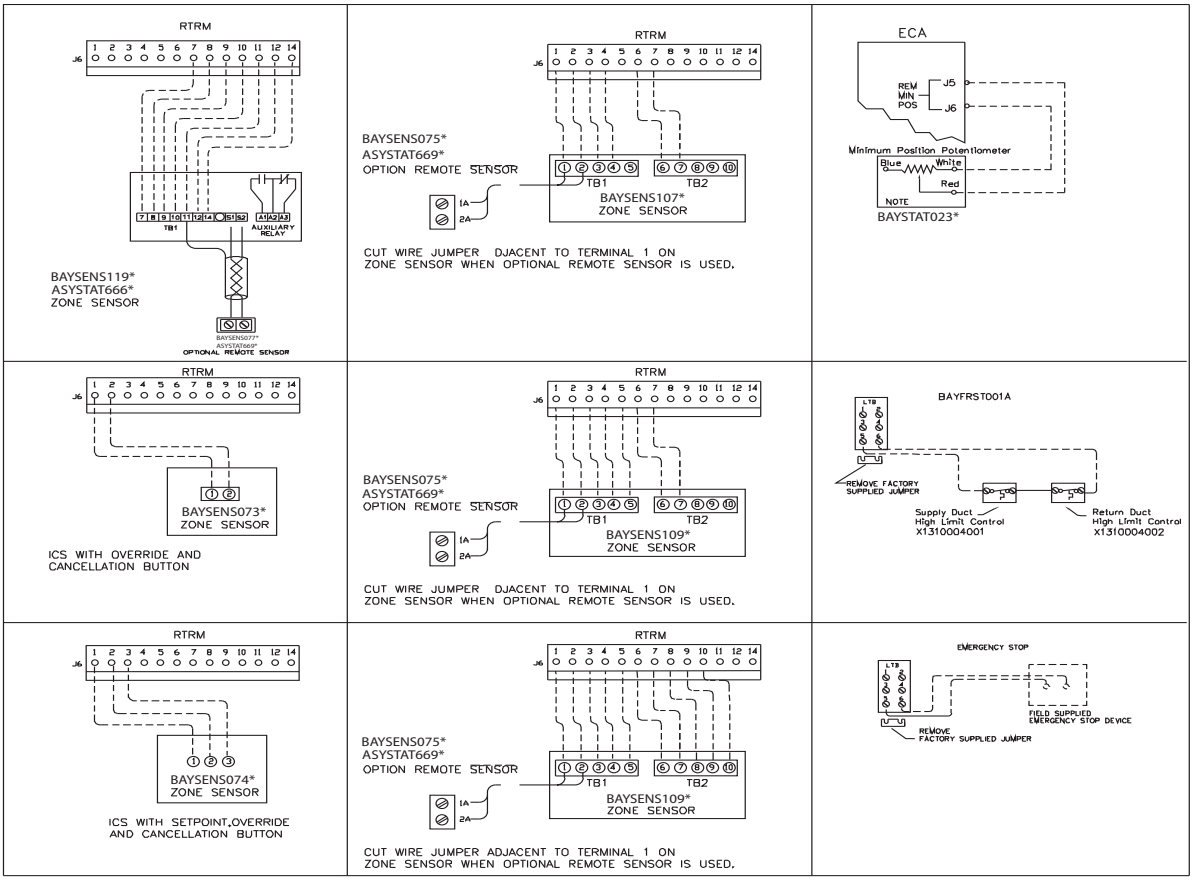
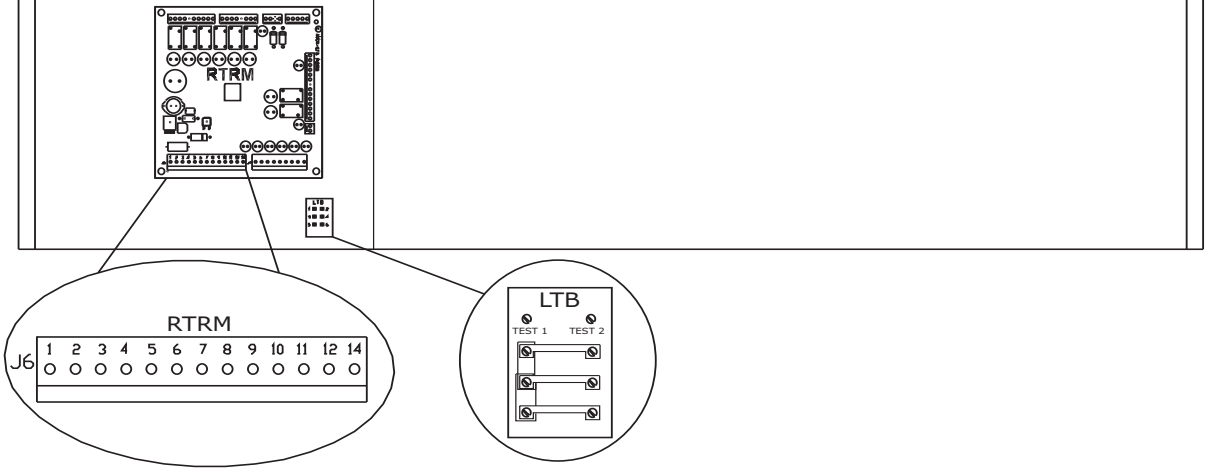


