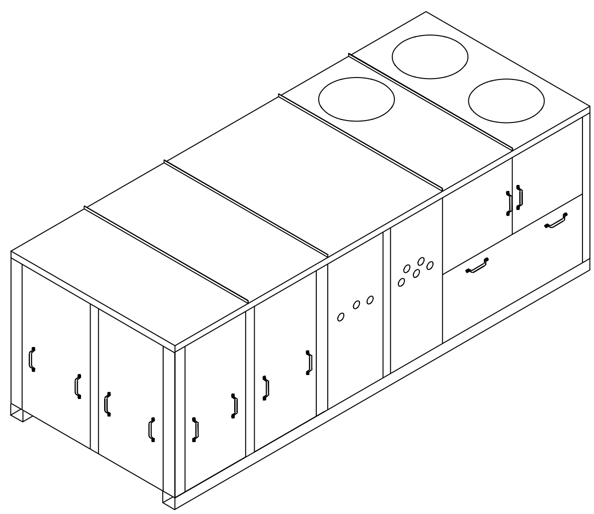
TRANE

Installation, Operation, Maintenance

Voyager™ Commercial

27.5 to 50 Ton 60 Hz
22.9 to 41.7 Ton 50 Hz
CV or VAV Rooftop Air Conditioners
with ReliaTel™ Controls, R-410A Refrigerant



Model Numbers

"B" and later design sequence
TC*, TE*, YC*330B, 360B, 420B, 480B, 600B (60 Hz/3 phase)
TC*, TE*, YC*275B, 305B, 350B, 400B, 500B (50 Hz/3 phase)

⚠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.

November 2010

RT-SVX34C-EN

Warnings, Cautions and Notices

Warnings, Cautions and Notices. Note that warnings, cautions and notices appear at appropriate intervals throughout this manual. Warnings are provided to alert installing contractors to potential hazards that could result in personal injury or death. Cautions are designed to alert personnel to hazardous situations that could result in personal injury, while notices indicate a situation that could result in equipment or property-damage-only accidents.

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 accidents.

Important Environmental Concerns!

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

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.

Literature Change History

RT-SVN34B-EN (April 2010)

Updated issue of manual: provides specific installation, operation and maintenance instructions for B and later design sequence on units with R-410A refrigerant.

RT-SVN34B-EN (January 2010)

Updated issue of manual: provides specific installation, operation and maintenance instructions for B and later design sequence on units with R-410A refrigerant.

RT-SVN34A-EN (March 2009)

Original issue of manual: provides specific installation, operation and maintenance instructions for A and later design sequence on units with R-410A refrigerant.

Overview of Manual

One copy of the appropriate service literature ships inside the control panel of each unit. The procedures discussed in this manual should only be performed by qualified, experienced HVAC technicians.

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.*

This booklet describes the proper installation, startup, operation, and maintenance procedures for TC_, TE_, and YC_22.9 to 50 Ton CV (Constant Volume) and VAV (Variable Air Volume) applications. Refer to the table of contents for a listing specific topics. Refer to the "System Troubleshooting" section at the end of this manual for troubleshooting information.

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.

60 Hz units with standard options are certified by Underwriters Laboratory.

⚠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 Personal Protective Equipment (PPE) recommended for the work being undertaken. ALWAYS refer to appropriate MSDS sheets and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS sheets and OSHA guidelines for information on allowable personal exposure levels, proper respiratory protection and handling recommendations.**
- **If there is a risk of arc or flash, technicians MUST put on all necessary Personal Protective Equipment (PPE) in accordance with NFPA70E for arc/flash protection PRIOR to servicing the unit.**

Failure to follow recommendations 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 codes could result in death or serious injury.

Table of Contents

Model Number Descriptions

60 Hz Description

Digit 1, 2 — Unit Function

TC = DX Cooling, No Heat
TE = DX Cooling, Electric Heat
YC = DX Cooling, Natural Gas Heat

Digit 3 — Unit Airflow Design

D = Downflow Configuration
H = Horizontal Configuration

Digit 4, 5, 6 — Nominal Cooling Capacity

330 = 27½ Tons
360 = 30 Tons
420 = 35 Tons
480 = 40 Tons
600 = 50 Tons

Digit 7 — Major Development Sequence

B = R-410A Refrigerant

Digit 8 — Power Supply[1]

E = 208/60/3
F = 230/60/3
4 = 460/60/3
5 = 575/60/3

Digit 9 — Heating Capacity[4]

0 = No Heat (TC only)
L = Low Heat (YC only)
H = High Heat (YC only)
J = Low Heat-Stainless Steel Gas Heat Exchanger (YC only)
K = High Heat-Stainless Steel Gas Heat Exchangers (YC only)
M = Low Heat-Stainless Steel Gas Heat Exchanger w/ Modulating control (27.5-35 ton YC only)
P = High Heat-Stainless Steel Gas Heat Exchangers w/ Modulating control (27.5-35 ton YC only)
R = Low Heat-Stainless Steel Gas Heat Exchanger w/ Modulating control (40-50 ton YC only)
T = High Heat-Stainless Steel Gas Heat Exchangers w/ Modulating control (40-50 ton YC only)

Note: *When second digit is "E" for Electric Heat, the following values apply in the ninth digit.*

A = 36 kW (27 kW for 208v)
B = 54 kW (41 kW for 208v)
C = 72 kW
D = 90 kW
E = 108 kW

Digit 10 — Design Sequence

A = First

Digit 11 — Exhaust[6]

0 = None
1 = Barometric Relief (Available w/ Economizer only)
2 = 100% Power Exhaust Fan (Available w/ Economizer only)
3 = 50% Power Exhaust Fan (Available w/ Economizer only)
4 = 100% Fresh Air Tracking Power Exhaust Fan (Available w/ Economizer only)
5 = 50% Fresh Air Tracking Power Exhaust Fan (Available w/ Economizer only)
6 = 100% Power Exhaust w/ Statitrac™

Digit 12 — Filter

A = 2" Std Eff, Throwaway Filters
B = 2" MERV 8, High Eff, Throwaway Filters
C = 4" MERV 8, High Eff, Throwaway Filters
D = 4" MERV 14, High Eff, Throwaway Filters

Digit 13 — Supply Fan Motor, HP

1 = 7.5 Hp
2 = 10 Hp
3 = 15 Hp
4 = 20 Hp

Digit 14 — Supply Air Fan Drive Selections[3]

A	=	550 RPM	H	=	500 RPM
B	=	600 RPM	J	=	525 RPM
C	=	650 RPM	K	=	575 RPM
D	=	700 RPM	L	=	625 RPM
E	=	750 RPM	M	=	675 RPM
F	=	790 RPM	N	=	725 RPM
G	=	800 RPM			

Digit 15 — Fresh Air Selection

A = No Fresh Air
B = 0-25% Manual Damper
C = 0-100% Economizer, Dry Bulb Control
D = 0-100% Economizer, Reference Enthalpy Control
E = 0-100% Economizer, Differential Enthalpy Control
F = "C" Option and Low Leak FreshAir Damper
G = "D" Option and Low Leak Fresh Air Damper
H = "E" Option and Low Leak Fresh Air Damper

Digit 16 — System Control

1 = Constant Volume
2 = VAV Supply Air Temperature Control w/o Inlet Guide Vanes
3 = VAV Supply Air Temperature Control w/Inlet Guide Vanes
4 = VAV Supply Air Temperature Control w/Variable Frequency Drive w/o Bypass
5 = VAV Supply Air Temperature Control w/Variable Frequency Drive and Bypass

Note: *Zone sensors are not included with option and must be ordered as a separate accessory.*

Miscellaneous Options

Digit 17

A = Service Valves[2]

Digit 18

B = Through the Base Electrical Provision

Digit 19

C = Non-Fused Disconnect Switch with External Handle

Digit 20

D = Factory-Powered 15A GFI Convenience Outlet and Non-Fused Disconnect Switch with External Handle

Digit 21

E = Field-Powered 15A GFI Convenience Outlet

Digit 22

F = Trane Communication Interface (TCI)

Digit 23

G = Ventilation Override

Digit 24

H = Hinged Service Access

Digit 25

H = Tool-less Condenser Hail Guards
J = Condenser Coil Guards

Digit 26

K = LCI (LonTalk)
B = BACnet Communications Interface (BCI)

Digit 27

* = Unused Digit

Digit 28

M = Stainless Steel Drain Pans

Digit 29 — Condenser Coil Options

0 = Standard Efficiency Condenser Coil
N = Standard Efficiency Condenser Coil with Black Epoxy Pre-Coating

Digit 30-31 — Miscellaneous Options

P = Discharge Temperature Sensor
R = Clogged Filter Switch

Digit 32 — Dehumidification Option

T = Modulating Hot Gas Reheat

Model Number Notes

1. All voltages are across the line starting only.
2. Option includes Liquid, Discharge, Suction Valves.
3. Supply air fan drives A thru G are used with 27½-35 ton units only and drives H thru N are used with 40 & 50 ton units only.
4. Electric Heat KW ratings are based upon voltage ratings of 208/240/480/600 V. For a 240 V heater derated to 208 V, the resulting kW rating decreases from 36 kW to 27 kW, and from 54 kW to 41 kW. Voltage offerings are as follows: (see Table 19, p. 47 for additional information):

Tons	Electric Heater Rated Voltage	KW 27/36	KW 41/54	KW 72	KW 90	KW 108
27½ to 35	208	x	x			
	240	x	x			
	480	x	x	x	x	
	600		x	x	x	
40 and 50	208		x			
	240		x			
	480		x	x	x	x
	600		x	x	x	x

5. The service digit for each model number contains 32 digits; all 32 digits must be referenced.
6. Ventilation override exhaust mode is not available for the exhaust fan with fresh air tracking power exhaust. VOM is available for the exhaust fan without fresh air tracking power exhaust.

50 Hz Description

Digits 1, 2 – Unit Function

TC = DX Cooling, No Heat
TE = DX Cooling, Electric Heat
YC = DX Cooling, Natural Gas Heat

Digit 3 – Unit Airflow Design

D = Downflow Configuration
H = Horizontal Configuration

Digits 4, 5, 6 – Nominal Cooling Capacity

275 = 22.9 Tons (82 kW)
305 = 25.4 Tons (89 kW)
350 = 29.2 Tons (105 kW)
400 = 33.3 Tons (120 kW)
500 = 41.7 Tons (148 kW)

Digit 7 – Major Development Sequence

B = R-410A Refrigerant

Digit 8 – Power Supply[1]

C = 380/50/3
D = 415/50/3

Digit 9 – Heating Capacity[4]

0 = No Heat (TC only)
L = Low Heat (YC only)
H = High Heat (YC only)

Note: *When second digit is "E" for Electric Heat, the following values apply in the ninth digit.*

380V / 415V

A = 23 kW / 27 kW
B = 34 kW / 40 kW
C = 45 kW / 54 kW
D = 56 kW / 67 kW
E = 68 kW / 81 kW

Digit 10 – Design Sequence

A = First

Digit 11 – Exhaust[6]

0 = None
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2 = 100% Power Exhaust Fan (Available w/ Economizer only)
3 = 50% Power Exhaust Fan (Available w/ Economizer only)
4 = 100% Fresh Air Tracking Power Exhaust Fan (Available w/ Economizer only)
5 = 50% Fresh Air Tracking Power Exhaust Fan (Available w/ Economizer only)
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A = 2" (51 MM) Std Eff, Throwaway Filters
B = 2" (51 MM) MERV 8, High Eff, Throwaway Filters
C = 4" (102 MM) MERV 8, High Eff, Throwaway Filters
D = 4" (102 MM) MERV 14, High Eff, Throwaway Filters

Digit 13 – Supply Fan Motor, HP

1 = 7.5 Hp (5.6 kW)
2 = 10 Hp (7.5 kW)
3 = 15 Hp (10 kW)
4 = 20 Hp (15 kW)

Digit 14 – Supply Air Fan Drive Selections[3]

A	=	458 RPM	H	=	417 RPM
B	=	500 RPM	J	=	437 RPM
C	=	541 RPM	K	=	479 RPM
D	=	583 RPM	L	=	521 RPM
E	=	625 RPM	M	=	562 RPM
F	=	658 RPM	N	=	604 RPM
G	=	664 RPM			

Digit 15 – Fresh Air Selection

A = No Fresh Air
B = 0-25% Manual Damper
C = 0-100% Economizer, Dry Bulb Control
D = 0-100% Economizer, Reference Enthalpy Control
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Note: *Zone sensors are not included with option and must be ordered as a separate accessory.*

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C = Non-Fused Disconnect Switch with External Handle

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1. All voltages are across-the-line starting only.
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4. Electric Heat kW ratings are based upon voltage ratings of 380/415 V. Heaters A, B, C, D are used with 22.9-29.2 ton (82-105 kW) units only and heaters B, C, D, E are used with 33.3-41.7 ton (120-148 kW) units only.
5. The service digit for each model number contains 32 digits; all 32 digits must be referenced.
6. Ventilation override exhaust mode is not available for the exhaust fan with fresh air tracking power exhaust. VOM is available for the exhaust fan without fresh air tracking power exhaust.

General Information

Commonly Used Acronyms/Abbreviations

BAS = Building Automation System
CFM = Cubic Feet per Minute
CLV = Cooling Valve (Reheat only)
COMM = Module Designation for TCI/LCI
CV = Constant Volume
CW = Clockwise
CCW = Counterclockwise
DSP = Direct Space Pressure control
DTS = Discharge Air Sensor
DWU = Daytime Warm-up
E/A = Exhaust Air
ECA = Economizer Actuator
EET = Entering Evaporator Temperature Sensor
F/A = Fresh Air
FFS = Fan Failure Switch
ICS = Integrated Comfort System (See BAS)
IDM = Indoor Fan Motor
IGV = Inlet Guide Vanes
I/O = Input/Output
IOM = Installation, Operation and Maintenance manual (Ships with each unit)
LCI = LonTalk® Communication Interface
LCI-R = LonTalk Communication Interface with ReliaTel
LH = Left Hand
MAS = Mixed Air Sensor
MAT = Mixed Air Temperature
MWU = Morning Warm Up
NSB = Night Setback (programmable ZSM BAYSENS119*)
O/A = Outside Air
OAH = Outside Air Humidity
OAT = Outside Air Temperature
PGA = Power Exhaust Actuator
PSIG = Pounds Per Square Inch Gauge pressure
PHM = Phase monitor
R/A = Return Air
RAH = Return Air Humidity
RAT = Return Air Temperature sensor
RH = Right Hand
RHP = Reheat Pumpout Solenoid
RHV = Reheat Valve
RLP = Reheat Low Pressure Cutout
RPM = Revolutions Per Minute
RTAM = ReliaTel Airhandler Module
RTDM = ReliaTel Dehumidification Module
RTVM = ReliaTel Ventilation Module

RTOM	=	ReliaTel Options Module
RTRM	=	ReliaTel Refrigeration Module
S/A	=	Supply Air
SPC	=	Space Pressure Calibration Solenoid
SPP	=	Space Pressure Transducer
SPT	=	Static Pressure Transducer
TCI	=	Trane Communication Interface
TCO	=	Temperature Cutout
TDL	=	Temperature Discharge Limit
VAV	=	Variable Air Volume
VFD	=	Variable Frequency Drive
VHR	=	Ventilation Heat Relay (VAV box relay)
W.C.	=	Water Column
XFSP	=	Exhaust Fan Setpoint
ZSM	=	Sensor, Zone Sensor, Zone Sensor Module, Zone Panel

About the Unit

Overall unit dimensional data is illustrated in Figure 1, p. 17 to Figure 9, p. 22. Each package rooftop unit ships fully assembled and charged with the proper refrigerant quantity from the factory. They are controlled by a microelectronic unit control processor. Several solid state modules are grouped to form the "Control System". The number of modules within any given control system will be dependent upon the options and accessories ordered with the unit. Acronyms are used extensively throughout this manual when referring to the "Control System" (see acronyms/abbreviations previous page).

Basic unit components include:

- Scroll compressors
- One (1) Intertwined Evaporator Coil
- One (1) Intertwined Condenser Coil
- One (1) Supply Fan
- Three (3) to Four (4) Condenser Fans
- Filters (type is dependent on option selection)

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. Glass wool fibers may also cause respiratory, skin or eye irritation.

- 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.

An optional roof curb, specifically designed for the Voyager commercial rooftop units is available from Trane. The roof curb kit must be field assembled and installed according to the latest edition of the curb installation guide.

Unit Inspection

As soon as the unit arrives at the job site:

- Verify that the nameplate data corresponds to the sales order and bill of lading (including electrical data).
- Visually inspect the exterior of the unit, including the roof, for physical signs of shipping damage.
- Check for material shortages. Figure 11 on page 23 illustrates where "ship with" items are placed inside the unit.

If the job site inspection reveals damage or material shortages, file a claim with the carrier immediately. Specify the type and extent of the damage on the "bill of lading" before signing. Do not install a damaged unit without the Appropriate Trane sales representative's approval!

- Visually check 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.

⚠WARNING

No Step Surface!

Do not walk on the sheet metal drain pan. Walking on the drain pan could cause the supporting metal to collapse. Failure of the drain pan could result in death or serious injury.

Bridging between the unit's main supports may consist of multiple 2 by 12 boards or sheet metal grating.

- If concealed damage is discovered, notify the carrier's terminal office 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 the 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.

Storage

Take precautions to prevent condensate formation inside the unit electrical components and motors when:

a. The unit is stored before it is installed; or,

b. The unit is set on the roof curb and temporary auxiliary 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) to minimize ambient air from entering the unit until it is ready for startup.

Do not use the unit heater as temporary heat without completing the startup procedures detailed under "Unit startup".

Trane will not assume responsibility for equipment damage resulting from accumulation of condensate on the unit electrical components.

Pre-Installation

The checklist listed below is a summary of the steps required to successfully install a Voyager Commercial rooftop 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.

General Unit Requirements

Downflow Models Only:

- An optional roof curb, specifically designed for the Voyager commercial rooftop units is available from Trane. The roof curb kit must be field assembled and installed according to the latest edition of the curb installation guide.
- Assemble and install the roof curb, including necessary gaskets. Make sure the curb is level.
- Install and secure the ductwork to the curb.

All Units:

- Check unit for shipping damage and material shortage. (Refer to "Unit inspection" section).
- Rigging the unit. Refer to Figure 12, p. 24.
- Placing the unit on curb; check for levelness. See “Roof Curb and Ductwork” on page 16.
- Ensure that the unit-to-curb seal is tight and without buckles or cracks.
- Install an appropriate drain line to the evaporator condensate drain connections, as required. Refer to Figure 14, p. 29.
- Service Valve Option; See “Starting the Compressor” on page 98.
- Return/Fresh-air damper adjustment. Refer to “Economizer Damper Adjustment” on page 94.
- Exhaust Fan Damper Stop Adjustment. Refer to Exhaust Damper Adjustment figures, beginning with Figure 46, p. 103.

Electrical Requirements

(See Figure 18, “Typical Field Power Wiring,” on page 34.)

- Verify that the electrical power supply characteristics comply 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 and unit power terminal block HTB1, or to the optional unit-mounted disconnect switch.

⚠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 codes could result in death or serious injury.

- Properly ground the unit.

Field Installed Control Wiring

(Figure 19, p. 41 and Figure 20, p. 42.)

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

- Complete the field wiring connections for the constant volume controls as applicable. Refer to the "Low Voltage Wiring" on page 39 for guidelines.
- Complete the field wiring connections for the variable air volume controls as applicable. Refer to the "Low Voltage Wiring" on page 39 for guidelines.

Gas Heat Requirements

(See "Installation Piping" on page 53.)

- Gas supply line properly sized and connected to the unit gas train.
- All gas piping joints properly sealed.
- Drip leg Installed in the gas piping near the unit.
- Gas piping leak checked with a soap solution. If piping connections to the unit are complete, do not pressurize piping in excess of 0.50 psig or 14 inches w.c. to prevent component failure.
- Main supply gas pressure adequate.
- Flue Tubes clear of any obstructions.

TRANE

Unit Dimensions and Weights

Recommended Clearances

Adequate clearance around and above each Voyager Commercial unit is required to ensure proper operation and to allow sufficient access for servicing.

If the unit installation is higher than the typical curb elevation, a field constructed catwalk around the unit is recommended to provide safe, easy access for maintenance and servicing. Table 1, p. 23 lists the recommended clearances for single and multiple unit installation. These clearances are necessary to assure adequate serviceability, cataloged capacities, and peak operating efficiency.

If the clearances available on the job site appear to be inadequate, review them with your Trane sales representative.

Roof Curb and Ductwork

The curbs for the 27.5 to 50 Ton commercial rooftop units enclose the entire unit base area. They are referred to as "full perimeter" type curbs.

Step-by-step instructions for the curb assembly and installation with curb dimensions and curb configuration for "A", "B", and "C" cabinets ship with each Trane accessory roof curb kit. (See the latest edition of the curb installation guide) Follow the instructions carefully to assure proper fit when the unit is set into place.

The S/A and R/A ductwork adjoining the roof curb must be fabricated and installed by the installing contractor before the unit is set into place. Trane curbs include flanges around the openings to accommodate duct attachment.

Ductwork installation recommendations are included in the instruction booklet that ships with each Trane accessory roof curb kit.

Note: *For sound consideration, cut only the holes in the roof deck for the supply and return duct penetration. Do Not remove the roof decking from the inside perimeter of the curb.*

If a Trane curb accessory kit is not used:

a. The ductwork can be attached directly to the S/A and R/A openings. Be sure to use a flexible duct connector at the unit.

b. For "built-up" curbs supplied by others, gaskets must be installed around the curb perimeter flange, S/A opening, and R/A openings.

c. Insulation must be installed on the bottom of the condenser section of the unit.

Horizontal Ductwork

When attaching the ductwork to a horizontal unit, provide a water tight flexible connector at the unit to prevent noise transmission from the unit into the ductwork. Refer to figures beginning on page 17 for the S/A and R/A opening dimensions.

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

If optional power exhaust is selected, an access door must be field-installed on the horizontal return ductwork to provide access to exhaust fan motors.

Figure 1. 60 Hz 27½-35, 50 Hz 23-29 Tons (TC, TE, YC Low Heat)

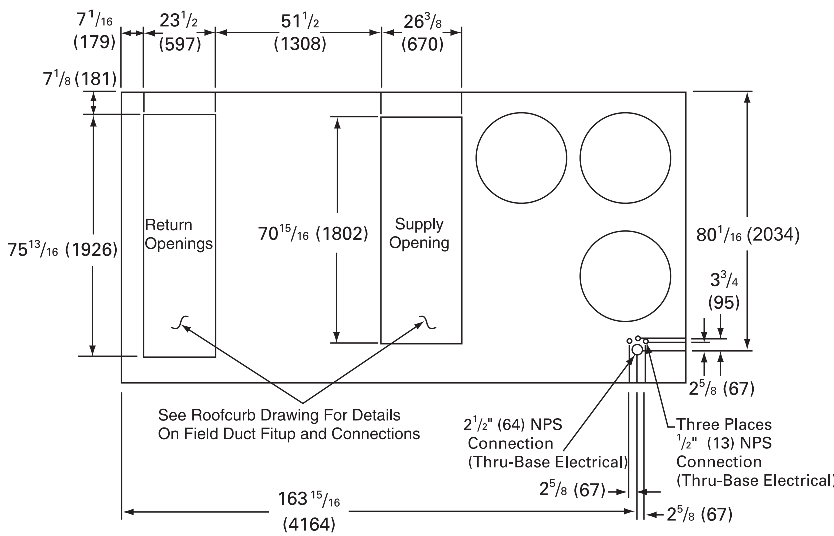
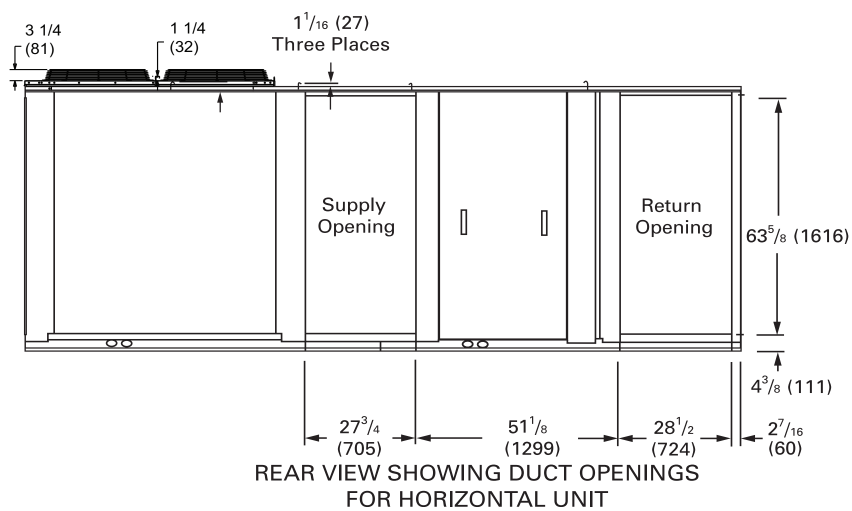
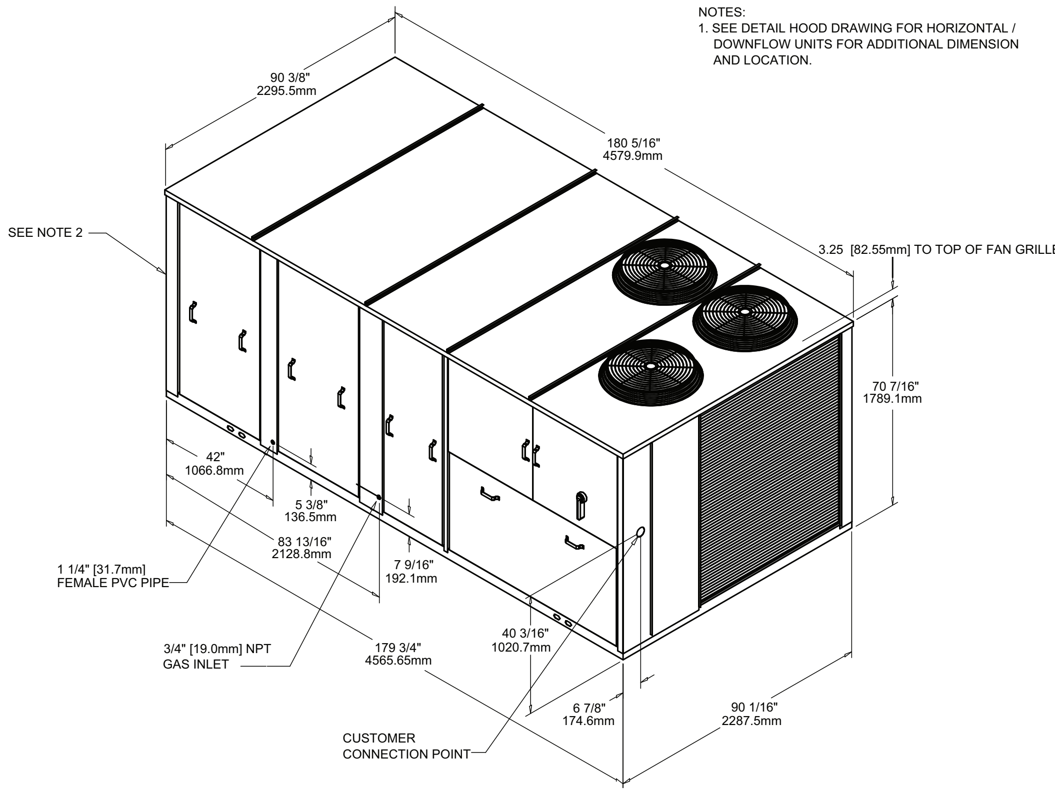


Figure 2. Rear view showing duct openings for horizontal units



Unit Dimensions and Weights

Figure 3. 60 Hz 27½-35, 50 Hz 23-29 Tons (TC, TE, YC Low Heat)



Note: *Dimensions in ( ) are mm, 1"= 25.4 mm.*

Figure 4. 60 Hz 27½-35, 50 Hz 23-29 Tons (YC High Heat)

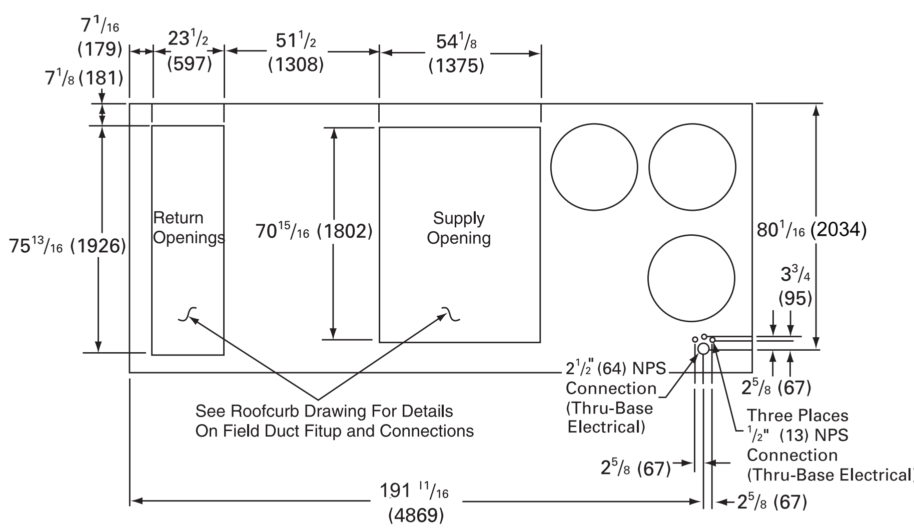


Figure 5. Duct openings, 60 Hz 27½-35, 50 Hz 23-29 Tons (YC High Heat)

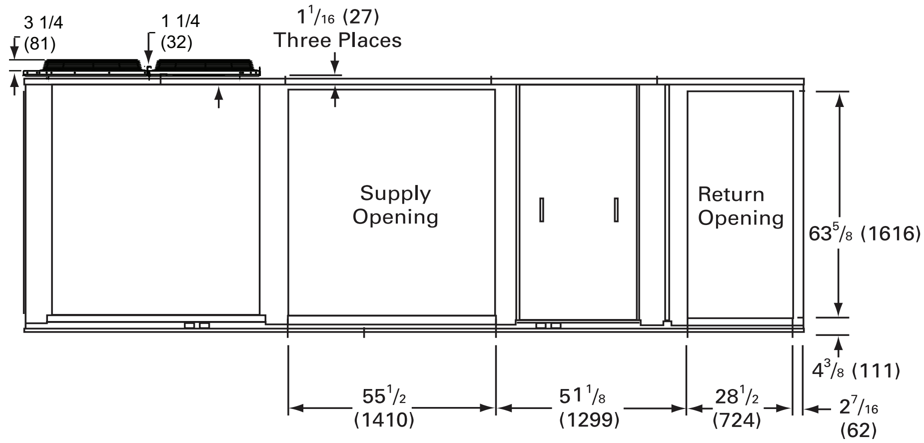
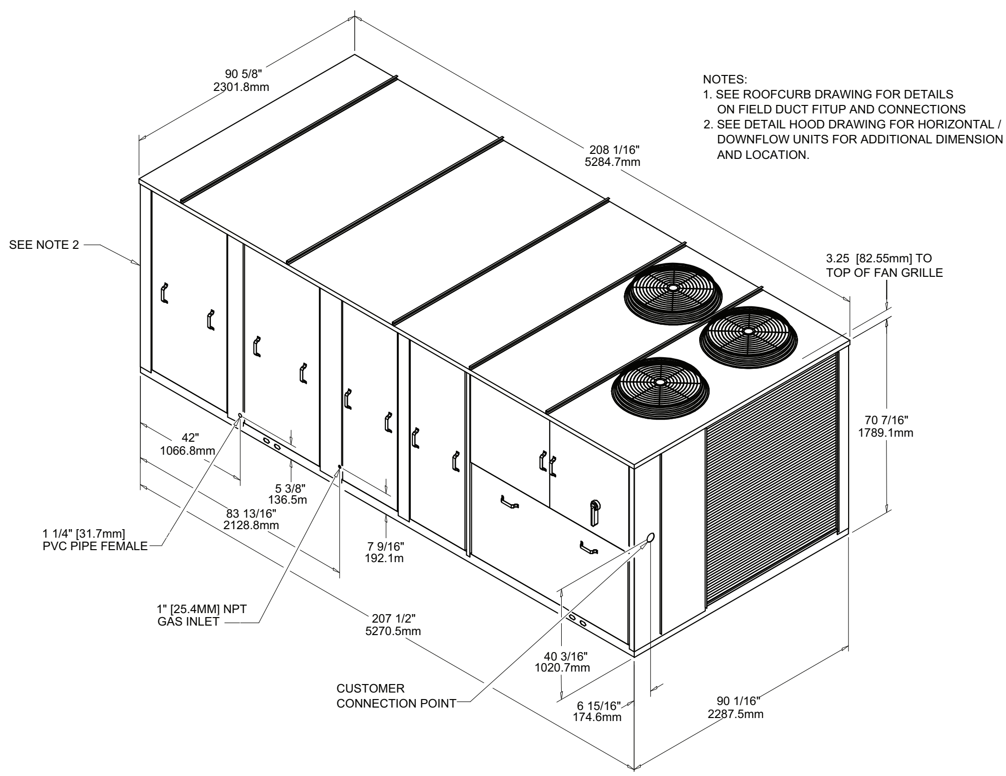


Figure 6. 60 Hz 27½-35, 50 Hz 23-29 Tons (YC High Heat)



Note: *Dimensions in ( ) are mm, 1"= 25.4 mm.*

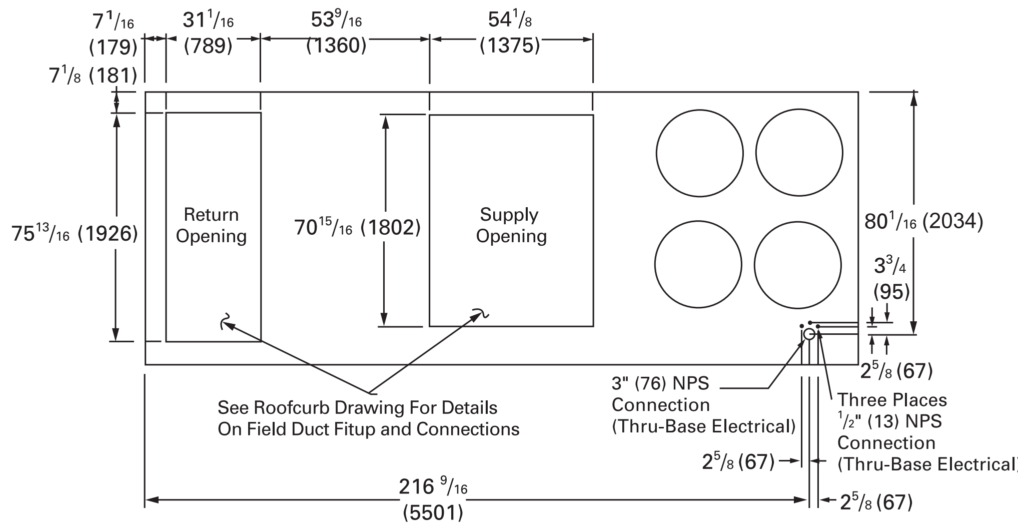


Figure 7. 60 Hz 40-50, 50 Hz 33-42 Tons (TC, TE, YC Low and High Heat)

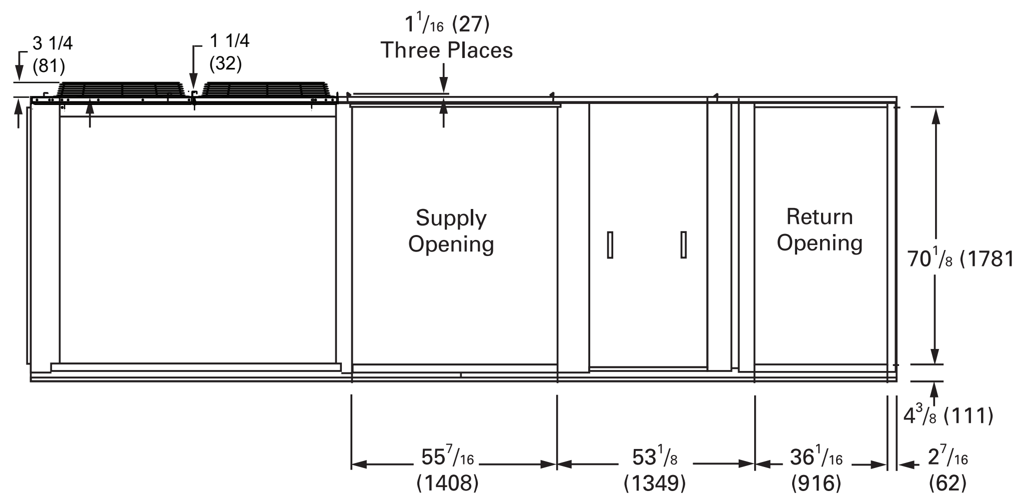
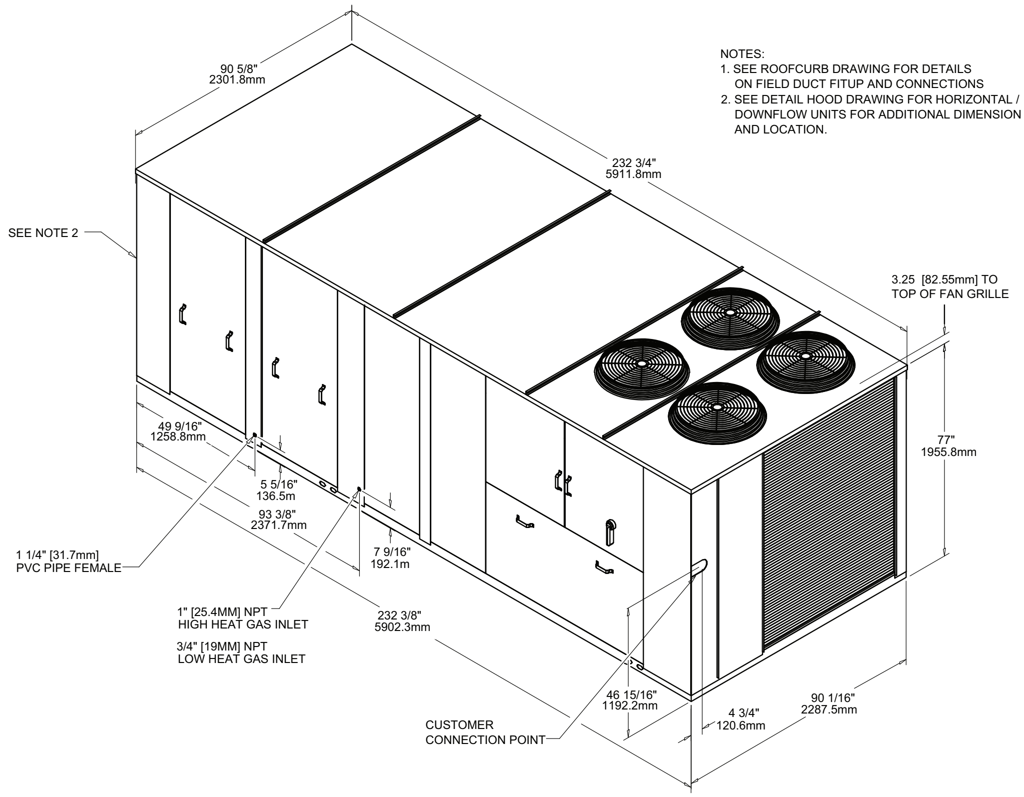


Figure 8. Duct openings, 60 Hz 40-50, 50 Hz 33-42 Tons (TC, TE, YC Low and High Heat)

Figure 9. 60 Hz 40-50, 50 Hz 33-42 Tons (TC, TE, YC Low and High Heat)



Note: *Dimensions in ( ) are mm, 1"= 25.4 mm.*

Figure 10. Fresh Air and Power Exhaust Dimensions for TC*, TE*, and YC* Units

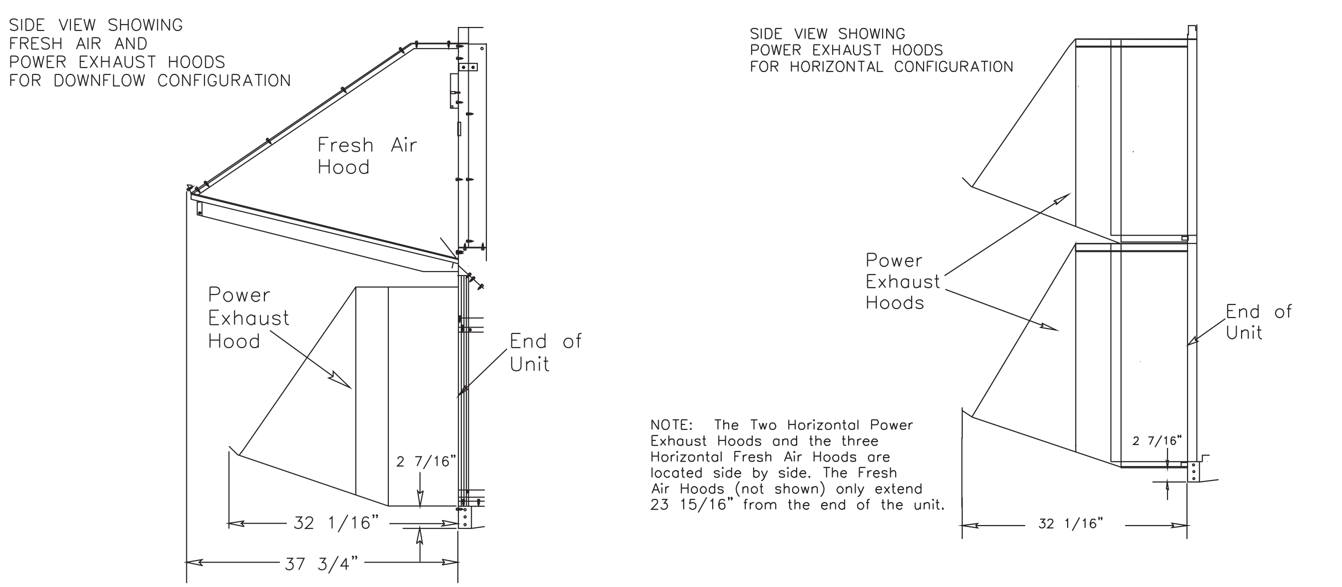
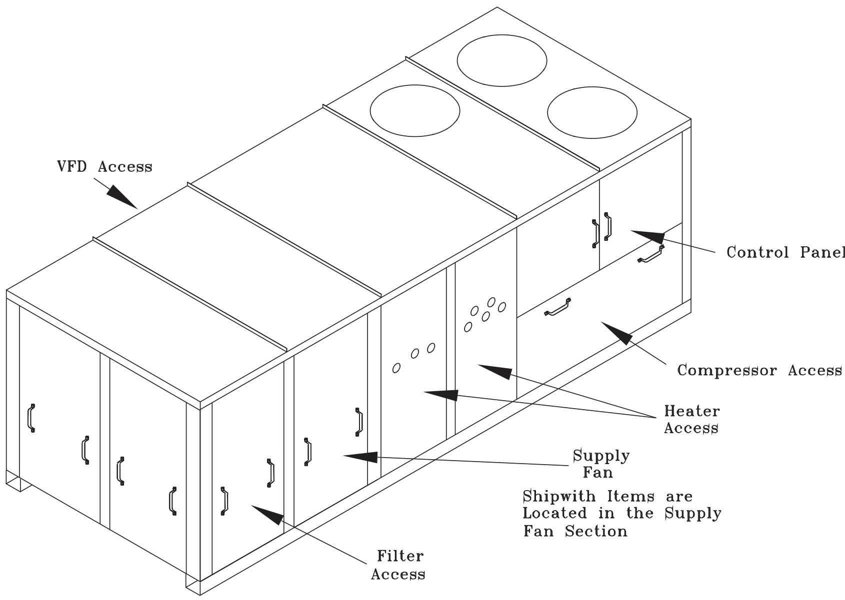


Figure 11. Location of "Ship With" Items for TC*, TE*, and YC* Units



Unit Rigging and Placement

⚠WARNING
Heavy Objects!

Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) 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 may cause equipment or property-only damage. Failure to properly lift unit may result in death or serious injury.

Use spreader bars as shown in the diagram. Refer to the Installation manual or nameplate for unit weight. Refer to the Installation instructions located inside the control panel for further rigging information.

1. Verify that the roof curb has the proper gaskets installed and is level and square to assure an adequate curb-to-unit seal.

   The units must be as level as possible in order to assure proper condensate flow out of the unit. The maximum side-to-side and end-to-end slope allowable in any application is listed in Table 2, p. 23.

