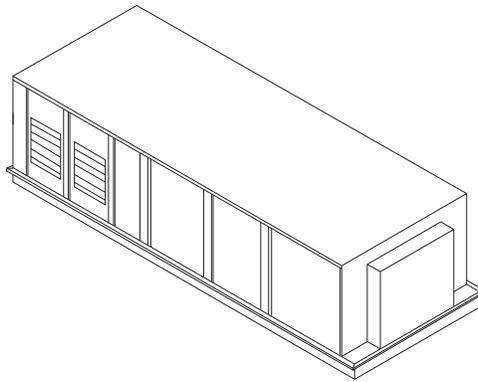




# Installation, Operation, and Maintenance

## IntelliPak™

Commercial Rooftop Air Handlers with  
CV, VAV, or SZVAV Controls



### Models:

#### "H or 2" and later Design Sequence

WEHE Casings 2, 3, 4, 5, 6 & 9 (4,000-46,000 cfm)

WFHE Casings 2, 3, 4, 5, 6 & 9 (4,000-46,000 cfm)

WLHE Casings 2, 3, 4, 5, 6 & 9 (4,000-46,000 cfm)

WSHE Casings 2, 3, 4, 5, 6 & 9 (4,000-46,000 cfm)

WXHE Casings 2, 3, 4, 5, 6 & 9 (4,000-46,000 cfm)

### 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.



# Warnings, Cautions and Notices

**Warnings, Cautions and Notices.** Note that warnings, cautions and notices appear at appropriate intervals throughout this manual. Warnings are provide to alert installing contractors to potential hazards that could result in death or personal injury. 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.

Read this manual thoroughly before operating or servicing this unit.

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

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

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

**NOTICE:** Indicates a situation that could result in equipment or property-damage only

## Important Environmental Concerns!

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

## Responsible Refrigerant Practices!

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

must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

**⚠ WARNING**

**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.

**⚠ 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 Personal Protective Equipment (PPE) in accordance with NFPA 70E or other country-specific requirements for arc flash protection, PRIOR to servicing the unit.

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

**⚠ WARNING**

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

The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22 refrigerant. Use **ONLY** R-410A rated service equipment or components with these units. 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 exploding under R-410A high pressures which could result in death, serious injury, or equipment damage.

## Overview of Manual

**Note:** *One copy of this service literature ships inside the control panel of each unit.*

This booklet describes proper installation, start-up, operation, and maintenance procedures for W\_HE Casings 2 through 9 Rooftop Air Handlers designed for Constant Volume (CV) and Variable Air Volume (VAV) applications. By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized.

**Important:** *The procedures discussed in this manual should only be performed by qualified, experienced HVAC technicians.*

It is important that periodic maintenance be performed to help assure trouble free operation. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

These units are available with an optional electronic Unit Control Module (UCM) network which provides operating functions that are significantly different than conventional units. Refer to the "Start-Up" and "Test Mode" procedures within this Installation, Operation, & Maintenance manual and the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications before attempting to operate or service this equipment.

## Unit Record Information

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

1. Complete Unit Model  
Number: \_\_\_\_\_
2. Unit Serial  
Number: \_\_\_\_\_
3. Unit "DL" Number ("design special" units only): \_\_\_\_\_
4. Wiring Diagram Numbers (from unit control panel):
  - schematics: \_\_\_\_\_
  - connection(s): \_\_\_\_\_
5. Unit Address  
(TCI): \_\_\_\_\_
6. Network ID LCI/  
BCI: \_\_\_\_\_



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## Model Number Descriptions

### DIGIT 15 – SUPPLY AIR FAN DRIVE

- 4 = 400 rpm
- 5 = 500 rpm
- 6 = 600 rpm
- 7 = 700 rpm
- 8 = 800 rpm
- 9 = 900 rpm
- A = 1000 rpm
- B = 1100 rpm
- C = 1200 rpm
- D = 1300 rpm
- E = 1400 rpm
- F = 1500 rpm
- G = 1600 rpm
- H = 1700 rpm

### DIGIT 16 – FRESH AIR

- A = No Fresh Air
- B = 0-25% Manual
- D = 0-100% Economizer

### DIGIT 17 – SYSTEM CONTROL

- 0 = No Controller
- 1 = CV - Zone Temperature Control
- 2 = CV - Discharge Temperature Control
- 3 = VAV Discharge Temperature Control
- 4 = CV - Zone Temperature Control  
Space Pressure Control with  
Exhaust/Return  
VFD w/o Bypass
- 5 = CV - Zone Temperature Control  
Space Pressure Control with  
Exhaust/Return  
VFD and Bypass
- 6 = VAV Discharge Temperature Control  
with VFD w/o Bypass
- 7 = VAV Discharge Temperature Control  
with VFD and Bypass
- 8 = VAV Discharge Temperature Control  
Supply and Exhaust Fan with VFD  
w/o Bypass
- 9 = VAV Discharge Temperature Control  
Supply and Exhaust Fan with VFD  
and Bypass

### DIGIT 18 – ZONE SENSOR

- 0 = Without Accessory Panel
- A = Dual Setpoint Changeover Zone  
Sensor (BAYSENS108\*)
- B = Changeover Zone Sensor w/  
System Lights (BAYSENS110\*)
- C = Room Zone Sensor w/ Override  
(BAYSENS073\*)
- D = Room Zone Sensor w/ Local  
Setpoint (BAYSENS074\*)
- L = Programmable Zone Sensor w/  
System Function Lights for both CV  
& VAV (BAYSENS119\*)

### DIGIT 19 – AIRFLOW CONFIGURATION

- D = Downflow - Normal Unit  
Configuration
- U = Upflow (Not available with  
Electric Heat)
- H = Horizontal (Not available with  
Electric Heat)

### DIGIT 20 – AGENCY APPROVAL

- 0 = None
- 1 = cULus

### DIGITS 21 - 42 – MISCELLANEOUS

- 21 A = Unit Disconnect Switch
- 22 B = Hot Gas Bypass
- 23 0 = Without Economizer
- 23 C = Economizer Control  
w/Comparative Enthalpy
- 23 Z = Economizer Control  
w/Reference Enthalpy
- 23 W = Economizer Control  
w/Dry Bulb
- 24 E = Low Leak Fresh Air Dampers
- 25 F = High Duct Temperature  
Thermostat
- 26 \* = \*Factory Use Only
- 27 J = Temperature Sensor
- 28 K = Generic BAS Module
- 30 M = Remote Human Interface
- 31 N = Ventilation Override Module
- 32 P = Remote Room Sensor
- 33 R = Extended Grease Lines
- 34 T = Access Doors
- 35 U = Remote Potentiometer
- 36 V = Inter-Processor Comm Bridge
- 37 Y = Trane communication interface  
(TCI) module
- 37 7 = Trane Lontalk communication  
interface (LCI) module
- 37 M = Trane BACnet Communication  
interface (BCI) Module
- 39 3 = Retrofit Wall Mount Plate
- 40 4 = Hz to Vertical Wall mount Plate
- 41 6 = Factory-Power 15A GFI Conv.  
Outlet
- 42 8 = 2" (51mm) Spring Isolators

**Tip:** *EXAMPLE – Model number:  
WFHE4004P058C48D3000A0W  
describes an air handler with the  
following characteristics:*

*DX cooling with natural gas  
heating, casing size 4,  
460/60/3 power supply,  
high heat model.  
100 percent exhaust with  
Statitrac, 7.5 HP exhaust fan  
motor with drive selection No. 8  
(800 RPM), high-efficiency  
throwaway filters, 10 HP supply  
fan motor with drive selection No.  
8 (800 RPM),  
0-100% economizer with dry bulb  
control, VAV discharge  
temperature control, no remote  
panel, downflow airflow  
configuration and unit mounted  
disconnect switch.*

# General Information

## Unit Nameplate Locations

One Mylar nameplate is located on the outside upper left corner of the control panel door. It includes the model number, serial number, electrical characteristics, weight, as well as other pertinent unit data. A small metal nameplate with the model number, serial number, and unit weight is located just above the Mylar nameplate. A third nameplate is located on the inside of the control panel.

## Precautionary Measures

**⚠ WARNING**

**Fiberglass Wool!**

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

1. Avoid breathing fiberglass dust.
2. Use a NIOSH approved dust/mist respirator.
3. Avoid contact with the skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves, and eye protection.
4. Wash clothes separately from other clothing: rinse washer thoroughly.
5. 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.

## Commonly Used Acronyms

For convenience, a number of acronyms and abbreviations are used throughout this manual. These acronyms are alphabetically listed and defined below.

- BAS = Building automation systems
- BCI = BACnet® Communication Interface module
- cfm = Cubic-feet-per-minute
- CKT = Circuit

- CV = Constant volume
- CW = Clockwise
- CCW = Counterclockwise
- E/A = Exhaust air
- ECEM = Exhaust/comparative enthalpy module
- F/A = Fresh air
- GBAS = Generic building automation system
- HGBP = Hot gas bypass
- HI = Human Interface
- HVAC = Heating, ventilation and air conditioning
- I/O = Inputs/outputs
- IOM = Installation/operation/ maintenance manual
- IPC = Interprocessor communications
- IPCB = Interprocessor communications bridge
- LCI-I = LonTalk Communication Interface for IntelliPak
- LH = Left-hand
- MCM = Multiple compressor module
- MWU = Morning warm-up
- NSB = Night setback
- O/A = Outside air
- psig = Pounds-per-square-inch, gauge pressure
- R/A = Return air
- RH = Right-hand
- rpm = Revolutions-per-minute
- RT = Rooftop unit
- RTM = Rooftop module
- S/A = Supply air
- SCM = Single circuit module
- SZ = Single-zone (unit airflow)
- SZVAV = Single zone variable air volume
- TCI = Tracer communications module
- UCM = Unit control modules
- VAV = Variable air volume
- VCM = Ventilation control module
- VOM = Ventilation override module
- w.c. = Water column
- XL = Across-the-line start

## Unit Description

Each Trane Commercial, Single-zone Rooftop Air Handler is fully assembled and the applicable controls are tested for proper operation before shipment.

Units ordered with direct expansion (DX) evaporator coils are leak-tested, evacuated and a Nitrogen holding charge of 30 psig is added. An optional roof curb for the W\_HE units are available from Trane. The roof curb kit must be field assembled and installed according to the latest edition of RT-SVN14\*-EN.

Trane Commercial Rooftop Air Handlers (when ordered with IntelliPak™ controls) are controlled by a microelectronic control system. The network of modules and their operation are significantly different than conventional units and are referred to as Unit Control



## General Information

Modules (UCM). The acronym UCM is used extensively throughout this document when referring to the control system network.

These modules through Proportional/Integral control algorithms perform specific unit functions which provide the best possible comfort level for the customer.

They are mounted in the control panel and are factory wired to their respective internal components. They receive and interpret information from other unit modules, sensors, remote panels, and customer binary contacts to satisfy the applicable request for economizing, mechanical cooling, heating, and ventilation. Refer to the

following discussion for an explanation of each module function.

### Rooftop Module (RTM - 1U48)

The Rooftop Module (RTM) responds to cooling, heating, and ventilation requests by energizing the proper unit components based on information received from other unit modules, sensors, remote panels, and customer supplied binary inputs. It initiates supply fan, exhaust fan, exhaust damper, variable frequency drive output, and economizer operation based on that information.

**Table 1. RTM resistance input vs. setpoint temperatures**

RTM cooling or heating setpoint input used as the source for a Zone temp setpoint (°F)	RTM cooling setpoint input used as the source for SUPPLY AIR temp setpoint cooling (°F)	Resistance (Ohms) Max. Tolerance 5%
40	40	1084
45	45	992
50	50	899
55	55	796
60	60	695
65	65	597
70	70	500
75	75	403
80	80	305
n/a	85	208
n/a	90	111

**Table 2. RTM resistance value vs. system operating mode**

Resistance applied to RTM MODE input Terminals (Ohms) Max. Tolerance 5%	Constant Volume Units	
	Fan Mode	System Mode
2320	Auto	Off
4870	Auto	Cool
7680	Auto	Auto
10770	On	Off
13320	On	Cool
16130	On	Auto
19480	Auto	Heat
27930	On	Heat

### Compressor Module (SCM & MCM - 1U49)

The Compressor module, (Single Circuit & Multiple Circuit), upon receiving a request for mechanical cooling, energizes the appropriate compressors and condenser fans. It monitors the compressor operation through feedback information it receives from various protection devices.

### Human Interface Module (HI - 1U65)

The Human Interface module enables the operator to adjust the operating parameters for the unit using its 16 key keypad. The 2 line, 40 character LCD screen provides status information for the various unit functions as well as menus for the operator to set or modify the operating parameters.

### Heat Module (1U50 used on heating units)

The Heat module, upon receiving a request for Heating, energizes the appropriate heating stages or strokes the Modulating Heating valve as required.

### Ventilation Override Module (VOM - Optional 1U51)

**Important:** *The ventilation override system should not be used to signal the presence of smoke caused by a fire as it is not intended nor designed to do so.*

The Ventilation Override module initiates specified functions such as; space pressurization, exhaust, purge, purge with duct pressure control, and unit off when any one of the five (5) binary inputs to the module are activated. The compressors and condenser fans are disabled during the ventilation operation. If more than one ventilation sequence is activated, the one with the highest priority is initiated.

### Interprocessor Communications Board (IPCB - Optional 1U55 used with the Remote Human Interface)

The Interprocessor Communication Board expands communications from the rooftop unit's UCM network to

a Remote Human Interface Panel. DIP switch settings on the IPCB module for this application should be; Switches 1 and 2 "Off", Switch 3 "On".

### Trane Communications Interface Module (TCI - Optional 1U54 used on units with Trane ICS™)

The Trane Communication Interface module expands communications from the unit UCM network to a Trane Tracer 100™ or a Tracer Summit™ system and allows external setpoint adjustment and monitoring of status and diagnostics. DIP Switch settings on the TCI module for these applications should be:

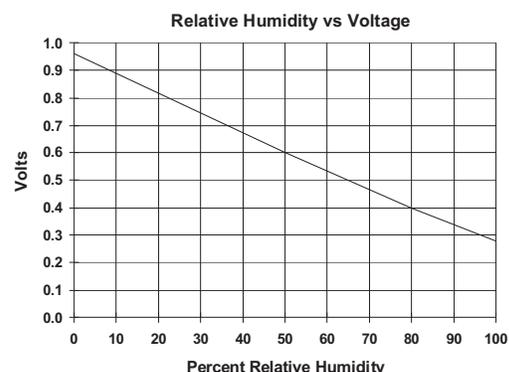
- Tracer 100 (Comm3): Switches 1, 2, and 3 are "Off";
- Tracer Summit (Comm4): Switch 1 is "On", switches 2 and 3 are "Off"

### Lontalk/BACnet Communication Interface Module (LCI/BCI - Optional 1U54/1U104 - used on units with Trane ICS or 3rd party Building Automation Systems)

The Lontalk/BACnet Communication Interface modules expand communications from the unit UCM network to a Trane Tracer Summit™ or a 3rd party building automation system, and allow external setpoints and configuration adjustments and monitoring of status and diagnostics.

### Exhaust/Comparative Enthalpy Module (ECEM - Optional 1U52 used on units with Statitrac and/or comparative enthalpy options)

The Exhaust/Comparative Enthalpy module receives information from the return air humidity sensor, the outside air humidity sensor, and the return air temperature sensor to utilize the lowest possible humidity level when considering economizer operation. In addition, it receives space pressure information which is used to maintain the space pressure to within the setpoint control band. Refer to Figure 1, p. 12 for the humidity vs voltage input values.





## General Information

### Ventilation Control Module (VCM - Design special option only)

The Ventilation Control Module (VCM) is located in the filter section of the unit and is linked to the unit's UCM network. Using a "velocity pressure" sensing ring located in the fresh air section, allows the VCM to monitor and control the quantity of fresh air entering the unit to a minimum airflow setpoint.

An optional temperature sensor can be connected to the VCM which enables it to control a field installed fresh air preheater.

An optional CO<sub>2</sub> sensor can be connected to the VCM to control CO<sub>2</sub> reset. The reset function adjust the minimum cfm upward as the CO<sub>2</sub> concentrations increase. The maximum effective (reset) setpoint value for fresh air entering the unit is limited to the systems operating cfm. [Table 3](#) lists the Minimum Outside Air cfm vs Input Voltage.

**Table 3. Minimum outside air cfm vs input voltage**

Minimum Outside Air Setpoint w/VCM Module & Traq™ Sensing		
Casing	Input Volts	CFM
2	0.5 - 4.5 vdc	0 - 14000
3	0.5 - 4.5 vdc	0 - 17000
4	0.5 - 4.5 vdc	0 - 22000
5	0.5 - 4.5 vdc	0 - 28000
6	0.5 - 4.5 vdc	0 - 33000
9	0.5 - 4.5 vdc	0 - 46000

**Note:** Refer to the "Traq™ Sensor Sequence of Operation" section for VCM operation.

### Velocity Pressure Transducer/Solenoid Assembly Generic Building Automation System Module (GBAS - Optional 1U51 used with non-Trane building control systems)

The Generic Building Automation System (GBAS) module allows a non-Trane building control system to communicate with the rooftop unit and accepts external setpoints in form of analog inputs for cooling, heating, supply air pressure, and a binary input for demand limit. Refer to the "Field Installed Control Wiring" section (p. 49), for the input wiring to the GBAS module ([Figure 36, p. 61](#)) and the various desired setpoints ([Table 16, p. 61](#)) with the corresponding DC voltage inputs for both VAV and CV applications.

For complete application details of the module, refer to Engineering Bulletin UN-PRB001-EN.

### Input Devices & System Functions

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

Refer to the unit's electrical schematic for the specific module connections.

### Constant Volume & Variable Air Volume Units Supply Air Temperature Sensor (3RT9)

Is an analog input device used with CV & VAV applications. It monitors the supply air temperature for; supply air temperature control (VAV), supply air temperature reset (VAV), supply air temperature low limiting (CV), supply air tempering (CV/VAV). It is mounted in the supply air discharge section of the unit and is connected to the RTM (1U48).

### Return Air Temperature Sensor (3RT6)

Is an analog input device used with a return humidity sensor on CV & VAV applications when the comparative enthalpy option is ordered. It monitors the return air temperature and compares it to the outdoor temperature to establish which temperature is best suited to maintain the cooling requirements. It is mounted in the return air section and is connected to the ECEM (1U52).

### Entering Evaporator Temperature Sensor (3RT28 and 3RT29)

This analog input device is used with the Leaving Evaporator Temp sensor to provide Low Charge Protection of the refrigerant systems. The difference in these two temperatures will be monitored during compressor operation and compressor circuits will be shut down if this difference exceeds a Human Interface selectable setpoint value.

### Leaving Evaporator Temperature Sensor (3RT14 and 3RT15)

An analog input device used with CV and VAV applications that monitors the refrigerant temperature inside the evaporator coil to prevent coil freezing. It is attached to the suction line near the evaporator coil and is connected to the MCM. It is factory set for 30°F and has an adjustable range of 25°F to 35°F. The compressors are staged "Off" as necessary to prevent icing. After the last compressor stage has been turned "Off", the compressors will be allowed to restart once the evaporator temperature rises 10°F above the "coil frost cutout temperature" and the minimum three minute "Off" time has elapsed.

### Filter Switch (3S21)

Is a binary input device used on CV & VAV applications. It measures the pressure differential across the unit filters. It is mounted in the filter section and is connected to the RTM (1U48). A diagnostic SERVICE signal is sent to the remote panel if the pressure differential across the filters is at least 0.5" w.c. The contacts will automatically open when the pressure differential across the filters decrease to 0.4" w.c. The switch differential can be field adjusted between 0.17" w.c. to 5.0" w.c. ± 0.05" w.c.

### Supply and Exhaust Airflow Proving Switches (3S68 and 3S69)

3S68 is a binary input device used on CV & VAV applications to signal the RTM when the supply fan is operating. It is located in the supply fan section of the unit and is connected to the RTM (1U48). During a request for fan operation, if the differential switch is detected to be open for 40 consecutive seconds; compressor operation is turned "Off", heat operation is turned "Off", the request for supply fan operation is turned "Off" and locked out, exhaust dampers (if equipped) are "closed", economizer dampers (if equipped) are "closed", and a manual reset diagnostic is initiated.

3S69 is a binary input device used on all rooftop units equipped with an exhaust fan. It is located in the exhaust fan section of the unit and is connected to the RTM (1U48). During a request for fan operation, if the differential switch is detected to be open for 40 consecutive seconds, the economizer is closed to the minimum position setpoint, the request for exhaust fan operation is turned "Off" and locked out, and a manual reset diagnostic is initiated. The fan failure lockout can be reset; at the Human Interface located in the unit's control panel, by Tracer, or by cycling the control power to the RTM (1S70 Off/On).

### Supply and Exhaust Fan Circuit Breakers (1CB1, 1CB2)

The supply fan and exhaust fan motors are protected by circuit breakers 1CB1 and 1CB2 respectively. They will trip and interrupt the power supply to the motors if the current exceeds the breaker's "must trip" value. The rooftop module (RTM) will shut all system functions "Off" when an open fan proving switch is detected.

### Saturated Condenser Temperature Sensors (2RT1 and 2RT2)

Are analog input devices used on CV & VAV applications mounted inside a temperature well located on a condenser tube bend. They monitor the saturated refrigerant temperature inside the condenser coil and are connected to the SCM/MCM (1U49). As the saturated refrigerant temperature varies due to operating conditions, the condenser fans are cycled "On" or "Off" as required to maintain acceptable operating pressures.

### Outdoor Air Humidity Sensor (3U63)

Is an analog input device used on CV & VAV applications with 100% economizer. It monitors the outdoor humidity levels for economizer operation. It is mounted in the fresh air intake section and is connected to the RTM (1U48).

### Return Air Humidity Sensor (3U64)

Is an analog input device used on CV & VAV applications with the comparative enthalpy option. It monitors the return air humidity level and compares it to the outdoor humidity level to establish which conditions are best suited to maintain the cooling requirements. It is mounted

in the return air section and is connected to the ECEM (1U52).

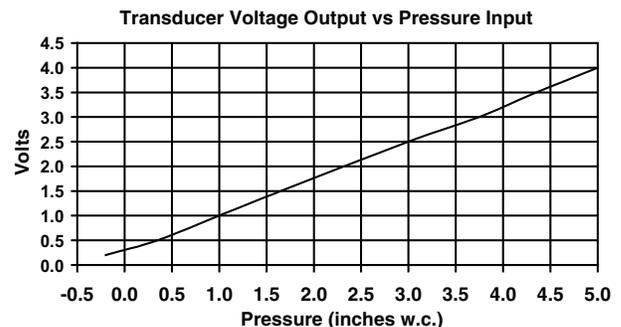
### Status/Annunciator Output

Is an internal function within the RTM (1U48) module on CV & VAV applications that provides:

- diagnostic and mode status signals to the remote panel (LEDs) and to the Human Interface.
- control of the binary Alarm output on the RTM.
- control of the binary outputs on the GBAS module to inform the customer of the operational status and/or diagnostic conditions.

### Space Pressure Transducer (3U62)

Is an analog input device used on CV & VAV applications with the Statitrac option. It modulates the exhaust dampers to keep the space pressure within the building to a customer designated controlband. It is mounted in the filter section just above the exhaust damper actuator and is connected to the ECEM (1U52). Field supplied pneumatic tubing must be connected between the space being controlled and the transducer assembly.



### Morning Warm-Up - Zone Heat

When a system changes from an unoccupied to an occupied mode with the MWU option, the unit heater or external heat (i.e. VAV reheat boxes) will be brought on if the space temperature is below the MWU setpoint. The heat will remain on until the temperature reaches the MWU setpoint.

### Supply Air Temperature Low Limit

Uses the supply air temperature sensor input to modulate the economizer damper to minimum position in the event the supply air temperature falls below the occupied heating setpoint temperature.

### Freezestat (4S12)

Is a binary input device used on CV & VAV units with Hydronic Heat. It is mounted in the heat section and connected to the Heat Module (1U50). If the temperature of the air entering the heating coil falls to 40°F, the normally open contacts on the freezestat closes signalling the Heat Module (1U50) and the Rooftop Module (RTM) to:



## General Information

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- drive the Hydronic Heat Actuator (4U15) to the full open position.
- turn the supply fan "Off".
- closes the outside air damper;
- turns "On" the SERVICE light at the Remote Panel.
- initiates a "Freezestat" diagnostic to the Human Interface.

### High Duct Temp Thermostats (Optional 3S16 and 3S17)

Are binary input devices used on CV & VAV applications with a Trane Communication Interface Module (TCI). They provide "high limit" shutdown of the unit and requires a manual reset. They are factory set to open if the supply air temperature reaches 240°F, or the return air temperature reaches 135°F. Once tripped, the thermostat can be reset by pressing the button located on the sensor once the air temperature has decreased approximately 25°F below the cutout point.

### Chilled Water Valve Control

The 0 to 10 VDC output from the heat module doubles as the chilled water controller. The unit has isolating relays to switch between heat and cool.

## Constant Volume (CV) Units

### Zone Temperature - Cooling

Relies on input from a sensor located directly in the space, while a system is in the occupied "Cooling" mode. It modulates the economizer (if equipped) and/or stages the mechanical cooling "On and Off" as required to maintain the zone temperature to within the cooling setpoint deadband.

### Zone Temperature - Heating

Relies on input from a sensor located directly in the space, while a system is in the occupied "Heating" mode or an unoccupied period, to stage the heat "on and off" or to modulate the heating valve (hydronic heat only) as required to maintain the zone temperature to within the heating setpoint deadband. The supply fan will be requested to operate any time there is a requested for heat. On gas heat units, the fan will continue to run for 60 seconds after the furnace is turned off.

### Supply Air Tempering

On CV units equipped with heat, if the supply air temperature falls 10°F below the occupied heating setpoint temperature while the heater is "Off", the first stage of heat will be turned "On". The heater is turned "Off" when the supply air temperature reaches 10°F above the occupied heating setpoint temperature.

## Variable Air Volume (VAV) Units

### Occupied Heating - Supply Air Temperature

When a VAV unit is equipped with "Modulating Heat", and the system is in an occupied mode, and the field supplied changeover relay contacts (5K87) have closed, the supply air temperature will be controlled to the customer specified supply air heating setpoint. It will remain in the heating status until the changeover relay contacts are opened.

### Occupied Cooling - Supply Air Temperature

When a VAV unit is in the occupied mode, the supply air temperature will be controlled to the customer specified supply air cooling setpoint by modulating the economizer and/or staging the mechanical cooling "On and Off" as required. The changeover relay contacts must be open on units with "Modulating Heat" for the cooling to operate.

### Daytime Warm-up

On VAV units equipped with heat, if the zone temperature falls below the daytime warm-up initiate temperature during the occupied mode, the system will switch to the unoccupied mode and stage the heat "On" to control to the occupied heating setpoint. When the zone temperature reaches the daytime warm-up termination setpoint, the heat will be turned "Off" and the system will transition to the occupied mode.

### Unoccupied Heating - Zone Temperature

When a VAV unit is equipped with Gas, Electric, or hydronic heat and is in an unoccupied mode, the zone temperature will be controlled to within the customer specified setpoint deadband.

### Supply Air Tempering

On VAV units equipped with "Modulating Heat", if the supply air temperature falls 10°F below the supply air temperature setpoint, the hydronic heat valve will modulate to maintain the supply air temperature to within the low end of the setpoint deadband.

### Supply Duct Static Pressure Control (Occupied)

The RTM relies on input from the duct pressure transducer when a unit is equipped with a Variable Frequency Drive to position the supply fan speed to maintain the supply duct static pressure to within the static pressure setpoint deadband. Refer to the Transducer Voltage Output vs Pressure Input values listed in the Space Pressure Transducer (3U62) section, (p. 11.)

### Single Zone Variable Air Volume (SZVAV) Only

The IntelliPak controls platform will support Single Zone VAV as an optional unit control type in order to meet ASHRAE 90.1. The basic control will be a hybrid VAV/CV configured unit that provides discharge temperature control to a varying discharge air temperature target

setpoint based on the space temperature and/or humidity conditions. Concurrently, the unit will control and optimize the supply fan speed to maintain the zone temperature to a zone temperature setpoint.

### **Supply Fan Output Control**

Units configured for Single Zone VAV control will utilize the same supply fan output control scheme as on traditional VAV units except the VFD signal will be based on zone heating and cooling demand instead of the supply air pressure.

### **VFD Control**

Single Zone VAV units will be equipped with a VFD-controlled supply fan which will be controlled via a 0-10VDC signal from the Rooftop Module (RTM). With the RTM supply fan output energized and the RTM VFD output at 0VDC, the fan speed output is 37% (22Hz) from the VFD by default; and at 10VDC the fan speed output is 100% (60Hz). The control scales the 0-10VDC VFD output from the RTM linearly to control between the 37-100% range.

The VFD will modulate the supply fan motor speed, accelerating or decelerating as required to maintain the zone temperature to the zone temperature setpoint. When subjected to high ambient return conditions the VFD will reduce its output frequency to maintain operation. Bypass control is offered to provide full nominal airflow in the event of drive failure.

### **Ventilation Control**

Units configured for Single Zone VAV control will require special handling of the OA Damper Minimum Position control in order to compensate for the non-linearity of airflow associated with the variable supply fan speed and damper combinations. Units configured for TRAQ with or without DCV will operate identically to traditional units with no control changes.

### **Space Pressure Control**

For units configured with Space Pressure Control with or without Statitrac, the new schemes implemented for economizer minimum position handling require changes to the existing Space Pressure Control scheme in order to prevent over/under pressurization. The overall scheme will remain very similar to VAV units with Space Pressure Control with the exception of the dynamic Exhaust Enable Setpoint.

For SZVAV an Exhaust Enable Setpoint must be selected during the 100% Fan Speed Command. Once selected, the difference between the Exhaust Enable Setpoint and Design OA Damper Minimum Position at 100% Fan Speed Command will be calculated. The difference calculated will be used as an offset and added to the Active Building Design OA Minimum Position Target in order to calculate the dynamic Exhaust Enable Target, which will be used throughout the Supply Fan Speed/OA Damper Position range.

The Exhaust Enable Target could be above or below the Active Building Design OA Minimum Position Target Setpoint, based on the Active Exhaust Enable Setpoint being set above or below the Building Design Minimum Position at 100% Fan Speed Command. Note that an Exhaust Enable Setpoint of 0% will result in the same effect on Exhaust Fan control as on VAV applications with and without Statitrac.

### **Occupied Cooling Operation**

For normal cooling operation, cooling capacity will be staged or modulated in order to meet the calculated discharge air target setpoint. If the current active cooling capacity is controlling the discharge air within the deadband, no additional cooling capacity change will be requested. As the Discharge Air Temperature rises above the deadband, the algorithm will request additional capacity as required (additional compressors or economizer). As the Discharge Air Temperature falls below the deadband, the algorithm will request a reduction in active capacity.

### **Default Economizer Operation**

By default, the unit will be setup to optimize the minimum supply fan speed capability during Economizer Only operation. If the economizer is able to meet the demand alone, due to desirable ambient conditions, the supply fan speed will be allowed to increase above the minimum prior to utilizing mechanical cooling if discharge air setpoint falls below the discharge air Lower Limit (Cooling) setpoint.

### **Unoccupied Mode**

In Unoccupied mode the unit will utilize setback setpoints, 0% Minimum OA Damper position, and Auto Fan Mode operation as on normal CV units. The Supply Fan speed, and cooling and modulating types of heat, will be controlled to the discharge air target setpoint as is done during occupied periods. The Supply fan speed during staged heat control will be forced to 100% as on normal CV units.

### **Occupied Heating Operation**

Occupied heating operation has two separate control sequences; staged and modulated. All staged heating types will drive the supply fan to maximum flow and stage heating to control to the Zone Heating Setpoint. For units with Hydronic and Gas heat, modulated SZVAV Heating. On an initial call for heating, the supply fan will drive to the minimum heating airflow.

On an additional call for heating, the heat will control in order to meet the calculated discharge air target setpoint. As the load in the zone continues to request heat operation, the supply fan will ramp-up while the control maintains the heating discharge air temperature. Heating can be configured for either the energy saving SZVAV Heating solution as described above, or the traditional, less efficient CV Heating solution.



## General Information

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### Compressor (DX) Cooling

Compressor control and protection schemes will function identical to that of a traditional unit. Normal compressor proving and disable input monitoring will remain in effect as well as normal 3-minute minimum on, off, and inter-stage timers. Also, all existing head pressure control schemes will be in effect.

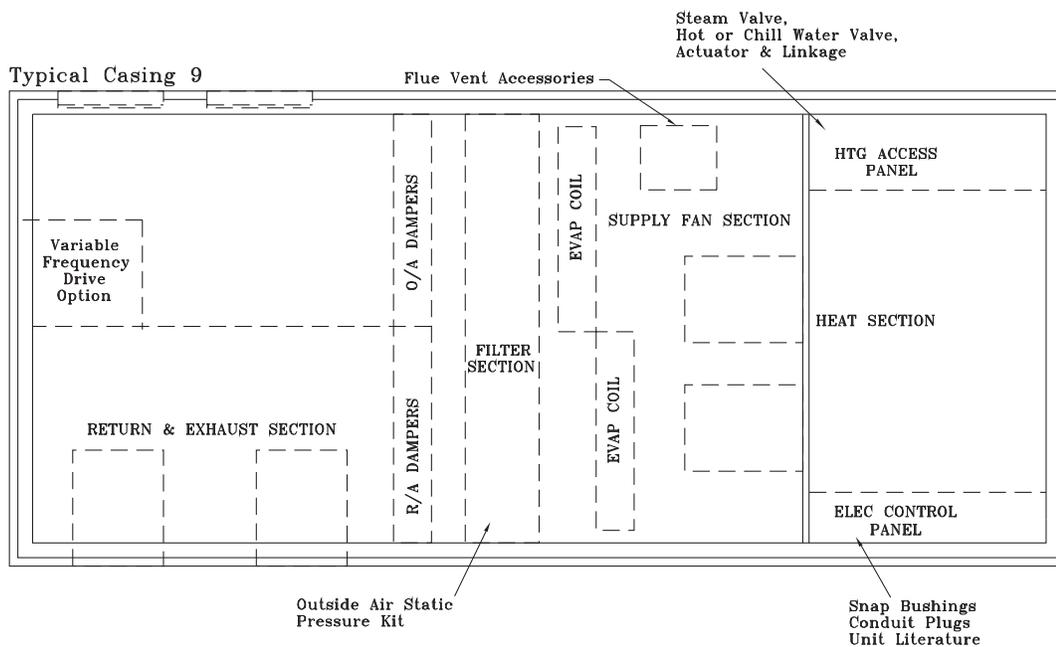
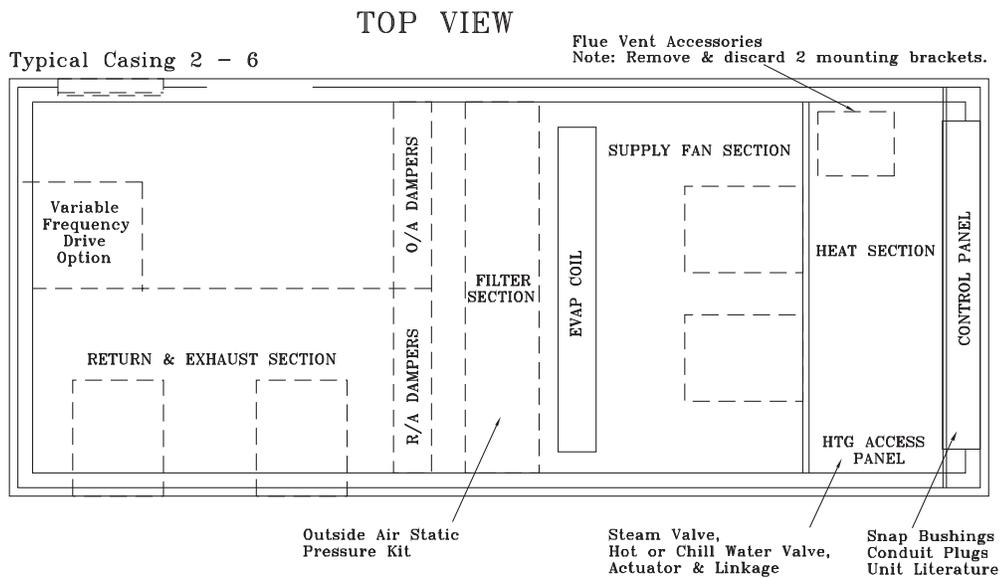
### Cooling Sequence

If the control determines that there is a need for active cooling capacity in order to meet the calculated discharge air target setpoint, once supply fan proving has been made, the unit will begin to stage compressors accordingly. Note that the compressor staging order will be based on unit configuration and compressor lead/lag status.

Once the discharge air target setpoint calculation has reached the Minimum Setpoint and compressors are being utilized to meet the demand, as the discharge air target setpoint value continues to calculate lower the algorithm will begin to ramp the supply fan speed up toward 100%. Note that the supply fan speed will remain at the compressor stage's associated minimum value (as described below) until the discharge air target setpoint value is calculated below the discharge air temperature Minimum Setpoint (limited discharge air target setpoint).

As the cooling load in the zone decreases the zone cooling algorithm will reduce the speed of the fan down to minimum per compressor stage and control the compressors accordingly. As the compressors begin to de-energize, the supply fan speed will fall back to the Cooling Stage's associated minimum fan speed, but not below. As the load in the zone continues to drop, cooling capacity will be reduced in order to maintain the discharge air within the  $\pm 1/2$  discharge air target deadband.

Figure 1. Unit component layout and "ship with" locations





# Installation

## Unit Inspection

As soon as the unit arrives at the job site

- Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).
- Verify that the power supply complies with the unit nameplate specifications.
- Verify that the power supply complies with the electric heater specifications on the unit nameplate.
- Visually inspect the exterior of the unit, including the roof, for signs of shipping damage.
- Check for material shortages. Refer to the Component Layout and Ship with Location illustration, (Figure 1, p. 15).

**Note:** If the job site inspection of the unit 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.

- Visually inspect the internal components for shipping damage as soon as possible after delivery and before it is stored. Do Not walk on the sheet metal base pans.

### ⚠ 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, resulting in the operator/technician to fall. Failure to follow this recommendation could result in death or serious injury.**

- If concealed damage is discovered, notify the carrier's terminal of damage immediately by phone and by mail. Concealed damage must be reported within 15 days.

Request an immediate joint inspection of the damage by the carrier and the consignee. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.

## Storage

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

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

**Note:** Do not use the unit's heater for temporary heat without first completing the start-up procedure detailed under "Starting the Unit".

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

## Unit Clearances

Figure 3, p. 18 illustrates the minimum operating and service clearances for either a single or multiple unit installation. These clearances are the minimum distances necessary to assure adequate serviceability, cataloged unit capacity, and peak operating efficiency.

Providing less than the recommended clearances may result in "short-circuiting" of exhaust and economizer airflows.

## Unit Dimensions & Weight Information

Overall unit dimensional data for the W\_HE unit is illustrated in Figure 4, p. 19. A Center-of-Gravity illustration and the dimensional data is shown in Table 4, p. 25. Table 6, p. 30 lists the typical unit and curb operating weights. Weights shown represent approximate operating weights. Actual weights are stamped on the unit nameplate.

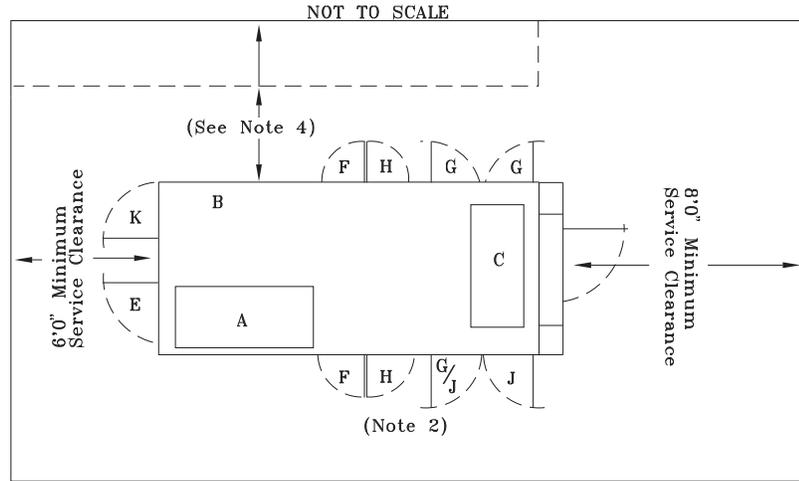


**Figure 3. Typical W\_HE casings 2 through 9 clearances for single or multiple unit installation**

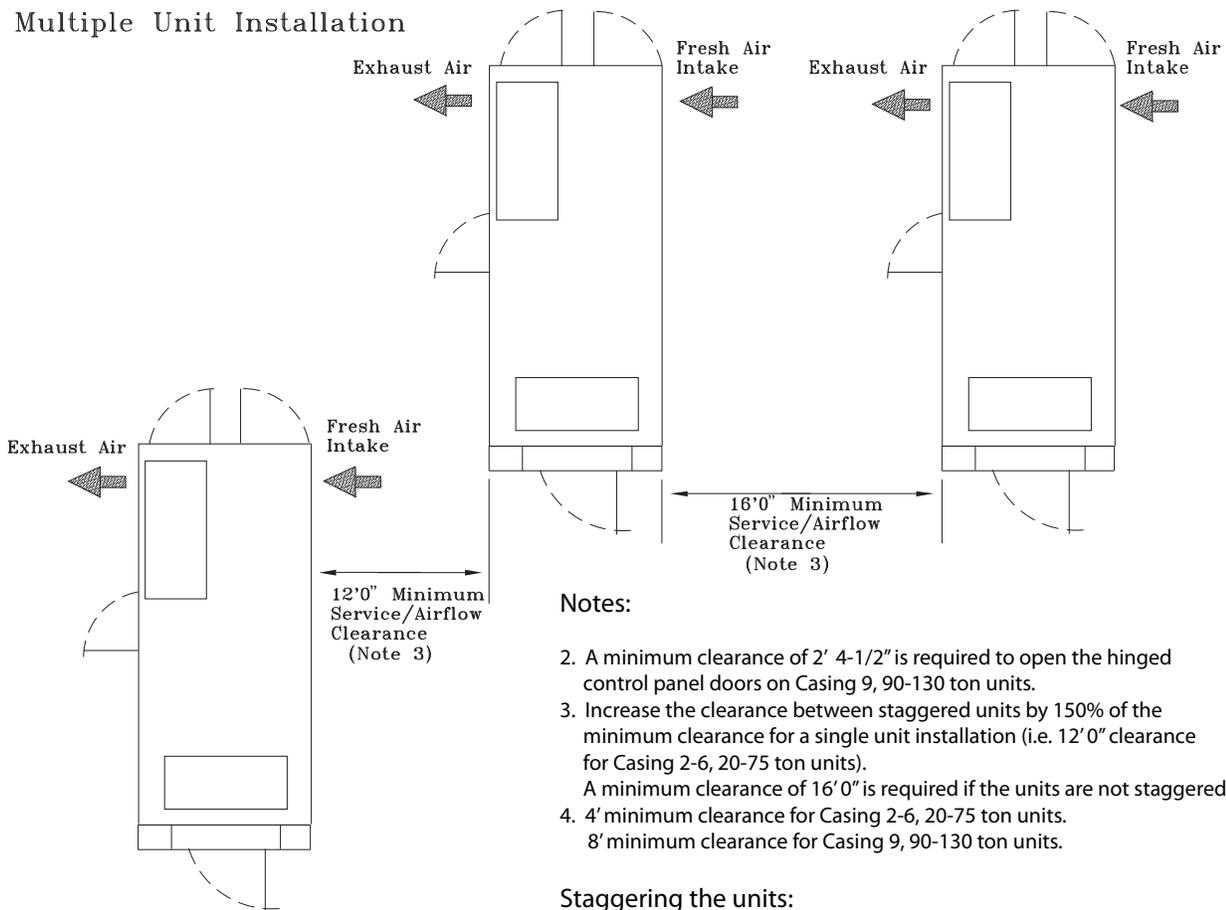
### Single Unit Installation

**Legend**

- A = Return Air Opening
- B = Fresh Air Intake
- C = Supply Air Opening
- E = Optional 2'10-3/4" Access Door (180° swing)
- F = Hinged 2'10-3/4" Filter Access Door (180° swing)
- G = Hinged 2'10-3/4" Heater Access Door (180° swing)
- H = Hinged 2'10-3/4" Supply Fan Access Door (180° swing) (90 thru 130 Ton)
- J = Hinged 2'4-1/2" Control Panel Door (180° swing) (90 thru 130 Ton)
- K = VFD Access Panel



### Multiple Unit Installation



**Notes:**

2. A minimum clearance of 2' 4-1/2" is required to open the hinged control panel doors on Casing 9, 90-130 ton units.
3. Increase the clearance between staggered units by 150% of the minimum clearance for a single unit installation (i.e. 12' 0" clearance for Casing 2-6, 20-75 ton units).  
A minimum clearance of 16' 0" is required if the units are not staggered.
4. 4' minimum clearance for Casing 2-6, 20-75 ton units.  
8' minimum clearance for Casing 9, 90-130 ton units.