Figure 17. Typical field wiring diagrams for optional controls





Space Temperature Averaging

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

Using the BAYSENS016* or BAYSENS075*, at least four sensors are required to accomplish space temperature averaging. Example #1 illustrates two series circuits with two sensors in each circuit wired in parallel. The square of any number of remote sensors is required. Example #2 illustrates three sensors squared in a series/parallel circuit. Using BAYSENS075*, two sensors are required to accomplish space temperature averaging. Example #3 illustrates the circuit required for this senor. Table 6, p. 25 lists the temperature versus resistance coefficient for all sensing.

Figure 18. Space temperature averaging examples

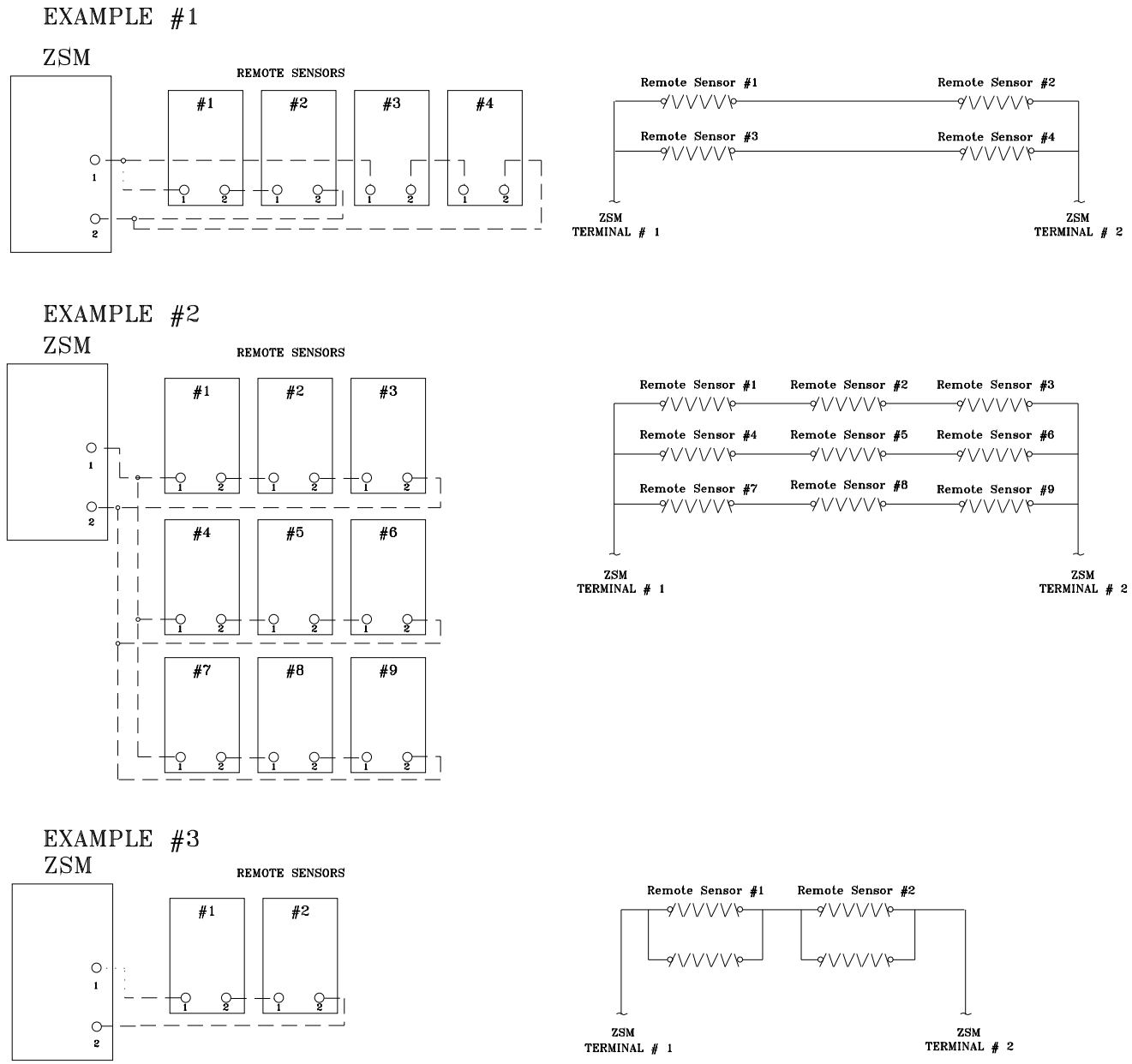


Table 6. Temperature vs. resistance

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

Voltage Imbalance

Three phase electrical power to the unit must meet stringent requirements for the unit to operate properly. Measure each leg (phase-to-phase) of the power supply. Each reading must fall within the utilization range stamped on the unit nameplate. If any of the readings do not fall within the proper tolerances, notify the power company to correct this situation before operating the unit.

Excessive three phase voltage imbalance between phases will cause motors to overheat and eventually fail. The maximum allowable voltage imbalance is 2%. Measure and record the voltage between phases 1, 2, and 3 and calculate the amount of imbalance as follows:

% Voltage Imbalance =

$$100\left(\frac{AV - VD}{AV}\right)$$

where Average Voltage (AV);

$$AV = \left(\frac{Volt1 + Volt2 + Volt3}{3}\right)$$

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:

$$\frac{221 + 230 + 227}{3} = 2.2 percent$$