Figure 12. Unit Rigging

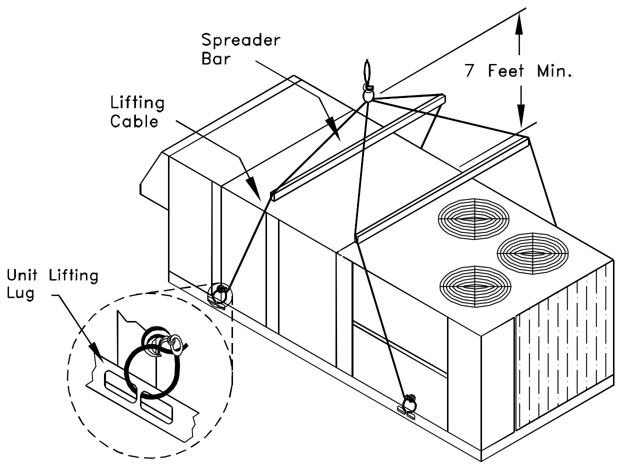


Table 1. Minimum Operating Clearances Installation (Horizontal and Downflow Configurations)

Recommended Clearances			
Single Unit	**Economizer/ Exhaust End**	**Condenser Coil[(a)] Orientation End/Side**	**Service Side Access**
TC*, TE*, YC* 27.5 to 50 Tons	6 Feet	8 Feet	4 Feet
Distance Between Units			
Multiple Unit	**Economizer/ Exhaust End**	**End/Side**	**Service Side Access**
TC*, TE*, YC* 27.5 to 50 Tons	12 Feet	16 Feet	8 Feet

(a) Condenser coil is located at the end and side of the unit.

Table 2. Maximum Slope

Cabinet	End to End (inches)	Side to Side (inches)
"A" (27.5 - 35 Ton Low Heat)	3 1/2	1 5/8
"B" (27.5 - 35 Ton High Heat)	4	1 5/8
"C" (All 40 and 50 Ton Units)	4 1/2	1 5/8

Note: Do not exceed these allowances. Correct the improper slope by building up the curb base. The material used to raise the base must be adequate to support both the curb and the unit weight.

Figure 13. Center of Gravity

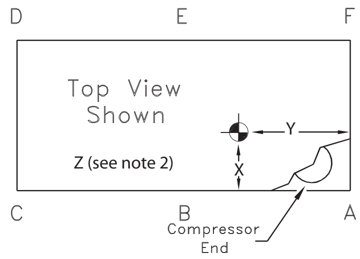


Table 3. Center of Gravity[1]

Unit Model	Center-of-Gravity (inches)								
	YC Low Heat Dimension			YC High Heat Dimension			TC/TE Dimension		
	X	Y	Z	X	Y	Z	X	Y	Z
***330/275*	41	76	33	41	84	33	42	76	33
***360/305*	43	77	33	43	85	33	44	77	33
***420/350*	42	78	33	42	86	33	43	78	33
***480/400*	42	111	35	42	111	35	42	111	35
***600/500*	43	108	35	43	108	35	43	108	35

Note: Center-of-gravity dimensions are approximate, and are based on the unit equipped with: standard efficiency coils, standard efficiency motors, economizer, inlet guide vanes, and throwaway filters
Note: Z dimension is upward from the base of the unit.
Example:
Locating the center-of-gravity for a YC-360 MBH High Heat unit with 100% exhaust.
X = 43 inches inward from the control panel side
Y = 85 inches inward from the compressor end
Z = 33 inches upward from the base

Table 4. Approximate Units Operating Weights — lbs./kg[1]

Unit Model	Basic Unit Weights[1]							
	YC Low Heat		YC High Heat		TC		TE	
**D330/275	3750	1701	4130	1873	3620	1642	3640	1651
**H330/275	3790	1719	4220	1914	3660	1660	3680	1669
**D360/305	3845	1744	4225	1916	3715	1685	3735	1694
**H360/305	3885	1762	4315	1957	3755	1703	3775	1712
**D420/350	3970	1801	4350	1973	3840	1742	3860	1751
**H420/350	4010	1819	4440	2014	3880	1760	3900	1769
**D480/400	4764	2161	4884	2215	4539	2059	4564	2070
**H480/400	4859	2204	4984	2261	4599	2091	4634	2102
**D600/500	5174	2347	5294	2401	4949	2245	4974	2256
**D600/500	5269	2390	5394	2447	5019	2277	5044	2288

Notes:
1. Basic unit weight includes minimum horsepower supply fan motor.

Table 5. Point Loading Average Weight[1,2] — lbs./kg

Model	A		B		C		D		E		F	
**D330/275	846	384	688	313	743	337	745	338	604	275	503	228
**H330/275	867	393	707	321	767	348	753	342	613	279	513	233
**D360/305	836	379	680	309	779	353	741	336	621	285	568	258
**H360/305	897	407	696	316	766	348	729	330	590	268	636	288
**D420/350	892	405	692	314	779	353	765	347	633	288	590	268
**H420/350	867	393	869	395	690	313	758	344	601	273	654	297
**D480/400	820	372	856	388	937	425	742	336	762	346	769	349
**H480/400	841	381	876	397	957	434	754	342	775	352	782	355
**D600/500	894	406	955	428	970	440	756	343	862	391	866	393
**H600/500	915	415	966	438	990	449	768	348	875	397	879	399

Notes:
1. Point Loading is identified with corner A being the corner with the compressors. As you move clockwise around the unit as viewed from the top, mid-point B, corner C, corner D, mid-point E and corner F.
2. Point load calculations provided are based on the unit weight for YC high heat gas models.

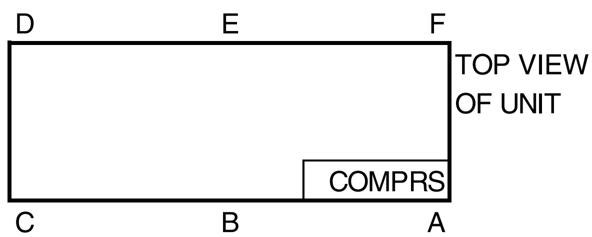


Table 6. Approximate Operating Weights[1] — Optional Components — lbs./kg

Unit Model	Baro. Relief	Power Exhaust	0-25% Man Damper	Econ.	Inlet Guide Vanes	Var. Freq. Drives (VFD's) W/O Bypass	Var. Freq. Drives (VFD's) With Bypass	Serv Valves	Thru-the base Elec.	Non-Fused Discon. Switch	Factory. GFI with Discon. Switch	Roof Curb Lo	Roof Curb Hi
**D330/275	110/50	165/74	50/23	260/117	55/25	85/39	115/52	18/8	6/3	30/14	85/38	310/141	330/150
**H330/300	145/65	200/90	50/23	285/128	55/25	85/39	115/52	18/8	6/3	30/14	85/38	310/141	330/150
**D360/305	110/50	165/74	50/23	260/117	55/25	85/39	115/52	18/8	6/3	30/14	85/38	310/141	330/150
**H330/305	145/65	200/90	50/23	285/128	55/25	85/39	115/52	18/8	6/3	30/14	85/38	310/141	330/150
**D420/350	110/50	165/74	50/23	260/117	55/25	85/39	115/52	18/8	6/3	30/14	85/38	310/141	330/150
**H420/350	145/65	200/90	50/23	285/128	55/25	85/39	115/52	18/8	6/3	30/14	85/38	310/141	330/150
**D480/400	110/50	165/74	50/23	290/131	70/32	115/52	150/68	18/8	6/3	30/14	85/38	365/169	365/169
**H480/400	145/65	200/90	50/23	300/135	70/32	115/52	150/68	18/8	6/3	30/14	85/38	365/169	365/169
**D600/500	110/50	165/74	50/23	290/131	70/32	115/52	150/68	18/8	6/3	30/14	85/38	365/169	365/169
**H600/500	145/65	200/90	50/23	300/135	70/32	115/52	150/68	18/8	6/3	30/14	85/38	365/169	365/169

Note:
1. Basic unit weight includes minimum horsepower supply fan motor.

Installation General Requirements

Condensate Drain Connection

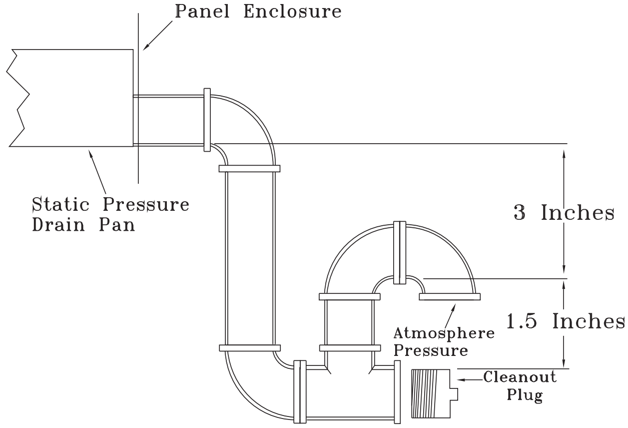
Each commercial rooftop unit is equipped with one (1) 1-1/4 inch Female PVC condensate drain connection.

Refer to Figure 11, p. 23 for the location of the connector. A condensate trap must be installed due to the drain connection being on the "negative pressure" side of the fan. Install a P-Trap at the unit using the guidelines in Figure 14, p. 26.

Pitch the drain line at least 1/2 inch for every 10 feet of horizontal run to assure proper condensate flow.

Ensure that all condensate drain line installations comply with applicable building and waste disposal codes.

Figure 14. Condensate Trap Installation



O/A Sensor & Tubing Installation

An Outside Air Pressure Sensor is shipped with all units designed to operate on variable air volume applications and units with Statitrac™.

A duct pressure transducer and the outside air sensor is used to control the discharge duct static pressure to within a customer-specified controlband. Refer to the illustration in Figure 15, p. 27 and the following steps to install the sensor and the pneumatic tubing.

1. Remove the O/A pressure sensor kit located inside the fan section. The kit contains the following items;
   - an O/A static pressure sensor
   - a sensor mounting bracket
   - 50’ of 3/16" O.D. pneumatic tubing
   - mounting hardware
2. Using two #10-32 x 1-3/4" screws provided, install the sensor's mounting bracket to the factory provided bracket (near the fan section).
3. Using the #10-32 x 1/2" screws provided, install the O/A static pressure sensor vertically to the sensor bracket .
4. Remove the dust cap from the tubing connector located below the sensor in the vertical support.

5. Attach one end of the 50' x 3/16" O.D. factory provided pneumatic tubing to the sensor's top port, and the other end of the tubing to the connector in the vertical support. Discard any excess tubing.

Units with Statitrac™

1. Open the filter access door, and locate the Statitrac Transducer Assembly illustrated in Figure 16, p. 28. There are two tube connectors mounted on the left of the solenoid and transducers. Connect one end of the field provided 1/4" (length 50-100 ft.) or 3/8" (length greater than 100 ft.) O.D. pneumatic tubing for the space pressurization control to the fitting indicated in the illustration.
2. Route the opposite end of the tubing to a suitable location inside the building. This location should be the largest open area that will not be affected by sudden static pressure changes.

Figure 15. Pressure Tubing

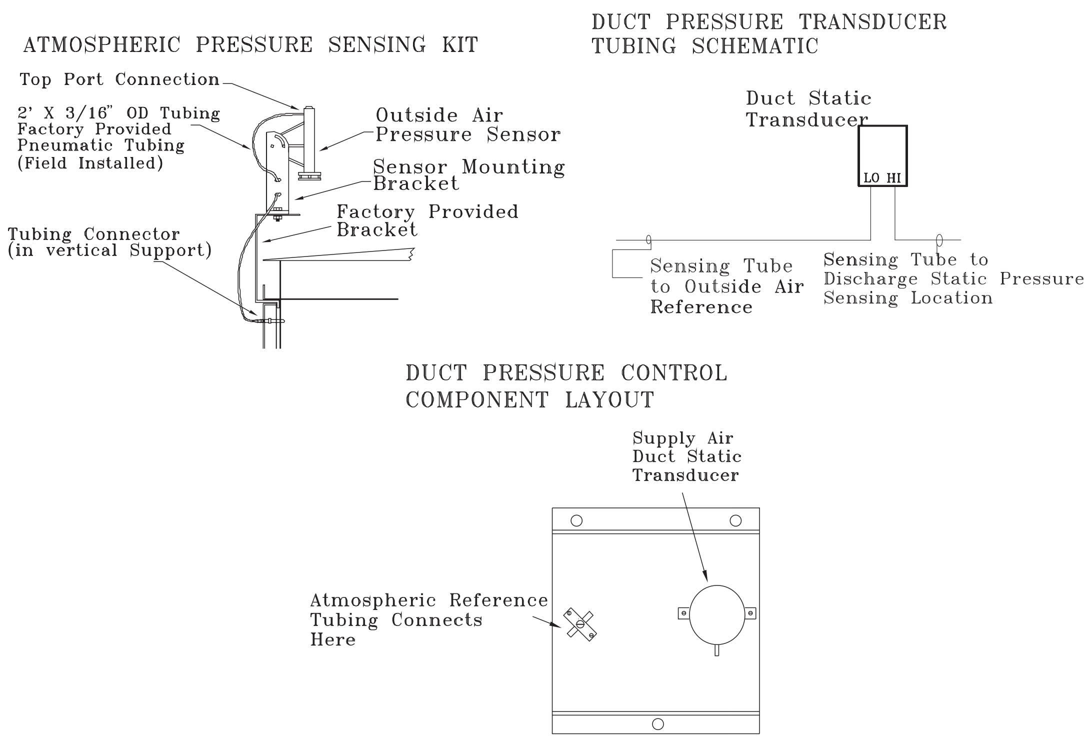
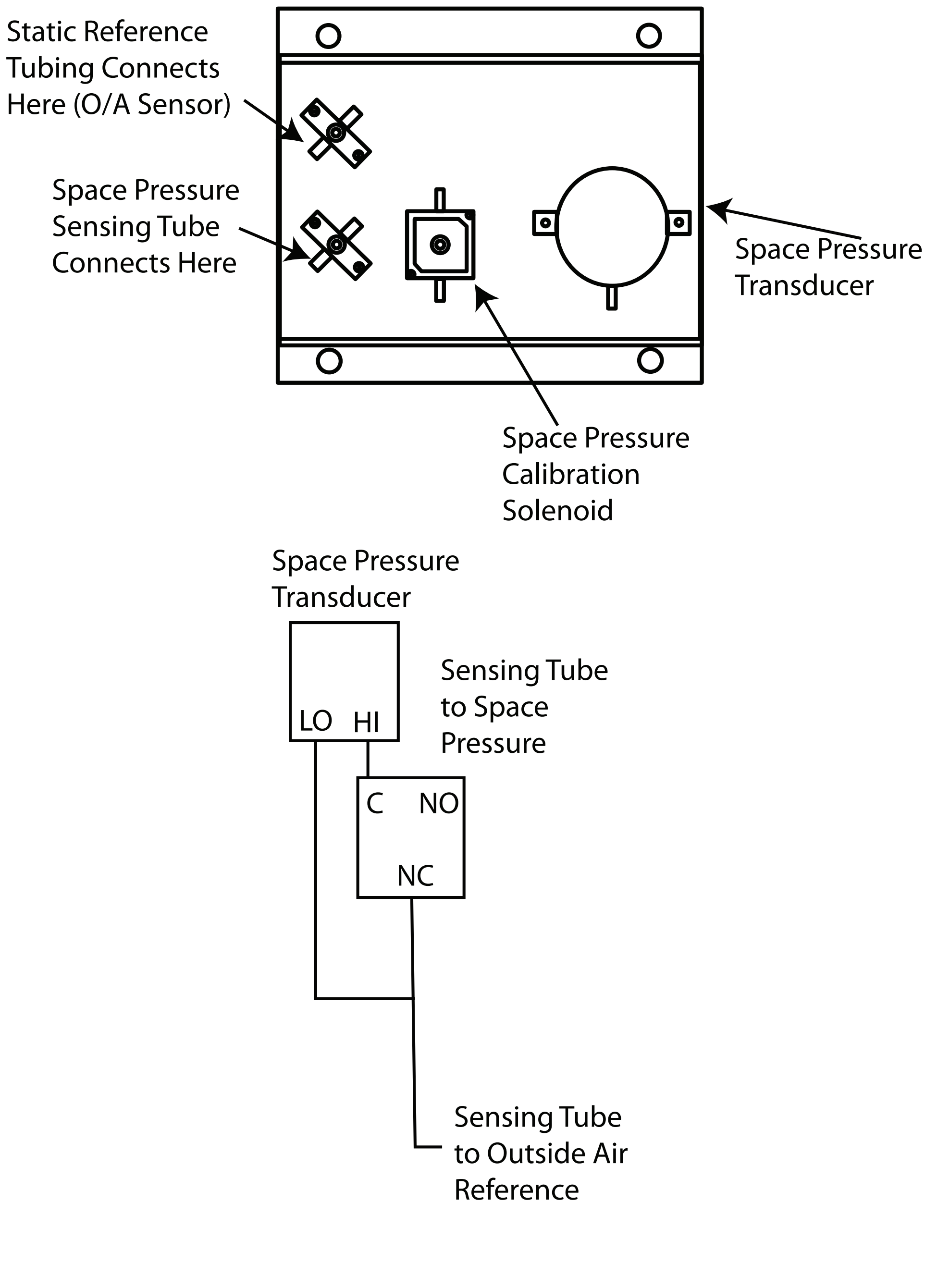


Figure 16. Statitrac Transducer Assembly



Installation Electrical

Disconnect Switch External Handle (Factory Mounted Option)

Units ordered with the factory mounted disconnect switch come equipped with an externally mounted handle. This allows the operator to disconnect power from the unit without having to open the control panel door. The handle location and its three positions are shown below;

ON - Indicates that the disconnect switch is closed, allowing the main power supply to be applied at the unit.

OFF - Indicates that the disconnect switch is open, interrupting the main power supply at the unit.

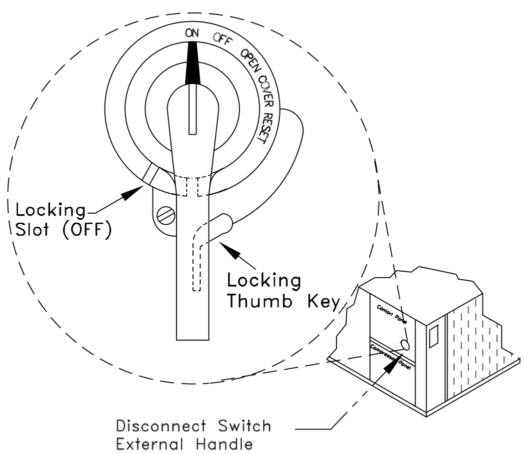
OPEN COVER/RESET - Turning the handle to this position releases the handle from the disconnect switch, allowing the control panel door to be opened.

⚠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.

Once the door has been opened, it can be closed with the handle in any one of the three positions outlined above, provided it matches the disconnect switch position. The handle can be locked in the "OFF" position. While holding the handle in the "OFF" position, push the spring loaded thumb key, attached to the handle, into the base slot. Place the lock shackle between the handle and the thumb key. This will prevent it from springing out of position.

Figure 17. Disconnect Switch



An overall layout of the field required power wiring is illustrated in Figure 18. To insure that the unit 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 name plate ratings for all components. The available power supply must be within 10% of the rated voltage stamped on the nameplate. Use only copper conductors to connect the 3-phase 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 may result in equipment damage.

Main Power Wiring

⚠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 codes could result in death or serious injury.

1. Table 7, p. 32 and Table 9, p. 34 list the electrical data. 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. Refer to "Electrical Wire Sizing and Protection Device Equations" on page 35 for determining:
   a. The appropriate electrical service wire size based on "Minimum Circuit Ampacity" (MCA),
   b. The "Maximum Over current Protection" (MOP) device.
   c. The "Recommended Dual Element fuse size" (RDE).
2. If the unit is not equipped with an optional factory installed Nonfused disconnect switch, a field supplied disconnect switch must be installed at or near the unit in accordance with the National Electrical Code (NEC latest edition). Refer to DSS calculations "Electrical Wire Sizing and Protection Device Equations" on page 35 for determining correct size.

   Location for the electrical service entrance is shown in the unit dimensional drawings beginning with Figure 1, p. 17. Complete the unit's power wiring connections onto either the main terminal block HTB1, or the factory mounted nonfused disconnect switch inside the unit control panel.

Note: *When the factory installed through-the-base option is not used, the installing contractor is required to seal any holes made in the base of the unit to prevent water from leaking into the building.*

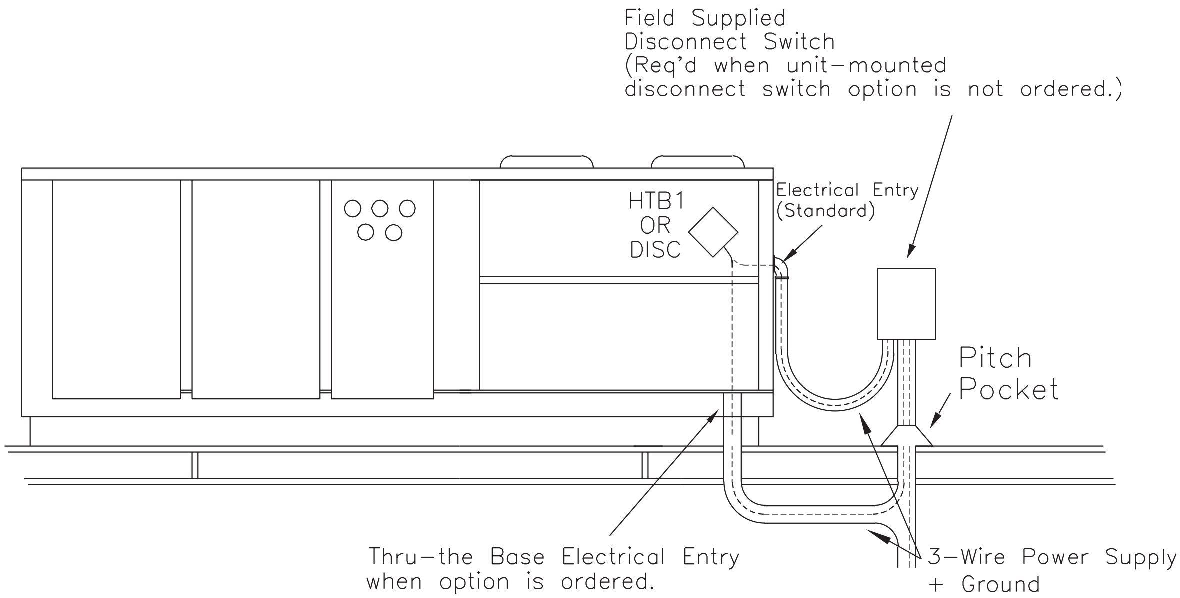
3. Provide proper grounding for the unit in accordance with local and national codes.

Thru-the-Base Electrical (Optional Accessory)

Liquid-tite conduit couplings are secured to the base of the unit for both power and control wiring. Liquid-tite conduit must be field installed between the couplings and the unit control box to prevent water leaks into the building.

Note: *If the unit is set on the roof curb and temporary auxiliary heat is provided in the building, it is recommended that the electrical and control wiring conduit opening in the control box be temporarily sealed to provide a vapor barrier.*

Figure 18. Typical Field Power Wiring



⚠ WARNING

HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.
FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

⚠ AVERTISSEMENT

VOLTAGE HASARDEUX!
DECONNECTEZ TOUTES LES SOURCES ELECTRIQUES INCLUANT LES DISJONCTEURS SITUES A DISTANCE AVANT D'EFFECTUER L'ENTRETIEN.
FAUTE DE DECONNECTER LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRETIEN PEUT ENTRAINER DES BLESSURES CORPORELLES SEVERES OU LA MORT.

⚠ CAUTION

USE COPPER CONDUCTORS ONLY!
UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.
FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.

CUSTOMER CONNECTION WIRE RANGE

UNITS WITH MAIN POWER TERMINAL BLOCK (ALL VOLTAGES)

BLOCK SIZE	WIRE QTY.	CONNECTOR WIRE RANGE
310 AMP	1	#6-350 MCM

UNITS WITH MAIN POWER DISCONNECT SWITCH

200-208-230 VOLT UNITS

DISCONNECT SIZE	WIRE QTY.	CONNECTOR WIRE RANGE
225 AMP	1	#1-300 MCM
B 400 AMP (≤310 MCA)	1	250-500 MCM
B 400 AMP (>310 MCA)	2	3/0-250 MCM

380-415-460-480-575 VOLT UNITS

DISCONNECT SIZE	WIRE QTY.	CONNECTOR WIRE RANGE
100 AMP	1	#14-1/0
250 AMP	1	#4-350 MCM

NOTES

A. BLOCK SIZE & DISCONNECT SIZE IS CALCULATED BY SELECTING THE SIZE GREATER THAN OR EQUAL TO 1.15 X (SUM OF UNIT LOADS). SEE UNIT LITERATURE FOR UNIT LOAD VALUES.

B. 400 AMP DISCONNECT SELECTED BY EQUATION GIVEN IN NOTE A, AND BY THE UNIT MCA VALUE. SEE UNIT LITERATURE FOR APPROPRIATE MCA EQUATION.

Table 7. 27½-50 Ton Electrical Service Sizing Data—60Hz[1]

Model	Electrical Characteristics	Allowable Voltage Range	Compressor			Fan Motors								
						Supply		Condenser			Exhaust			
			No/Ton	RLA (Ea.)	LRA (Ea.)	HP	FLA	No	HP	FLA (Ea.)	50%	100% [2]	HP	FLA (Ea.)
											No.			
TC/TE/ YC*330	208/60/3	187-229	1/12,1/ 13	44.0/50.5	304/315	7.5 10.0	21.5 29.0	3	1.1	7.0	1	2	1.0	4.1
	230/60/3	207-253	1/12,1/ 13	44.0/50.5	304/315	7.5 10.0	18.8 25.2	3	1.1	7.0	1	2	1.0	4.1
	460/60/3	414-506	1/12,1/ 13	21.0/23.0	147/158	7.5 10.0	9.4 12.6	3	1.1	3.5	1	2	1.0	1.8
	575/60/3	517-633	1/12,1/ 13	17.5/19.0	122/136	7.5 10.0	7.5 10.1	3	1.1	2.8	1	2	1.0	1.4
TC/TE/ YC*360	208/60/3	187-229	2/13	50.5	315/315	7.5 10.0	21.5 29.0	3	1.1	7.0	1	2	1.0	4.1
	230/60/3	207-253	2/13	50.5	315/315	7.5 10.0	18.8 25.2	3	1.1	7.0	1	2	1.0	4.1
	460/60/3	414-506	2/13	23.0	158/158	7.5 10.0	9.4 12.6	3	1.1	3.5	1	2	1.0	1.8
	575/60/3	517-633	2/13	19.0	136/136	7.5 10.0	7.5 10.1	3	1.1	2.8	1	2	1.0	1.4
TC/TE/ YC*420	208/60/3	187-229	1/13,1/ 15	50.5/56.0	315/351	7.5 10.0 15.0	21.5 29.0 40.7	3	1.1	7.0	1	2	1.0	4.1
	230/60/3	207-253	1/13,1/ 15	50.5/56.0	315/351	7.5 10.0 15.0	18.8 25.2 37.8	3	1.1	7.0	1	2	1.0	4.1
	460/60/3	414-506	1/13,1/ 15	23.0/27.5	158/197	7.5 10.0 15.0	9.4 12.6 18.9	3	1.1	3.5	1	2	1.0	1.8
	575/60/3	517-633	1/13,1/ 15	19.0/23.0	136/146	7.5 10.0 15.0	7.5 10.1 15.1	3	1.1	2.8	1	2	1.0	1.4
TC/TE/ YC*480	208/60/3	187-229	1/13,1/ 20	50.5/76.0	315/485	10.0 15.0	29.0 40.7	4	1.1	7.0	1	2	1.5	5.4
	230/60/3	207-253	1/13,1/ 20	50.5/76.0	315/485	10.0 15.0	25.2 37.8	4	1.1	7.0	1	2	1.5	5.4
	460/60/3	414-506	1/13,1/ 20	23.0/34.0	158/215	10.0 15.0	12.6 18.9	4	1.1	3.5	1	2	1.5	2.7
	575/60/3	517-633	1/13,1/ 20	19.0/27.3	136/175	10.0 15.0	10.1 15.1	4	1.1	2.8	1	2	1.5	2.2

Table 7. 27½-50 Ton Electrical Service Sizing Data—60Hz1

Model	Electrical Characteristics	Allowable Voltage Range	Compressor			Fan Motors								
						Supply		Condenser			Exhaust			
			No/Ton	RLA (Ea.)	LRA (Ea.)	HP	FLA	No	HP	FLA (Ea.)	50%	100% 2	HP	FLA (Ea.)
											No.			
TC/TE/ YC*600	208/60/3	187-229	2/13,1/ 15	50.5/56.0	315/351	10.0 15.0 20.0	29.0 40.7 56.1	4	1.1	7.0	1	2	1.5	5.4
	230/60/3	207-253	2/13,1/ 15	50.5/56.0	315/351	10.0 15.0 20.0	25.2 37.8 49.4	4	1.1	7.0	1	2	1.5	5.4
	460/60/3	414-506	2/13,1/ 15	23.0/27.5	158/197	10.0 15.0 20.0	12.6 18.9 24.7	4	1.1	3.5	1	2	1.5	2.7
	575/60/3	517-633	2/13,1/ 15	19.0/23.0	136/146	10.0 15.0 20.0	10.1 15.1 19.6	4	1.1	2.8	1	2	1.5	2.2

Notes:
1. All customer wiring and devices must be installed in accordance with local and national electrical codes.
2. 100% Power Exhaust is with or without Statitrac™.

Table 8. Electrical Service Sizing Data — Crankcase Heaters — (Heating Mode Only)—60Hz

Nominal Unit Size (Tons)	FLA Add Unit Voltage			
	200	230	460	575
27½ - 35	1	1	1	1
40, 50	2	2	1	1

Table 9. Electrical Service Sizing Data—50Hz

Model	Electrical Characteristics	Compressor No/Ton	Compressor RLA (Ea.)	Compressor LRA (Ea.)	Fan Motors Supply HP(kW)	Fan Motors Supply FLA	Fan Motors Condenser[1] No.	Fan Motors Condenser[1] HP(kW)	Fan Motors Condenser[1] FLA (Ea.)	Fan Motors Exhaust 50% No.	Fan Motors Exhaust 100%[4] No.	Fan Motors Exhaust HP (kW)	Fan Motors Exhaust FLA (Ea.)
TC/TE/YC*275	380-415/50/3	1/10, 1/11	21.0/23.0	147/ 158	7.5 (5.6)	13.6/ 14.1	3	.75 (.56)	4.4	1	2	.75 (.56)	1.7
					10 (6.8)	16.0/ 15.5							
TC/TE/YC*305	380-415/50/3	2/11	23.0	158	7.5 (5.6)	13.6/ 14.1	3	.75 (.56)	4.4	1	2	.75 (.56)	1.7
					10 (6.8)	16.0/ 15.5							
TC/TE/YC*350	380-415/50/3	1/11, 1/12	23.0/27.5	158/ 197	7.5 (5.6)	13.6/ 14.1	3	.75 (.56)	4.4	1	2	.75 (.56)	1.7
					10 (6.8)	16.0/ 15.5							
					15 (10.5)	24.0/ 26.0							
TC/TE/YC*400	380-415/50/3	1/11, 1/17	23.0/34.0	158/ 215	10 (6.8)	16.0/ 15.5	4	.75 (.56)	4.4	1	2	1.0 (.75)	2.5
					15 (10.5)	24.0/ 26.0							
TC/TE/YC*500	380-415/50/3	2/11, 1/12	23.0/27.5	158/ 197	10 (6.8)	16.0/ 15.5	4	.75 (.56)	4.4	1	2	1.0 (.75)	2.5
					15 (10.5)	24.0/ 26.0							
					20 (12.8)	29.0/ 28.0							

Notes:
1. All condenser fan motors are single phase.
2. All customer wiring and devices must be installed in accordance with local and national electrical codes.
3. Allowable voltage range for the 380V unit is 342-418V, allowable voltage range for the 415V unit is 373-456.
4. 100% Power Exhaust is with or without Statitrac

Table 10. Electrical Service Sizing Data — Crankcase Heaters — (Heating Mode Only)—50Hz

Nominal Unit Size (Tons)	FLA Add Unit Voltage 380	FLA Add Unit Voltage 415
23 - 29	1	1
33 - 42	1	1

Table 11. Electrical Service Sizing Data — Electric Heat Module (Electric Heat Only)

Models: TED/TEH 330—600 Electric Heat FLA						
Nominal Unit Size (Tons)	Nominal Unit Voltage	KW Heater				
		36	54	72	90	108
		FLA	FLA	FLA	FLA	FLA
27½-35	208	74.9	112.4	—	—	—
	230	86.6	129.9	—	—	—
	460	43.3	65.0	86.6	108.3	—
	575	—	52.0	69.3	86.6	—
40- 50	208	—	112.4	—	—	—
	230	—	129.9	—	—	—
	460	—	65.0	86.6	108.3	129.9
	575	—	52.0	69.3	86.6	103.9

Note:
1. All FLA in this table are based on heater operating at 208, 240, 480, and 600 volts.

Electrical Wire Sizing and Protection Device Equations

To correctly size the main power wiring based on MCA (Minimum Circuit Ampacity), use the appropriate equation listed below. Read the definitions that follow and then use Calculation #1 for determining MCA (Minimum Circuit Ampacity), MOP (Maximum Over current Protection), and RDE (Recommended Dual Element fuse size) for TC (Cooling Only) units and YC (Cooling with Gas Heat) units. Use Calculation #2 for TE (Cooling with Electric Heat) units.

Load Definitions:

LOAD 1 = CURRENT OF THE LARGEST MOTOR (Compressor or Fan Motor)

LOAD 2 = SUM OF THE CURRENTS OF ALL REMAINING MOTORS

LOAD 3 = FLA (Full Load Amps) OF THE ELECTRIC HEATER Table 11, p. 35

LOAD 4 = ANY OTHER LOAD RATED AT 1 AMP OR MORE

CRANKCASE HEATERS FOR HEATING MODE ONLY - 208/230 VOLT

- 27.5 - 35 Ton Units, Add 1 Amp
- 40 - 50 Ton Units, Add 2 Amps

460/575 VOLT

- 27.5 - 35 Tons Units, Add 1 Amp
- 40 - 50 Ton Units, Add 1 Amp

Calculation #1 - TC*, YC*-27.5 to 50 Ton Units

MCA = (1.25 x Load 1) + Load 2 + Load 4

MOP = (2.25 x Load 1) + Load 2 + Load 4 (See Note 1)

RDE = (1.5 x Load 1) + Load 2 + Load 4 (See Note 2)

Calculation # 2 - TE*-27.5 to 50 Ton Units

A. Single Source Power (all voltages)

To calculate the correct MCA (Minimum Circuit Ampacity), MOP (Maximum Over current Protection), and RDE (Recommended Dual Element fuse size), two (2) sets of calculations must be performed;

1. Calculate the MCA, MOP and/or RDE values using the above equation as if the unit is operating in the cooling mode.
2. Calculate the MCA, MOP and/or RDE values as if the unit is operating in the heating mode, as follows:

Note: *When determining loads, the compressors and condenser fan motors do not operate during the heating cycle.*

Units with less than 50 KW Heaters

MCA = 1.25 x (Load 1 + Load 2 + Load 4) + (1.25 x Load 3)

Units with 50 KW or Larger Heaters

MCA = 1.25 x (Load 1 + Load 2 + Load 4) + Load 3

The MCA value stamped on the nameplate is the largest of the two calculated values.

MOP = (2.25 x Load 1) + Load 2 + Load 3 + Load 4 (See Note 1)

The MOP value stamped on the nameplate is the largest of the two calculated values.

RDE = (1.5 x Load 1) + Load 2 + Load 3 + Load 4 (See Note 2)

Note: *Select an over current protection device equal to the MOP value. If the calculated MOP value does not equal a standard size protection device listed in NEC 240-6, select the next lower over current protection device. If the calculated MOP value is less than the MCA value, select the lowest over current protection device which is equal to or larger than the MCA, providing the selected over current device does not exceed 800 amps.*

Note: *Select a Dual Element Fuse equal to the RDE value. If the calculated RDE value does not equal a standard dual element fuse size listed in NEC 240-6, select the next higher fuse size. If the calculated RDE value is greater than the MOP value, select a Dual Element fuse equal to the calculated MOP (Maximum Over current Protection) value*

Disconnect Switch Sizing (DSS)

Calculation A. - YC*, TC*, and TE* Units:

DSS = 1.15 X (LOAD1 + LOAD2 + LOAD4)

For TE* units, use calculations A and B.

Calculation B. - TE* Units:

DSS = 1.15 X (LOAD3 + Supply Fan FLA + Exhaust Fan FLA).

Use the larger value of calculations A or B to size the electrical disconnect switch.

Low Voltage Wiring

An overall layout of the various control options available for a Constant Volume application is illustrated in Figure 19, p. 39. Figure 20, p. 40 illustrates the various control options for a Variable Air Volume application. The required number of conductors for each control device are listed in the illustration.

A typical field connection diagram for the sensors and other options are shown in the following section "Remote Panels and Sensors". These diagrams are representative of standard applications and are provided for general reference only. Always refer to the wiring diagram that shipped with the unit for specific electrical schematic and connection information.

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

Control Power Transformer

⚠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 24 volt control power transformers are equipped with internal circuit breakers. They are to be used only with the accessories called out in this manual. If a circuit breaker trips, be sure to turn off all power to the unit before attempting to reset it.

On units equipped with the VFD option, an additional control power transformer is used. The secondary is protected with fuses. Should the fuse blow, be sure to turn off all power to the unit before attempting to replace it.

Field Installed AC Control Wiring

⚠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:
Use Copper Conductors Only!

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

Before installing any connecting wiring, refer to Table 12, p. 37 for conductor sizing guidelines and;

- Use copper conductors unless otherwise specified.
- Ensure that the AC control voltage 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 may cause component failure due to insufficient AC voltage supply.*

- Refer to dimensional information beginning with Figure 1, p. 17 for the electrical access locations provided on the unit.
- Do not run the AC low voltage wiring in the same conduit with the high voltage power supply wiring.

Be sure to check all loads and conductors for grounds, shorts, and miswiring. After correcting any discrepancies, reset the circuit breakers by pressing the black button located on the left side of the transformer.

Table 12. AC Conductors

Distance from unit to control	Recommended wire size
000-460 feet	18 gauge
461-732 feet	16 gauge
733-1000 feet	14 gauge

Field Installed DC Control Wiring

⚠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:

Use Copper Conductors Only!

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

Before installing the connecting wiring between the components utilizing a DC analog output/input signal and the unit, refer to Table 13, p. 38 for conductor sizing guidelines and;

- Use standard copper conductor thermostat wire unless otherwise specified.
- Ensure that the wiring between the controls and the unit's termination point does not exceed two and a half (2-1/2) ohms/conductor for the length of the run.

Note: *Resistance in excess of 21/2 ohms per conductor can cause deviations in the accuracy of the controls.*

- Refer to dimensional drawings beginning with Figure 1, p. 17 for the electrical access locations provided on the unit.
- Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

Table 13. DC Conductors

Distance from unit to control	Recommended wire size
000-150 feet	22 gauge
151-240 feet	20 gauge
241-385 feet	18 gauge
386-610 feet	16 gauge
611-970 feet	14 gauge

Units equipped with the Trane Communication Interface (TCI) option, which utilizes a serial communication link;

- Must be 18 AWG shielded twisted pair cable Belden 8760 or equivalent).
- Must not exceed 5,000 feet maximum for each link.
- Must not pass between buildings.

Figure 19. Typical Field Wiring Requirements for CV Control Options

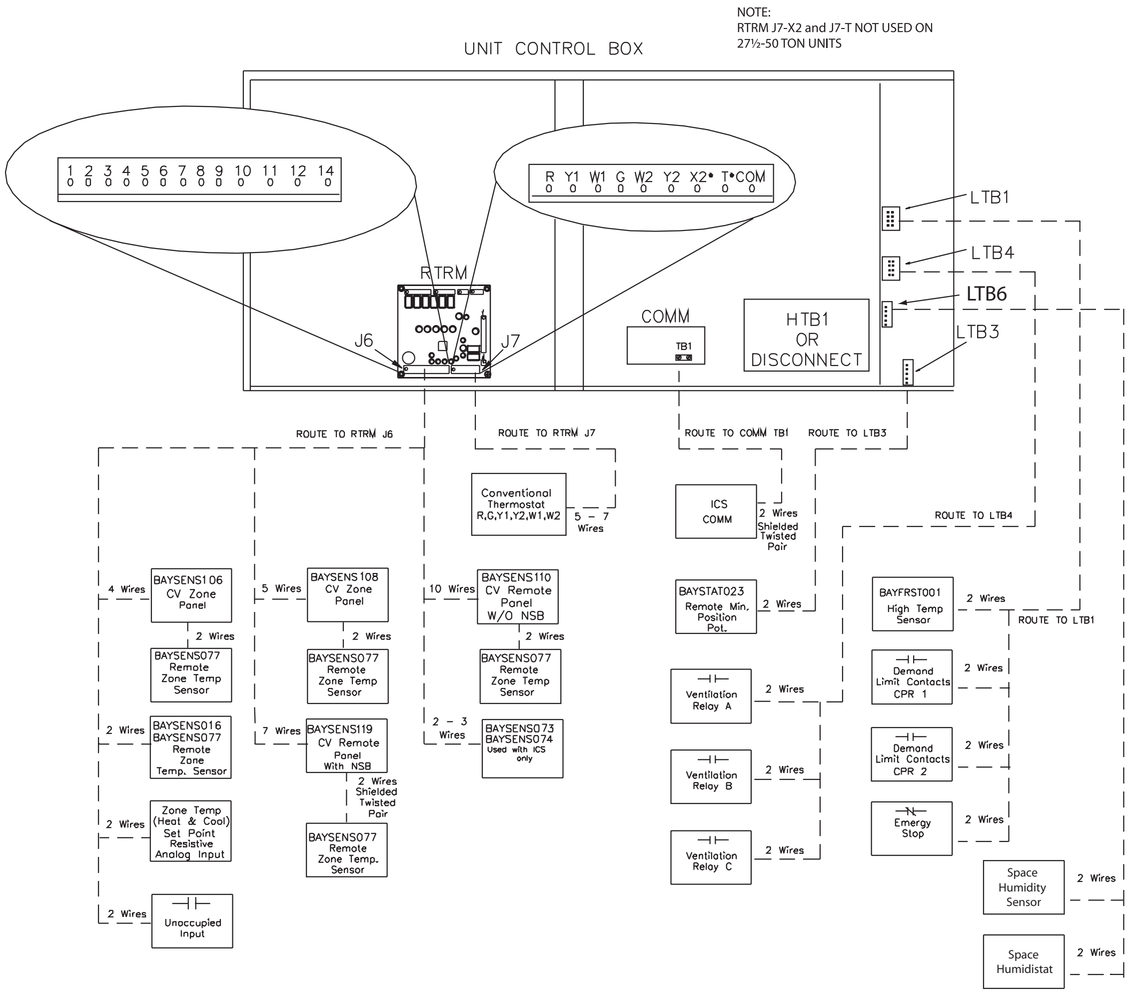
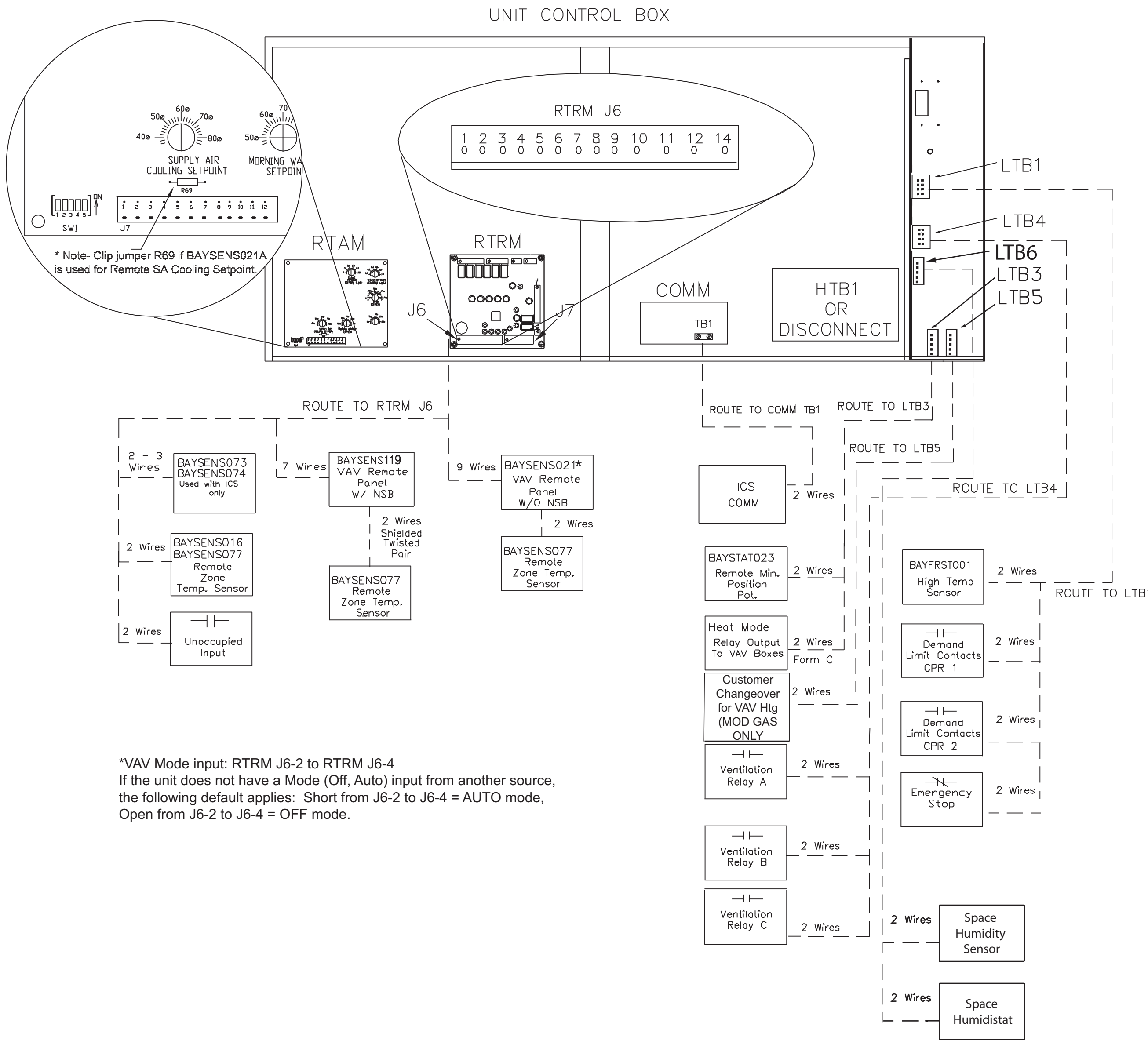
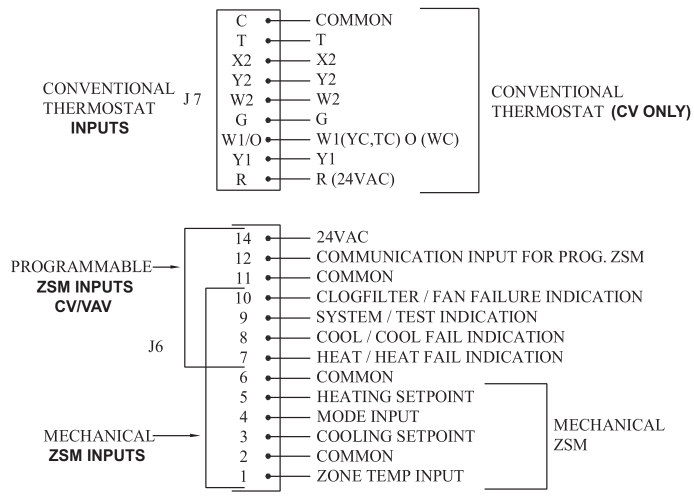


Figure 20. Typical Field Wiring Requirements for VAV Control Options



*VAV Mode input: RTRM J6-2 to RTRM J6-4
If the unit does not have a Mode (Off, Auto) input from another source, the following default applies: Short from J6-2 to J6-4 = AUTO mode, Open from J6-2 to J6-4 = OFF mode.