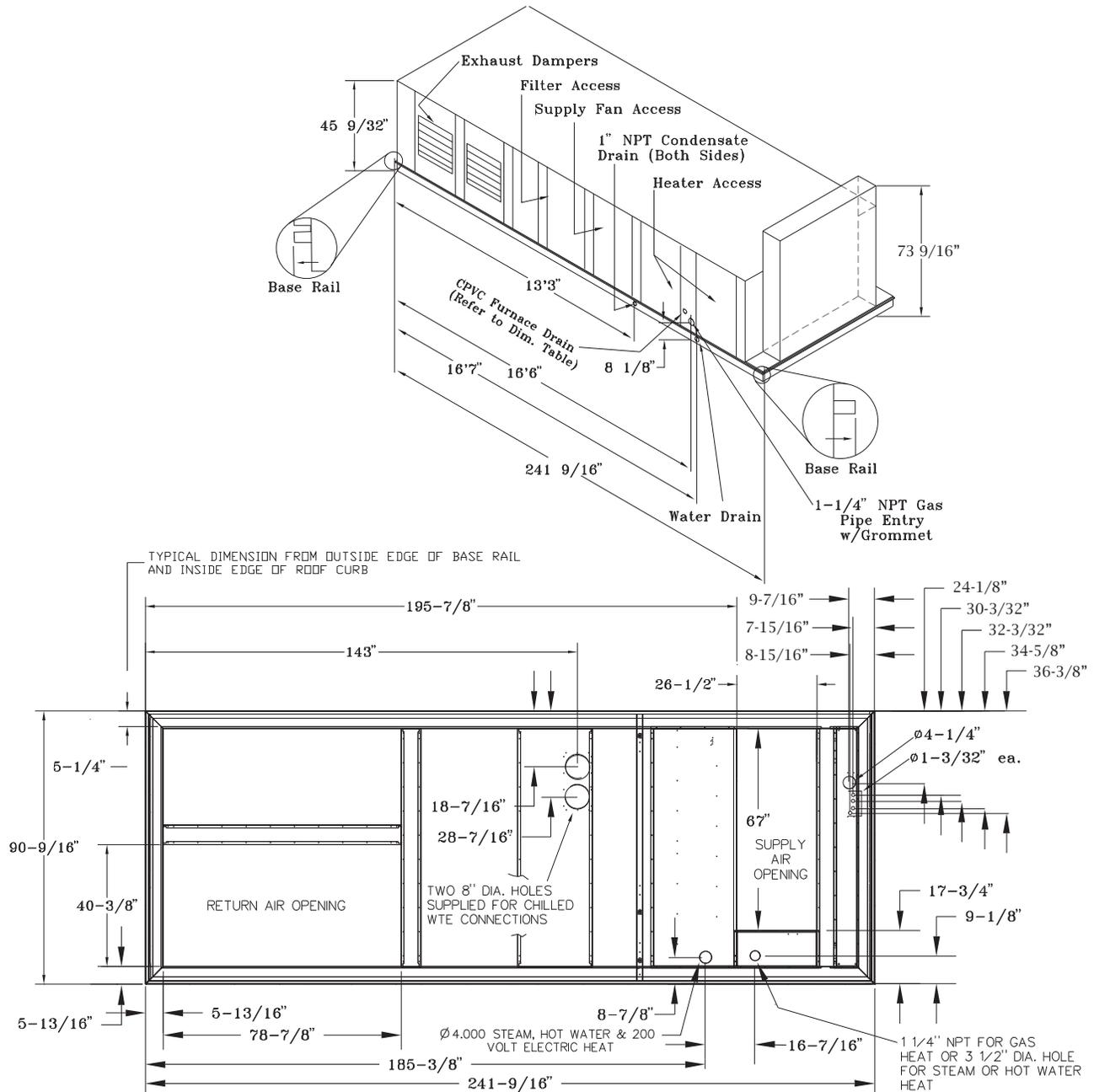
**Staggering the units:**

- a. minimizes span deflection which deters sound transmission; and
- b. maximizes proper diffusion of the exhaust air before it reaches the adjacent unit's fresh air intake.

Casing 2	Furnace Size/MBH	Dimensions (Note)	
		Length	Height
20 & 25 Ton	Low = 235	195-5/32	"9-5/32"
	High = 500	195-5/32	"9-5/32"

**Note:** The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

**Figure 4. W\_HE casing 2 (20 and 25 ton)**

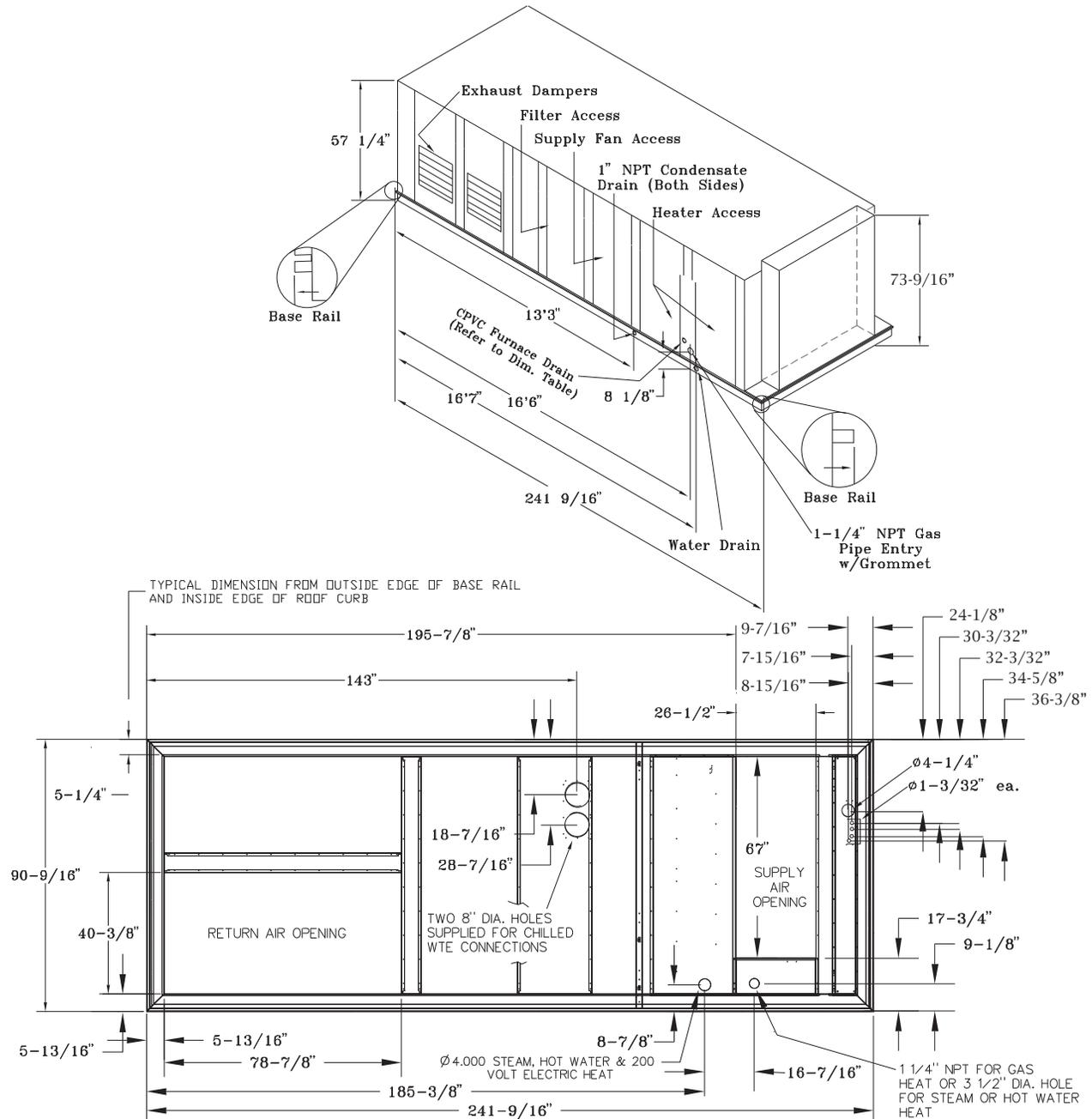


# Installation

Casing 3	Furnace Size/ MBH	Dimensions <sup>(a)</sup>	
		Length	Height
30 Ton	Low = 350	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"

(a) The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

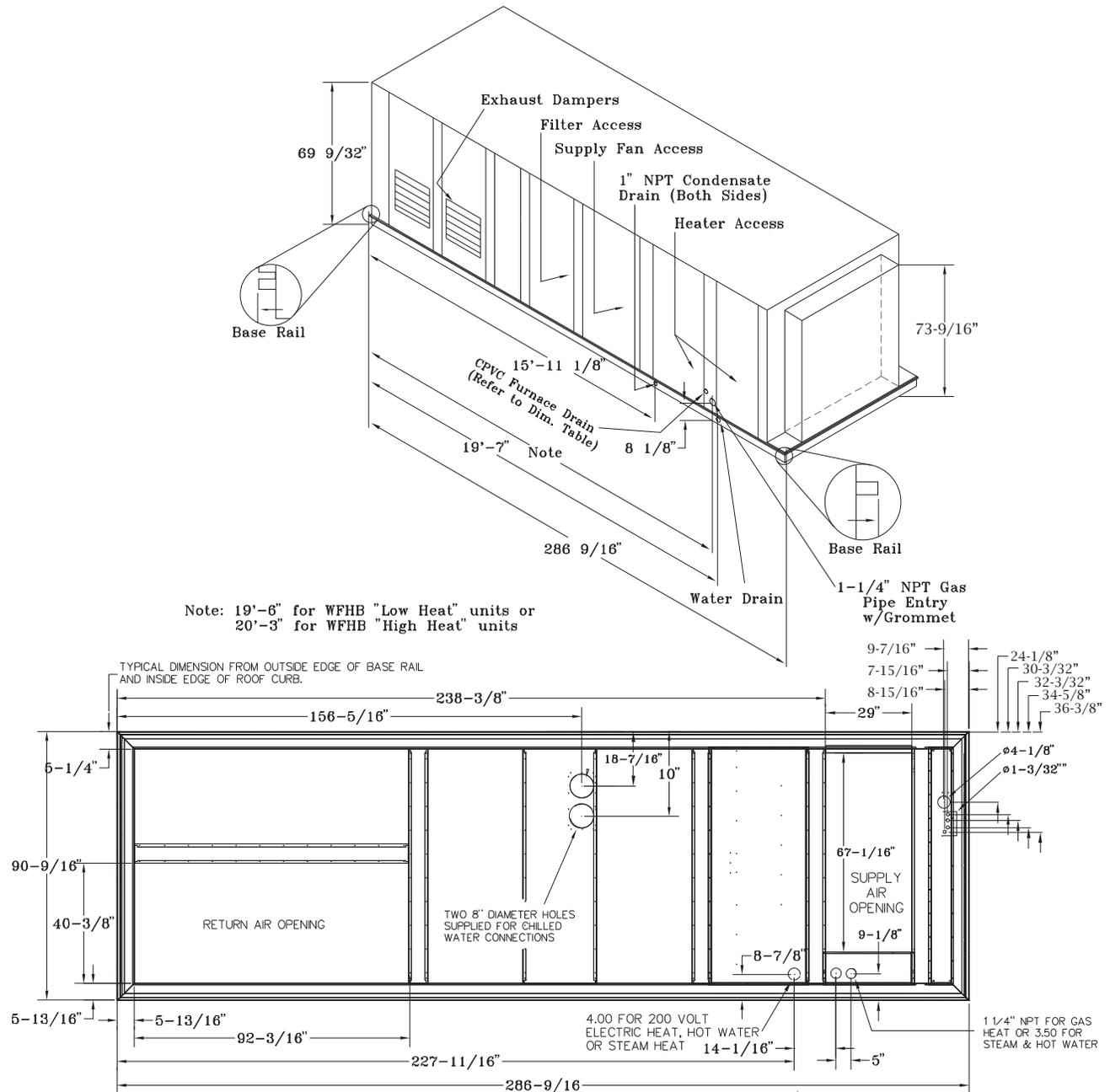
**Figure 5. W\_HE casing 3 (30 ton)**



Casing 4	Furnace Size/ MBH	Dimensions <sup>(a)</sup>	
		Length	Height
40 Ton	Low = 350	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"

(a) The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

Figure 6. W\_HE casing 4 (40 ton)



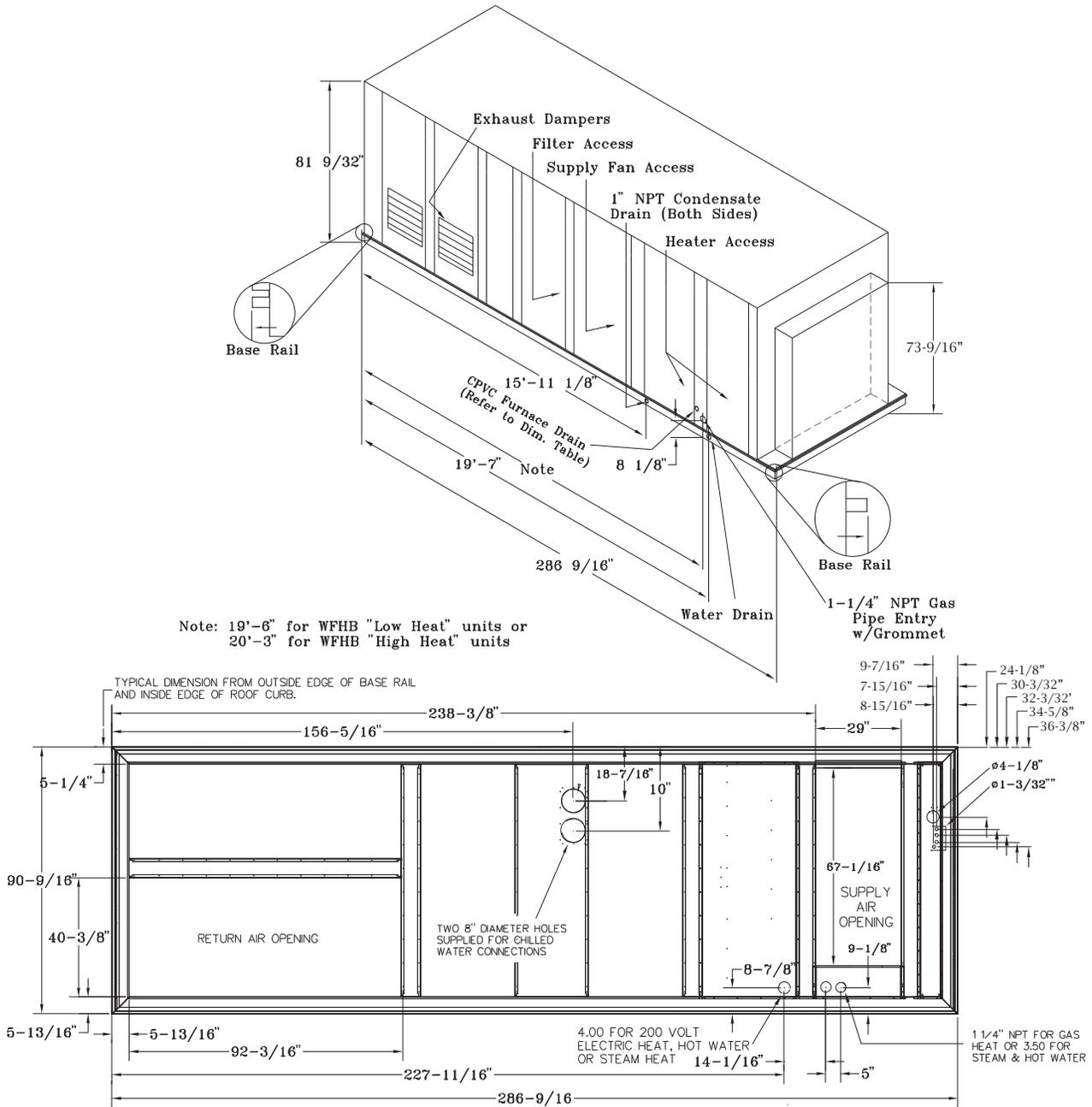


# Installation

Casing 5	Furnace Size/ MBH	Dimensions <sup>(a)</sup>	
		Length	Height
50 Ton	Low = 500	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"

(a) The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

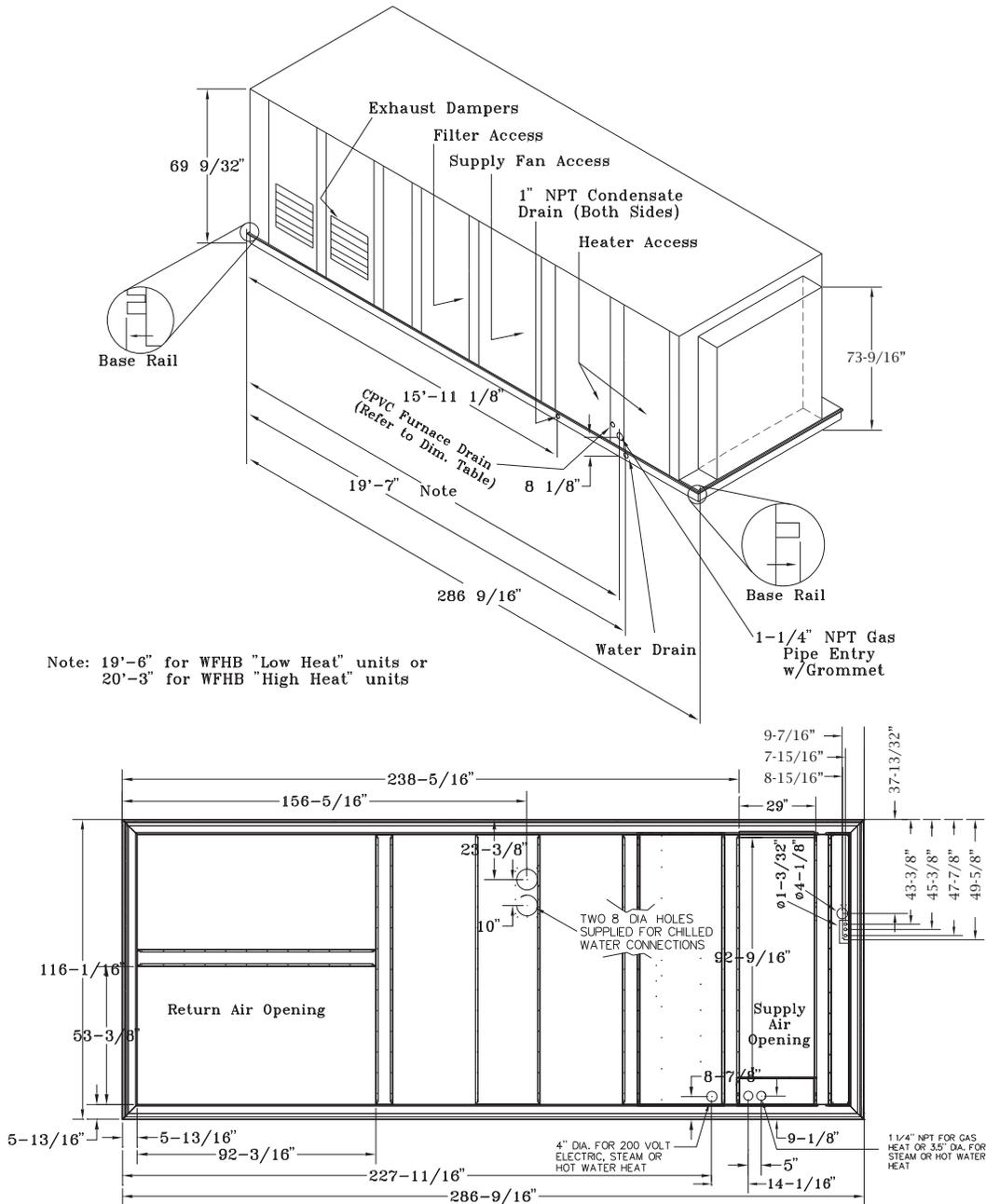
**Figure 7. W\_HE casing 5 (50 ton)**



Casing 6	Furnace Size/ MBH	Dimensions <sup>(a)</sup>	
		Length	Height
60-75 Ton	Low = 500	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"

(a) The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

Figure 8. W\_HE casing 6 (60-75 ton)

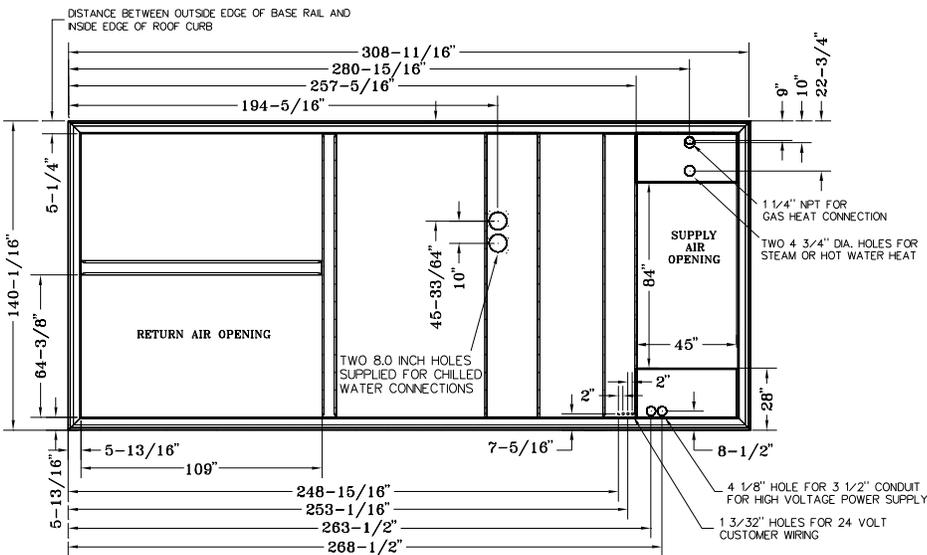
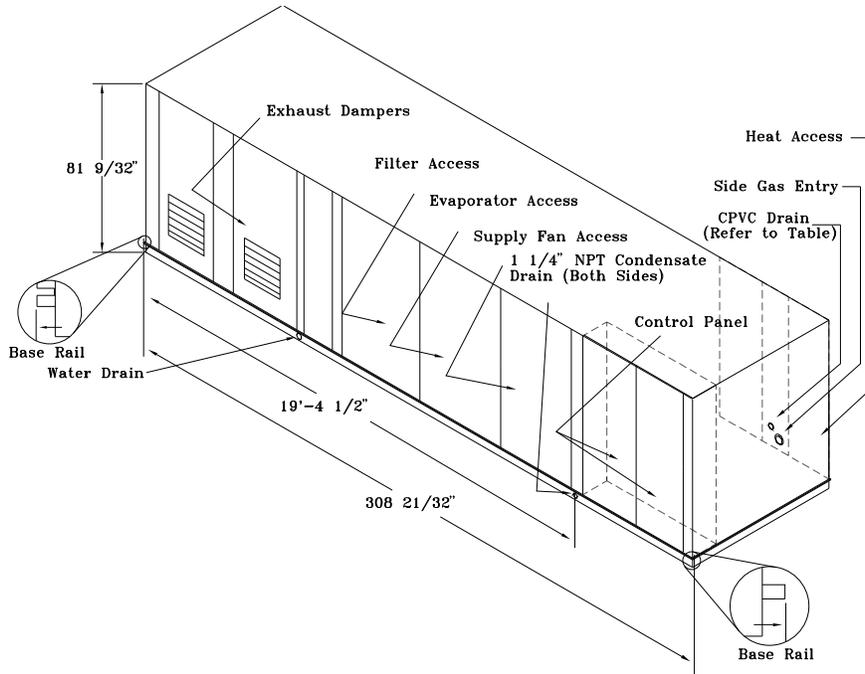


# Installation

Casing 9	Furnace Size/ MBH	Dimensions <sup>(a)</sup>	
		Length	Height
90-130 Ton	1000	267-3/16"	10-11/32"

(a) The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

**Figure 9. W\_HE casing 9 (90-130 ton)**



**Table 4. W\_HE center-of-gravity data<sup>(a)</sup>**

Unit Model	Casing Size	Units with 100% Exhaust Fan									
		Std. DX Coil		2 Row		4 Row		6 Row		8 Row	
				Chilled Water		Chilled Water		Chilled Water		Chilled Water	
		A	B	A	B	A	B	A	B	A	B
WEHE WLHE WSHE WXHE	2	10' 4"	3' 4"	10' 4"	3' 4"	10' 4"	3' 4"	10' 4"	3' 4"	N/A	N/A
	3	10' 2"	3' 4"	10' 2"	3' 4"	10' 2"	3' 4"	10' 4"	3' 4"	N/A	N/A
	4	12' 2"	3' 4"	12' 1"	3' 4"	12' 0"	3' 4"	12' 0"	3' 4"	N/A	N/A
	5	12' 0"	3' 4"	11' 10"	3' 4"	11' 9"	3' 4"	11' 9"	3' 4"	N/A	N/A
	6	11' 10"	4' 1"	11' 9"	4' 0"	11' 9"	4' 0"	11' 8"	4' 0"	N/A	N/A
	9	12' 8"	5' 4"	12' 6"	5' 4"	12' 4"	5' 2"	12' 4"	5' 1"	12' 4"	5' 1"
WFHE	2	10' 8"	3' 4"	10' 8"	3' 4"	10' 8"	3' 4"	10' 8"	3' 4"	N/A	N/A
	3	10' 7"	3' 4"	10' 7"	3' 4"	10' 7"	3' 4"	10' 7"	3' 4"	N/A	N/A
	4	12' 10"	3' 4"	12' 8"	3' 4"	12' 7"	3' 4"	12' 7"	3' 4"	N/A	N/A
	5	12' 6"	3' 4"	12' 6"	3' 4"	12' 4"	3' 4"	12' 4"	3' 4"	N/A	N/A
	6	12' 4"	4' 1"	12' 4"	4' 0"	12' 2"	4' 0"	12' 2"	4' 0"	N/A	N/A
	9	13' 4"	5' 7"	13' 1"	5' 4"	13' 0"	5' 4"	12' 10"	5' 4"	12' 9"	5' 2"
Unit Model	Casing Size	Units without Exhaust Fan									
		Std. DX Coil		2 Row		4 Row		6 Row		8 Row	
				Chilled Water		Chilled Water		Chilled Water		Chilled Water	
		A	B	A	B	A	B	A	B	A	B
WEHE WLHE WSHE WXHE	2	11' 1"	3' 6"	11' 0"	3' 6"	11' 0"	3' 6"	11' 0"	3' 6"	N/A	N/A
	3	11' 1"	3' 6"	11' 0"	3' 6"	11' 0"	3' 6"	11' 0"	3' 6"	N/A	N/A
	4	13' 4"	3' 6"	13' 1"	3' 6"	13' 0"	3' 6"	12' 10"	3' 6"	N/A	N/A
	5	13' 1"	3' 6"	12' 10"	3' 6"	12' 9"	3' 6"	12' 8"	3' 6"	N/A	N/A
	6	13' 1"	4' 4"	13' 0"	4' 4"	12' 10"	4' 4"	12' 8"	4' 2"	N/A	N/A
	9	14' 2"	5' 9"	14' 0"	5' 7"	13' 9"	5' 6"	13' 7"	5' 4"	13' 4"	5' 4"
WFHE	2	11' 6"	3' 6"	11' 6"	3' 6"	11' 4"	3' 6"	11' 4"	3' 6"	N/A	N/A
	3	11' 4"	3' 6"	11' 4"	3' 6"	11' 4"	3' 6"	11' 4"	3' 6"	N/A	N/A
	4	13' 10"	3' 6"	13' 8"	3' 6"	13' 7"	3' 6"	13' 6"	3' 6"	N/A	N/A
	5	13' 8"	3' 6"	13' 6"	3' 6"	13' 4"	3' 6"	13' 2"	3' 6"	N/A	N/A
	6	13' 7"	4' 4"	13' 6"	4' 4"	13' 4"	4' 2"	13' 2"	4' 2"	N/A	N/A
	9	14' 9"	6' 0"	14' 6"	5' 9"	14' 3"	5' 8"	14' 1"	5' 7"	14' 0"	5' 6"

continued on next page



# Installation

**Table 4. (continued) W\_HE center-of-gravity data<sup>(a)</sup>**

Unit Model	Casing Size	Units with Supply and Exhaust Fan (VFD)									
		Std. DX Coil		2 Row		4 Row		6 Row		8 Row	
		A	B	Chilled Water		Chilled Water		Chilled Water		Chilled Water	
		A	B	A	B	A	B	A	B	A	B
WEHE WLHE WSHE WXHE	2	9' 7"	3' 4"	9' 7"	3' 4"	9' 7"	3' 4"	9' 8"	3' 4"	N/A	N/A
	3	9' 6"	3' 4"	9' 6"	3' 4"	9' 7"	3' 6"	9' 7"	3' 6"	N/A	N/A
	4	11' 4"	3' 4"	11' 4"	3' 6"	11' 4"	3' 6"	11' 4"	3' 6"	N/A	N/A
	5	11' 2"	3' 6"	11' 1"	3' 6"	11' 1"	3' 6"	11' 1"	3' 6"	N/A	N/A
	6	11' 2"	4' 4"	11' 1"	4' 2"	11' 1"	4' 2"	11' 1"	4' 2"	N/A	N/A
	9	11' 9"	5' 7"	11' 8"	5' 6"	11' 7"	5' 4"	11' 7"	5' 4"	11' 6"	5' 2"
WFHE	2	10' 0"	3' 4"	10' 0"	3' 4"	10' 0"	3' 4"	10' 0"	3' 4"	N/A	N/A
	3	9' 10"	3' 4"	9' 10"	3' 4"	10' 0"	3' 6"	10' 0"	3' 6"	N/A	N/A
	4	12' 1"	3' 4"	12' 0"	3' 4"	11' 10"	3' 6"	11' 10"	3' 6"	N/A	N/A
	5	11' 9"	3' 6"	11' 8"	3' 6"	11' 8"	3' 6"	11' 7"	3' 6"	N/A	N/A
	6	11' 8"	4' 2"	11' 7"	4' 2"	11' 7"	4' 2"	11' 6"	4' 1"	N/A	N/A
	9	12' 4"	5' 8"	12' 4"	5' 7"	12' 2"	5' 6"	12' 1"	5' 4"	12' 1"	5' 4"

(a) Dimensions shown for the center-of-gravity are approximate and are based on a unit equipped with: Standard coils, 100% economizer, throwaway filters, 100% economizer, throwaway filters, hi-efficiency motors, 460 volt XL start, high capacity heat section (as applicable).

Casing Size	Typical Unit Operating Weight <sup>(a)</sup>												Roof Curb Max. Wgt W <sub>HE</sub> <sup>(b)</sup>			
	Std. DX Coil			2 Row Chilled Water			4 Row Chilled Water			6 Row Chilled Water				8 Row Chilled Water		
	WE, WL	WSHE	WFHE	WXHE	WE, WL	WSHE	WFHE	WXHE	WE, WL	WSHE	WFHE	WXHE		WE, WL	WSHE	WFHE
2	3690	3950	3560	3810	4075	3680	3970	4235	3840	4130	4395	4000	—	—	—	510
3	4165	4430	4040	4280	4545	4150	4510	4775	4380	4740	5005	4610	—	—	—	510
4	5324	5500	5170	5575	6050	5420	5840	6315	5685	6105	6580	5950	—	—	—	550
5	5945	6430	5790	6155	6630	6000	6480	6955	6325	6795	7270	6640	—	—	—	550
6	7070	7545	6915	7265	7740	7110	7625	8100	7470	7985	8460	7830	—	—	—	640
9	10655	11300	10500	10320	10965	10165	10865	11510	10710	11405	12050	11250	11955	12600	11800	770

Casing Size	Typical Unit Operating Weight <sup>(c)</sup>												Roof Curb Max. Wgt W <sub>HB</sub> <sup>(b)</sup>			
	Std. DX Coil			2 Row Chilled Water			4 Row Chilled Water			6 Row Chilled Water				8 Row Chilled Water		
	WE, WL	WSHE	WFHE	WXHE	WE, WL	WSHE	WFHE	WXHE	WE, WL	WSHE	WFHE	WXHE		WE, WL	WSHE	WFHE
2	3990	4255	3860	4115	4380	3985	4275	4540	4145	4435	4700	4305	—	—	—	510
3	4510	4775	4380	4625	4890	4495	4855	5120	4725	5085	5350	4955	—	—	—	510
4	5730	6205	5575	5980	6455	5825	6245	6720	6090	6510	6985	6355	—	—	—	550
5	6410	6885	6255	6625	7100	6470	6945	7420	6790	7265	7740	7110	—	—	—	550
6	7585	8060	7430	7780	8255	7625	8140	8615	7985	8500	8975	8345	—	—	—	640
9	11505	12150	11350	11170	11815	11015	11715	12360	11560	12255	12900	12100	12805	13450	12650	770

(a) The weights shown in this table represents the typical unit operating weights for the heating/cooling function indicated with an economizer and exhaust fan installed.

(b) Roof curb weights include the curb and pedestal.

(c) The weights shown represents the typical unit operating weights for the heating/cooling function indicated with an economizer, exhaust fan with supply & exhaust VFD installed. The actual weight is stamped on unit nameplate.

**Table 5. Component weights (Lbs.) — casings 2-9**

Casing Size	2	3	4	5	6	9
Cabinet <sup>(a)</sup>	2264	2467	3100	3330	3815	5144
Roof Curb	510	510	550	550	640	770
Evap Coil (R-410A)	192	237	310	366	490	(6-Row) 866

**Table 5. Component weights (Lbs.) — casings 2-9**

<b>Chilled Water Coil<sup>(b)</sup> - Aluminum (Shipping/Operating)</b>	462/564	591/751	(1) 344/418 (1) 424/517	(2) 462/564	(1) 451/551 (1) 554/680	(5-Row) 722 (2) 957/1184
<b>Chilled Water Coil<sup>(b)</sup> - Copper (Shipping/Operating)</b>	955/1057	1307/1468	(1) 702/777 (1) 872/965	(2) 955/1057	1) 955/1057 (1) 1173/1299	(2) 2097/2325
<b>Hot Water Coil</b>	217	217	269	269	324	
<b>Steam Coil</b>	176	176	256	256	312	552
<b>Supply Motor Std.</b>	122	231	304	345	455	448
<b>Supply Motor Hi-Eff.</b>	140	195	280	360	480	(2) 455
<b>Exhaust Motor - Std.</b>	60	104	122	191	231	(2) 480
<b>Exhaust Motor - Hi-Eff.</b>	64	113	140	189	195	455
<b>Supply Fan Assy.</b>	234	344	530	530	748	480
<b>Variable Frequency Drive</b>	21	27	32	38	49	(2) 735
<b>Exhaust Fan Assy</b>	234	234	344	324	530	(2) 100
<b>Gas Heat Low (Includes Control Box)</b>	270	306	306	395	395	748
<b>Gas Heat High (Includes Control Box)</b>	395	395	630	630	630	800
<b>Electric Heat<sup>(c)</sup> (Includes Control Box)</b>	130	130	155	155	155	
<b>Main Control Box<sup>(c)</sup></b>	150	150	200	220	250	155
<b>Filter Assembly<sup>(c)</sup></b>	60	70	70	85	100	350
<b>FA/RA Damper<sup>(c)</sup></b>	45	60	75	90	95	125
<b>Exhaust Damper<sup>(c)</sup></b>	(2) 30	(2) 35	(2) 50	(2) 55	(2) 50	150
<b>Eliminator Panel</b>	(1) 50	(1) 58	(1) 68	(2) 75	(2) 60	(2) 55

(a) Cabinet weights are estimated based on:  
 4.4 Lbs./Ft<sup>2</sup> of surface for Casing Sizes 2-5.  
 4.6 Lbs./Ft<sup>2</sup> of surface area for Casing Size 6.

(b) Chilled Water coil weights are for maximum size coil.

(c) Estimated Weights

## Roof Curb and Ductwork

The roof curbs for W\_HE casings 2 through 9 units consists of a "full perimeter" enclosure to support the unit.

Before installing any roof curb:

1. Verify that it is the correct curb for the unit,
2. Verify that it includes the necessary gaskets and hardware,
3. Verify that the purposed installation location provides the required clearance for proper operation.
4. Insure that the curb is level and square. The top surface of the curb must be true to assure an adequate curb-to-unit seal.

Step-by-step curb assembly and installation instructions ship with each Trane accessory roof curb kit. Refer to the applicable sections in the current edition of RT-SVN14\*-EN for W\_HE casings 2 through 9. Follow the instructions carefully to assure proper fit-up when the unit is set into place.

**Note:** To assure proper condensate flow during operation, the unit (and curb) must be as level as possible. The maximum slope allowable for rooftop unit applications is 4" end-to-end and 2"

*side-to-side excluding WSHE. Units with steam coils (WSHE's) must be set level!*

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

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

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

Trane's Engineering Bulletin RT-PRB022-EN provides additional information concerning duct design and sound reduction.

## Pitch Pocket Location

The location of the main supply power entry for W\_HE Casings 2 through 6 units is located in the bottom right-hand area of the control panel. [Figure 8, p. 23](#) illustrates the electrical entrance location for the control panel. If the power supply conduit penetrates the building's roof



## Installation

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beneath this opening, it is recommended that a pitch pocket be installed. Due to the accessibility of the electrical entrance, the pitch pocket can be installed after the unit is placed on the curb.

If a Trane Curb Accessory Kit is not used:

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

**Note:** *If a "built-up" curb is provided by others, keep in mind that these commercial rooftop air handler units do not require a "Pedestal"*

## Unit Rigging & Placement

### **⚠ WARNING**

#### **Heavy Objects!**

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

**Note:** *Use spreader bars as shown in diagram [Figure 10, p. 29](#). Refer to [Installation Manual](#) or nameplate for unit weight. Refer to [Installation Instructions](#) located inside control panel for further rigging information.*

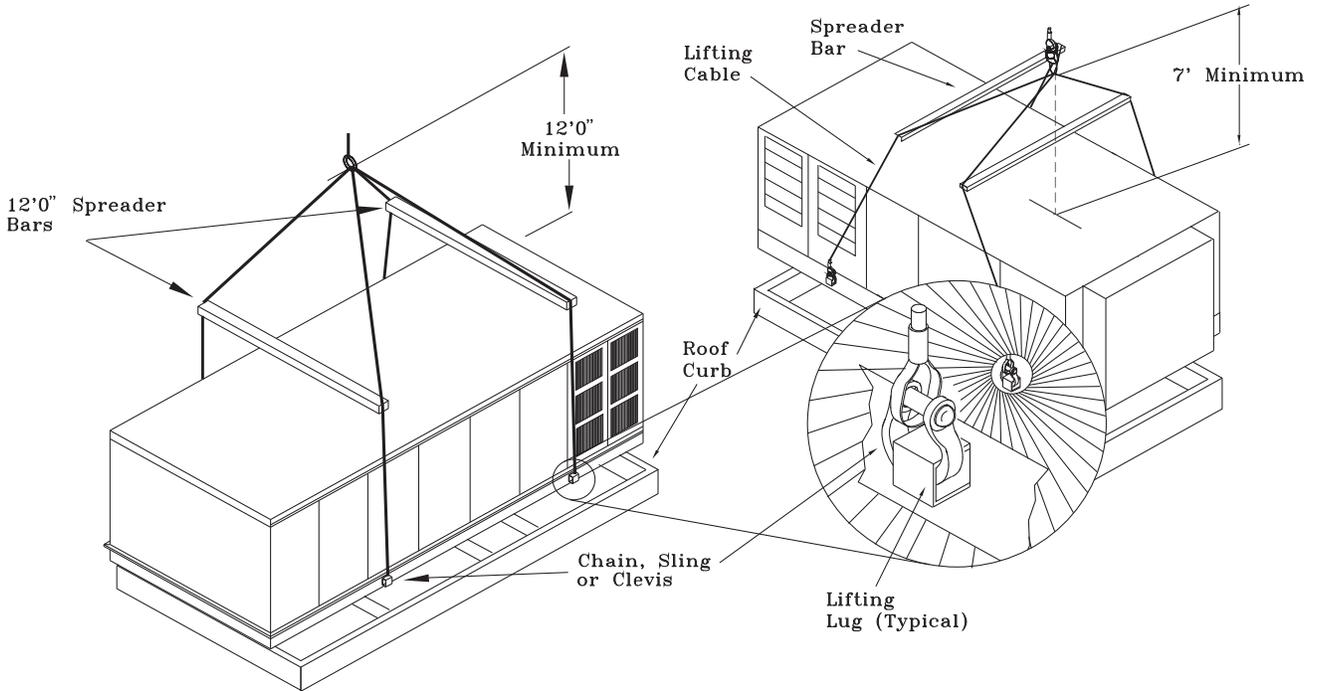
1. Attach adequate strength lifting slings (cables or chains) to all four lifting lugs on W\_HE casings 2 through 9. The minimum distance between the lifting hook and the top of the unit should be 7 feet for casings 2 through 9. [Figure 10, p. 29](#) illustrates the installation of spreader bars to protect the unit and to facilitate a uniform lift.
2. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
3. Lift the unit and position it over the curb and pedestal. (These units have a continuous base rail around the air handler section which matches the curb.)
4. Align the base rail of the air handler with the curb rail while lowering the unit onto the curb. Make sure that the gasket on the curb is not damaged while positioning the unit.

A cross section of the juncture between the unit and the roof curb is shown in [Figure 11, p. 29](#).

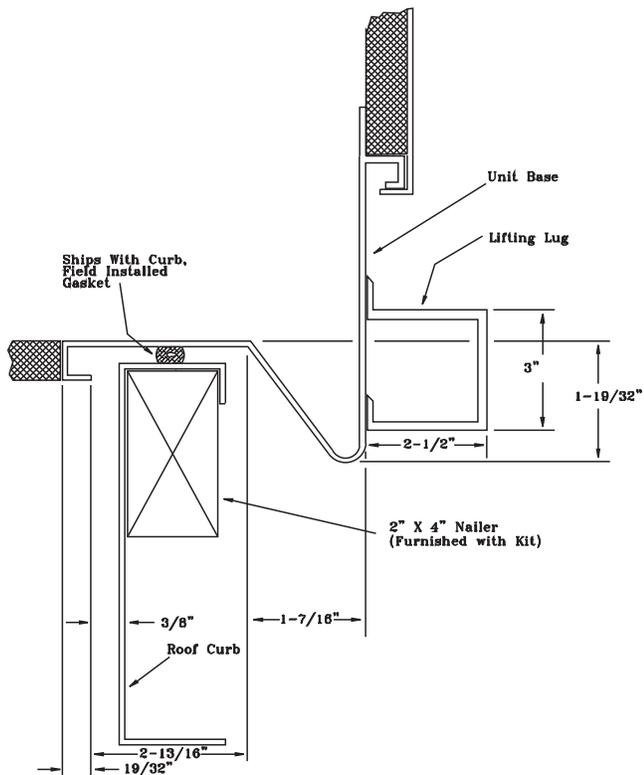
**Figure 10. Unit rigging**

Typical Casing #9 Unit

Typical Casing #2, 3, 4, 5 & 6 Unit



**Figure 11. Typical unit base & roof curb cross section**





## Installation

### General Unit Requirements

- The checklist listed below is a summary of the steps required to successfully install a Commercial Rooftop Air Handler unit. This checklist is intended to acquaint the installing personnel with what is required in the installation process. It does not replace the detailed instructions called out in the applicable sections of this manual.
- Check the unit for shipping damage and material shortage; file a freight claim and notify Trane office.
- Verify that the installation location of the unit will provide the required clearance for proper operation.
- Assemble and install the roof curb, including the necessary gaskets. (Refer to the applicable sections in the current edition of RT-SVN14\*-EN for W\_HE casings 2 through 9. Make sure the curb is level.
- Fabricate and install ductwork; secure ductwork to curb.
- Rigging and placing the unit.
- Install and connect condensate drain lines to each evaporator drain connection.
- Remove the shipping hold-down bolts and shipping channels from the supply and exhaust fans (applicable with rubber or spring isolators).
- Check all optional supply and exhaust fan spring isolators for proper adjustment.

### Main Electrical Power Requirements

#### **⚠ WARNING**

##### **Proper Field Wiring and Grounding Required!**

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

- Verify that the power supply complies with the unit nameplate specifications.
- Inspect all control panel components; tighten any loose connections.
- Connect properly sized and protected power supply wiring to a field-supplied/installed disconnect and unit.
- Properly ground the unit.

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

### Field Installed 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.**

- Complete the field wiring connections for the constant volume controls as applicable. Refer to "Field Installed Control Wiring" for guidelines.
- Complete the field wiring connections for the variable air volume controls as applicable. Refer to "Field Installed Control Wiring" for guidelines.

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

### Requirements for Electric Heat Units

All WEHE Units (380 minimum voltage)

- Verify that the power supply complies with the electric heater specifications on the unit and heater nameplate.
- Inspect the heater junction box and control panel; tighten any loose connections.
- Check electric heat circuits for continuity.