VD (reading farthest from average) = 221

The percentage of Imbalance equals:

$$100\left(\frac{226 - 221}{226}\right) = 2.2 percent$$

The 2.2% imbalance in this example exceeds the maximum allowable imbalance of 2.0%. This much imbalance between phases can equal as much as a 20% current imbalance with a resulting increase in motor winding temperatures that will decrease motor life. If the voltage imbalance is over 2%, notify the proper agencies to correct the voltage problem before operating this equipment.

Electrical Phasing (Three Phase Motors)

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

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

- 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.
- 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 is 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.

Final Steps

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

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

Factory-Mounted Unit Options

Circuit Breaker (FIYUCB) & Unit Disconnect (FIYUDC)

⚠WARNING

Hazardous Voltage w/Capacitors!

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

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

⚠WARNING

Proper Field Wiring and Grounding Required!

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

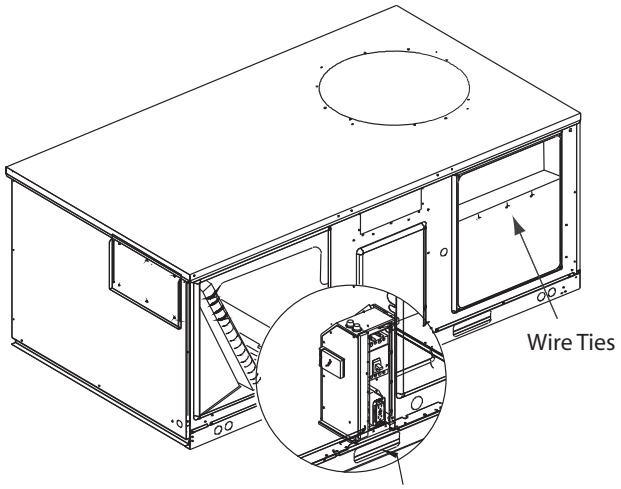
Important: *All phases of this installation must comply with NATIONAL, STATE, and LOCAL CODES. In addition to local codes, the installation must comply with National Electric Code - ANSI/NFPA NO. 70 LATEST REVISION.*

1. Field connections are made by first removing all access panels on the front of the unit. Unscrew the assembly around the outside of the disconnect switch or circuit breaker. This assembly is located between the evaporator and heat section of the unit (Figure 19, p. 27).