Figure 21. RTRM Zone Sensor/Thermostat Connections



Remote Panels and Sensors

Constant Volume Control Options

The RTRM must have a zone sensor or conventional thermostat to operate the rooftop unit. If using a zone sensor, mode capability depends upon the type of sensor and/or remote panel selected to interface with the RTRM. The possibilities are: Fan selection ON or AUTO, System selection HEAT, COOL, AUTO, and OFF. Refer to Figure 21 on page 41 for conventional thermostat connections.

The following Constant Volume controls are available from the factory for field installation.

⚠WARNING

Hazardous Voltage!

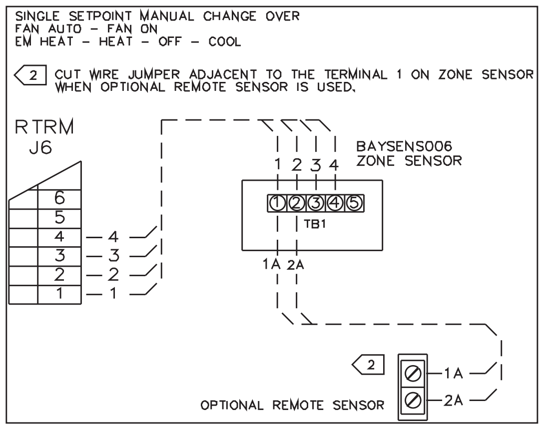
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Zone Panel (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 capability.

Figure 22. Zone Panel (BAYSENS106*)

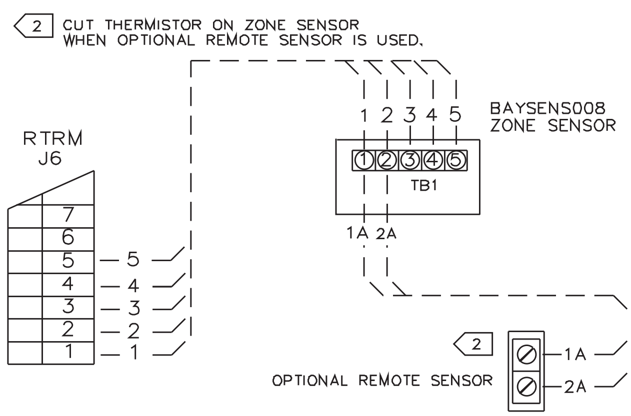
SINGLE SETPOINT MANUAL CHANGE OVER



Zone Panel (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 BAYSENS077*.

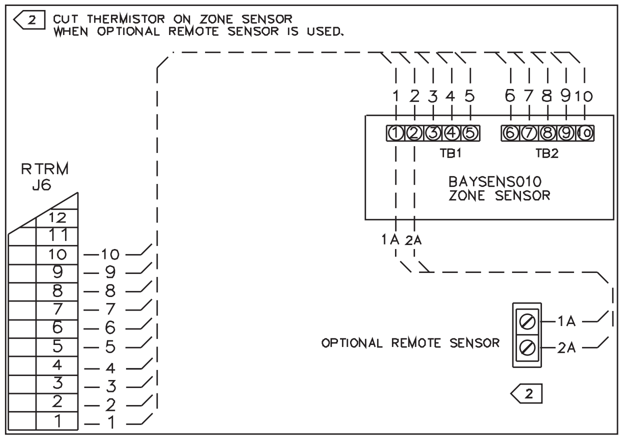
Figure 23. Zone Panel (BAYSENS108*)



Remote Panel W/O NSB (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 LED's. It is a manual or auto changeover control with dual setpoint capability. It can be used with a remote zone temperature sensor BAYSENS077*.

Figure 24. Remote Panel W/O NSB (BAYSENS110*)



Variable Air Volume Control Options

The RTRM must have a mode input in order to operate the rooftop unit. The normal mode selection used with a remote panel with or without night setback, or ICS is AUTO and OFF. Table 9 lists the operating sequence should a CV zone sensor be applied to a VAV system having selectable modes; i.e. Fan selection ON or AUTO. System selection HEAT, COOL, AUTO, and OFF.

Default Mode Input for Discharge Air Control

For unit stand-alone operation without a remote panel or an ICS connected, jumper between terminals J6-2 and J6-4 on RTRM.

VHR Relay Output

For stand alone 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 25. VHR Relay Output

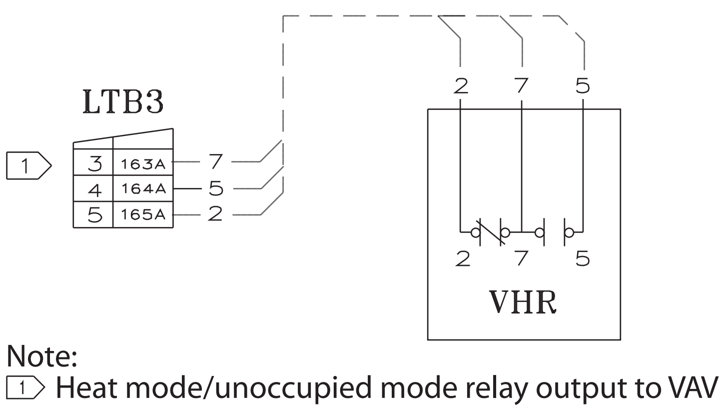


Table 14. Variable Air Volume Mode Operation

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

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

The following Variable Air Volume controls are available from the factory for field installation

Remote Zone Sensor (BAYSENS016*)

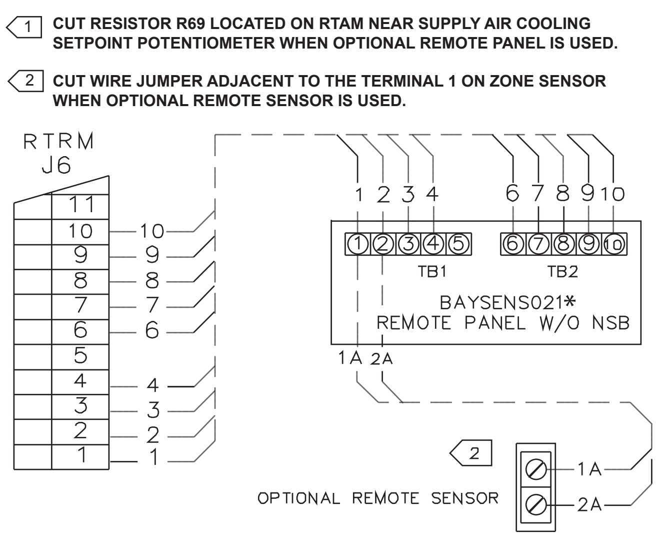
This bullet type temperature sensor can be used for; outside air (ambient) sensing, return air temperature sensing, supply air temperature sensing, remote temperature sensing (uncovered), and for VAV zone reset. Wiring procedures vary according to the particular application and equipment involved. Refer to the unit wiring diagrams, engineering bulletins, and/or any specific instructions for connections. See Table 10 for the Temp vs Resistance coefficient.

Remote Panel W/O NSB (BAYSENS021*)

This electronic sensor features two system switch settings (Auto and Off), four system status LED's with single setpoint capability. It can be used with a remote zone temperature sensor BAYSENS077*.

The following Constant Volume or Variable Air Volume controls are available from the factory for field installation.

Figure 26. Remote Panel W/O NSB (BAYSENS021*)

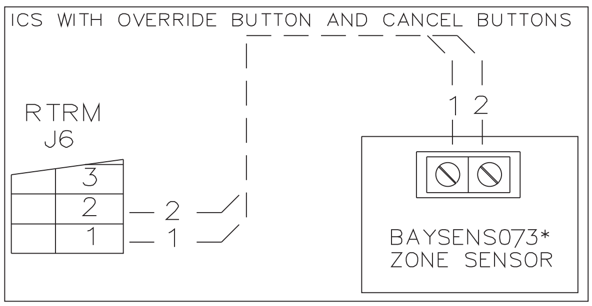


The following Constant Volume or Variable Air Volume controls are available from the factory for field installation.

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^{TM} building management system.

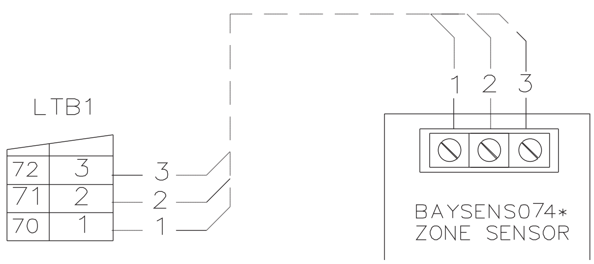
Figure 27. Remote Zone Sensor (BAYSENS073*)



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^{TM} building management system.

Figure 28. Remote Zone Sensor (BAYSENS074*)



Remote Zone Sensor (BAYSENS077*)

This electronic sensor can be used with BAYSENS106*, 108*, 110*, 119*, or 021* 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.

Remote Panel with NSB (BAYSENS119*)

This 7 day programmable sensor features four periods for Occupied\Unoccupied programming per day. Either one or all four periods can be programmed. If the power is interrupted, the program is retained in permanent memory. If power is off longer than 2 hours, only the clock and day may have to be reset.

The front panel allows selection of Occupied/Unoccupied periods with two temperature inputs (Cooling Supply Air Temperature and Heating Warm-up temperature) per occupied period. The occupied supply air cooling setpoint ranges between 40o and 80o Fahrenheit. The warm-up setpoint ranges between 50 and 90 degrees Fahrenheit with a 2 degrees deadband. The Unoccupied cooling setpoint ranges between 45 and 98 degrees Fahrenheit. The unoccupied heating setpoint ranges between 43 and 96 degrees Fahrenheit.

Note: *In modulating gas heat units, the supply air heating setpoint is the active setpoint with a BAYSENS119* and must be set for the heater to function properly. The modulating furnace will not react to the Discharge Heating Setpoint on the NSB.*

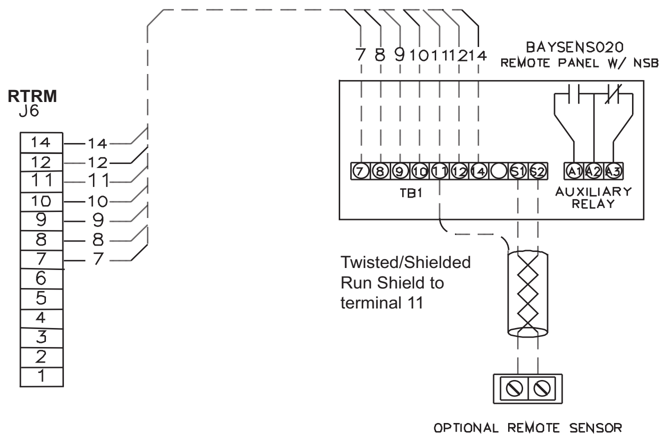
The liquid crystal display (LCD) displays zone temperature, temperature setpoints, week day, time, and operational mode symbols.

The options menu is used to enable or disable these applicable functions:

Morning warm-up, economizer minimum position override during unoccupied status, heat installed, remote zone temperature sensor, 12/24 hour time display, and daytime warm-up. See Table 15 on page 48 for the Temp vs Resistance coefficient if an optional remote sensor is used.

During an occupied period, an auxiliary relay rated for 1.25 amps @ 30 volts AC with one set of single pole double throw contacts is activated.

Figure 29. Remote Sensor with Night Setback BAYSENS119

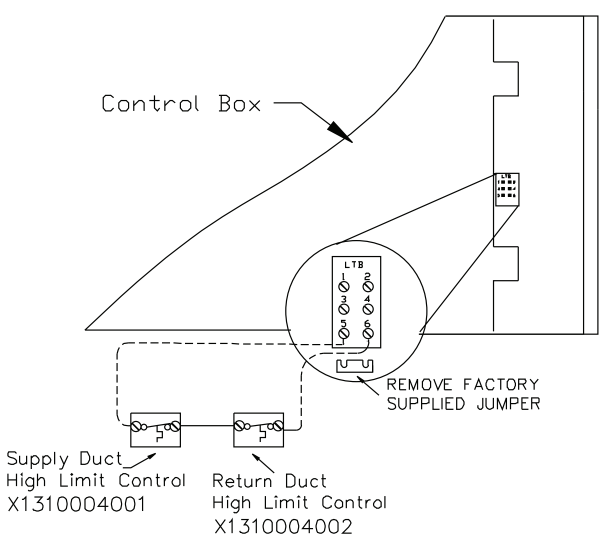


High Temperature Sensor (BAYFRST003*)

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

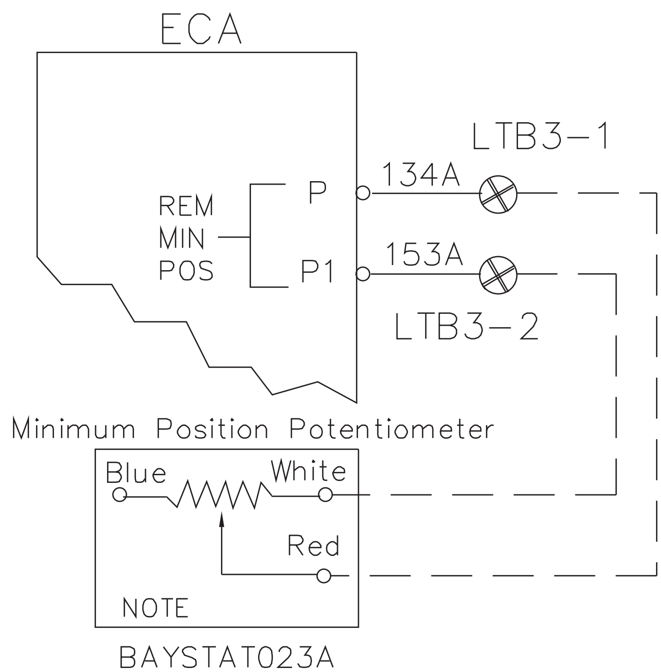
Figure 30. High Temperature Sensor (BAYFRST003*)



Remote Minimum Position Potentiometer (BAYSTAT023*)

This device can be used with units with an economizer. It allows the operator to remotely set the position of the economizer dampers from 0% to 50% of fresh air entering the space.

Figure 31. Remote Minimum Position Potentiometer (BAYSTAT023)



Space Temperature Averaging

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

The fewest number of sensors required to accomplish space temperature averaging is four. Example #1 illustrates two series circuits with two sensors in each circuit wired in parallel. Any number squared, is the number of remote sensors required. Example #2 illustrates three sensors squared in a series/parallel circuit. NSB panel remote sensors must use twisted/shielded cable.

Figure 32. Space Temperature Averaging

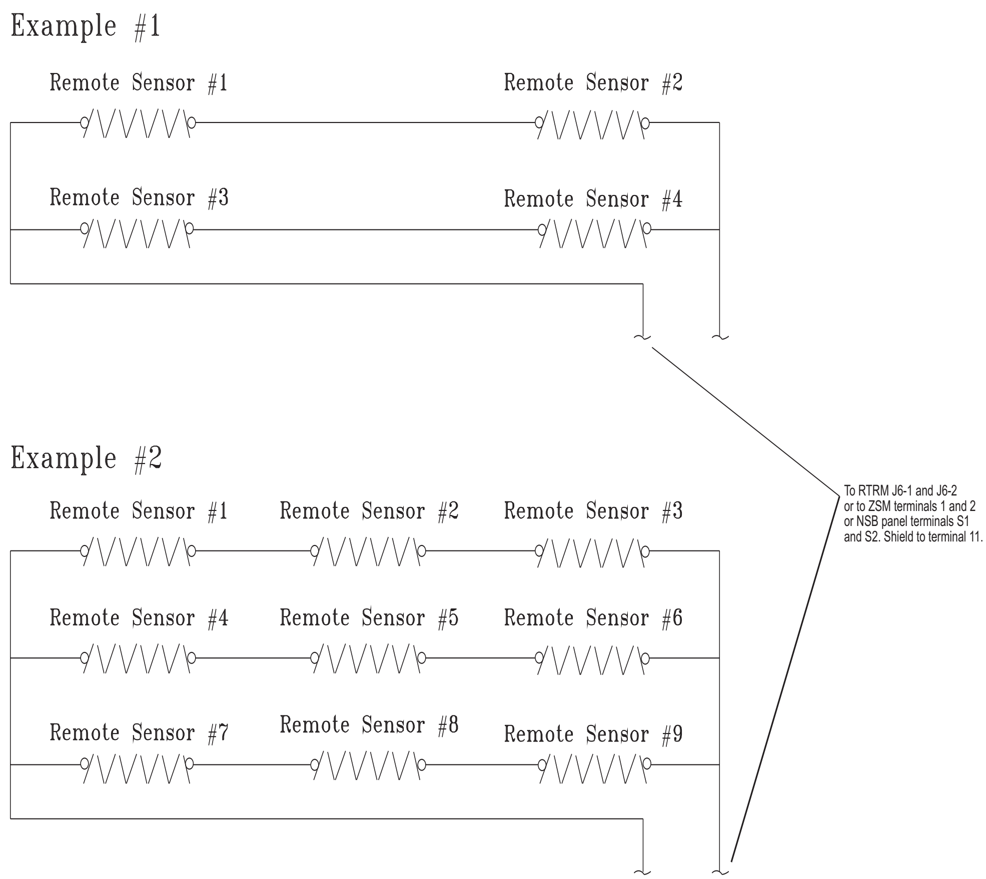


Table 15. Temperature vs. Resistance (temperature vs. resistance coefficient is negative)

Degrees F°	Nominal Resistance
-20°	170.1 K - Ohms
-15°	143.5 K - Ohms
-10°	121.4 K - Ohms
-5°	103.0 K - Ohms
0°	87.56 K - Ohms
5°	74.65 K - Ohms
10°	63.80 K - Ohms
15°	54.66 K - Ohms
20°	46.94 K - Ohms
25°	40.40 K - Ohms
30°	34.85 K - Ohms
35°	30.18 K - Ohms
40°	26.22 K - Ohms
45°	22.85 K - Ohms

Table 15. Temperature vs. Resistance (temperature vs. resistance coefficient is negative)

Degrees F°	Nominal Resistance
50°	19.96 K - Ohms
55°	17.47 K - Ohms
60°	15.33 K - Ohms
65°	13.49 K - Ohms
70°	11.89 K - Ohms
75°	10.50 K - Ohms
80°	9.297 K - Ohms
85°	8.247 K - Ohms
90°	7.330 K - Ohms
95°	6.528 K - Ohms
100°	5.824 K - Ohms

TRANE

Installation Piping

General Requirements

All internal gas piping for YC* rooftop units are factory installed and leak tested. Once the unit is set into place, a gas supply line must be field installed and connected to the gas train located inside the gas heat compartment.

⚠WARNING
Hazardous Gases and Flammable Vapors!

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

Access holes are provided on the unit as shown in Figure 11, p. 23 to accommodate side panel entry. Following the guidelines listed below will enhance both the installation and operation of the furnace.

Note: *In the absence of local codes, the installation must conform with the American National Standard Z223.1a of the National Fuel Gas Code, (latest edition).*

1. To assure sufficient gas pressure at the unit, use Table 16 to determine the appropriate gas pipe size for the heating capacity listed on the unit's nameplate.

   If a gas line already exists, verify that it is sized large enough (Table 16) to handle the additional furnace capacity.
2. Take all branch piping from any main gas line from the top at 90 degrees or side at 45 degrees to prevent moisture from being drawn in with the gas.
3. Ensure that all piping connections are adequately coated with joint sealant and properly tightened. Use a piping compound that is resistant to liquid petroleum gases.
4. Provide a drip leg near the unit.

NOTICE:
Gas Valve Damage!

Failure to use a pressure regulating device will result in incorrect gas pressures. This can cause erratic operation due to gas pressure fluctuations as well as damage to the gas valve.

Oversizing the regulator will cause irregular pulsating flame patterns, burner rumble, potential flame outages, as well as possible gas valve damage.

5. Install a pressure regulator at the unit that is adequate to maintain 6" w.c. for natural gas and 11" w.c. for LP gas while the unit is operating in the "High Heat" mode. A minimum inlet gas pressure of 2.5" w.c. for natural gas and 8" w.c. for LP gas is required while operating in the "High Heat" mode.

Note: *Gas pressure in excess of 14" w.c. or 0.5 psig will damage the gas train.*

⚠WARNING
Hazard of Explosion!

Never use an open flame to detect gas leaks. Explosive conditions may occur. Use a leak test solution or other approved methods for leak testing. Failure to follow recommended safe leak test procedures could result in death or serious injury or equipment or property-only-damage.

6. Leak test the gas supply line using a soap-and-water solution or equivalent before connecting it to the gas train.

7. Pressure test the supply line before connecting it to the unit to prevent possible gas valve damage and the unsafe operating conditions that will result.

   Note: *Do not rely on gas train shutoff valves to isolate the unit while conducting gas pressure/ leak test. These valves are not designed to withstand pressures in excess of 14" w.c. or 0.5 psig.*

Connecting the Gas Supply Line to the Furnace Gas Train

Follow the steps below to complete the installation between the supply gas line and the furnace. Refer to Figure 33, p. 52 for the Gas Train configuration.

1. Connect the supply gas piping using a "ground-joint" type union to the furnace gas train and check for leaks.
2. Provide adequate support for the field installed gas piping to avoid stressing the gas train and controls.
3. Adjust the inlet supply gas pressure to the recommended 6" for natural gas or 11" w.c. for LP gas.

Table 16. Sizing Natural Gas Pipe Mains and Branches

Gas Supply Pipe Run (ft)	Gas Input (Cubic Feet/Hour)*					
	1-1/4" Pipe	1-1/2" Pipe	2" Pipe	2-1/2" Pipe	3" Pipe	4" Pipe
10	1050	1600	3050	4800	8500	17500
20	730	1100	2100	3300	5900	12000
30	590	890	1650	2700	4700	9700
40	500	760	1450	2300	4100	8300
50	440	670	1270	2000	3600	7400
60	400	610	1150	1850	3250	6800
70	370	560	1050	1700	3000	6200
80	350	530	990	1600	2800	5800
90	320	490	930	1500	2600	5400
100	305	460	870	1400	2500	5100
125	275	410	780	1250	2200	4500
150	250	380	710	1130	2000	4100
175	225	350	650	1050	1850	3800
200	210	320	610	980	1700	3500

Notes:
1. If more than one unit is served by the same main gas supply, consider the total gas input (cubic feet/hr.) and the total length when determining the appropriate gas pipe size.
2. Obtain the Specific Gravity and BTU/Cu.Ft. from the gas company.
3. The following example demonstrates the considerations necessary when determining the actual pipe size.

Example: A 40' pipe run is needed to connect a unit with a 500 MBH furnace to a natural gas supply having a rating of 1,000 BTU/Cu.Ft. and a specific gravity of 0.60

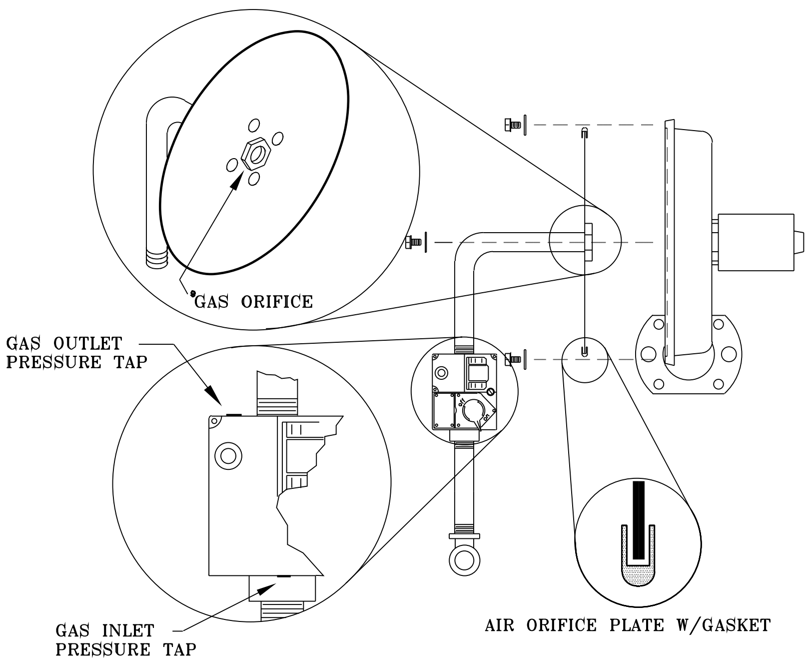
Cu.Ft/Hour = Furnace MBH Input
Gas BTU/Cu.Ft. X Multiplier Table 17, p. 52
Cu.Ft/Hour = 500 Table 16 indicates that a 1-1/4" pipe is required.

*Table is based on a specific gravity of 0.60. Use Table 17, p. 52 or the specific gravity of the local gas supply.

Table 17. Specific Gravity Multiplier

Specific Gravity	Multiplier
0.5	1.1
0.55	1.04
0.6	1
0.65	0.96

Figure 33. Gas Train Configuration for Low Heat Units (high heat units utilize two gas trains.)



Startup

Unit Control Modules

RTRM - ReliaTel Refrigeration Module

The RTRM is the main information receiving module. It interprets the information received from all other unit modules, sensors, remote panels, customer binary contacts and responds by activating the various unit components to satisfy the applicable request for economizing, cooling, heating, exhaust, ventilation.

The RTRM configuration is set through the wire harness to function within one of four system applications:

1. Constant Volume Supply Air with No Heat
2. Constant Volume Supply Air with Gas or Electric Heat.
3. Variable Supply Air Volume with No Heat.
4. Variable Supply Air Volume with Gas or Electric Heat.

ECA - Economizer Actuator (Optional)

The ECA monitors the mixed air temperature, return air temperature, minimum position setpoint (local or remote), ambient dry bulb/enthalpy sensor or comparative humidity (return air humidity against ambient humidity) sensors, if selected, to control the dampers to an accuracy of +/- 5% of the stroke. The actuator is spring returned to the closed position any time power is lost to the unit. It is capable of delivering up to 25 inch pounds of torque and is powered by 24 VAC. Refer to "Cooling with an Economizer" for the proper Potentiometer settings for dry bulb/Enthalpy control.

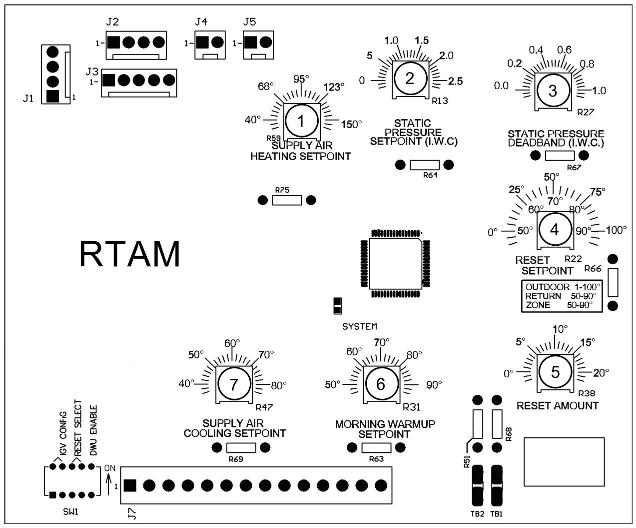
PEA - Power Exhaust Actuator (Optional)

If the unit is ordered with tracking power exhaust, the PEA will track the economizor damper position as long as the exhaust fan setpoint on the RTOM module has been exceeded. The actuator limits the maximum travel of the exhaust barometric damper.

RTAM - ReliaTel Airhandler Module (Standard with VAV)

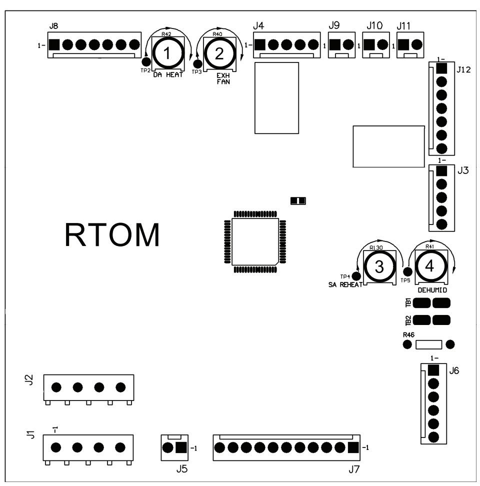
The RTAM receives information from the supply duct static pressure transducer. Attached to the module are the supply air heating potentiometer, supply air cooling setpoint potentiometer, supply pressure setpoint potentiometer, static pressure deadband potentiometer, morning warm-up setpoint potentiometer, reset setpoint potentiometer, and 5 DIP switches. (See Figure 34, p. 54.)

Figure 34. RTAM Module



1 = Supply Air Heating Setpoint
2 = Static Pressure Setpoint (iwc)
3 = Static Pressure Deadband (iwc)
4 = Reset Setpoint
5 = Reset Amount
6 = Morning Warmup Setpoint
7 = Supply Air Cooling Setpoint

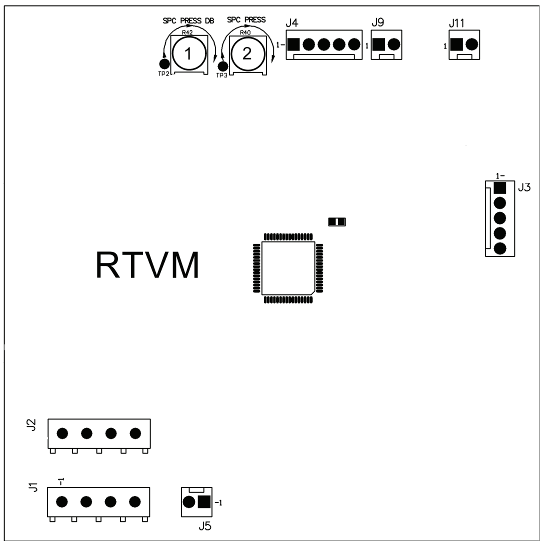
Figure 35. RTOM Module



1 = Discharge Air Heat Setpoint**
2 = Exhaust Fan Enable Setpoint
3 = Supply Air Reheat Setpoint
4 = Dehumidification (%) Setpoint

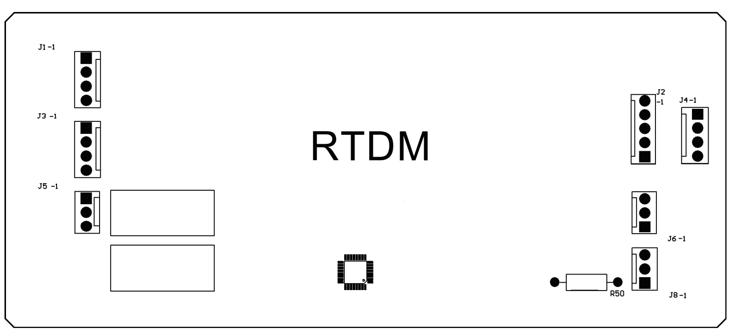
** Discharge Air Heat Setpoint is required for Single Zone VAV operation and Modulating Gas Heat operation with a Thermostat on CV units.

Figure 36. RTVM Module



1 = Space Pressure Deadband (iwc)
2 = Space Pressure Setpoint (iwc)

Figure 37. RTDM Module



The RTAM module provides a 2 to 10 VDC output to control the IGV actuator or Variable Frequency Drive. DIP switches located on the RTAM configures the unit to use the output for IGV's or a VFD. Customer changeover input from Low Voltage Terminal Board (LTB5) activates VAV heating. The Supply Air Heating setpoint must be set to the desired discharge air temperature for heating. This VAV heating mode is available only with modulating gas heat units. In this mode the gas heaters modulate and the supply air pressure control remains active to satisfy the zone settings.

For constant volume (CV) units with modulating gas heat using a conventional thermostat, the Discharge Air SP on the RTOM must be set to desired discharge air temperature in order for the unit to function properly. See Figure 35, p. 54 For VAV units with modulating gas heat, the Supply Air Heating Setpoint on the RTAM is used to control the heat setpoint in the changeover heating mode.

The RTVM (Ventillation Module) provides a 2 to 10 VDC signal to control the Exhaust Blade Actuator in order to relieve positive building pressure. The signal output will be modulated based on the measured values from the Space Pressure Transducer. The Space Pressure Calibration Solenoid will ensure that the RTVM reads a differential pressure between the building pressure and atmospheric pressure. The Space Pressure Setpoint and Space Pressure Deadband are set by adjusting potentiometers located on the RTVM.

The RTDM (Dehumidification Module) provides a pulsed signal output to control the Cooling and Reheat Modulating Valves. The RTDM will also monitor the Entering Evaporator Temperature as well as protect against a low refrigerant pressure in the reheat circuit.

DIP Switches:

Switch 1 is "OFF" for IGV's and "ON" for VFD's.

Switch 2 is "OFF" for VAV, "ON" for VAV without IGV.

Switch 3 and 4 operation are explained under "supply air temperature reset".

Switch 5 is "OFF" for DWU Disabled and "ON" for DWU Enabled.

Conventional Thermostat Connections (Standard with CV)

This feature allows conventional thermostats to be used in conjunction with the RTRM on Constant Volume Applications only. It utilizes the conventional wiring scheme of R, Y1, Y2, W1, W2/X, and G. Refer to Figure 21, p. 41 for conventional thermostat connections. Applicable thermostats to be used with the conventional thermostat inputs are:

Table 18. Thermostats

Vendor	Part #	Trane Part #
Honeywell	T7300	
Honeywell	T874D1082	BAYSTAT011
Enerstat	MS-1N	BAYSTAT003

TCI - 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 a Trane Tracer™ panel. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installation instructions that ship with each kit when field installation is necessary.

LCI - LonTalk® Communication Interface (Optional)

This module is used when the application calls for a LonTalk building management type control system. It allows the control and monitoring of the system through a Trane Tracer Summitt panel or 3rd party LonTalk system. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installation instructions that ship with each kit when field installation is necessary.

BCI - BACnet® Communication Interface (Optional)

This module is used when the application calls for a BACnet building management type control system. It allows the control and monitoring of the system through a Trane Tracer SC panel or 3rd party BACnet system. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installations instructions that ship with each kit when field installation is necessary.

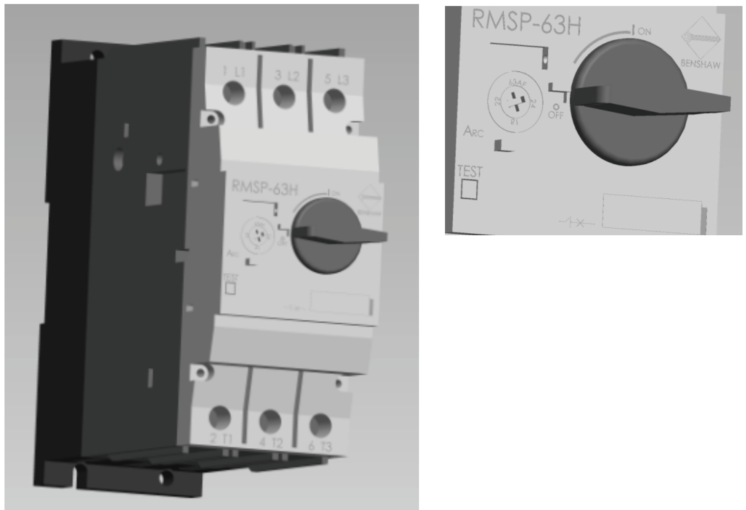
Manual Motor Protectors (380V through 575V Only):

Manual motor protectors will be used as branch circuit protection for compressors and supply fan motors. These devices are capable of providing both overload and short-circuit protection.

Before operating, the manual motor protector must be switched with the rotary on/off switch to the “ON” position and the overload setpoint dial must be set to the appropriate rating of the motor.

Important: *In order to avoid nuisance trips, the overload setpoint dial must be adjusted to the following calculated value: Overload Setting = (Motor FLA) x 1.12*
Overload Setting = (Compressor RLA) x 1.12

Figure 38. Manual Motor Protectors



System Operation

Economizer Operation with a Conventional Thermostat (CV only)

If the ambient conditions are suitable for economizer operation, the economizer is activated as the 1st step of cooling from Y1. The dampers are controlled to provide a supply air temperature of 50° F +/- 5° F. If the economizer is disabled due to ambient conditions, the 1st stage of mechanical cooling is activated.

While economizing, if an additional stage of cooling is activated from Y2, the 1st stage of mechanical cooling is activated. If the economizer is disabled due to ambient conditions, the 2nd stage of mechanical cooling is activated.

The supply fan is activated from the G terminal and will cycle with a call for heat or cooling if in the "Auto" mode. It will run continuously in the "On" mode regardless of any other system demand.

On gas heat units, first and second stages are activated by the W1 and W2 terminals on the CTI. On electric heat units, only two stages of heat are available. If the W2 terminal is activated without activating the W1 terminal, the RTRM will bring on both stages of electric heat.

The Conventional Thermostat connections can also be utilized as a generic building automation system interface for constant volume ICS applications. Due to the limited heating and cooling steps when using a conventional thermostat, compressor staging will vary on units with three compressors.

Note: *If a conventional thermostat is used with a unit that has modulating gas heat, the unit will control to the Discharge Air SP potentiometer on the RTOM when heating with a W1 call only. The unit will go to high fire with W1 + W2.*

Microelectronic Control Features

1. Anti short cycle timer (ASCT) function. Compressor operation is programmed for 3 minutes of minimum “ON” time, and 3 minutes of minimum “OFF” time. Enhances compressor reliability, and ensures proper oil return.

2. Delay between stages timer function. When combined with a standard Zone Sensor Module, the Reliatel Refrigeration Module (RTRM) provides a 10 second minimum “ON” delay for compressor staging.
3. Built in Fan Delay Relay function for Constant Volume Units. When the fan mode switch on the Zone Sensor Module is set in the auto position, the RTRM provides individual supply fan timing sequences for each system in heating and cooling. The RTRM provides different timing sequences for Gas Heat units and Cooling only units.
4. Low ambient cooling to 0° F with Frostat™.
5. Built in electric heat staging, provides a 10 second “ON” delay between resistance heat stages.
6. Compressor cycle rate minimization, extends compressor life expectancy. Minimizes damaging compressor inrush current, and guards against short cycling.
7. Economizer preferred cooling allows fully integrated economizer operation with mechanical cooling if actually needed.

   On constant volume applications, a 3 minute delay allows the RTRM to evaluate the rate of change in the zone. If the zone temperature is dropping faster than acceptable parameters, the compressor(s) will not be allowed to operate.
8. Free night setback allows the unit to enter an unoccupied mode by simply shorting across terminals RTRM J6-11 and J6-12. The short can be achieved by a set of dry contacts or a time clock. Once this short has been made the unit will close the economizer dampers, go from continuous fan to auto fan operation, and:

CV Unit w/Mechanical ZSM

If the unit has a valid cooling and heating setpoint, the setup/setback is a minimum of 7°.

If the unit does not have both setpoints, the setup/setback is 0°.

If the unit has neither setpoint, the unoccupied cooling/heating setpoints will be 74°F/71°F.

This input is ignored if a conventional thermostat is used.

VAV unit w/o ICS or NSB engerizes heating if the space temperature drops to 10° F below the MWU setpoint but not less than 50° F

This option can not be used with programmable ZSM or with an ICSTM system.

9. Low pressure cutouts on all compressors have been added to insure compressor reliability in low refrigerant flow situations. The compressor(s) will lockout after four consecutive low pressure control trips during the compressor minimum 3 minute "on" time. The lockout will have to be manual reset as explained in this document.

Economizer Operation with CV Controls

The control point for the economizer is designed to control at least 1.5° F below the cooling setpoint or 1.5° F above the heating setpoint, whichever produces the highest economizer control setpoint.

Example:

Heating Setpoint = 68°

Cooling Setpoint = 70°

The control temperature for the economizer will be 1.5° above the heating setpoint due to it producing the least amount of offset.

Heating Setpoint = 55°

Cooling Setpoint = 75°

Because of the spread between the heating and cooling setpoints, the control will choose to control the economizer at an offset temperature of 1.5° F below the cooling setpoint. This will be the highest resulting control setpoint temperature while maintaining the least amount of offset.

The percentage that the economizer dampers open is based on two factors:

1. The zone temperature minus the economizer setpoint, and
2. The zone temperature minus the outdoor air temperature.

Note: *Table 19 lists the percentages the dampers will open based on these conditions.*

Table 19. Percent of Damper Travel

Zone - ODT	Zone Temp - Econ Setpoint °F					
	0.0 - 0.5	0.5 - 1.0	1.0 - 2.0	2.0 - 3.0	3.0 - 5.0	> 5.0
0 - 7 F	0%	3%	9%	30%	90%	100%
7 - 14 F	0%	2%	6%	20%	60%	100%
> 14 F	0%	1%	3%	10%	30%	100%

While economizing, if the supply air temperature falls below 50°F, the damper will not be allowed to open any further until the supply air temperature rises above 50°F. If the supply air temperature falls below 45°F, the dampers will be driven to minimum position and held there until the supply air temperature rises above 50°F.

The mechanical cooling is disabled while in an economizing state until two conditions are met;

1. The economizer dampers have been fully open for three minutes, and;
2. The calculated rate of change in the zone temperature is less than 12° F per hour.

If the economizer is disabled due to unsuitable conditions, the economizer is at the selected minimum position when the supply fan is "On", and is closed when the supply fan is "Off". The mechanical cooling will cycle as though the unit had no economizer.

Modulating Power Exhaust

If the unit is equipped with the modulating power exhaust option, the power exhaust actuator will follow the position of the economizer actuator.

Mechanical Cooling without an Economizer (CV only)

Mechanical cooling is used to maintain the zone temperature. The RTRM is designed to limit the compressor cycle rates to within 10 cycles per hour based on the minimum compressor "on" and "off" times.

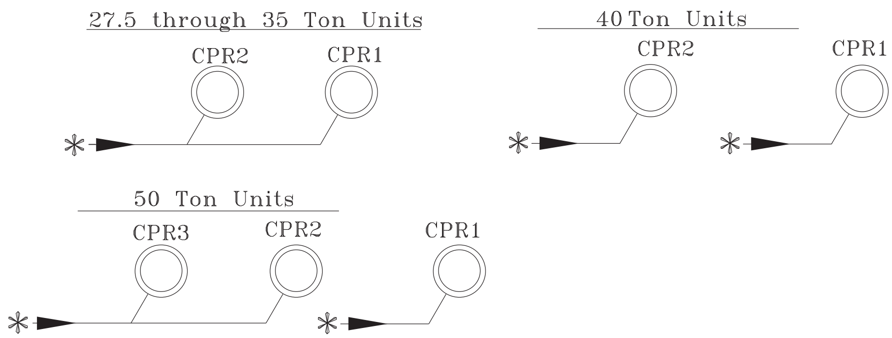
It stages the mechanical cooling to control the zone temperature to within +/- 2° F of the sensor setpoint at the sensed location. Table 20 lists the compressor stepping sequence.