#### **WEHE Units w/200V or 230V Electric Heat:**

(Requires Separate Power Supply to Heater)

- Connect properly sized and protected power supply wiring for the electric heat from a dedicated, field supplied/installed disconnect switch to terminal block 4TB2, or to an optional unit mounted disconnect switch 4S15.

### Requirements for Gas Heat

- 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.
- Factory-supplied flue assembly installed on the unit.
- Connect the 3/4" CPVC furnace drain stubout to a proper condensate drain.

## Requirements for Hot Water Heat (WLHE)

- Route properly sized water piping through the base of the unit into the heating section.
- Install the factory-supplied, 3-way modulating valve.
- Complete the valve actuator wiring.

## Requirements for Steam Heat (WSHE)

- Install an automatic air vent at the top of the return water coil header.
- Route properly sized steam piping through the base of the unit into the heating section.
- Install the factory-supplied, 2-way modulating valve
- Complete the valve actuator wiring.
- Install 1/2", 15-degree swing-check vacuum breaker(s) at the top of each coil section. Vent breaker(s) to the atmosphere or merge with return main at discharge side of steam trap.
- Position the steam trap discharge at least 12" below the outlet connection on the coil.
- Use float and thermostatic traps in the system, as required by the application.

## O/A Pressure Sensor and Tubing Installation

(All units with Statitrac)

- O/A pressure sensor mounted to the roof bracket.
- Factory supplied pneumatic tubing installed between the O/A pressure sensor and the connector on the vertical support.
- Field supplied pneumatic tubing connected to the proper fitting on the space pressure transducer located

in the filter section, and the other end routed to a suitable sensing location within the controlled space.

## Condensate Drain Connection

Each casing 2 through 6 unit is equipped with a 1" evaporator condensate drain connection (1.25" on Casing 9) on each side of the unit. Due to the size of these units, a condensate drain line must be connected to both evaporator drain connections. Refer to [Figure 4, p. 19](#) - [Figure 8, p. 23](#) for the location of the drain connections.

A condensate trap must be installed due to the drain connection being on the "negative pressure" side of the fan. Install the P-Traps at the unit using the guidelines in [Figure 12, p. 31](#).

Pitch the drain lines at least 1/2 inch for every 10 feet of horizontal run to assure proper condensate flow. Do not allow the horizontal run to sag causing a possible double-trap condition which could result in condensate backup due to "air lock".

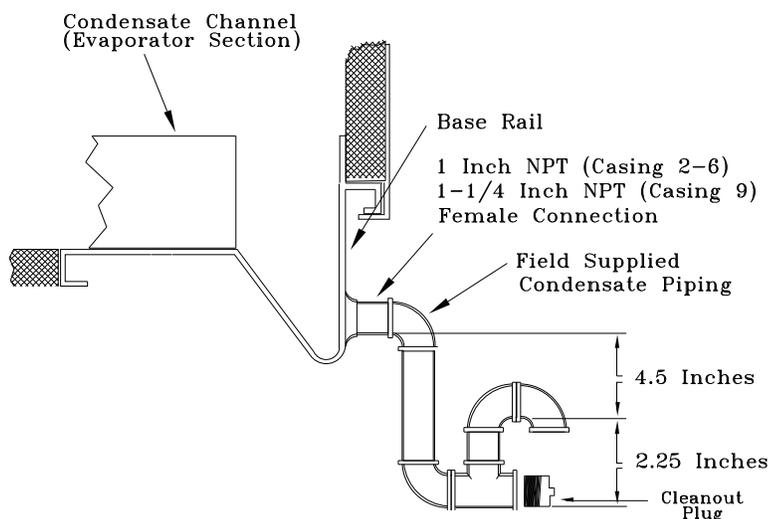
## Units with Gas Furnace

Units equipped with a gas furnace have a 3/4" CPVC drain connection stubbed out through the vertical support in the gas heat section. It is extremely important that the condensate be piped to a proper drain. Refer to [Figure 4, p. 19](#) - [Figure 8, p. 23](#) for the location of the drain connection.

**Note:** Units equipped with an optional modulating gas furnace will likely operate in a condensing mode part of the time.

An additional 1-1/4" non-connectable water drain is located in the base rail within the heating section. Ensure that all condensate drain line installations comply with applicable building and waste disposal codes.

**Figure 12. Condensate trap installation**



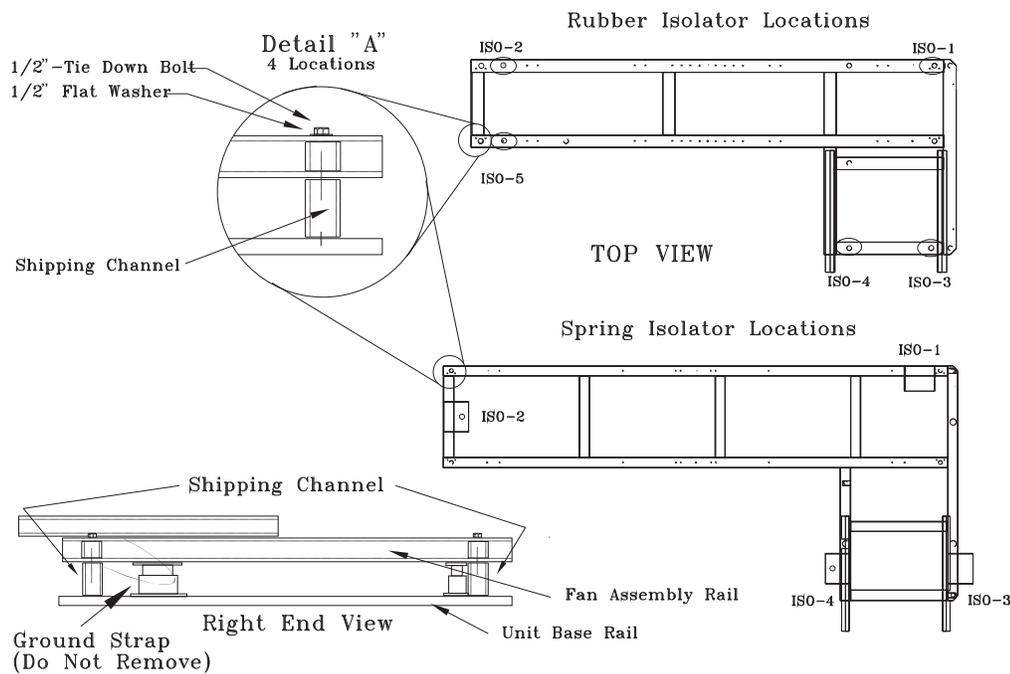
## Shipping Fasteners

### Removing Supply and Exhaust Fan Shipping Channels (Motors >5Hp)

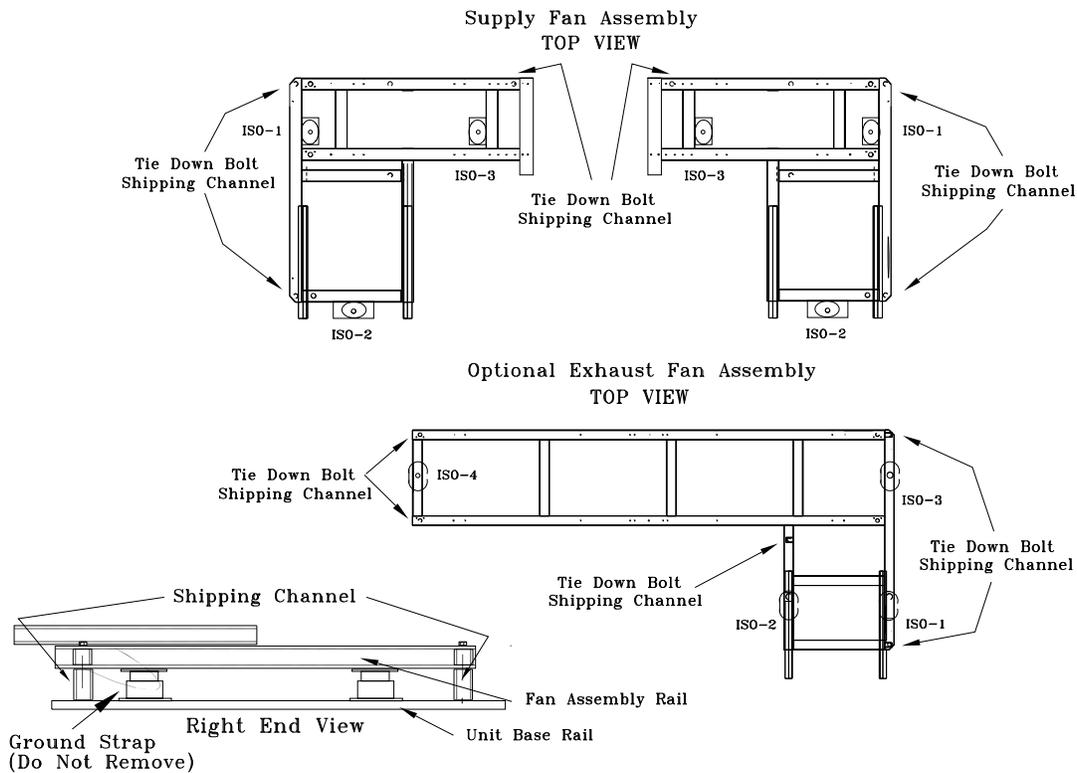
Each supply fan assembly and exhaust fan assembly for W\_HE (casings 2 through 6) units shipped with a motor larger than 5 hp is equipped with rubber isolators, (as standard), or optional spring isolators. Each supply fan assembly and exhaust fan assembly for W\_HE (casing 9) unit is equipped with spring isolators. Shipping channels are installed beneath each fan assembly and must be removed. To locate and remove these channels, refer to [Figure 13, p. 32](#) and use the following procedures.

1. Remove and discard the shipping bolts from the fan assembly rails.
2. Elevate the fan-and-motor assembly and slide the shipping channels out from between the fan assembly rails and the unit's base rail.
3. Lower the fan-and-motor assembly onto the isolators. Make sure that the pins at the top of the isolators are engaged in the corresponding holes on the fan assembly.
4. Verify that the fan assembly is being supported by the isolators.

**Figure 13. Removing fan assembly shipping hardware – W\_HE casings 2-6**



**Figure 14. Removing fan assembly shipping hardware – W\_HE casing 9**



**Note:** Fan assemblies not equipped with rubber or spring isolators have mounting bolts at the same locations and must not be removed.

## O/A Sensor & Tubing Installation

An Outside Air Pressure Sensor is shipped with all units designed to operate on variable air volume applications or constant volume units with 100% modulating exhaust w/ Statitrac.

On VAV systems, a duct pressure transducer (3U60) and the outside air sensor is used to control the discharge duct static pressure to within a customer-specified parameter.

On CV & VAV units equipped with 100% modulating exhaust w/Statitrac, a space pressure transducer (3U62) and the outside air sensor is used to control the exhaust fan and dampers to relieve static pressure, to within a customer-specified parameter, within the controlled space. Refer to [Figure 15](#) and the following steps to install the sensor and the pneumatic tubing.

1. Remove the O/A pressure sensor kit located inside the filter section. The kit contains the following items:
  - an O/A static pressure sensor
  - a sensor mounting bracket
  - 2' 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 installed bracket (near the filter section).

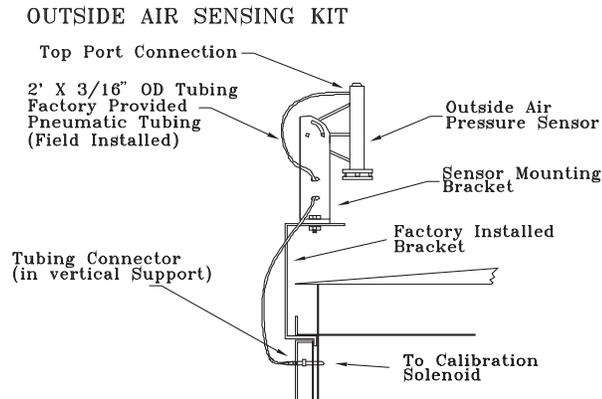
3. Using the #10-32 x 1/2" screws provided, install the O/A static pressure sensor vertically to the sensor bracket.
4. Remove the dust cap from the tubing connector located below the sensor in the vertical support.
5. Attach one end of the 2' x 3/16" O.D. factory provided pneumatic tubing to the sensor's top port, and the other end of the tubing to the connector in the vertical support. Discard any excess tubing.

## Units with Statitrac™

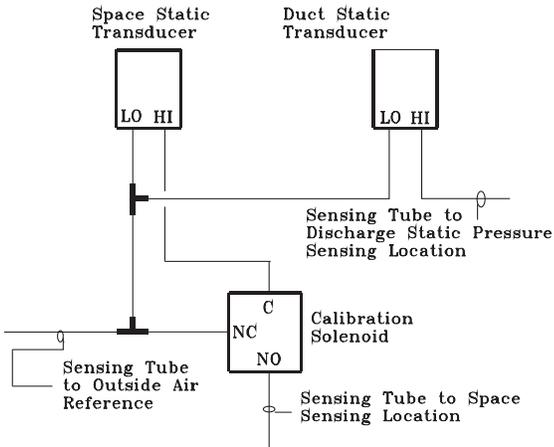
6. Open the filter access door, and locate the DSP control devices (Refer to [Figure 15](#)). There are three tube connectors mounted on the left of the solenoid and transducers. Connect one end of the field provided 3/16" O.D. pneumatic tubing for the space pressurization control to the bottom fitting. 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.

**Important:** If the building has two or more large areas, the static pressures can be averaged by routing equal length tubes to each location.

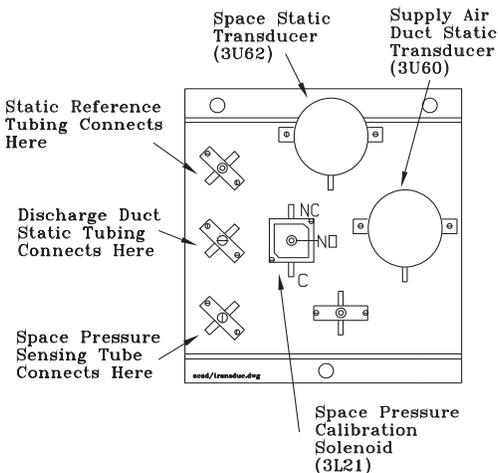
**Figure 15. Outside air sensor & tubing**



DUCT & SPACE PRESSURE TRANSDUCER TUBING SCHEMATIC



DUCT & SPACE STATIC PRESSURE CONTROL COMPONENT LAYOUT



## Gas Heat Units (WFHE)

All internal gas piping is factory-installed and pressure/leak-tested before shipment. Once the unit is set into

place, the gas supply line must be field-connected to the elbow located inside the gas heat control compartment.

### ⚠ WARNING

#### Flammable Vapors!

When connecting to existing gas lines be sure to shut off the gas supply ahead of connection point. To avoid explosion or possible fire, always purge all residual gas from piping before cutting into existing line or removing threaded fittings. Failure to shut off the gas supply and remove all gas vapors could result in death or serious injury.

### ⚠ 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 or lead to excessive carbon monoxide. 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 4, p. 19](#) - [Figure 8, p. 23](#) to accommodate a side or bottom pipe entry on W\_HE Casings 2 through 9. 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 6, p. 35](#) as a guide to determine the appropriate gas pipe size for the unit heating capacity listed on the unit's nameplate.
2. If a gas line already exist, verify that it is sized large enough to handle the additional furnace capacity before connecting to it.
3. Take all branch piping from any main gas line from the top at 90° degrees or at 45° degrees to prevent moisture from being drawn in with the gas.
4. 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.
5. Provide a drip leg near the unit.
6. Install a pressure regulator at the unit that is adequate to maintain 7" w.c. for natural gas while the furnace is operating at full capacity.

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

Failure to use a pressure regulating device will result in incorrect gas pressure. This can cause erratic operation due to gas pressure fluctuations as well as damage the gas valve. Over sizing the regulator will cause irregular pulsating flame patterns, burner rumble, potential flame outages, and possible gas valve damage.

If a single pressure regulator serves more than one rooftop unit, it must be sized to ensure that the inlet gas pressure does not fall below 7" w.c. with all the furnaces operating at full capacity. The gas pressure must not exceed 14" w.c. when the furnaces are off.

7. Provide adequate support for all field installed gas piping to avoid stressing the gas train and controls.

**⚠ WARNING**

**Hazard of Explosion!**

**Never use an open flame to detect gas leaks. It could result in an explosion. Use a leak test solution for leak testing. Failure to follow recommended safe leak test procedures could result in death or serious injury or equipment or property-only-damage.**

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

**Table 6. Sizing natural gas pipe mains & branches**

Gas Supply Pipe Run (ft)	Gas Input (Cubic Feet/Hour) <sup>(a)</sup>					
	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

$$\begin{aligned} \text{Cu.Ft./Hour} &= \text{Furnace MBH Input} \\ \text{Gas BTU/Cu.Ft.} \times \text{Multiplier (Table 6, p. 30)} \\ \text{Cu.Ft./Hour} &= 500 \end{aligned}$$

Table 6, p. 30 indicates that a 1-1/4" pipe is required.

(a) Table is based on a specific gravity of 0.60. Use Table 3-1 for the specific gravity of the local gas supply.

**Table 7. Modulating gas heat settings**

Natural Gas					
Heater Size (MBH)	Gas Orifice	Full Modulation	Partial Modulation	Valve Actuator	
		Air Damper Actuator Voltage Range (VDC)	Air Damper Actuator Voltage Range (VDC)	Left (Coarse) Setting	Right (Fine) Setting
500	#21	7 - 10	7 - 9.7	2.3	-1
850	#H	6 - 10	6 - 8.7	1.3	-1
1000	#N	5 - 10	5 - 8.7	0.9	0

LP					
Heater Size (MBH)	Gas Orifice	Full Modulation	Partial Modulation	Valve Actuator	
		Air Damper Actuator Voltage Range (VDC)	Air Damper Actuator Voltage Range (VDC)	Left (Coarse) Setting	Right (Fine) Setting
500	#34 / #53	7 - 10	7 - 9.7	6	1
850	#32	6 - 10	6 - 8.7	3.2	1
1000	#29	5 - 10	5 - 8.7	1.9	0

**Note:** Valve actuator settings are approximate and may require "fine tuning" to properly set. Right (fine) settings given are in notches from the "zero" midpoint location on sight gage.

**Table 8. Gas heating capacity altitude correction factors**

Capacity Multiplier	Altitude (Ft.)						
	Sea Level To 2000	2001 To 2500	2501 To 3500	3501 To 4500	4501 To 5500	5501 To 6500	6501 To 7500
	1.00	.92	.88	.84	.80	.76	.72

**Note:** Correction factors are per AGA Std. 221.30 - 1964, Part VI, 6.12. Local codes may supersede.

**Table 9. Specific gravity multipliers**

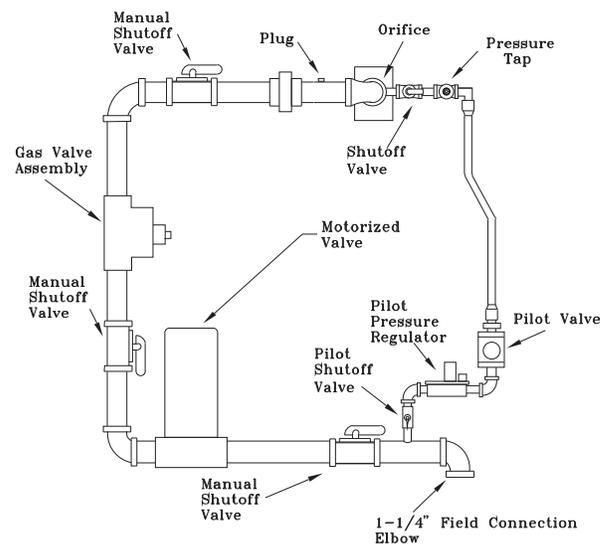
Specific Gravity	Multiplier
0.50	1.10
0.55	1.04
0.60	1.00
0.65	0.96

### Connecting the Gas Supply Line to the Furnace Gas Train

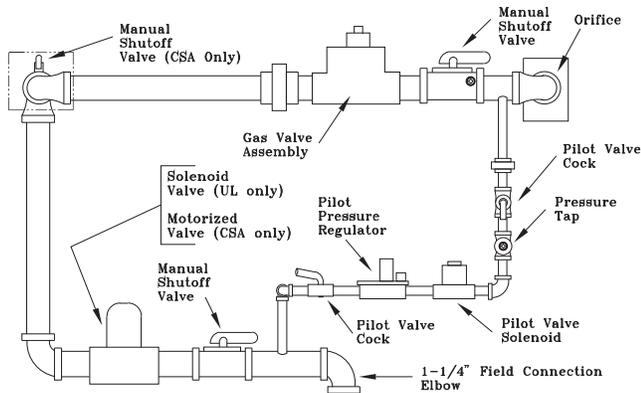
Follow the steps below to complete the installation between the supply gas line and the furnace. Refer to [Figure 17 - Figure 19](#) for the appropriate gas train configuration.

1. Connect the supply gas piping using a "ground-joint" type union to the furnace gas train and check for leaks.
2. Adjust the inlet supply pressure to the recommended 7" to 14" w.c. parameter for natural gas.
3. Ensure that the piping is adequately supported to avoid gas train stress.

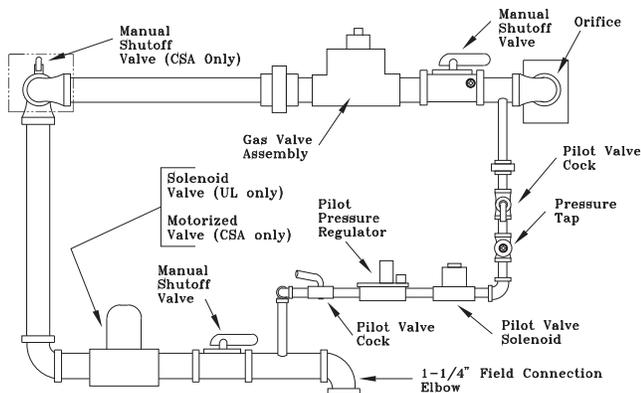
**Figure 16. 1000 MBH - unit gas trains (natural gas)**



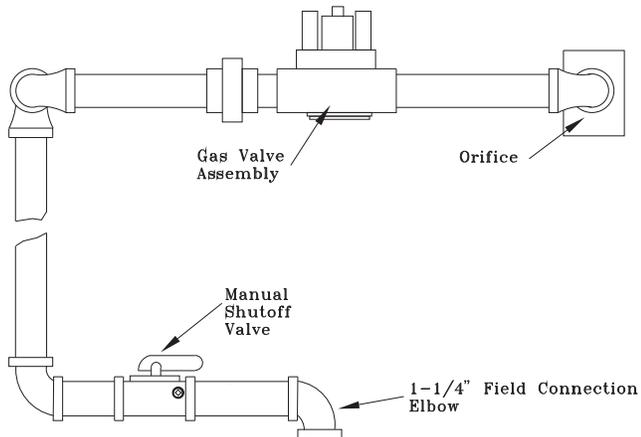
**Figure 17. 500 and 850 MBH - unit gas trains (natural gas)**



**Figure 18. 500 and 850 MBH - unit gas trains (natural gas)**

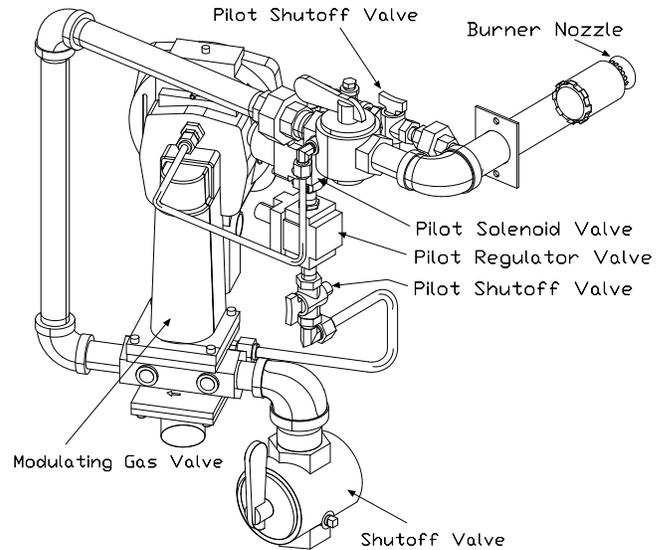


**Figure 19. 235 and 350 MBH - unit gas trains (natural gas)**



## Modulating

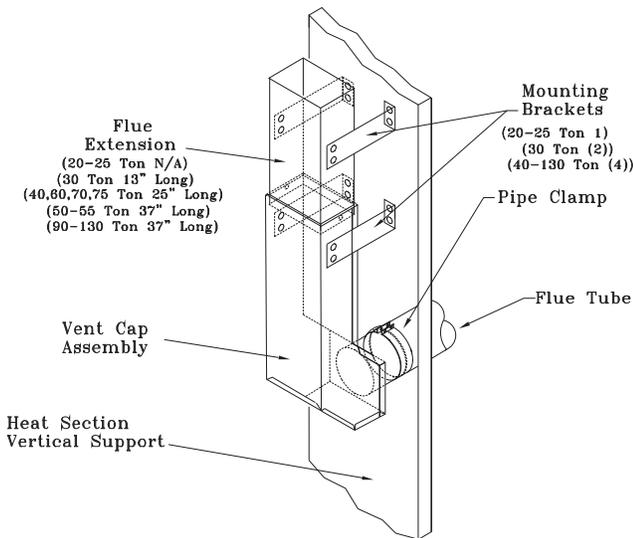
**Figure 20. Modulating gas valve**



## Flue Assembly Installation

1. Locate the flue assembly and the extension (refer to [Figure 21, p. 38](#) for extension usage).
2. Install the flue extension onto the flue assembly as shown in [Figure 21](#).
3. Slide the pipe clamp onto the heater flue tube located inside the heater compartment.
4. Insert the tube on the flue assembly into the hole located in the vertical support for the heat section.
5. Butt both flue tube sections together and center the pipe clamp over joint.
6. Using the pre-punched holes in the flue assembly, extension, and the vertical support, install the appropriate number of mounting brackets. Refer to [Figure 21](#) for details.

Figure 21. Flu assembly



### Hot Water Heat Units (WLHE)

Hot water heating coils are factory installed inside the heater section of the unit. Once the unit is set into place, the hot water piping and the three way modulating valve (factory provided, field installed) must be installed. The valve can be installed inside the heat section or near the unit. If the valve is installed in a remote location, use field supplied wiring to extend the control wires from the heater section to the valve. Two access holes are provided in the unit base as shown in [Figure 4, p. 19](#) - [Figure 8, p. 23](#).

Following the guidelines listed below will enhance both the installation and operation of the "wet heat" system. [Figure 22, p. 39](#) illustrates the recommended piping configurations for the hot water coil. [Table 10, p. 38](#) lists the coil connection sizes.

**Note:** The valve actuators are not waterproof. Failure to protect the valve from moisture may result in the loss of heating control.

1. Support all field-installed piping independently from the heating coil.
2. Use swing joints or flexible connectors adjacent to the heating coil. (These devices will absorb the strains of expansion and contraction.)
3. All return lines and fittings must be equal to the diameter of the "outlet" connection on the hot water coil.
4. Install a "Gate" type valve in the supply branch line as close as possible to the hot water main and upstream of any other device or takeoff.
5. Install a "Gate" type valve in the return branch lines as close as possible to the return main and down stream of any other device.
6. Install a strainer in the hot water supply branch as shown in [Figure 22](#).

7. Install the 3-way valve in an upright position, piped for valve seating against the flow. Ensure that the valve's location lends itself to serviceability.
8. The Type "W" hot water coil used in WLHE units is self-venting only when the tube water velocity exceeds 1.5 feet per second (fps). If the tube velocity is less than 1.5 feet per second, either:
  - a. Install an automatic air vent at the top of the return header, using the tapped pipe connection;
 or,
  - b. Vent the coil from the top of the return header down to the return piping. At the vent connection, size the return piping to provide sufficient water velocity.
9. Install a "Globe" type valve in the Bypass line as shown in [Figure 22, p. 39](#).

Table 10. Connection sizes for hot water & steam coil (a)

Unit Model and Size	Heat Section Capacity <sup>(b)</sup>	Coil Connections (diameter in inches)	
		Supply	Return
WLHE (20 - 130) Casing 2 - 9	High or Low Heat	2-1/2"	2-1/2"
WSHE (20 - 30) Casings 2 & 3	High or Low Heat	3"	1-1/4"
WSHE (90-130) Casing 9	Low Heat <sup>(c)</sup>	1-1/2"	1"
WSHE (40 - 75) Casings 4, 5 & 6 <sup>(c)</sup>	High Heat	3"	1-1/2"
	Low Heat	1-1/2"	1"

(a) Type W coils—with center offset headers—are used in WLHE units; Type NS coils are used in WSHE units.

(b) See Digit 9 of the "Model Number Descriptions," p. 5 to determine the heating capacity.

(c) WSHE - 40 thru 130 Ton units have multiple headers

### Steam Heat Units (WSHE)

Steam heating coils are factory installed inside the heater section of the unit. The coils are pitched, within the units, to provide the proper condensate flow from the coil.

**Important:** To maintain the designed degree of pitch for the coil, the unit must be installed absolutely level.

Once the unit is set into place, the steam piping and the two way modulating valve (factory provided, field installed) must be installed. The valve can be installed inside the heater section or near the unit. If the valve is installed in a remote location, use field supplied wiring to extend the control wires from the heater section to the valve. Two access holes are provided in the unit base as shown in [Figure 4, p. 19](#) - [Figure 8, p. 23](#).

Following the guidelines listed below will enhance both the installation and operation of the "wet heat" system. [Figure 24, p. 40](#) illustrates the recommended piping configurations for the steam coil. [Table 10, p. 38](#) list the coil connection sizes.

**Important:** *The valve actuators are not waterproof. Failure to protect the valve from moisture may result in the loss of heating control.*

1. Support all field-installed piping independently from the heating coil.
2. Use swing joints or flexible connectors adjacent to the heating coil. (These devices will absorb the strains of expansion and contraction.)
3. Install the 2-way valve in an upright position. Ensure that the valve's location lends itself to serviceability.
4. Pitch the supply and return steam piping downward 1" per 10' of run in the direction of flow.
5. All return lines and fittings must be equal to the diameter of the "outlet" connection on the steam coil(s). If the steam trap connection is smaller than the coil "outlet" diameter, reduce the pipe size between the strainer and the steam trap connections only.
6. Install a 1/2" 15 degree swing-check vacuum breaker at the top of the return coil header using the tapped pipe connection. Position the vacuum breaker as close to the coil as possible.

**Note:** *Vacuum breakers should have extended lines from the vent ports to the atmosphere or connect each vent line to the return pipe on the discharge side of the steam traps.*

7. Install a "Gate" type valve in the supply branch line as close as possible to the steam main and upstream of any other device.
8. Install a "Gate" type valve in the return branch line as close as possible to the condensate return main and downstream of any other device.
9. Install a strainer as close as possible to the inlet of the control valve and steam trap(s).

10. Steam trap selection should be based on the maximum possible condensate flow and the recommended load factors.
11. Install a Float-and-Thermostatic (FT) type trap to maintain proper flow. They provide gravity drains and continuous discharge operation. FT type traps are required if the system includes either;
  - a. An atmospheric pressure/gravity condensate return;
  - or,
  - b. A potentially low pressure steam supply.
12. Position the outlet or discharge port of the steam trap at least 12" below the outlet connection on the coil(s). This will provide adequate hydrostatic head pressure to overcome the trap losses and assure complete condensate removal.

### Casings 4, 5, 6 and 9 units

Utilizes two steam coils stacked together. These two coils must be piped in a parallel arrangement. The steps listed below should be used in addition to the previous steps.

Figure 24, p. 40 illustrates the recommended piping configuration for the steam coils.

13. Install a strainer in each return line before the steam trap.
14. Trap each steam coil separately as described in [Step 10](#) and [Step 11](#) to prevent condensate backup in one or both coils.
15. In order to prevent condensate backup in the piping header supplying both coil sections, a drain must be installed utilizing a strainer and a steam trap as shown in [Figure 24, p. 40](#).

**Figure 22. Hot water piping configuration for W\_HE casings 2 - 6**

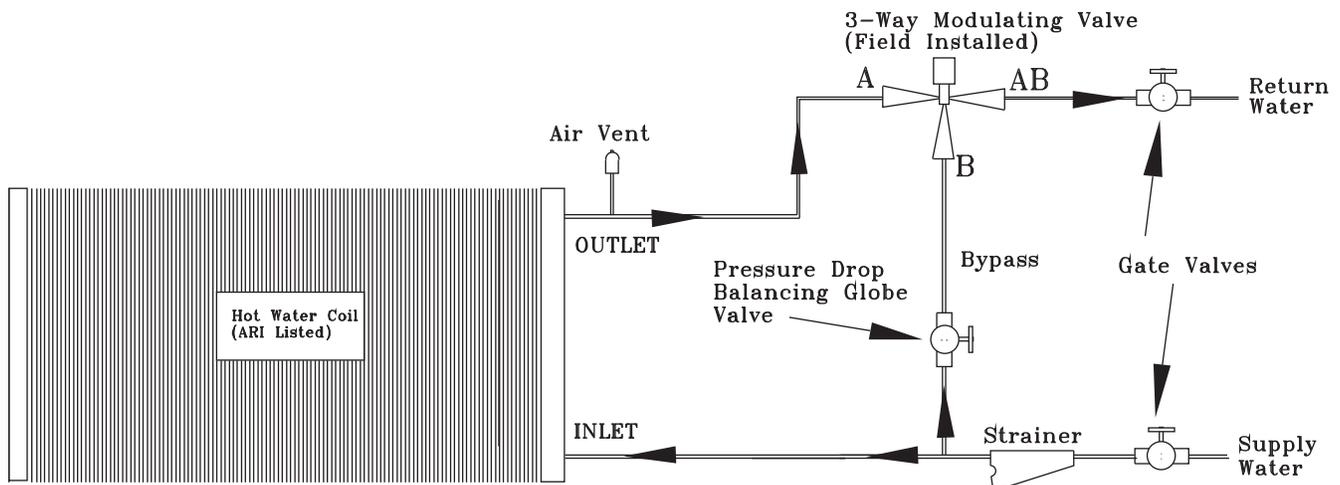


Figure 23. Hot water piping configuration for W\_HE casing 9

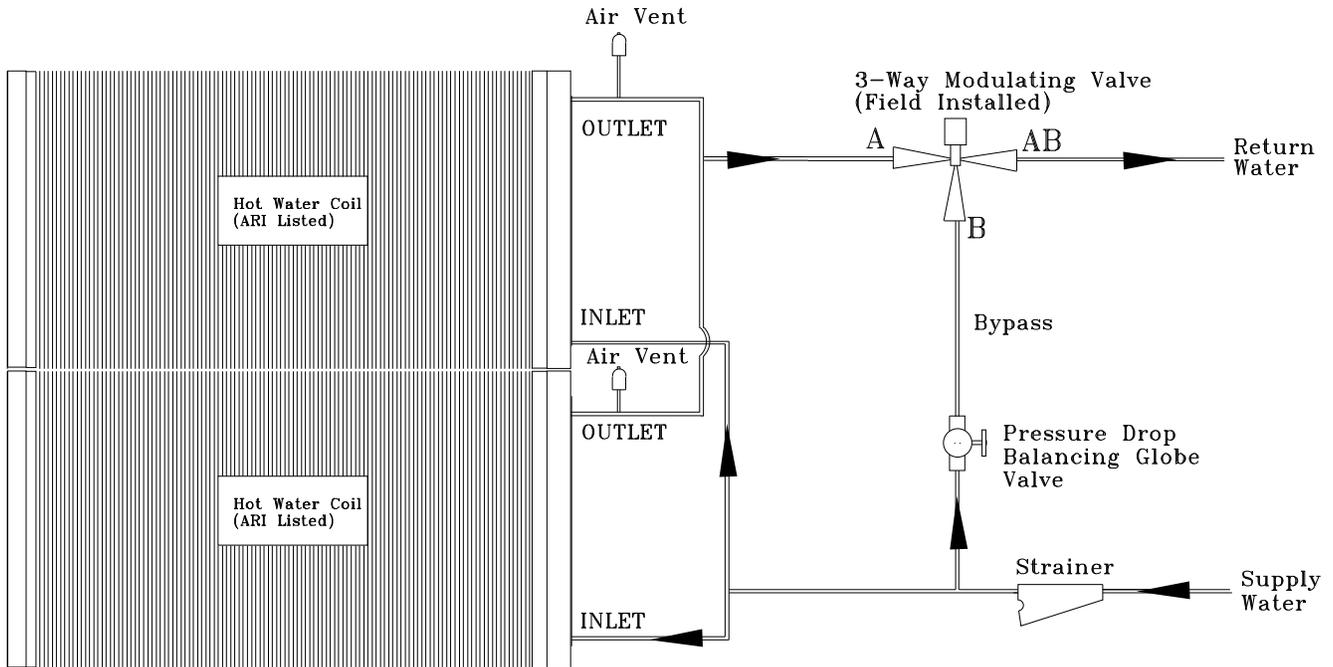


Figure 24. Steam coil piping configuration for W\_HE casings 2&3

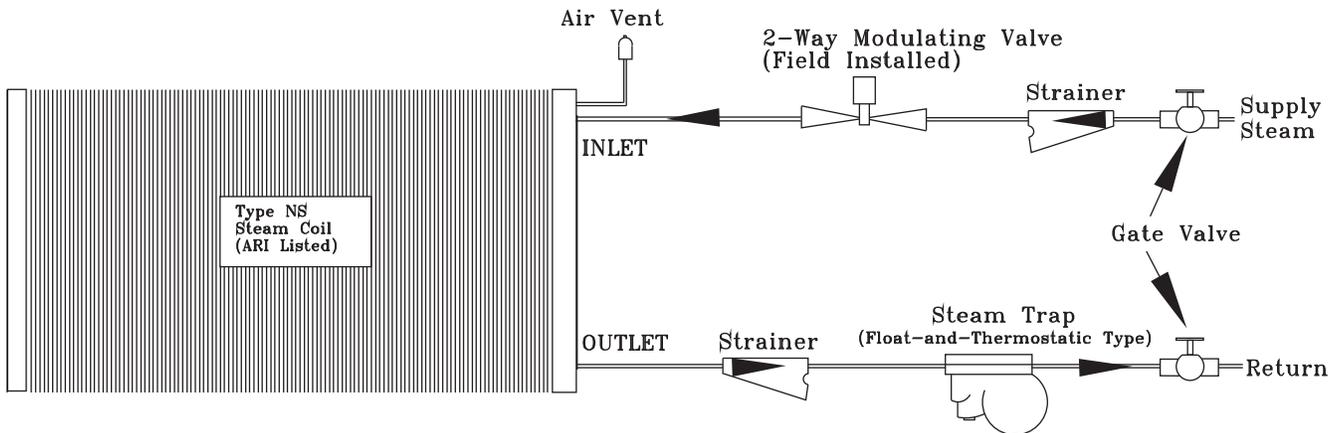
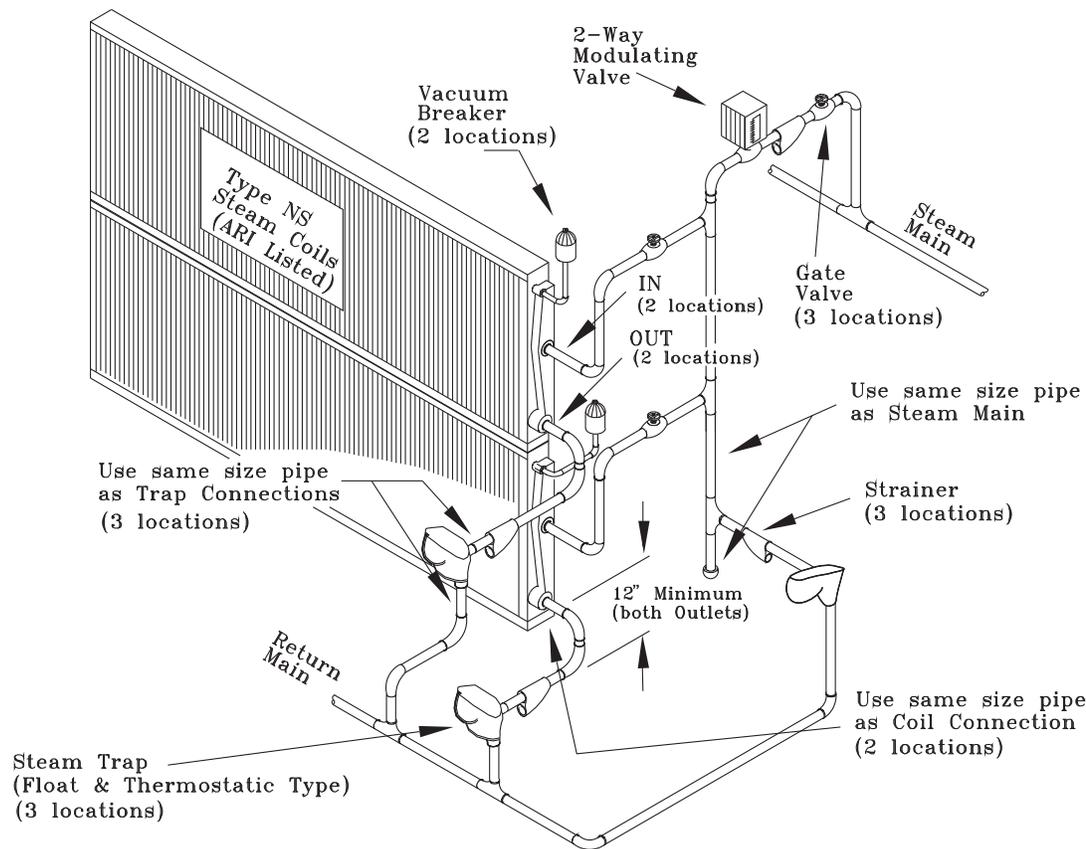


Figure 25. Steam coil piping configuration for W\_HE casings 4, 5, 6 and 9



## Chilled Water Units

Chilled water coils are factory installed inside the cooling section of the unit. Once the unit is set into place, the chilled water piping and the appropriate modulating valve (factory provided, field installed) must be installed. Two access holes are provided in the unit base as shown in [Figure 4, p. 19](#) - [Figure 8, p. 23](#). Chilled Water coil inlet and outlet connections are 2 1/2 inch male NPT.

Support all field-installed piping independently from the chilled water coil.

**Important:** *The valve actuators are not waterproof. Failure to protect the valve from moisture may result in the loss of cooling control.*

When applying air handlers with a chiller water coil and an economizer, the coil should be completely drained for winter operation. If the coil can not be completely drained, the coil should be filled with a glycol mixture that will protect the solution from freezing to design winter ambient temperatures.

## Disconnect Switch External Handle (Factory Mounted Option)

Units ordered with the factory mounted disconnect switch comes 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 locations 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.

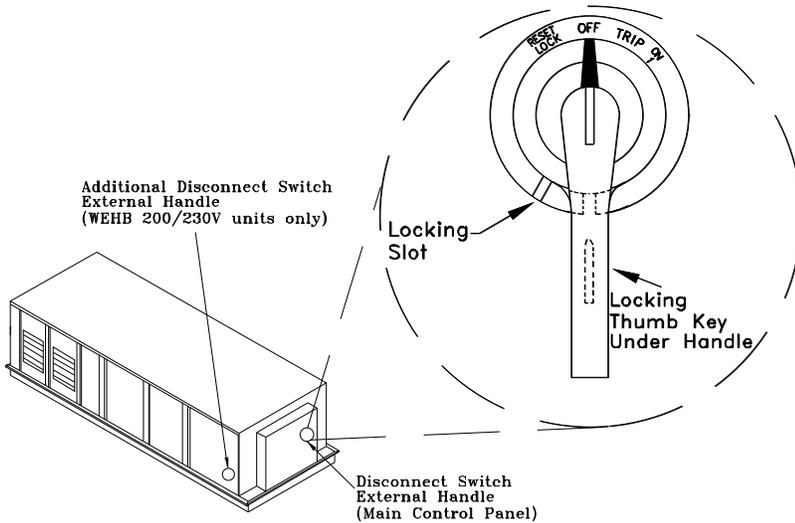
"OFF" - Indicates that the disconnect switch is open, interrupting the main power supply to the unit controls.

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

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.

An overall layout of the field required power wiring is illustrated in [Figure 27, p. 44](#). To insure that the unit's supply power wiring is properly sized and installed, follow the guidelines outlined below.

**Figure 26. Disconnect switch external handle**


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

Verify that the power supply available is compatible with the unit's nameplate ratings 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 could result in equipment damage.