   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/Unpowered Convenience Outlet

⚠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.

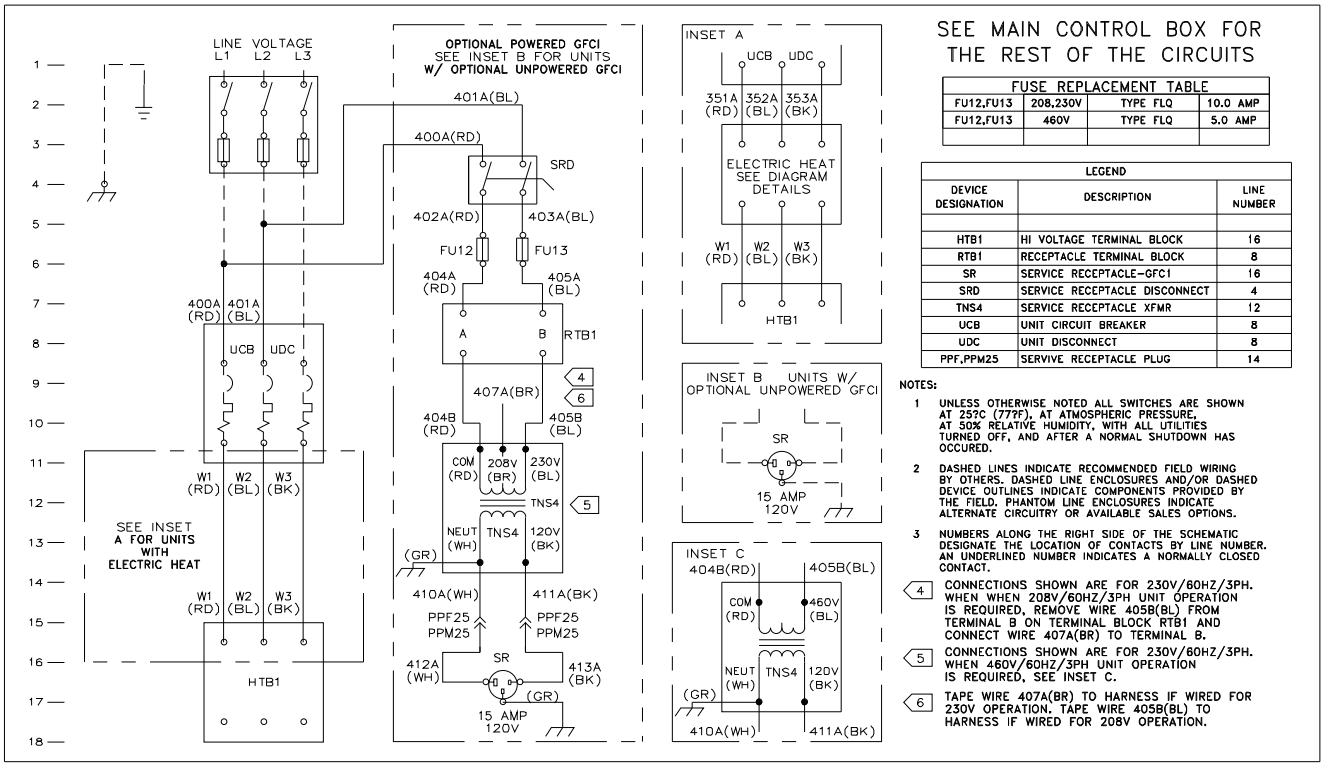
Powered Convenience Outlet Powered Option (FIYCOPO)

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.

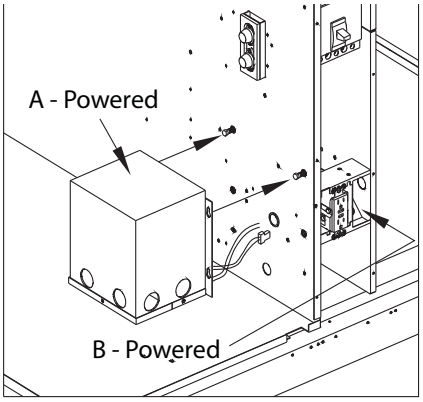
Figure 20. Wiring schematic 12½ through 25 ton options



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-Requisite

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

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

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

Smoke Detector Installation

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

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

⚠WARNING

Hazardous Voltage w/Capacitors!