Table 20. Compressor Staging with Lead/Lag Disabled

Unit Model	"ON"			"OFF"		
	Step 1	Step 2	Step 3	Step 3	Step 2	Step 1
27.5 - 35	CPR 1[1]	CPR 1, 2	N/A	N/A	CPR 1, 2	CPR 1[1]
40	CPR 1[2]	CPR 2[3]	CPR 1, 2	CPR 1, 2	CPR 2[3]	CPR 1[2]
50	CPR 1[2]	CPR 2,3[4]	CPR 1, 2, 3	CPR 1, 2, 3	CPR 2, 3[4]	CPR 1[2]

Notes:
1. Single circuit, dual manifolded compressors
2. Number one refrigeration circuit, Standalone compressor, is "On".
3. First stage is off. Number two refrigeration circuit, standalone compressor, is "On"
4. First Stage is "Off", Number two refrigeration circuit, manifolded compressor pair operating simultaneously, is "On".

Figure 39. Compressors



Zone Temperature - Occupied Cooling (CV only)

When the unit is in the cooling mode and the zone temperature raises above the cooling setpoint controlband, the economizer and the compressor stages will be cycled as required by the zone sensor, remote panel, or Tracer®.

Zone Temperature - Occupied Heating (CV only)

When the unit is in the heating mode and the zone temperature falls below the heating setpoint controlband, the necessary stages of heat will cycle to raise the temperature to within the setpoint controlband.

Supply Fan (CV only)

When the Fan Selection Switch is in the "AUTO" position and a call for cooling is initiated, the supply fan will delay starting for approximately one second. When the Fan Selection Switch is in the "ON" position, the supply fan will run continuously. If air flow through the unit is not proven by the differential pressure switch (factory setpoint 0.15 " 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 LED output will pulse. The system will remain locked out until a reset is initiated either manually or through ICS or a mode transition from OFF to a non-OFF mode.

Supply Air Tempering (CV only)

This function allows the supply air temperature to be maintained within a low limit parameter during minimum ventilation periods. When the system is in the "Heating" mode of operation, the low limit parameter is equal to the heating setpoint minus 10 degrees F.

When an economizer is installed, air tempering is allowed with ICSTM when the fan system switch is in the "ON" position with no call for heating. If the supply air temperature falls 10 degrees F below the heating setpoint, the next available stage of heat will be turned on. It will remain on until the supply air temperature reaches 10 degrees above the heating setpoint. A unit with modulating gas heat will activate heat at 10 degrees below the setpoint and modulate to maintain the heating setpoint.

VAV Supply Air Tempering (Only Available with Modulating Gas Heat)

Hot refrigerant gas will be modulated to prevent the Discharge Air Temperature from falling below the Discharge Temperature Deadband. Upon satisfying the Supply Air Tempering requirements a 5 minute SA Tempering Delay timer will start whenever the modulating reheat valve is commanded to 0 and must time out before the unit will be allowed to re-enter "Cool" mode. This timer will be reset to 5 minutes whenever there is an active call for "Supply Air Tempering" demands. Tempering will be discontinued whenever (a) the 5 minute "Supply Air Tempering Delay" timer has timed-out and (b) there is an active cooling request for VAV Occupied Cooling.

Variable Air Volume Applications

Supply Air Temperature Control - Occupied Cooling and Heating

The RTRM is designed to maintain a selectable supply air temperature of 40° F to 90° F with a +/- 3.5° F deadband. In cooling, if supply air temperature is more than 3.5 degrees warmer than the selected temperature, a stage of cooling will be turned "On" (if available). Then if the supply air temperature is more than 3.5 degrees cooler than the selected temperature, a stage of cooling will be turned "Off".

At very low airflows the unit may cycle stages "On" and "Off" to maintain an average discharge air temperature outside the 7 degree deadband.

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

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

Supply Air Temperature Control with an Economizer

The economizer is utilized to control the supply air cooling at +1.5° F around the supply air temperature setpoint range of 40° F and 90° F providing the outside air conditions are suitable.

While economizing, the mechanical cooling is disabled until the economizer dampers have been fully open for three minutes. If the economizer is disabled due to unsuitable conditions, the mechanical cooling will cycle as though the unit had no economizer.

VHR Relay Output

During unoccupied mode, daytime warm-up (DWU) and morning warm-up (MWU) the IGV's or VFD's will open to 100%. All VAV boxes must be opened through an ICS program or by the VHR wired to the VAV boxes. The RTRM will delay 100% fan operation approximately 6.5 minutes when switching from occupied cooling mode to a heating mode.

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

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

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

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

Morning Warm-up (MWU) Control

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

Daytime Warm-up (DWU) Control

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

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

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

If the system control is remote (Tracer™), the DWU setpoint is equal to the Tracer Occupied heating setpoint. The initiation and termination setpoints are selectable setpoints designated by Tracer.

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

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

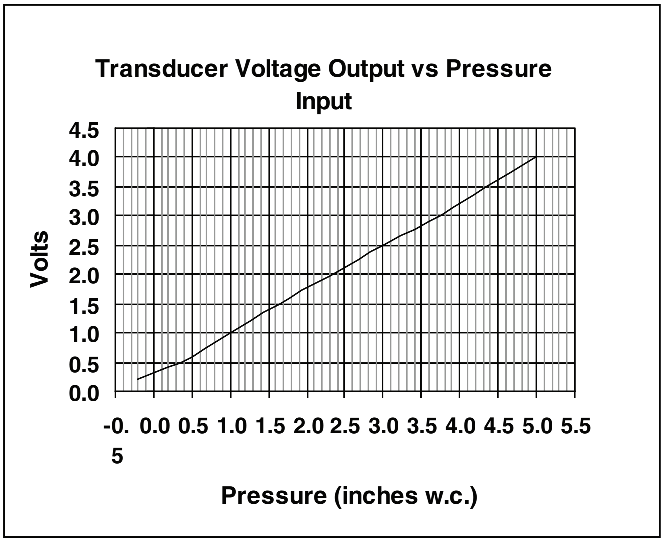
Note: *When a LCI is installed on a VAV unit, the MWU setpoint located on the RTAM board is ignored. The MWU and DWU setpoints come from the higher priority LCI-R DAC.*

Supply Duct Static Pressure Control

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

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 40. Output vs. Input



Supply Air Temperature Reset

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

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

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

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

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

Constant Volume or Variable Air Volume Applications

Off Mode

This mode is set at the zone sensor or by ICS. During this status, no heating, ventilation, or mechanical cooling is being performed. When switching the "System" selector to the "Off" mode from any other mode, any diagnostic data and diagnostic indication signal will be retained as long as the system remains in the "Off" status. Switching the "System" selector from the "Off" mode back to any other mode of operation will reset all diagnostics.

Zone Temperature - Unoccupied Cooling (CV Only)

While a building is in an unoccupied period as designated by a remote panel with night setback, ICS or RTRM J6-11 and J6-12, the necessary stages of cooling will cycle to maintain the zone temperature to within the unoccupied setpoint deadband. If an economizer is enabled, it will modulate in an attempt to maintain the zone temperature to within the setpoint deadband.

Zone Temperature - Unoccupied Heating

While a building is in an unoccupied period as designated by a remote panel with night setback or ICS, the necessary stages of heat will cycle to maintain the zone temperature to within the unoccupied setpoint deadband. For VAV systems, the IGV's or VFD's will operate at 100% during this mode. It will be necessary to drive VAV boxes to their maximum position through ICS programming or the factory provided VHR relay.

Mechanical Cooling with an Economizer

The economizer is utilized to control the zone temperature providing the outside air conditions are suitable. The method used to determine economizer effectiveness, depending on the available data, is described below in descending order of complexity. The most sophisticated method available is always used.

Table 21. Economizer Effectiveness

Method used to determine econmizer effectiveness	Required
Comparative Enthalpy	OAT, OAH, RAT, RAH
Reference Enthalpy	OAT, OAH
Reference Dry Bulb	OAT
Unable to determine effectiveness	OAT data is invalid or unavailable

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

1. Ambient Temperature - controlling the economizing cycle by sensing the outside air dry bulb temperature. Table 22 lists the selectable dry bulb values by potentiometer setting.
2. Reference Enthalpy - controlling the economizer cycle by sensing the outdoor air humidity. Table 22 lists the selectable enthalpy values by potentiometer setting. If the outside air enthalpy value is less than the selected value, the economizer is allowed to operate.

Table 22. Economizer Configuration

Selection	Dry Bulb	Enthalpy Value
A	73°F	27 BTU/LB Air
B	70	25 BTU/LB Air
C	67	23 BTU/LB Air
D	63	22 BTU/LB Air
E	55	19 BTU/LB Air

3. Comparative Enthalpy - By utilizing a humidity sensor and a temperature sensor in both the return air stream and the outdoor air stream, the economizer will be able to establish which conditions are best suited for maintaining the zone temperature, i.e., indoor conditions or outdoor conditions.

Gas Heat Control

The ignition sequence and timing are provided by a separate heat control module. The RTRM only provides the heating outputs to initiate 1st and 2nd stages and control the combustion blower relays. Both stages of the furnace, when initiated after each cycle, will start and operate for one minute then cycle back if only one stage is required. Units with modulating heat capabilites will light on high fire for one minute and then modulate to the appropriate heating rate for the building load present.

When the fan selection switch is in the "AUTO" mode, the fan will be delayed from coming on for approximately 30 seconds after a call for heat has been initiated. The fan will remain on for approximately 90 seconds after the heating setpoint has been satisfied.

Electric Heat Control

The RTRM provides two heating outputs for 1st and 2nd stages with a 10 second delay between each stage. When the fan selection switch is in the "AUTO" mode, the fan will start approximately 1 second before the 1st heater stage is activated. The fan and heater will cycle off after the heating setpoint has been satisfied.

Clogged Filter Option

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. The switch is adjustable and can be set for a particular application. The clogged filter switch is normally open and will automatically close when the pressure differential across the filters falls below the clogged filter setpoint. The RTOM will generate a SERVICE diagnostic that will be sent to the zone sensor or remote panel when the clogged filter switch has been closed for at least 2 minutes during supply fan operation. The system will continue to operate regardless of the status of the clogged filter switch.

Ventilation Override

Note: *Applying 24 volts to one of the three Ventilation Override Inputs manually activates ventilation override. One input is provided to request the Pressurize Mode, the second input the Purge Mode, and the third input the Exhaust Mode.*

When Pressurize is selected, activating Ventilation Override will cause the supply fan to run, the economizer to open to 100%, the exhaust fan to turn (remain) off, the IGV to fully open, or the VFD to run at full speed, and the VAV boxes to fully open.

When Purge is selected, activating Ventilation Override will cause the supply fan to run, the economizer to open to 100%, the exhaust fan to run, the IGV to fully open, or the VFD to run at full speed, and the VAV boxes to fully open.

When Exhaust is selected, activating Ventilation Override will cause the supply fan to turn off, the economizer to close to 0%, the exhaust fan to run, the IGV to close, or the VFD to stop, and the VAV boxes to operate normally.

If more than one mode is requested at the same time, the Pressurize request will have priority followed by Purge. When any Ventilation Override Mode is active, all heating and cooling is turned off. For the case where the unit is required to turn off, the Emergency Stop input is used. The ICS can also initiate any ventilation override mode. Table 23, p. 65 lists the sequence of events within the system for each ventilation mode. Refer to the unit wiring diagram for contact switching and wiring.

Note: *Fresh air tracking will not work with VOM.*

Table 23. Ventilation Override Sequence

Affected Function	Mode and Priority		
	Pressurize	**Purge**	**Exhaust[a]**
	1	2	3
Heat/Cool	off	off	off
IGV/VFD	open/full	open/full	open/full
	speed	speed	speed
Supply Fan	on	on	off
Exhaust Fan	off	on	on
Economizer	open	open	closed
VAV Boxes	forced open	forced open	normal operation

(a) Exhaust mode 3 is not available with the tracking power exhaust option.

Emergency Stop

When this binary input is opened, all outputs are immediately turned off and the system will not be allowed to restart until the binary input is closed for approximately 5 seconds minimum. The shut down is communicated to Tracer™ if applicable and the Heat and Cool LED outputs (RTRM J6-7 and J6-8) will blink at a nominal rate of 1 blink per second.

Phase Monitor

The Phase Monitor is a 3 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

This input incorporates the low pressure cutout of each refrigeration circuit and can be activated by opening a field supplied contact.

If this circuit is open before a compressor(s) is started, neither compressor in that circuit will be allowed to operate.

Anytime this circuit is opened for 5 continuous seconds, the compressor(s) in that circuit are turned off immediately. The compressor(s) 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(s) in that circuit will be locked out, a diagnostic communicated to Tracer, and a manual reset will be required to restart the compressor(s).

The dehumidification option has one reheat low pressure cutout (RLP). The RLP is located on the reheat circuit.

Dehumidification Low Pressure Control

The RLP has been added to insure proper refrigerant management during active modulating hot gas reheat operation.

The RLP will be ignored for the first 10 minutes of compressor run time during active hot gas reheat operation. Anytime this circuit is opened for 5 continuous seconds, the compressor(s) in that circuit are turned off immediately. The compressor(s) will not be allowed to restart for a minimum of 3 minutes. If four consecutive open conditions occur during active dehumidification, the compressor(s) in that circuit will be locked out.

High Pressure Cutout and Temperature Discharge Limit

The high pressure controls and temperature discharge limit are wired in series between the compressor outputs on the RTRM and the compressor contactors. On 27.5, 30, and 35 Ton units, if the high pressure safety switch or temperature discharge limit opens, the RTRM senses a lack of current while calling for cooling and locks both compressors out with an auto reset. On 40 and 50 Ton units, if the high pressure safety or temperature discharge limit opens, the compressor(s) on the affected circuit is locked out. If the compressor output circuit is opened four consecutive times during compressor operation, the RTRM will generate a manual reset lockout.

Power Exhaust Control (Standard)

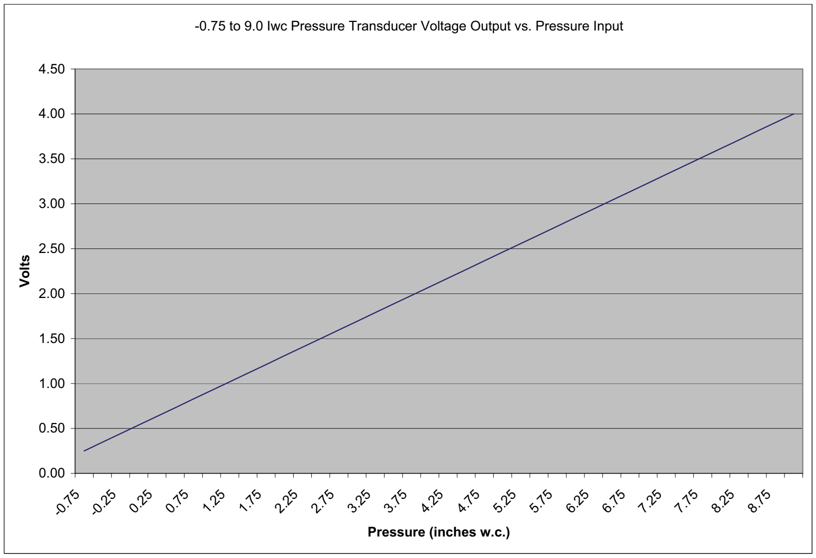
The power exhaust fan is started whenever the position of the economizer dampers meets or exceed the power exhaust setpoint when the supply fan is on.

The setpoint potentiometer is on the RTOM and is factory set at 25%.

Space Pressure Control--Statitrac

A pressure transducer is used to measure and report direct space (building) static pressure. The user-defined control parameters used in this control scheme are Space Pressure Setpoint and Space Pressure Deadband. As the Economizer opens, the building pressure rises and enables the Exhaust Fan. The Exhaust dampers will be modulated to maintain Space Pressure within the Space Pressure Deadband.

Figure 41. Transducer Voltage Output vs. Pressure Input for Supply, Return and Building Pressure



Power Exhaust Control (Tracking)

The power exhaust dampers proportionally track or follow the fresh air (economizer) damper position. The offset between the fresh air and the exhaust damper(s) is adjustable, see figures beginning with “(Downflow) Tracking Exhaust Damper Adjustment” on page 93. Refer to Power Exhaust Fan Performance" tables beginning with Table 42, p. 92

Lead/Lag Control

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 remove the jumper connection J3-8 at the RTRM Lead/Lag input. When it is activated, each time the designated lead compressor(s) 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 compressor.

Table 24. Capacity Steps with Lead/Lag Enabled

Unit Size		Step 1	Step 2	Step 3
TC*330	LEAD	48%	100%	
	LAG	52%	100%	
TC*360	LEAD	50%	100%	
	LAG	50%	100%	
TC*420	LEAD	47%	100%	
	LAG	53%	100%	
TC*480	LEAD	40%	60%	100%
	LAG	60%	100%	
TC*600	LEAD	32%	68%	100%
	LAG	68%	100%	

Coil Frost Protection

The Frostat™ control monitors the suction line temperature to prevent the evaporator from freezing due to low operating temperatures whenever there is a demand for cooling. When a closed circuit has occurred for 5 seconds minimum, the RTRM turns off all of the cooling outputs providing the 3 minute minimum "On" time for the compressor(s) has elapsed. The Supply Fan will be held "On" until the Frostat has been open for 5 continuous seconds or for 60 seconds after the last compressor was shut "Off", whichever is the longest. The compressor shutdown is communicated to Tracer, if applicable. There is no local diagnostic for this condition.

Dehumidification Frost Protection

Two control schemes will be active on units configured for Dehumidification. The first employs the use of the Frostat function. The second scheme takes precedence over Frostat. Operation will be as described below.

The second scheme is only in control during active dehumidification and includes the use of an Entering Evaporator Temperature sensor (EET). If the EET drops below 35°F for 10 continuous minutes compressors will stage off. For dual circuit units one circuit will be staged off. For single circuit units one compressor will be staged off. The compressors which have been staged off will not be energized until the unit leaves the current dehumidification cycle or a dehumidification purge is initiated.

VFD Programming Parameters

See System Troubleshooting section.

Condenser Fan Sequencing Control

The condenser fans are cycled according to the outdoor air temperature and the number of cooling steps that are operating. Table 25, p. 68 lists the temperatures at which the A and B Condenser Fan Outputs on the RTRM switches the fans "Off". The fans are switched back "ON" when the outdoor temperature rises approximately 5° F above the "Off" temperature.

Figure 42, p. 69 shows the condenser fans as viewed from the top of the unit facing the control panel. Whenever a condenser fan is cycled back "On", the condenser fan Outputs A and B and the compressor steps are de-energized for approximately seven seconds to prevent problems with fan windmill.

Table 25. Condenser Fan/Compressor Sequence

Unit Size	Compressor Staging Sequence			Condenser Fan Output		O/A Temp. (°F)
(Tons)	Step 1	Step2	Step 3	Output A	Output B	Fans "Off"
27.5 - 30	CPR 1*			Fan #2		70
					Fan #3	90
		CPR 1, 2	N/A	Fan #2		-10
					Fan #3	60
35	CPR 1*			Fan #2		65
					Fan #3	85
		CPR 1, 2	N/A	Fan #2		-20
					Fan #3	55

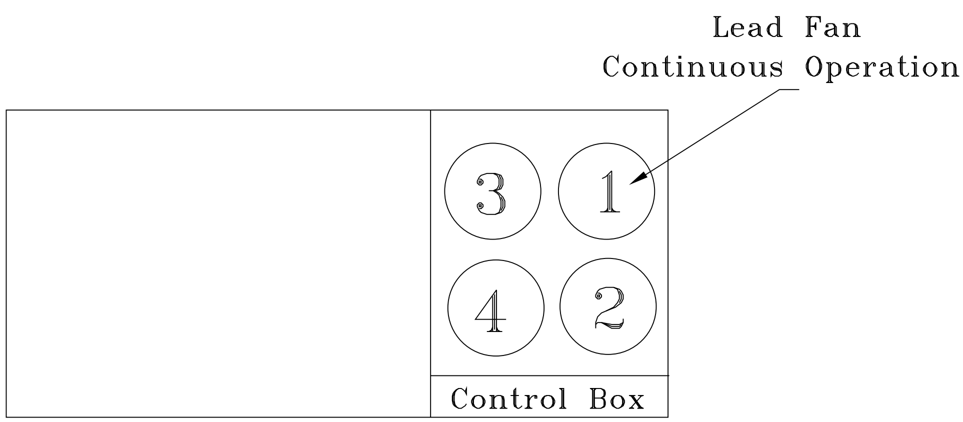
Table 25. Condenser Fan/Compressor Sequence

Unit Size	Compressor Staging Sequence			Condenser Fan Output		O/A Temp. (°F)
(Tons)	Step 1	Step2	Step 3	Output A	Output B	Fans "Off"
				Fan #2	Fan #3, 4	50
						70
	CPR 1 **			Fan #2	Fan #3, 4	20
40		CPR 2***				60
			CPR 1, 2	Fan #2	Fan #3, 4	-30
						50
				Fan #2	Fan #3, 4	20
						60
	CPR 1**			Fan #2	Fan #3, 4	-10
50		CPR 2, 3****				55
			CPR 1, 2, 3	Fan #2	Fan #3, 4	-30
						50

Notes:
1. The Compressor(s) listed under each step are the operating compressors. On 27.5 to 35 Ton units with Lead/Lag, CPR1 will alternate but the fan sequence will remain the same. On 40 & 50 Ton units with Lead/Lag, the compressor(s) in step 2 & 3 will alternate and the fan sequence listed for that step will be in operation.
2. Conventional thermostat sequence: Y1=CPR1, Y2=CPR2 (40 CPR 2 & 50 CPR 2,3), Y1 + Y2 = CPR1,2 (40 CPR 1,2 & 50 CPR 1,2,3)
   3. During active dehumidification all compressors will be staged "On".
3. During active dehumidification all compressors will be staged "On".
   For units equipped with four condenser fans (40 and 50 Ton), the condenser fan output states will be controlled based on the O/A temperature. If O/A is above 85°F, all condenser fan outputs will be energized. If O/A falls below 80°F, Output B will de-energize and will not re-energize again until the O/A rises above 85°F.
   For units configured with three condenser fans (27.5 to 35 Ton), a maximum of two condenser fans will energize. Output A will energize above 85°F and de-energize when the O/A falls below 80°F; Output B will remain de-energized during active dehumidification. If O/A falls below 80°F, Output A will de-energize and will not re-energize again until O/A rises above 85°F

* Single circuit, manifolded compressors pair.
** First Stage, Number one refrigeration circuit, Standalone compressor is "On".
*** First Stage is "Off", Number two refrigeration circuit, standalone compressor is "On"
****First stage is "Off", Number two refrigeration circuit, manifolded compressor pair is "On" operating simultaneously

Figure 42. Condenser Fan Location



Be sure to complete all of the procedures described in this section before starting the unit for the first time.

Preparing the Unit for Operation

Use the checklist provided below in conjunction with the "Installation Checklist" 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.
- Check the compressor crankcase oil level. Oil should be visible in the compressor oil sight glass. The oil level may be above the sight glass prior to the initial start. Use appropriate lighting (flashlight) to verify the presence of oil.
- Prior to unit startup allow the crankcase heater to operate a minimum of 8 hours to remove liquid refrigerant from the compressor sump.
- Optional Service Valves - Verify that the discharge service valve, suction service valve, and liquid line service valve is fully open on each circuit.
- 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.
- Inspect the interior of the unit for tools and debris and install all panels in preparation for starting the unit.

Electrical Phasing

Unlike traditional reciprocating compressors, scroll compressors are phase sensitive. Proper phasing of the electrical supply to the unit is critical for proper operation and reliability.

The compressor motor is internally connected for clockwise rotation with the incoming power supply 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 Ideal - Sperry 61-520 Phase Sequence Indicator and following the steps below:

- Open the disconnect switch or circuit protector switch that provides the supply power to the unit's power terminal block or to the unit mounted disconnect switch.

⚠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.

- To be consistent with the compressor leads, connect the phase sequence indicator leads to the terminal block or unit mounted disconnect switch as follows;

Table 26. Phase Sequence Leads

Phase Sequence Leads	Unit Power Terminal
Red (phase A)	L1
Blue (phase B)	L2
Black (Phase C)	L3

- Turn the "System" selection switch to the "Off" position and the "Fan" selection switch (if Applicable) to the "Auto" position.
- Close the disconnect switch or circuit protector switch that provides the supply power to the unit's power terminal block or unit mounted disconnect switch.

⚠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.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK HTB1 OR UNIT DISCONNECT SWITCH.

- 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 main electrical power and recheck phasing. If the phasing is correct, open the disconnect switch or circuit protection switch and remove the phase sequence indicator.

Voltage Supply and Voltage Imbalance

Supply Voltage

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.

Voltage Imbalance

Excessive voltage imbalance between phases in a three phase system 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 = where;

$$\frac{(AV - VD)}{AV} \times 100$$

AV (Average Voltage) =

$$\frac{Volt1 + Volt2 + Volt3}{3}$$

Volt 1, Volt 2, Volt 3 = 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:

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

VD (reading farthest from average) = 221

The percentage of Imbalance equals:

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

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 at the job site is over 2%, notify the proper agencies to correct the voltage problem to within 2.0% before operating this equipment.

Starting the Unit

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

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

⚠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.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK HTB1 OR UNIT DISCONNECT SWITCH.

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 LED located on the RTRM module is turned "On" within one second of power-up if internal operation is okay. The economizer dampers are driven open for 5 seconds then fully closed (if applicable).

When an economizer is installed DO NOT ENTER the TEST mode until all calibration startup functions have been completed. Otherwise, the economizer actuator and power exhaust output may not function properly during any of the test mode steps. Allow 2 minutes after unit power up to complete economizer calibration before entering the test mode function.

Use 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 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 LED will glow continuously and the unit will revert to the "System" control, i.e. zone temperature for constant volume units or discharge air temperature for variable air volume units.

Test Modes

There are three methods in which the "Test" mode can be cycled at LTB1-Test 1 and LTB1-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 startup of either a Constant Volume or Variable Air Volume 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 startup 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 startup 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 Constant Volume or Variable Air Volume test steps, test modes, and step resistance values to cycle the various components, refer to Table 28, p. 74.

Service Test Switch Location

A toggle service switch has been offered as a standard option to provide hassle free startup option for the service person in the field. This toggle switch is located under the control panel behind the front cover.

Table 27. Service Test Switch

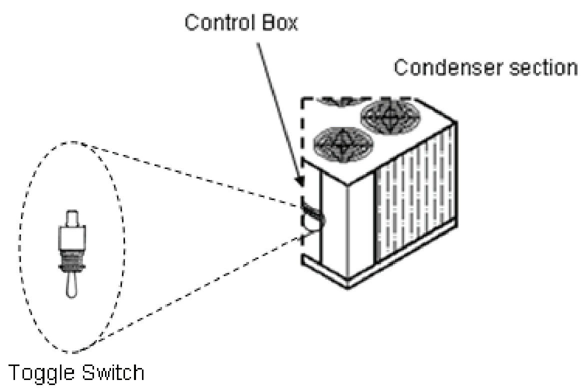


Table 28. Test Mode States for VAV Units with Modulating Dehumidification

TEST STEP	MODE	IGV	FAN	ECON	COMP 1	COMP 2	HEAT 1	HEAT 2	Pumpout	Cool Valve	Reheat Valve
1	IGV TEST OPEN	OPEN	OFF	CLOSED	OFF	OFF	OFF	OFF	ON	100%	0%
2	IGV TEST CLOSED	CLOSED	OFF	CLOSED	OFF	OFF	OFF	OFF	ON	100%	0%
3	MIN VENT	IN CONTROL	ON	MIN	OFF	OFF	OFF	OFF	ON	100%	0%
4	ECON TEST OPEN	IN CONTROL	ON	OPEN	OFF	OFF	OFF	OFF	ON	100%	0%
5	COOL STAGE 1	IN CONTROL	ON	MIN	ON	OFF	OFF	OFF	ON	100%	0%
6	COOL STAGE 2	IN CONTROL	ON	MIN	OFF	ON ,	OFF	OFF	ON	100%	0%
7	COOL STAGE 3	IN CONTROL	ON	MIN	ON	ON	OFF	OFF	ON	100%	0%
8	REHEAT	IN CONTROL	ON	MIN	ON	ON	OFF	OFF	OFF	50%	50%
9	HEAT STAGE 1	OPEN	ON	CLOSED	OFF	OFF	ON	OFF	ON	100%	0%
10	HEAT STAGE 2	OPEN	ON	CLOSED	OFF	OFF	ON	ON	ON	100%	0%
11	RESET										

Table 29. Test Mode States for CV Units with Modulating Dehumidification

TEST STEP	MODE	FAN	ECON	COMP 1	COMP 2	HEAT 1	HEAT 2	Pumpout	Cool Valve	Reheat Valve
1	MIN VENT	ON	MIN	OFF	OFF	OFF	OFF	ON	100%	0%
2	ECON TEST OPEN	ON	OPEN3	OFF	OFF	OFF	OFF	ON	100%	0%
3	COOL STAGE 1	ON	MIN	ON1	OFF	OFF	OFF	ON	100%	0%
4	COOL STAGE 2	ON	MIN	OFF	ON1	OFF	OFF	ON	100%	0%
5	COOL STAGE 3	ON	MIN	ON1, 2	ON1, 2	OFF	OFF	ON	100%	0%
6	REHEAT	ON	MIN	ON1	ON1	OFF	OFF	OFF	50%	50%
7	HEAT STAGE 1	ON	MIN	OFF	OFF	ON	OFF	ON	100%	0%
8	HEAT STAGE 2	ON	MIN	OFF	OFF	ON	ON	ON	100%	0%
9	RESET									

Verifying Proper Fan Rotation

Using the Service Test guide in Table 28, momentarily jump across the test terminals one time for constant volume applications, or three consecutive times for a variable air volume application, to start the Minimum Ventilation Test.

⚠WARNING
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 death or serious injury.

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

The economizer will drive to the minimum position setpoint, exhaust fans may start at random, IGV's will be controlled by discharge pressure (if applicable), and the supply fan will start.

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

If the fan is rotating backwards, open the main power disconnect switch upstream of the unit terminal block or the unit factory mounted disconnect switch.

⚠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.

Interchange any two of the field connected power wires at the unit terminal block or factory mounted disconnect switch.

Note: *Interchanging "Load" side power wires at the supply fan contactor will only affect the Fan Rotation. Ensure that the voltage phase sequence at the main unit terminal block or the unit mounted disconnect switch is ABC as outlined in the "Electrical Phasing" section.*

Verifying Proper Air Flow (CFM)

(CV, IGV's or VFD's)

1. All systems - Set the minimum position setting for the economizer to 0o degrees using the setpoint potentiometer located on the Economizer Actuator in the return section with the supply fan "On" and rotating in the proper direction:

   CV applications - Measure the amperage at the supply fan contactor and compare it with the full load amp (FLA) rating stamped on the motor nameplate.

   IGV's - With the O/A dampers fully closed, measure the amperage at the supply fan contactor and compare it with the full load amp (FLA) rating stamped on the motor nameplate.

   VFD's - With the O/A dampers fully closed, read the amperage displayed on the VFD screen and compare it to the motor nameplate.

Note: *On VAV applications, IGV's will be under control of the Discharge Static Pressure setpoint for the first six minutes of this test mode. Verify that the IGV's have been driven to the full open position or the VFD output is at 60 Hz before measuring the fan motor amps.*

   If the actual amperage exceeds the nameplate value, static pressure is less than design and air flow is too high. If the actual amperage is below the nameplate value, static pressure is greater than design and air flow is too low.

2. To determine the actual CFM (within + 5%), plot the fan's operating RPM and the Theoretical BHP onto the appropriate Fan Performance Curve in Figure 43, p. 78 and Figure 44, p. 78.

Theoretical BHP Formula:

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

Where the two points intersect, read straight down to the CFM line. Use Table 38, p. 87 to select a new fan drive if the CFM is not within specifications.

Table 30. Supply Fan Performance—27½-35 Ton—60 Hz

CFM Std. Air	Total Static Pressure (in. wg)1																	
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	308	1.17	372	1.62	427	2.09	475	2.55	525	3.11	574	3.75	620	4.42	661	5.09	701	5.77
8500	317	1.33	381	1.82	436	2.33	480	2.77	528	3.34	574	3.97	620	4.66	662	5.36	702	6.08
9000	326	1.51	391	2.04	443	2.55	489	3.08	532	3.58	577	4.22	620	4.91	663	5.64	703	6.40
9500	337	1.72	401	2.28	451	2.80	498	3.39	537	3.87	580	4.50	621	5.18	663	5.93	703	6.70
10000	349	1.96	411	2.54	459	3.09	506	3.69	545	4.25	584	4.81	624	5.48	664	6.23	703	7.02
10500	363	2.22	421	2.82	468	3.40	513	3.98	555	4.65	589	5.17	628	5.84	666	6.56	703	7.34
11000	376	2.52	430	3.11	479	3.74	521	4.33	563	5.03	598	5.63	633	6.22	670	6.95	706	7.73
11500	390	2.83	438	3.41	489	4.10	530	4.72	570	5.38	607	6.11	639	6.68	674	7.37	709	8.14
12000	404	3.18	447	3.74	499	4.48	538	5.13	578	5.79	615	6.56	648	7.22	679	7.83	713	8.59
12500	417	3.55	457	4.10	509	4.88	549	5.58	586	6.24	623	7.00	657	7.78	687	8.42	718	9.10
13000	431	3.95	468	4.50	518	5.30	559	6.04	594	6.73	630	7.45	665	8.30	696	9.04	724	9.69
13500	445	4.39	479	4.92	526	5.73	569	6.53	604	7.26	638	7.98	673	8.82	705	9.68	733	10.38
14000	459	4.85	490	5.39	535	6.19	579	7.04	614	7.81	647	8.56	680	9.35	713	10.26	742	11.09
14500	473	5.35	503	5.90	544	6.68	588	7.59	624	8.40	656	9.18	688	9.96	720	10.86	751	11.78

CFM Std. Air	Total Static Pressure (in. wg)1					
	2.50		2.75		3.00	
	RPM	BHP	RPM	BHP	RPM	BHP
8000	738	6.48	773	7.18	805	7.88
8500	739	6.82	774	7.54	807	8.28
9000	740	7.16	775	7.92	809	8.70
9500	740	7.48	776	8.30	810	9.12
10000	742	7.86	777	8.68	812	9.54
10500	742	8.20	777	9.05	812	9.94
11000	741	8.56	777	9.43	812	10.35
11500	743	8.95	777	9.83	812	10.78
12000	747	9.43	780	10.30	812	11.21
12500	750	9.90	783	10.79	814	11.70
13000	755	10.45	786	11.30	817	12.22
13500	760	11.04	790	11.88	821	12.81
14000	768	11.79	795	12.52	824	13.39
14500	778	12.59	803	13.30	829	14.10

Notes:
1. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops, (evaporator coil, filters, optional economizer, optional heating system, optional roof curb).
2. The pressure drop from the supply fan to the space cannot exceed 2.25”.
3. Maximum air flow for 27½ ton — 12,100 cfm, 30 ton — 13,200 cfm, 35 ton — 14,400 cfm.
4. Maximum motor horsepower for 27½ ton — 10 hp, 30 ton — 10 hp, 35 ton — 15 hp.

Table 31. Supply Fan Performance—40 and 50 Ton—60 Hz

CFM Std. Air	Total Static Pressure (in. wg)[1]																	
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	307	2.29	353	2.86	394	3.45	436	4.11	471	4.75	509	5.43	543	6.14	575	6.89	606	7.63
13000	324	2.79	368	3.40	407	4.06	446	4.73	482	5.43	515	6.13	550	6.87	582	7.65	612	8.44
14000	341	3.35	384	4.03	422	4.74	457	5.42	494	6.19	525	6.93	556	7.69	589	8.49	619	9.32
15000	359	3.99	401	4.77	437	5.48	471	6.24	504	6.99	537	7.82	566	8.62	595	9.42	625	10.27
16000	376	4.72	418	5.60	452	6.32	485	7.14	515	7.92	548	8.77	578	9.65	604	10.49	632	11.36
17000	394	5.53	434	6.50	468	7.26	500	8.12	529	8.97	558	9.79	589	10.73	616	11.65	641	12.54
18000	413	6.42	451	7.48	485	8.34	515	9.18	544	10.11	571	10.99	598	11.89	628	12.88	654	13.87
19000	431	7.42	469	8.55	501	9.53	530	10.37	559	11.34	585	12.29	611	13.22	637	14.17	665	15.24
20000	449	8.52	486	9.72	518	10.83	547	11.69	573	12.66	600	13.69	625	14.70	648	15.64	675	16.71

CFM Std. Air	Total Static Pressure (in. wg)[1]									
	2.50		2.75		3.00		3.25		3.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	640	8.45	670	9.25	700	10.03	727	10.81	755	11.61
13000	640	9.23	671	10.12	701	10.98	729	11.85	756	12.69
14000	647	10.16	674	11.04	700	11.89	729	12.85	757	13.79
15000	653	11.14	680	12.05	706	12.97	731	13.89	757	14.86
16000	659	12.23	687	13.16	713	14.14	738	15.10	762	16.10
17000	666	13.45	694	14.42	719	15.37	744	16.39	768	17.39
18000	677	14.81	700	15.76	726	16.78	751	17.77	774	18.81
19000	690	16.29	711	17.27	734	18.29	758	19.34	782	20.41
20000	701	17.83	724	18.91	745	19.94	765	20.99	788	22.12

Notes:
1. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops, (evaporator coil, filters, optional economizer, optional heating system, optional roof curb).
2. The pressure drop from the supply fan to the space cannot exceed 2.50".
3. Maximum air flow for 40 ton — 17,600 cfm, 50 ton — 20,000 cfm.
4. Maximum motor horsepower for 40 ton — 15 hp, 50 ton — 20 hp.

Figure 43. Supply Fan Performance Curves 27.5 - 35 Ton—60Hz

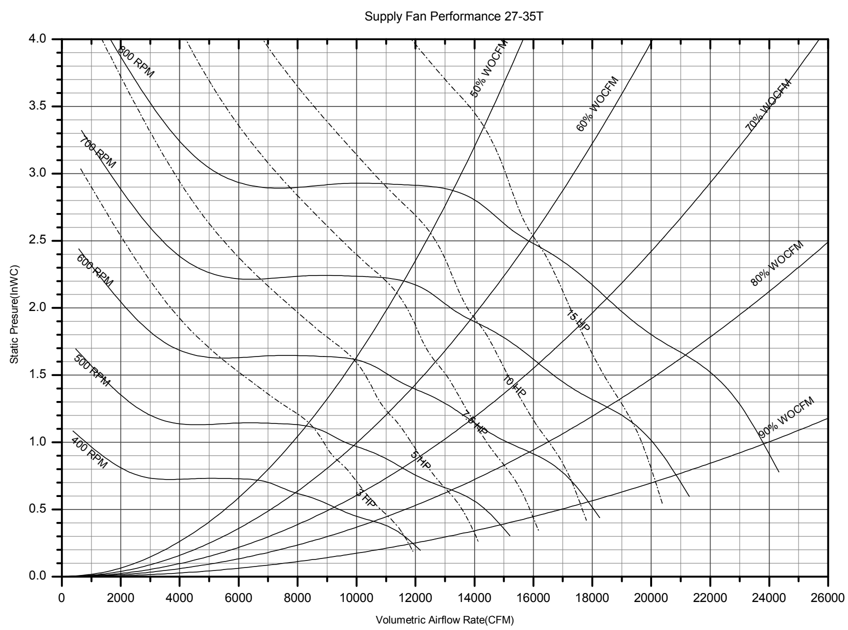


Figure 44. Supply Fan Performance Curves 40 and 50 Ton—60Hz

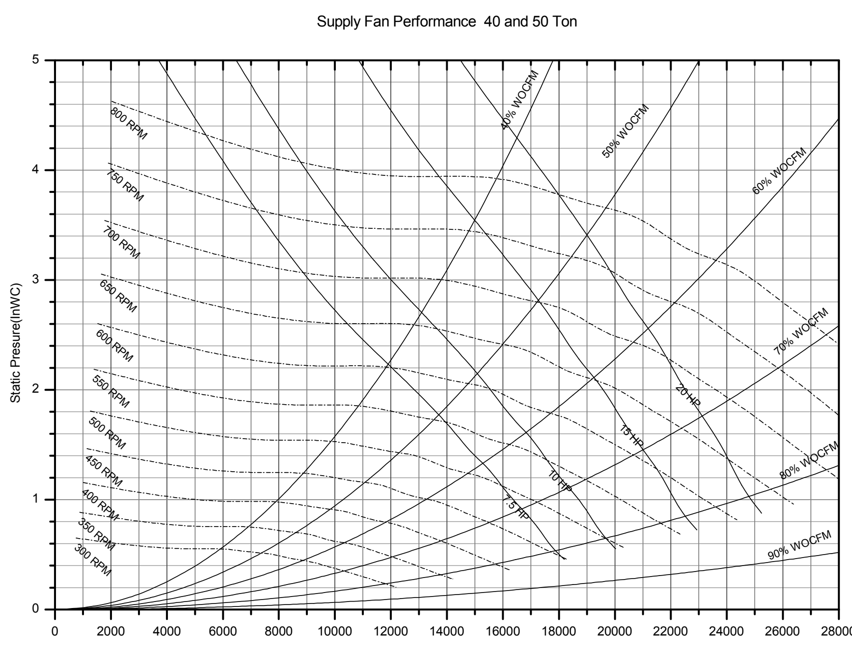


Table 32. Supply Fan Performance—22.9-29.1 Ton (I-P)—50 Hz

SCFM	Static Pressure (in. wg)																	
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6670	283	0.80	351	1.18	410	1.58	469	2.08	524	2.63	573	3.20	617	3.78	659	4.37	696	4.96
7085	291	0.90	358	1.31	413	1.70	469	2.21	524	2.78	574	3.37	619	3.98	660	4.59	698	5.22
7500	299	1.02	364	1.43	418	1.86	472	2.35	524	2.92	574	3.55	619	4.18	661	4.82	699	5.46
7915	306	1.14	371	1.58	425	2.05	475	2.51	524	3.08	574	3.72	620	4.38	661	5.04	701	5.73
8330	313	1.27	378	1.75	433	2.25	478	2.69	527	3.26	574	3.89	620	4.58	662	5.27	702	5.99
8745	321	1.42	386	1.93	439	2.43	484	2.92	530	3.45	574	4.08	620	4.79	663	5.51	702	6.24
9160	330	1.58	394	2.12	445	2.62	492	3.18	533	3.67	577	4.30	620	4.99	664	5.74	703	6.50
9575	339	1.76	403	2.32	452	2.84	499	3.44	538	3.93	580	4.53	622	5.22	663	5.96	703	6.76
9990	349	1.95	411	2.54	459	3.08	505	3.68	545	4.24	583	4.80	624	5.49	663	6.21	703	7.02
10405	360	2.17	419	2.77	467	3.34	511	3.92	552	4.57	588	5.09	628	5.77	665	6.49	703	7.28
10820	371	2.41	426	3.00	475	3.62	518	4.20	560	4.90	595	5.46	631	6.07	668	6.80	705	7.59
11235	383	2.66	434	3.25	483	3.90	525	4.50	566	5.19	603	5.85	634	6.41	671	7.13	707	7.90
11650	394	2.93	441	3.51	492	4.21	532	4.83	572	5.51	610	6.25	642	6.84	675	7.50	710	8.26
12065	405	3.23	449	3.79	500	4.53	540	5.18	578	5.83	616	6.61	649	7.30	680	7.90	714	8.67

SCFM	Static Pressure (in. wg)					
	2.50		2.75		3.00	
	RPM	BHP	RPM	BHP	RPM	BHP
6670	733	5.60	767	6.23	800	6.88
7085	735	5.86	769	6.52	802	7.18
7500	736	6.13	771	6.82	803	7.49
7915	737	6.40	772	7.10	806	7.83
8330	739	6.70	773	7.41	807	8.16
8745	740	6.99	775	7.73	808	8.49
9160	740	7.25	776	8.06	809	8.83
9575	740	7.54	777	8.38	810	9.17
9990	741	7.83	776	8.65	811	9.51
10405	742	8.14	777	8.99	812	9.86
10820	741	8.41	777	9.31	812	10.21
11235	742	8.74	778	9.63	812	10.55
11650	745	9.11	778	9.96	812	10.89
12065	747	9.47	779	10.34	811	11.24

Notes:

1. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops, (evaporator coil, filters, optional economizer, optional heating system, optional roof curb).
2. The pressure drops from the supply fan to the space should not exceed 2.25” (558.8 Pa) positive.
3. Maximum air flow 23 ton (80 kW) is 4756 L/s, 25 ton is 5190 L/s, 29 ton is 5663 L/s
4. Maximum motor kW for 23 ton unit is 7.5 (10 hp), 25 ton is 7.5 kW (10 hp), 29 ton is 11.2 kW (15 hp).