**Electric Heat Units (WEHE)**

**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.

**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.**

WEHE Casing 2 through 6 (20 - 75 Ton) electric heat units operating on 200/230 volts require two power supplies as illustrated in [Figure 27, p. 44](#). Unless the unit was ordered with the optional factory mounted non-fused disconnect switches, two field-supplied disconnect switches must be installed at or near the unit. The power wires for the electric heat is routed into the electric heat control panel using the thru-the-base access provided in the heating section. Refer to the appropriate unit base layout in [Figure 4, p. 19](#) - [Figure 8, p. 23](#) for the electrical entrance locations and dimensional data.

W\_HE Casings 2 through 6 (20 - 75Ton) units operating on 460/575 volts and all Casing 9 units require one power entry as illustrated in [Figure 27](#).

Use the information provided in [Table 11, p. 46](#) and the Electrical Service Sizing Equations (beginning on [p. 47](#)) to determine the appropriate wire size and Maximum Over Current Protection for the heaters/unit.

**Note:** Each power supply must be protected from short circuit and ground fault conditions. To comply with NEC, protection devices must be sized according to the "Maximum Over current protection" (MOP) or "Recommended Dual Element" (RDE) fuse size data on the unit nameplate.

Provide grounding for the supply power circuit in the electric heat control box.

## Main Unit 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 code could result in death or serious injury.

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

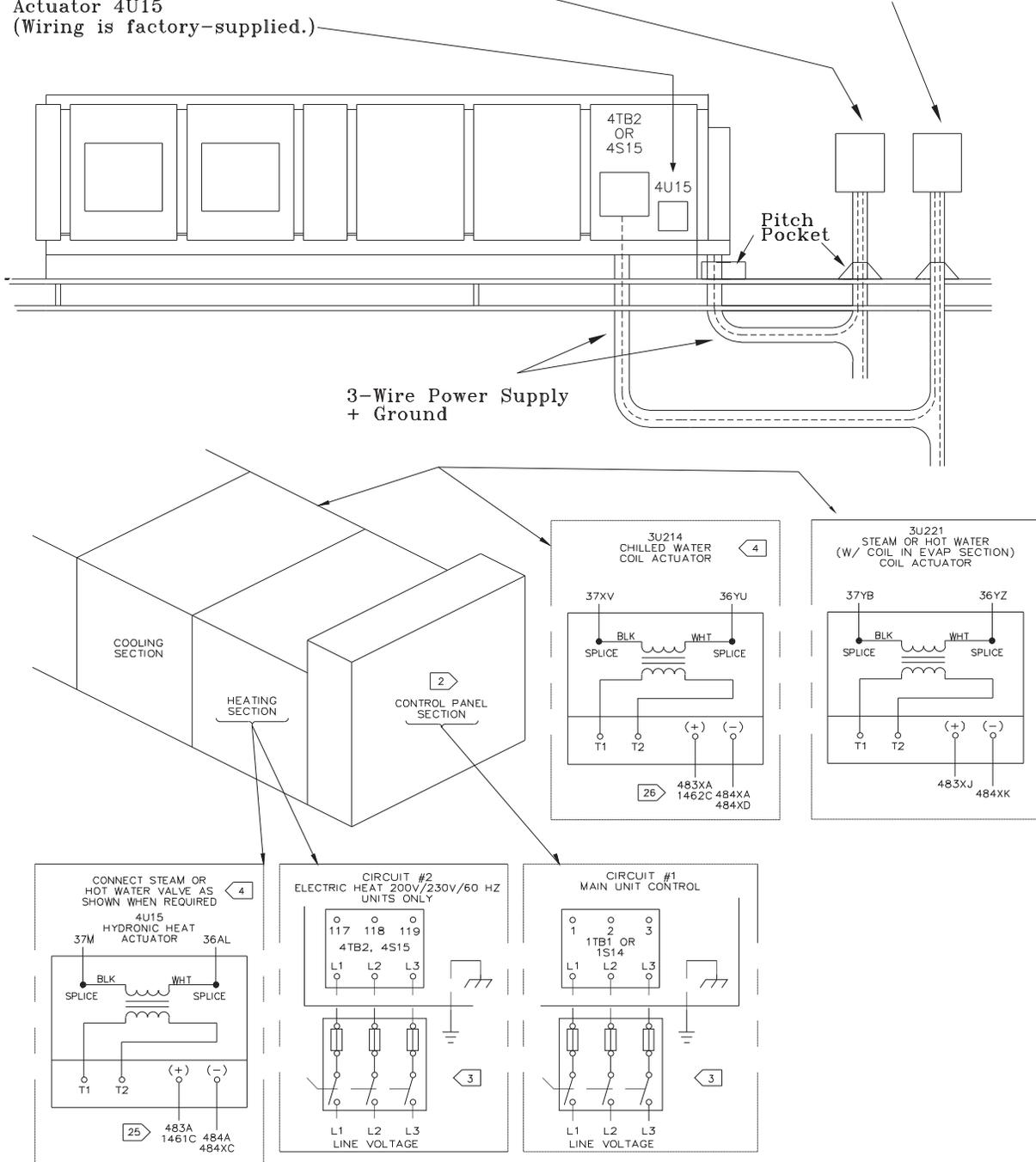
1. [Figure 29, p. 46](#) list the field connection wire ranges for both the main power terminal block 1TB1 and the optional main power disconnect switch 1S14. [Table 11](#) list the component electrical data for Casing 2-9 units. The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements. Protection devices must be sized according to the electrical data on the nameplate. Refer to [p. 47, Electrical Service Sizing Equations](#), 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 non-fused 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 [p. 47, DSS calculation](#), for determining the correct size.
3. Location for the electrical service entrance is shown in [Figure 4, p. 19 - Figure 8, p. 23](#). Complete the unit's power wiring connections onto either the main terminal block 1TB1, or the factory mounted non-fused disconnect switch 1S14, inside the unit control panel. Refer to the customer connection diagram that shipped with the unit for specific termination points.
4. Provide proper grounding for the unit in accordance with local and national codes.

**Figure 27. Typical field power wiring for W\_HE casings 2 through 6**

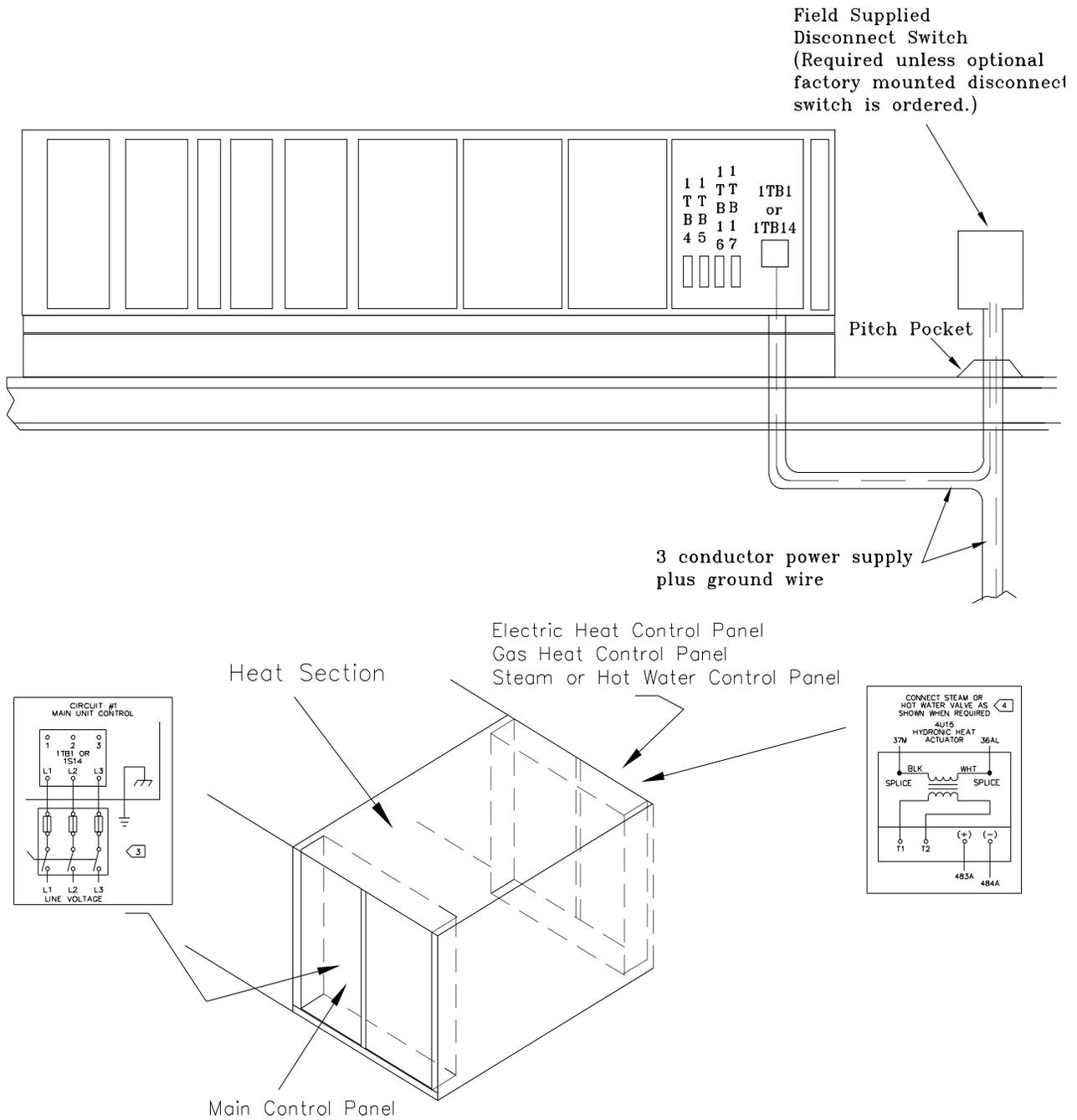
(WL/WS)HE Units Only:  
 4 Field Electrical  
 Connection at valve  
 Actuator 4U15  
 (Wiring is factory-supplied.)

Field Supplied  
 Disconnect Switch  
 (Req'd unless factory mounted  
 disconnect switch is ordered.)

WEHE 200/230 ONLY:  
 Additional field supplied  
 Disconnect Switch  
 (Req'd unless factory mounted  
 disconnect switch is ordered.)



**Figure 28. Typical field power wiring for W\_HE casings 9**



**Note:** Refer to [Figure 29, p. 46](#) for Customer Connection Wire Range notes.



# Installation

**Figure 29. Customer connection wire range**

CUSTOMER CONNECTION WIRE RANGE			
<b>NOTES</b> A. BLOCK SIZE DISCONNECT SIZE ARE CALCULATED BY SELECTING THE SIZE GREATER THAN OR EQUAL TO 1.15 X (SUM OF UNIT LOADS). SEE UNIT LITERATURE FOR UNIT LOAD VALUES.	<u>UNITS WITH MAIN POWER TERMINAL BLOCK (ALL VOLTAGES)</u>		
	<u>BLOCK SIZE</u>	<u>WIRE QTY.</u>	<u>CONNECTOR WIRE RANGE</u>
	335 AMP	(1)	#6 - 350 MCM
	760 AMP	(2)	#4 - 500 MCM
	840 AMP	(2)	#2 - 600 MCM
	<u>UNITS WITH MAIN POWER DISCONNECT SWITCH (ALL VOLTAGES)</u>		
	<u>DISCONNECT SIZE</u>	<u>WIRE QTY.</u>	<u>CONNECTOR WIRE RANGE</u>
	100 AMP	(1)	#14 - 1/0
	250 AMP	(1)	#4 - 350 kcmil
	400 AMP	(1)	#1 - 600 kcmil
		(2) OR	#1 - 250 kcmil OR
	600 AMP	(2)	250-500 MCM
	1000 AMP	(3)	3/0 - 500 kcmil

**NOTES:**

1. ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES.
2. CUSTOMER CONNECTIONS - MAIN UNIT CONTROL (CIRCUIT #1) - ARE LOCATED IN THE CONDENSER SECTION FOR 20 THRU 75 TON UNITS. CUSTOMER CONNECTIONS FOR 90 THRU 130 TON UNITS ARE LOCATED IN THE HEATING SECTION.
3. SEE CUSTOMER CONNECTION WIRE RANGE TABLE FOR ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (1TB1/4TB2) OR DISCONNECT SWITCH (1S14/4S15).
4. WIRES TO THE OPTIONAL STEAM AND/OR HOT WATER HEAT VALVE ARE SUPPLIED WITH THE UNIT. WIRE CONNECTIONS TO THE VALVE TO BE MADE BY THE CUSTOMER.

**Table 11. Electrical service sizing data for W\_HE casings 2 - 9**

Unit Component(s)	200/60/3, Nominal (180-220V Utiliz.)	230/60/3, Nominal (207-253V Utiliz.)	460/60/3, Nominal (414-506V Utiliz.)	575/60/3, Nominal (517-633V Utiliz.)
<b>Electric Heat (WEHE Only):</b>	<b>FLA (1)</b>	<b>FLA (1)</b>	<b>FLA (1)</b>	<b>FLA (1)</b>
30 Kw	83.3	72.2	36.1	28.9
50 Kw	138.8	120.3	60.1	48.1
70 Kw	194.3	168.4	84.2	67.4
90 Kw	249.8	216.5	108.3	86.6
110 Kw	305.3	264.6	132.3	105.9
130 Kw	-n/a-	-n/a-	156.4	125.1
150 Kw	-n/a-	-n/a-	180.4	144.3
170 Kw	-n/a-	-n/a-	204.5	163.6
190 Kw	-n/a-	-n/a-	228.5	182.8
<b>Combustion Blower Motor (WFHE Only):</b>	<b>FLA</b>	<b>FLA</b>	<b>FLA</b>	<b>FLA</b>
235, 350, 500 MBh	2.1	1.8	0.9	0.7
850 & 1,000 MBh	2.8	2.4	1.2	1

**Note:** "Full load amp" values shown for the electric heat were determined at 480 and 600 volts, respectively.

**Table 12. Electrical service sizing data — motors — 20-130 tons**

Motor HP	Supply/Exhaust/Return Fan Motor			
3	11.0	8.6	4.3	3.8
5	15.2	13.2	6.6	5.4
7½	21.5	18.8	9.4	7.5
10	29.0	25.2	12.6	10.1
15	40.7	37.8	18.9	15.1
20	56.1	49.4	24.7	19.6
25	70.5	62.0	31.0	24.5
30	85.5	73.2	36.6	29.2
40 <sup>(a)</sup>	—	—	47.6	39.0
50 <sup>(a)</sup>	—	—	60.5	48.0

(a) 40 & 50 Hp motor available as standard in 460 & 575 volt only.

## Power Wire Sizing and Electrical Service Sizing Equations

To correctly size the main power wiring for the unit, use the appropriate calculation(s) listed below. Read the load definitions that follow and use Calculation #1 for determining the MCA (Minimum Circuit Ampacity), MOP (Maximum Over current Protection), and RDE (Recommended Dual Element fuse size) for WXHE (Extended Casing) units, WLHE and WSHE (Cooling with Wet Heat) units, and WFHE (Cooling with Gas Heat) units. Use Calculation #2 for WEHE (Cooling with electric Heat) units.

### Load Definitions:

LOAD 1	= Current of the largest motor
LOAD 2	= Sum of the currents of all remaining motors
LOAD 3	= Current of electric heaters
LOAD 4	= Control power transformer
	20 - 40 Ton Units, add 3 FL Amps for wire sizing formula
	50 - 75 Ton Units, add 6 FL Amps for wire sizing formula
	= and any other load rated at 1 Amp or more

### Calculation #1 - WXHE, WLHE, WSHE, and WFHE Units.

$$\text{MCA} = (1.25 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 4}$$

$$\text{MOP} = (2.25 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 4}$$

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240 - 6, select the next lower standard fuse rating.

**Note:** If selected MOP is less than the MCA, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.

$$\text{RDE} = (1.5 \times \text{LOAD1}) + \text{LOAD2} + \text{LOAD4}$$

Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240 - 6, select the next higher standard fuse rating.

**Note:** If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.

### Calculation #2 - Rooftop units with Electric Heat WEHE Casings 2 through 9

#### A. Single Source Power (380V, 415V, 460V, and 575V)

To arrive at the correct MCA, MOP, and RDE values for these units, you must perform two sets of calculations. First calculate the MCA, MOP, and RDE values as if the unit was operating in the cooling mode (use the equations given in Calculation #1 above). Then calculate the MCA, MOP, and RDE values as if the unit was operating in the heating mode as follows. (Keep in mind when determining LOADS that the compressors do not operate while the unit is in the heating mode).

For units using heaters less than 50 kW:

$$\text{MCA} = 1.25 \times (\text{LOAD 1} + \text{LOAD 2} + \text{LOAD 4}) + (1.25 \times \text{LOAD 3})$$

For units using heaters equal to or greater than 50 kW:

$$\text{MCA} = 1.25 \times (\text{LOAD 1} + \text{LOAD 2} + \text{LOAD 4}) + \text{LOAD 3}$$

The nameplate MCA value will be the larger of the cooling mode MCA value or the heating mode MCA value calculated above.

$$\text{MOP} = (2.25 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 3} + \text{LOAD 4}$$

The selected MOP value will be the larger of the cooling mode MOP value or the heating mode MOP value calculated above. Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240 - 6, select the next lower standard fuse rating.

**Note:** If selected MOP is less than the MCA, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.

$$\text{RDE} = (1.5 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 3} + \text{LOAD 4}$$

The selected RDE value will be the larger of the cooling mode RDE value or the heating mode RDE value calculated above. Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240 - 6, select the next higher standard fuse rating.

**Note:** If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.

### Power Wire Sizing and Protection Device Equations

#### B. Dual Source Power units (200V and 230V)

These units will have two circuit values shown on the nameplate. The first circuit value will be the refrigeration



## Installation

(cooling mode) values calculated using calculation #1 above. The second set of circuit values shown on the nameplate will be for the electric heating circuit as follows.

$$\text{MCA} = (1.25 \times \text{LOAD } 3) \quad \text{MOP} = (1.25 \times \text{LOAD } 3)$$

Select a fuse rating for the electric heating circuit that's equal to the MOP value obtained in the equation above. If the MOP value does not equal a standard fuse size as listed in NEC 240 - 6, select the next lower standard fuse rating (see note below for exception).

**Note:** *If selected MOP is less than the MCA obtained in the equation above, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.*

$$\text{RDE} = \text{LOAD } 3$$

Select a fuse rating for the electric heating circuit that's equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240 - 6, select the next higher standard fuse rating.

**Note:** *If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.*

### Disconnect Switch Sizing (DSS)

#### Calculation #1 - WX, WF, WL, or WS Single Power Source Units

$$\text{DSS} = 1.15 \times (\text{LOAD } 1 + \text{LOAD } 2 + \text{LOAD } 4)$$

#### Calculation #2 - All WEHE Single Power Source Units

$$\text{DSS} = 1.15 \times (\text{LOAD } 3 + \text{Supply Fan FLA} + \text{Exhaust Fan FLA.})$$

PLUS

$$\text{DSS} = 1.15 \times (\text{LOAD } 1 + \text{LOAD } 2 + \text{LOAD } 4)$$

Use the larger value of the two calculations to size the electrical service.

#### Calculation #3 - WEHE (200/230 Volt) casing 2 through 6 (20 - 75 Ton Dual Power Source Units)

**DSS** = 1.15 X LOAD 3 for the Electric heater **AND** Calculation #1 for the Refrigeration Components.

The Rooftop Module (RTM) must have a mode input in order to operate the rooftop unit. The flexibility of having several system modes depends upon the type of sensor and/or remote panel selected to interface with the RTM. An overall layout of the various control options available for a Constant Volume application, with the required number of conductors for each device, is illustrated in [Figure 30, p. 53](#).

[Figure 33, p. 57](#) illustrates the various control options with the required number of conductors for a Variable Air Volume application.

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

The various field installed control panels, sensors, switches, and contacts discussed in this section require both AC and DC consideration. 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.

### 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.**

### Controls using 24 VAC

Before installing any connecting wiring, refer to [Figure 4, p. 19](#) - [Figure 8, p. 23](#) for the electrical access locations provided on the unit and [Table 13](#) for AC conductor sizing guidelines, and;

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

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

- Be sure to check all loads and conductors for grounds, shorts, and improper wiring.

**Table 13. 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

- d. Do not run the AC low voltage wiring in the same conduit with the high voltage power wiring.

### Controls using DC Analog Input/Outputs

Before installing any connecting wiring between the unit and components utilizing a DC analog input/output signal, refer to [Figure 4, p. 19](#) - [Figure 8, p. 23](#) for the electrical access locations provided on the unit and [Table 14](#) 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 (2.5) ohms/conductor for the length of the run.

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

**Table 14. 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

- c. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

Units equipped with a Trane Communication Interface (TCI), BACnet Communication Interface (BCI), or LonTalk communication Interface (LCI) 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.

### Constant Volume System Controls

#### 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 automatic changeover control with dual setpoint capability. It can be used with a remote zone sensor

BAYSENS077\*. Refer to [Table 15, p. 52](#) for the Temperature vs. Resistance coefficient.

#### Constant Volume 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 automatic changeover control with dual setpoint capability.

### Variable Air Volume System Controls

#### VAV Changeover Contacts (5K87)

These contacts are connected to the RTM when daytime heating on VAV units with internal or external hydronic heat is required. Daytime (occupied) heating switches the system to a CV type mode of operation. Refer to the unit wiring diagram for the field connection terminals in the unit control panel. The switch must be rated at 12 ma @ 24 VDC minimum.

### Constant Volume or Variable Air Volume System Controls

#### Remote Human Interface Module (5U66)

The Remote Human Interface module enables the operator to set or modify the operating parameters of the unit using it's 16 key keypad and view the operating status of the unit on the 2 line, 40 character LCD screen without leaving the building. However, the Remote Human Interface module can not be used to perform any service functions.

One remote panel is designed to monitor and control up to four units providing each of the units are equipped with an IPCB module. Use the installation instructions that shipped with the module to install it, and the appropriate illustrations in [Figure 27, p. 44](#) or [Figure 33, p. 57](#) to connect it to the unit.

#### Remote Panel w/ 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 cooling setpoint ranges between 40°F and 80°F. The warm-up setpoint ranges between 50°F and 90°F with a 2° deadband. The Unoccupied cooling setpoint ranges between 45°F and 98°F. The heating setpoint ranges between 43°F and 96°F.

The liquid crystal display (LCD) displays zone temperature, temperature setpoints, week day, time, and operational mode symbols. The DIP switches on the subbase are used to enable or disable applicable functions, i.e.; Morning warm-up, economizer minimum position override during



## Installation

unoccupied status, heat installed, remote zone temperature sensor, 12/24 hour time display, and daytime warm-up. Refer to [Table 15, p. 52](#) for the Temperature vs. Resistance coefficient.

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.

### Remote Zone Sensor (BAYSENS073\*)

This electronic analog sensor features remote zone sensing and timed override with override cancellation. It is used when the RTM has been programmed as the source for zone temperature control. Refer to [Table 15](#) for the Temperature vs. Resistance coefficient.

### Remote Zone Sensor (BAYSENS074\*)

This electronic analog sensor features single setpoint capability and timed override with override cancellation. It is used with a Trane Integrated Comfort™ system. Refer to [Table 15](#) for the Temperature vs. Resistance coefficient.

### Remote Zone Sensor (BAYSENS016\*)

This bullet type analog temperature sensor can be used for; outside air (ambient) sensing, return air temperature sensing, supply air temperature sensing, remote temperature sensing (uncovered), morning warm-up temperature sensing, and for VAV zone reset. Wiring procedures vary according to the particular application and equipment involved. When this sensor is wired to a BAYSENS119\* Remote Panel, wiring must be 18 AWG Shielded Twisted Pair (Belden 8760 or equivalent). Refer to [Table 15](#) for the Temperature vs. Resistance coefficient.

### Remote Zone Sensor (BAYSENS077\*)

This electronic analog sensor can be used with BAYSENS119\* 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 Minimum Position Potentiometer (BAYSTAT023\*)

The remote minimum position potentiometer is used on units with an economizer. It allows the operator to remotely set the economizer's minimum position (which controls the amount of outside air entering the unit). Use the installation instructions that shipped with the potentiometer to install it, and the appropriate illustrations in [Figure 27, p. 44](#) or [Figure 33, p. 57](#) to connect it to the unit.

### External Auto/Stop Switch (5S67)

A field supplied single pole single throw switch (5S67) may be used to shut down the unit operation. This switch is a binary input wired to the RTM. When opened, the unit shuts down immediately and can be cancelled by closing the switch. Refer to the appropriate illustrations in

[Figure 27](#) or [Figure 33](#) for the proper connection terminals in the unit control panel. The switch must be rated for 12 ma @ 24 VDC minimum.

### VOM Contacts (5K90, 5K91, 5K92, 5K93, 5K94)

If the unit is equipped with a Ventilation Override Module (VOM), (i.e. unit model number digit 21+ is a "N"), a number of special functions can be specified by the building owner or contractor. These functions can include, but are not limited to; (1) Unit Off, (2) Pressurization, (3) Exhaust, (4) Purge, and (5) Purge with Duct Pressure Control. They are controlled by binary inputs wired to the VOM. These functions can be initiated by; a toggle switch, a time clock, or an ICS™ output. The switch must be rated for 12 ma @ 24 VDC minimum. The following preset sequences can be modified by the customer;

1. VOM Mode "A" Priority 1 - Unit Off:
  - Supply fan - OFF
  - VFD - 0% (if equipped)
  - Exhaust fan - OFF, Exhaust dampers Closed
  - O/A dampers - Closed
  - Heat - All stages OFF, Modulating Heat output at 0 vdc
  - Occupied/Unoccupied output - Deenergized (Occupied)
  - VO Relay - Energized
  - Preheater State - Off (if equipped)
2. VOM Mode "B" Priority 2 - Pressurize:
  - Supply fan - ON
  - VFD - 100% (if equipped)
  - Exhaust fan - OFF, Exhaust dampers - Closed
  - O/A dampers - Open
  - Heat - All stages OFF, Modulating Heat output at 0 vdc
  - Occupied/Unoccupied output - Energized (Unoccupied)
  - VO Relay - Energized
  - Preheater State - Off (if equipped)
3. VOM Mode "C" Priority 3 - Exhaust:
  - Supply fan - OFF
  - VFD - 0% (if equipped)
  - Exhaust fan - ON, Exhaust dampers - Open
  - O/A dampers - Closed
  - Heat - All stages OFF, Modulating Heat output at 0 vdc
  - Occupied/Unoccupied output - Deenergized (Occupied)
  - VO Relay - Energized
  - Preheater State - Off (if equipped)

4. VOM Mode "D" Priority 4 - Purge:
- Supply fan - ON
  - VFD - 100% (if equipped)
  - Exhaust fan - ON, Exhaust dampers - Open
  - O/A dampers - Open
  - Heat - All stages OFF, Modulating Heat output at 0 vdc
  - Occupied/Unoccupied output - Energized (Unoccupied)
  - VO Relay - Energized
  - Preheater State - Off (if equipped)
5. VOM Mode "E" Priority 5 - Purge with duct pressure control:
- Supply fan - ON
  - VFD - (if equipped) Controlled by S/A Pressure Control with supply air pressure highlimit disabled.
  - Exhaust fan - ON, Exhaust dampers - Open
  - O/A dampers - Open
  - Heat - All stages OFF, Modulating Heat output at 0 vdc
  - Occupied/Unoccupied output - Energized (Unoccupied)
  - VO Relay - Energized
  - Preheater State - Off (if equipped)

"OFF" - will appear in the Ventilation Override screen after all VOM binary inputs have been reset (opened).

Due to codes in some areas, the definitions for some or all of the VOM modes may have to be locked into the program by the user. Once the definitions are locked, the Ventilation Override Module must be replaced in order to reprogram that sequence.

Refer to [Figure 27, p. 44](#) or [Figure 33, p. 57](#) for the proper connection terminals in the unit control panel for each of the VOM initiating device's and the appropriate Programming, Troubleshooting Guide (PTG Latest Edition) for programming instructions.

### **Emergency Override Definitions (with LCI-I/BCI-I module installed)**

When an LCI-I/BCI-I module is installed, the user can initiate one of five (5) Emergency Override sequences that have the following predefined unit operation:

#### **PRESSURIZE**

- Supply Fan - On
- Exhaust Fan - Off (if equipped)
- Exhaust Dampers - Closed (if equipped)
- OA Dampers - Open
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.

- Occupied/Unoccupied output - Energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

#### **DEPRESSURIZE**

- Supply Fan - Off
- Exhaust Fan - On (if equipped)
- Exhaust Dampers - Open (if equipped)
- OA Dampers - Closed
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - De-energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

#### **PURGE**

- Supply Fan - On
- Exhaust Fan - On (if equipped)
- Exhaust Dampers - Open (if equipped)
- OA Dampers - Open
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - Energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

#### **SHUTDOWN**

- Supply Fan - Off
- Exhaust Fan - Off (if equipped)
- Exhaust Dampers - Closed (if equipped)
- OA Dampers - Closed
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - De-energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

#### **FIRE**

- Supply Fan - Off
- Exhaust Fan - Off (if equipped)
- Exhaust Dampers - Closed (if equipped)
- OA Dampers - Closed
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - De-energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)



## Installation

### Temperature vs. Resistance Coefficient

The UCM network relies on various sensors located throughout the system to provide temperature information in the form of an analog input. All of the sensors used have the same temperature vs. resistance co-efficient and are made from Keystone Carbon D97 material with a 1 degree Centigrade tolerance.

**Table 15. Temperature vs. resistance coefficient**

Temp (°F)	Resistance (in. 1000 Ohms)	Temp (°F)	Resistance (in. 1000 Ohms)
-40	346.1	71	11.6
-30	241.7	72	11.31
-20	170.1	73	11.03
-10	121.4	74	10.76
-5	103	75	10.5
0	87.56	76	10.25
5	74.65	77	10
10	63.8	78	9.76
15	54.66	79	9.53
20	46.94	80	9.3
25	40.4	85	8.25
30	34.85	90	7.33
35	30.18	100	5.82
40	26.22	105	5.21
45	22.85	110	4.66
50	19.96	120	3.76
55	17.47	130	3.05
60	15.33	140	2.5
65	13.49	150	2.05
66	13.15	160	1.69
67	12.82	170	1.4
68	12.5	180	1.17
69	12.19	190	0.985
70	11.89	200	0.83

### Occupied/Unoccupied Contacts (5K86)

To provide Night Setback control if a remote panel with NSB (BAYSENS119\*) was not ordered, a field supplied contact (5K86) must be installed. This binary input provides the Occupied/Unoccupied status information of the building to the RTM. It can be initiated by a time clock, or a Building Automation System control output. The relay's contacts must be rated for 12 ma @ 24VDC minimum. Refer to the appropriate illustrations in [Figure 27, p. 44](#) or [Figure 33, p. 57](#) for the proper connection terminals in the unit control panel.

### Emergency Stop Switch (5S71)

A normally closed (N.C.) switch (5S71) wired to the RTM may be used during emergency situations to shut down all unit operations. When opened, an immediate shutdown occurs. An emergency stop diagnostic is entered into the

Human Interface and the unit must be manually reset. Refer to the appropriate illustrations in [Figure 27](#) or [Figure 33, p. 57](#) for the proper connection terminals in the unit control panel. The switch must be rated for 12 ma @ 24VDC minimum.

### Outside Air Sensor (3RT3) - BAYSENS016A

This device senses the outdoor air temperature and sends this information in the form of an analog input to the RTM. It's factory installed on units with an economizer, but can be field provided/installed and used for informational purposes on units without an economizer. Refer to the appropriate illustrations in [Figure 27](#) or [Figure 33, p. 57](#) for the proper connection terminals in the unit control panel. Refer to Table 3-10 for Temperature vs. Resistance coefficient.

### Generic Building Automation System (1U51)

The Generic Building Automation System (GBAS) module allows a non-Trane building control system to communicate with the rooftop unit and accepts external setpoints in form of analog inputs for cooling, heating, demand limiting, and supply air pressure parameters.

Generic Building Automation System Module (GBAS 0-5vdc) - Provided for those cases where non-Tracer building management system is used. The GBAS module provides a binary input for Demand Limiting, four (4) analog inputs for setpoint adjustment and five (5) relay outputs for diagnostic reporting. Inputs can use a potentiometer or 0-5 vdc signal.

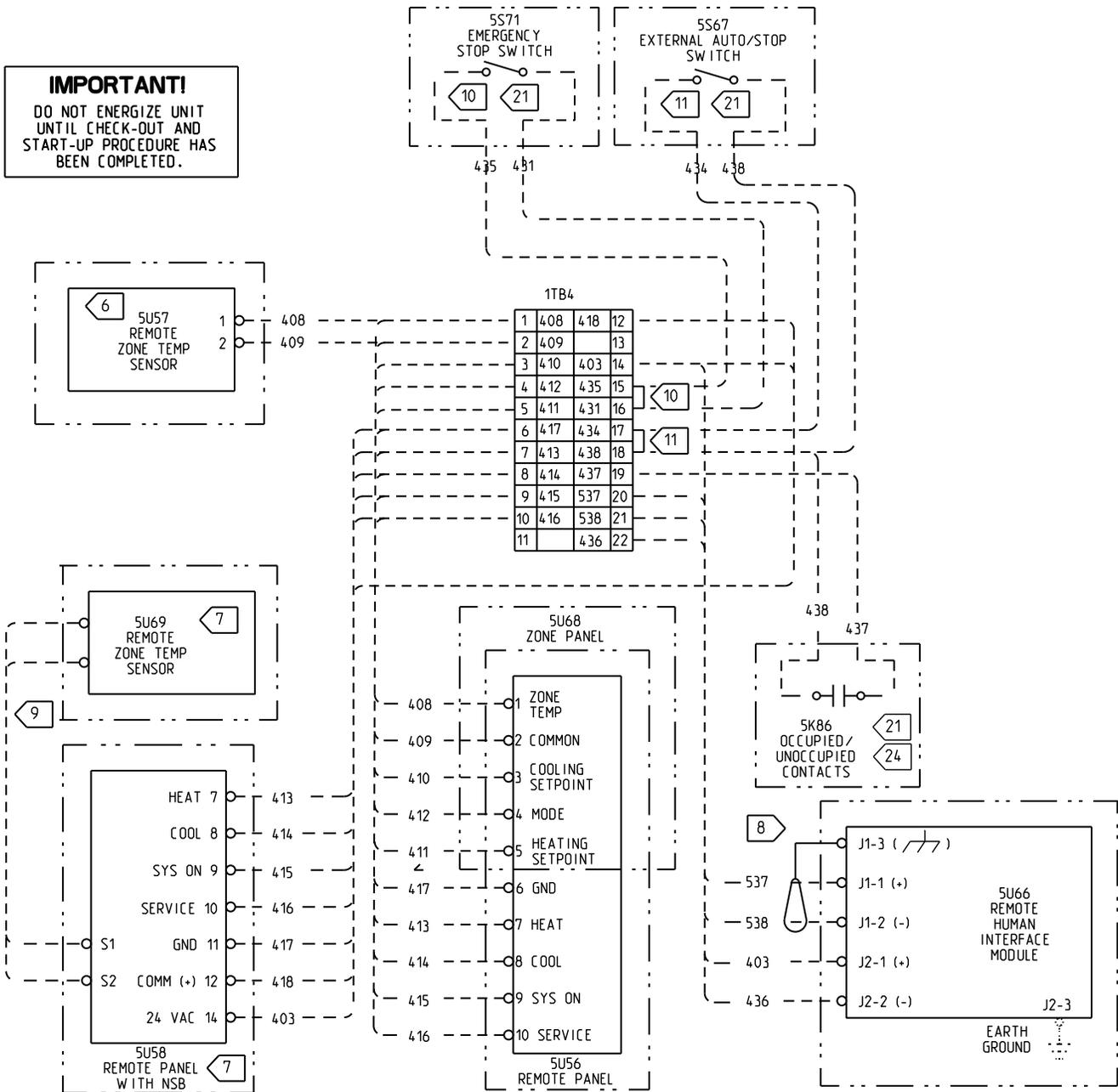
Generic Building Automation System Module (GBAS 0-10 vdc) - Used to provide broad control capabilities for building automation systems other than Trane's Tracer™ system. The GBAS module provides a binary input for Demand Limiting, four (4) analog inputs for setpoint adjustment and four (4) analog outputs as well as one (1) relay output for diagnostic reporting. Inputs can use a potentiometer or 0-10 vdc signal.

Refer to [Figure 33, p. 57](#) for the input wiring to the GBAS module and the various desired setpoints with the corresponding DC voltage inputs for both VAV and CV applications.

For complete application details of the module, refer to Engineering Bulletin UN-PRB001-EN.

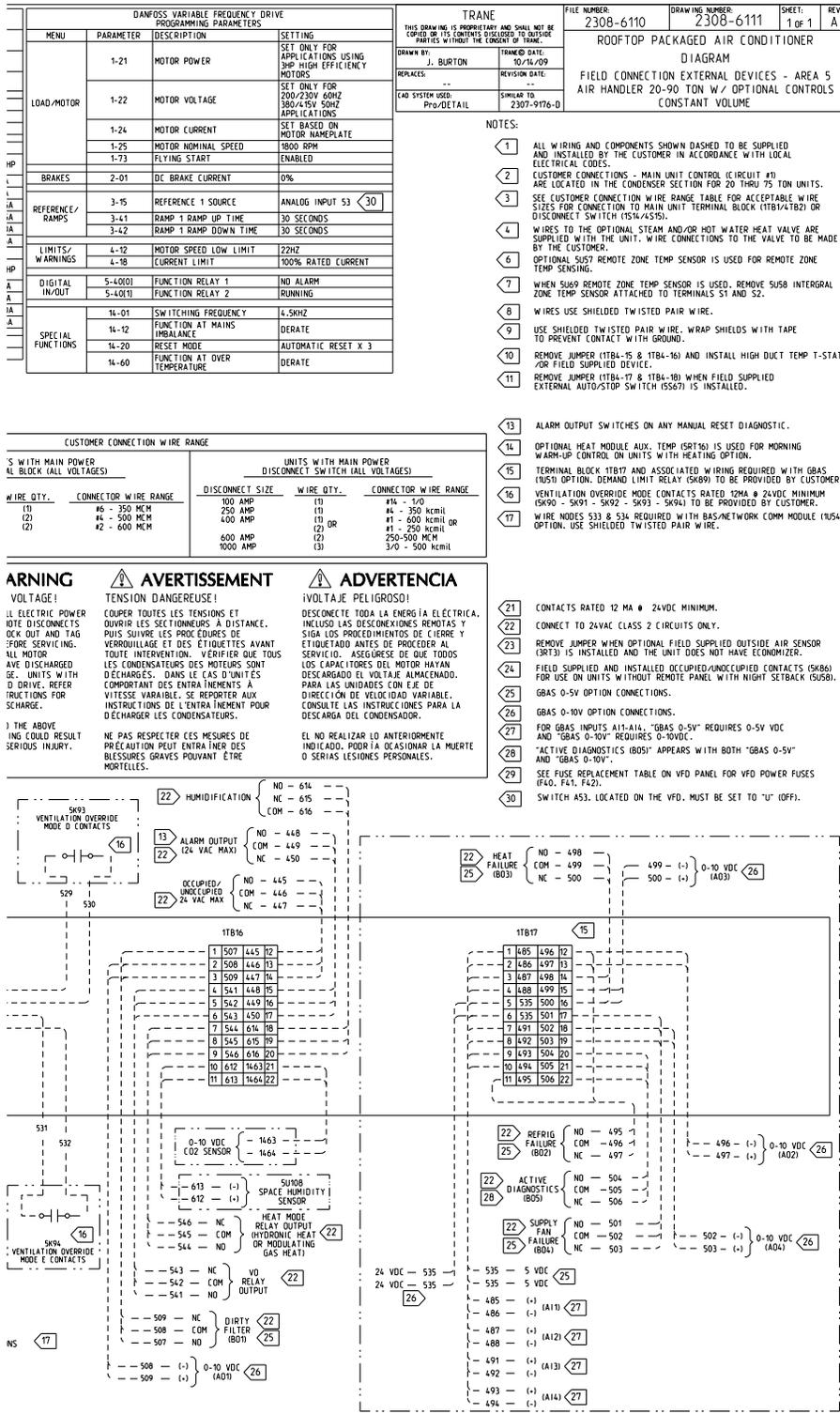
**Note:** Refer to wiring notes, [Figure 32, p. 56](#)

**Figure 30. Typical field wiring schematic for W\_HE casings 2-9 CV control options. Refer to wiring notes, Figure 32, p. 56.**





**Figure 31. (continued from previous page) typical ventilation override binary output wiring diagram for W\_HE casings 2-9 CV control options. Refer to wiring notes, Figure 32, p. 56.**



- NOTES:**
- ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES.
  - CUSTOMER CONNECTIONS - MAIN UNIT CONTROL (CIRCUIT #1) ARE LOCATED IN THE CONDENSER SECTION FOR 20 THRU 75 TON UNITS.
  - SEE CUSTOMER CONNECTION WIRE RANGE TABLE FOR ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (11814/182) OR DISCONNECT SWITCH (1514/4315).
  - WIRES TO THE OPTIONAL STEAM AND/OR HOT WATER HEAT VALVE ARE SUPPLIED WITH THE UNIT. WIRE CONNECTIONS TO THE VALVE TO BE MADE BY THE CUSTOMER.
  - OPTIONAL SWS7 REMOTE ZONE TEMP SENSOR IS USED FOR REMOTE ZONE TEMP SENSING.
  - WHEN SWS9 REMOTE ZONE TEMP SENSOR IS USED, REMOVE SWS8 INTERGRAL ZONE TEMP SENSOR ATTACHED TO TERMINALS S1 AND S2.
  - WIRES USE SHIELDED TWISTED PAIR WIRE.
  - USE SHIELDED TWISTED PAIR WIRE, WRAP SHIELDS WITH TAPE TO PREVENT CONTACT WITH GROUND.
  - REMOVE JUMPER (118A-15 & 118A-16) AND INSTALL HIGH DUCT TEMP T-STAT /OR FIELD SUPPLIED DEVICE.
  - REMOVE JUMPER (118A-17 & 118A-18) WHEN FIELD SUPPLIED EXTERNAL AUTO/STOP SWITCH (SS67) IS INSTALLED.
  - ALARM OUTPUT SWITCHES ON ANY MANUAL RESET DIAGNOSTIC.
  - OPTIONAL HEAT MODULE AUX. TEMP (SRT36) IS USED FOR MORNING WARM-UP CONTROL ON UNITS WITH HEATING OPTION.
  - TERMINAL BLOCK 11817 AND ASSOCIATED WIRING REQUIRED WITH GBAS (RUS) OPTION. DEMAND LIMIT RELAY (S409) TO BE PROVIDED BY CUSTOMER.
  - VENTILATION OVERRIDE MODE CONTACTS RATED 12MA @ 24VDC MINIMUM (SK90 - SK91 - SK92 - SK93 - SK94) TO BE PROVIDED BY CUSTOMER.
  - WIRE NODES 533 & 534 REQUIRED WITH BAS/NETWORK COMM MODULE (RUS4) OPTION. USE SHIELDED TWISTED PAIR WIRE.
  - CONTACTS RATED 12 MA @ 24VDC MINIMUM.
  - CONNECT TO 24VAC CLASS 2 CIRCUITS ONLY.
  - REMOVE JUMPER WHEN OPTIONAL FIELD SUPPLIED OUTSIDE AIR SENSOR (SRT3) IS INSTALLED AND THE UNIT DOES NOT HAVE ECONOMIZER.
  - FIELD SUPPLIED AND INSTALLED OCCUPIED/UNOCCUPIED CONTACTS (SK86) FOR USE ON UNITS WITHOUT REMOTE PANEL WITH NIGHT SETBACK (SUS6).
  - GBAS 0-5V OPTION CONNECTIONS.
  - GBAS 0-10V OPTION CONNECTIONS.
  - FOR GBAS INPUTS A11-A14, "GBAS 0-5V" REQUIRES 0-5V VDC AND "GBAS 0-10V" REQUIRES 0-10VDC.
  - "ACTIVE DIAGNOSTICS (B05)" APPEARS WITH BOTH "GBAS 0-5V" AND "GBAS 0-10V".
  - SEE FUSE REPLACEMENT TABLE ON VFD PANEL FOR VFD POWER FUSES (F40, F41, F42).
  - SWITCH AS3, LOCATED ON THE VFD, MUST BE SET TO "V" (OFF).