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

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

⚠WARNING

Proper Field Wiring and Grounding Required!

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

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

Figure 22. Brackets

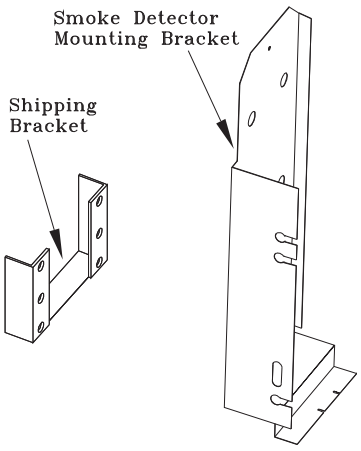
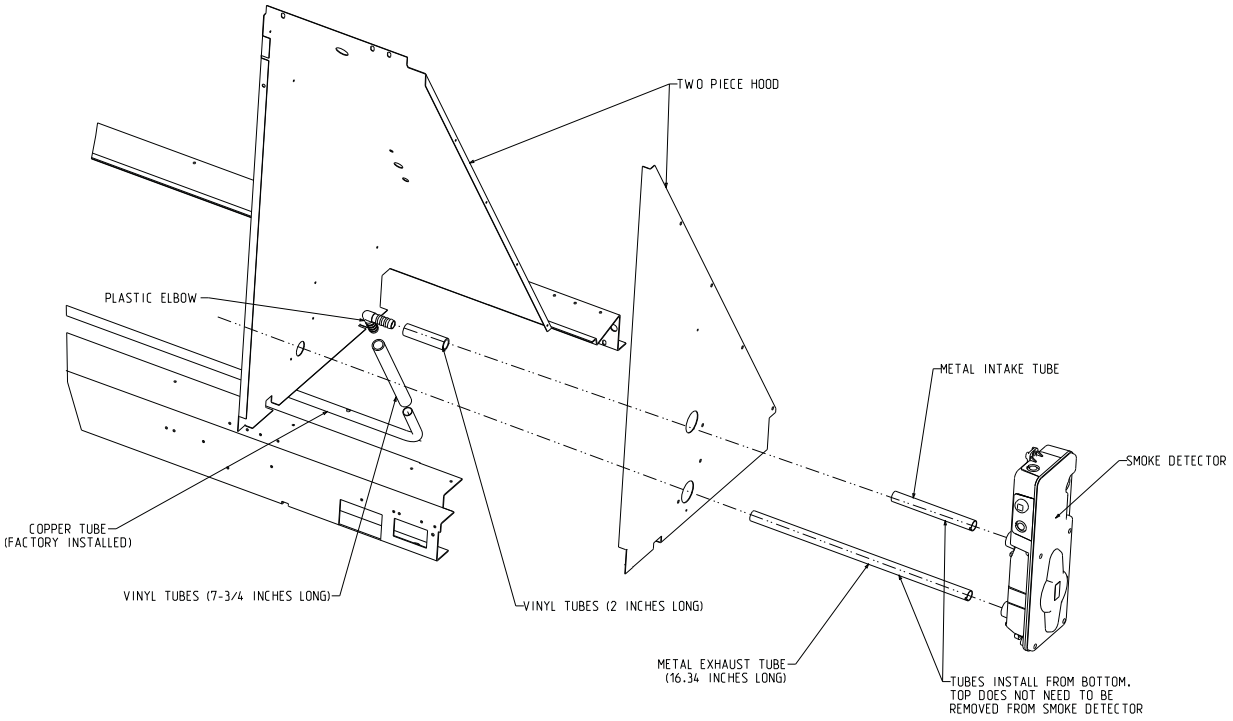


Figure 23. Return air smoke detector for downflow units



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

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

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

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

8. Connect the leg of the plastic elbow without the vinyl tubing attached that was installed in Step 5 to the smoke detector inlet tube pushing it onto the piece of vinyl tubing attached to the inlet tube.
9. Refer to Figure 24, p. 31 for wire connections of return air smoke detector to the unit wiring harness.
10. This completes the installation of the return air smoke detector. If the unit's air filter(s) and/or barometric relief filter were removed to ease installation of the smoke detector, they need to be replaced at this time.