Figure 45. Supply Fan Performance—22.9-29.2 Tons—50Hz

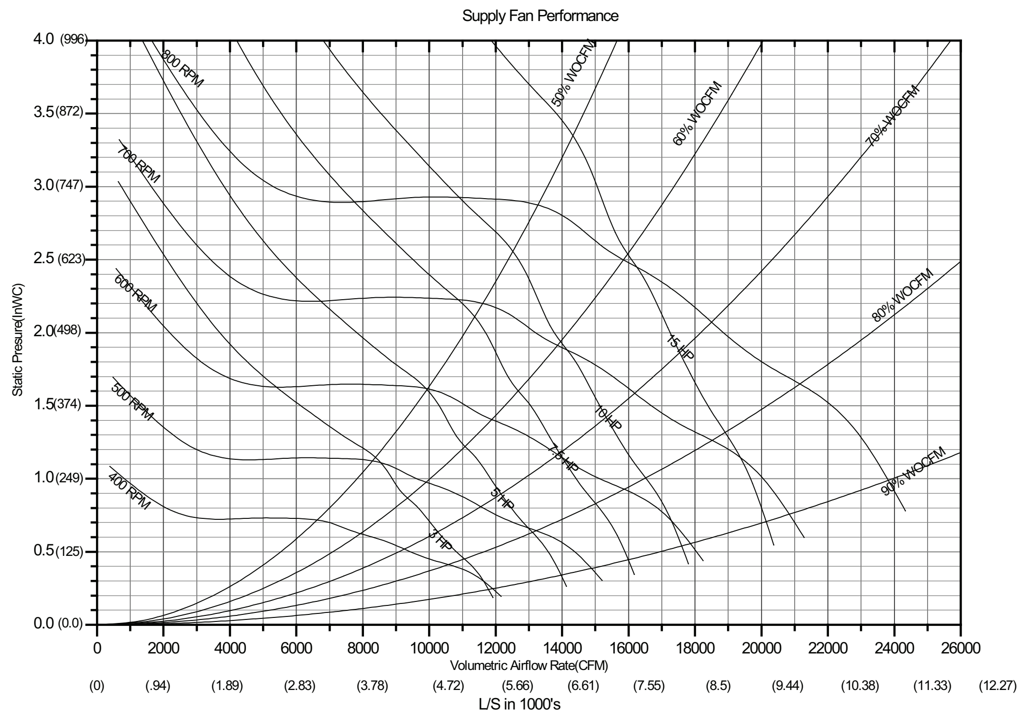


Table 33. Supply Fan Performance—82-105 kW (SI)—50 Hz

	Static Pressure (Pascals)																	
	62.9		124.1		186.2		248.3		310.4		372.5		434.6		496.7		558.8	
(L/s)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)
3148	283	0.59	351	0.88	410	1.17	469	1.55	524	1.96	573	2.39	617	2.82	659	3.26	696	3.70
3344	291	0.67	358	0.98	413	1.27	469	1.65	524	2.07	574	2.52	619	2.97	660	3.42	698	3.89
3539	299	0.76	364	1.07	418	1.39	472	1.75	524	2.18	574	2.64	619	3.12	661	3.59	699	4.07
3735	306	0.85	371	1.18	425	1.53	475	1.87	524	2.29	574	2.77	620	3.26	661	3.76	701	4.27
3931	313	0.95	378	1.30	433	1.68	478	2.01	527	2.43	574	2.90	620	3.41	662	3.93	702	4.46
4127	321	1.06	386	1.44	439	1.81	484	2.18	530	2.58	574	3.04	620	3.57	663	4.11	702	4.65
4323	330	1.18	394	1.58	445	1.95	492	2.37	533	2.74	577	3.21	620	3.72	664	4.28	703	4.84
4519	339	1.31	403	1.73	452	2.12	499	2.56	538	2.93	580	3.38	622	3.89	663	4.45	703	5.04
4715	349	1.45	411	1.89	459	2.30	505	2.74	545	3.17	583	3.58	624	4.09	663	4.63	703	5.23
4910	360	1.62	419	2.06	467	2.49	511	2.93	552	3.40	588	3.79	628	4.31	665	4.84	703	5.43
5106	371	1.80	426	2.24	475	2.70	518	3.13	560	3.65	595	4.07	631	4.53	668	5.07	705	5.66
5302	383	1.98	434	2.42	483	2.91	525	3.36	566	3.87	603	4.37	634	4.78	671	5.32	707	5.89
5498	394	2.19	441	2.62	492	3.14	532	3.60	572	4.11	610	4.66	642	5.10	675	5.59	710	6.16
5694	405	2.41	449	2.83	500	3.38	540	3.87	578	4.35	616	4.93	649	5.44	680	5.89	714	6.46

	Static Pressure (Pascals)					
	620.9		683.0		745.1	
(L/s)	RPM	(kW)	RPM	(kW)	RPM	(kW)
3148	733	4.18	767	4.65	800	5.13
3344	735	4.37	769	4.86	802	5.36
3539	736	4.57	771	5.08	803	5.58
3735	737	4.77	772	5.29	806	5.84
3931	739	5.00	773	5.53	807	6.08
4127	740	5.21	775	5.76	808	6.33
4323	740	5.41	776	6.01	809	6.58
4519	740	5.62	777	6.25	810	6.84
4715	741	5.84	776	6.45	811	7.09
4910	742	6.07	777	6.70	812	7.35
5106	741	6.27	777	6.94	812	7.62
5302	742	6.52	778	7.18	812	7.87
5498	745	6.79	778	7.43	812	8.12
5694	747	7.06	779	7.71	811	8.38

Notes:

1. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops, (evaporator coil, filters, optional economizer, optional heating system, optional roof curb).
2. The pressure drops from the supply fan to the space should not exceed 2.25” (558.8 Pa) positive.
3. Maximum air flow 23 ton (80 kW) is 4756 L/s, 25 ton is 5190 L/s, 29 ton is 5663 L/s
4. Maximum motor kW for 23 ton unit is 7.5 (10 hp), 25 ton is 7.5 kW (10 hp), 29 ton is 11.2 kW (15 hp).

Table 34. Supply Fan Performance—33.3 and 41.7 Tons (I-P)—50 Hz

	Static Pressure (in. wg)																	
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9996	273	1.46	324	1.95	372	2.49	417	3.04	458	3.64	495	4.25	535	4.92	572	5.59	605	6.23
10829	287	1.78	336	2.30	383	2.87	422	3.44	464	4.06	501	4.71	535	5.38	572	6.11	606	6.81
11662	301	2.14	348	2.69	390	3.27	432	3.91	469	4.53	506	5.21	541	5.91	573	6.64	607	7.41
12495	315	2.53	360	3.12	401	3.74	442	4.41	476	5.07	512	5.76	546	6.49	578	7.24	609	8.03
13328	329	2.96	373	3.60	412	4.27	450	4.94	486	5.67	518	6.38	551	7.12	584	7.91	614	8.71
14161	344	3.45	387	4.14	424	4.85	459	5.55	495	6.31	527	7.08	557	7.83	589	8.62	619	9.45
14994	358	3.99	401	4.77	437	5.48	470	6.23	503	6.98	538	7.83	565	8.61	594	9.41	625	10.27
15827	373	4.58	415	5.45	449	6.17	482	6.98	513	7.75	546	8.61	576	9.46	602	10.30	630	11.14
16660	388	5.24	429	6.19	463	6.93	495	7.78	525	8.61	554	9.43	586	10.36	613	11.26	637	12.13

	Static Pressure (in. wg)									
	2.50		2.75		3.00		3.25		3.50	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9996	636	6.90	665	7.63	691	8.35	717	9.10	743	9.87
10829	638	7.53	669	8.24	697	8.99	722	9.77	748	10.57
11662	639	8.17	671	8.97	699	9.73	727	10.47	751	11.26
12495	639	8.82	670	9.66	700	10.49	728	11.33	755	12.13
13328	642	9.52	671	10.38	700	11.27	729	12.17	756	13.04
14161	648	10.31	674	11.16	702	12.08	730	13.01	757	13.96
14994	653	11.13	680	12.03	706	12.96	731	13.87	757	14.88
15827	659	12.04	686	12.99	711	13.92	737	14.90	761	15.87
16660	664	13.04	691	13.97	717	14.94	742	15.96	765	16.94

Notes:

1. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops, (evaporator coil, filters, optional economizer, optional heating system, optional roof curb).
2. The pressure drops from the supply fan to the space should not exceed 2.5” wg (620.9 Pa) positive.
3. Max cfm for 33 ton unit 6825 L/s, 42 ton -7860 L/s
4. Max motor hp for 33 ton unit-11.2 kW (15 hp), 42 ton 14.9 kW (20 hp)

Figure 46. Supply Fan Performance—33.3 and 41.7 Ton (IP)—50Hz

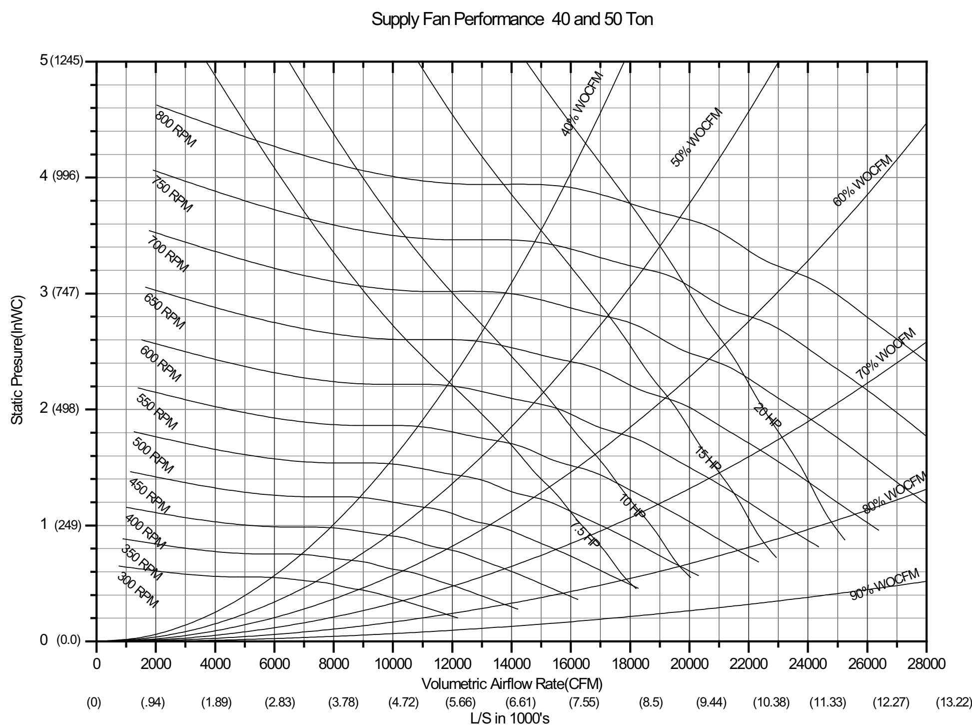


Table 35. Supply Fan Performance—105-148 kW (SI)—50 Hz

	Static Pressure (Pascals)																	
	62.1		124.2		186.3		248.1		310.4		372.5		434.6		496.7		558.8	
(L/s)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)
4717	273	1.09	324	1.46	372	1.86	417	2.27	458	2.72	495	3.17	535	3.67	572	4.17	605	4.64
5111	287	1.33	336	1.72	383	2.14	422	2.57	464	3.03	501	3.51	535	4.01	572	4.55	606	5.08
5504	301	1.59	348	2.00	390	2.44	432	2.91	469	3.38	506	3.88	541	4.41	573	4.95	607	5.52
5897	315	1.88	360	2.33	401	2.79	442	3.29	476	3.78	512	4.30	546	4.84	578	5.40	609	5.99
6290	329	2.21	373	2.68	412	3.19	450	3.69	486	4.23	518	4.76	551	5.31	584	5.90	614	6.49
6683	344	2.57	387	3.09	424	3.62	459	4.14	495	4.70	527	5.28	557	5.84	589	6.43	619	7.05
7076	358	2.97	401	3.56	437	4.09	470	4.65	503	5.21	538	5.84	565	6.42	594	7.02	625	7.66
7469	373	3.42	415	4.07	449	4.60	482	5.20	513	5.78	546	6.42	576	7.06	602	7.68	630	8.31
7862	388	3.91	429	4.61	463	5.17	495	5.80	525	6.42	554	7.03	586	7.73	613	8.40	637	9.05

	Static Pressure (Pascals)									
	620.9		683.0		745.1		807.2		869.3	
(L/s)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)
4717	636	5.14	665	5.69	691	6.22	717	6.78	743	7.36
5111	638	5.62	669	6.14	697	6.70	722	7.28	748	7.88
5504	639	6.09	671	6.69	699	7.25	727	7.81	751	8.40
5897	639	6.57	670	7.20	700	7.83	728	8.45	755	9.05
6290	642	7.10	671	7.74	700	8.41	729	9.07	756	9.72
6683	648	7.69	674	8.32	702	9.01	730	9.71	757	10.41
7076	653	8.30	680	8.97	706	9.66	731	10.35	757	11.10
7469	659	8.98	686	9.69	711	10.38	737	11.11	761	11.84
7862	664	9.72	691	10.42	717	11.14	742	11.90	765	12.63

Notes:

1. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops, (evaporator coil, filters, optional economizer, optional heating system, optional roof curb).
2. The pressure drops from the supply fan to the space should not exceed 2.5” wg (620.9 Pa) positive.
3. Max cfm for 33 ton unit 6825 L/s, 42 ton -7860 L/s
4. Max motor hp for 33 ton unit-11.2 kW (15 hp), 42 ton 14.9 kW (20 hp)

Table 36. TC*/YC* 300 - 600 MBH Economizer (R/A) Damper Pressure Drop[a] — 60 Hz

Unit Capacity	Airflow (Cfm)	Pressure Drop[b]	Unit Capacity	Airflow (Cfm)	Pressure Drop[b]	Unit Capacity	Airflow (Cfm)	Pressure Drop [b]
27.5	8000	0.035	30	9000	0.042	35	10000	0.051
	8000	0.035		9000	0.042		10000	0.051
	8500	0.038		9500	0.046		10500	0.056
	9000	0.042		10000	0.051		11000	0.061
	9500	0.046		10500	0.056		11500	0.067
	10000	0.051		11000	0.061		12000	0.073
	10500	0.056		11500	0.067		12500	0.095
	11000	0.061		12000	0.073		14000	0.103
	11500	0.067		12500	0.08		14500	0.111
	12000	0.073		13000	0.087			
	12500	0.08						
40	12000	0.072	50	15000	0.098			
	12500	0.075		15500	0.104			
	13000	0.079		16000	0.11			
	13500	0.083		16500	0.117			
	14000	0.087		17000	0.124			
	14500	0.092		17500	0.132			
	15000	0.098		18000	0.14			
	15500	0.104		18500	0.149			
	16000	0.11		19000	0.159			
	16500	0.117		19500	0.168			
	17000	0.124		20000	0.179			
	17500	0.132						
	18000	0.14						

(a) Static Pressure Drops for the return air damper must be added to the system external static pressure as an accessory when using the fan performance tables and the fan curves to determine actual fan performance.
(b) Pressure Drops are listed in inches of water column.

Table 37. Component Static Pressure Drops (in. W.G.)1—60 Hz

Nominal Tons	CFM Std Air	Heating System				ID Coil		Filters2				Inlet Guide Vanes	Economizer
		Gas Heat		Electric Heat3				Throw-away	MERV 8 High Eff.		MERV14 High Eff		
		Low	High	1 Element	2 Element	Dry	Wet	2"	2"	4"	4"		
27½	8000	0.08	0.06	0.05	0.06	0.12	0.19	0.08	0.12	0.11	0.19	0.05	0.05
	9000	0.1	0.08	0.07	0.07	0.14	0.22	0.09	0.14	0.13	0.23	0.07	0.06
	10000	0.13	0.1	0.08	0.09	0.17	0.26	0.1	0.16	0.15	0.27	0.08	0.07
	11000	0.15	0.12	0.1	0.11	0.20	0.30	0.12	0.2	0.17	0.31	0.1	0.09
	12000	0.18	0.14	0.12	0.13	0.23	0.34	0.13	0.21	0.2	0.35	0.12	0.10
30	9000	0.1	0.08	0.07	0.07	0.14	0.22	0.09	0.14	0.13	0.23	0.07	0.06
	10000	0.13	0.1	0.08	0.09	0.17	0.26	0.1	0.16	0.15	0.27	0.08	0.07
	11000	0.15	0.12	0.1	0.11	0.20	0.30	0.12	0.2	0.17	0.31	0.1	0.09
	12000	0.18	0.14	0.12	0.13	0.23	0.34	0.14	0.23	0.21	0.36	0.12	0.10
	13000	0.21	0.16	0.14	0.15	0.27	0.38	0.15	0.26	0.23	0.39	0.14	0.11
35	10500	0.14	0.11	0.09	0.1	0.25	0.37	0.11	0.18	0.16	0.29	0.09	0.07
	11500	0.17	0.13	0.11	0.12	0.29	0.42	0.13	0.21	0.19	0.33	0.11	0.09
	12500	0.2	0.15	0.13	0.14	0.33	0.48	0.14	0.24	0.21	0.37	0.13	0.10
	13500	0.23	0.18	0.15	0.16	0.38	0.53	0.15	0.26	0.23	0.4	0.15	0.11
	14500	0.26	0.2	0.18	0.19	0.42	0.59	0.17	0.3	0.27	0.43	0.18	0.12
40	12000	0.01	0.03	0.08	0.13	0.24	0.36	0.1	0.19	0.17	0.34	0.04	0.09
	13000	0.01	0.04	0.1	0.15	0.28	0.41	0.12	0.23	0.2	0.36	0.05	0.11
	14000	0.02	0.05	0.11	0.18	0.31	0.46	0.13	0.25	0.22	0.39	0.05	0.12
	15000	0.02	0.05	0.13	0.2	0.35	0.50	0.14	0.28	0.24	0.44	0.06	0.10
	16000	0.02	0.06	0.15	0.23	0.39	0.55	0.15	0.31	0.27	0.48	0.07	0.14
	17000	0.02	0.07	0.17	0.26	0.43	0.60	0.17	0.35	0.3	0.54	0.08	0.15
50	15000	0.02	0.05	0.13	0.2	0.44	0.63	0.14	0.28	0.24	0.44	0.06	0.13
	16000	0.02	0.06	0.15	0.23	0.49	0.69	0.15	0.31	0.27	0.48	0.07	0.14
	17000	0.02	0.07	0.17	0.26	0.54	0.75	0.17	0.35	0.3	0.54	0.08	0.16
	18000	0.03	0.08	0.19	0.29	0.59	0.82	0.18	0.38	0.33	0.58	0.09	0.18
	19000	0.03	0.08	0.21	0.32	0.65	0.89	0.19	0.42	0.35	0.64	0.1	0.21
	20000	0.03	0.09	0.23	0.36	0.71	0.96	0.2	0.45	0.38	0.67	0.11	0.23

Notes:

1. Static pressure drops of accessory components must be added to external static pressure to enter fan selection tables.
2. Throwaway filter option limited to 300 ft/min face velocity.
3. Electric Heaters 36-54 KW contain 1 element; 72-108 KW 2 elements.

Table 38. Supply Fan Drive Selection — 60Hz

	7.5 HP		10 HP		15 HP		20 HP	
Nominal Tons	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.
27.5T	550	A	700	D				
	600	B	750*	E				
	650	C						
30T	550	A	700	D				
	600	B	750	E				
	650	C						
35T	600	B	650	C	790**	F		
			700	D	800*	G		
40T			500	H	625	L		
			525	J	675	M		
			575	K	725	N		
50T			525	J	625	L	725	N
			575	K	675	M		

Notes:
* For YC gas/electric only.
** For TC and TE Cooling and Electric Heat units only.

Table 39. Component Static Pressure Drops in. wg (I-P)—50 Hz

Nominal Std Tons (kW)	CFM Std Air	Heating System				ID Coil		Filters				Inlet Guide Vanes	Economizer
		Gas Heat		Electric Heat				Throw-away	MERV 8 High Eff.		MERV14 High Eff		
		Low	High	1 Element	2 Element	Dry	Wet	2"	"2"	4"	4"		
23 (80)	6670	0.07	0.05	0.04	0.05	0.09	0.14	0.05	0.08	0.07	0.16	0.04	0.03
	7500	0.08	0.07	0.06	0.06	0.11	0.17	0.07	0.11	0.1	0.19	0.06	0.04
	8330	0.1	0.08	0.07	0.08	0.13	0.20	0.08	0.13	0.12	0.21	0.07	0.05
	9170	0.13	0.1	0.08	0.09	0.15	0.23	0.09	0.15	0.14	0.24	0.08	0.06
	10000	0.15	0.12	0.1	0.11	0.17	0.26	0.11	0.18	0.16	0.27	0.1	0.07
25 (88)	7500	0.08	0.07	0.06	0.06	0.11	0.17	0.07	0.11	0.1	0.19	0.06	0.04
	8330	0.1	0.08	0.07	0.08	0.13	0.20	0.08	0.13	0.12	0.21	0.07	0.05
	9170	0.13	0.1	0.08	0.09	0.15	0.23	0.09	0.15	0.14	0.24	0.08	0.06
	10000	0.15	0.12	0.1	0.11	0.17	0.26	0.11	0.18	0.17	0.28	0.12	0.07
29 (103)	8750	0.11	0.09	0.08	0.08	0.18	0.28	0.09	0.15	0.13	0.23	0.08	0.05
	9580	0.14	0.11	0.09	0.1	0.21	0.32	0.1	0.17	0.16	0.26	0.11	0.07
	11200	0.19	0.15	0.13	0.14	0.28	0.41	0.12	0.21	0.19	0.32	0.13	0.08
	12100	0.22	0.17	0.15	0.16	0.31	0.46	0.13	0.22	0.21	0.36	0.15	0.09
33 (118)	10000	0.01	0.03	0.07	0.11	0.18	0.28	0.11	0.18	0.16	0.27	0.03	0.07
	10800	0.01	0.03	0.08	0.13	0.20	0.31	0.12	0.21	0.18	0.29	0.04	0.08
	11700	0.01	0.04	0.1	0.15	0.23	0.35	0.13	0.23	0.2	0.32	0.04	0.09
	12500	0.01	0.04	0.11	0.17	0.26	0.39	0.14	0.26	0.23	0.35	0.05	0.1
	13300	0.02	0.05	0.12	0.19	0.29	0.42	0.15	0.28	0.25	0.37	0.06	0.11
	14200	0.02	0.06	0.14	0.22	0.32	0.46	0.17	0.32	0.28	0.41	0.07	0.12
42 (146)	12500	0.01	0.04	0.11	0.17	0.33	0.48	0.14	0.26	0.23	0.35	0.05	0.1
	13300	0.02	0.05	0.12	0.19	0.36	0.53	0.15	0.28	0.25	0.37	0.06	0.11
	14200	0.02	0.06	0.16	0.24	0.40	0.58	0.17	0.34	0.29	0.42	0.07	0.12
	15800	0.02	0.07	0.18	0.27	0.48	0.68	0.19	0.38	0.34	0.47	0.08	0.14
	16700	0.03	0.08	0.2	0.3	0.53	0.74	0.2	0.41	0.36	0.52	0.09	0.16

Note: Static pressure drops of accessory components must be added to external static pressure to enter fan performance tables.

Table 40. Component Static Pressure Drops Pa (SI)—50 Hz

Nominal Std Tons (kW)	L/s Std Air	Heating System: Gas Heat Low	Heating System: Gas Heat High	Heating System: Electric Heat 1 Element	Heating System: Electric Heat 2 Element	ID Coil Dry	ID Coil Wet	Filters: Throw-away Adder	Filters: MERV 8 High Eff. 50 mm	Filters: MERV 8 High Eff. 100 mm	Filters: MERV14 High Eff 100 mm	Inlet Guide Vanes	Economizer
80 (23)	3150	17	13	11	12	21	34	12	19	17	38	11	8
	3540	21	16	14	15	26	41	17	26	24	45	14	10
	3930	26	20	17	19	30	48	19	31	29	50	17	12
	4320	31	24	21	23	36	55	22	36	34	57	21	15
	4720	37	29	25	27	41	62	26	43	38	65	25	17
88 (25)	3540	21	16	14	15	26	41	17	26	24	45	14	10
	3930	26	20	17	19	30	48	19	31	29	50	17	12
	4320	31	24	21	23	36	55	22	36	34	57	25	15
	5120	44	34	29	32	41	62	26	43	41	67	29	17
103 (29)	4130	29	22	19	21	44	68	22	36	31	55	19	13
	4520	34	27	23	25	51	78	24	41	38	62	23	16
	4920	41	32	27	29	66	97	29	50	46	77	27	19
	5310	47	37	32	34	75	109	31	53	50	86	32	23
118 (33)	4720	2	7	18	27	43	67	26	43	38	65	8	17
	5120	3	8	21	32	49	75	29	50	43	69	10	19
	5510	3	10	24	37	56	84	31	55	48	77	11	21
	5900	4	11	27	42	62	92	34	62	55	84	13	24
	6290	4	12	31	48	69	101	36	67	60	88	15	27
	6680	5	14	35	54	77	111	41	77	67	98	16	30
146 (42)	5900	4	11	27	42	78	115	34	62	55	84	13	24
	6290	4	12	31	48	86	126	36	67	60	88	15	27
	6680	5	14	35	54	96	139	41	82	72	100	16	30
	7070	5	16	39	60	115	162	46	91	82	112	18	34
	7470	6	18	44	67	126	176	48	98	86	124	21	39

Note: Static pressure drops of accessory components must be added to external static pressure to enter fan performance tables.

Table 41. Supply Air Fan Drive Selections - 50 Hz

Nominal Tons (kW)	7.5 hp (5.6 kW)		10 hp (7.5 kW)		15 hp (10 kW)		20 hp (15 kW)	
	rpm	Drive No	rpm	Drive No	rpm	Drive No	rpm	Drive No
23 (80)	458	A	—	—	—	—	—	—
	500	B	—	—	—	—	—	—
	541	C	—	—	—	—	—	—
	583	—	583	D	—	—	—	—
	625	—	625*	E	—	—	—	—
25 (88)	458	A	—	—	—	—	—	—
	500	B	—	—	—	—	—	—
	541	C	—	—	—	—	—	—
	583	—	583	D	—	—	—	—
	625	—	625	E	—	—	—	—
29 (103)	500	B	—	—	—	—	—	—
	541	—	541	C	—	—	—	—
	583	—	583	D	—	—	—	—
	658	—	—	—	658**	F	—	—
	664	—	—	—	664*	G	—	—
33 (118)	417	—	417	H	—	—	—	—
	437	—	437	J	—	—	—	—
	479	—	479	K	—	—	—	—
	521	—	—	—	521	L	—	—
	562	—	—	—	562	M	—	—
	604	—	—	—	604	N	—	—
42 (146)	437	—	437	J	—	—	—	—
	479	—	479	K	—	—	—	—
	521	—	—	—	521	L	—	—
	562	—	—	—	562	M	—	—
	604	—	—	—	—	—	604	N

Notes:
1. *For YC gas/electrics only.
2. **For TC and TE Cooling only and with electric Heat units only.

Exhaust Fan Operation

To start the optional power exhaust fans, use the economizer test procedures in Table 28, p. 74 to drive the economizer dampers to the open position. The exhaust fans will start when the damper position is equal to or greater than the exhaust fan setpoint. If optional power exhaust is selected, an access door must be field-installed on the horizontal return ductwork to provide access to exhaust fan motors.

⚠WARNING
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 death or serious injury.

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

Verify that the fans are operating properly and the CFM is within the job specifications. Refer to power exhaust fan performance tables beginning with Table 42, p. 92 for the exhaust fan performance characteristics.

Available power adjustments:

1. The power exhaust fan(s) comes on based on the position of the of the exhaust fan setpoint potentiometer on the RTOM (Reliatel Options Module). The setpoint is factory set at 25%. The exhaust fan(s) will come on anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.
2. Physical damper blade stops limit the amount of exhaust airflow by limiting the maximum opening of the damper blades. These stops (sliding brackets secured with wing-nuts) are present under the rain hood on the non-modulating power exhaust option. There is one stop on each side of each damper. The practical range of blade position control is between 1.5" and 4.0" blade opening. The damper is wide-open at 4.0". The stops on each side of a damper must be in the same position, such that the damper blade connecting member contacts the stops at the same time.
3. The modulating power exhaust actuator tracks the position of the economizer damper actuator such that the power exhaust dampers proportionally follow or track the fresh air damper position.
4. When the Statitrac option is selected, the exhaust actuator will operate independently of the economizer in order to relieve positive building pressure. If a Space Pressure Transducer failure occurs, the unit will revert back to fresh air tracking control.
5. The proportional offset between the dampers is adjusted under the rain hood by hole position selection on the power exhaust actuator jack shaft on the damper linkage arm.

Note: *The damper is a barometric damper that continues to function as a pressure relief damper up to the maximum stop position.*

Note: *To adjust the damper blade stops, refer to figures Figure 47, p. 93 to Figure 50, p. 94*

If the fan speed needs to be changed from the current operating speed, refer to the unit wiring diagram and the XTB1 and XTB2 terminal strip located in the economizer section.

Table 42. Power Exhaust Fan Performance—27.5-35 Ton—60 Hz

	Power Exhaust Selection			
	50% (min)		100% (max)	
	Damper Blade Open Distance (in)			
	1.5 (min)	4.0 (max)	1.5 (min)	4.0 (max)
Return Duct Static (in. wc)	CFM			
0.0	3812	6866	7624	13742
0.1	3497	5296	6995	10591
0.2	3190	4458	6325	9000
0.3	2884	3812	5768	7635
0.4	2621	3359	5241	6719
0.5	2342	2885	4683	5771

Table 43. Power Exhaust Fan Performance—40-50 Ton—60 Hz

	Power Exhaust Selection			
	50% (min)		100% (max)	
	Damper Blade Open Distance (in)			
	1.5 (min)	4.0 (max)	1.5 (min)	4.0 (max)
Return Duct Static (in. wc)	CFM			
0.0	4854	8035	9708	16069
0.1	4575	7410	9151	14820
0.2	4262	6450	8552	13496
0.3	4011	6027	8021	12054
0.4	3718	5526	7436	11051
0.5	3467	5186	6933	10373

Table 44. Power Exhaust Fan Performance—22.9 - 29.2 Ton—50 Hz

	Power Exhaust Selection			
	50% (min)		100% (max)	
	Damper Blade Open Distance (mm)			
	38.1 (min)	101.6 (max)	38.1 (min)	101.6 (max)
Return Duct Static (Pa)	L/s			
0.0	1499	2701	2999	5405
24.9	1375	2083	2751	4166
49.8	1255	1753	2488	3540
74.7	1134	1499	2269	3003
99.6	1031	1321	2061	2643
124.5	921	1135	1842	2270

Table 45. Power Exhaust Fan Performance—33.3 - 41.7 Ton—50 Hz

	Power Exhaust Selection			
	50% (min)		100% (max)	
	Damper Blade Open Distance (mm)			
	38.1 (min)	101.6 (max)	38.1 (min)	101.6 (max)
Return Duct Static (Pa)	L/s			
0.0	1909	3160	3818	6321
24.9	1800	2915	3599	5829
49.8	1676	2537	3364	5308
74.7	1577	2371	3155	4741
99.6	1462	2173	2925	4347
124.5	1364	2040	2727	4080

Figure 47. (Downflow) Tracking Exhaust Damper Adjustment

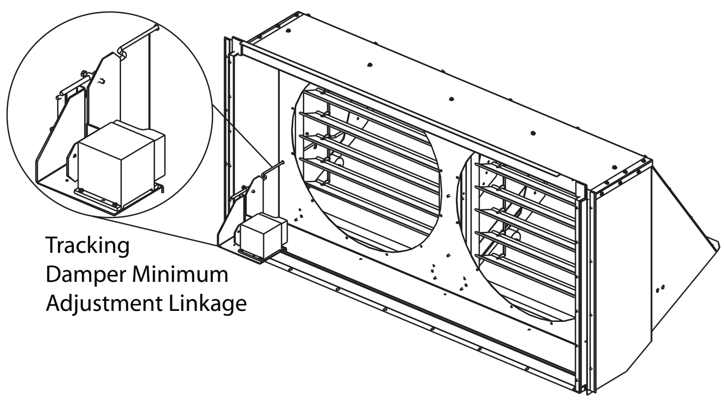


Figure 48. (Horizontal) Tracking Exhaust Damper Adjustment

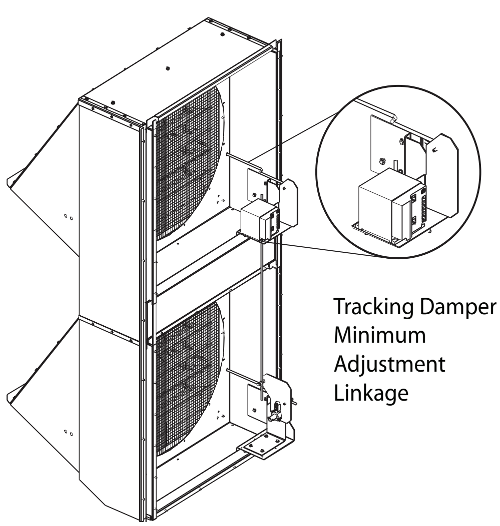


Figure 49. (Downflow) Standard Exhaust Maximum Damper Position

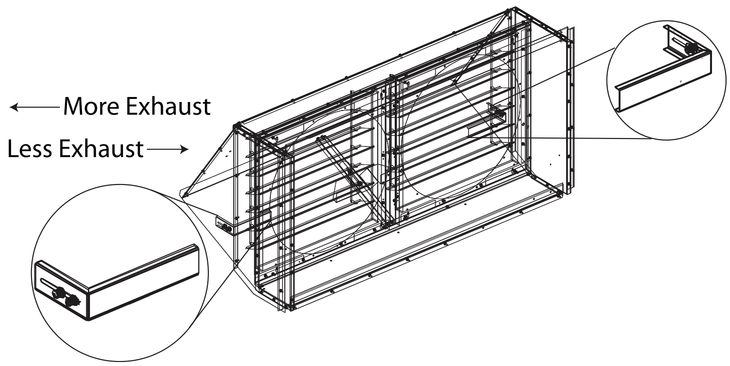
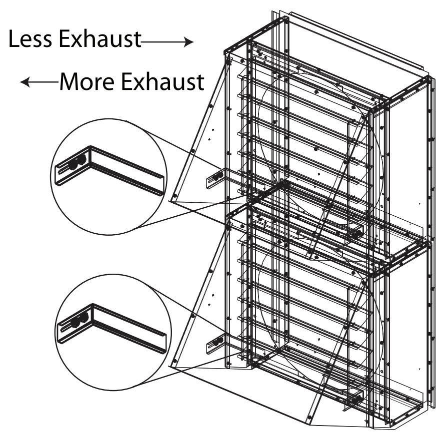


Figure 50. (Horizontal) Standard Exhaust Maximum Damper Position



Economizer Damper Adjustment

Economizer (O/A) Dampers

Arbitrarily adjusting the outside air dampers to open fully when the return air dampers are fully closed can overload the supply fan motor or deliver higher CFM to the space than designed. This causes higher operating duct static pressures and over pressurization of the space when the unit is operating in the "economizer" mode.

The O/A and R/A damper linkage is attached to a plate with a series of holes that allows the installer or operator to modify the O/A damper travel to compensate for various R/A duct losses. The purpose of adjusting the amount of O/A damper travel is to maintain a balance or equal pressure between the O/A dampers and the pressure drop of the return air system. Figure 51, p. 97 illustrates the damper assembly and Table 46, p. 95 through Table 49, p. 96 list the various damper positions based on the air flow (CFM) and the return duct losses (static pressure) for Downflow and Horizontal units.

To adjust the O/A damper for the correct pressure drop:

1. Measure the return duct static pressure.
2. Enter the calculated CFM from the previous section "Verifying Proper Airflow" Table 36, p. 85 to obtain the return air damper pressure drop.

3. Add the measured return duct static pressure and the return air damper pressure drop together to obtain the Total Return Static Pressure. Apply this calculation and the calculated CFM to the appropriate Table 46, p. 95 through Table 49, p. 96.
4. Set the drive rod swivel to the appropriate hole according to Table 46, p. 95 through Table 49, p. 96. The units are shipped using hole "A" with no reference to any specific operating condition.

Table 46. 27.5 - 35 Ton Downflow Units, Economizer (O/A) Damper Static Pressure Setup

System Design	Return Air Duct Static + Return Air Damper Static (Inches of Water)						
CFM	0.20	0.40	0.60	0.80	1.00	1.20	1.40
	Drive Rod Position						
8000	B	E	E	E	E	E	E
8500	B	D	E	E	E	E	E
9500	A	C	E	E	E	E	E
10000	A	C	D	E	E	E	E
10500	A	C	D	E	E	E	E
11000	A	B	D	D	E	E	E
11500	A	B	C	D	E	E	E
12000	A	A	C	D	E	E	E
12500	A	A	C	D	D	E	E
13000	A	A	B	B	C	D	E

Table 47. 27.5 - 35 Ton Horizontal Unit Economizer (O/A) Damper Static Pressure Setup

System Design	Return Air Duct Static + Return Air Damper Static (Inches of Water)						
CFM	0.20	0.40	0.60	0.80	1.00	1.20	1.40
	Drive Rod Position						
8000	A	F	G	G	G	G	G
8500	A	F	G	G	G	G	G
9000	A	E	G	G	G	G	G
9500	A	E	F	G	G	G	G
10000	A	D	E	G	G	G	G
11000	A	D	E	F	G	G	G
11500	A	B	E	F	G	G	G
12000	A	A	D	F	G	G	G
12500	A	A	D	E	F	G	G
13000	A	A	D	E	F	G	G
13500	A	A	C	E	F	F	G
14000	A	A	C	D	E	F	G
14500	A	A	B	D	E	F	F

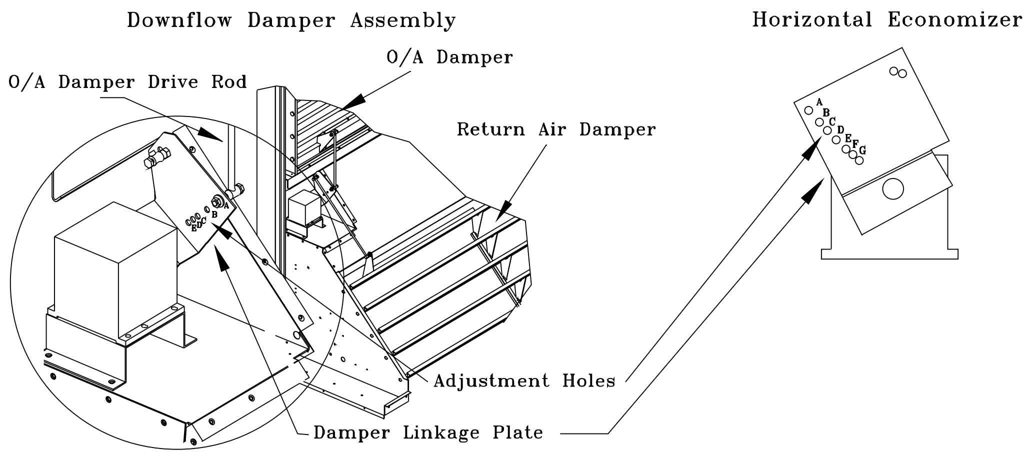
Table 48. 40 - 50 Ton Downflow Unit Economizer (O/A) Damper Static Pressure Setup

System Design	Return Air Duct Static + Return Air Damper Static (Inches of Water)						
CFM	0.20	0.40	0.60	0.80	1.00	1.20	1.40
	Drive Rod Position						
12000	A	A	C	D	E	E	E
12500	A	A	C	D	D	E	E
13000	A	A	B	C	D	E	E
13500	A	A	B	C	D	D	E
14000	A	A	B	C	C	D	E
14500	A	A	B	B	C	D	D
15000	A	A	A	B	C	D	D
15500	A	A	A	B	C	D	D
16000	A	A	A	B	C	C	D
16500	A	A	A	B	B	C	D
17000	A	A	A	B	B	C	C
17500	A	A	A	A	B	C	C
18000	A	A	A	A	B	C	C
18500	A	A	A	A	B	B	C
19000	A	A	A	A	B	B	C
19500	A	A	A	A	B	B	B
20000	A	A	A	A	A	B	B

Table 49. 40 - 50 Ton Horizontal Unit Economizer (O/A) Damper Static Pressure Setup

System Design	Return Air Duct Static + Return Air Damper Static (Inches of Water)						
CFM	0.20	0.40	0.60	0.80	1.00	1.20	1.40
	Drive Rod Position						
12000	A	B	E	F	G	G	G
12500	A	B	D	E	F	G	G
13000	A	A	D	E	F	G	G
13500	A	A	D	E	F	G	G
14000	A	A	C	E	F	F	G
14500	A	A	C	D	E	F	F
15000	A	A	B	D	E	F	F
15500	A	A	B	D	E	E	F
16000	A	A	A	C	D	E	F
16500	A	A	A	C	D	E	F
17000	A	A	A	B	D	E	E
17500	A	A	A	B	D	E	E
18000	A	A	A	B	C	D	E
18500	A	A	A	A	C	D	E
19000	A	A	A	A	B	D	E
19500	A	A	A	A	B	C	E
20000	A	A	A	A	B	C	D

Figure 51. Economizer (O/A) damper assembly



Manual Fresh Air Damper

Units ordered with the 25% manual fresh air option have two slidable dampers. By adjusting one or both, the desired amount of fresh air entering the system can be obtained.

To adjust the fresh air damper;

1. Turn the "System" selection switch to the "Off" position and the "Fan" selection switch (if Applicable) to the "Auto" position.
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's power terminal block or the unit factory mounted disconnect switch.

⚠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.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK HTB1 OR UNIT DISCONNECT SWITCH.

3. Remove the mist eliminator retainer bracket and the mist eliminators from the fresh air hood.
4. Remove the five (5) screws in the top and bottom of each fresh air damper located inside the hood area.

⚠WARNING
Rotating Components!

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

5. Using the Service Test guide in Table 28, p. 74, momentarily jump across the test terminals one time for constant volume applications, or three consecutive times for a variable air volume application, to start the Minimum Ventilation Test.

6. With the supply fan "On" and rotating in the proper direction, measure the return duct static pressure.
7. Using the Table below, enter the desired amount of fresh air and the return air static pressure reading to obtain the proper damper opening dimension.

Table 50. Damper Adjustment

Damper Opening (In.)		Return Air Static Pressure - Inches w.c.							
Damper # 1	Damper # 2	-0.20	-0.40	-0.60	-0.80	-1.00	-1.20	-1.40	-1.60
2	0	430	590	725	840	950	1040	1120	740
4	0	780	1080	1330	1545	1730	1890	2035	2170
6	0	1185	1620	1990	2300	2575	2815	3030	3240
8	0	1530	2110	2600	3025	3390	3705	3985	4240
10	0	1930	2655	3270	3800	4250	4650	5005	5345
10	2	2295	3165	3910	4545	5095	5575	6010	6415
10	4	2660	3650	4510	5255	5905	6480	6995	7470
10	6	3010	4150	5130	5965	6690	7330	7900	8440
10	8	3345	4600	5680	6610	7410	8120	8765	9365
10	10	3690	5125	6350	7395	8295	9075	9775	10420

8. Loosen the adjustment screws on each side of the damper and slide it downward to the required opening.
9. Tighten the adjustment screws and re-install the mist eliminators and the mist eliminator retainer bracket.

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

Before closing the disconnect switch, ensure that the compressor discharge service valve(s), suction service valve(s), and liquid line service valve(s) are backseated.

Starting the Compressor

Optional service valves must be fully opened before startup (suction, discharge, liquid line and oil line).

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.

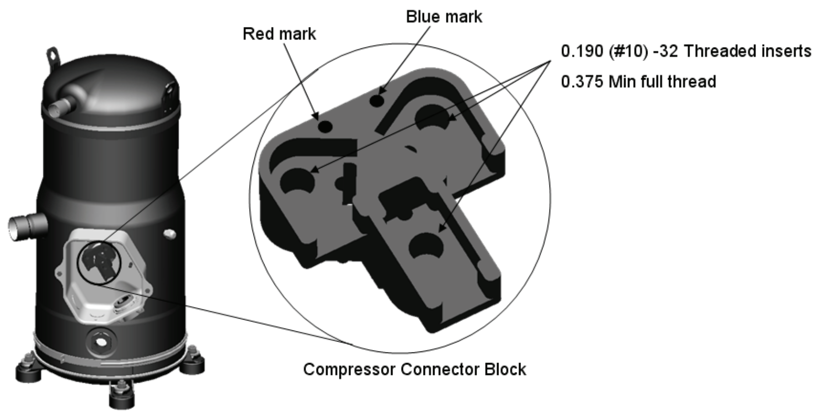
Starting 27.5 to 35 Ton Units

Install a set of service gauges onto the suction and discharge service ports. To start the compressor test, close the main power disconnect switch or the unit mounted disconnect switch.

Jump across the "Test terminals" on LTB1 or toggle the test switch three consecutive times if it is a constant volume application, or five times if it is a variable air volume application for two to three seconds per jump. Refer to Table 28, p. 74 Table 29, p. 74 for the Cooling Test sequence.

Note: *The compressors are protected from reverse rotation caused by improper sequencing of the customer supplied unit power wires by the unit phase monitor. It is imperative to verify correct sequencing of compressor power wires to prevent compressor failure from reverse* *rotation. Refer to the unit wiring schematic and/or wire color markers vs. the compressor terminal block color markers.*

Figure 52. Economizer (O/A) damper assembly



If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed. If allowed to run backward for even a very short period of time, internal compressor damage may occur and compressor life may be reduced. If allowed to run backwards for an extended period of time, the compressor will likely fail or the motor windings will overheat and cause the motor winding thermostats to open. The opening of the motor winding thermostat will cause a "compressor trip" diagnostic and stop the compressor.

Starting 40 to 50 Ton Units

Install a set of service gauges onto the suction and discharge service ports of each circuit. Follow the same procedures as above to start the first stage of compressor operation.

After the compressor and the condenser fans have been operating for approximately 30 minutes, use Table 51, p. 101 through Table 64, p. 108 to determine the proper operating pressures for that circuit.