**Figure 32. Wiring notes for CV controls**

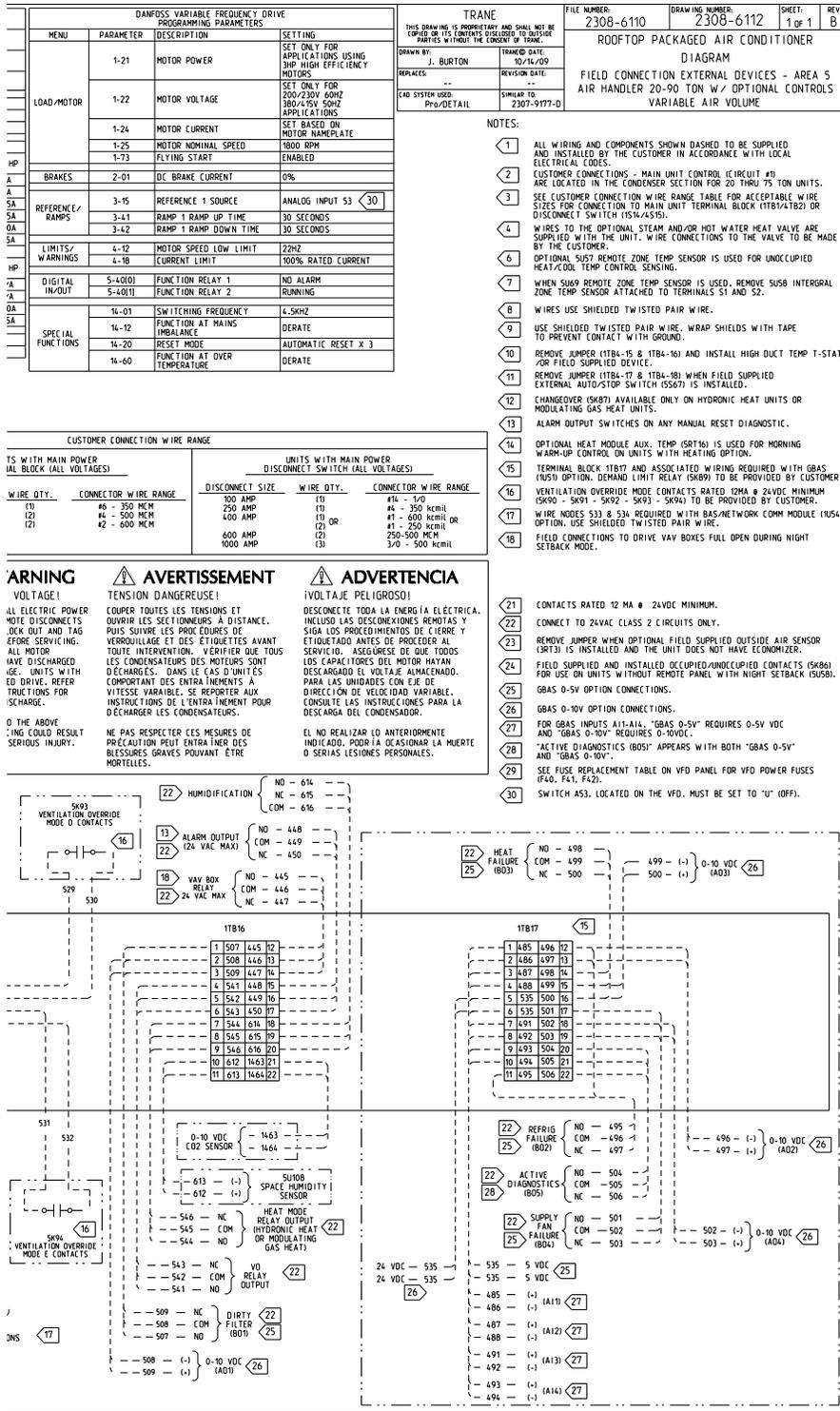
## NOTES:

- 1 ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES.
- 2 CUSTOMER CONNECTIONS - MAIN UNIT CONTROL (CIRCUIT #1) ARE LOCATED IN THE CONDENSER SECTION FOR 20 THRU 75 TON UNITS.
- 3 SEE CUSTOMER CONNECTION WIRE RANGE TABLE FOR ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (1TB1/4TB2) OR DISCONNECT SWITCH (1S14/4S15).
- 4 WIRES TO THE OPTIONAL STEAM AND/OR HOT WATER HEAT VALVE ARE SUPPLIED WITH THE UNIT. WIRE CONNECTIONS TO THE VALVE TO BE MADE BY THE CUSTOMER.
- 6 OPTIONAL 5U57 REMOTE ZONE TEMP SENSOR IS USED FOR REMOTE ZONE TEMP SENSING.
- 7 WHEN 5U69 REMOTE ZONE TEMP SENSOR IS USED, REMOVE 5U58 INTERGRAL ZONE TEMP SENSOR ATTACHED TO TERMINALS S1 AND S2.
- 8 WIRES USE SHIELDED TWISTED PAIR WIRE.
- 9 USE SHIELDED TWISTED PAIR WIRE. WRAP SHIELDS WITH TAPE TO PREVENT CONTACT WITH GROUND.
- 10 REMOVE JUMPER (1TB4-15 & 1TB4-16) AND INSTALL HIGH DUCT TEMP T-STAT /OR FIELD SUPPLIED DEVICE.
- 11 REMOVE JUMPER (1TB4-17 & 1TB4-18) WHEN FIELD SUPPLIED EXTERNAL AUTO/STOP SWITCH (5S67) IS INSTALLED.
- 13 ALARM OUTPUT SWITCHES ON ANY MANUAL RESET DIAGNOSTIC.
- 14 OPTIONAL HEAT MODULE AUX. TEMP (5RT16) IS USED FOR MORNING WARM-UP CONTROL ON UNITS WITH HEATING OPTION.
- 15 TERMINAL BLOCK 1TB17 AND ASSOCIATED WIRING REQUIRED WITH GBAS (1U51) OPTION. DEMAND LIMIT RELAY (5K89) TO BE PROVIDED BY CUSTOMER.
- 16 VENTILATION OVERRIDE MODE CONTACTS RATED 12MA @ 24VDC MINIMUM (5K90 - 5K91 - 5K92 - 5K93 - 5K94) TO BE PROVIDED BY CUSTOMER.
- 17 WIRE NODES 533 & 534 REQUIRED WITH BAS/NETWORK COMM MODULE (1U54) OPTION. USE SHIELDED TWISTED PAIR WIRE.
- 21 CONTACTS RATED 12 MA @ 24VDC MINIMUM.
- 22 CONNECT TO 24VAC CLASS 2 CIRCUITS ONLY.
- 23 REMOVE JUMPER WHEN OPTIONAL FIELD SUPPLIED OUTSIDE AIR SENSOR (3RT3) IS INSTALLED AND THE UNIT DOES NOT HAVE ECONOMIZER.
- 24 FIELD SUPPLIED AND INSTALLED OCCUPIED/UNOCCUPIED CONTACTS (5K86) FOR USE ON UNITS WITHOUT REMOTE PANEL WITH NIGHT SETBACK (5U58).
- 25 GBAS 0-5V OPTION CONNECTIONS.
- 26 GBAS 0-10V OPTION CONNECTIONS.
- 27 FOR GBAS INPUTS A11-A14, "GBAS 0-5V" REQUIRES 0-5V VDC AND "GBAS 0-10V" REQUIRES 0-10VDC.
- 28 "ACTIVE DIAGNOSTICS (B05)" APPEARS WITH BOTH "GBAS 0-5V" AND "GBAS 0-10V".
- 29 SEE FUSE REPLACEMENT TABLE ON VFD PANEL FOR VFD POWER FUSES (F40, F41, F42).
- 30 SWITCH A53, LOCATED ON THE VFD, MUST BE SET TO "U" (OFF).





**Figure 34. (continued from previous page) Typical ventilation override binary output wiring diagram for W\_HE casings 2-9 VAV control options. Refer to wiring notes, Figure 35, p. 60.**



**Figure 35. Wiring notes - VAV**

## NOTES:

- 1 ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES.
- 2 CUSTOMER CONNECTIONS - MAIN UNIT CONTROL (CIRCUIT #1) ARE LOCATED IN THE CONDENSER SECTION FOR 20 THRU 75 TON UNITS.
- 3 SEE CUSTOMER CONNECTION WIRE RANGE TABLE FOR ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (1TB1/4TB2) OR DISCONNECT SWITCH (1S14/4S15).
- 4 WIRES TO THE OPTIONAL STEAM AND/OR HOT WATER HEAT VALVE ARE SUPPLIED WITH THE UNIT. WIRE CONNECTIONS TO THE VALVE TO BE MADE BY THE CUSTOMER.
- 6 OPTIONAL 5U57 REMOTE ZONE TEMP SENSOR IS USED FOR UNOCCUPIED HEAT/COOL TEMP CONTROL SENSING.
- 7 WHEN 5U69 REMOTE ZONE TEMP SENSOR IS USED, REMOVE 5U58 INTERGRAL ZONE TEMP SENSOR ATTACHED TO TERMINALS S1 AND S2.
- 8 WIRES USE SHIELDED TWISTED PAIR WIRE.
- 9 USE SHIELDED TWISTED PAIR WIRE. WRAP SHIELDS WITH TAPE TO PREVENT CONTACT WITH GROUND.
- 10 REMOVE JUMPER (1TB4-15 & 1TB4-16) AND INSTALL HIGH DUCT TEMP T-STAT /OR FIELD SUPPLIED DEVICE.
- 11 REMOVE JUMPER (1TB4-17 & 1TB4-18) WHEN FIELD SUPPLIED EXTERNAL AUTO/STOP SWITCH (5S67) IS INSTALLED.
- 12 CHANGEDOVER (5K87) AVAILABLE ONLY ON HYDRONIC HEAT UNITS OR MODULATING GAS HEAT UNITS.
- 13 ALARM OUTPUT SWITCHES ON ANY MANUAL RESET DIAGNOSTIC.
- 14 OPTIONAL HEAT MODULE AUX. TEMP (5RT16) IS USED FOR MORNING WARM-UP CONTROL ON UNITS WITH HEATING OPTION.
- 15 TERMINAL BLOCK 1TB17 AND ASSOCIATED WIRING REQUIRED WITH GBAS (1U51) OPTION. DEMAND LIMIT RELAY (5K89) TO BE PROVIDED BY CUSTOMER.
- 16 VENTILATION OVERRIDE MODE CONTACTS RATED 12MA @ 24VDC MINIMUM (5K90 - 5K91 - 5K92 - 5K93 - 5K94) TO BE PROVIDED BY CUSTOMER.
- 17 WIRE NODES 533 & 534 REQUIRED WITH BAS/NETWORK COMM MODULE (1U54) OPTION. USE SHIELDED TWISTED PAIR WIRE.
- 18 FIELD CONNECTIONS TO DRIVE VAV BOXES FULL OPEN DURING NIGHT SETBACK MODE.
- 21 CONTACTS RATED 12 MA @ 24VDC MINIMUM.
- 22 CONNECT TO 24VAC CLASS 2 CIRCUITS ONLY.
- 23 REMOVE JUMPER WHEN OPTIONAL FIELD SUPPLIED OUTSIDE AIR SENSOR (3RT3) IS INSTALLED AND THE UNIT DOES NOT HAVE ECONOMIZER.
- 24 FIELD SUPPLIED AND INSTALLED OCCUPIED/UNOCCUPIED CONTACTS (5K86) FOR USE ON UNITS WITHOUT REMOTE PANEL WITH NIGHT SETBACK (5U58).
- 25 GBAS 0-5V OPTION CONNECTIONS.
- 26 GBAS 0-10V OPTION CONNECTIONS.
- 27 FOR GBAS INPUTS A11-A14, "GBAS 0-5V" REQUIRES 0-5V VDC AND "GBAS 0-10V" REQUIRES 0-10VDC.
- 28 "ACTIVE DIAGNOSTICS (B05)" APPEARS WITH BOTH "GBAS 0-5V" AND "GBAS 0-10V".
- 29 SEE FUSE REPLACEMENT TABLE ON VFD PANEL FOR VFD POWER FUSES (F40, F41, F42).
- 30 SWITCH A53, LOCATED ON THE VFD, MUST BE SET TO "U" (OFF).

**Table 16. GBAS voltage vs. setpoint**

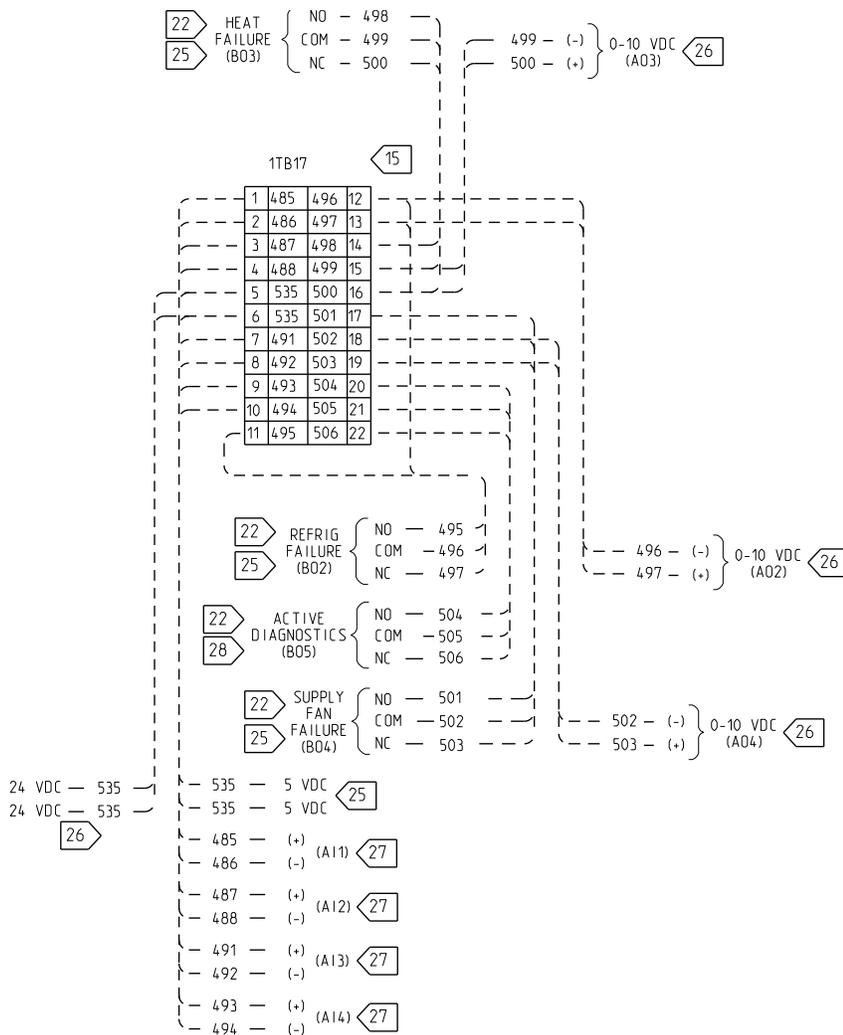
Unit Type		Setpoint	Input Voltage <sup>(a)</sup>	Setpoint Range
VAV	CV			
X	X	Unoccupied Zone Cooling Setpoint	0.5 to 4.5 vdc	50°F to 90°F
	X	Occupied Zone Cooling Setpoint	0.5 to 4.5 vdc	50°F to 90°F
X	X	Occupied Zone Heating Setpoint	0.5 to 4.5 vdc	50°F to 90°F
X		S/A Cooling Setpoint	0.5 to 4.5 vdc	40° to 90°F
X		S/A Heating Setpoint (VAV Hydro Only)	0.5 to 4.5 vdc	40° to 180°F
X	X	Space Static Pressure Setpoint	0.5 to 4.5 vdc	0.03 to 0.3 IWC
X		Supply Duct Static Pressure Setpoint	0.5 to 4.5 vdc	0.00 to 5.0 IWC

**Notes:**

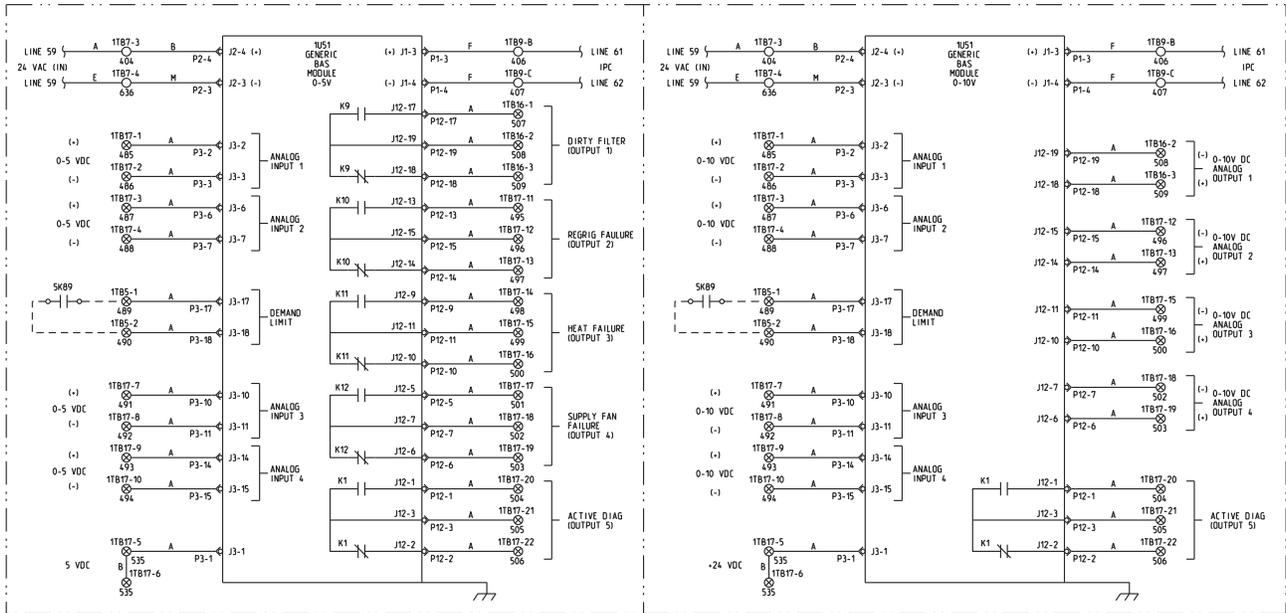
1. Voltage inputs less than 0.5 will be interpreted as 0.5 vdc.
2. Voltage inputs higher than 4.5 will be interpreted as 4.5 vdc.

(a) The actual inputted value will be displayed on the Human Interface.

**Figure 36. Typical GBAS analog input wiring schematic for W\_HE casings 2-9 CV or VAV control options. Refer to wiring notes on Figure 32, p. 56.**



**Figure 36. (continued from previous page) Typical GBAS analog input wiring schematic for W\_HE casings 2 through 9 CV or VAV control options**



**Table 17. GBAS Voltage vs. Setpoint**

Setpoint	GBAS 0-5 VDC	GBAS 0-10 VDC	Valid Range
Occ Zone Cooling Setpoint(CV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 90°F
Unocc Zone Cooling Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 90°F
Occ Zone Heating Setpoint(CV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 90°F
Unocc Zone Heating Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 90°F
SA Cooling Setpoint (VAV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	40 to 90°F
SA Cooling Setpoint (SZVAV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	40 to 70°F
Zone Cooling Setpoint (SZVAV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 80°F
SA Heating Setpoint (VAV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	40 to 180°F
SA Heating Setpoint (SZVAV only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	65 to 95°F
Space Static Pressure Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	-0.20 to 0.30 IWC
SA Static Pressure Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	0.7 to 5.1 IWC
Min OA Flow Setpoint 1	0.5 to 4.5 VDC	0.5 to 9.5 VDC	0 to Unit Max Flow
MWU Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 90°F
Econ Dry Bulb Enable Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	50 to 140°F
SA_Reheat_Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	60 to 90°F
Minimum Position Setpoint 3	0.5 to 4.5 VDC	0.5 to 9.5 VDC	0 to 100%
Occ Dehumidification Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	40 to 65%
Unocc Dehumidification Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	40 to 65%
Occ Humidification Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	20 to 50%
Unocc Humidification Setpoint	0.5 to 4.5 VDC	0.5 to 9.5 VDC	20 to 50%

**Notes:**

1. If DCV is enabled this is used for Design Minimum OA Flow Setpoint
2. If DCV is enabled, this is used for Design Minimum OA Damper Position Setpoint

**Table 18. GBAS 0-10 VDC output range**

Setpoint	GBAS 0-10vdc	Valid Range
Outdoor Air Temperature	0.5 to 9.5vdc	-40 to 200°F
Zone Temperature	0.5 to 9.5vdc	-40 to 200°F
Supply Air Temperature (VAV only)	0.5 to 9.5vdc	-40 to 200°F
Supply Air Pressure (VAV only)	0.5 to 9.5vdc	0.0 to 7.91 wc
Space Pressure	0.5 to 9.5vdc	-0.67-0.67 wc
Space RH	0.5 to 9.5vdc	0-100%
OA RH	0.5 to 9.5vdc	0-100%
Space CO2 Level	0.5 to 9.5vdc	50-2000 PPM
Cooling Capacity%	0.5 to 9.5vdc	0-100%
Heating Capacity%	0.5 to 9.5vdc	0-100%
Outdoor Air Damper Position	0.5 to 9.5vdc	0-100%
Outdoor Airflow	0.5 to 9.5vdc	0 to 65,000 CFM



# System Start-up

## Cooling Sequence of Operation (IntelliPak Controls Only)

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

### SZVAV Cooling Sequence of Operation

Single Zone VAV units will be equipped with a VFD controlled supply fan which will be controlled via the 0-10VDC RTM VFD output and the RTM Supply Fan output. With the RTM Supply Fan output energized and the RTM VFD output at 0Vdc the fan speed output is 37% (22Hz) from the VFD motor, by default, and at 10VDC the Fan Speed output is 100% (60Hz). The control scales the 0-10Vdc VFD output from the RTM linearly to control between the 37%-100% controllable range.

If the RTM determines that there is a need for active cooling capacity in order to meet the calculated Temperature Setpoint (Tset), the unit will begin to stage compressors accordingly once supply fan proving has been made. Note that the compressor staging order will be based on unit configuration and compressor lead/lag status.

Once the Tset calculation has reached its bottom limit (Tset Lower Limit Setpoint) and compressors are being utilized to meet the demand, the Tset value continues to calculate below the Tset Lower Limit Setpoint and the algorithm will begin to ramp the Supply Fan Speed up toward 100%. Note that the supply fan speed will remain at the compressor stage's associated minimum value (as described below) until the Tset value is calculated below the Tset Lower Limit Setpoint.

As the cooling load in the zone decreases the zone cooling algorithm will reduce the speed of the fan down to minimum per compressor stage and control the compressor outputs accordingly. As the compressors begin to de-energize, the Supply Fan speed will fall back to the Cooling Stage's associated minimum fan speed, but not below. As the load in the zone continues to drop cooling capacity will be reduced in order to maintain the discharge air within the  $\pm \frac{1}{2}$  Tset deadband.

### Cooling Stages Minimum Fan Speed

As the unit begins to stage compressors to meet the cooling demand, the following minimum Supply Fan Speeds will be utilized for each corresponding Cooling Stage. Note that the Supply Fan Speed will be allowed to ramp up beyond 37% as determined by the active Tset calculation; the speeds below are only the minimum speeds per cooling stage. Note that when transitioning between active cooling stages, compressors may energize prior to the supply fan reaching the minimum speed for the associated step.

1. 2-Stage DX Cooling -The minimum fan speed for units with 2 stages of DX Cooling will be 37% of the unit's full

airflow capacity. At Stage 1 of DX Cooling the minimum Fan Speed will be 37% and at Stage 2 of DX Cooling the Fan Speed will be at a minimum of 67%.

2. 3-Stage DX Cooling -There are no IntelliPak applications with 3 stages of DX Cooling.
3. 4-Stage DX Cooling -The minimum fan speed for units with 4 stages of DX Cooling will be 37% of the unit's total airflow. At Stage 1 the minimum Supply Fan Speed will be 37%, at Stage 2 the minimum Supply Fan Speed will be 58%, and at Stages 3 & 4 the minimum Supply Fan Speed will be 67%.

### Units without an Economizer

Upon entering an "occupied" mode of operation, the RTM receives input from the remote panel to start the supply fan. For constant volume applications, the RTM supply fan contacts K2 close which energizes the supply fan contactor 1K16. When the supply fan starts, the fan proving switch (3S68) closes, signaling the RTM that airflow has been established. The VFD will begin to ramp the fan, (if equipped).

When a cooling request is sent to the RTM from a zone temperature sensor, the RTM evaluates the operating condition of the system using the supply air temperature input and the outdoor temperature input before sending the request to the SCM/MCM. Once the request is sent to the SCM/MCM, the compressor module checks the compressor protection circuit before closing "Stage 1" (K10 on SCM or K11 on MCM). After the first functional stage has started, the compressor module monitors the saturated refrigerant temperature and closes the condenser fan output contact "1A", when the saturated refrigerant temperature rises above the "lower limit" setpoint.

### Units with an Economizer

Upon entering an "occupied" mode of operation, the RTM receives input from the remote panel to start the supply fan. For constant volume applications, the RTM supply fan contacts K2 close which energizes the supply fan contactor 1K16. When the supply fan starts, the fan proving switch (3S68) closes, signaling the RTM that airflow has been established. The RTM opens the economizer dampers to the specified "minimum position".

When a cooling request is sent to the RTM from the zone temperature sensor, the RTM evaluates the operating condition of the system using the supply air temperature input and the outdoor temperature input before sending the request to the SCM/MCM for mechanical cooling. If the outdoor conditions are suitable for cooling (temperature and humidity are within specified setpoints), the RTM will attempt to maintain the zone temperature without using any compressors. If the zone temperature can not be maintained within the setpoint deadband, the RTM sends a cooling request to the SCM/MCM. The compressor module checks the compressor protection circuit before

closing "Stage 1" (K10 on SCM or K11 on MCM). After the first functional stage has started, the compressor module monitors the saturated refrigerant temperature and closes the condenser fan output contact "1A", when the saturated refrigerant temperature rises above the "lower limit" setpoint.

### Units with Traq™ Sensor

The fresh air enters the unit through the Traq™ Sensor assembly and is measured by velocity pressure flow rings. The velocity pressure flow rings are connected to a pressure transducer/solenoid assembly. The solenoid is used for calibration purposes to compensate for temperature swings that could affect the transducer. The Ventilation Control Module (VCM) utilizes the velocity pressure input, the RTM outdoor air temperature input, and the minimum outside air cfm setpoint to modify the volume (cfm) of fresh air entering the unit as the measured airflow deviates from setpoint.

When the optional temperature sensor is installed and the Preheat function is enabled, the sensor will monitor the combined (averaged) fresh air and return air temperatures. As this mixed air temperature falls below the Preheat Actuate Temperature Setpoint, the VCM will activate the preheat binary output used to control a field installed heater. The output will be deactivated when the temperature rises 5° above the Preheat Actuate Temperature Setpoint.

When the optional CO<sub>2</sub> sensor is installed and the CO<sub>2</sub> Reset is enabled, as the CO<sub>2</sub> concentration increases above the CO<sub>2</sub> Reset Start Value, the VCM will modify the minimum outside air cfm setpoint to increase the amount of fresh air entering the unit. The setpoint will be adjusted upward until the CO<sub>2</sub> Maximum Reset Value is reached. The maximum effective (reset) setpoint value for fresh air entering the unit is limited to the systems operating cfm. As the CO<sub>2</sub> concentration decreases, the effective (reset) setpoint value is adjusted downward toward the minimum outside air cfm setpoint.

### Units equipped with 100% modulating exhaust

The exhaust dampers are controlled through an Exhaust/Comparative Enthalpy Module (ECEM). The ECEM receives input from a space transducer and modulates the exhaust dampers to maintain the space pressure to within the specified setpoint controlband.

### Gas Heating Sequence of Operation

#### Standard Two Stage Gas Furnace

The control systems for the rooftop units are wired to ensure that the heating and cooling cannot occur simultaneously. A typical electrical schematic for the Fenwal and Honeywell ignition control system is illustrated in [Figure 38, p. 68](#) and [Figure 39, p. 69](#). Refer to the wiring diagram while reviewing the following sequence of operation.

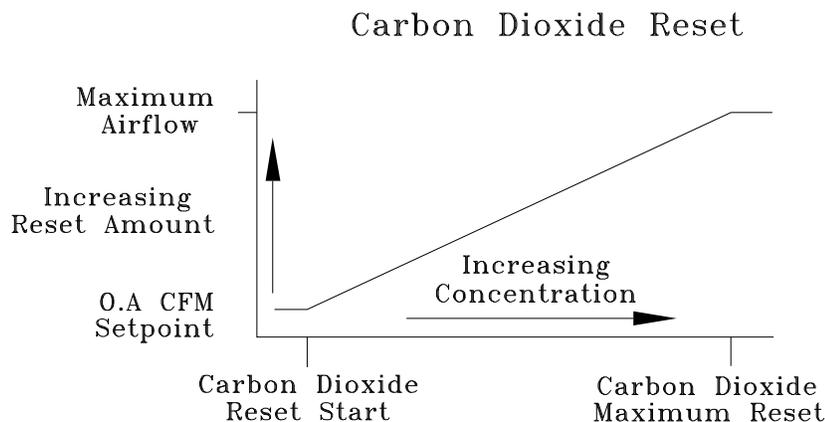
#### Honeywell Ignition System

When a heating requirement exists, the Rooftop Module (RTM) starts the supply fan and sends a request for heat to the Heat Module. The Heat Module closes K1 contacts and starts the combustion blower motor (4B11). The combustion blower motor starts on low speed through the normally closed combustion blower relay (4K33) contacts.

The supply airflow switch (4S38) and the combustion air switch (4S25) closes. Power is applied through the high limit cutout (4S26) to the Honeywell ignition control board (4U18). The ignition control board (4U18) starts a prepurge timing cycle. At the end of the prepurge cycle, the ignition transformer (4T7) and the pilot solenoid valve (4L9) are energized. This starts a 10 second trial for pilot ignition. When the pilot flame is established and sensed by the flame sensing rod (4U19), stage 1 of the main gas valve (4L7) and the 60 seconds sequencing time delay relay (4DL6) is energized.

The system will operate in the low heat mode until there is an additional call for heat is established by closing the K3 contacts on the Heat Module.

**Figure 37. CO<sub>2</sub> reset**





## System Start-up

On Variable Air Volume systems, the sequencing time delay relay (4DL6) will energize the combustion blower motor relay (4K33) which switches the combustion blower motor to high speed and energizes the 2nd stage solenoid on the gas valve (4L7) after approximately 60 seconds.

If the flame rod (4U19) does not detect a pilot flame within the 10 second trial for ignition period, the control will lockout. If a flame failure occurs during operation, the gas valve (4L7), the sequencing time delay relay (4DL6), and the combustion blower relay (4K33) is de-energized. The system will purge and attempt to relight the pilot. If a flame is not detected after this attempt, the Honeywell ignition control (4U18) will lock out. The combustion blower motor will continue to operate as long as a heating demand exists and the system switch (4S24) is "On".

Once the heating demand has been satisfied, the combustion blower and the Honeywell ignition control board (4U18) is de-energized.

### Propane Gas

Units that operate on propane gas after 1990 have two (2) additional controls that affect the combustion blower motor operation and the sequence of the gas valve operation.

With the post purge time delay relay (4DL4), the additional service switch (4S24), and the additional 115 volt control relay (4K31) installed, the sequence of operation is as follows:

Power is applied to the Honeywell ignition control board (4U18) through the high limit switch (4S26). The Honeywell ignition control board (4U18) will sequence through its prepurge timing and pilot ignition sequence to The post purge time delay relay (4DL4) delays the starting of the combustion blower motor by approximately 60 seconds. Once the timing has elapsed, the combustion blower motor will start, closing the combustion air switch (4S25).

Energize the control relay (4K31) and the sequence time delay relay (4DL6). 24 volts is applied from the new service switch (4S24) through the normally open control relay (4K31) contacts to energize the 1st stage solenoid on the gas valve (4L7).

On an additional call for heat, the K3 contacts on the Heat Module will close to energize the combustion blower relay (4K33) which switches the combustion blower motor to high speed and closes its normally open contacts allowing 24 volts to energize the 2nd stage on the gas valve (4L7).

Once the heating demand has been satisfied, the Honeywell ignition control board (4U18) and the post purge time delay relay (4DL4) is de-energized. The combustion blower motor will continue to operate for approximately 15 seconds to purge the heat exchanger on the "Off" cycle.

## Modulating Gas Sequence of Operation

### Full and Limited Modulating Gas Furnace

A typical electrical schematic for the modulating ignition control system is illustrated in [Figure 40, p. 70](#). As you review it and the sequence of operations, keep the following in mind:

1. The furnace will not light unless the manual gas valves are open and the control circuit switch 4S24 is closed.
2. The control systems are wired to ensure that heating and cooling cannot occur simultaneously.
3. The unit supply fans must run continuously so air flow switch 4S38 will stay closed.
4. Modulating Gas heat is available during both occupied and unoccupied operation.

Whenever there is a call for heat, 1U50-K1 energizes and combustion blower motor 4B11 begins to operate at High speed on the 850 and 1000 MBH heaters. The blower will operate on low speed for the 500 MBH. A relay 4K119 in parallel with the main gas valve actuator control output, insures the actuator will be open prior to proof of flame. This will force the combustion air actuator 4U82 to the open position, causing the auxiliary switch on 4U82 to close. This insures complete purging of the combustion chamber during the 60 second purge cycle.

Ignition control IC board 4U18 will not energize, however, unless the supply air flow switch 4S38, combustion air flow switch 4S25, high limit cutout 4S26, the auxiliary switch on combustion air actuator 4U82 and the proof of closure switch on gas valve 4L22 are closed. These are all part of the safety interlock system.

With all these conditions satisfied, the IC board energizes and initiates an internal 60 second prepurge time delay. When the prepurge period expires, 4U18 energizes both the ignition transformer 4T7 and solenoid 4L9 on the intermittent pilot valve. At that point, 4U18 gives electrode 4E1 approximately 10 seconds to establish a pilot flame. (The presence of this flame is proven by flame rod 4U19.)

If 4U18 does not detect a pilot flame at the end of this period, it will shut down and lock out the ignition / combustion circuit.

If the pilot is ignited within 10 seconds, the IC board de-energizes the ignition transformer 4T7 and electrode 4E1. At this point, relay 4K119 will energize, starting the combustion air actuator and the furnace. The feedback signal from the discharge temperature sensor will cause the modulating output from the heat module to change the damper position as required to maintain the outlet temperature within the desired band.

## Flame Failure

In the event that IC board 4U18 loses the “proof-of-flame” input signal during furnace operation, it will make one attempt at reignite. If a flame is not reestablished within the 10 second trial period, 4U18 will shut down and lock out the ignition /combustion control circuit. (Combustion blower motor 4B11 continues to run as long as a heating requirement exists and control circuit switch 4S24 is ON.)

Once locked out on flame failure, the IC board will not reactivate the ignition/combustion control circuit until it is reset manually. To do this, press the reset button on the front of the IC board case.

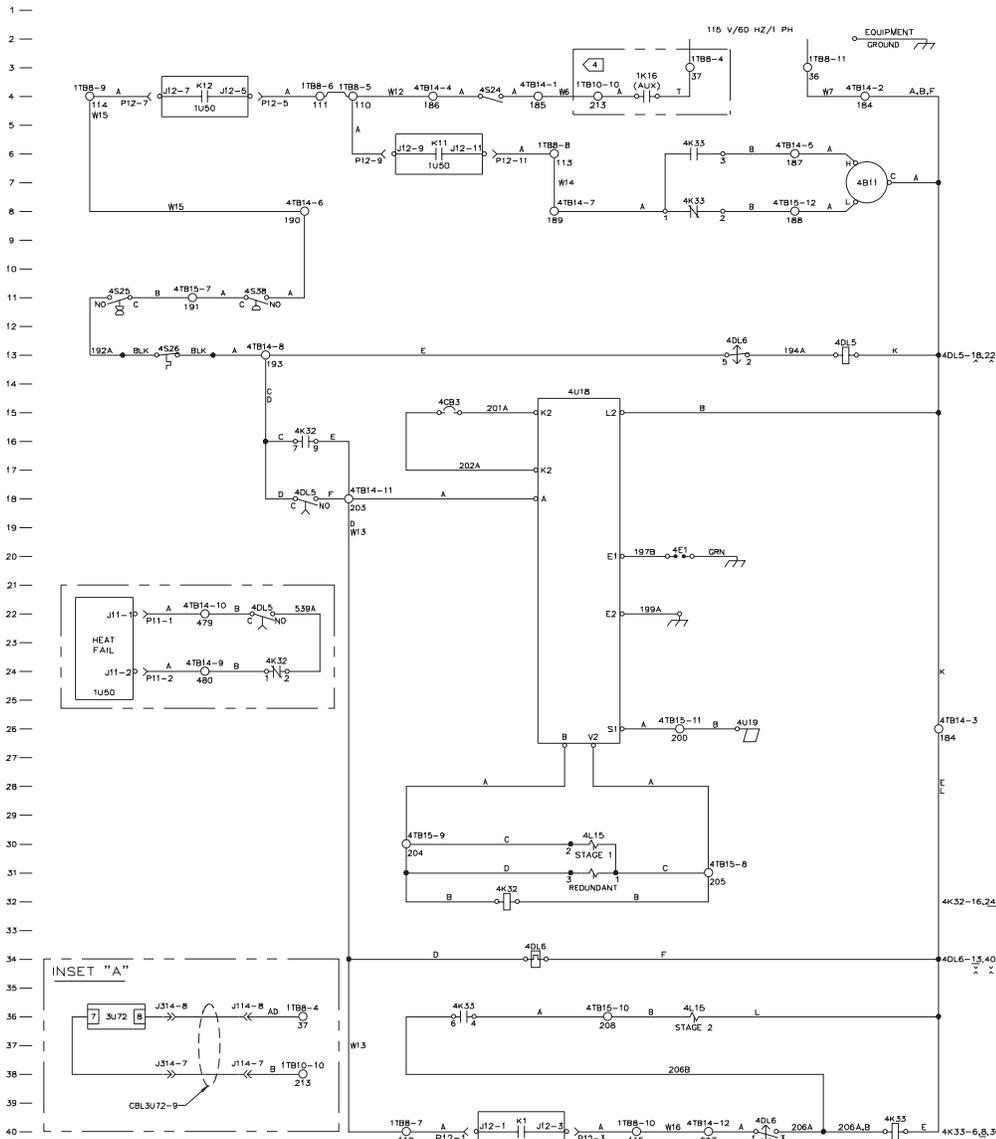
A set of relay contacts are available for external use for heat fail (Information Only).

**Important:** *The modulating gas heaters are factory adjusted for the proper air/gas ratio at minimum and nameplate rated firing MBH for most areas in the country.*



# System Start-up

Figure 38. Typical fenwall ignition control system



**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 SITUÉS 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.

DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1TB8	CONTROL TERMINAL BLOCK	3
1U50	HEAT MODULE	4,6,40,24
3U72	SUPPLY VAR. FREQ. DRIVE	36
4B11	COMBUSTION BLOWER MOTOR	7
4CB3	CIRCUIT BREAKER	15
4DL5	PRE-PURGE TIME DELAY	13
4DL6	SEQUENCING TIME DELAY	34
4E1	ELECTRODE	20
4K32	INTERLOCK RELAY	32
4K33	COMBUSTION BLOWER RELAY	40
4L15	2 STAGE GAS VALVE	30,31,36
4S24	CONTROL CIRCUIT SWITCH	4
4S25	COMBUSTION AIR FLOW SWITCH	11
4S26	HIGH LIMIT CUTOFF	13
4S38	SUPPLY AIR FLOW SWITCH	11
4TB14,4TB15	CONTROL TERMINAL BLOCK	15
4U18	IGNITION CONTROL BOARD	15
4U19	FLAME ROD	26

- NOTES:
- UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
  - DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINE INDICATES WIRING BY TRANE CO.
  - NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT. AN OPEN ARROWHEAD BELOW THE LINE NUMBER POINTING UPWARD INDICATES A NORMALLY CLOSED CONTACT WHICH BEGINS TIMING WHEN ENERGIZED.
  - WHEN UNIT HAS SUPPLY FAN V.F.D. OPTION, SEE INSET "A" FOR CONNECTIONS.

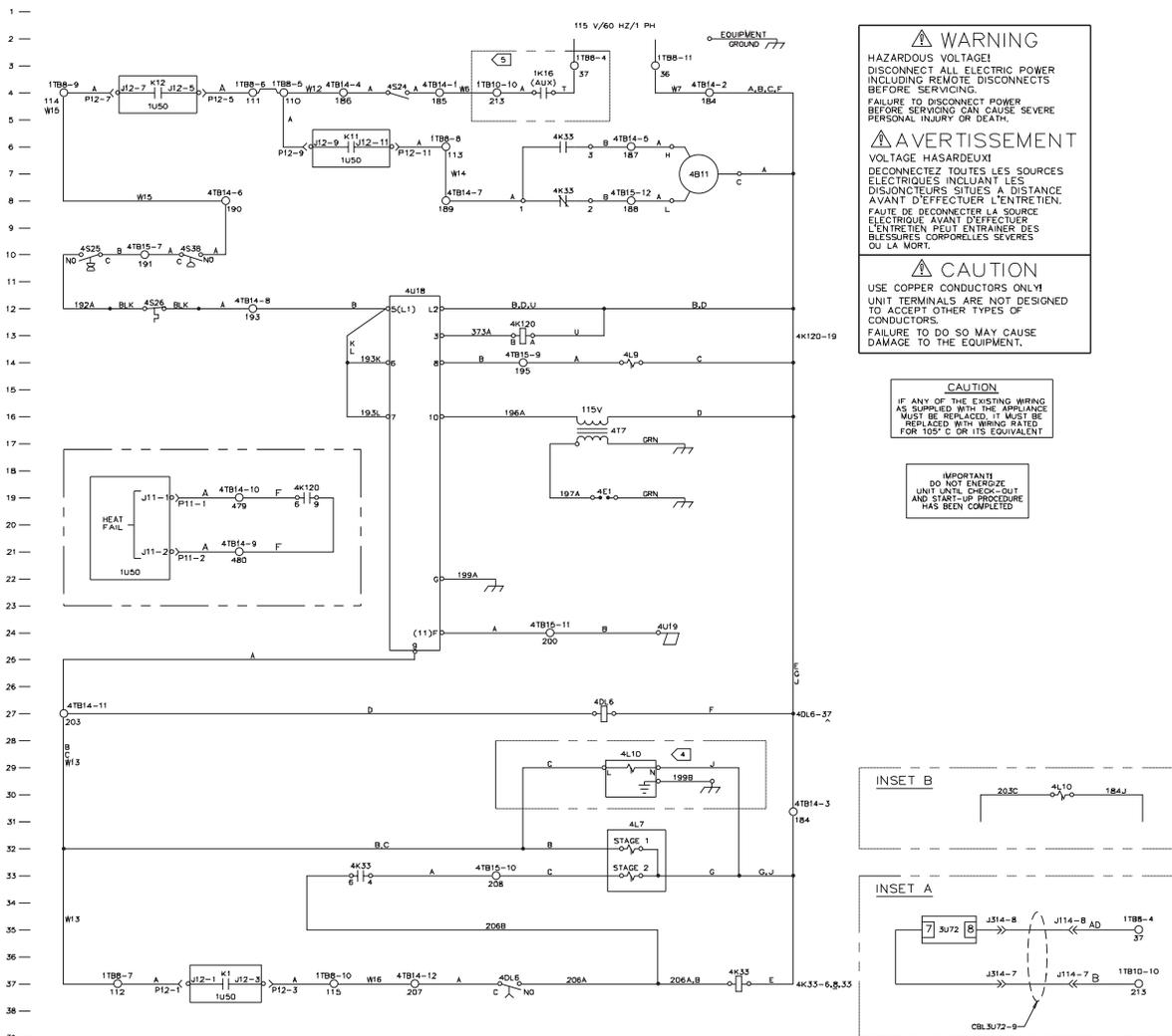
DEVICE PREFIX	LOCATION CODE
AREA	LOCATION
1	INSIDE UNIT CONTROL PANEL
4	GAS HEAT SECTION

**IMPORTANT!**  
DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURE HAS BEEN COMPLETED.

**CAUTION**  
IF ANY OF THE EXISTING WIRING AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING RATED FOR 105°C OR ITS EQUIVALENT.

2306-8936F

**Figure 39. Typical Fenwall ignition control system**



**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 HASARDEUXI  
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 ENTRAENER 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.