Airflow & Sampling

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

Important: *The return air smoke detector is designed to shut off the unit if smoke is sensed in the return air stream. This function is performed by sampling the airflow entering the unit at the return air opening. 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 detector from performing its design function.*

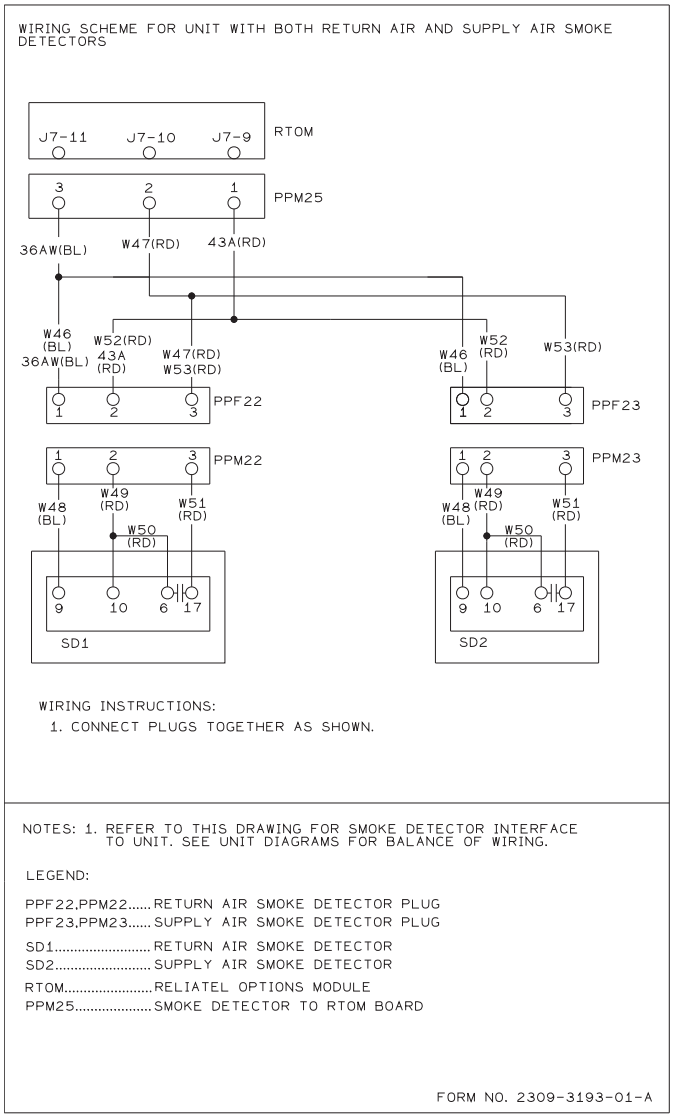
In order for the return air smoke detector to properly sense smoke in the return air stream, the air velocity entering the unit must be between 500 and 4000 feet per minute.

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



Air-Fi™ Wireless Communication Interface (WCI)

When installed, the Trane Air-Fi Wireless Communication Interface is located in the evaporator section, near the return air ductwork. The exact mounting location is dependent on the airflow configuration, cabinet size, and fresh air selection. Refer to Figure 25 through Figure 27.