Jump across the "Test Terminals" once again. This will allow the second stage compressors to start. The first stage compressor will shut off providing the 3 minute "On" time has elapsed.

Note: *When the second refrigerant circuit is requested to operate, both compressors of the 50 ton unit will run simultaneously. Verify that the compressors are rotating in the correct direction.*

Observe the operation of the compressor(s) and the system operating pressures. After compressors and condenser fans for the circuit have been operating for approximately 30 minutes, use Table 54, p. 103 through Table 64, p. 108 to determine the proper operating pressures. For subcooling guidelines, refer to "Checking Subcooling" at the end of this section.

Units with Lead/Lag function disabled, jump across the "Test Terminals" once again. This will allow the third stage of cooling (number one circuit) to start providing the 3 minute "Off" time has been satisfied.

The 40 and 50 ton units employ the use of line weights to dampen vibration. Do not remove, relocate, or over-torque these weights. The torque specification for the attaching bolts is 6 ft-lbs ± 1.0 ft-lb.

The location of the line weights is shown below.

Figure 53. Line Weight Locations—50 Ton

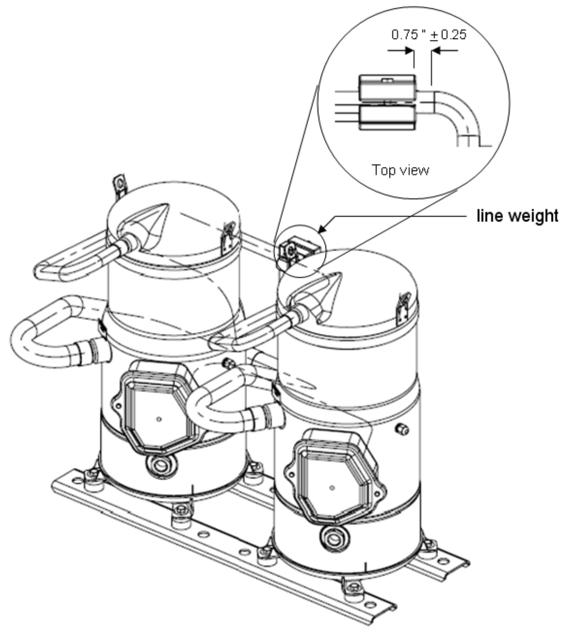
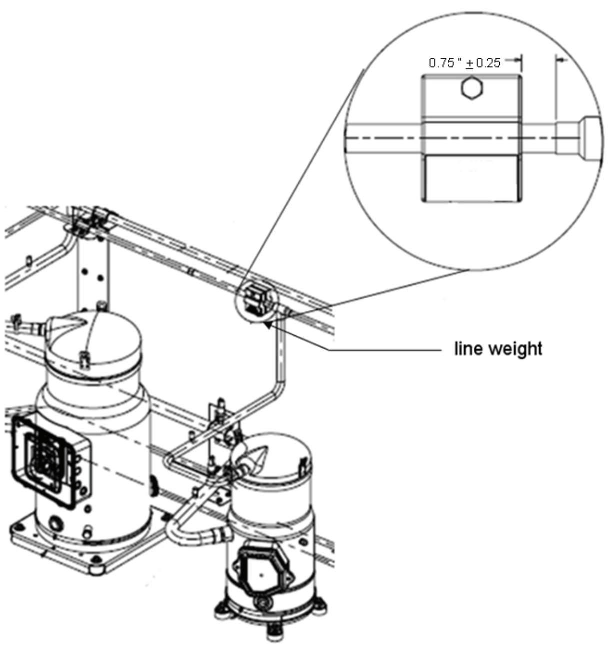


Figure 54. Line Weight Locations—40 Ton



Compressor Oil

Once all of the compressors have been started, verify that the oil level is visible through the sight glass or above the sight glass. Use appropriate lighting (flash light) to verify the presence of oil. A tandem manifold set may have different oil heights, but still must be visible in the sight glass or above the sight glass.

After shutting the compressors off, check the oil's appearance. Discoloration of the oil indicates that an abnormal condition has occurred. If the oil is dark, overheating may have occurred. Potential causes of overheating: compressor is operating at extremely high condensing temperatures; high superheat; a compressor mechanical failure; or, occurrence of a motor burnout. If the oil is black and contains metal flakes, a mechanical failure has occurred. This symptom is often accompanied by a high compressor amperage draw.

Refer to the Refrigeration system in the maintenance section for details on testing and replacing oil.

Table 51. 27.5 Ton—Operating Pressure (60Hz)

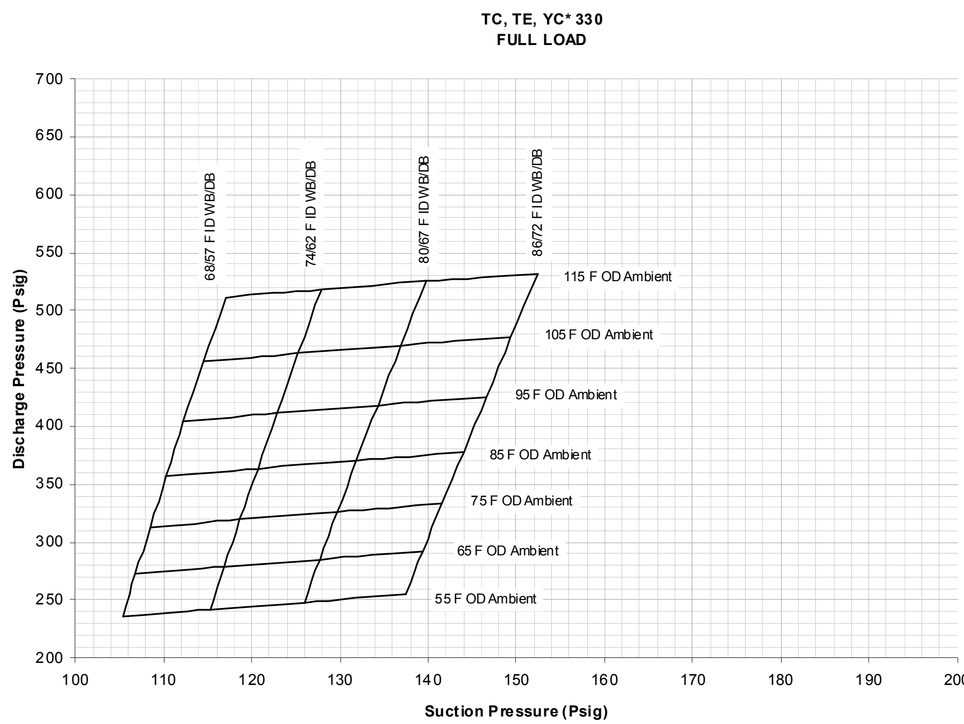


Table 52. 30 Ton—Operating Pressure (60 Hz)

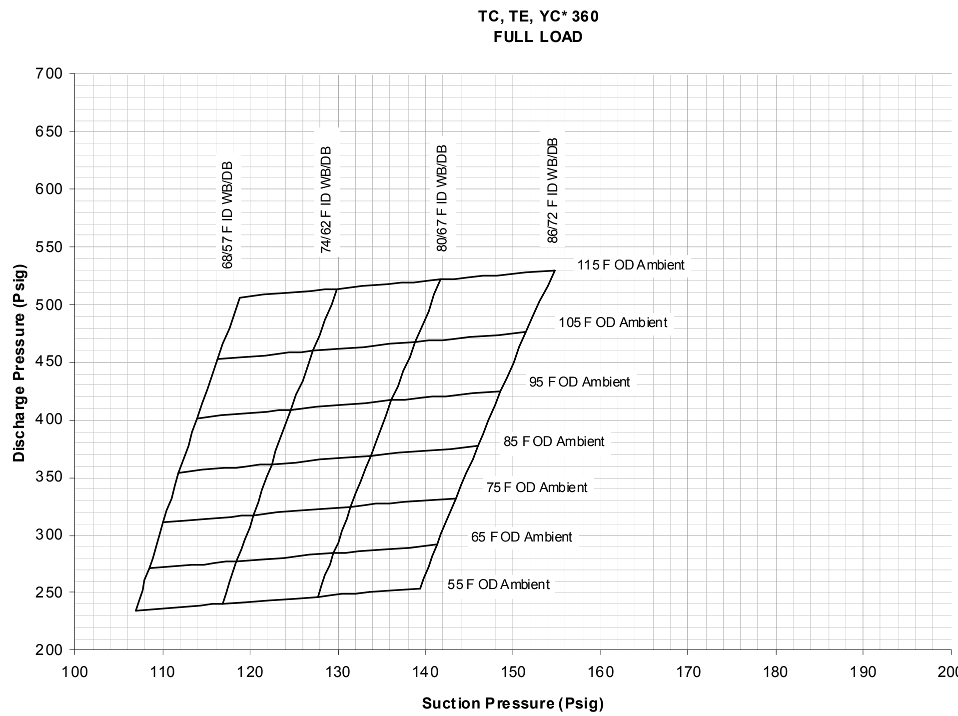


Table 53. 35 Ton—Operating Pressure (60 Hz)

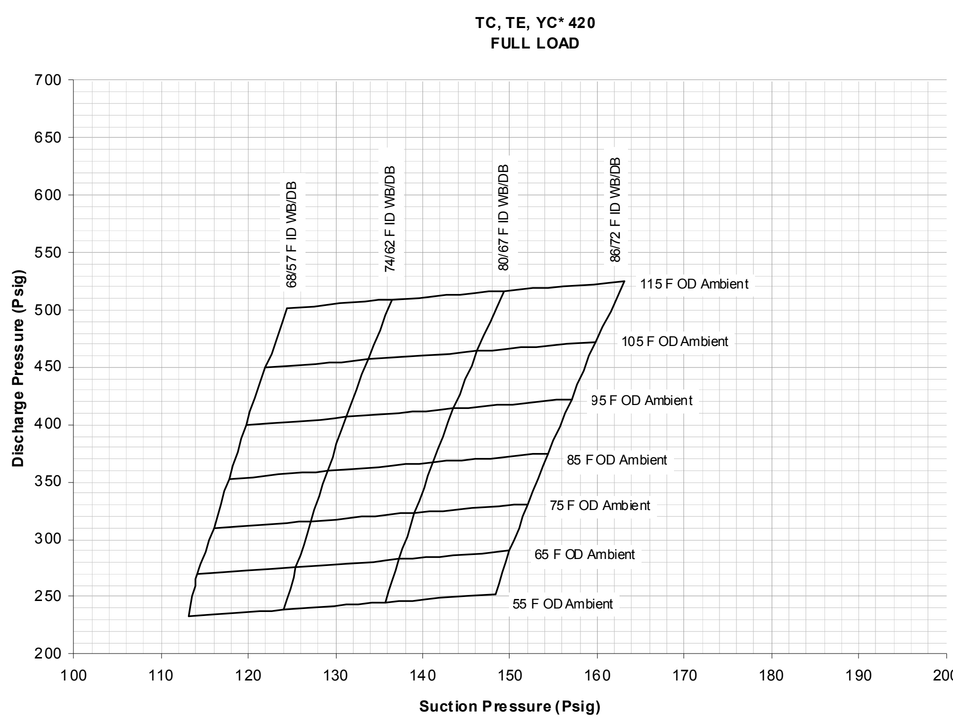


Table 54. 40 Ton Dual Circuit—Operating Pressure (60 Hz)

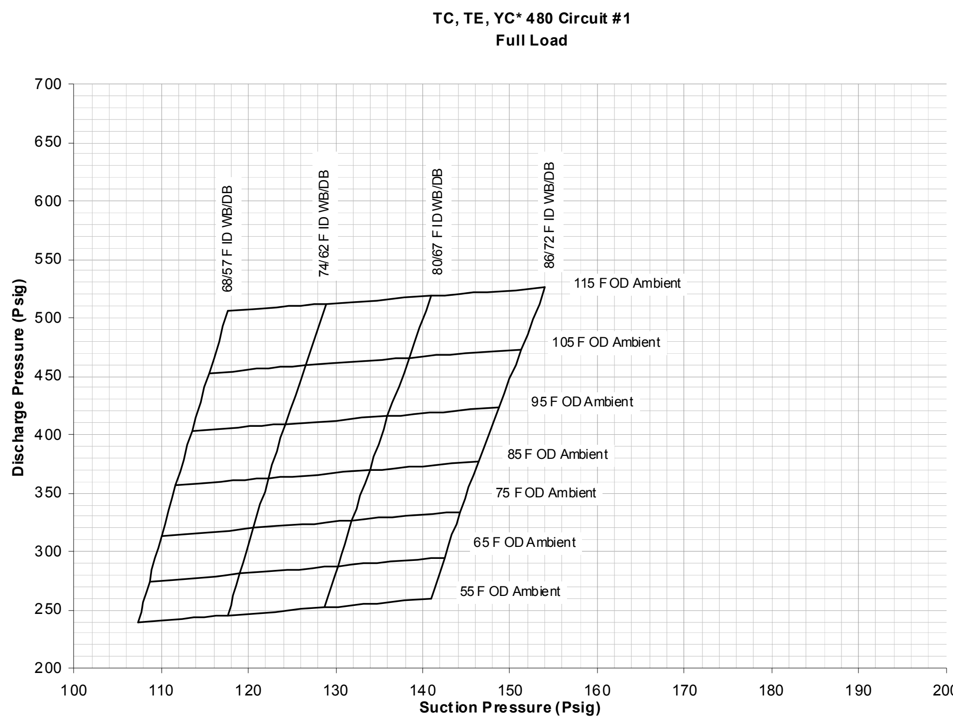


Table 55. 40 Ton Dual Circuit—Operating Pressure (60 Hz)

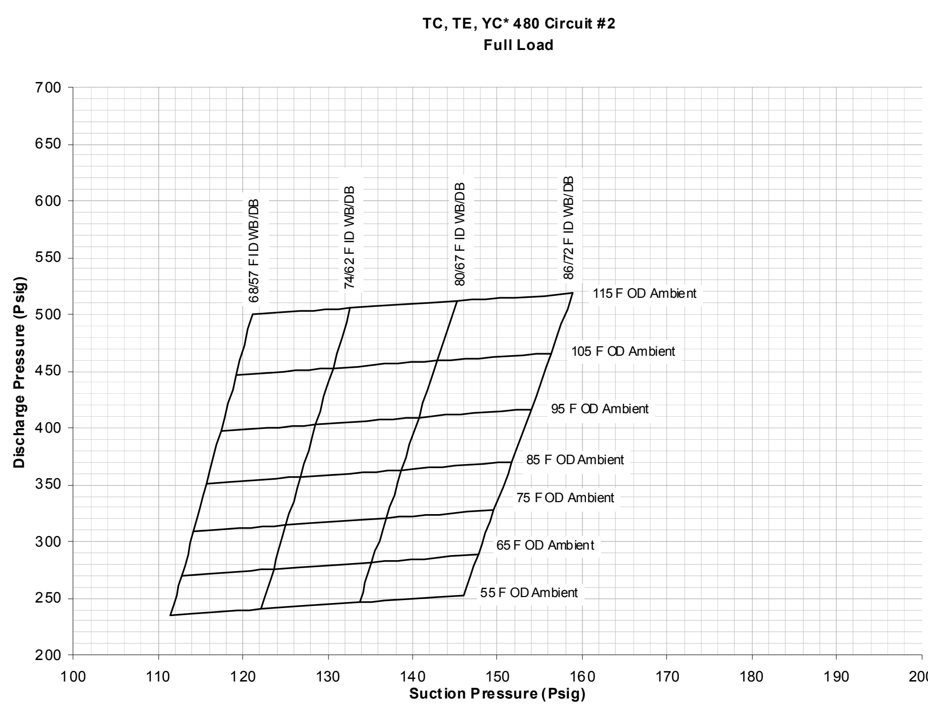


Table 56. 50 Ton Dual Circuit—Operating Pressures (60 Hz)

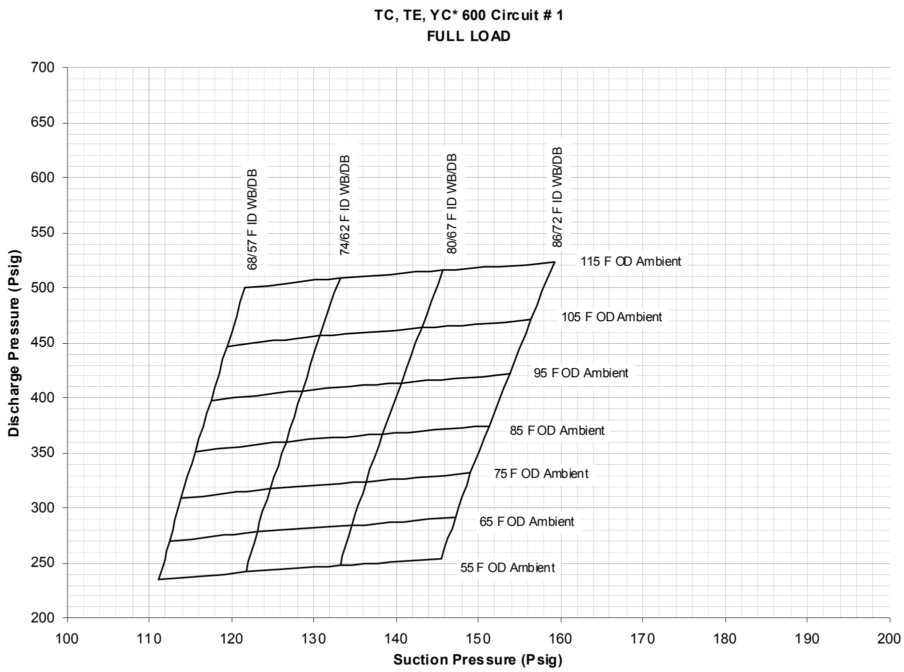


Table 57. 50 Ton Dual Circuit—Operating Pressures (60 Hz)

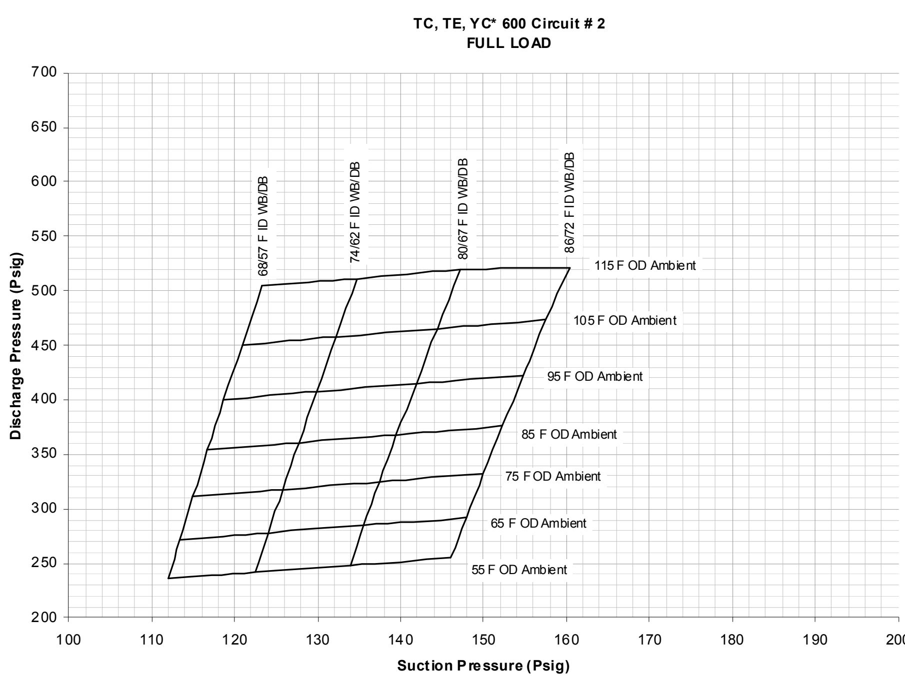


Table 58. 22.9 Ton—Operating Pressure (50 Hz)

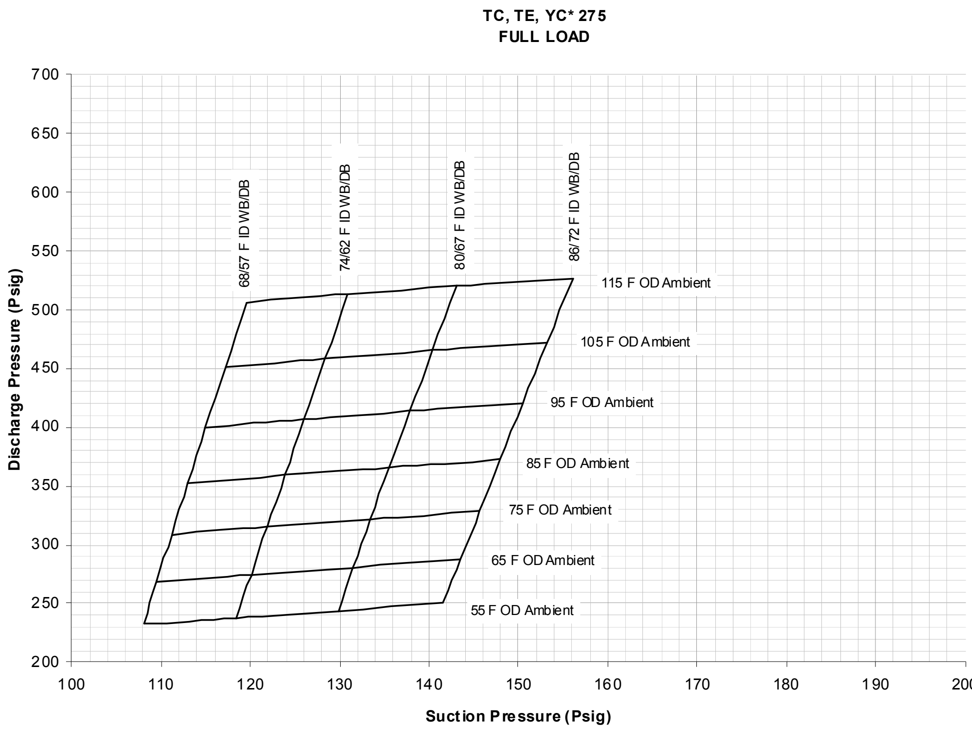


Table 59. 25.4 Ton—Operating Pressure (50 Hz)

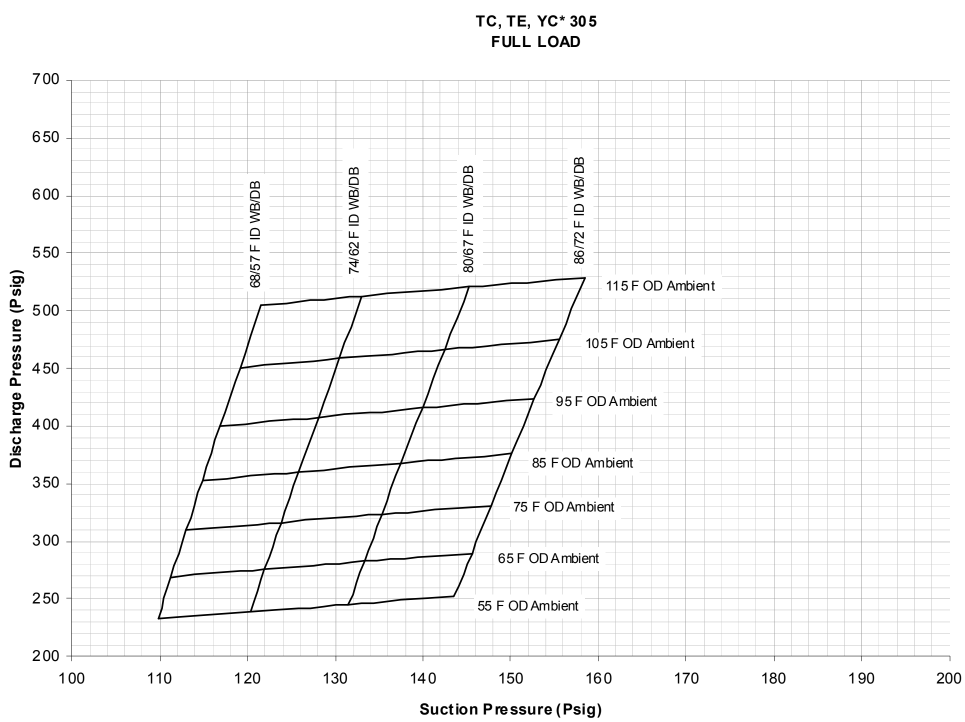


Table 60. 29.2 Ton—Operating Pressures (50 Hz)

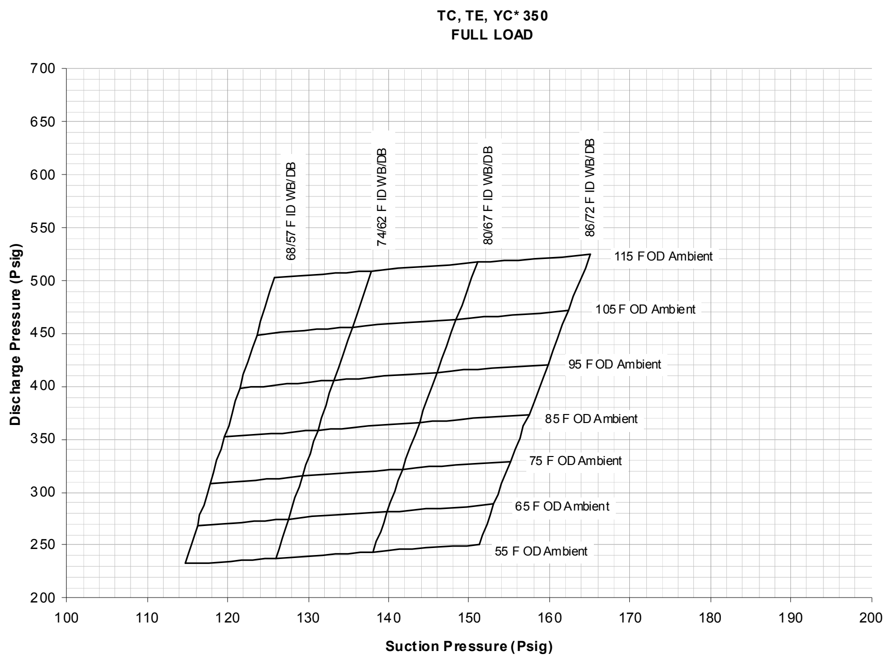


Table 61. 33.3 Ton Dual Circuit—Operating Pressure (50 Hz)

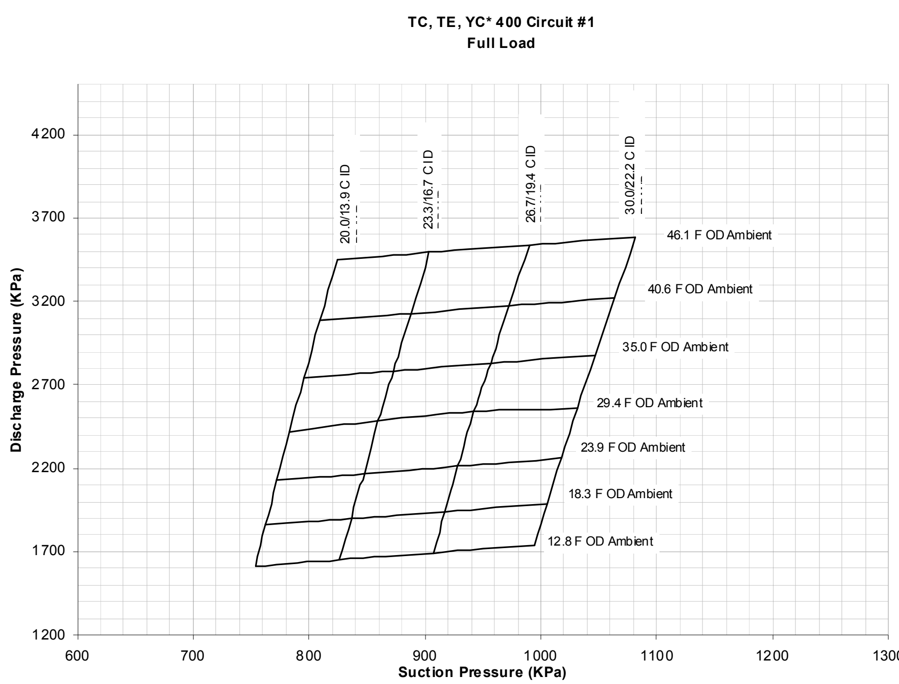


Table 62. 33.3 Ton Dual Circuit—Operating Pressure (50 Hz)

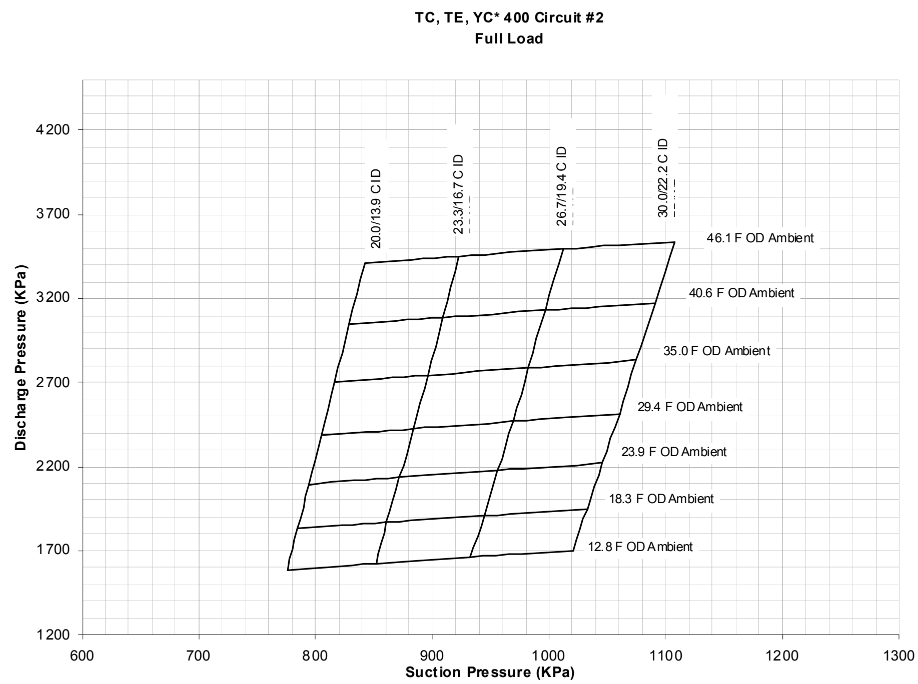


Table 63. 41.7 Ton Dual Circuit—Operating Pressures (50 Hz)

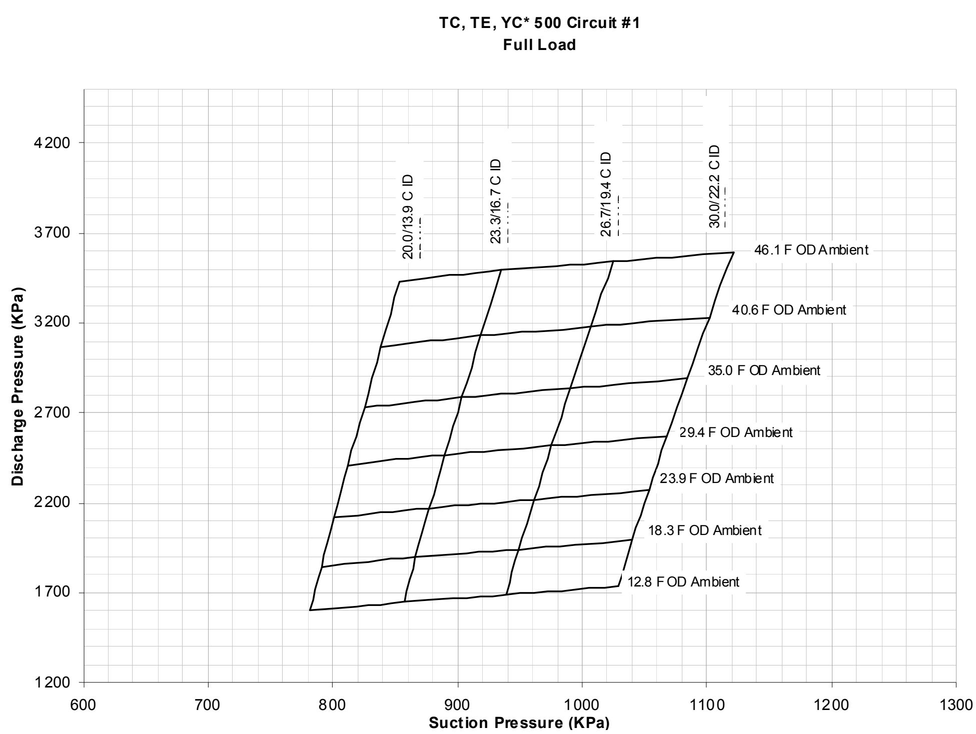
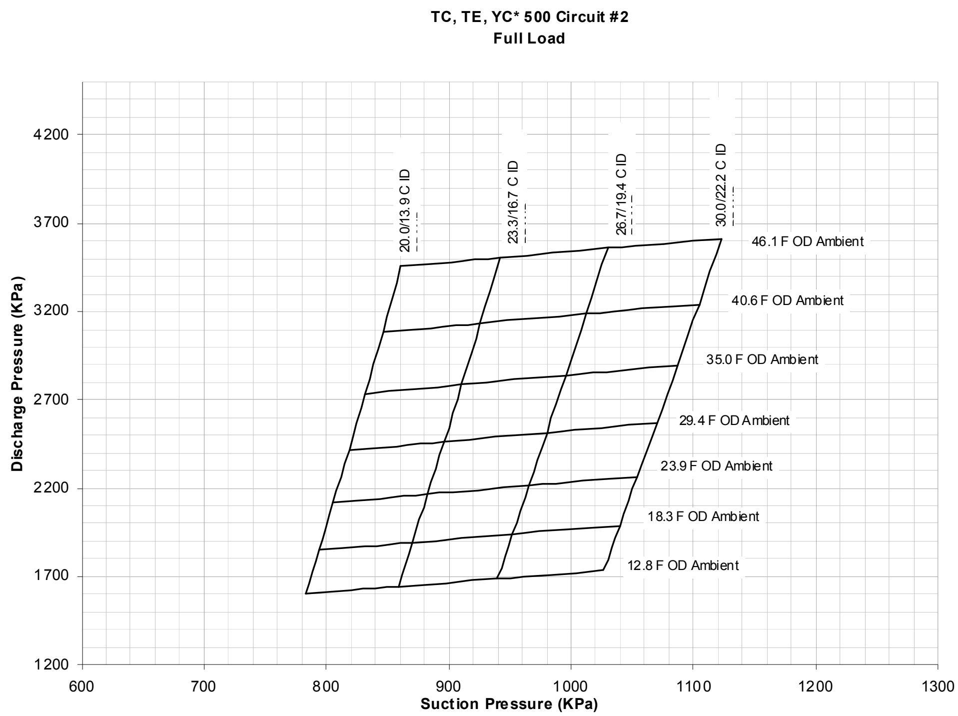


Table 64. 41.7 Ton Dual Circuit—Operating Pressures (50 Hz)



Scroll Compressor Operational Noises

Because the scroll compressor is designed to accommodate liquids (both oil and refrigerant) and solid particles without causing compressor damage, there are some characteristic sounds that differentiate it from those typically associated with a reciprocating compressor. These sounds (which are described below) are characteristic, and do not affect the operation or reliability of the compressor.

At Shutdown

When a Scroll compressor shuts down, the gas within the scroll compressor expands and causes momentary reverse rotation until the discharge check valve closes. This results in a “flutter” type sound.

At Low Ambient Startup

When the compressor starts up under low ambient conditions, the initial flow rate of the compressor is low due to the low condensing pressure. This causes a low differential across the thermal expansion valve that limits its capacity. Under these conditions, it is not unusual to hear the compressor rattle until the suction pressure climbs and the flow rate increases.

During Normal Operation

The scroll compressor emits a higher frequency tone (sound) than a reciprocating compressor.

Compressor Crankcase Heaters

Each compressor is equipped with a crankcase heater. When the compressor is "Off", the crankcase heater is energized. When the compressor is "On", the crankcase heater is de-energized. The proper operation of the crankcase heater is important to maintain an elevated compressor oil temperature during the "Off" cycle which reduces the potential for refrigerant to migrate into the compressor oil.

If present during a compressor start, liquid refrigerant could damage compressor bearings due to reduced lubrication and eventually could cause compressor mechanical failures.

Prior to the initial start or when power to the unit has been "Off" for an extended period, allow the crankcase heater to operate a minimum of 8 hours before starting the unit.

Charging by Subcooling

The unit is shipped with a complete refrigerant charge. However, if it becomes necessary to add refrigerant, it should be done so by adding charge to obtain an acceptable subcooling as described below. Refer to the maintenance section for proper refrigerant charging practices.

The outdoor ambient temperature must be between 65° and 105° F and the relative humidity of the air entering the evaporator must be above 40 percent. When the temperatures are outside of these ranges, measuring the operating pressures can be meaningless.

With the unit operating at "Full Circuit Capacity", acceptable subcooling ranges between 14° F to 22° F.

Measuring Subcooling

⚠WARNING
R-410A Refrigerant under Higher Pressure than R-22!

The unit described in this manual uses R-410A refrigerant which operates at higher pressures than R-22 refrigerant. Use ONLY R-410A rated service equipment or components with this unit. For specific handling concerns with R-410A, please contact your local Trane representative. Failure to use R-410A rated service equipment or components could result in equipment or components exploding under R-410A high pressures which could result in death, serious injury, or equipment damage.

1. At the liquid line service valve, measure the liquid line pressure. Using a Refrigerant R-410A pressure/temperature chart, convert the pressure reading into the corresponding saturated temperature.
2. Measure the actual liquid line temperature as close to the liquid line service valve as possible. To ensure an accurate reading, clean the line thoroughly where the temperature sensor will be attached. After securing the sensor to the line, insulate the sensor and line to isolate it from the ambient air.

Note: *Glass thermometers do not have sufficient contact area to give an accurate reading.*

3. Determine the system subcooling by subtracting the actual liquid line temperature (measured in step 2) from the saturated liquid temperature (converted in step 1).

Gas Heat Units

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

Follow the Test Guide in Table 28, p. 74 or Table 29, p. 74 to start the unit in the heating mode. Jumping the "Test" terminals several times for two to three seconds will be required.

When starting the unit for the first time or servicing the heaters, it is a good practice to start the heater with the main gas supply turned "Off".

All heating units have either two stage or modulating heat capabilities. The "High" heat models contain two heat exchangers. In staged units, the heat exchangers operate simultaneously at either the low or high fire state. In modulating units, the modulating furnace fires first and adjusts to the needed capacity. If more heat is required than the modulating can provide, the second bank is fired at full fire and the modulating bank again adjusts to the heating load present.

Check both ignition systems (if applicable) when going through the test procedures.

Once the ignition system and ignitors have been checked, open the main power disconnect switch to reset the RTRM.

⚠WARNING
Hazardous Gases and Flammable Vapors!

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

⚠WARNING
Hazardous Pressures!

When using dry nitrogen cylinders for pressurizing units for leak testing, always provide a pressure regulator on the cylinder to prevent excessively high unit pressures. Never pressurize unit above the maximum recommended unit test pressure as specified in applicable unit literature. Failure to properly regulate pressure could result in a violent explosion, which could result in death or serious injury or equipment or property-only-damage.

Turn the main gas supply to the unit "On" and check the gas pressure at the unit's gas train. Refer to the "Field Installed Gas Piping" section for the proper gas supply pressure and Figure 33, p. 52 for the location of the gas pressure taps.

Close the main power disconnect switch and start the first stage heating Test again. Wait approximately 60 seconds for the heater to switch to low fire and check the manifold gas pressure. The manifold pressure for a two stage burner must be set at negative 0.2" w.c., +/- 0.05" w.c. The manifold pressure on a modulating burner should be set at a positive 0.5" w.c., +/-0.05" w.c. For modulating burners, expect to see the manifold pressure reading fluctuate while the burner is operating, but it should never read negative.

⚠CAUTION
Hot Surfaces!

Surface temperatures may exceed 300°F (150°C) on flue and heat exchanger components. Contact of bare skin on hot surfaces could result in minor to severe burns.

Jump the test terminals momentarily to initiate second stage heat operation. The combustion blower motor should go to high speed. The second stage of heat in units with modulating gas will initiate the second heater bank to fire and both banks will operate at high fire. The manifold pressures of the two heater banks in a high heat modulating unit will be different. The pressure setting of the two stage burner will be a negative 0.2" w.c., while the modulating burner will be a positive 0.5" w.c.

Note: *When firing a modulating unit for the first time, a "humming", or resonance sound may be heard. This is an operational sound made by the burner screen as it burns in. This sound is not a concern unless it persists longer than the first few times the unit is fired.*

Electric Heat Units

Start the service test and check the amperage draw for each heating stage. Refer to the heater electrical data in Table 11, p. 35 for the full load amps of a specific heater size.

Once the operation of the heaters have been checked, open the main power disconnect switch or the unit mounted disconnect switch to shut the unit "Off" and to reset the RTRM.

This concludes the setup and testing for the major components and controls within the unit. Follow the Test guide in Table 28, p. 74 and Table 29, p. 74 to verify that the optional IGVs, VFD, economizer actuator, minimum ventilation controls are functioning.

Final Unit Checkout

After completing all of the checkout and startup 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:

- Verify that the RTRM is in the normal operation mode. The LED located on the UCP module is "on" and glowing continuously.

For Constant Volume Units;

- Verify that the "Mode" selection switch and the "Zone Temperature" setpoints are set and/or programmed at the sensor modules.

For Variable Air Volume Units;

The RTAM has input setpoint potentiometers inside the control panel that are set at the factory which will allow the unit to operate and maintain system control. For specific job specifications;

- Verify that the control input potentiometers are set according to the job specifications, i.e.;
  - Outside air reset temperature - _______ Setpoint
  - Reset amount °F. - _______ Setpoint
  - Static pressure - _______ Setpoint
  - Static pressure deadband - ________ Setpoint
  - Discharge air temperature - _______Setpoint
  - Morning warmup temperature - _______ Setpoint
  - Exhaust Fan - _______ Setpoint
- Inspect the unit for misplaced tools, hardware and debris.
- Verify that all unit exterior panels—including the control panel doors—are secured in place.

Sequence of Operation

Mechanical Cooling Sequence Of Operation

Time delays are built into the controls to increase reliability and performance by protecting the compressors and maximizing unit efficiency.

Dehumidification (Modulating Hot Gas Reheat) Sequence of Operation

When the relative humidity in the controlled space (as measured by the sensor assigned to space humidity sensing) rises above the space humidity setpoint, compressors and the supply fan will energize to reduce the humidity in the space. All compressors on both refrigerant circuits will be staged up during active dehumidification.

A Voyager Commercial Rooftop unit can contain one or two refrigerant circuits. Units with dehumidification will have one circuit with an outdoor condenser coil located in the outdoor section for normal head pressure control and a reheat coil located in the indoor air stream section for supply air reheat; both coils are for the same circuit. For 40-50 ton Voyager Commercial units the reheat circuit is circuit# 2. For 27.5-35 ton Voyager Commercial units there is only one circuit.

During dehumidification mode, the CLV AND RHP will modulate which will allow refrigerant to flow through both the condenser coil and the reheat coil. The RHP will be de-energized when in dehumidification mode.

During dehumidification mode, the Supply Air Temperature is controlled to the Supply Air Reheat Setpoint by controlling the reheat and cooling modulating valve position. The range for the Supply Air Reheat Setpoint is 65°F to 80°F and the default is 70°F. The Supply Air Reheat Setpoint is adjusted by using a potentiometer on the RTOM.

During cooling operation, the cooling valve (CLV) will be open 100% and the reheat valve (RHV) will be closed which will allow refrigerant to flow through the condenser coil and not the reheat coil. During cooling mode the reheat pump-out solenoid (RHP) will also be energized to allow refrigerant to be removed from the reheat coil.

During cooling or dehumidification mode, to ensure proper oil distribution throughout the reheat and cooling condenser circuits, a purge is initiated by a hardcoded purge interval timer. After the purge interval timer reaches 60 minutes, the unit performs a purge for a fixed 3-minute time period. During this state the reheat and cooling valve will be driven 50% and the reheat pump-out solenoid is energized.

See Dehumidification Low Pressure Control section for the reheat low pressure control (RLP) function during active dehumidification.

See Dehumidification Frost Protection section for the control scheme during active dehumidification.

See the Condenser Fan / Compressor sequence section for Condenser fan staging during active dehumidification.

Sensible cooling or heating control overrides dehumidification control. For both multi-circuit and single circuit units, any sensible heating request will terminate dehumidification control. If heating is active at the time a call for dehumidification control is received the heating operation must complete and an additional 5 minutes from the time heat is terminated must elapse before dehumidification will be allowed.

Note: *Occupied VAV operation in cooling mode will consider a critical zone temperature and when the sensible cooling requirements of this zone are not being met, the unit will terminate dehumidification control.*

Note: *Occupied CV and all unoccupied operation will terminate dehumidification if the sensible zone cooling requirements exceeds one-half the available cooling capacity of the unit.*

Units without an Economizer

For 27.5 to 35 Ton units, when mechanical cooling is required, the RTRM energizes the Compressor Contactor (CC1) coil. When the CC1 contacts close, the Compressor CPR1 and Outdoor Fan Motor (ODM1) will start providing the 3 minute "off" time has elapsed. ODM2 and ODM3 cycles off/on based on the outdoor ambient temperature as measured by the Outdoor Air Sensor (OAS). CPR1 cycles off as required providing the 3 minute "on" time has elapsed.