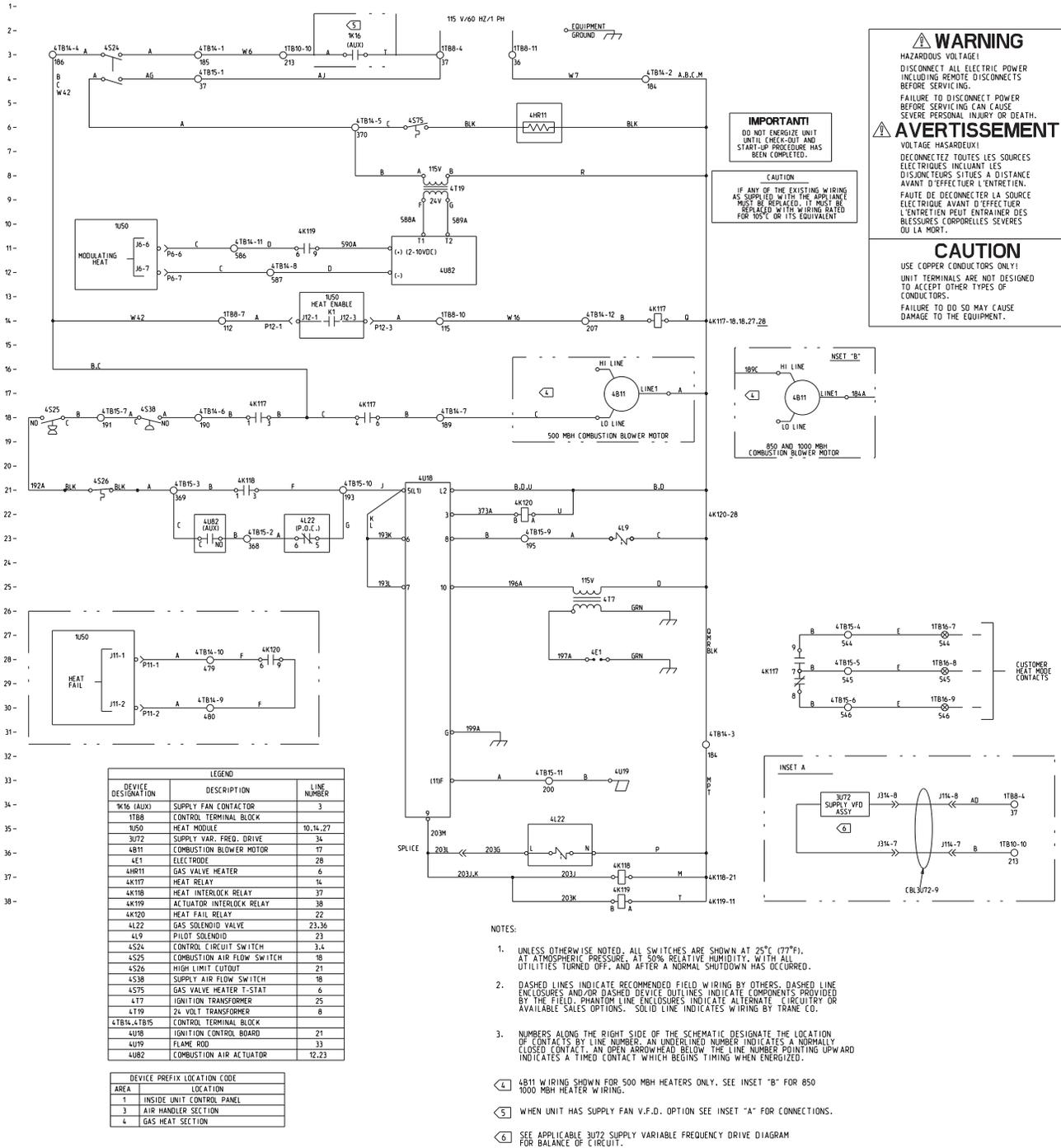
**CAUTION**  
IF ANY OF THE EXISTING WIRING AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING RATED FOR 105° C OR ITS EQUIVALENT!

**IMPORTANT!**  
DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURE HAS BEEN COMPLETED.

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1TB8	CONTROL TERMINAL BLOCK	3
1U50	HEAT MODULE	4,6,21,37
3U72	SUPPLY VAR. FREQ. DRIVE	35
4B11	COMBUSTION BLOWER MOTOR	7
4DL6	SEQUENCING TIME DELAY	27
4E1	ELECTRODE	19
4K33	COMBUSTION BLOWER RELAY	37
4K120	HEAT FAIL RELAY	13
4L7	GAS SOLENOID	32,33
4L9	PILOT SOLENOID	14
4L10	SAFETY SOLENOID	29
4S24	CONTROL CIRCUIT SWITCH	4
4S25	COMBUSTION AIR FLOW SWITCH	10
4S26	HIGH LIMIT CUTOFF	12
4S38	SUPPLY AIR FLOW SWITCH	10
4T7	IGNITION TRANSFORMER	16
4TB14,4TB15	CONTROL TERMINAL BLOCK	
4U18	IGNITION CONTROL BOARD	12
4U19	FLAME ROD	24

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	INSIDE UNIT CONTROL PANEL
3	AIR HANDLER SECTION
4	GAS HEAT SECTION

- NOTES:
- UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
  - DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINE INDICATES WIRING BY TRANE CO.
  - NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT. AN OPEN ARROWHEAD BELOW THE LINE NUMBER POINTING UPWARD INDICATES A TIMED CONTACT WHICH BEGINS TIMING WHEN ENERGIZED.
  - 500 AND 850 MBH UL WIRING SHOWN. FOR CSA WIRING AND 1000 MBH UL WIRING SEE INSETS "B" & "C".
  - WHEN UNIT HAS SUPPLY FAN V.F.D. OPTION SEE INSET "A" FOR CONNECTIONS.

**Figure 40. Typical modulating gas heat schematic & connections diagram**






## System Start-up

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### Electric Heat Sequence of Operation

A typical electrical schematic for a 3-circuit, 70 kW electric furnace control circuit appears in [Figure 41, p. 73](#). As you review it and the sequence of operation described below, remember these points:

Whenever there is a call for heat, 1U50-K1 energizes. This energizes HEAT 1 contactors 4K34 and 4K35 which, in turn, energize two of the six 4HR3 heating elements.

**Important:** *Electric heater 4HR3 will only energize if both of the heat section's high limit safety controls—4S27 and 4S33—are closed.*

1. High limit Switch 4S27 will trip if exposed to a temperature of  $133 + 5^{\circ}\text{F}$ , and reset automatically once the temperature falls to  $110 + 5^{\circ}\text{F}$ . It is mounted on the control-box-side of the electric heat element assembly.
2. Linear high limit 4S33 is encased in a capillary that extends across the unit's supply air opening, and is anchored near the bottom of the heat section control box. It is designed to trip if the temperature across any 6" span of the capillary exceeds  $185 + 10^{\circ}\text{F}$  (Refer to [Table 34, p. 99](#)).

The HEAT 2 (4K36, 4K37) and HEAT 3 (4K38, 4K39) contactors are not energized unless the 1st stage bank of heating elements already operating are not satisfying the heating load.

### Wet Heat Sequence of Operation

Electrical circuitry for units with steam or hot water heat is limited to the connections associated with the modulating valve actuator (4U15) and the freezestat (4S12).

Like the furnaces described earlier, SL/SH control systems are wired to ensure that simultaneous heating and cooling cannot occur. The supply fan will cycle "On" and "Off" with each call for heat during both an occupied and unoccupied period.

Whenever there is a call for heat, 1U50-K3 energizes. This allows a modulated voltage signal to be sent to the "Wet" heat actuator 4U15. Depending on the value of this signal, 4U15 regulates the flow of steam or hot water through the coil by positioning the valve stem at some point between fully closed (6 VDC) and fully open (8.5 VDC).

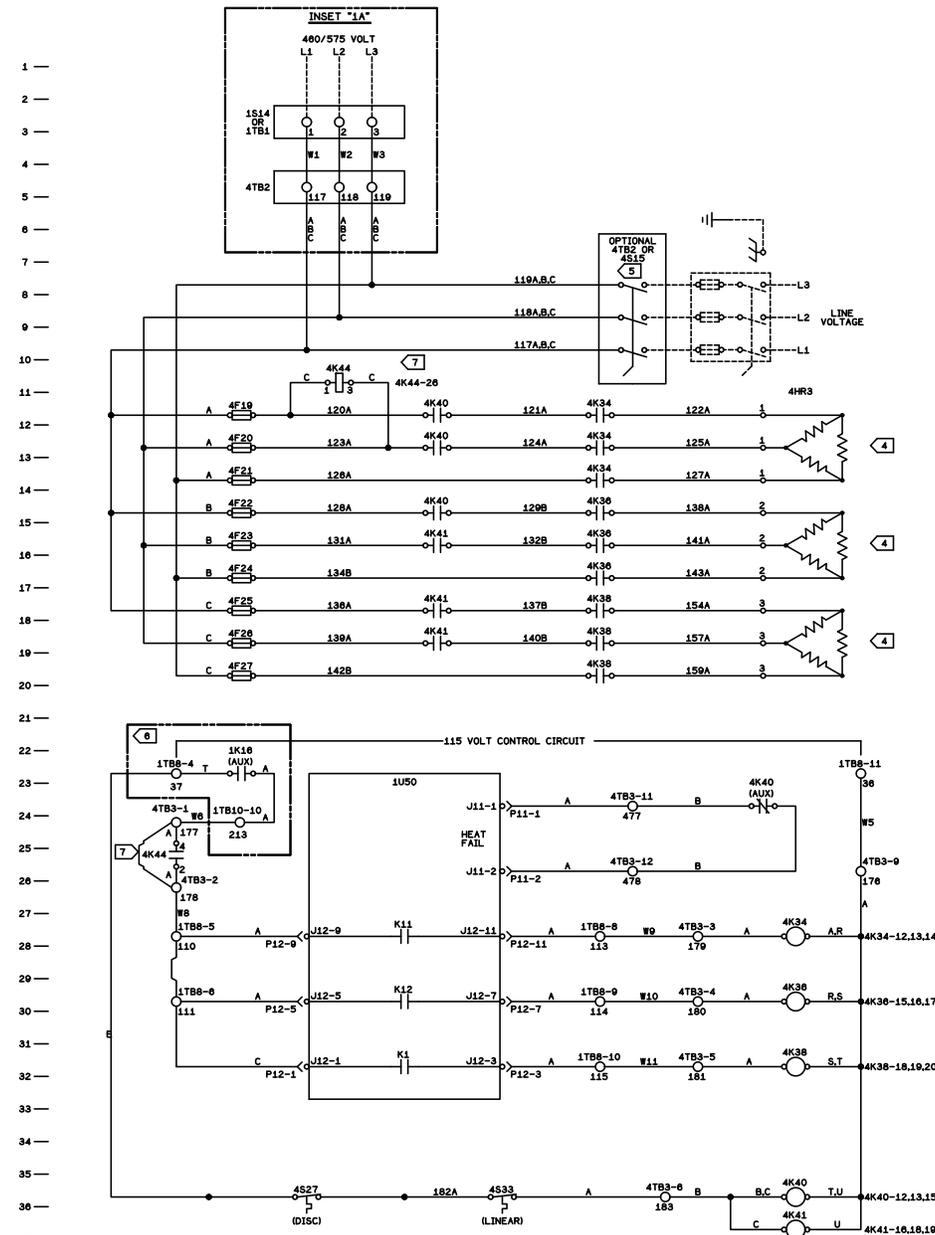
### Freeze Protection

A freezestat (4S12) is mounted inside the heat section of WLHE and WSHE units to prevent the "wet" heat coil from freezing during the "Off" cycle. If the temperature of the air leaving the heating coils falls to  $40^{\circ}\text{F}$ , the freezestat's normally-open contacts close, completing the heat fail circuit on the UCM. When this occurs:

- a. The supply fan is turned "Off".
- b. "Wet" heat actuator 4U15 fully opens to allow hot water or steam to pass through the heating coil and prevent freeze-up.
- c. A "Heat Fail" diagnostic is displayed on the Human Interface LCD screen.

For heating control settings and time delay specifications, refer to [Table 34](#).

Figure 41. Typical (3 Circuit) electric furnace schematic

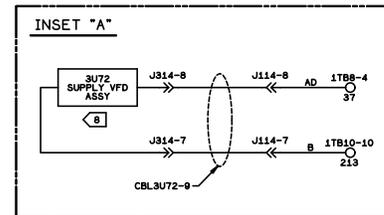


**WARNING**  
HAZARDOUS VOLTAGE!  
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.  
FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

**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 ENTRAÎNER 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.

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	INSIDE UNIT CONTROL PANEL
4	ELECTRIC HEAT SECTION



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S14	MANUAL DISCONNECT SWITCH	3
1TB1	POWER TERMINAL BLOCK	3
1TB8	CONTROL TERMINAL BLOCK	
IU50	HEAT MODULE	24
3U72	SUPPLY VAR. FREQ. DRIVE	23
4F19-4F27	ELECTRIC HEAT FUSE	12-20
4HR3	ELECTRIC HEATER	12-20
4K34	HEAT 1 CONTACTOR	28
4K36	HEAT 2 CONTACTOR	30
4K38	HEAT 3 CONTACTOR	32
4K40,4K41	BACK-UP CONTACTOR	36,37
4K44	INTERLOCK RELAY	11
4S15	MANUAL DISCONNECT SWITCH	6
4S27	HIGH LIMIT (DISC)	36
4S33	HIGH LIMIT (LINEAR)	36
4TB2	POWER TERMINAL BLOCK	5,8
4TB3	CONTROL TERMINAL BLOCK	

- NOTES:
- UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
  - DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINE INDICATES WIRING BY TRANE CO.
  - NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT. AN OPEN ARROWHEAD BELOW THE LINE NUMBER POINTING UPWARD INDICATES A TIMED CONTACT WHICH BEGINS TIMING WHEN ENERGIZED.
- HEATING ELEMENTS ARE SHOWN DELTA CONNECTED. ELEMENTS MAY BE WYE CONNECTED.
  - POWER CONNECTION SHOWN TO 4TB2/4S15 IS FOR 200V & 230V UNITS. SEE INSET "A" FOR 480V AND 575V UNITS.
  - WHEN UNIT HAS SUPPLY FAN V.F.D. OPTION, SEE INSET "A" FOR CONNECTIONS.
  - 4K44 AND ASSOCIATED WIRING USED ON 200V AND 230V UNITS. REMOVE NUMBER AND INSTALL 4K44 CONTACTS (LINE 28) WHEN REQUIRED. DISREGARD 4K44 TERMINAL DESIGNATIONS ON 480V OR 575V UNITS.
  - SEE APPLICABLE 3U72 SUPPLY VARIABLE FREQUENCY DRIVE DIAGRAM FOR BALANCE OF CIRCUIT.

## System Start-up

Use the checklist provided below in conjunction with the "General Unit Requirement" checklist to ensure that the unit is properly installed and ready for operation. Be sure to complete all of the procedures described in this section before starting the unit for the first time.

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

- Turn the field supplied disconnect switch, located upstream of the rooftop unit, to the "Off" position.
- Turn the 115 volt control circuit switch 1S1 to the "Off" position. It is located in the secondary of the 1T1 transformer.
- Turn the 24 volt control circuit switch 1S70 to the "Off" position. It is located in the secondary of the 1T2 & 1T3 transformers.
- Turn the "System" selection switch (at the Remote Panel) to the "Off" position and the "Fan" selection switch (if Applicable) to the "Auto" or "Off" position.
- Check all electrical connections for tightness and "point of termination" accuracy.
- 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 Service/Maintenance section of this manual for instructions.
- Inspect the interior of the unit for tools and debris. Install all panels in preparation for starting the unit.

### Electrical Phasing

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

- Turn the field supplied disconnect switch that provides power to terminal block 1TB1 or to the factory mounted disconnect switch 1S14 to the "Off" position.
- Connect the phase sequence indicator leads to the terminal block or to the factory mounted disconnect switch as follows:

**Table 19.**

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

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

- Close the disconnect switch or circuit protector switch that provides the main power supply to terminal block 1TB1 or to the factory mounted disconnect switch 1S14.
- Observe the ABC and CBA phase indicator lights on the face of the sequencer. The ABC indicator light will glow if the phase is ABC. If the CBA indicator light glows, open the disconnect switch or circuit protection switch and reverse any two power wires.
- Restore the main electrical power and recheck the phasing. If the phasing is correct, open the disconnect switch or circuit protection switch and remove the phase sequence indicator.

### Voltage Supply and Voltage Imbalance

#### Voltage Supply

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

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

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

V1, V2, V3 = Line Voltage Readings

VD = Line Voltage reading that deviates the farthest from the average voltage.

**Example:** If the voltage readings of the supply power measured 221, 230, and 227, the average volts would be:

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

VD (reading farthest from average) = 221

The percentage of Imbalance equals:

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

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

**Table 20. Service test guide for component operation**

COMPONENT BEING TESTED	COMPONENT CONFIGURATION								Occ Unocc Relay <sup>(a)</sup>
	Supply Fan	Exhaust Fan	Heat Stages			Econo Damper	Exhaust Damper	VFD Output	
			1	2	3				
<b>SUPPLY FAN*</b>	On	Off	Off	Off	Off	Closed	Closed	100%	Unocc
<b>EXHAUST FAN</b>	Off	On	Off	Off	Off	Closed	100% Open	100%	Default
<b>GAS HEAT (Full Cap.)</b>	On	Off	On	On	N/A	Closed	Closed	100%	Unocc
Stage 1	On	Off	On	Off	N/A	Closed	Closed	100%	Unocc
Stage 2	On	Off	Off	On	N/A	Closed	Closed	100%	Unocc
Full Modulating (For High Fire Adjustment)	On	Off		90% Select		Closed	Closed	100%	Unocc
Full Modulating (For Low Fire Adjustment)	On	Off		5% Select		Closed	Closed	100%	Unocc
Limited Modulating (For High Fire Adjustment)	On	Off		90% Select		Closed	Closed	100%	Unocc
Limited Modulating (For Low Fire Adjustment)	On	Off		33% Select		Closed	Closed	100%	Unocc
<b>ELECT HEAT (Full Cap.)</b>	On	Off	On	On	On	Closed	Closed	100%	Unocc
Stage 1	On	Off	On	Off	Off	Closed	Closed	100%	Unocc
Stage 2	On	Off	Off	On	Off	Closed	Closed	100%	Unocc
Stage 3	On	Off	Off	Off	On	Closed	Closed	100%	Unocc
<b>Modulating Hydronic Heat</b>	Off	Off	100% Select			Closed	Closed	0%	Default
<b>Pre - Heater</b>	Off	Off	On	N/A	N/A	Closed	Closed	0%	Default
<b>Fresh Air Dampers</b>	Off	Off	Off	Off	Off	100% Open	Closed	0%	Default
<b>Exhaust Dampers</b>	Off	Off	Off	Off	Off	100%	100% Open	0%	Default

(a) RTM OCC/UNOCC output in the Service Test Mode must be in the unoccupied mode to open the system VAV boxes or to drive the VFD to 100%.



## System Start-up

### Verifying Proper Fan Rotation

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position and the "Fan" selection switch for constant volume units is in the "Auto" position. (VAV units do not utilize a "Fan" selection input.)
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of RT-SVP04\*-EN (VAV), RT-SVP05\*-EN (CV) for the SERVICE TEST screens and programming instructions.
5. Use [Table 20, p. 75](#) to program the unit Fans for operation by scrolling through the displays. All of the Fans (Supply & Exhaust fans) can be programmed to be "On", if desired. Verify proper fan rotation for VFDs with bypass.
6. Once the configuration for the Fans is complete, press the NEXT key until the LCD displays the "Start test in \_\_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

#### **⚠ WARNING**

##### **Rotating Components!**

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

7. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fans will begin to operate.
8. Check the supply fan and the exhaust fans (if equipped) for proper rotation. The direction of rotation is indicated by an arrow on the fan housings. Check the condenser fans for clockwise rotation when viewed from the top.

If all of the fans are rotating backwards;

- a. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan 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.**

- b. Open the field supplied disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the open position while working at the unit.
- c. Interchange any two of the field connected main power wires at the unit terminal block 1TB1 or the factory mounted disconnect switch 1S14.

**Note:** *Interchanging "Load" side power wires at the fan contactors will only affect the fan rotation. Ensure that the voltage phase sequence at the main terminal block 1TB1 or the factory mounted disconnect switch 1S14 is ABC as outlined in the "Electrical Phasing" section.*

If some of the fans are rotating backwards;

- a. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan 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.**

- b. Open the field supplied disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the open position while working at the unit.
- c. Interchange any two of the fan motor leads at the contactor for each fan that is rotating backwards.

### System Airflow Measurements

#### Constant Volume Systems

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position and the "Fan" selection switch for constant volume units is in the "Auto" position. (VAV units do not utilize a "Fan" selection input.)

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use [Table 20, p. 75](#) to program the Supply Fan for operation by scrolling through the displays.
6. Once the configuration for the Fan is complete, press the NEXT key until the LCD displays the "Start test in \_\_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

### **⚠ WARNING**

#### **Rotating Components!**

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

7. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fans will begin to operate.
8. With the system in the SERVICE MODE and the supply fan rotating in the proper direction, measure the amperage at the supply fan contactor 1K16 & 1K15. If the amperage exceeds the motor nameplate value, the static pressure is less than design and the airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and cfm may be too low. To determine the actual cfm ( $\pm 5\%$ );

- a. Measure the actual fan rpm
- b. Calculate the Theoretical bhp
  - i. Actual Motor Amps X Motor (hp) Motor Nameplate Amps
- c. Plot this data onto the appropriate Fan Performance Curve in [Figure 42, p. 79](#) - [Figure 45, p. 81](#). Where the two points intersect, read straight down to the cfm line.

Use this data to assist in calculating a new fan drive if the cfm is not at design specifications.

An alternate method with less accuracy is to measure the static pressure drop across the evaporator coil. This can be accomplished by;

- a. Drilling a small hole through the unit casing on each side of the coil.

### **NOTICE:**

#### **Equipment Damage!**

**Coil damage can occur if care is not taken when drilling holes in this area.**

- b. Measure the difference between the pressures at both locations.
  - c. Plot this value onto the appropriate pressure drop curve in [Figure 47, p. 82](#) or [Figure 48, p. 82](#). Use the data in [Table 22, p. 101](#) (Component Static Pressure Drops) to assist in calculating a new fan drive if the cfm is not at design specifications.
  - d. Plug the holes after the proper cfm has been established.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.

#### **Variable Air Volume Systems**

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position.

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.

## System Start-up

4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of RT-SVP04\*-EN (VAV), RT-SVP05\*-EN (CV) for the SERVICE TEST screens and programming instructions.
5. Use [Table 20, p. 75](#) to program the following system components for operation by scrolling through the displays;
  - Supply Fan
  - Variable Frequency Drive (100% Output, if applicable)
  - RTM Occ/Unocc Output (Unoccupied)
6. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
  - a. Drilling a small hole through the unit casing on each side of the coil. Coil damage can occur if care is not taken when drilling holes in this area.
  - b. Measure the difference between the pressures at both locations.
  - c. Plot this value onto the appropriate pressure drop curve in [Figure 47- Figure 48, p. 82](#). Use the data in [Table 22, p. 101-](#) (Component Static Pressure Drops) to assist in calculating a new fan drive if the cfm is not at design specifications.
  - d. Plug the holes after the proper cfm has been established.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.

### Exhaust Airflow Measurement (Optional with all Units)

#### **⚠ WARNING**

##### **Rotating Components!**

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

7. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fan will begin to operate.
8. With the VFD at 100% and the supply fan operating at full airflow capability, measure the amperage at the supply fan contactor 1K16 & 1K15. If the amperage exceeds the motor nameplate value, the static pressure is less than design and the airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and cfm may be too low. To determine the actual cfm ( $\pm 5\%$ );
  - a. Measure the actual fan rpm
  - b. Calculate the Theoretical bhp  

$$\frac{\text{Actual Motor Amps} \times \text{Motor hp}}{\text{Motor Nameplate Amps}}$$
  - c. Plot this data onto the appropriate Fan Performance Curve in [Figure 42, p. 79](#) - [Figure 41, p. 73](#). Where the two points intersect, read straight down to the cfm line.

Use this data to assist in calculating a new fan drive if the cfm is not at design specifications. An alternate method with less accuracy is to measure the static pressure drop across the evaporator coil. This can be accomplished by;

#### **⚠ WARNING**

##### **Hazardous Voltage!**

**HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.**

1. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
2. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
3. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of RT-SVP04\*-EN (VAV) or RT-SVN05\*-EN (CV) for the SERVICE TEST screens and programming instructions.
4. Use [Table 20, p. 75](#) to program the following system components for operation by scrolling through the displays;
  - Exhaust Fan
  - Exhaust Dampers (100% Open, if applicable)
  - Fresh Air dampers (100% Open)
  - Variable Frequency Drive (100%, if applicable)
  - RTM Occ/Unocc Output (Default)
5. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

### **⚠ WARNING**

#### **Rotating Components!**

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

6. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fans will begin to operate.
7. With the exhaust dampers open and the exhaust fan operating at full airflow capability, measure the amperage at the exhaust fan contactor 1K17. If the amperage exceeds the motor nameplate value, the static pressure is less than design and airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and cfm may be too low. To determine the actual cfm ( $\pm 5\%$ );
  - a. Measure the actual fan rpm
  - b. Calculate the Theoretical bhp  

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

Use [Table 25, p. 104](#) - [Table 29, p. 106](#) to calculate a new fan drive if the cfm is not at design specifications.

8. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.

### **Traq™ Sensor Airflow Measurement (Optional with all units equipped with an economizer)**

1. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition RT-SVP04\*-EN (VAV) or RT-SVN05\*-EN (CV) for the SERVICE TEST screens and programming instructions.
2. Use [Table 20, p. 75](#) to program the following system components for Economizer operation by scrolling through the displays;
  - Supply Fan (On)
  - Fresh Air dampers (Selected% Open)
  - Variable Frequency Drive (100% Output, if applicable)
  - RTM Occ/Unocc Output (Unoccupied)
  - Outside Air cfm Setpoint
  - Outside Air Pre-Heater Operation (if applicable)
3. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to

designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

### **⚠ WARNING**

#### **Rotating Components!**

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

4. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fans will begin to operate.
5. With the unit operating in the "TEST MODE", the amount of outside air flowing through the Traq™ sensor can be view by switching to the "STATUS MENU" screen "OA cfm.
6. Scroll to the "ECONOMIZER ENABLE/ECONOMIZER POSITION" screen by pressing the "NEXT" key and read the corresponding damper opening percentage (%).
7. Press the STOP key at the Human Interface Module in the unit control panel to stop the unit operation.



# System Start-up

Figure 42. W\_HE casing 2 supply fan performance curve

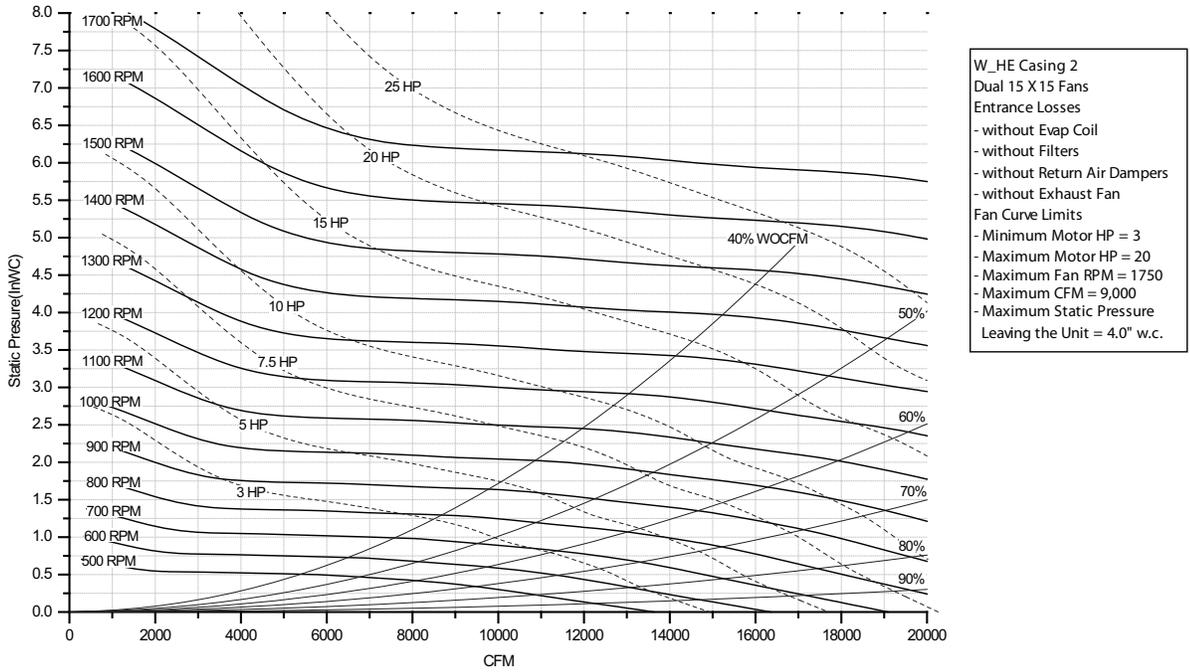
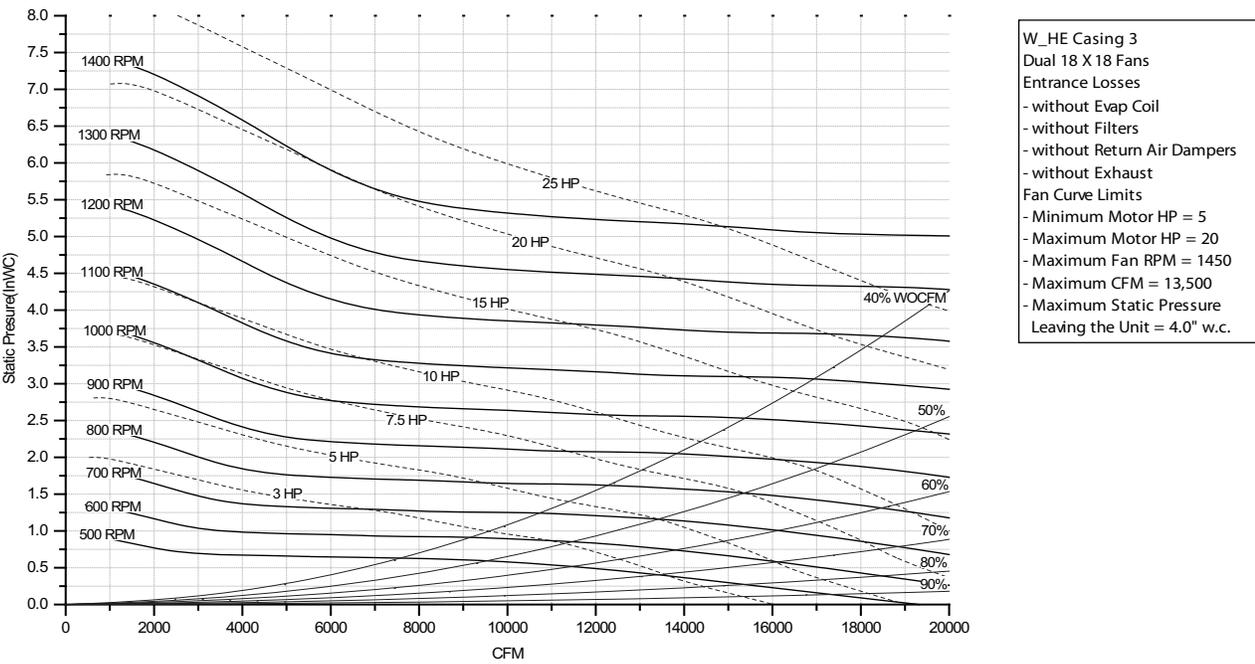
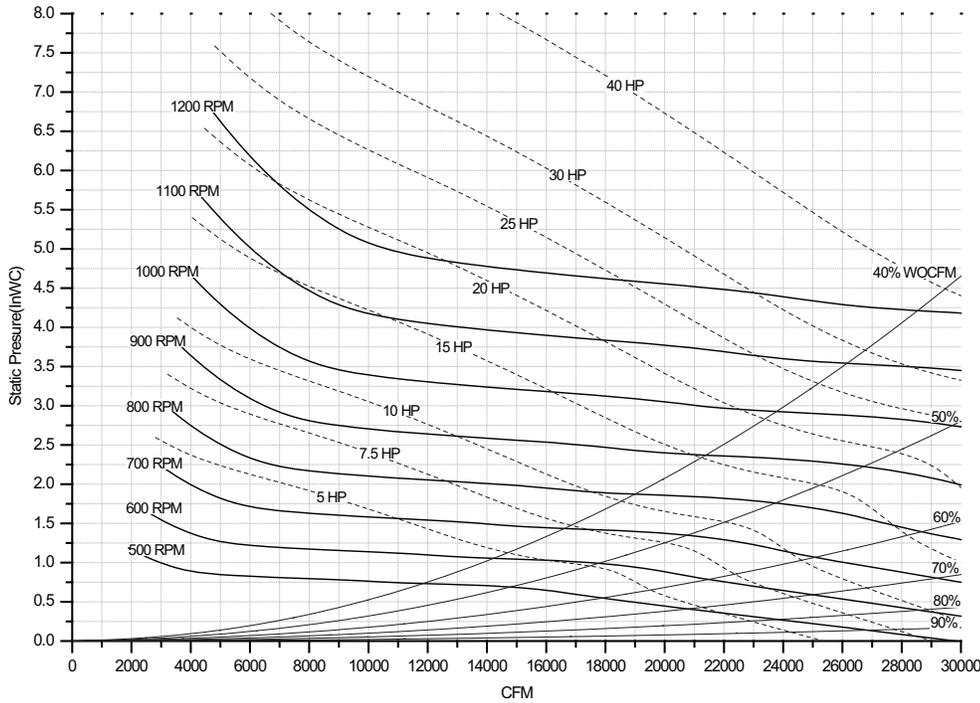


Figure 43. W\_HE casing 3 supply fan performance curve

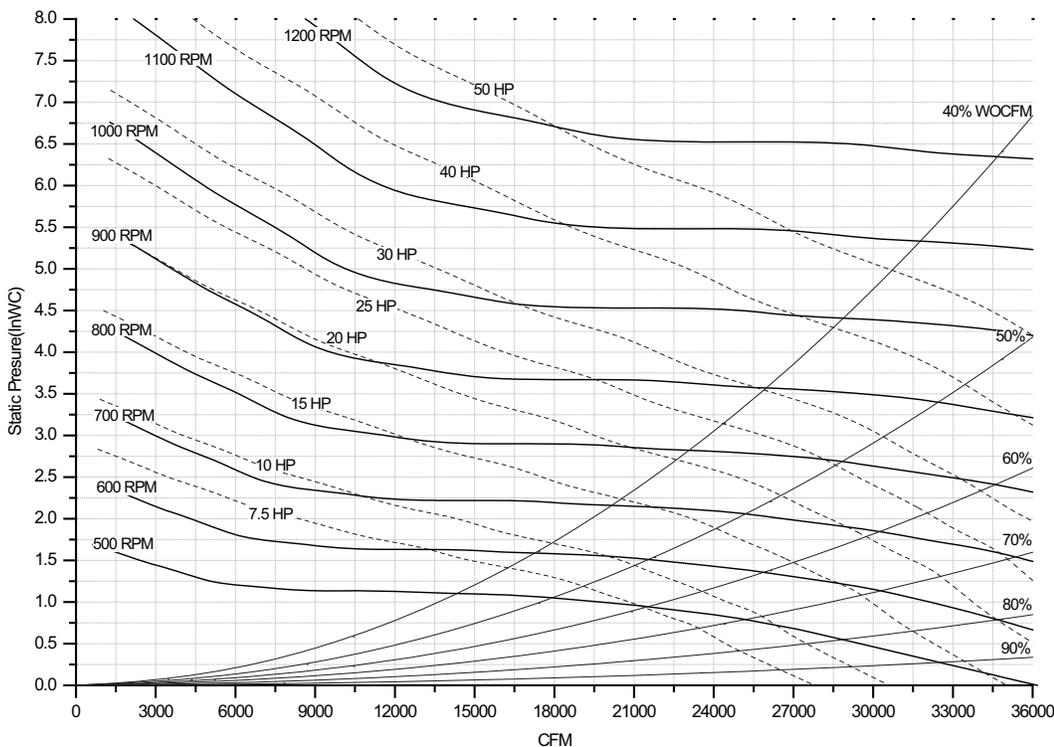


**Figure 44. W\_HE casing 4 & 5 supply fan performance curve**



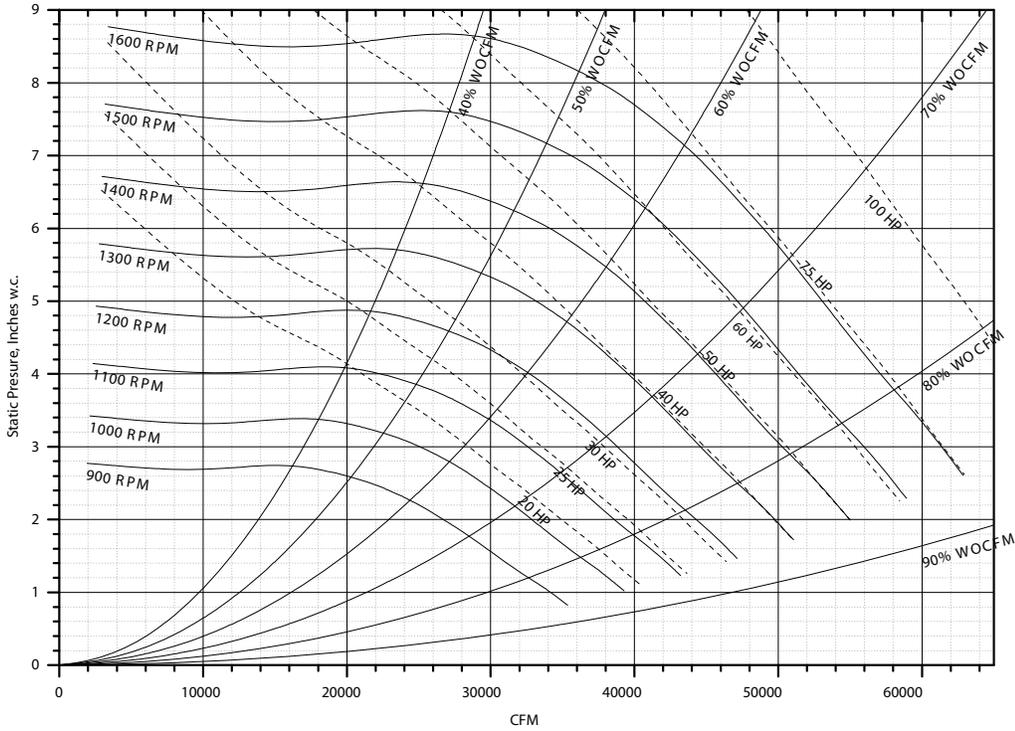
W\_HE Casing 4 & 5  
 Dual 20 X 20 Fans  
 Entrance Losses  
 - without Evap Coil  
 - without Filters  
 - without Return Air Dampers  
 - without Exhaust  
 Fan Curve Limits  
 - Minimum Motor HP = 7.5  
 - Maximum Motor HP  
 C40, C50 = 30 HP  
 - Maximum Fan RPM  
 7.5 - 15 HP = 1141  
 20 - 30 HP = 1170  
 - Maximum CFM  
 4 = 18,000  
 5 = 22,500  
 - Maximum Static Pressure  
 Leaving the Unit = 4.0" w.c.

**Figure 45. W\_HE casing 6 supply fan performance curve**



W\_HE Casing 6  
 Dual 22 X 22 Fans  
 Entrance Losses  
 - without Evap Coil  
 - without Filters  
 - without Return Air Dampers  
 - without Exhaust  
 Fan Curve Limits  
 - Minimum Motor HP = 10  
 - Maximum Motor HP = 50  
 - Maximum Fan RPM = 1130  
 - Maximum CFM = 27,000  
 - Maximum Static Pressure  
 Leaving the Unit = 4.0" w.c.

**Figure 46. W\_HE casing 9 supply fan performance curve**



**Figure 47. Wet airside pressure drop at 0.075 lb/cu.ft. casing 2 - 9 standard evaporator coil**

**Evaporator Wet Airside Pressure Drop at 0.075 lb/cu.ft. Casings 2-9**

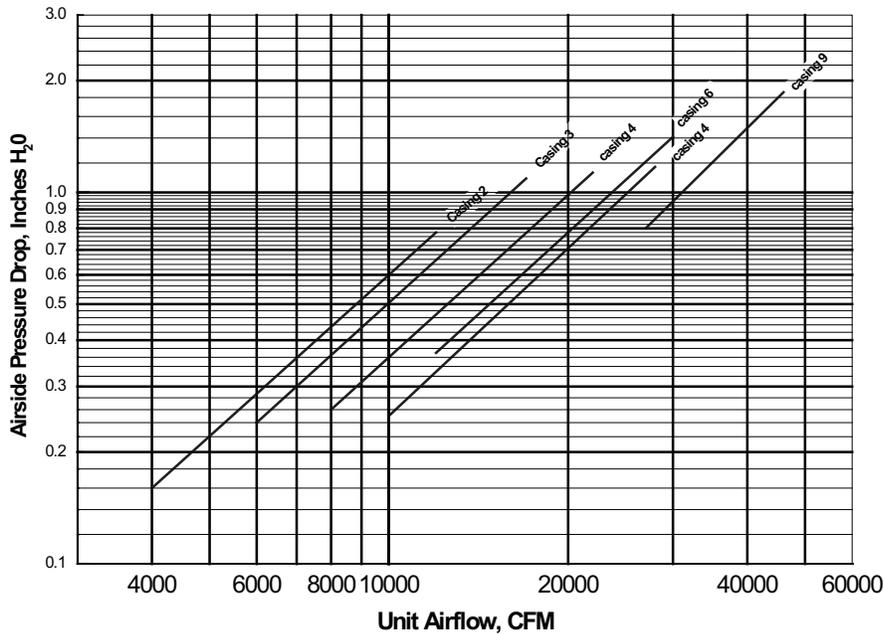
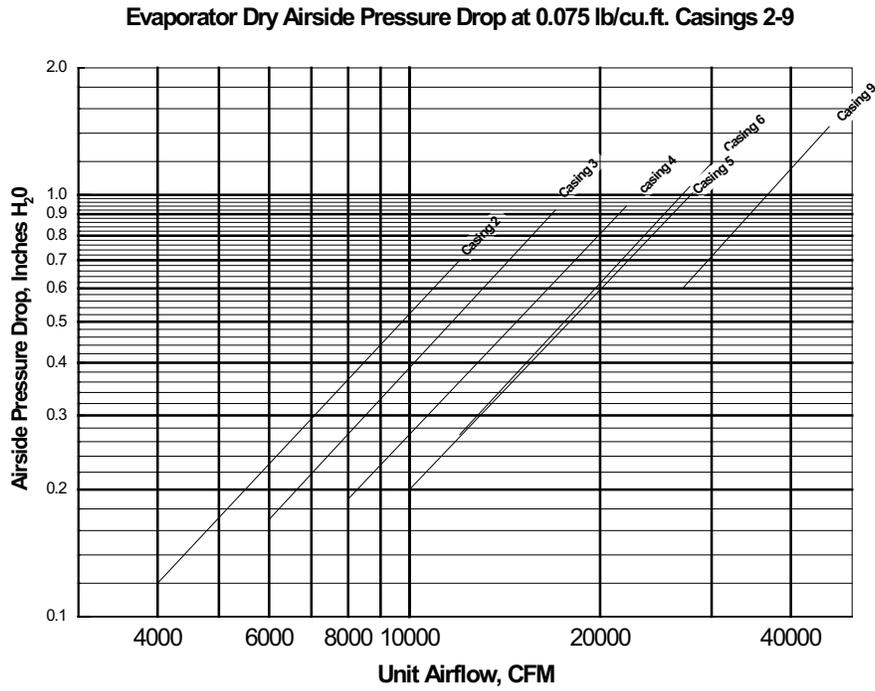


Figure 48. Dry airside pressure drop at 0.075 lb/cu.ft. W\_HE casings 2 - 9 standard evaporator coil





## System Start-up

**Table 21. Component static pressure drops (in. W.G.)**

Casing Size	CFM Std Air	Evaporator Coil - R-410A		Heating System						
		Dry	Wet	Natural Gas		Electric All kW's	Hot Water		Steam	
				Low	High		Low	High	Low	High
		<b>4-Row</b>								
2	4000	.12	.16	.02	N/A	.02	.05	.06	.02	.06
	6000	.24	.29	.05	.05	.04	.09	.12	.05	.12
	8000	.37	.44	.09	.09	.07	.15	.19	.10	.20
	9000	.45	.52	.12	.12	.09	.19	.24	.12	.22
	10000	.53	.06	.14	.15	.11	.23	.28	.15	.29
	12000	.7	.78	.20	.22	.17	.33	.40	.22	.42
		<b>5-Row</b>								
3	6000	.17	.24	.05	.05	.04	.09	.12	.05	.12
	9000	.33	.45	.11	.12	.09	.19	.24	.12	.22
	12000	.53	.67	.20	.21	.16	.31	.39	.22	.41
	14000	.68	.83	.26	.29	.22	.40	.51	.30	.50
	15000	.76	.92	.30	.33	.25	.45	.57	.33	.52
	17000	.92	1.09	.39	.42	.35	.58	.73	.42	.67
		<b>5-Row</b>								
4	8000	.19	.26	.09	N/A	.07	.09	.11	.05	.11
	10000	.27	.36	.14	.11	.11	.13	.16	.08	.16
	12000	.36	.48	.20	.15	.16	.17	.22	.11	.21
	16000	.57	.73	.34	.26	.29	.28	.36	.20	.36
	17000	.62	.79	N/A	.29	.32	.31	.39	.22	.41
	20000	.81	.99	N/A	.41	.44	.42	.52	.30	.51
	22000	.94	1.13	N/A	.50	.53	.51	.63	.36	.62
		<b>4-Row</b>								
5	10000	.2	.25	.12	.10	.11	.13	.16	.07	.15
	14000	.34	.42	.26	.20	.22	.22	.28	.15	.28
	17000	.46	.57	.39	.29	.32	.31	.40	.22	.41
	20000	.59	.73	.58	.41	.44	.42	.52	.30	.51
	24000	.79	.94	.73	.58	.62	.48	.72	.45	.75
	28000	1.01	1.17	.99	.79	.84	.62	.98	.61	.99
		<b>6-Row</b>								
6	12000	.27	.37	.10	.08	.06	.10	.13	.06	.11
	16000	.43	.58	.18	.14	.11	.17	.21	.11	.19
	20000	.62	.8	.27	.21	.17	.24	.31	.16	.27
	24000	.83	1.03	.40	.30	.24	.33	.42	.22	.39
	28000	1.06	1.28	.48	.33	.32	.44	.55	.32	.50
	30000	1.19	1.41	.62	.38	.37	.51	.63	.37	.57
		<b>6-Row</b>								
9	27000	0.60	0.80	N/A	.25	.13	.26	.31	.22	.32
	32000	0.80	1.03	N/A	.31	.16	.35	.41	.30	.43
	37000	1.01	1.32	N/A	.39	.23	.45	.52	.40	.55
	42000	1.25	1.62	N/A	.46	.29	.56	.65	.50	.68
	45000	1.40	1.80	N/A	.52	.32	.63	.73	.58	.76
	46000	1.45	1.86	N/A	.55	.34	.65	.75	.61	.79

Continued on next page

**Table 21. Component static pressure drops (in. W.G.)**

Casing Size	CFM Std Air	Filters					Std Roof Curb	Econ.with or w/o Exhaust Fan
		Throwaway		Perm Wire Mesh	Bag & Prefilter	Cartridge & Prefilter		
		Std Fiber	High Effic.					
2	4000	.03	.03	.01	.3	.24	.01	.03
	6000	.06	.06	.02	.5	.44	.02	.06
	8000	.09	.09	.03	.71	.68	.05	.12
	9000	.11	.11	.04	.83	.81	.07	.15
	10000	.13	.13	.05	.95	.95	.10	.19
	12000	.15	.15	.06	1.19	1.26	.14	.27
3	6000	.04	.04	.01	.34	.26	.02	.06
	9000	.07	.07	.02	.54	.48	.07	.15
	12000	.11	.11	.04	.75	.75	.16	.27
	14000	.14	.14	.06	.95	.95	.25	.39
	15000	.16	.16	.07	1.03	1.06	.30	.43
17000	.21	.21	.09	1.20	1.30	.39	.59	
4	8000	.04	.04	.02	.37	.31	.01	.03
	10000	.06	.06	.02	.49	.43	.02	.03
	12000	.08	.08	.03	.61	.56	.04	.07
	16000	.12	.12	.05	.88	.87	.10	.09
	17000	.13	.13	.06	.95	.95	.12	.11
	20000	.17	.17	.08	1.17	1.22	.19	.17
	22000	.21	.21	.10	—	—	.23	.20
5	10000	.04	.04	.01	.37	.30	.03	.05
	14000	.07	.07	.03	.56	.50	.07	.08
	17000	.10	.10	.04	.72	.68	.12	.11
	20000	.12	.12	.05	.88	.88	.19	.17
	24000	.16	.16	.07	1.11	1.17	.30	.23
	28000	.20	.20	.10	—	—	.39	.30
6	12000	.05	.05	.01	.44	.37	.02	.07
	16000	.07	.07	.02	.63	.58	.05	.10
	20000	.10	.10	.03	.84	.82	.10	.16
	24000	.11	.11	.04	1.06	1.08	.16	.23
	28000	.17	.17	.06	—	—	.30	.30
	30000	.20	.20	.07	—	—	.34	.34
9	27000	.11	.13	N/A	.68	.65	—	.20
	32000	.14	.16	N/A	.84	.84	—	.31
	37000	.17	.19	N/A	1.02	1.04	—	.41
	42000	.21	.22	N/A	1.19	1.06	—	.52
	45000	.24	.24	N/A	—	—	—	.63
	46000	N/A	.24	N/A	—	—	—	.64

**Notes:**

1. Static pressure drops of accessory components must be added to external static pressure to enter fan selection tables.
2. Gas heat section maximum temperature rise of 60°F.
3. Throwaway filter option limited to 300 ft/min face velocity.
4. Bag filter option limited to 740 ft/min face velocity.
5. Horizontal roof curbs assume 0.50" static pressure drop or double the standard roof curb pressure drop, whichever is greater.
6. No additional pressure loss for model WXHE.