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

Figure 25. WCI mounting location - WSD150-240

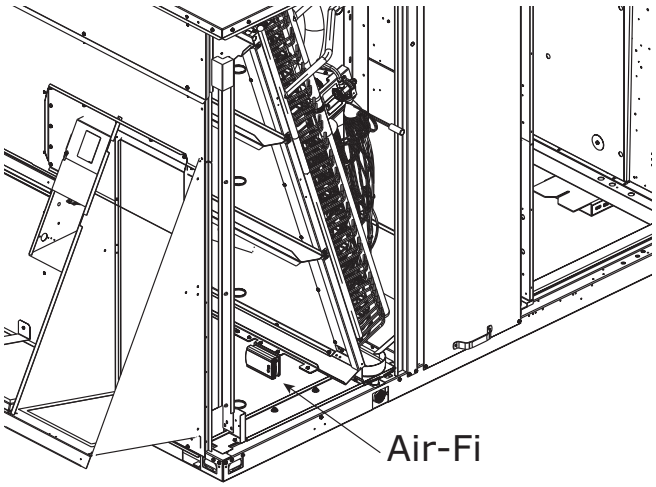


Figure 26. WCI mounting location - WSH150-240

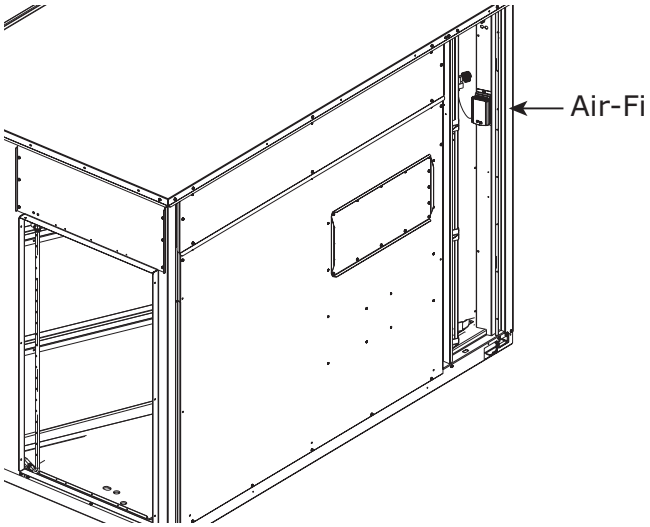
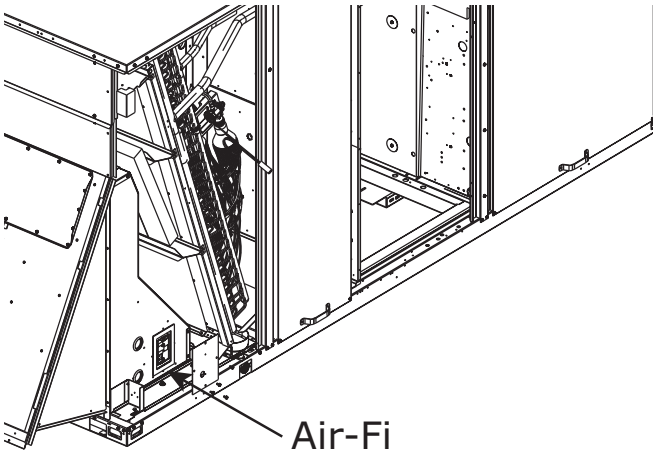


Figure 27. WCI mounting location - WSD150-240 - with low leak economizer



Pre-Start

Test Modes

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

1. Step Test Mode - This method initiates the different components of the unit, one at a time, by temporarily shorting across the two test terminals for two to three seconds.

   For the initial start-up of the unit, this method allows the technician to cycle a component “On” and have up to one hour to complete the check.

2. Resistance Test Mode - This method can be used for start-up providing a decade box for variable resistance outputs is available. This method initiates the different components of the unit, one at a time, when a specific resistance value is placed across the two test terminals. The unit will remain in the specific test mode for approximately one hour even though the resistance is left on the test terminals.

3. Auto Test Mode - This method is not recommended for start-up due to the short timing between individual component steps. This method initiates the different components of the unit, one at a time, when a jumper is installed across the test terminals. The unit will start the first test step and change to the next step every 30 seconds. At the end of the test mode, control of the unit will automatically revert to the applied “System” control method.

For unit test steps, test modes, and step resistance values to cycle the various components, refer to Table 7, p. 33.

Table 7. Service test guide for component operation

TEST STEP	MODE	Fan	Econ[a]	Comp 1	Comp 2	Heat 1	Heat 2	Ohms
1	Fan	On	Minimum Position Off Setpoint 0%	Off	Off	Off	2.2K	
	Minimum Ventilation	On	Selectable	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 to or greater than the exhaust fan setpoint.
(b) The condenser fans will operate any time a compressor is "On" providing the outdoor air temperatures are within the operating values.
(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 percent using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel Control

Using the Service Test Guide in Table 7, p. 33, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

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

With the fan operating properly, determine the total system airflow (CFM) by;

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

Actual Motor Amps X Motor HP

Motor Nameplate Amps

    b. Using the fan performance tables in the unit Service Facts, plot the actual RPM (step 1) and the BHP (step 2a) to obtain the operating CFM.
3. If the required CFM is too low, (external static pressure is high causing motor HP output to be below table value),
    a. Relieve supply and/or return duct static.
    b. Change indoor fan speed and repeat steps 1 and 2.