With CPR1 operating for a minimum of 3 minutes. If additional cooling is required, the RTRM energizes the 2nd compressor contactor (CC2) to bring on CPR2. While CPR1 continues to run, CPR2 cycles on/off as needed to meet the cooling requirements.

For 40 Ton constant volume and variable air volume applications, once CPR1 has operated for a minimum of 3 minutes, and additional cooling is required, the RTRM cycles CPR1 off and energizes compressor contactor CC2. If additional cooling is required, the RTRM energizes compressor contactor (CC1) providing CPR1 has been off for a minimum of 3 minutes. This configuration will allow the dual circuit unit to operate with three steps of cooling if CPR1 is the lead compressor.

For 50 Ton constant volume and variable air volume applications, once CPR1 has operated for a minimum of 3 minutes, and additional cooling is required, the RTRM cycles CPR1 off and energizes compressor contactors CC2 and CC3 simultaneously. If additional cooling is required, the RTRM energizes compressor contactor (CC1) providing CPR1 has been off for a minimum of 3 minutes. This configuration allow the dual circuit unit to operate with three steps of cooling if CPR1 is the lead compressor.

If the indoor Fan selection switch is set to the "AUTO" position on constant volume applications, the RTRM energizes the Indoor Fan Contactor (F) coil approximately one second after energizing first stage compressor contactor (CC1). When the cooling cycle is complete and CC1 is de-energized, the RTRM keeps the Fan on for approximately 60 seconds to enhance unit efficiency. On variable air volume applications, the Fan operates continuously.

Economizer operation based on Dry Bulb

Standard economizer dry bulb change over has five field selectable temperatures 55, 63, 67, 70, 73° F. Refer to Table 22, p. 64 for the proper potentiometer setting for each temperature selection.

The economizer option allows cooling utilizing outdoor air when the temperature is below the specified dry bulb setpoint (73° ±2° F factory setting). The air is drawn into the unit through modulating dampers. The ECA modulates the economizer dampers from minimum position to full open based on a 1.5° F control point below either the space temperature setpoint for constant volume applications or 1.5° F around the supply air temperature setpoint for variable air volume applications.

If the Mixed Supply Air Sensor (MAS) senses that supply air temperature is too cold, the dampers are held in their current position until the supply air temperature rises, or begin to modulate toward the minimum position if the supply air temperature continues to drop.

The economizer control allows fully integrated cooling operation between the compressor(s) and the economizer when needed to satisfy the cooling setpoint. The RTRM will not allow a compressor to operate until the economizer dampers have been fully open for at least three minutes. The RTRM evaluates the rate of temperature change during this delay and will energize compressor(s) as needed to maintain temperatures within setpoint deadbands.

If a power exhaust option is installed:

1. The power exhaust fan(s) comes on based on the position of the of the exhaust fan setpoint potentiometer on the RTOM (Reliatel Options Module). The setpoint is factory set at 25%. The exhaust fan(s) will come on anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.
2. Physical damper blade "stops" that limit the amount of exhaust airflow by limiting the maximum opening of the damper blades. These stops (sliding brackets secured with wing-nuts) are present under the rain hood on the non-modulating power exhaust option. There is

one stop on each side of each damper. The practical range of blade position control is between 1.5" and 4.0" blade opening. The damper is wide-open at 4.0". The stops on each side of a damper must be in the same position, such that the damper blade connecting member contacts the stops at the same time.

3. The modulating power exhaust actuator is a slave to the position of the economizer damper actuator such that the power exhaust dampers proportionally follow or track the fresh air damper position. The proportional offset between the dampers is adjusted under the rain hood by hole position selection of the power exhaust actuator jack shaft on the damper linkage arm.
4. When the Statitrac™ option is selected, the Exhaust Blade Actuator will modulate independently to the economizer in order the relieve positive building pressure. If the space pressure transducer fails, the unit will revert back to fresh air tracking control.

Economizer operation based on Reference Enthalpy

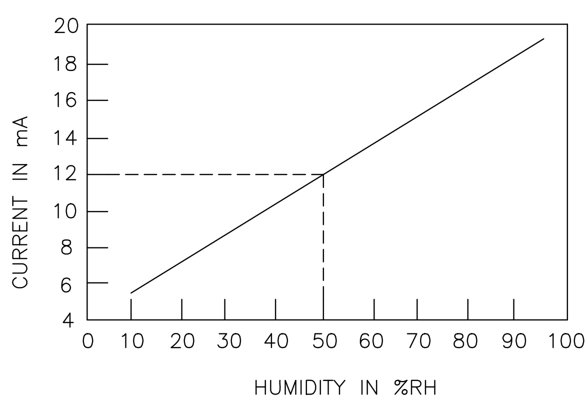
Reference enthalpy is accomplished by using an Outdoor Humidity Sensor (OHS). The reference enthalpy is field selectable to one of five standard enthalpies. Refer to Table 22, p. 64 for the proper potentiometer setting for each enthalpy selection.

If the outdoor air enthalpy is greater than the selected reference enthalpy, the economizer will not operate and the damper will not open past the minimum position setting.

If the outdoor air enthalpy is less than the reference enthalpy, the dampers will modulate to maintain a 45° to 55° F minimum supply air temperature (constant volume or variable air volume applications). The ECA modulates the economizer dampers from minimum position to fully open based on a 1.5° F control point below either the space temperature setpoint for constant volume applications or 1.5° F below the discharge air temperature setpoint for variable air volume applications. With reference enthalpy control, reference enthalpy is not allowed if the outdoor temperature is below 32° F. Below 32° F, dry bulb economizer control is enabled.

If communications between the Outdoor Humidity Sensor (OHS) and the Economizer Actuator Control (ECA) were to fail, the economizer will operate using the dry bulb parameters.

Figure 55. Humidity vs. Current Input



Economizer Operation based on Comparative Enthalpy

Comparative enthalpy is accomplished by using an outdoor humidity sensor (OHS), return humidity sensor (RHS), and the return air sensor (RAS).

If the outdoor air enthalpy is greater than the return air enthalpy, the economizer will not operate and the damper will not open past the minimum position setting. The economizer will not operate at outdoor air temperatures above 75° F.

If the outdoor air enthalpy is less than the return air enthalpy, the dampers will modulate to maintain a 45° to 55° F supply air temperature (constant volume or variable air volume applications). The ECA modulates the economizer dampers from minimum position to fully open based on a 1.5° F control point below either the space temperature setpoint for constant volume applications or 1.5° F around the supply air temperature setpoint for variable air volume applications. Refer to Figure 55, p. 114 for the Humidity versus Voltage Input Values.

If either or both the return air humidity sensor (RHS) or the return air sensor (RAS) fails, the economizer will operate using the reference enthalpy setpoint perimeters.

Gas Heat Sequence Of Operation

When heating is required, the RTRM initiates the heating cycle through the ignition control module (IGN). The IGN normally open contacts close to start the combustion blower motor (CBM) on high speed. Next, the IGN control energizes the hot surface igniter (IP) for 45 seconds. After a preheat period, the gas valve (GV) is energized for approximately 7 seconds. If the burner lights, the gas valve remains energized. If the burner fails to ignite, the ignition module will attempt two retries and then lock out if flame is not proven. The unit will attempt to ignite at 60 minute intervals until the heating call is removed.

An IGN lockout due to flame loss can be reset by:

1. Open and close the main power disconnect switch.
2. Switch the MODE switch on the zone sensor to “Off” and then to the desired position (VAV units – remove and reapply the mode input).
3. Allow the IGN to reset automatically after one hour.

When ignition takes place, the hot surface igniter (IP) is de-energized and functions as the flame sensor.

Two Stage—If, after 60 seconds, the unit requires 1st stage heating only, the IGN will change the combustion blower from high speed to low speed. If additional heating is required and first stage heat has been operating for a minimum of 10 seconds, the IGN inducer relay will change the combustion blower motor (CBM) to high speed, delivering second stage heat capacity.

Modulating—Units with modulating heat will fire the modulating bank first at high fire for 60 seconds. The unit will then modulate the heater to the necessary rate. If the modulating heat bank cannot satisfy the zone needs alone, the second bank will come on and the modulating will find the appropriate operating point.

Constant Volume (CV) unit fan operation

If the Fan selection switch is in the “AUTO” position for constant volume units, the RTRM will delay starting the supply fan for 30 seconds to allow the heat exchanger to warm up. When the zone temperature rises above the heating setpoint, the IGN control module will terminate the heat cycle. The supply fan remains energized for an additional 90 seconds.

Variable Air Volume (VAV) unit fan operation (2 stage and modulating gas heat)

During Unoccupied heating, Morning Warmup, and Daytime Warmup mode, the VFD or IGV must be at 100%. Therefore, before the unit can heat, the VHR relay must have been energized for at least 6 minutes to ensure that the VAV boxes have driven to maximum. For example, 6 minutes after a Daytime Warmup mode is initiated, the VFD / IGV output will go to 100% and then the heat cycle will begin. The VHR relay is energized during Unoccupied mode, Morning Warmup mode, and Daytime Warmup mode. This 6 minute delay before ig(next heading)

Variable Air Volume (VAV) unit fan operation (modulating gas heat only)

During Changeover Heat (LTB5-1 shorted to LTB5-2), the unit will heat to the Supply Air Heating Setpoint +/- 7F. The VFD/IGV will modulate to maintain the Static Pressure Setpoint.

Ignition Control Module

There is a green LED located on the ignition module. Any time the Ignition module is powered, the LED will be on to provide status of the ignition system.

- Steady OFF - no power/ internal failure
- Steady ON - no diagnostic, no call for heat
- Slow flash rate ¾ second on, ¼ second off - normal call for heat

Error Code Flashes

- One flash - Communication loss between RTRM and IGN
- Two flashes - System lockout; failed to detect or sustain flame (3 tries, lockout after 3rd try)
- Three flashes - Not used
- Four flashes - High limit switch TCO1, TCO2, or TCO3 open (auto reset)
- Five flashes - Flame sensed and gas valve not energized; or flame sensed and no call for heat (auto reset)

The pause between groups of flashes is approximately two seconds.

High Temperature Limit Operation and Location

All of the heater limit controls are automatic reset. The high limit cutouts (TCO1) and/or (TCO3) protect against abnormally high supply air temperature. The fan failure limit (TCO2) protects against abnormally high heat build up due to excessive high limit (TCO1) (TCO3) cycling if the indoor fan motor (IDM) fails. If TCO1, TCO2, or TCO3 open during a heating call, the heat will shut down and the supply fan will be forced to run. The heat will automatically restart should the TCO circuit re-close during an active heating call. While the TCO circuit is open, a heat fail diagnostic will be sent from the IGN to the RTRM.

The TCO1 and TCO3 is located in the bottom right corner of the burner assemblies on both downflow and horizontal units. TCO2 is located on the IDM partition panel; below and to the right of the blower housing on downflow units. On horizontal units, TCO2 is located on the IDM partition panel above the blower housing.

Electric Heat Sequence Of Operation

Constant (CV). When heat is required and the Fan selection switch is in the “AUTO” position for constant volume applications, the RTRM energizes the Supply Fan approximately one second before energizing the first stage electric heat contactor (AH). A 10 second minimum "off" time delay must elapse before the first stage heater is activated. When the heating cycle is completed, the RTRM de-energizes the Fan and the heater contactor (AH) at the same time.

The RTRM cycles the first stage of heat as required to maintain zone temperature. If the first stage cannot satisfy the heating requirement, the RTRM energizes the second stage electric heat contactors (BH) and (CH) providing first stage has been on for at least 10 seconds or the second stage has been off for at least 10 seconds. (CH contactor is used on 54KW and larger heaters.)

The RTRM cycles the second stage electric heat as required to maintain the zone temperature.

Variable Air Volume (VAV). During Unoccupied heating, Morning Warmup, or Daytime Warmup, the VHR relay will be energized for at least 6 minutes and the IGV or VFD output will go to 100%. The heaters will stage on and off to satisfy the zone temperature setpoint.

Low Pressure Control (LPC) Sequence of Operation (ReliaTel Control)

When the LPC is opened for one (1) continuous second, the compressor for that circuit is turned off immediately. The compressor will not be allowed to restart for a minimum of three (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 ICSTM if applicable, and a manual reset will be required to restart the compressor.

High Pressure Control and Temperature Discharge Limit (ReliaTel Control)

The Temperature Discharge Limit (TDL) is located in the Compressor Output circuit and is connected in series with the High Pressure Control (HPC). The RTRM will register an auto reset lockout if either the high pressure control switch or the temperature discharge limit opens during compressor operation. If the compressor output circuit is opened four consecutive times during compressor operation, the RTRM will generate a manual reset lockout.

Maintenance

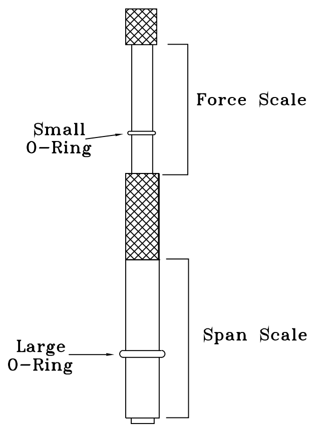
Fan Belt Adjustment

The Supply 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 installing new belts, do not stretch them over the sheaves; instead, loosen the adjustable motor-mounting base.

Once the new belts are installed, adjust the belt tension using a Browning or Gates tension gauge (or equivalent) illustrated in Figure 56.

Figure 56. Typical Belt Tension Gauge



1. To determine the appropriate belt deflection:
   a. Measure the center-to-center distance, in inches, between the fan sheave and the motor sheave.
   b. Divide the distance measured in Step 1a by 64; the resulting value represents the amount of belt deflection for 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.
4. Place the large end of the gauge on the belt at the center of the belt span. Depress the gauge plunger until the large O-ring is even with the of the second belt or even with a straightedge placed across the sheaves.
5. Remove the tension gauge from the belt. Notice that the small O-ring now indicates a value other than zero on the force scale. This value represents the force (in pounds) required to deflect the belt(s) the proper distance when properly adjusted.
6. Compare the force scale reading in step 5 with the appropriate “force” value in Figure 57. If the force reading is outside of the listed range for the type of belts used, either readjust the belt tension or contact a qualified service representative.

Note: *The actual belt deflection force must not exceed the maximum value shown in Figure 57, p. 120.*

7. Recheck the new belt's tension at least twice during the first 2 to 3 days of operation. Readjust the belt tension as necessary to correct for any stretching that may have occurred. Until the new belts are “run in”, the belt tension will decrease rapidly as they stretch.

Table 65. Supply Fan Sheave and Belt Table

			Fan Sheave[a][b][c]		Fan Bushing[c]		Motor Sheave[c][d]		Motor Bushing[c][e]		
Tons	Motor	RPM	Browning	SST	Browning	SST	Browning	SST	Browning	SST	Belt
27.5 & 30	7.5 hp	550	BK190 X 1 7/16	BK190-1-7/16			BK62H	BK62H	H 1-3/8	H-1-3/8	BX108 Notched
		600	BK160 X 1 7/16	BK160-1-7/16			BK57H	BK57H	H 1-3/8	H-1-3/8	BX100 Notched
		650	BK160 X 1 7/16	BK160-1-7/16			BK62H	BK62H	H 1-3/8	H-1-3/8	BX103 Notched
27.5 & 30	10 hp[f]	650	BK190 X 1 7/16	BK190-1-7/16			BK75H	BK75H	H 1-3/8	H-1-3/8	BX108 Notched
		700	BK160 X 1 7/16	BK160-1-7/16			BK67H	BK67H	H 1-3/8	H-1-3/8	BX103 Notched
		750	BK160 X 1 7/16	BK160-1-7/16			BK72H	BK72H	H 1-3/8	H-1-3/8	BX103 Notched
35	7.5 hp	600	BK160 X 1 7/16	BK160-1-7/16			BK57H	BK57H	H 1-3/8	H-1-3/8	BX100 Notched
	10 hp	650	BK190 X 1 7/16	BK190-1-7/16			BK75H	BK75H	H 1-3/8	H-1-3/8	BX108 Notched
		700	BK160 X 1 7/16	BK160-1-7/16			BK67H	BK67H	H 1-3/8	H-1-3/8	BX103 Notched
	15 hp[g]	790	BK160 X 1 7/16	BK160-1-7/16			1B5V68	1B68SDS	B 1 5/8	SDS 1 5/8	BX103 Notched
		800	BK160 X 1 7/16	BK160-1-7/16			1B5V70	1B70SDS	B 1 5/8	SDS 1 5/8	BX103 Notched
40	10 hp	500	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2BK36H	2BK36H	H 1-3/8	H-1-3/8	BX95 Notched
		525	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2BK40H	2BK40H	H 1-3/8	H-1-3/8	BX95 Notched
		575	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2BK45H	2BK45H	H 1-3/8	H-1-3/8	BX95 Notched
	15 hp	625	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2B5V42	2B42SH	P1 1-5/8	SH 1 5/8	BX95 Notched
		675	2B5V136	2B136SK	B 1 11/16	SK 1 11/16	2B5V50	2B50SDS	B 1 5/8	SDS 1 5/8	BX97 Notched
		725	2B5V136	2B136SK	B 1 11/16	SK 1 11/16	2B5V54	2B54SDS	B 1 5/8	SDS 1 5/8	BX97 Notched
50	10 hp	525	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2BK40H	2BK40H	H 1-3/8	H-1-3/8	BX95 Notched
		575	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2BK45H	2BK45H	H 1-3/8	H-1-3/8	BX95 Notched
	15 hp	625	2B5V124	2B124SK	B 1 11/16	SK 1 11/16	2B5V42	2B42SH	P1 1-5/8	SH 1 5/8	BX95 Notched
		675	2B5V136	2B136SK	B 1 11/16	SK 1 11/16	2B5V50	2B50SDS	B 1 5/8	SDS 1 5/8	BX97 Notched
	20 hp	725	2B5V136	2B136SK	B 1 11/16	SK 1 11/16	2B5V54	2B54SDS	B 1 5/8	SDS 1 5/8	BX97 Notched

(a) Browning BK160 X 1 7/16 and SST BK160-1-7/16 sheaves are interchangeable.
(b) Browning BK190 X 1 7/16 and SST BK190-1-7/16 sheaves are interchangeable.
(c) All other sheaves & bushings are interchangeable only in sheave/bushing combination sets. Sets do not mix vendors.
(d) Browning and SST sheaves with identical numbers are interchangeable and can be used with each other's bushings.
(e) Browning H 1-3/8 and SST H-1-3/8 bushings are interchangeable and can be used with each other's sheaves.
(f) For YC gas/electrics only.
(g) For TC and TE Cooling only and with electric heat units only.

Monthly Maintenance

⚠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.

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

Filters

- Inspect the return air filters. Clean or replace them if necessary. Refer to the table below for filter information.

Table 66. Filters

Unit Model	Quantity	Filter Dimension (inches)
TC, TE, YC*330 - 420	16	15½ X 19½ X 2 or 4*
TC, TE, YC*480 & 600	17	15½ X 19½ X 2 or 4*

* Filter dimensions are actual. Nominal filter size is 16 x 20.

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 "Coil Cleaning" later in this section.
- 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.
- Manually rotate the condenser fans to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.

Figure 57. Belt Deflection

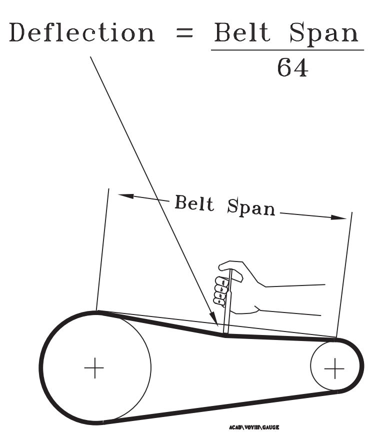


Table 67. Deflection Force

Belts Cross Section	Small P.D Range	Deflection Force (Lbs.)					
		Super Gripbelts		Gripnotch		Steel Cable Gripbelts	
		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

Table 68. Deflection Force

Belt Cross Section	Small P.D Range	Deflection Force (Lbs.)			
		358 Gripbelts		358 Gripnotch Belts	
		Min.	Max.	Min.	Max.
5V	4.4 - 8.7	—	—	10	15
	7.1 - 10.9	10 1/2	15 3/4	12 7/8	18 3/4
	11.8 - 16.0	13	19 1/2	15	22

- 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. These bearing are considered permanently lubricated for normal operation. For severe dirty applications, if relubrication becomes necessary, use a lithium based grease. See Table 69, p. 123 for recommended greases.

Note: *The bearings are manufactured using a special synthetic lithium based grease designed for long life and minimum relube intervals. Over lubrication can be just as harmful as not enough.*

Use a hand grease gun to lubricate these bearings; add grease until a light bead appears all around the seal. Do not over lubricate!

After greasing the bearings, check the setscrews to ensure that the shaft is held securely. Make sure that all bearing braces are tight.

- Check the supply fan belt(s). If the belts are frayed or worn, replace them.
- Check the condition of the gasket around the control panel doors. These gaskets must fit correctly and be in good condition to prevent water leakage.
- Verify that all 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 oil level (each circuit);

- compressor suction and discharge pressures (each circuit);
- superheat and subcooling (each circuit);

Record this data on an “operator’s maintenance log” like the one shown in Table 31. If operating pressures indicate a refrigerant shortage, measure the system superheat and system subcooling. For guidelines, refer to "Charging by Subcooling".

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. Refer to general service bulletin MSCU-SB-1 (latest edition).*

Heating Season

⚠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.

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

- Inspect the unit air filters. If necessary, clean or replace them.
- Check supply fan motor bearings; repair or replace the motor as necessary.
- Check the fan shaft bearings for wear. Replace the bearings as necessary. These bearing are considered permanently lubricated for normal operation. For severe dirty applications, if relubrication becomes necessary, use a lithium based grease. See Table 69, p. 123 for recommended greases.

Note: *The bearings are manufactured using a special synthetic lithium based grease designed for long life and minimum relube intervals. Too much lubrication in a bearing can be just as harmful as not enough.*

Use a hand grease gun to lubricate the bearings; add grease until a light bead appears all around the seal. Do not over lubricate!

After greasing the bearings, check the setscrews to ensure that the shaft is held securely. Make sure that all bearing braces are tight.

- 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.
- YC* units only - Check the heat exchanger(s) for any corrosion, cracks, or holes.
- Check the combustion air blower for dirt. Clean as necessary.

⚠WARNING

Hazardous Gases and Flammable Vapors!

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

⚠WARNING
Hazardous Pressures!

When using dry nitrogen cylinders for pressurizing units for leak testing, always provide a pressure regulator on the cylinder to prevent excessively high unit pressures. Never pressurize unit above the maximum recommended unit test pressure as specified in applicable unit literature. Failure to properly regulate pressure could result in a violent explosion, which could result in death or serious injury or equipment or property-only-damage.

- Open the main gas valve and apply power to the unit heating section; then initiate a "Heat" test using the startup procedure described in "Verifying Proper Heater Operation".
- Verify that the ignition system operates properly.

Note: *Typically, it is not necessary to clean the gas furnace. However, if cleaning does become necessary, remove the burner plate from the front of the heat exchanger to access the drum. Be sure to replace the existing gaskets with new ones before reinstalling the burner.*

Table 69. Grease Recommendations

Recommended Grease	Recommended Operating Range
Exxon Unirex #2	
Mobil 532	-20 F to 250 F
Mobil SHC #220	
Texaco Premium RB	

Coil Cleaning

Regular coil maintenance, including annual cleaning—enhances the unit's operating efficiency by minimizing:

- compressor head pressure and amperage draw;
- water carryover;
- fan brake horsepower; and,
- static pressure losses.

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

To clean refrigerant coils, use a soft brush and a sprayer. Contact the local Trane Parts Center for appropriate detergents.

1. Remove enough panels from the unit to gain safe access to coils (for the 50 ton unit with the 3rd coil closest to the bulk-head, safe access can be gained by removal of the unit side panels).

⚠WARNING
No Step Surface!

Do not walk on the sheet metal base. Walking on the base could cause the supporting metal to collapse. Failure of the base could result in death or serious injury.

Note: *Bridging between the main supports required before attempting to enter into the unit. Bridging may consist of multiple 2 by 12 boards or sheet metal grating.*

2. Straighten any bent coil fins with a fin comb.
3. Remove loose dirt and debris from both sides of the coil with a soft brush.

4. Mix the detergent with water according to the manufacturer's instructions. If desired, heat the solution to 150° F maximum to improve its cleansing capability.
5. Pour the cleaning solution into the sprayer. If a high-pressure sprayer is used:
   a. The minimum nozzle spray angle is 15 degrees.
   b. Do not allow sprayer pressure to exceed 600 psi.
   c. Spray the solution perpendicular (at 90 degrees) to the coil face.
   d. Maintain a minimum clearance of 6" between the sprayer nozzle and the coil.
6. Spray the leaving-airflow side of the coil first; then spray the opposite side of the coil. Allow the cleaning solution to stand on the coil for five minutes.
7. Rinse both sides of the coil with cool, clean water.
8. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 7 and 8.
9. Reinstall all of the components and panels removed in Step 1; then restore power to the unit.
10. With a fin comb, straighten any coil fins which were inadvertently bent during the cleaning process.

Fall Restraint

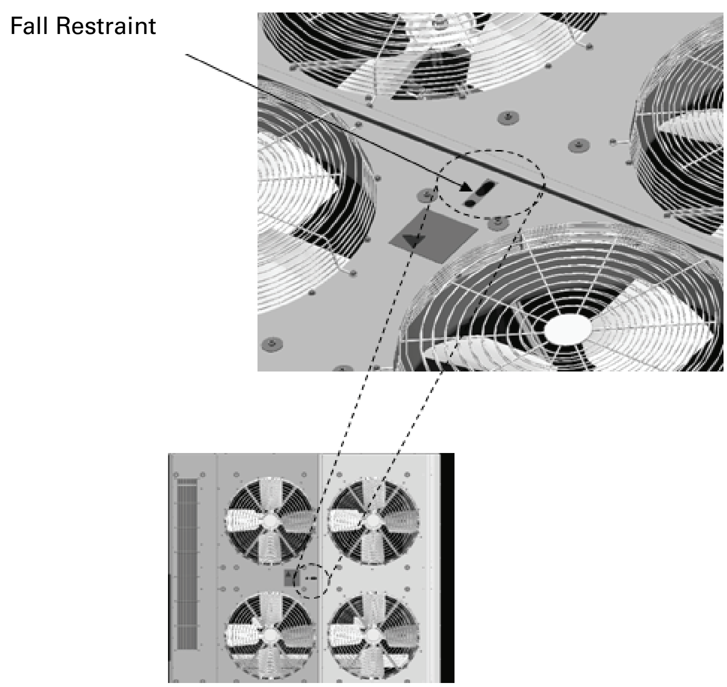
⚠WARNING

Falling Off Equipment!

This unit is built with fall restraint slots located on unit top that must be used during servicing. This slot is to be used with fall restraint equipment that will not allow an individual to reach the unit edge, but will NOT prevent falling to the ground, for they are NOT designed to withstand the force of a falling individual. Failure to wear a fall restraint equipment and use the fall restraint slots could result in death or serious injury.

The fall restraint is located approximately 3 feet from the unit edge. Figure 58, p. 124

Figure 58. Fall restraint



Refrigeration System

⚠WARNING

R-410A Refrigerant under Higher Pressure than R-22!

The unit described in this manual uses R-410A refrigerant which operates at higher pressures than R-22 refrigerant. Use ONLY R-410A rated service equipment or components with this unit. For specific handling concerns with R-410A, please contact your local Trane representative.

Failure to use R-410A rated service equipment or components could result in equipment or components exploding under R-410A high pressures which could result in death, serious injury, or equipment damage.

⚠WARNING

Contains Refrigerant!

System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives. Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death or serious injury or equipment damage.

Refrigerant Evacuation and Charging

The unit is fully charged with R-410A refrigerant from the factory. However, if it becomes necessary to remove or recharge the system with refrigerant, it is important that the following actions are taken. Failure to do so may cause permanent damage to the compressor.

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.*

- To prevent cross contamination of refrigerants and oils, use only dedicated R-410A service equipment.
- Disconnect unit power before evacuation and do not apply voltage to compressor while under vacuum. Failure to follow these instructions will result in compressor failure.
- Due to the presence of POE oil, minimize system open time. Do not exceed 1 hour.
- When recharging R-410A refrigerant, it should be charged in the liquid state.
- It is recommended that the compessor should be off when the initial refrigerant recharge is performed
- It is recommended that the initial refrigerant be charged into the liquid line prior to starting the compressor. This will minimize the potential damage to the compressor due to refrigerant in the compressor at startup.

Note: *Do not charge liquid refrigerant into the suction line with the compressor off. This increases both the probability that the compressor will start with refrigerant in the compressor oil sump and the potential for compressor damage.*

- If suction line charging is needed to complete the charging process, only do so with the compressor operating.
- Allow the crankcase heater to operate a minimum of 8 hours before starting the unit.

Compressor Oil

If a motor burn out is suspected, use an acid test kit to check the condition of the oil. Test results will indicate an acid level has exceeded the limit if a burn out occurred. Oil test kits must be used for POE oil (OIL00079 for a quart container or OIL00080 for a gallon container) to determine whether the oil is acid.

If a motor burn out has occurred, change the oil in both compressors in a tandem set. This will require that the oil equalizer tube be removed to suck the oil out of the oil sump. A catch pan must be used to catch the oil when the compressor oil equalizer line is loosened.

Note: *Refrigerant oil is detrimental to some roofing materials. Care must be taken to protect the roof from oil leaks or spills.*

Charge the new oil into the Schrader valve on the shell of the compressor. Do to the moisture absorption properties of POE oil, do not use POE oil from a previously opened container. Also discard any excess oil from the container that is not used.

Compressor model	Oil amount
CSHD142-161	7.0 pts
CSHD183	7.6 pts
CSHN250	14.2 pts

Compressor Replacements

Electrical Phasing

If it becomes necessary to replace a compressor, it is very important to review and follow the Electrical Phasing procedure described in the startup procedure of this manual.

If the compressors are allowed to run backward for even a very short period of time, internal compressor damage may occur and compressor life may be reduced. If allowed to run backwards for an extended period of time the motor windings can overheat and cause the motor winding thermostats to open. This will cause a "compressor trip" diagnostic and stop the compressor

If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed. Check the electrical phasing at the compressor terminal box. If the phasing is correct, before condemning the compressor, interchange any two leads to check the internal motor phasing.

Precision Suction Restrictor

Tandem manifold compressors that have unequal capacity sizes utilize a precision suction restrictor Figure 59, p. 126 to balance the oil levels in the compressors. This restrictor is placed in the smaller capacity compressor. When replacing this compressor, it is imperative that the proper restrictor is selected from those provided with the replacement compressor. See Table 70, p. 127 and Figure 60, p. 127

When the compressors are restarted, verify that correct oil levels are obtained with both compressors operating.

Figure 59. Precision Suction Restrictor

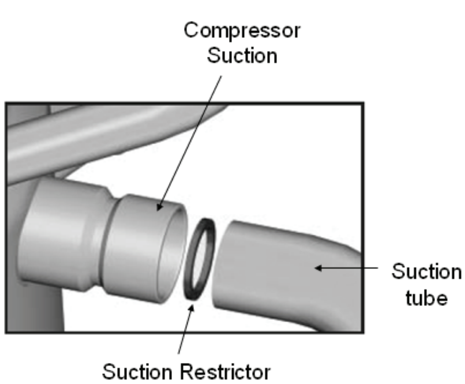


Table 70. Compressor Models/Restrictor Locations

				Restrictor Location		
Model T**/Y**	Compressor CPR3	Compressor CPR2	Compressor CPR1	CPR3	CPR2	CPR1
330		CSHD142	CSHD161		X	
420		CSHD161	CSHD184		X	
600	CSHD155	CSHD183	CSHD161	X		

Figure 60. Compressors

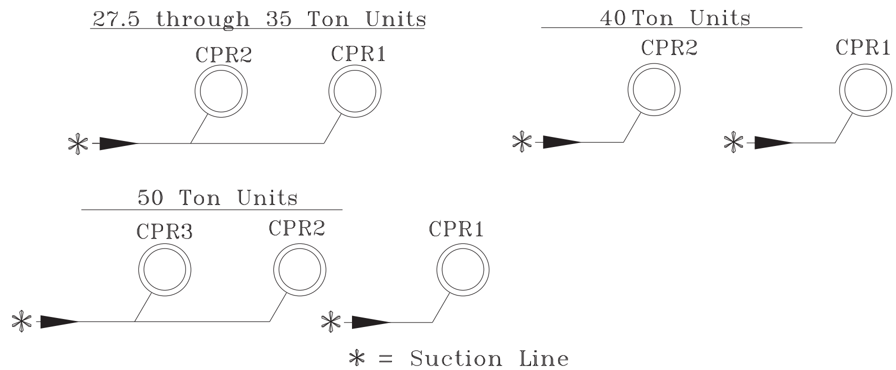


Table 71. Sample Operator's Maintenance Log (see note)

Date	Current Ambient Temp. (F)	Refrigerant Circuit #1						Refrigerant Circuit #2					
		Compr Oil Level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Sub-cool. (F)	Compr. Oil Level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Sub-cool. (F)
		- 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					

Note: With the unit running, check and record the data requested above each month during the cooling season.

Diagnostics

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 Unit Control. All diagnostics and system status information stored in the RTRM will be lost when the main power is turned "Off".

⚠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.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK HTB1 OR UNIT DISCONNECT SWITCH.

1. Verify that the LED on the RTRM is on. If the LED is on or blinking (2 blinks every 2 seconds). If so, go to step 3.
2. If the LED is not on, verify that 24 VAC is present between RTRM 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) and fuse. If the LED is not on or blinking yet 24VAC is present, the RTRM has failed and must be replaced.
3. If the LED is blinking, a diagnostic is definitely present. If the LED is on, certain diagnostics may still be present. Utilizing "Method 1" or "Method 2" in the “System Status Diagnostic” section, check the following system status:
   - Service status
   - Heating status
   - Cooling status

   If any diagnostic is seen, refer to the appropriate Diagnostics section for CV units or VAV units. Once the condition causing the diagnostic is cleared, proceed to step 5.
4. If any diagnostic is seen, refer to the appropriate Diagnostics section for CV units or VAV units. Once the condition causing the diagnostic is cleared, proceed to step 5.
5. If no diagnostics are present, use one of the TEST mode procedures described in the "Unit Startup" section 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 Steps 7 and 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/Diagnostics

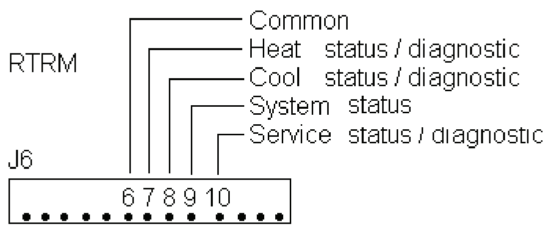
System status and/or diagnostics can be observed at the ZSM, through ICS, or at the unit by using a DC voltmeter. The LED on the RTRM module does not indicate whether diagnostics are present or not. This RTRM LED is an indicator that the RTRM has power, and it pulses during the TEST mode.

Terminal locations

System Status / Diagnostics checkout procedure (DC volt meter required)

The method described below to determine unit status or to see if diagnostics are present assumes the Zone Sensor or NSB panel is not within sight or close by or is not being used. If a zone sensor is within sight however, DC readings need not be taken - just look at the LED or display and go to STEP 3.

Figure 61. Terminal Locations



1. Measure and record DC voltage from J6-6 (common) to each output: J6-7, J6-8, J6-9, and J6-10.
2. Using the data below, determine if each output is ON, OFF, or PULSING.

   All voltages are approximate - this is a sensitive circuit, so the type of voltmeter used, sensor connections etc. may all slightly affect the reading.

   ON = 30VDC if no NSB or ZSM with LED's is connected, 25VDC if NSB panel (BAYSENS119*) is connected, 2VDC if ZSM w/ LED's (BAYSENS110*, BAYSENS021*) is connected.

   OFF = 0.75 VDC regardless of ZSM / NSB connection

   PULSING (DIAGNOSTIC PRESENT) = A distinct pulsing from 0.75 VDC to 30 VDC will be seen depending on the type of meter used. Some meters may only pulse between 20 and 30 volts DC.
3. Refer to the data in "What Outputs Mean" section to determine course of action.

What Outputs Mean:

HEAT J6-7

- On = system is actively heating
- Off = system is not actively heating
- Pulsing = a diagnostic is present

(see DIAGNOSTICS section).

COOL J6-8

- On = system is actively cooling
- Off = system is not actively cooling
- Pulsing = a diagnostic is present

(see DIAGNOSTICS section).

SYSTEM J6-9

- On = RTRM has power
- Off = RTRM does not have power or has failed
- Pulsing = unit is in the TEST mode

SERVICE J6-10 On = dirty air filter indication

Off = normal operation

Pulsing = a diagnostic is present

(see DIAGNOSTICS section).

Note: *Diagnostics for CV or VAV units are listed separately. The same diagnostic may have a different meaning depending on whether the unit has VAV controls or CV controls.*

Diagnostics (CV units only)

If only one diagnostic is present, refer to that diagnostic listing below. If more than one diagnostic is present, refer to combination diagnostics such as COOL + HEAT as appropriate. On a BAYSENS119*, the display will show HEAT FAIL or COOL FAIL or SERVICE (or an appropriate combination) if a diagnostic is present. If the unit is using a conventional thermostat, diagnostics are still available by using a DC voltmeter as described above.

HEAT (YC only)

1. TCO1, TCO2 or TCO3 has opened.
2. IGN Module lockout (see gas heat section for troubleshooting).

COOL

1. Zone temp input (RTRM J6-1) is open, shorted, or has failed after the RTRM sensed a valid input. (See note)

Note: *Since CV units may use a conventional thermostat, the RTRM will not send a diagnostic if a zone sensor is not attached when power is applied to the unit. Also, the RTRM ignores a zone sensor if it is attached to a powered-up unit. (after a brief time-out). Therefore, always reset power after installing a mechanical ZSM to terminals RTRM J6-1 through J6-5.*

2. Cooling and heating setpoint inputs are both open, shorted, or failed, but the unit has a valid zone temp input.
3. Programmable ZSM (BAYSENS119*) has failed to communicate after successful communication has occurred.
4. CC1 or CC2 24 VAC control circuit has opened 3 times during a cooling mode. Check CC1, CC2 coils or any controls in series with the coils (winding thermostat, HPC, circuit breaker auxiliary contacts).
5. LPC 1 or LPC 2 has opened during the 3 minute minimum "on" time during 4 consecutive compressor starts. Check LPC 1 circuit by measuring voltage from RTRM J1-8 to chassis ground. Check LPC 2 circuit by measuring voltage from RTRM J3-2 to chassis ground. If 24 VAC is not present, the circuit is open. 24 VAC should be present at these terminals at all times.

SERVICE

1. The supply fan proving switch (FFS) has failed to close within 40 seconds after the fan starts or has closed during fan operation.

HEAT + COOL

1. The Emergency Stop input (LTB1-5 and LTB1-6) is open. Check this input at the RTRM by measuring voltage from RTRM J1-12 to chassis ground. 24 VAC should be present whenever the Emergency Stop input is closed.
2. Outdoor air sensor (OAS) input is open, shorted, or has failed.

HEAT + COOL + SERVICE

1. Smoke Detector input active.
2. Supply Air Temperature Failure on units with modulating dehumidification
3. Entering Evaporator Temperature Failure on units with modulating dehumidification.
4. RTDM Communication Failure on units with modulating dehumidification.

Diagnostics (VAV only)

If only one diagnostic is present, refer to that diagnostic. If more than one diagnostic is present, refer to combination diagnostics such as COOL + HEAT as appropriate. On a BAYSENS119*, the display will show HEAT FAIL or COOL FAIL or SERVICE (or an appropriate combination) if a diagnostic is present.

HEAT (YC only)

1. TCO1, TCO2, or TCO3 has opened.
2. IGN Module lockout (see gas heat section for troubleshooting).

COOL

1. Discharge air sensor (DTS) is open, shorted, or has failed.
2. Zone temp input (RTRM J6-1) is open, shorted, or failed during an unoccupied mode. If the unit has a default mode input (jumper from RTRM J6-2 to RTRM J6-4, a valid zone temp input is needed for unoccupied heating, MWU and DWU.
3. CC1 or CC2 24 VAC control circuit has opened 3 times during a cooling mode. Check CC1, CC2 coils or any controls in series with the coils (winding thermostat, HPC, circuit breaker auxiliary contacts).
4. LPC 1 or LPC 2 has opened during the 3 minute minimum "on" time during 4 consecutive compressor starts. Check LPC 1 circuit by measuring voltage from RTRM J1-8 to chassis ground. Check LPC 2 circuit by measuring voltage from RTRM J3-2 to chassis ground. If 24 VAC is not present, the circuit is open. 24 VAC should present at these terminals at all times.

SERVICE

1. The supply fan proving switch (FFS) has failed to open within 40 seconds after the fan starts or has closed during fan operation.

COOL + SERVICE

1. Static Pressure Transducer output voltage at RTAM J1-3 is less than 0.25VDC. The transducer output is open, shorted, or the transducer is reading a negative supply air pressure.

HEAT + COOL

1. The Emergency Stop input (TB1-5 and TB1-6) is open. Check this input at the RTRM by measuring voltage from RTRM J1-12 to chassis ground. 24 VAC should be present whenever the Emergency Stop input is closed.
2. Outdoor air sensor (OAS) input is open, shorted, or has failed.

HEAT + COOL + SERVICE

1. Static Pressure High Duct Static Trip. The static pressure has exceeded 3.5" W.C. three consecutive times.

1. Smoke Detector input active.
2. Supply Air Temperature Failure on units with modulating dehumidification
3. Entering Evaporator Temperature Failure on units with modulating dehumidification.
4. RTDM Communication Failure on units with modulating dehumidification.

Resetting Cooling and Ignition Lockouts

Cooling Failures and Ignition Lockouts are reset in an identical manner. Method 1 explains resetting the system from the space; Method 2 explains resetting the system at the unit.

Note: *Before resetting Cooling Failures and Ignition 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.

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 (ZSM) Service Indicator

The ZSM SERVICE LED is used to indicate a clogged filter, an active Smoke Detector, or a Fan Failure trip.

Clogged Filter Switch

This LED will remain on 2 minutes after 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) minutes.

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

Smoke Detector Switch

The LED will flash anytime that the N.O. Smoke Detector input is closed and will be reset anytime that the input is returned to its N.O. state. During an Active Smoke Detector trip the unit will be shut down.

Fan Failure Switch

The LED will flash 40 seconds after the fan is turned "On" if the Fan Proving Switch is not made. This LED will remain flashing until the unit is reset by means explained above. If the "Fan Failure" switch opens for at least 40 seconds during fan operation (indicating a fan failure) the unit will stop.

RTRM Zone Sensor Module (ZSM) Test

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

Table 72. Zone Sensor Module (ZSM) Terminal Identification (Constant Volume only)

Terminal #	Terminal I.D.	Terminal #	Terminal I.D.
J6-1	ZTEMP	J6-6	LED COMMON
J6-2	SIGNAL COMMON	J6-7	HEAT LED
J6-3	CSP*	J6-8	COOL LED
J6-4	MODE	J6-9	SYS ON LED
J6-5	HSP	J6-10	SERVICE LED

Test 1

Zone Temperature Thermistor (ZTEMP)

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

Table 73. Resistance Values

Zone or Set PointTemperature	Nominal ZTEMP Resistance	Nominal CSP or HSP Resistance
50° F	19.9 K-Ohms	889 Ohms
55° F	17.47 K-Ohms	812 Ohms
60° F	15.3 K-Ohms	695 Ohms
65° F	13.49 K-Ohms	597 Ohms
70° F	11.9 K-Ohms	500 Ohms
75° F	10.50 K-Ohms	403 Ohms
80° F	9.3 K-Ohms	305 Ohms
85° F	8.25 K-Ohms	208 Ohms
90° F	7.3 K-Ohms	110 Ohms

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 the chart above for approximate resistances at the given set points.

CSP = Terminals 2 and 3

Range = 100 to 900 Ohms approximate

HSP = 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 ZSM. The possible switch combinations are listed below with their corresponding resistance values.

Table 74. Nominal Resistance

VAV System Switch	CV System Switch	CV Fan Switch	Nominal Resistance
OFF	OFF	AUTO	2.3 K-Ohms
	COOL	AUTO	4.9 K-Ohms
AUTO	AUTO	AUTO	7.7 K-Ohms
	OFF	ON	11.0 K-Ohms
	COOL	ON	13.0 K-Ohms
	AUTO	ON	16.0 K-Ohms
	HEAT	AUTO	19.0 K-Ohms
	HEAT	ON	28.0 K-Ohms

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

Note: *Measurements should be made from LED common (ZSM terminal 6 to respective LED terminal). Refer to the Zone Sensor Module (ZSM) Terminal Identification table at the beginning of this section.*

Programmable & Digital Zone Sensor Test

Testing serial communication voltage

1. Verify 24 VAC is present between terminals RTRM J6-14 and RTRM J6-11.
2. Disconnect wires from RTRM J6-11 and RTRM J6-12. Measure the voltage between RTRM J6-11 and RTRM J6-12; it should be approximately 32 VDC.
3. Reconnect wires to terminals RTRM J6-11 and RTRM J6-12. Measure voltage again between RTRM J6-11 and RTRM 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 "Unit Startup".
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

CV Units

If the RTRM 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 from the potentiometers, the RTRM will control in the default mode instantaneously. The temperature sensing thermistor in the Zone Sensor Module for CV applications is the only component required for the "Default Mode" to operate.