## System Start-up

**Table 22. Supply air fan drive selections — casings 2-6**

Casing Size	3 Hp		5 Hp		7½ Hp		10 Hp		15 Hp		20 Hp		25 Hp		30 Hp		40 Hp		50 Hp	
	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No
2	500	5	700	7	900	9	1100	B	1200	C	1400	E								
	600	6	800	8	1000	A	1200	C	1300	D	1500	F								
	700	7	900	9	1100	B	1300	D	1400	E	1600	G								
	800	8	1000	A	1200	C	1400	E	1500	F	1700	H								
	900	9	1100	B	1300	D			1600	G										
3			600	6	700	7	800	8	900	9	1100	B								
			700	7	800	8	900	9	1000	A	1200	C								
			800	8	900	9	1000	A	1100	B	1300	D								
			900	9	1000	A	1100	B	1200	C	1400	E								
									1300	D										
4					500	5	700	7	800	8	900	9	1000	A	1000	A				
					600	6	800	8	900	9	1000	A	1100	B	1100	B				
					700	7	900	9	1000	A	1100	B								
					800	8														
5					500	5	600	6	700	7	800	8	900	9	1000	A				
					600	6	700	7	800	8	900	9	1000	A	1100	B				
					700	7	800	8	900	9	1000	A	1100	B						
					800	8	900	9	1000	A	1100	B								
6					400	4	500	5	600	6	700	7	800	8	900	9	1000	A		
					500	5	600	6	700	7	800	8	900	9	1000	A	1100	B		
					600	6	700	7	800	8	900	9	1000	A	1100	B				
					700	7	800	8	900	9	1000	A								

**Table 23. Supply air fan drive selections — casing 9**

RPM	15 Hp	20 Hp	25 Hp	30 Hp	40 Hp
	Drive No.				
1000	A	A			
1100	B	B	B		
1200	C	C	C	C	
1300		D	D	D	D
1400			E	E	E
1500			F	F	F
1600				G	G

**Table 24. W\_HE casings 2-6 100% modulating exhaust fan performance**

Casing Size	CFM Std. Air	Negative Static Pressure															
		0.250		0.500		0.750		1.000		1.2500		1.500		1.750		2.000	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64				
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66						
	8000	487	1.10	583	1.56	674	2.11	757	2.72								
	10000	567	1.88	643	2.37	719	2.96										
3	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64	927	3.22	988	3.84
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66	882	3.28	948	3.94	1010	4.64
	8000	487	1.10	583	1.56	674	2.11	757	2.72	834	3.38	904	4.09	970	4.82	1030	5.59
	10000	567	1.88	643	2.37	719	2.96	794	3.63	864	4.35	931	5.11	993	5.91	1053	6.77
	12000	651	2.98	716	3.56	779	4.18	843	4.88	905	5.64	967	6.47	1026	7.34		
	14000	736	4.47	796	5.17	850	5.83	904	6.57	960	7.38						
4	7500	318	0.67	444	1.21	545	1.85	629	2.54	702	3.27	767	4.02	828	4.83	884	5.66
	9000	331	0.97	444	1.47	543	2.17	628	2.94	702	3.75	770	4.60	831	5.48	887	6.37
	12000	381	2.13	460	2.40	546	3.04	627	3.89	701	4.83	769	5.82	831	6.87	889	7.93
	14000	422	3.40	486	3.49	557	3.98	631	4.76	701	5.72	768	6.78	830	7.90	888	9.07
	16000	468	5.12	520	5.07	579	5.37	643	6.01	707	6.88	769	7.92	829	9.08	887	10.32
5	9000	331	0.97	444	1.47	543	2.17	628	2.94	702	3.75	770	4.60	831	5.48	887	6.37
	12000	381	2.13	460	2.40	546	3.04	627	3.89	701	4.83	769	5.82	831	6.87	889	7.93
	15000	445	4.20	502	4.21	567	4.61	636	5.32	704	6.26	769	7.32	830	8.47	888	9.67
	18000	516	7.41	559	7.19	609	7.32	662	7.76	719	8.49	776	9.44	833	10.56	887	11.79
	20000	566	10.31	602	9.91	644	9.88	690	10.15	739	10.69	789	11.48	841	12.48	893	13.68
6	12000	351	1.49	423	2.09	502	3.00	572	4.02	634	5.07	690	6.09	740	7.04	784	7.91
	15000	412	2.68	460	3.15	521	3.96	585	5.02	646	6.24	702	7.53	749	8.83	801	10.14
	18000	478	4.41	516	4.88	557	5.54	607	6.49	662	7.66	715	9.01	766	10.48	814	12.01
	21000	549	6.75	578	7.36	612	7.92	647	8.71	688	9.77	735	11.03	781	12.46	827	14.03
	24000	617	9.83	644	10.59	672	11.22	702	11.88	732	12.77	766	13.89	805	15.22	846	16.72
	27000	688	15.11	711	15.09	736	15.45	761	16.18	788	17.02	815	17.92	844	18.99	876	20.31

Note: Shaded areas of table identify nonstandard drive selections.

**Table 25. W\_HE casing 9 100% modulating exhaust fan performance**

Casing Size	CFM Std. Air	Negative Static Pressure																			
		0.250		0.500		0.750		1.000		1.250		1.500		1.750		2.000		2.250		2.500	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9	28000	495	12.81	519	13.30	547	13.93	582	15.27	619	17.14	655	18.85	689	20.51	721	22.51	750	24.43	777	26.28
	30000	527	15.67	550	16.22	573	16.71	604	17.84	637	19.53	672	21.63	705	23.38	737	25.16	768	27.31	795	29.37
	32000	559	18.92	581	19.53	602	20.03	628	20.90	658	22.39	690	24.39	723	26.63	753	28.44	784	30.37	811	32.54
	34000	591	22.60	612	23.28	632	23.84	653	24.48	681	25.74	710	27.55	739	29.75	771	32.16	799	34.04	828	36.04
	36000	623	26.73	643	27.47	662	28.09	680	28.62	705	29.66	732	31.25	759	33.29	788	35.76	817	38.26	844	40.23
	38000	656	31.34	675	32.14	693	32.83	710	33.42	730	34.17	755	35.51	780	37.38	806	39.60	834	42.26	861	44.90
	40000	688	36.46	707	37.31	724	38.07	741	38.73	757	39.29	779	40.45	804	42.09	827	44.14	853	46.63	879	49.41



## System Start-up

**Table 26. 100% exhaust fan drive selections — casings 2 to 6**

Casing Size	3 Hp		5 Hp		7½ Hp		10 Hp		15 Hp		20 Hp	
	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No
2	500	5										
	600	6										
	700	7										
	800	8										
	900	9										
3	500	5	700	7	800	8						
	600	6	800	8	900	9						
	700	7	900	9	1000	A						
	800	8	1000	A	1100	B						
	900	9										
4			400	4	600	6	700	7				
			500	5	700	7	800	8				
			600	6	800	8						
			700	7								
			800	8								
5			400	4	600	6	700	7	700	7		
			500	5	700	7	800	8	800	8		
			600	6	800	8			900	9		
			700	7								
			800	8								
6			400	4	600	6	600	6	700	7	800	8
			500	5	700	7	700	7	800	8		
			600	6								

**Table 27. 100% exhaust fan drive selections — casing 9**

Casing Size	15 HP		20 HP		25 HP		30 HP		40 HP	
	RPM	Drive No								
9	500	5	500	5	600	6	600	6	700	7
	600	6	600	6	700	7	700	7	800	8
			700	7	800	8	800	8		

**Table 28. W\_HE casings 2-6 50% modulating exhaust fan performance**

Casing Size	CFM Std. Air	Negative Static Pressure													
		0.200		0.400		0.600		0.800		1.000		1.200		1.400	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2	2000	346	0.14	465	0.27	560	0.43	641	0.60	712	0.79	776	1.00	836	1.21
	3000	397	0.27	495	0.42	583	0.61	662	0.81	731	1.03	795	1.27	854	1.51
	4000	469	0.51	546	0.68	621	0.88	691	1.11	757	1.36	818	1.62	876	1.90
	5000	548	0.88	613	1.08	675	1.30	736	1.55	794	1.81	850	2.10	903	2.39
	6000	630	1.40	690	1.66	742	1.90	793	2.16	844	2.45	894	2.75	943	3.06
3	2000	346	0.14	465	0.27	560	0.43	641	0.60	712	0.79	776	1.00	836	1.21
	3000	397	0.27	495	0.42	583	0.61	662	0.81	731	1.03	795	1.27	854	1.51
	4000	469	0.51	546	0.68	621	0.88	691	1.11	757	1.36	818	1.62	876	1.90
	5000	548	0.88	613	1.08	675	1.30	736	1.55	794	1.81	850	2.10	903	2.39
	6000	630	1.40	690	1.66	742	1.90	793	2.16	844	2.45	894	2.75	943	3.06
	7000	714	2.10	769	2.42	818	2.72	862	3.00	906	3.29	950	3.61	993	3.95
4 & 5	3000	281	0.20	396	0.39	486	0.60	560	0.83	625	1.07	683	1.33	737	1.61
	5000	326	0.55	404	0.73	485	0.99	559	1.29	627	1.61	687	1.94	741	2.28
	7000	411	1.35	459	1.51	513	1.74	571	2.04	629	2.39	686	2.77	740	3.18
	9000	508	2.80	540	2.92	578	3.13	618	3.40	662	3.72	706	4.09	751	4.50
	11000	609	5.05	633	5.16	661	5.34	691	5.58	723	5.87	756	6.21	792	6.59
6	4000	271	0.29	364	0.54	438	0.82	499	1.07	550	1.30	601	1.56	651	1.87
	6000	339	0.71	391	0.90	456	1.22	517	1.60	572	2.01	622	2.43	668	2.85
	8000	425	1.55	460	1.73	497	1.96	542	2.30	591	2.72	639	3.20	684	3.73
	10000	517	2.88	543	3.13	571	3.34	600	3.59	632	3.94	649	4.37	707	4.87
	12000	612	4.84	651	5.15	655	5.43	678	5.68	702	5.95	726	6.29	752	6.71
	13000	659	6.09	679	6.44	699	6.76	720	7.04	741	7.31				

Note: Shaded areas of table identify nonstandard drive selections.

**Table 29. W\_HE casing 9 50% modulating exhaust fan performance**

Casing Size	CFM Std. Air	Negative Static Pressure																			
		0.250		0.500		0.750		1.000		1.250		1.500		1.750		2.000		2.250		2.500	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9	12000	432	4.09	461	4.31	502	4.86	545	5.67	585	6.35	622	7.19	655	7.99	686	8.78	717	9.57	748	10.48
	14000	495	6.40	519	6.65	547	6.96	582	7.64	619	8.57	655	9.42	689	10.26	721	11.26	750	12.21	777	13.14
	16000	559	9.46	581	9.77	602	10.02	628	10.45	658	11.20	690	12.19	723	13.32	753	14.22	784	15.18	811	16.27
	18000	623	13.36	643	13.73	662	14.05	680	14.31	705	14.83	732	15.63	759	16.65	788	17.88	817	19.13	844	20.12
	20000	688	18.23	707	18.66	724	19.03	741	19.36	757	19.65	779	20.22	804	21.04	827	22.07	853	23.31	879	24.70



## System Start-up

**Table 30. 50% exhaust fan drive selections (casings 2-9)**

Casing Size	3 HP		5 HP		7½ HP		15 HP	
	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No
2	500	5						
	600	6						
	700	7						
	800	8						
	900	9						
3	500	5	800	8				
	600	6	900	9				
	700	7	1000	A				
	800	8						
	900	9						
4 & 5			500	5	600	6		
			600	6	700	7		
			700	7				
6			400	4	700	7		
			500	5				
			600	6				
9							500	5
							600	6
							700	7
							800	8

## Economizer Damper Adjustment

### Exhaust Air Dampers

With the unit "Off", verify that the exhaust dampers (if equipped) close tightly when the unit is off. Adjust the damper linkage as necessary to ensure proper closure. An access panel is provided under each damper assembly.

### Fresh Air & Return Air Damper Operation

The fresh air and return air damper linkage is accessible from the filter section of the unit. The damper linkage connecting the fresh air dampers to the return air dampers is preset from the factory in the number 1 position. Refer to [Table 31, p. 90](#) for the appropriate linkage position for the unit and operating airflow (cfm).

### **⚠ WARNING**

#### **Reinforce base sheet metal surface!**

**Do NOT walk on the base sheet metal surface before it has been reinforced. Bridging between the unit's main supports may consist of multiple 2 by 12 boards or sheet metal grating. Failure to comply could result in death or serious injury.**

Arbitrarily adjusting the fresh air dampers to open fully when the return air dampers are closed or; failing to maintain the return air pressure drop with the fresh air dampers when the return air dampers are closed, can

overload the supply fan motor and cause building pressurization control problems due to improper cfm being delivered to the space.

The fresh air/return air damper linkage is connected to a crank arm with a series of holes that allows the installer or operator to modify the amount of fresh air damper travel in order to match the return static pressure. Refer to [Table 31](#) for the equivalent return air duct losses that correspond to each of the holes illustrated in [Figure 49, p. 92](#).

### To Adjust the Fresh Air Damper Travel:

1. Drill a 1/4" hole through the unit casing up stream of the return air dampers. Use a location that will produce an accurate reading with the least amount of turbulence. Several locations may be necessary, and average the reading.

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door located in the unit control panel and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the RT-SVP04\*-EN (VAV) or RT-SVP05\*-EN (CV) for the SERVICETEST screens and programming instructions.
5. Use [Table 20, p. 75](#) to program the following system components for operation by scrolling through the Human Interface displays;
  - Supply Fan (On)
  - Variable Frequency Drive (100% Output, if applicable)
  - RTM Occ/Unocc Output (Unoccupied)
  - Fresh Air Dampers (Closed)
6. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
7. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fan will begin to operate.
8. With the fresh air dampers fully closed and the supply fan operating at 100% airflow requirements, measure the return static pressure at the location determined in step 1.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.
10. Compare the static pressure reading to the static pressure ranges and linkage positions in [Table 32, p. 91](#) for the unit size and operating cfm.
11. Remove the drive rod and swivel from the crank arm(s). If only one hole requires changing, loosen only that end.
12. Manually open the return air dampers to the full open position.
13. Manually close the fresh air dampers.
14. Re-attach the drive rod and swivel to the appropriate hole(s). The length of the drive rod may need to be adjusted to align with the new hole(s) location. If so, loosen the lock nut on the drive rod against the swivel. Turn the swivel "in" or "out" to shorten or lengthen the rod as necessary. For some holes, both ends of the rod will have to be adjusted.
15. Tighten the lock nut against the swivel(s).
16. Plug the holes after the proper cfm has been established.

**Table 31. F/A damper travel adjustment**

Position of Connecting Rod (See <a href="#">Figure 49, p. 92</a> )	Damper Crank Arm Hole Configuration
Position #1	2 - 3
Position #2	2 - 4
Position #3	2 - 5
Position #4	2 - 6
Position #5	1 - 8
Position #6	1 - 7

**Note:** As shipped from the factory, the connect rod is installed in Position #1.

**Note:** Use the tables below to select the appropriate crank arm hole configuration based on the; a. specific unit, b. operating cfm, c. and return static pressure.

**⚠ WARNING**

**Rotating Components!**

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

7. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fan will begin to operate.
8. With the fresh air dampers fully closed and the supply fan operating at 100% airflow requirements, measure the return static pressure at the location determined in step 1.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.
10. Compare the static pressure reading to the static pressure ranges and linkage positions in [Table 32, p. 91](#) for the unit size and operating cfm.

To relocate the fresh air/return air connecting rod to balance the fresh air damper pressure drop against the return static pressure, use the following steps. If no adjustment is necessary, proceed to [Step 16](#).



## System Start-up

**Table 32. Fresh air damper pressure drop (inches w.c.)**

### Casing 2 (20 and 25 Ton) Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
4000	0.03	0.04	0.06	0.13	0.16	0.33
6000	0.03	0.04	0.10	0.20	0.30	0.90
8000	0.19	0.21	0.32	0.52	0.75	1.75
9000	0.30	0.35	0.48	0.76	1.08	2.40
10000	0.45	0.51	0.70	1.05	1.57	-
11000	0.62	0.71	0.95	1.42	2.15	-

### Casing 5 (50 Ton) Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
10000	0.03	0.04	0.09	0.18	0.23	0.55
14000	0.09	0.12	0.20	0.35	0.50	1.36
18000	0.31	0.36	0.50	0.79	1.10	-
20000	0.45	0.51	0.70	1.05	1.57	-
22000	0.58	0.66	0.75	1.30	1.95	-
24000	0.75	0.88	1.10	1.75	2.50	-

### Casing 3 (30 Ton) Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
6000	0.03	0.04	0.07	0.15	0.20	0.43
8000	0.03	0.05	0.11	0.21	0.30	0.90
10000	0.15	0.19	0.26	0.43	0.62	1.50
11000	0.20	0.25	0.37	0.60	0.85	1.85
12000	0.31	0.36	0.50	0.79	1.10	2.40
13000	0.42	0.48	0.62	0.97	1.42	-

### Casing 6 (60 - 75 Ton) Units

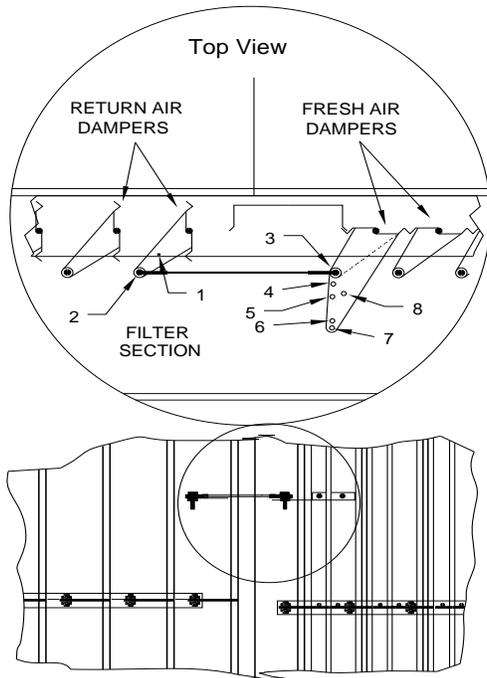
CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
14000	0.03	0.04	0.12	0.25	0.35	1.05
18000	0.19	0.21	0.32	0.52	0.75	1.75
22000	0.45	0.51	0.70	1.05	1.57	-
26000	0.70	0.80	1.02	1.58	2.30	-
28000	0.88	1.03	1.30	2.20	-	-
30000	1.05	1.22	1.55	2.65	-	-

### Casing 4 (40 Ton) Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
8000	0.03	0.04	0.08	0.16	0.21	0.52
10000	0.03	0.05	0.11	0.21	0.30	0.90
12000	0.10	0.13	0.21	0.38	0.55	1.40
14000	0.20	0.25	0.37	0.60	0.85	1.85
16000	0.41	0.46	0.60	0.94	1.38	-
18000	0.56	0.65	0.74	1.28	1.92	-

### Casing 9 (90 - 130 Ton) Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
27000	0.31	0.36	0.50	0.79	1.10	2.40
32000	0.55	0.64	0.72	1.25	1.88	-
36000	0.75	0.88	1.10	1.75	2.50	-
40000	1.00	1.18	1.50	2.50	-	-
43000	1.20	1.42	1.92	-	-	-
46000	1.40	1.58	2.29	-	-	-

**Figure 49. Fresh air & return air linkage adjustment**


## Thermostatic Expansion Valves

The reliability and performance of the refrigeration system is heavily dependent upon proper expansion valve adjustment. Therefore, the importance of maintaining the proper superheat cannot be over emphasized. Accurate measurements of superheat will provide the following information.

1. How well the expansion valve is controlling the refrigerant flow.
2. The efficiency of the evaporator coil.
3. The amount of protection the compressor is receiving against flooding or overheating. The expansion valves shipped installed in this unit were factory set to control between 14-18°F at the ARI full load rating conditions (approximately 45°/125°F saturated suction/ discharge). At part load, expect a properly adjusted expansion valve to control to 8-12°F superheat. In typical applications, field adjustment should not be required unless the valves are replaced or damaged. Systems operating with lower superheat could cause serious compressor damage due to refrigerant floodback.

Systems operating with superheat exceeding 20°F:

- Could cause excessive compressor cycling on internal winding thermostat which leads to compressor motor failure.
- Lowers the efficiency of the evaporator by reducing the heat transfer capability.

Tables are based on outdoor ambient between 65°F & 105°F, relative humidity above 40 percent. Measuring the operating pressures can be meaningless outside of these ranges.

### Measuring Superheat

1. Measure the suction pressure at the suction line gauge access port located near the compressor.
2. Using a Refrigerant/Temperature chart, convert the pressure reading to a corresponding saturated vapor temperature.
3. Measure the suction line temperature as close to the expansion valve bulb, as possible. Use a thermocouple type probe for an accurate reading.
4. Subtract the saturated vapor temperature obtained in step 2 from the actual suction line temperature obtained in step 3. The difference between the two temperatures is known as "superheat".

When adjusting superheat, recheck the system subcooling before shutting the system "Off".

### Electric, Steam and Hot Water Start-Up (Constant Volume & Variable Air Volume Systems)

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position.

#### **⚠ WARNING**

#### **Hazardous Voltage!**

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

2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of RT-SVP04\*-EN (VAV) or RT-SVP05\*-EN (CV) for the SERVICE TEST screens and programming instructions.
5. Use [Table 20, p. 75](#) to program the following system components for operation by scrolling through the Human Interface displays;



## System Start-up

### Electric Heat

- Supply Fan (On)
- Variable Frequency Drive (100% Output, if applicable)
- RTM Occ/Unocc Output (Unoccupied)
- Heat Stages 1 & 2 (On)

### Steam or Hot Water Heat

- Supply Fan (On)
  - Variable Frequency Drive (100% Output, if applicable)
  - RTM Occ/Unocc Output (Unoccupied)
  - Hydronic Heat Actuator (100% Open)
  - Open the main steam or hot water valve supplying the rooftop heater coils.
6. Once the configuration for the appropriate heating system is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
  7. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the fan will begin to operate.
  8. Once the system has started, verify that the electric heat or the hydronic heat system is operating properly by using appropriate service technics; i.e. amperage readings, delta tees, etc.
  9. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

### Gas Furnace Start-Up

#### (Constant Volume & Variable Air Volume Systems)

It is important to establish and maintain the appropriate air/fuel mixture to assure that the gas furnace operates safely and efficiently.

Since the proper manifold gas pressure for a particular installation will vary due to the specific BTU content of the local gas supply, adjust the burner based on CO<sub>2</sub> and O<sub>2</sub> levels.

The volume of air supplied by the combustion blower determines the amount of O<sub>2</sub> available for combustion, while the manifold gas pressure establishes fuel input. By measuring the percentage of CO<sub>2</sub> produced as a by-product of combustion, the operator can estimate the amount of O<sub>2</sub> used and modify the air volume or the gas pressure to obtain the proper air/fuel ratio.

Arriving at the correct air/fuel mixture for a furnace results in rated burner output, limited production of carbon monoxide, and a steady flame that minimizes nuisance shutdowns.

### **⚠ 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 or lead to excessive carbon monoxide. 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**

#### **Flammable Vapors!**

When connecting to existing gas lines be sure to shut off the gas supply ahead of connection point. To avoid explosion or possible fire, always purge all residual gas from piping before cutting into existing line or removing threaded fittings. Failure to shut off the gas supply and remove all gas vapors could result in death or serious injury.

### Two Stage Gas Furnace

#### High-Fire Adjustment

1. Use [Table 20, p. 75](#) to program the following system components for operation by scrolling through the Human Interface displays;

#### Gas Heat

- Supply Fan (On)
  - Variable Frequency Drive (100% Output, if applicable)
  - RTM Occ/Unocc Output (Unoccupied)
  - Heat Stages 1 & 2 (On)
  - Turn the 115 volt control circuit switch 4S24 located in the heater control panel to the "On" position.
  - Open the manual gas valve, located in the gas heat section.
2. Once the configuration for the appropriate heating system is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
  3. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the system will begin to operate.
  4. Once the system has started, check the appearance of the flame through the sight glass provided on the front of the heat exchanger. In appearance, a normal flame

has a clearly defined shape, and is primarily (75%) blue in color with an orange tip.

5. Check the manifold gas pressure by using the manifold pressure port on the gas valve. Refer to [Table 33, p. 94](#) for the required manifold pressure for high-fire operation. If it needs adjusting, remove the cap covering the high-fire adjustment screw on the gas valve. Refer to [Figure 52, p. 95](#) for the adjustment screw location. Turn the screw clockwise to increase the gas pressure or counterclockwise to decrease the gas pressure.
6. Use a CO<sub>2</sub> analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in [Figure 50, p. 94](#). Take several samples to assure that an accurate reading is obtained. Refer to [Table 33](#) for the proper CO<sub>2</sub> levels. A carbon dioxide level exceeding the range in [Table 33](#) indicates incomplete combustion due to inadequate air or excessive gas.

### Air Volume Adjustment (O<sub>2</sub>)

7. Use an O<sub>2</sub> analyzer and measure the percentage of O<sub>2</sub> in the flue gas. Take several samples to assure an accurate reading. Compare the measured O<sub>2</sub> level to the combustion curve in [Figure 51, p. 95](#). The O<sub>2</sub> content of the flue gas should be 4 to 5%. If the O<sub>2</sub> level is outside this range, adjust the combustion air damper to increase or decrease the amount of air entering the combustion chamber. Refer to [Figure 54, p. 98](#) for the location of the combustion air damper.
8. Recheck the O<sub>2</sub> and CO<sub>2</sub> levels after each adjustment. After completing the high-fire checkout and adjustment procedure, the low-fire setting may require adjusting.

### Low-Fire Adjustment (500 MBH, 850 & 1,000 MBH only)

1. Use the TEST initiation procedures outlined in the previous section to operate the furnace in the low-fire state (1st Stage).
2. Use a CO<sub>2</sub> analyzer and measure the percentage of CO<sub>2</sub> in the flue gas. Refer to the illustration in [Figure 50, p. 94](#). Take several samples to assure that an accurate reading is obtained. Refer to [Table 33, p. 94](#) for the proper CO<sub>2</sub> levels. If the measured CO<sub>2</sub> level is within the listed values, no adjustment is necessary. A CO<sub>2</sub> level exceeding the range in [Table 33](#) indicates incomplete combustion due to inadequate air or excessive gas.
3. Check the manifold gas pressure by using the manifold pressure port on the gas valve. Refer to [Table 33](#) for the required manifold pressure during low-fire operation. If it needs adjusting, remove the cap covering the low-fire adjustment screw on the gas valve. Refer to [Figure 52, p. 95](#) for the adjustment screw location. Turn the screw clockwise to increase the gas pressure or counterclockwise to decrease the gas pressure.

**Note:** Do not adjust the combustion air damper while the furnace is operating at low-fire.

4. Check the CO<sub>2</sub> levels after each adjustment.
5. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

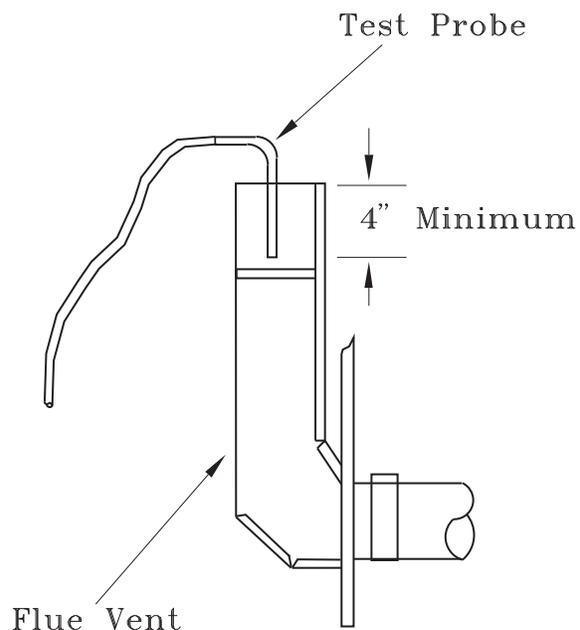
**Table 33. Recommended manifold pressures and CO<sub>2</sub> levels during furnace operation (see notes)**

Furnace Stage	MBH	Firing Rate	Manifold	
			% CO <sub>2</sub>	Pressure
High-Fire	235	100%	8.5-9.5	3.0-3.5
Low-Fire	117	50%	6.0-7.0	0.9
High-Fire	350	100%	8.5-9.5	3.0-3.5
Low-Fire	175	50%	6.0-7.0	0.9
High-Fire	500	100%	8.5-9.5	3.0-3.5
Low-Fire	250	50%	6.0-7.0	1.25
High-Fire	850	100%	8.5-9.5	3.0-3.5
Low-Fire	500	59%	6.0-7.0	1.25
High-Fire	1000	100%	8.5-9.5	3.0-3.5
Low-Fire	500	50%	6.0-7.0	1.25

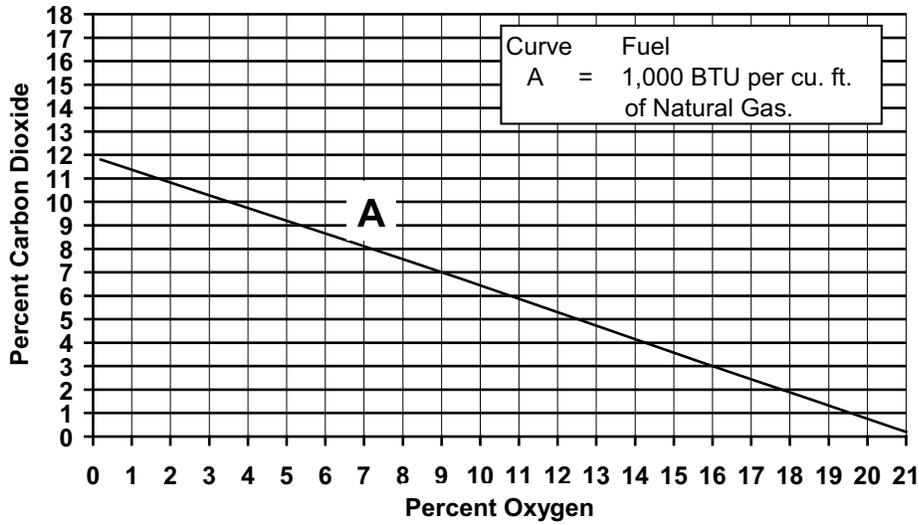
**Notes:**

1. Manifold pressures are given in inches w.c.
2. High fire manifold pressure is adjustable on all heaters.
3. Low fire manifold pressure is non-adjustable on 235 MBH and 350 MBH heaters.

**Figure 50. Flue gas carbon dioxide & oxygen measurements**

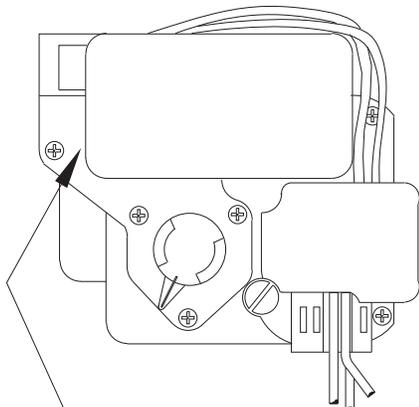


**Figure 51. Natural gas combustion curve (ratio of O<sub>2</sub> to CO<sub>2</sub> in percent)**

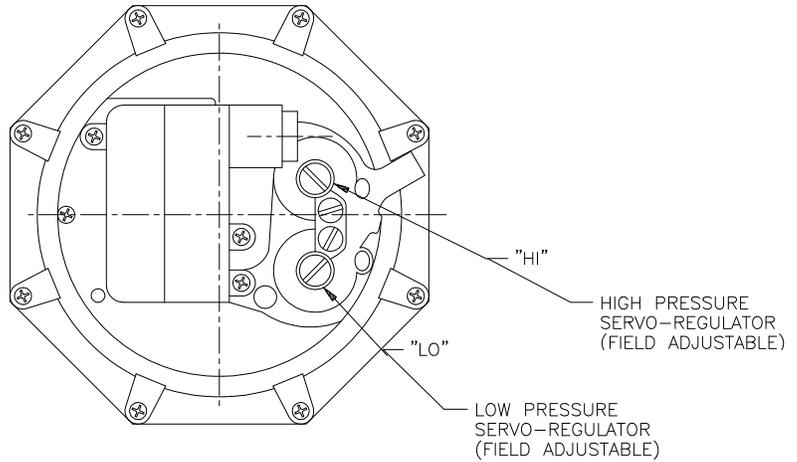


**Figure 52. Gas valve adjustment screw locations**

Top View  
235/350 MBH



"High-Fire" Manifold Pressure Adjustment Screw is Located Under this Cover (Turn Clockwise to Increase) (Turn Counterclockwise to Decrease)



"HI"  
HIGH PRESSURE SERVO-REGULATOR (FIELD ADJUSTABLE)  
"LO"  
LOW PRESSURE SERVO-REGULATOR (FIELD ADJUSTABLE)

## Full Modulating Gas Furnace

Full Modulating gas heaters are available for the 500, 850 and 1000 MBH heater sizes. These heaters are available in the same cabinet sizes as the current heaters. The firing rate of the unit can vary from the pilot rate of 125 MBH up to the nameplate rating of the unit. The turn down ratios, therefore, vary from 4:1 for the 500 MBH to 8:1 for the 1000 MBH heater.

## Heat Exchanger

The heat exchanger drum, tubes and front and rear headers are constructed from stainless steel alloys.

## Unit Control

The unit is controlled by a supply air temperature sensor located in the supply air stream for VAV units. CV units have two sensors, one located in the supply air stream and the zone sensor. The temperature sensor signal is sent to the Heat module of the IntelliPak Unit Control. The control signal from the Heat Module is an inverse proportional 5 -10V DC. The higher the voltage signal, the lower the call for heat.

The 5 -10V DC. signal controls the angular position of the combustion air damper through a direct coupled damper actuator motor. The position of the air damper in turn controls the combustion air pressure that is sensed by the modulating gas valve. The greater the combustion air pressure, the greater the call for gas and the higher the firing rate of the heater. As the temperature setpoint is reached, the Modulating Heat control will cause the combustion air actuator to change the damper position to a lower firing rate that matches the heat load of the space.

1. Use [Table 20, p. 75](#) to program the following system components for operation by scrolling through the Human Interface displays;

## Gas Heat

- Supply Fan (On)
  - Variable Frequency Drive (100% Output, if applicable)
  - RTM Occ/Unocc Output (Unoccupied)
  - High Fire (90%)
  - Turn the 115 volt control circuit switch 4S24 located in the heater control panel to the "On" position.
  - Open the manual gas valve, located in the gas heat section.
2. Once the configuration for the appropriate heating system is complete, press the NEXT key until the LCD displays the "Start test in \_\_Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
  3. Press the TEST START key to start the test. Remember that the delay designated in the previous step must elapse before the system will begin to operate.

4. Once the system has started, check the appearance of the flame through the sight glass provided on the front of the heat exchanger. In appearance, a normal flame has a clearly defined shape, and is primarily (75%) blue in color with an orange tip.
5. Check the inlet gas pressure at the modulating gas valve. The inlet pressure should be 6" to 8" w.c.
6. Use a CO<sub>2</sub> analyzer and measure the percentage of CO<sub>2</sub> in the flue gas. Refer to the illustration in [Figure 50, p. 94](#). Take several samples to assure that an accurate reading is obtained. If the measured CO<sub>2</sub> level is between 8.0 and 9.5%, no adjustment is necessary. If the CO<sub>2</sub> is outside this range, it indicates incomplete combustion due to inadequate air or excessive gas.

The pressure ratio and bias adjustment screws are located on top of the regulator under a sealed plate. The actual settings can be seen through windows on each side of the regulator. Refer to the illustration in [Figure 53, p. 97](#).

**Note:** *The burner capacity is controlled by the movement of the air damper. This has been preset at the factory and normally does not need field adjustment. The combustion quality (air/gas) is controlled by the settings on the regulator (the plus (+) and minus (-) indications relate to the change in gas flow.*

7. Set the air/gas ratio to the desired value using the #1 adjustment screw until the optimum values between (8.0 and 9.5%) are obtained (course setting).
8. Use [Table 20, p. 75](#) to program the minimum (5%) firing rate. Allow the system to operate for approximately 10 minutes.
9. Use a CO<sub>2</sub> analyzer and measure the percentage of CO<sub>2</sub> in the flue gas. If the measured CO<sub>2</sub> level is between 6.0 and 8.0%, no adjustment is necessary. If an adjustment is needed, turn the #2 adjustment screw on the regulator in the Plus (+) direction to increase the CO<sub>2</sub> and in the Minus (-) direction to decrease the CO<sub>2</sub>. Refer to the illustration in [Figure 53](#) for the adjustment screw location.

**Note:** *It is normal for the low fire CO<sub>2</sub> to be lower than the high fire.*

10. If the measured CO<sub>2</sub> level is below the recommended values for low heat, return the burner to 90% fire rate and repeat steps 6 and 7, to achieve optimum combustion.
11. Program the burner for 100% operation and recheck the CO<sub>2</sub> or O<sub>2</sub> value.
12. Check the flue gas values at several intermediate output levels. If corrections are necessary;
  - Adjust the pressure ratio screw 1 at high fire operation only.
  - Adjust the bias screw 2 at low fire operation only.

## System Start-up

- Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

### Limited Modulating Gas Furnace

Limited Modulating gas heaters are available for the 500, 850 and 1000 MBH heater sizes. These heaters are available in the same cabinet sizes as the current heaters. The firing rate of the unit can vary from 33% rated MBH up to the nameplate rating of the unit. The turn down ratios, therefore, is limited to 3:1.

### Heat Exchanger

The heat exchanger drum, tubes and front and rear headers utilizes the same materials as the standard two stage furnace.

### Unit Control

The unit is controlled by a supply air temperature sensor located in the supply air stream for VAV units. CV units have two sensors, one located in the supply air stream and the zone sensor. The temperature sensor signal is sent to the Heat module of the IntelliPak Unit Control. The control signal from the Heat Module is an inverse proportional 5 -10V DC. The higher the voltage signal, the lower the call for heat.

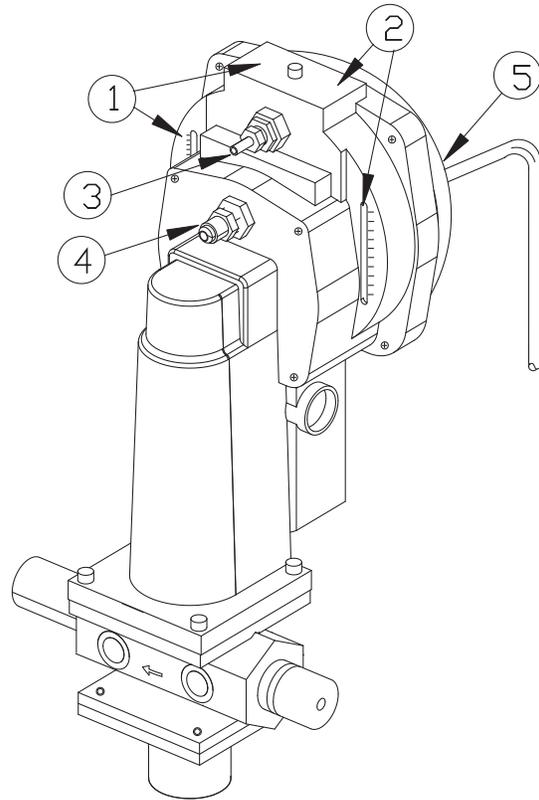
The 5 -10V DC. signal controls the angular position of the combustion air damper through a direct coupled damper actuator motor. The position of the air damper in turn controls the combustion air pressure that is sensed by the modulating gas valve. The greater the combustion air pressure, the greater the call for gas and the higher the firing rate of the heater. As the temperature setpoint is reached, the Modulating Heat control will cause the combustion air actuator to change the damper position to a lower firing rate that matches the heat load of the space.

- To verify and check system optimum combustion, use [Table 20, p. 75](#) to program the limited modulating heat system components for 90% operation by scrolling through the Human Interface displays.
- Follow the checkout procedures discussed in the previous steps.

**Note:** The minimum firing rate for a limited modulating gas furnace in step 8 is 33%. Travel of the combustion air damper is limited by a welded stop.

- Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

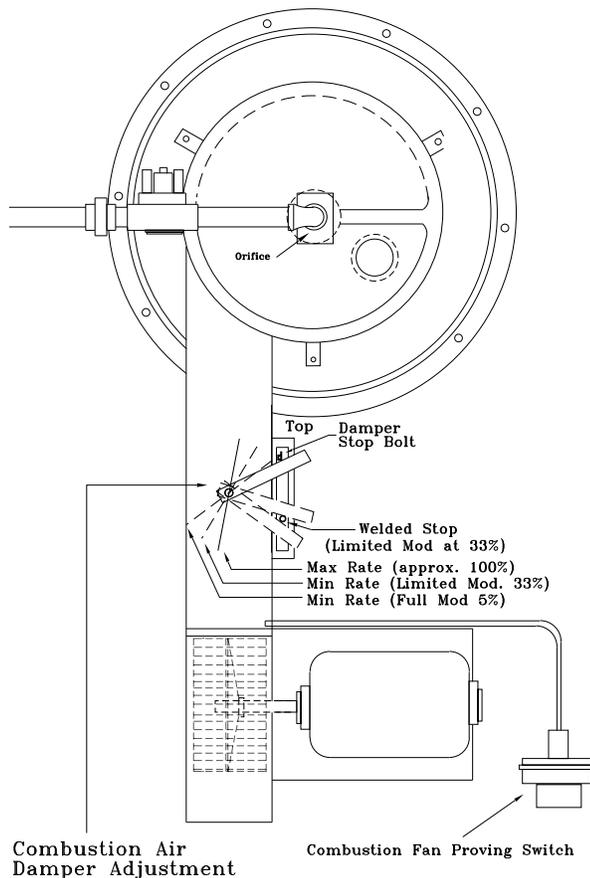
**Figure 53. Modulating gas regulator**



**Figure 53 – Modulating Gas Regulator Legend**

- Adjustment and indication of the air to gas ratio.
- Adjustment and indication of the bias.
- Connection for the Ambient compensation line.
- Connection for the gas pressure sensing line.
- Connection for the air pressure sensing line.

**Note:** There are no serviceable parts on the SKP70 actuator. Should it become inoperative, replace the actuator.

**Figure 54. Typical gas furnace damper assembly**


## Final Unit Checkout

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

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

- Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
- Turn the 115 volt control circuit switch 1S1 "Off".
- Turn the 24 volt control circuit switch 1S70 to the "On" position.
- At the Human Interface Module, press the "SETUP" key. The LCD screen will display various preset "parameters of operation" based on the unit type, size, and the installed options. Compare the factory preset information to the specified application requirements. If adjustments are required, follow the step-by-step instructions provided in RT-SVP04\*-EN (VAV) or RT-SVP05\*-EN (CV).
- Program the Night Setback (NSB) panel (if applicable) for proper unoccupied operation. Refer to the programming instructions for the specific panel.
- Verify that the Remote panel "System" selection switch, "Fan" selection switch, and "Zone Temperature" settings for constant volume systems are correct.
- Verify that the Remote panel "System" selection switch and the "Supply Air Temperature" settings for variable air volume systems are correct.
- Inspect the unit for misplaced tools, hardware, and debris.
- Turn the 115 volt control circuit switch 1S1 "On".
- Verify that all exterior panels are secured in place.
- Press the "AUTO" key at the Human Interface Module to begin system operation. The system will start automatically once the dampers modulate and a request for either heating or cooling has been given.
- Verify the control panel doors are secured in place.

# Service & Maintenance

**Table 34. Control settings and time delays**

Control Description	Elec. Designation	Contacts Open	Contacts Closed
Combustion Airflow Switch (Gas Heat Only)	4S25	see Note 1	0.1 - 0.25" wc rise in press diff
High Limit Cutout (Gas Heat Only)	4S26	250 + 15°F	210°F
Supply Airflow Switch (Gas Heat Only)	4S38	0.03 - 0.12" wc	0.15 + 0.05" wc rise in press diff
Disch High Limit (Electric Heat Only)	4S27	133 + 5°F	110 + 5°F
Linear High Limit (Electric Heat Only)	4S33	185 + 10°F (std./cULus) 165 F + 10°F (cULus)	145°F (std./cULus) 125°F (cULus)
Freezestat (Hydronic Heat Only)	4S12	(N.O.) Auto Reset	40°F
Gas Heat Units Prepurge Timer: Fenwall	4DL5	N.C. - timed to close	60 seconds
Honeywell	4U18	internal timing function	60 seconds
Sequencing Time Delay Relay	4DL6	N.C. - timed to close	60 seconds + 20%

**Note:** The combustion airflow switch (4S25) differential is 0.02" - 0.08" wc.



# Service & Maintenance

**Figure 55. Unit internal fuse replacement data for air-cooled units**

<b>TRANE</b> <small>THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS DISCLOSED TO OUTSIDE PARTIES WITHOUT THE CONSENT OF TRANE.</small>		FILE NUMBER: 2313-1107	DRAWING NUMBER: 2313-1108	SHEET: 1 OF 1	REV C
DRAWN BY: D. SHANNON	TRANE® DATE: 2-22-11	<b>ROOFTOP PACKAGED AIR CONDITIONER DIAGRAM</b> FIELD CONNECTION EXTERNAL DEVICES - AREA 5 20-130 TON CONSTANT VOLUME & SINGLE ZONE VAV			
REPLACES: 2307-9176	REVISION DATE: 1-20-12				
CAD SYSTEM USED: Pro/DETAIL	SIMILAR TO: --				

**NOTES:**

- 19 15A FUSE REPLACEMENT IS REQUIRED FOR 50 THRU 60 TON - 0.50 KVA TRANSFORMER WITH 200V - 230V - 460V OR 575V UNIT VOLTAGE.  
20A FUSE REPLACEMENT IS REQUIRED FOR 50 THRU 60 TON - 0.50 KVA TRANSFORMER WITH 380V OR 415V UNIT VOLTAGE.
- 29 SEE FUSE REPLACEMENT TABLE ON VFD PANEL FOR VFD POWER FUSES (F40, F41, F42).

FUSE REPLACEMENT TABLE												
CONDENSER FAN FUSE 1F1 THRU 1F6 CLASS RKS	UNIT VOLTAGE	200	230	380	415	460	575					
	TIME DELAY	25A	25A	15A	15A	15A	15A					
CONTROL POWER FUSE												
CONTROL (1T1) TRANSFORMER RATING		0.25 KVA	0.30 KVA	0.50 KVA	0.75 KVA	1.00 KVA	1.50 KVA					
1F7 CLASS CC - TYPE FNQ-R	20-30 TON	6.25A	6.25A	--	10A	--	--					
	40 TON	15A	20A	--	20A	--	--					
	50-60 TON	--	--	15A	--	20A	--					
	70-75 TON	--	--	--	--	15A	20A					
	90-130 TON	--	--	--	--	15A	20A					
ELECTRIC HEAT FUSE	4F19 THRU 4F36, 4F46, 47, 48			CLASS K5			60A					
COMPRESSOR PROTECTION FUSE	1F44 & 1F45			TYPE MTH			6A					
TRANSFORMER CIRCUIT FUSE	1F72 THRU 1F74			TYPE FNQ-R			15A					
STANDARD MOTORS												
VFD PROTECTION FUSES 29	UNIT VOLTAGE	FUSE RATING	3 HP	5 HP	7.5 HP	10 HP	15 HP	20 HP	25 HP	30 HP	40 HP	50 HP
OPTIONAL SUPPLY FAN 20 THRU 130 TON 1F57-1F62  OPTIONAL EXHAUST / RETURN FAN 20 THRU 130 TON 1F63-1F65 (CLASS "T" FUSES)	200V/60/3	600V	40A	45A	80A	100A	125A	175A	225A	225A	350A	N/A
	230V/60/3	600V	25A	45A	60A	90A	125A	150A	175A	225A	300A	N/A
	380V/50/3	600V	15A	30A	45A	50A	90A	100A	125A	150A	200A	N/A
	415V/50/3	600V	15A	30A	45A	50A	90A	100A	125A	150A	200A	N/A
	460V/60/3	600V	15A	25A	35A	45A	60A	90A	100A	125A	150A	200A
575V/60/3	600V	15A	15A	25A	35A	50A	70A	80A	90A	125A	175A	
OPTIONAL CONVENIENCE OUTLET FUSE 1F55 AND 1F56 (TIME DELAY TYPE FNQ-R FUSE)	200V/60/3	230V/60/3	380V/50/3	415V/50/3	460V/60/3	575V/60/3						
	12A	10A	N/A	N/A	5A	4A						
CUSTOMER CONNECTION WIRE RANGE												
NOTES:  A. BLOCK SIZE & DISCONNECT SIZE ARE CALCULATED BY SELECTING THE SIZE GREATER THAN OR EQUAL TO 1.15 X (SUM OF UNIT LOADS). SEE UNIT LITERATURE FOR UNIT LOAD VALUES.	UNITS WITH MAIN POWER TERMINAL BLOCK (ALL VOLTAGES)						UNITS WITH MAIN POWER DISCONNECT SWITCH (ALL VOLTAGES)					
	BLOCK SIZE	WIRE QTY	CONNECTOR WIRE RANGE			DISCONNECT SIZE	WIRE QTY	CONNECTOR WIRE RANGE				
	335 AMP	(1)	#6 - 350 MCM			100 AMP	(1)	#14 - 1/0				
	760 AMP	(2)	#4 - 500 MCM			250 AMP	(1)	#4 - 350 kcmil				
	840 AMP	(2)	#2 - 600 MCM			400 AMP	(1) OR	#1 - 600 kcmil OR				
							(2)	#1 - 250 kcmil				
						600 AMP	(2)	250 - 500 MCM				
					1000 AMP	(3)	3/0 - 500 kcmil					

**Table 35. Filter data**

Unit Model	Panel-Type Filters		Bag-Type Filters		Cartridge Filters (Box-Type)		Panel-Type Prefilters	
	Qty. <sup>(a)</sup>	Size of each	Qty. <sup>(b)</sup>	Size of each	Qty. <sup>(b)</sup>	Size of each	Qty. <sup>(c)</sup>	Size of each
W_HE-Casing 2 C20 & C25	12	20 X 20 X 2	4	12 X 24 X 19	4	24 X 12 X 12	4	12 X 24 X 2
			3	24 X 24 X 19	3	24 X 24 X 12	3	24 X 24 X 2
W_HE-Casing 3 C30	16	20 X 20 X 2	2	12 X 24 X 19	2	24 X 12 X 12	2	12 X 24 X 2
			6	24 X 24 X 19	6	24 X 24 X 12	6	24 X 24 X 2
W_HE-Casing 4 C40	16	20 X 25 X 2	5	12 X 24 X 19	5	24 X 12 X 12	5	12 X 24 X 2
			6	24 X 24 X 19	6	24 X 24 X 12	6	24 X 24 X 2
W_HE-Casing 5 C50	20	20 X 25 X 2	3	12 X 24 X 19	3	24 X 12 X 12	3	12 X 24 X 2
			9	24 X 24 X 19	9	24 X 24 X 12	9	24 X 24 X 2
W_HE-Casing 6 C60, C70 & C75	35	16 X 20 X 2	6	12 X 24 X 19	6	24 X 12 X 12	6	12 X 24 X 2
			8	24 X 24 X 19	8	24 X 24 X 12	8	24 X 24 X 2
W_HE-Casing 9 C90 & D11	25	24 X 24 X 2	3	12 X 24 X 19	3	24 X 12 X 12	3	20 X 24 X 2
			15	24 X 24 X 19	15	24 X 24 X 12	15	24 X 24 X 2
W_HE-Casing 9 D12 & D13	25	24 X 24 X 2	3	12 X 24 X 19	3	24 X 12 X 12	3	20 X 24 X 2
			15	24 X 24 X 19	15	24 X 24 X 12	15	24 X 24 X 2

(a) Dimensions shown for "Panel-Type Filters" apply to "Throw away", "Cleanable Wire Mesh", and "High Efficiency Throw away" Filters.

(b) W\_HE units ordered with "Bag-Type Filters" or "Cartridge Filters" (box-type) include a bank of "Panel-Type Prefilters"

(c) The same "Panel-Type Prefilters" are used with "Bag-Type" and "Cartridge (box-type)" filters.

**Table 36. "Wet heat" coil fin data**

Model	Coil Type	Coil Rows	Total Coil Face Area (sq.ft.)	Fins per Foot	Fins per Foot
WLHE Casings 2 & 3, C20, C25, C30	WC Prima Flo (hot water)	2	13.75	80	110
WLHE Casings 4 & 5, C40, C50	WC Prima Flo (hot water)	2	19.25	80	110
WLHE Casing 6, C60, C70, C75	WC Prima Flo (hot water)	2	26.25	80	110
WLHE Casing 9, C90, D11, D12, D13	WC Prima Flo (hot water)	2	17.5 (2)	80	110
WSHE Casings 2 & 3, C20, C25, C30	NS (steam)	1	13.75	42	96
WSHE Casings 4 & 5, C40, C50, C55	NS (steam)	1	13.75 (1) 5.5 (1)	42	96
WSHE Casing 6, C60, C70, C75	NS (steam)	1	18.75 (1) 7.5 (1)	42	72
WSHE Casing 9, C90, D11, D12, D13	NS (steam)	1	17.5 (2)	52	96

**Note:** To determine unit heating capacity (i.e., "low heat" or "high heat"), refer to Digit 9 of the model number stamped on the unit nameplate.

**Table 37. Grease recommendations**

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



## Service & Maintenance

**Table 38. Refrigerant coil fin data**

Casing	Evaporator Coil		
	Size (ft <sup>2</sup> )	Rows/Fin Series	Tube Diameter/Surface
2	20.3	4/168	1/2"/Enhanced
	20.3	4/168	1/2"/Enhanced
3	25.5	5/168	3/8"/Enhanced
4	32.5	5/168	3/8"/Enhanced
5	38	4/168	1/2"/Enhanced
6	43	6/168	3/8"/Enhanced
9	59.3	6/148	1/2"/Enhanced

**Table 39. Supply and exhaust fan VFD programming parameters<sup>(a)</sup>**

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/3hp.
	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 Speed	Set Based on Motor Nameplate	Sets the motor rpm
Limits & Warnings	4-18	Current Limit	100% x Rated Current	Limits the maximum current to motor

(a) These parameters are motor specific and the actual motor nameplate rating must be used. Do not use the unit nameplate values.

### 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 39 have been set before replacing the drive.

*Load & Motor, press OK, use the Down button to select 1-2, press OK, and finally use the Down button until parameter 1-23 is displayed. Parameter 1-23 can then be modified by pressing OK button and using Up and Down 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:

- At the unit, turn the 115 volt control circuit switch 1S70 to the "Off" position.
- Turn the 24 volt control circuit switch to the "Off" position.
- To modify parameters:
  - Press Main Menu button (press [Back] button if the main menu does not display)
  - Use the Up and Down Arrow buttons to find the parameter menu group (first part of parameter number)
  - Press OK
  - Use Up and Down Arrow buttons to select the correct parameter sub-group (first digit of second part of parameter number)
  - Press OK

**⚠ WARNING**

**Hazardous Voltage w/Capacitors!**

**Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. 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.**

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

**Note:** 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 Down button to scroll down to

- (f) Use Up and Down Arrow buttons to select the specific parameter
  - (g) Press OK
  - (h) To move to a different digit within a parameter setting, use the Left and Right Arrow buttons (Highlighted area indicates digit selected for change)
  - (i) Use Up and Down Arrow 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 (3) for each menu selection setting in [Table 39, p. 102](#).
  5. To reset all 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 main supply and wait until the display turns off.
    - (f) Reconnect the main supply - the frequency converter is now reset.
    - (g) Ensure parameter 14-22 Operation Mode has reverted back to "Normal Operation"

### Notes:

- *Item 5 resets the drive to the default factory settings. The program parameters listed in [Table 39, p. 102](#) will need to be verified or changed as described in [Item 3](#) and [Item 4](#).*
  - *Some of the parameters listed in the [Table 39, p. 102](#) 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.*
  - *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.*
6. Follow the start-up procedures for supply fan in the "Variable Air Volume System" section or the "Exhaust Airflow Measurement" start-up procedures for the exhaust fan.
  7. After verifying that the VFD(s) are operating properly, press the STOP key at the Human Interface Module to stop the unit operation.
  8. Follow the applicable steps in the "Final Unit Checkout" section to return the unit to its normal operating mode 9.

## Fan Belt Adjustment

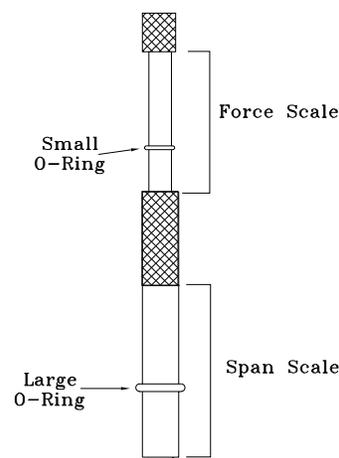
The supply fan belts and optional exhaust fan belts must be inspected periodically to assure proper unit operation. Replacement is necessary if the belts appear frayed or

worn. Units with dual belts require a matched set of belts to ensure equal belt length.

When removing or installing the new belts, do not stretch them over the sheaves. Loosen the belts using the belt tension adjustment bolts on the motor mounting base. Once the new belts are installed, using a Browning or Gates tension gauge (or equivalent) illustrated in [Figure 56](#); adjust the belt tension as follows;

1. To determine the appropriate belt deflection;
  - a. Measure the center-to-center distance (in inches) between the fan and motor sheaves.
  - b. Divide the distance measured in [Step a](#) by 64; the resulting value represents the amount of belt deflection that corresponds to the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in [Step b](#).
3. Set the small O-ring at zero on the force scale of the gauge plunger.
4. Place the large end of the gauge at the center of the belt span; then depress the gauge plunger until the large O-ring is even with the top of the next belt — or even with a straightedge placed across the fan and motor sheaves as illustrated in [Figure 57, p. 104](#).
  - a. Remove the belt tension gauge. The small O-ring now indicates a number other than zero on the plunger's force scale. This number represents the force (in pounds) required to give the needed deflection.

**Figure 56. Belt tension gauge**



5. Compare the "force" scale reading ([Step 5](#)) with the appropriate "force" value listed in [Figure 40, p. 104](#). If the "force" reading is outside the range, readjust the belt tension.

**Note:** Actual belt deflection "force" must not exceed the maximum "force" value shown in the [Figure 40, p. 104](#).

## Service & Maintenance

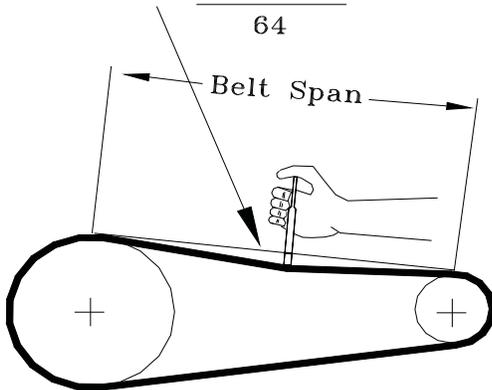
6. Recheck the tension of the new belts at least twice during the first 2 to 3 days of operation. Belt tension will decrease rapidly until the new belts are "run in." Readjust the belt tension as necessary to correct for any stretching that may have occurred.

**Table 40. Belt tension measurement and deflection ranges**

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
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		

**Figure 57. Belt span**

$$\text{Deflection} = \frac{\text{Belt Span}}{64}$$

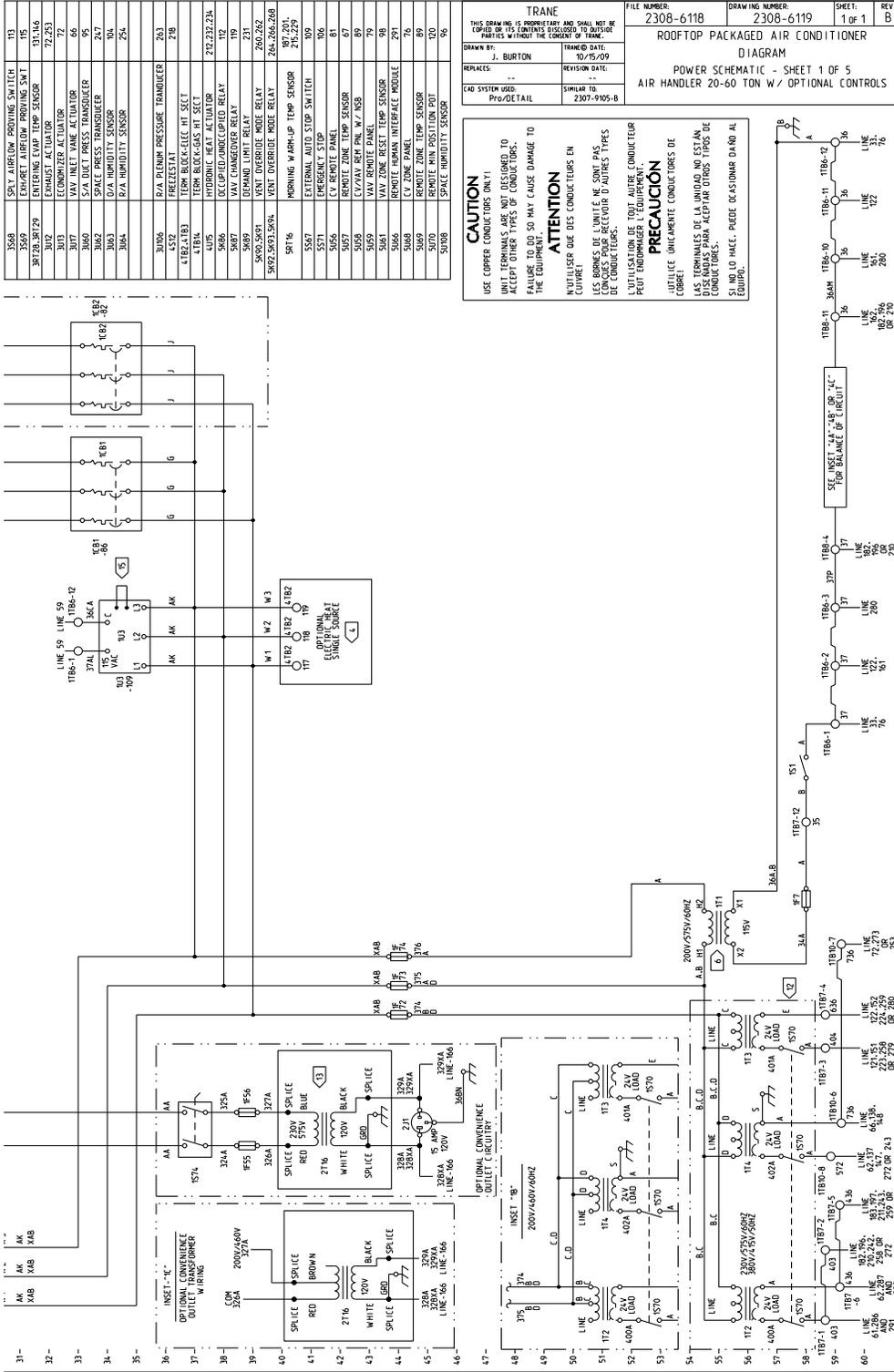






# Service & Maintenance

### Figure 58. (continued from previous page) Typical power wiring schematic - power wires - standard - casing 2-9 air handler with optional controls





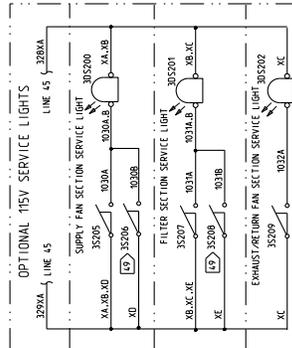
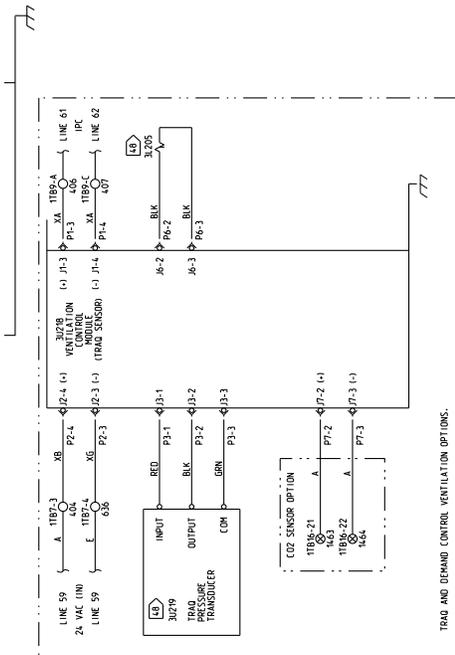


Service & Maintenance

Figure 59. (continued from previous page) Typical wiring schematic for air handler with DX coil, casing 2-9

TRANE		FILE NUMBER:	DRAWING NUMBER:	SHEET:	REV
THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS REPRODUCED OR USED BY ANY PARTIES WITHOUT THE CONSENT OF TRANE.			2308-6141	1 OF 1	A
DRAWN BY:	J. BURTON	TRANE DATE:	10/25/09	ROOFTOP PACKAGED AIR CONDITIONER DIAGRAM	
REPLACES:	--	REVISION DATE:	--	SCHEMATIC - MULTIPLE CIRCUIT COMPRESSOR MODULE AIR HANDLER W/ OPTIONAL CONTROLS 20-90 TON SHEET 3 OF 5	
CAD SYSTEM USED:	PRO/DETAIL	SIMILAR TO:	2307-5915-A		
			2308-6020-A		

- NOTES
- 42 > STAGING SHOWN WITH LEAD/AG DISABLED.
  - 43 > RTCL & RTFC SENSORS ARE FACTORY INSTALLED. WHEN USING A CLK DX COOLING COIL, WHEN AN FC STYLE COIL IS USED, THESE SENSORS ARE SHIP WITH ITEMS.
  - 48 > 3L205, 3U209 AND ASSOCIATED WIRING NOT USED ON UNITS WITH DEMAND CONTROL VENTILATION OPTION.
  - 49 > 3S206, 3S208 AND ASSOCIATED WIRING USED ON UNITS WITH SERVICE LOOP OPTION WITH EXTRA ACCESS DOORS IN SUPPLY AND RETURN SECTIONS OF UNIT.

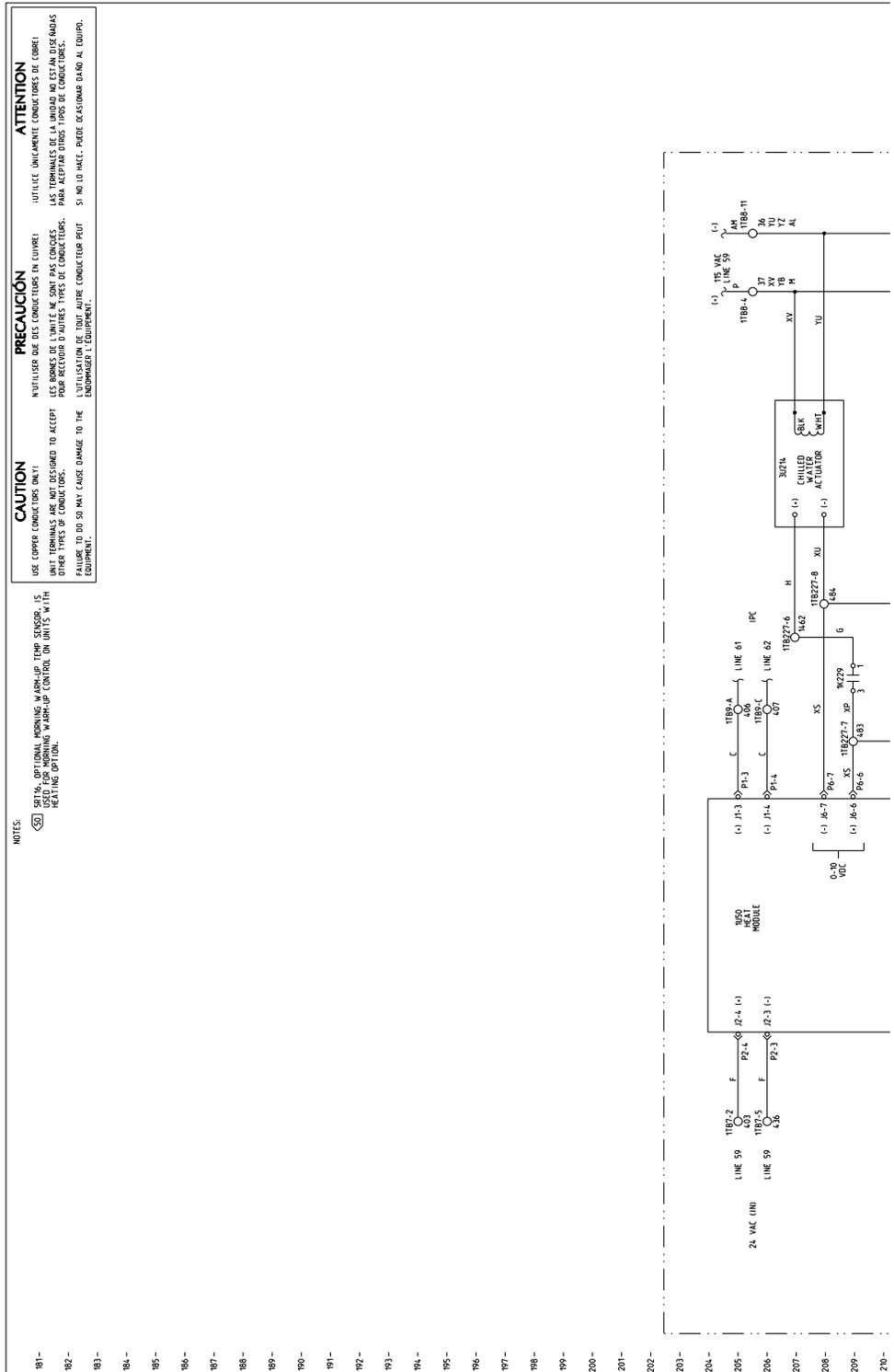


**CAUTION**  
USE COPPER CONDUCTORS ONLY!  
UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.  
FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.

**PRECAUCIÓN**  
NO UTILIZAR QUE LOS CONDUCTORES EN COBRE!  
LAS BORNAS DE LA UNIDAD NO ESTÁN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES.  
SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.

**ATTENTION**  
UTILISE UNICAMENTE CONDUCTEURS DE COBRE!  
LES TERMINALES DE LA UNIDAD NO SONT PAS CONÇUES POUR ACCEPTER D'AUTRES TIRES DE CONDUCTEURS.  
SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.

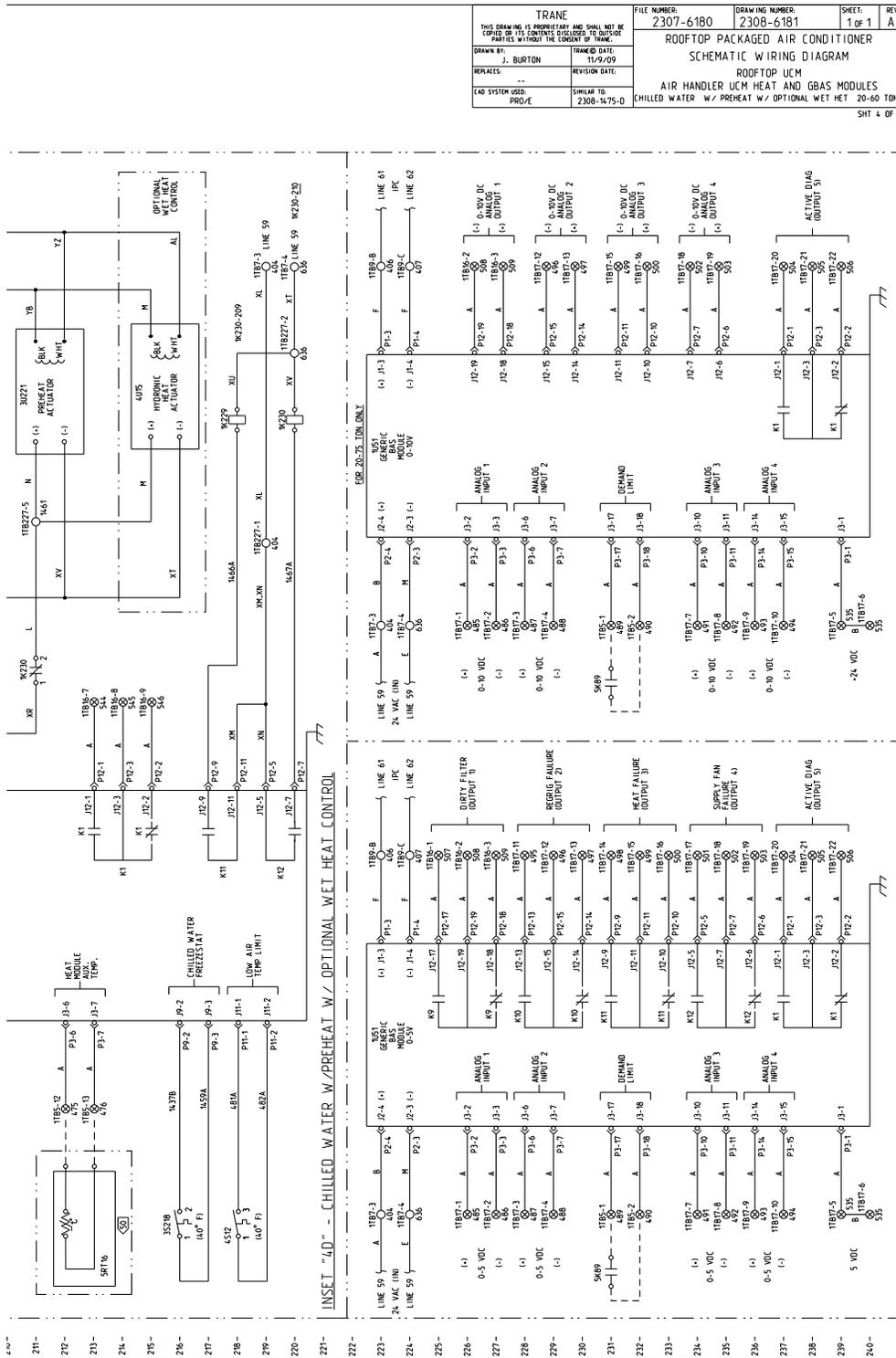
Figure 60. Typical wiring schematic for air handler chilled water with or without preheat, casing 2-9





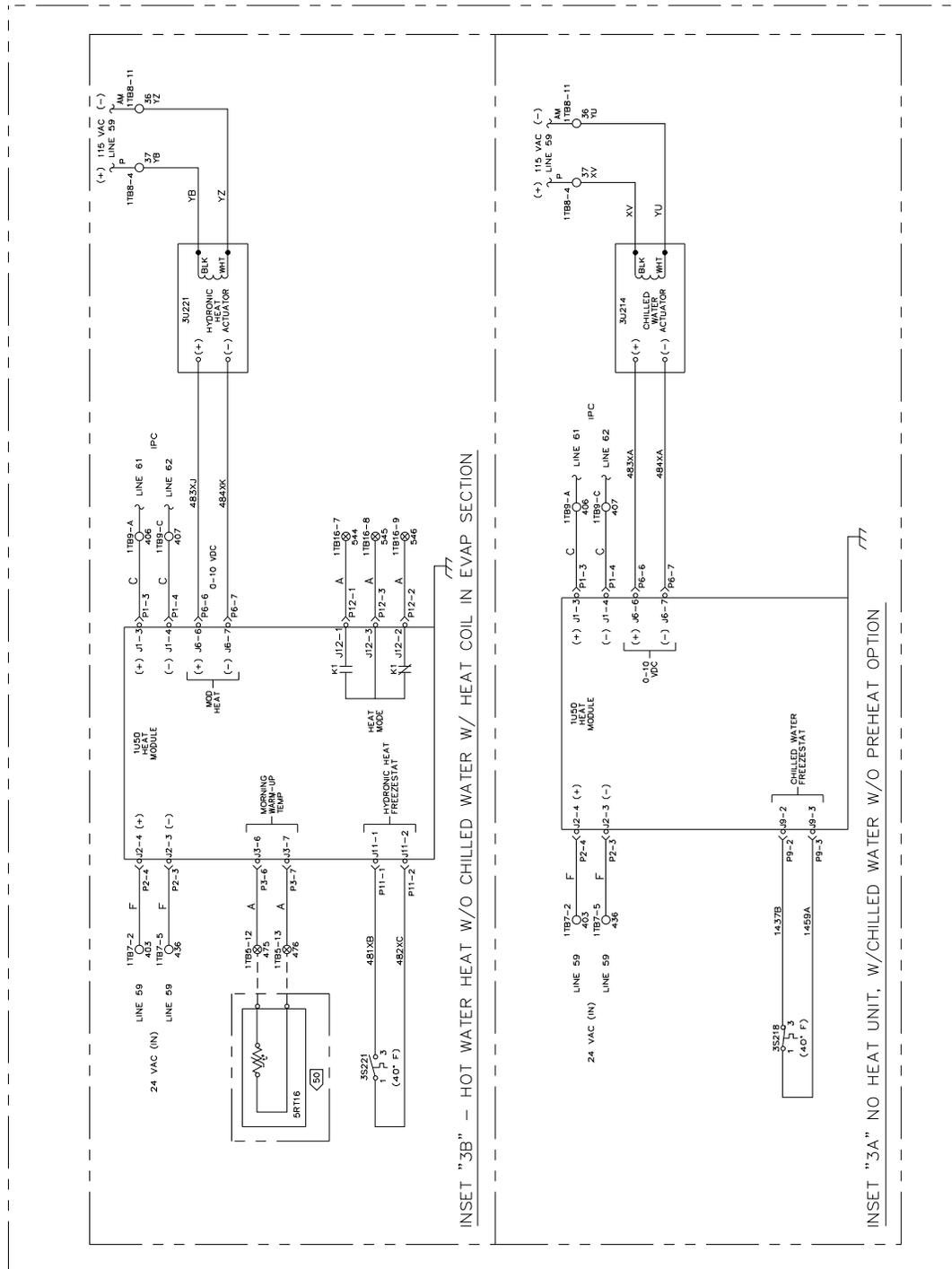
# Service & Maintenance

### Figure 60. (continued from previous page) Typical wiring schematic for air handler chilled water with or without preheat, casing 2-9



# Monthly Maintenance

Figure 61. Typical RTM wiring schematic for casing 2 - 9



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

### ⚠ WARNING

#### Hazardous Voltage!

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

#### Filters

- Inspect the return air filters. Clean or replace them if necessary. Refer to the [Table 35, p. 101](#) for filter information.

#### Cooling Season

- Check the unit's drain pans and condensate piping to ensure that there are no blockages.
- Inspect the evaporator 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.
- 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.
- Lubricate the supply fan shaft bearings with a lithium based grease. Refer to [Table 37, p. 101](#) for recommended greases.

**Important:** *The bearings are manufactured using a special synthetic lithium based grease designed for long life and minimum lube 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 to the bearings and fan wheels. Make sure that all bearing supports are tight.

- Check the supply fan belt(s). If the belts are frayed or worn, replace them. Refer to the "Fan Belt Adjustment" section for belt replacement and adjustments.
- 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 wire terminal connections are tight.
- Remove any corrosion present on the exterior surfaces of the unit and repaint these areas.

- Generally inspect the unit for unusual conditions (e.g., loose access panels, leaking piping connections, etc.)
- Make sure that all retaining screws are reinstalled in the unit access panels once these checks are complete.

#### Heating Season

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

### ⚠ WARNING

#### Hazardous Voltage!

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

- Inspect the unit's air filters. If necessary, clean or replace them.
- Check supply fan motor bearings; repair or replace the motor as necessary.
- Lubricate the supply fan shaft bearings with a lithium based grease. Refer to [Table 37, p. 101](#) for recommended greases.

**Important:** *The bearings are manufactured using a special synthetic lithium based grease designed for long life and minimum lube 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.
- Gas Heat Units only - Check the heat exchanger for any corrosion, cracks, or holes.
- Check the combustion air blower for dirt. Clean as necessary.

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

- Open the main gas valve and apply power to the unit heating section; then initiate a "Heat" test using the start-up procedure described in "Gas Furnace Start-Up".
- Verify that the ignition system operates properly.

## 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 and condenser coils using the instructions outlined below. Be sure to follow these instructions as closely as possible to avoid damaging the coils.

## Refrigerant Coils

To clean refrigerant coils, use a soft brush and a garden pump-type sprayer. A high-quality mild detergent is also required. If the detergent selected is strongly alkaline (pH value exceeds 8.5), add an inhibitor (contact your local Trane Parts Center for appropriate detergents). Spray the detergent on the complete surface of the coil, let stand for 5 minutes and thoroughly rinse with high volume low pressure sprayer. Clean the coil from the inside out, top down for best results

1. Remove the access panels on both sides of the unit and the filters.

### **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, resulting in the operator/technician to fall. Failure to follow this recommendation could result in death or serious injury.**

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

2. Straighten any bent coil fins with a fin comb. (Use the data in [Table 38, p. 102](#) to determine the appropriate fin comb size.)
3. 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.

### **WARNING**

#### **Hazardous Pressures!**

**Coils contain refrigerant under pressure. When cleaning coils, maintain coil cleaning solution temperature under 150°F to avoid excessive pressure in the coil. Failure to follow these safety precautions could result in coil bursting, which could result in death or serious injury.**

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

4. Pour the cleaning solution into the sprayer.
5. 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.
6. Rinse both sides of the coil with cool, clean water.
7. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 7 and 8.
8. Reinstall all of the components and panels removed in Step 2; then restore power to the unit.

## Steam or Hot Water Coils

To clean a steam or hot water coil, use a soft brush, a steam-cleaning machine, and water.

1. Verify that switches 1S1 and 1S70 are turned "OFF", and that the main unit disconnect is locked open.
2. Remove enough panels and components from the unit to gain sufficient access to the coil.
3. Straighten any bent coil fins with a fin comb. (Use the data in [Table 36, p. 101](#) to determine the appropriate fin comb size.)
4. Remove loose dirt and debris from both sides of the coil with a soft brush.
5. Use the steam-cleaning machine to clean the leaving-air side of the coil first; start at the top of the coil and work downward; then clean the entering-air side of the coil, starting at the top of the coil and working downward.
6. Check both sides of the coil; if it still appears dirty, repeat [Step 5](#).
7. Reinstall all of the components and panels removed in [Step 2](#); then restore power to the unit.



# Wiring Matrix

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

Diagram Number	Description
2308-6115	Connection, Control Box - w/Supply VFD Air Handler
2308-6116	Connection, Control Box - w/Exh/Rtn VFD Air Handler
2308-6117	Connection, Control Box - w/Sup & Exh/Rtn VFD Air Handler
2308-6119	Schematic, Power - Standard Air Handler
2308-6120	Schematic, Power - w/Supply VFD Air Handler
2308-6121	Schematic, Power - w/ Exhaust/Return VFD Air Handler
2308-6122	Schematic, Power - w/Sup & Exh/Rtn VFD Air Handler
2308-6129	Connection, Unit Control Module - w/ Supply VFD
2308-6130	Connection, Unit Control Module - w/ Exh/Rtn VFD
2308-6131	Connection, Unit Control Module - w/Sup & Exh/Rtn VFD
2308-6137	Connection, Raceway Devices - Air Handler Standard
2308-6138	Connection, Raceway Devices - w/ Supply VFD
2308-6139	Connection, Raceway Devices - w/ Exh/Rtn VFD
2308-6140	Connection, Raceway Devices - w/Sup & Exh/Rtn VFD
2308-6141	Schematic- Controls - MCM - 20-90 Ton
2308-6171	Connection, Standard - w/ Chilled Water
2308-6172	Connection - w/ Chilled Water & Sup VFD
2308-6173	Connection - w/ Chilled Water & Exh/Rtn VFD
2308-6174	Connection - w/ Chilled Water & Sup & Exh/Rtn VFD
2308-6181	Schematic-UCM - Heat - GBAS 0-5V-GBAS 0-10V- 20-60 Ton
2308-6182	Schematic - VCM - W/O EXH OR RTN VFD



# Warranty and Liability Clause

## Commercial Equipment Rated 20 Tons and Larger and Related Accessories

**PRODUCTS COVERED** - This warranty\* is extended by Trane 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 start-up or 18 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion or deterioration.

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.

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

The warranty and liability set forth herein are in lieu of all other warranties and liabilities, whether in contract or in negligence, express or implied, in law or in fact, including implied warranties of merchantability and fitness for particular use. In no event shall the Company be liable for any incidental or consequential damages.

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 WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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.

### **NOTICE:**

#### **Equipment Damage From Ultraviolet (UV) Lights!**

Trane does not recommend field installation of ultraviolet lights in its equipment for the intended purpose of improving indoor air quality. High intensity C-band ultraviolet light is known to severely damage polymer (plastic) materials and poses a personal safety risk to anyone exposed to the light without proper personal protective equipment. Polymer materials commonly found in HVAC equipment that may be susceptible include insulation on electrical wiring, fan belts, thermal insulation, various fasteners and bushings. Degradation of these materials can result in serious damage to the equipment.

Trane accepts no responsibility for the performance or operation of our equipment in which ultraviolet devices were installed outside of the Trane factory or its approved suppliers.



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