- To Increase Fan RPM; Loosen the pulley adjustment set screw and turn sheave clockwise.
- To Decrease Fan RPM; Loosen the pulley adjustment set screw and turn sheave counterclockwise.
- If the required CFM is too high, (external static pressure is low causing motor HP output to be above table value), change indoor fan speed and repeat steps 1 and 2.
- To stop the SERVICE TEST, turn the main power disconnect switch to the “Off” position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Return Air Smoke Detector

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

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

Start Up

Economizer Start-Up

Using the Service Test Guide in Table 7, p. 33, momentarily jump across the Test 1 & 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 Actuator (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 & 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 7, p. 33, continue the SERVICE TEST start-up procedure for each compressor circuit.

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

Scroll Compressors

a. Once each compressor has started, verify that the rotation is correct. To check rotation, use a set of refrigeration gauges hooked up to the suction and discharge pressure port. If the compressor is phased correctly the suction pressure should drop and the discharge pressure should rise when the compressor starts and runs. If a scroll compressor is rotating backwards, it will not pump, the suction and discharge pressure will not rise, and a loud rattling sound can be observed.

b. If the electrical phasing is incorrect, 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. If the compressor runs backward for an extended period not to exceed 5 seconds, the compressor will be damaged the motor winding can overheat and cause the motor winding thermostat to open and the oil can turn dark gray.

c. Check the compressor oil levels. The oil level in each compressor sight glass should be visible in the compressor sightglass. This only applies to CSHD compressors, SSA and SPA compressors don't have sight glasses.

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 the table below. The appropriate oil charge is also listed below*

2. After the compressor and condenser fan have started and operated for approximately 30 minutes, observe the operating pressures. Compare the operating pressures to the operating pressure curve in the Service Facts.
3. Check system superheat. Follow the instruction listed on the superheat charging curve in the Service Facts. Superheat should be within ±5°F of the superheat chart value.
4. Repeat steps 1 through 4 for each refrigerant circuit.
5. To stop the SERVICE TEST, turn the main power disconnect switch to the “Off” position or proceed to the next component start-up procedure.
6. *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 the following table. The appropriate oil charge is also listed below.*

Figure 28. Compressor terminal box

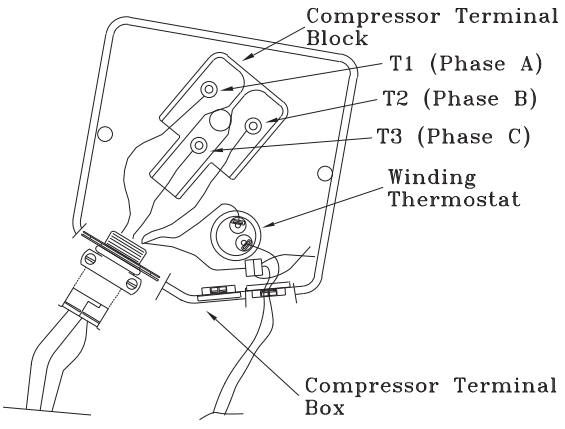


Table 8. Oil charge

Model	Circuit 1	Circuit 2
WS*150	56 oz	56 oz
WS*155/WS*180	56 oz	56 oz
WS*200/WS*240	112 oz	112 oz

Table 9. Compressor types

Tonnage	C1	C2
WS*150	SSA067	SSA067
WS*155/WS*180	SSA083	SSA083
WS*200/WS*240	CSHD125	CSHD125

Heating Start-Up

1. Clamp an amp meter around one of 1st stage heater power wires at the heater contactor.
2. Using the Service Test Guide in Table 7, p. 33, continue the SERVICE TEST start-up procedure for each compressor circuit.

   Momentarily jump across the Test 1 & Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component Test is started.
3. Verify that the heater stage is operating properly.
4. Clamp an amp meter around one of 2nd stage heater power wires at the heater contactor (if applicable).
5. Using the Service Test Guide in Table 7, p. 33, continue the SERVICE TEST start-up procedure for each compressor circuit. Momentarily jump across the Test 1 & Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component Test is started.
6. Verify that the heater stage is operating properly.
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.

Final System Setup

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

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