Table 75. Constant Volume Defaults

Component or Function	Default Operation
Cooling Setpoint (CSP)	74° F
Heating Setpoint (HSP) Economizer	71° F Normal Operation
Economizer Minimum Position	Normal Operation
Mode	Normal operation, or auto if ZSM mode switch has failed
Fan	Normal operation, or continuous if fan mode switch on ZSM has failed
Night Setback Mode	Disabled - Used with Integrated Comfort™ System and Programmable ZSM's only
Supply Air Tempering	Disabled - Used with Integrated Comfort™ Systems only

VAV Units

If the RTRM loses input from the building management system, the RTRM will control in the default mode after approximately 15 minutes. For VAV units, a "shorted" mode input is the only input required for the "Default Mode" to operate. If the RTRM loses setpoint inputs from the RTAM due to remote setpoint input failure, the RTRM will use default setpoint inputs as defined in the default chart for VAV units.

Table 76. Variable Air Volume Defaults

Component or Function	Default Operation
Supply Air Cooling Setpoint Failure	55° F
Supply Air Reset Setpoint Failure	Disable Reset
Supply Air Reset Amount	Disable Reset
Supply Air Static	
Setpoint Failure	0.5 IWC
Supply Air Static	
Deadband Failure	0.5 IWC
Morning Warm-Up	
Setpoint Failure	Disable MWU and DWU
Mode Failure "Open	"Unit Mode "Off"
Mode Failure "Shorted	"Unit Mode "Auto"

Economizer Actuator (ECA) Test Procedures

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: ¼ Second ON/2 Seconds OFF Communications Failure

1 Flash: Actuator Fault

2 Flashes: CO2 Sensor out of range

3 Flashes: RA Humidity Sensor out of range

4 Flashes: RA Temp Sensor out of range

6 Flashes: OA Humidity Sensor out of range

7 Flashes: OA Temp Sensor out of range

8 Flashes: MA Temp Sensor out of range

9-11 Flashes: Internal ECA failure

Note: *The Outdoor Air Sensor (OAS) is also used for the economizer operation. It is connected to the RTRM.*

Test 1

Voltage

Disconnect the OAS from the wires in the return air section. Check the voltage at the wires going to the RTRM. The voltage should be 5 (± 0.25) VDC.

Check the resistance at the wires going to the OAS and measure the temperature at the OAS location. Using the Temperature versus Resistance chart, verify the accuracy of the OAS.

If voltage specified is not present, the ECA has failed.

Test 2

Testing the ECA sensors.

1. Testing the Mixed Air Sensor (MAS). Disconnect the cable connected to MAT on the ECA.
   a. Measure the resistance of the sensor between the connector terminals P23-1 and P23-2.
   b. Measure the temperature at the MAS location. Using the Temperature versus Resistance chart, verify the accuracy using the Thermistor Resistance/Temperatue Chart Table 15 on page 52.

Replace the sensor if it is out of range.

2. Testing the Return Air Sensor (RAS). Disconnect the cable connected to RAT on the ECA. Using the Thermistor Resistance / Temperature Chart Table 15 on page 52.
   a. Measure the resistance of the sensor between the connector terminals P10-1 and P10-2.
   b. Measure the temperature at the RAS location. Using the Temperature versus Resistance chart, verify the accuracy of the RAS.

Replace the sensor if it is out of range.

3. Testing the Humidity Sensors.
   a. Return Humidity Sensor (RHS). Leave the sensor connected to the ECA, and measure the operating current. The normal current range is 4 to 20 mA (milliampere). Replace the sensor if it is out of range.
   b. Outdoor Humidity Sensor (OHS). Leave the sensor connected to the ECA, and measure the operating current. The normal current range is 4 to 20 mA (milliampere). Replace the sensor if it is out of range.

Note: *Both the RHS and the OHS are polarity sensitive. Verify that the polarity is correct before condemning the sensor. Incorrect wiring will not damage any of the controls, but they will not function if wired incorrectly.*

ReliaTel Air Module (RTAM) Test

Test 1

Testing the Inlet Guide Vane/Variable Frequency Drive (IGV/VFD) Output.

1. Using the "Test Mode" procedure for VAV applications in the "Unit Startup" section, step the unit to the first test (Step 1). Verify that 8.5 VDC is present between terminals J4-2 and J4-1 for IGV's or 10 VDC for VFD's.

Note: *If voltage is incorrect, verify RTAM DIP switch settings.*

2. If the voltage to the IGV/VFD is not present, verify that the wires are properly connected between the RTRM or COMM (Communications Module) and the RTAM.

If Step 2 checks out and the voltage is still not present at the IGV/VFD output, replace the RTAM.

Test 2

Testing the Static Pressure Transducer (SPT) Input

1. With main power to the unit turned "Off", disconnect all of the tubing to the Static Pressure Transducer.
2. With the system MODE "Off", apply power to the unit and measure the voltage between J1-4 and J1-1 on the RTAM. The voltage should be approximately 5 VDC. If not, check the wiring between the RTRM and the RTAM. If the wiring checks good, replace RTAM.
3. Measure the voltage between J1-3 and J1-1 on the RTAM. The voltage should be approximately 0.25 VDC. If not, check the wiring between the RTAM and the SPT. If the wiring checks good, replace the SPT.
4. Apply 2.0" w.c. pressure to the HI port on the static pressure transducer (SPT). Measure the voltage between J1-1 and J1-3. The voltage should be 1.75 (± .14) VDC. If not, replace the SPT.

Note: *The SPT is susceptible to interference from VFD's. Make sure the SPT is mounted on plastic standoffs and is not touching any sheet metal.*

Test 3

Testing the VAV Setpoint Potentiometers

Turn the main power disconnect switch "OFF". Check each potentiometer listed in the table below by measuring resistance. These potentiometers are built into the RTAM and are not replaceable.

Static Pressure Setpoint	0-560 ohms (Approximate)	RTAM J7-1,2
Static Pressure Deadband	0-560 ohms (Approximate)	RTAM J7-7,8
Reset Setpoint	0-560 ohms (Approximate)	RTAM J7-11,12
Reset Amount	0-560 ohms (Approximate)	RTAM J7-5,6
Morning Warmup Setpoint	0-560 ohms (Approximate)	RTAM J7-9,10
Supply Air Cooling Setpoint	0-560 ohms (Approximate)	RTAM J7-3,4
Supply Air Heating Setpoint	0-560 ohms (Approximate)	RTAM J7-13,14

Test 4

Testing the Inlet Guide Vane Actuator (IGVA)

1. Using the "Step Test Mode" procedure described in the "Unit Startup" section (Step 1 for VAV). Measure the voltage between the (+) and (-) terminals on the actuator. The voltage should be 8.5 VDC. If not, check the wiring between the RTAM and the IGV actuator. If the wiring checks good, return to Test 1.
2. If the voltage above is present and the actuator is not opening, verify that 24 VAC is present between terminals T1 and T2. If the voltage is present, replace actuator.

Note: *The IGVA can manually be driven open by shorting the (F) terminal to either the (+) or (-) terminals. The IGVA will drive closed when the short is removed.*

Test 5

Testing the VFD

1. Verify that the keypad in control box is powered. If not, check the power wires to the VFD and the Keypad cable.
2. Using the "Step Test Mode", procedure described in the "Unit Startup" section (Step 3 for VAV). Verify that the fan starts and the speed increases until the SA Pressure reaches the "Setpoint" on VAV Setpoint panel. If the fan does not start, check for "Fault Conditions" on the VFD Keypad.
3. If no "Fault Conditions" exist and the fan started but did not ramp up to speed, verify the "speed reference voltage" output from the RTAM between terminals J4-1 and J4-2.
4. If no "Fault Conditions" exist and the fan did not start, verify that the Fan relay is energized and the VFD "Start Command" is properly wired from the Fan relay, (24 volts on the Logic Input 2 (LI2) terminal). Verify that the jumper between +24V and the LI1 terminal is properly connected.
5. Verify that 115 VAC is present from the transformer on the VFD assembly panel.

Begin troubleshooting by checking for any diagnostics. See System Status/Diagnostics. Always verify the unit is operating in the proper "MODE" when troubleshooting.

Compressor—Blink Codes

The CSHN*** large commercial compressors come equipped with a compressor protection device capable of detecting phase reversal, phase loss, and phase unbalance. The compressor protection device uses a Green and Red LED to indicate the compressor status. A solid green LED denotes a fault-free condition; a blinking red LED indicates an identifiable fault condition.

Note: *If the compressor has tripped, the resistance will be 4500 ohms or greater; when reset, they will be less than 2750 ohms.*

Blink Code: The blink code consists of different on / off times of the Red LED which is repeated continuously until either the fault is cleared or until power is cycled.

Fault	LED on	LED off	LED on	LED off
PTC overheat or PTC reset delay active	short blink	long blink	short blink	long blink
Phase loss	long blink	long blink	long blink	long blink
Incorrect phase sequence	short blink	short blink	short blink	long blink

Table 77. Troubleshooting

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
A. Unit will not operate. No Heat, No Cool or No Fan operation.	**1.** No power to the Unit.	**1.** Check line voltage at service disconnect.
	2. No power to the RTRM.	**2.** Check for 24 VAC at RTRM J1-1 to system ground.
	3. Zone Sensor Module (ZSM) is defective or MODE circuit is open. (VAV only)	**3.** See Zone Sensor Module (ZSM) Test Procedures or short MODE input on VAV units.
	4. RTRM is defective.	**4.** If 24 VAC is present at the RTRM J1-1 to ground, the LED on the RTRMshould be on. If the LED is not lit, replace the RTRM.
	5. Supply Fan Proving (FFS) switch has opened.	**5.** Check the IDM and belts, replace as necessary.
	6. Emergency Stop input is open.	**6.** Check the Emergency Stop input.
CV Units Only		
B. Unit will not Heat or Cool, but the Fan switch operates.	**1.** Zone Sensor Module (ZSM) is defective.	**1.** Refer to the Zone Sensor Module (ZSM) Test Procedures.
	2. Problem in (ZSM) wiring.	**2.** Disconnect the ZSM wiring at RTRM and test the wires using the Zone Sensor Test Procedures to locate any wiring problems.
	3. RTRM is defective.	**3.** Disconnect the ZSM wiring at the RTRM and perform the Zone Sensor Module (ZSM) Test Procedures. If within range, replace RTRM.
CV or VAV (Unoccupied)		
C. Unit heats and cools, but will not control to set point.	**1.** Zone Sensor Module (ZSM) is defective.	**1.** Refer to the Zone Sensor Module (ZSM) Test Procedures.Refer to the Default Chart.
	2. Thermometer on the ZSM out of calibration.	**2.** Check and calibrate the thermometer.
D. CPR1 will not operate, ODM's will operate.	**1.** Compressor failure.	**1.** Test compressor, mechanically and electrically. Replace if necessary.
	2. Wiring, terminal, or mechanical CC1 contactor failure.	**2.** Check wires, terminals and CC1. Repair or replace if necessary.
	3. LPC1 has tripped	**3.** Leak check, repair, evacuate and recharge as necessary. Check LPC1 operation.
E. CPR1 operates, ODM's will not operate.	**1.** ODM has failed.	**1.** Check ODM's, replace if necessary.
	2. ODM capacitor(s) has failed.	**2.** Check ODM capacitors, replace if necessary.
	3. Wiring, terminal, or mechanical CC1 or CC2 contactor failure.	**3.** Check wires, terminals ,CC1 and CC2. Repair or replace if necessary.
	4. ODF 20 or 34 relay has failed	**4.**Check for proper voltage and contact closure. ODF20 and 34 have a 24 VAC holding Coil. If voltage is present, replace relay.
	5. RTRM is defective	**5.** Locate the P3 connector on the RTRM. Check for 24 VAC at terminal P3-6. If 24 VAC is not present, replace RTRM.

Table 77. Troubleshooting (continued)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
F. CPR1 and ODM1 will not operate.	**1.** No power to CC1 coil. Possible Cool Failure	**1.** Check wiring, terminals and applicable controls (CCB1, HPC1, TDL1, WTL1, LPC1)
	2. CC1 coil defective. Cool Failure Indicated.	**2.** Check CC1 coil. If open or shorted, replace CC1.
	3. CC1 contacts defective.	**3.** If 24 VAC is present at CC1coil, verify contact closure.
	4. RTRM is defective.	**4.** If 24 VAC is not present at CC1 coil, reset the Cool Failure by cycling the main power disconnect switch. Verify system MODE is set for cooling operation. If no controls have opened, and CC1 will not close, replace RTRM.
	5. LPC1 has tripped	**5.** Leak check, repair, evacuate, and recharge as necessary. Check LPC1 operation.
G. ODM 3 and/or 4 will not cycle.	**1.** OAS has failed.	**1.** Perform OAS Resistance/Temperature check. Replace if necessary.
	2. ODM3 and/or 4 capacitor has failed.	**2.** Check ODM capacitor, replace if necessary.
	3. Wiring, terminal, or CC2 contactor failure.	**3.** Check wires, terminals, and CC2. Repair or replace if necessary.
	4. ODM3 and/or 4 has failed.	**4.** Check ODM, replace if necessary.
	5. RTRM is defective.	**5.** Replace RTRM module
	6. ODF20 has failed.	**6.** Check for proper voltage and contact closure. ODF20 relay has a 24 VAC holding coil. If voltage is present, replace relay.
H. CPR2 and 3 (if applicable) will not operate.	**1.** No power to CC2 and/or 3 coil. Cool Failure Possible.	**1.** Check wiring, terminals and applicable controls (CCB2, CCB3, HPC2, LPC2, WTL2, WTL3, TDL2 & TDL3)
	2. CC2 and/or 3 coil defective. Cool Failure Indicated.	**2.** Verify integrity of CC2 and/or 3 coil windings. If open or shorted replace CC2 and/or CC3.
	3. CC2 and/or 3 contacts defective.	**3.** If 24 VAC is present at CC2 and/or 3 coil, replace relay.
	4. RTRM is defective.	**4.** 24 VAC is not present at CC2 and/or 3 coil. Reset the Cool Failure by cycling the service disconnect. Place the unit into Cool Stage 2 Mode, step 4 for constant Volume or step 6 for variable air volume, to insure CPR2 and 3 Compressor operation. Check input devices in #1 & #2 above, if no controls have opened, and CC2 and/or 3 will not close, replace RTRM.
	5. DLT2 and DLT3 has tripped.	**4.** Check for leaks, Open wire connections, Lose quick connect terminals, TDL2 and TDL3 resistance check.
I. Indoor motor (IDM) will not operate	**1.** IDM has failed.	**1.** Check IDM, replace if necessary.
	2. Wiring, terminal, or contactor failure.	**2.** Check wiring, terminals and F contactor. Repair or replace wiring, terminals, or fan contactor F.
	3. ZSM is defective.	**3.** Place unit in test mode. If the fan operates in the test mode, test the ZSM using the appropriate test procedures.
	4. RTRM is defective.	**4.** Check the RTRM fan output. Locate P2-1 on the RTRM. Measure voltage to ground. If 24 VAC is not present on a call for fan, replace the RTRM.
	5. Supply Fan Proving (FFS)switch has opened.	**5.** Check FFS and belts, repair or replace if necessary.

Table 77. Troubleshooting (continued)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
J. No Heat (YC's only) CFM will not run, IP warms up, GV is energized	**1.** CFM has failed.	**1.** Check CFM, replace if necessary.
	2. CFM capacitor has failed.	**2.** Disconnect BROWN wires from capacitor, test, and replace if necessary.
	3. Wiring, or terminal failure.	**3.** Check wiring, and terminals. Repair, or replace if necessary.
	4. TNS3 and/or 4 has failed. (460/575 V units only)	**4.** Check for 230 VAC at TNS3 and/or 4 secondary, between Y1 and Y2. If 230 VAC is not present, replace TNS3 and/or 4.
	5. Modulating gas is not configured properly.	**5.** Check RTOM wiring and control board software versions.
K. No Heat (YC's only) CFM runs, GV energizes, IP does not warm up.	**1.** TNS3 and/or 4 has failed.	**1.** Check for 115 VAC at TNS3 and/or 4 secondary, between X1 and X2. If 115 VAC is not present, replace TNS3 and/or 4.
	2. Wiring or terminal failure.	2. Check wiring and terminals. Repair or replace if necessary.
	3. IGN has failed.	3. Verify presence of 115 VAC at IGN L1 and L2. Check for 115 VAC between terminals PPM4-1 and PPM4-2, and PPM5-1 and PPM5-2 (if applicable) in the gas section. If 115 VAC is present for IP warmup, IGN is OK. If 115 VAC is not present, replace IGN.
	4. IP has failed.	**4.** With 115 VAC applied to IP, warm up should take place. Cold resistance of IP should be a minimum of 50 Ohms. Nominal current should be 2.5 to 3.0 Amps.
L. No Heat (YC's only) GV does not energize, CFM runs, IP warms up	**1.** Wiring or terminal failure.	**1.** Verify presence of 24 VAC between IGN J1-7 terminal to ground, if not present, check wiring and terminals. Repair or replace if necessary.
	2. IGN has failed.	**2.** Verify presence of 24 VAC between IGN J1-6 terminal to ground, if not present replace IGN.
	3. GV has failed, in two stage units	**3.** Measure voltage between TH and TR on the gas valve (GV). If 24 VAC is present and the GV will not open, replace the GV.
	4. Pressure switch failure, in mod heat units	**4.** In mod heat units, verify the pressure switch is wired correctly. If wired correctly, verify operation of pressure switch.
M. Low Heat Capacity Intermittant Heat. (YC's only) CFM runs in LO or HI speed only, or; may not operate at all in one speed or the other.	**1.** CFM has failed.	**1.** Check CFM, test LO and HI speed windings.
	2. IGN has failed.	**2.** Check IGN contacts. Contacts LO and CBM L1 should be closed to energize CFM LO speed windings. Contacts HI and CBM L1 should be closed to energize CFM HI speed.
N. No Heat (YC's only) "Fan" selection switch on the ZSM is in the"AUTO" position and the fan runs continuously.	**1.** TCO2 has opened. Heat Failure Indicated.	**1.** System Status Failure Diagnostic Place the unit in the HeatingTest Mode, steps 6 & 7 for constant volume or step 8 & 9 for variable air volume and check the complete heating system for failure. Make necessary repairs or adjustments to the unit.

Table 77. Troubleshooting (continued)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
O. No Heat (TE's only) Electric heat will not operate.	**1.** Heater contactor(s) have failed.	**1.** Check for 24 VAC at AH, BH,CH, and DH contactor coils. If 24 VAC is present on a call for heat, and the contacts do not close, the contactor has failed.
	2. Heater element temperature limit(s) is open.	2. Check line voltage between the element temperature limit terminals located in heat section. If line voltage is present, the limit is open. Repair heating unit, or replace limit(s) as needed.
	3. Wiring or terminal failure.	**3.** Check for wiring, or terminal failure in control and power ircuit. Repair or replace if necessary.
	4. Heater Element(s) has failed.	**4.** Check element and circuit integrity. Repair or replace as necessary. Replace open elements.
	5. RTRM is defective.	**5.** Check RTRM heat outputs. "First stage", locate P2 connector, connected to J2 on the RTRM. Locate wire 65E at terminal P2-9, measure between 65E and ground. If 24 VAC is present, repeat #3 above. If 24 VAC is not present, the RTRM has failed. "Second stage", Locate 67B wire at terminal P2-8, measure between 67B and ground. 24 VAC should be present. If 24 VAC is not present, the RTRM has failed.
P. Evaporator coil freezes up during low ambient operation.	**1.** System low on refrigerant charge.	**1.** Leak check, repair, evacuate, and recharge system as necessary.
	2. System low on air flow.	**2.** Check return air for obstruction or dirty filters. Check fan wheels, motors, and belts.
	3. Outdoor Air Sensor (OAS) has Failed.	**3.** Check OAS at connector P8 by disconnecting P8 from J8 on the RTRM. Check resistance between P8-1 and P8-2, refer to the Resistance versus Temperature chart. Replace sensor if necessary.
	4. FrostatTM has Failed	**4.** Check Frostat Switch
Q. Economizer will not operate.	**1.** Economizer connector not plugged into unit wiring harness.	**1.** Check connector, and connect if necessary.
	2. Economizer Actuator (ECA) has failed.	**2.** Verify that 24 VAC is present between ECA terminals 24 VAC and Common. Place the unit in econ test mode, economizer actuator should drive open. In any other unit test mode, economizer actuator should drive to minimum position. If ECA does not drive as specified, replace ECA.
	3. Wiring or terminal failure.	**3.** Check wiring and terminals. Repair or replace if necessary.
	4. ECA is defective.	**4.** Perform the ECA Test Procedures discussed previously.
R. Minimum position is at zero, cannot be adjusted. Economizer still modulates.	**1.** Remote Minimum position potentiometer has failed.	**1.** With the main power off, check the resistance between terminals P and P1 at the ECA by rotating the remote minimum position potentiometer knob. Resistance should be 50 to 200 Ohms.
	2. Minimum position potentiometer has failed.	**2.** Rotate the onboard minimum position potentiometer knob. If ECA does not drive to different minimum position, replace ECA.
S. Economizer goes to minimum position, and will not modulate.	**1.** OAS has failed.	**1.** Check the OAS at connector P8 by disconnecting P8 from J8 on the RTRM. Check resistance between P8-1 and P8-2, refer to the Resistance versus Temperature Chart. Replace sensor if necessary.
	2. MAS has failed.	**2.** Check the MAS at connector P23 by disconnecting P23 from MAT on the ECA. "MAT" is marked on the actuator. Check for resistance between P23-1 and P23-2, refer to the Resistance versus Temperature Chart. Replace sensor if necessary.

Table 77. Troubleshooting (continued)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
T. Economizer modulates, but system does not seem to operate as effeciently as in the past.	**1.** Comparative enthalpy setup, RAS or RHS failed. System is operating using Referance enthalpy.	**1.** Check the return air sensor (RAS) at connector P10 by disconnecting P10 from RAT on the ECA. Check for resistance between P10-1 and P10-2, refer to the Resistance versus Temperature Chart. Replace the sensor if necessary. Check the return air humidity sensor (RHS) by measuring the operating current at terminals RAH-1 and RAH-2 on the ECA. Normal operating current is 4 to 20 milliamps mA. ***Note:*** The humidity sensors are polarity sensitive, and will not operate if connected backwards.
	2. Referance enthalpy setup, OHS has failed. System is operating using dry bulb control.	**2.** Check the outside humidity sensor (OHS) by measuring the opeating current at terminals OAH-1, and OAH-2 on the ECA. Normal operating current is 4 to 20 milliamps mA.
	3. Comparative enthalpy setup, OHS has failed. System is operating using dry bulb control.	**3.** Perform #2 above.
U. Power Exhaust will not operate.	**1.** Exhaust motor has failed.	**1.** Check the exhaust fan motor, and replace if necessary.
	2. XFR has failed.	**2.** Check the exhaust fan contactor (XFR). Replace if necessary
	3. ECA has failed.	**3.** Perform the ECA Test Procedures discussed previously.
	4. XFSP has Failed	**4.** Perform the Exhaust Fan Setpoint Test Procedures discussed previously.
V. IGV/ VFD will not operate properly	**1.** RTAM has Failed	**1.** Perform the RTAM Test Procedures discussed previously.
	2. IGV / VFD has Failure	**2.** Check the IGV / VFD
	3. Setpoint Failure	**3.** Perform the IGV / VFD Setpoint Test Procedures discussed previously.
W. Power Exhause Fan cycles ON/OFF	**1.** Space Pressure Deadband is too narrow	**1.** Increase the Space Pressure Deadband.
	2. Space Pressure Setpoint is too high/low	**2.** Verify Building Pressure with maximum building exhaust enabled. Adjust Space Pressure Setpoint accordingly.

Table 78. Component Failure Mode

COMPONENT	FAILURE RESPONSE	NORMAL RANGE	DIAGNOSTIC
(OAS) Outdoor Air Sensor	**1.** Economizer in minimum position. Will not modulate.	-55 to 175 F 680K to 1.2K	Heat and cool failure output at RTRM J6-7 to J6-6 and RTRM J6-8 to J6-6. Heat and cool LED's blink at ZSM. Check at RTRM connector P8, between P8-1 & P8-2.
	2. ODM3 will not cycle off (runs continuously).	-55 to 175 F 680K to 1.2K	Check at RTRM connector P8.
(RAS) Return Air Sensor	**1.** Economizer operates using Reference Enthalpy	0 to 209 F 90K to 7.1K	ECA LED 4 Flashes. Check at ECA connector P1 between P10-1 & P10-2.
(MAS) Supply Air Sensor	**1.** Economizer in minimum position, will not modulate.	0 to 209 F 90K to 7.1K	ECA 8 flashes.
(OHS) Outdoor Humidity Sensor	**1.** Uses Dry Bulb operation and economizes if below 60 F DB.	4 to 20 mA 10 to 90% RH Honeywell C7600A.	ECA 6 flashes. Check at ECA OAH-1 and OAH-2 by measuring current draw.

Table 78. Component Failure Mode

COMPONENT	FAILURE RESPONSE	NORMAL RANGE	DIAGNOSTIC
(RHS) Return Humidity Sensor	**1.** Economizer operates using Referance Enthalpy.	4 to 20 mA 10 to 90% RH Honeywell C7600A.	Check at ECA ECA 3 flashes. RAH-1 and RAH-2 by measuring current draw.
Remote Minimum position Potentiometer	**1.** Economizer modulates but minimum position stays at zero.	Potentiometer range 50 to 200 Ohms.	*NONE* Check resistance at ECA P and P1 50 to 200 Ohms.
Cooling Setpoint (CSP) for CV ZSM slide potentiometer	**1.** Uses HSP and CSP CSP= HSP + 4 F or use RTRM Default Mode.	100 to 900 Ohms Use ZSM Test Procedures.	*NONE* Check at terminals 2 and 3 on ZSM
Heating Setpoint (HSP) for CV ZSM slide potentiometer	**1.** Uses CSP and HSP HSP= CSP - 4 F.	100 to 900 Ohms Use ZSM Test Procedures.	*NONE* Check at terminals 2 and 5 on ZSM.
TDL1, TDL2 or TDL3 (Temperature Discharge Limit)	**1.** Comp1, Comp2 or Comp3 will not operate.	Open 230 F +/- 6.5 F Close 180 F +/- 12.5 F Normally closed	Cool Failure Output at RTRM J6-8 to J6-6 LED blinks at ZSM.
HSP and CSP for CVare both lost.	**1.** Cannot control at ZSM, unit using RTRM Default Mode.	100 to 900 Ohms approx. Use ZSM Test Procedures.	If a sensor is used at RTRM J6-1 and J6-2, Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED Blinks at ZSM. If RTRM senses a zone temp input and then it is lost,
(ZTEMP) Zone Temperature Sensor CV or VAV during Unoccupied mode.	**1.** No Heating or Cooling ZSM "Fan" selection switch operates IDM during Unoccupied Mode.	-40 TO 150 F 346K to 2.1K	CV Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED Blinks at ZSM
TC01, TCO2, TC03 High Temp Limit	Heat goes off, IDM runs continuously.	Normally Closed Open 135 F Reset 105 F.	Heat Failure Output at RTRM J6-7 to J6-6 "HEAT" LED Blinks at ZSM.
(LPC1) Low Pressure Control	Compressor CPR1 will not operate.	Open 25 PSIG Close 41 PSIG.	Possible Cool Failure at RTRM J1-8 to Ground, 0 VAC. "COOL" LED Blinks at ZSM.
(LPC2) Low Pressure Control Dual Circuits Only	Compressor CPR2 will not operate.	Open 25 PSIG Close 41 PSIG.	Possible Cool Failure at RTRM J3-2 to Ground, 0 VAC. "COOL" LED blinks at ZSM.
(CCB1)	Compressor CPR1 will not operate.	Normally Closed range varies by unit.	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(CCB2 or CCB3) Compressor Overload	Compressor CPR2 or CPR3 will not operate.	Normally Closed range varies by unit	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(HPC1) High Pressure Control	Compressor CPR1 will not operate.	Open 650 psig Close 550 psig	Cool Failure Outputat RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(HPC2) High Pressure Control	Compressor CPR2 or CPR3 will not operate.	Open 650 psig Close 550 psig	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(WTL1) Winding Temperature Limit	Compressor CPR1 will not operate.	Normally Closed	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(WTL2 or WTL3) Winding Temperature Limit	Compressor CPR2 or CPR3 will not operate.	Normally Closed	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(CC1) Compressor Contactor 24 VAC coil	Compressor CPR1 will not operate.	Varies by unit	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.
(CC2 or CC3) Compressor Contactor 24 VAC coil	Compressor CPR2 or CPR3 will not operate.	Varies by unit	Cool Failure Output at RTRM J6-8 to J6-6 "COOL" LED blinks at ZSM.

Table 78. Component Failure Mode

COMPONENT	FAILURE RESPONSE	NORMAL RANGE	DIAGNOSTIC
(CFS) Clogged Filter Switch	This input is for "indication only and does not effect the normal operation of the unit.	"Normal operation = 0 VAC measured between terminals J5-1 and Ground.	SERVICE LED ON 2-30 VDC present at RTRM J6-6 and J6-10
(FFS) Supply Fan Proving Switch	Unit will not operate in any mode.	0.5" W.C. Normally Open	Service Failure Output at RTRM J6-6 to J6-10 "SERVICE" LED blinks at ZSM
(SPT) Static Pressure Transducer VAV	IGV will not open	0.25 - 4 VDC between J8 and J9 on VAV	Heat and Cool Failure Output at RTRM J6-7 to J6-6 & RTRM J6-8 to J6-6 "HEAT" and "COOL" LED's blink at ZSM

NONE = No LED indication

Table 79. Supply and Exhaust Fan VFD Programming Parameters for Model TR-1

Menu	Parameter	Description	Setting	Description
Load & Motor	102	Motor Power	Set Based on Motor Nameplate	Set only for applications using 3hp Hi-Efficiency motors. Set to 2.2 kW.
	103	Motor Voltage	Set Based on Motor Nameplate	Set only for 200/230v 60hz & 380/415 50hz applications
	105	Motor Current	Set Based on Motor Nameplate	Sets the motor FLA
	106	Motor RPM	Set Based on Motor Nameplate	Sets the motor RPM
Reference & Limits	215	Current Limit	1 x Rated Current	Limits the maximum current to motor

Table 80. Supply and Exhaust Fan VFD Programming Parameters for Model TR-200

Menu	Parameter	Description	Setting	Description
Load & Motor	1-21	Motor Power	Set Based on Motor Nameplate	Set only for applications using 3hp Hi-Efficiency motors. Set to 2.2 kW/3 hp.
	1-22	Motor Voltage	Set Based on Motor Nameplate	Set only for 200/230v 60hz & 380/415 50hz applications
	1-24	Motor Current	Set Based on Motor Nameplate	Sets the motor FLA
	1-25	Motor RPM	Set Based on Motor Nameplate	Sets the motor RPM
Limits and Warnings	4-18	Current Limit	100% Rated Current	Limits the maximum current to motor

TR-1 and TR-200 VFD Programming Parameters

Units shipped with an optional variable frequency drive (VFD) are preset and run tested at the factory. If a problem with a VFD occurs, ensure that the programmed parameters listed in Table 79 Table 80, p. 145 have been set before replacing the drive.

Note: *Model TR-1—Check to make sure that parameter 104 is set to 60 Hz. To check parameter 104 press the Extended Menu button, press the Left Arrow button until menu Load & Motor is shown, press the up arrow until parameter 104 is displayed. Parameter 104 can then be modified by pressing the Change Data button and then the Up Arrow button. When the desired selection has been made press the OK button.*

Note: *Model TR-200—Check to make sure that parameter 1-23 is set to 60 Hz. To check parameter 1-23 press the [Main Menu] button (press [Back] button if the main menu does not display), use the [▼] button to scroll down to Load & Motor, press OK, use the [▼] button to select 1-2, press OK, and finally use the [▼] button until parameter 1-23 is displayed. Parameter 1-23 can then be modified by pressing OK button and using [▲] and [▼] buttons. When the desired selection has been made, press the OK button.*

Should replacing the a VFD become necessary, the replacement is not configured with all of Trane's operating parameters. The VFD must be programmed before attempting to operate the unit.

To verify and/or program a VFD, use the following steps:

1. Remove the mode input (RTRM J6-2 and J6-4) or turn the NSB panel to OFF so that the fan will not attempt to start during programming.

⚠WARNING

Hazardous Voltage! w/Capacitors!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. 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.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

2. To modify TR-1 parameters:
   a. Press the Extended Menu button
   b. Press the Left or Right Arrow button to scroll through menus
   c. Press the up or down arrow to scroll through parameter settings within a specified menu
   d. Press the Change Data button to allow a parameter value to be changed
   e. Press the Up or Down arrow button to change the parameter
   f. Press OK button when desired change has been made.
3. To modify TR-200 parameters:
   a. Press Main Menu button (press [Back] button if the main menu does not display)
   b. Use the [▲] and [▼] buttons to find the parameter menu group (first part of parameter number)
   c. Press [OK]
   d. Use [▲] and [▼] buttons to select the correct parameter sub-group (first digit of second part of parameter number)
   e. Press [OK]
   f. Use [▲] and [▼] buttons to select the specific parameter

g. Press [OK]

h. To move to a different digit within a parameter setting, use the [▶ ◀] buttons (Highlighted area indicates digit selected for change)

i. Use [▲] and [▼] buttons to adjust the digit

j. Press [Cancel] button to disregard change, or press [OK] to accept change and enter the new setting

4. Repeat step two (TR-1)/step three (TR-200) for each menu selection setting in Table 79, p. 145 Table 80, p. 145.

5. To reset TR-1 programming parameters back to the factory defaults:

   a. Press the Extended Menu button
   b. Press the Left or Right Arrow button to scroll to the KEYB. & DISPLAY menu.
   c. Press the Down Arrow button to scroll to the Active Setup menu.
   d. Press the Change Data button.
   e. Press the Up Arrow button to scroll to the Factory Default setting.
   f. Press the OK button.
   g. Press the Up Arrow button to scroll to the Setup Copy menu.
   h. Press the Change Data button.
   i. Press the Up Arrow button to scroll to the Copy to Setup 1 setting.
   j. Press the OK button.
   k. Press the Up Arrow button to scroll to the Active Setup menu.
   l. Press the Change Data button.
   m. Press the Up Arrow button to scroll to the Setup 1 setting.
   n. Press the OK button.
   o. Press the Change Data button.
   p. Press the Up Arrow button to scroll to the Download All Parameters setting.
   q. Press the OK button

6. To reset TR-200 programming parameters back to the factory defaults:

   a. Go to parameter 14-22 Operation Mode
   b. Press [OK]
   c. Select “Initialization”
   d. Press [OK]
   e. Cut off the mains supply and wait until the display turns off.
   f. Reconnect the mains supply - the frequency converter is now reset.
   g. Ensure parameter 14-22 Operation Mode has reverted back to "Normal Operation".

Note: *Steps 5 and 6 reset the drive to the default factory settings. The program parameters listed in Table 79 and Table 80, p. 145 will need to be verified or changed as described in item 2 and 3.*

Note: *Some of the parameters listed in the tables are motor specific. Due to various motors and efficiencies available, use only the values stamped on the specific motor nameplate. Do not use the Unit nameplate values.*

Note: *A backup copy of the current setup may be saved to the LCP before changing parameters or resetting the drive. See LCP Copy in the VFD Operating Instructions for details.*

7. After verifying that the VFD(s) are operating properly, put the unit into normal operation.

Unit Wiring Diagram Numbers

Table 81. Unit Wiring Diagram Numbers

Diagram No.	Descriptions
2313-0601	Power Schematic (208V-575V)
2313-0700	Heat Power and Controls Schematic - Low Heat Gas Unit
2313-0701	Heat Power and Controls Schematic - High Heat Gas Unit
2313-0605	Heat Power and Controls Schematic - Low Heat Modulating Gas Unit
2313-0702	Heat Power and Controls Schematic - High Heat Modulating Gas Unit
2313-0607	Heat Power and Controls Schematic - 36kw and 54kw Electric Heat (380V-575V)
2313-0608	Heat Power and Controls Schematic - 36kw and 54kw Electric Heat (208V-230V)
2313-0609	Heat Power and Controls Schematic - 72kw/90kw/108kw Electric Heat (380V-575V)
2313-0610	Heat Power and Controls Schematic - Cooling Only
2313-0612	Refrigeration Controls Schematic - 27.5T-35T
2313-0613	Refrigeration Controls Schematic - 40T
2313-0614	Refrigeration Controls Schematic - 50T
2313-0616	Controls Options Schematic - Constant Volume w/o Statitrac
2313-0617	Controls Options Schematic - Variable Air Volume w/o Statitrac
2313-0618	Controls Options Schematic - Constant Volume w/ Statitrac
2313-0619	Controls Options Schematic - Variable Air Volume w/ Statitrac
2313-0715	Control Box Connection Print - 27.5-35T, CV, 2 Stage Gas Heat 208-230V
2313-0716	Control Box Connection Print - 40T, CV, 2 Stage Gas Heat 208-230V
2313-0717	Control Box Connection Print - 50T, CV, 2 Stage Gas Heat 208-230V
2313-0718	Control Box Connection Print - 27.5-35T, CV, 2 Stage Gas Heat 380-575V
2313-0719	Control Box Connection Print - 40T, CV, 2 Stage Gas Heat 380-575V
2313-0720	Control Box Connection Print - 50T, CV, 2 Stage Gas Heat 380-575V
2313-0721	Control Box Connection Print - 27.5-35T, CV, Modulating Gas Heat 208-230V
2313-0722	Control Box Connection Print - 40T, CV, Modulating Gas Heat 208-230V
2313-0723	Control Box Connection Print - 50T, CV, Modulating Gas Heat 208-230V
2313-0724	Control Box Connection Print - 27.5-35T, CV, Modulating Gas Heat 380-575V
2313-0725	Control Box Connection Print - 40T, CV, Modulating Gas Heat 380-575V
2313-0726	Control Box Connection Print - 50T, CV, Modulating Gas Heat 380-575V
2313-0633	Control Box Connection Print - 27.5-35T, CV, 36KW-54KW Electric Heat 208-230V
2313-0634	Control Box Connection Print - 27.5-35T, CV, 36KW-54KW Electric Heat 380-575V
2313-0635	Control Box Connection Print - 40T, CV, 54KW Electric Heat 208-230V
2313-0636	Control Box Connection Print - 40T, CV, 54KW Electric Heat 380-575V
2313-0637	Control Box Connection Print - 50T, CV, 54KW Electric Heat 208-230V
2313-0638	Control Box Connection Print - 50T, CV, 54KW Electric Heat 380-575V
2313-0639	Control Box Connection Print - 27.5-35T, CV, 72KW-90KW Electric Heat
2313-0640	Control Box Connection Print - 40T, CV, 72KW-108KW Electric Heat
2313-0641	Control Box Connection Print - 50T, CV, 72KW-108KW Electric Heat
2313-0727	Control Box Connection Print - 27.5-35T, VAV, 2 Stage Gas Heat 208-230V
2313-0728	Control Box Connection Print - 40T, VAV, 2 Stage Gas Heat 208-230V
2313-0729	Control Box Connection Print - 50T, VAV, 2 Stage Gas Heat 208-230V
2313-0730	Control Box Connection Print - 27.5-35T, VAV, 2 Stage Gas Heat 380-575V
2313-0731	Control Box Connection Print - 40T, VAV, 2 Stage Gas Heat 380-575V
2313-0732	Control Box Connection Print - 50T, VAV, 2 Stage Gas Heat 380-575V
2313-0733	Control Box Connection Print - 27.5-35T, VAV, Modulating Gas Heat 208-230V
2313-0734	Control Box Connection Print - 40T, VAV, Modulating Gas Heat 208-230V
2313-0735	Control Box Connection Print - 50T, VAV, Modulating Gas Heat 208-230V
2313-0736	Control Box Connection Print - 27.5-35T, VAV, Modulating Gas Heat 380-575V
2313-0737	Control Box Connection Print - 40T, VAV, Modulating Gas Heat 380-575V
2313-0738	Control Box Connection Print - 50T, VAV, Modulating Gas Heat 380-575V

Table 81. Unit Wiring Diagram Numbers

Diagram No.	Descriptions
2313-0654	Control Box Connection Print - 27.5-35T, VAV, 36KW-54KW Electric Heat 208-230V
2313-0655	Control Box Connection Print - 27.5-35T, VAV, 36KW-54KW Electric Heat 380-575V
2313-0656	Control Box Connection Print - 40T, VAV, 54KW Electric Heat 208-230V
2313-0657	Control Box Connection Print - 40T, VAV, 54KW Electric Heat 380-575V
2313-0658	Control Box Connection Print - 50T, VAV, 54KW Electric Heat 208-230V
2313-0659	Control Box Connection Print - 50T, VAV, 54KW Electric Heat 380-575V
2313-0660	Control Box Connection Print - 27.5-35T, VAV, 72KW-90KW Electric Heat
2313-0661	Control Box Connection Print - 40T, VAV, 72KW-108KW Electric Heat
2313-0662	Control Box Connection Print - 50T, VAV, 72KW-108KW Electric Heat
2313-0664	Raceway Devices Connection Print - 27.5-35T, CV, TE 36KW-54KW
23130665	Raceway Devices Connection Print - 27.5-35T, CV, TC/TE 72KW-90KW
2313-0666	Raceway Devices Connection Print - 40T, CV, TE 54KW-72KW
2313-0667	Raceway Devices Connection Print - 40T, CV, TC/TE 90KW-108KW
2313-0668	Raceway Devices Connection Print - 50T, CV, TE 54KW-72KW
2313-0669	Raceway Devices Connection Print - 50T, CV, TC/TE 90KW-108KW
2313-0670	Raceway Devices Connection Print - 27.5-35T, VAV, TE 36KW-54KW
2313-0671	Raceway Devices Connection Print - 27.5-35T, VAV, TC/TE 72KW-90KW
2313-0672	Raceway Devices Connection Print - 40T, VAV, TE 54KW-72KW
2313-0673	Raceway Devices Connection Print - 40T, VAV, TC/TE 90KW-108KW
2313-0674	Raceway Devices Connection Print - 50T, VAV, TE 54KW-72KW
2313-0675	Raceway Devices Connection Print - 50T, VAV, TC/TE 90KW-108KW
2313-0703	Raceway Devices Connection Print - 27.5-35T, CV, YC 2 Stage
2313-0704	Raceway Devices Connection Print - 40T, CV, YC 2 Stage
2313-0705	Raceway Devices Connection Print - 50T, CV, YC 2 Stage
2313-0706	Raceway Devices Connection Print - 27.5-35T, VAV, YC 2 Stage
2313-0707	Raceway Devices Connection Print - 40T, VAV, YC 2 Stage
2313-0708	Raceway Devices Connection Print - 50T, VAV, YC 2 Stage
2313-0709	Raceway Devices Connection Print - 27.5-35T, CV, YC Mod
2313-0710	Raceway Devices Connection Print - 40T, CV, YC Mod
2313-0711	Raceway Devices Connection Print - 50T, CV, YC Mod
2313-0712	Raceway Devices Connection Print - 27.5-35T, VAV, YC Mod
2313-0713	Raceway Devices Connection Print - 40T, VAV, YC Mod
2313-0714	Raceway Devices Connection Print - 50T, VAV, YC Mod
2313-0688	Control Box Connection Print - 27.5-35T, CV, Cooling Only 208-230V
2313-0689	Control Box Connection Print - 40T, CV, Cooling Only 208-230V
2313-0690	Control Box Connection Print - 50T, CV, Cooling Only 208-230V
2313-0691	Control Box Connection Print - 27.5-35T, CV, Cooling Only 380-575V
2313-0692	Control Box Connection Print - 40T, CV, Cooling Only 380-575V
2313-0693	Control Box Connection Print - 50T, CV, Cooling Only 380-575V
2313-0694	Control Box Connection Print - 27.5-35T, VAV, Cooling Only 208-230V
2313-0695	Control Box Connection Print - 40T, VAV, Cooling Only 208-230V
2313-0696	Control Box Connection Print - 50T, VAV, Cooling Only 208-230V
2313-0697	Control Box Connection Print - 27.5-35T, VAV, Cooling Only 380-575V
2313-0698	Control Box Connection Print - 40T, VAV, Cooling Only 380-575V
2313-0699	Control Box Connection Print - 50T, VAV, Cooling Only 380-575V

Warranty and Liability Clause

COMMERCIAL EQUIPMENT RATED 20 TONS AND LARGER AND RELATED ACCESSORIES

PRODUCTS COVERED - This warranty* is extended by Trane Inc. and applies only to commercial equipment rated 20 Tons and larger and related accessories.

The Company warrants for a period of 12 months from initial startup 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. 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 whatever 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.

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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.

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Manager - Product Service

Trane

Clarksville, Tn 37040-1008

PW-215-2688

*A 10 year limited warranty is provided on optional Full Modulation Gas Heat Exchanger.

*Optional Extended Warranties are available for compressors and heat exchangers of Combination Gas-Electric Air Conditioning Units.

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

RT-SVX34C-EN 04 Nov 2010
Supersedes RT-SVX34B-EN (April 2010)

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