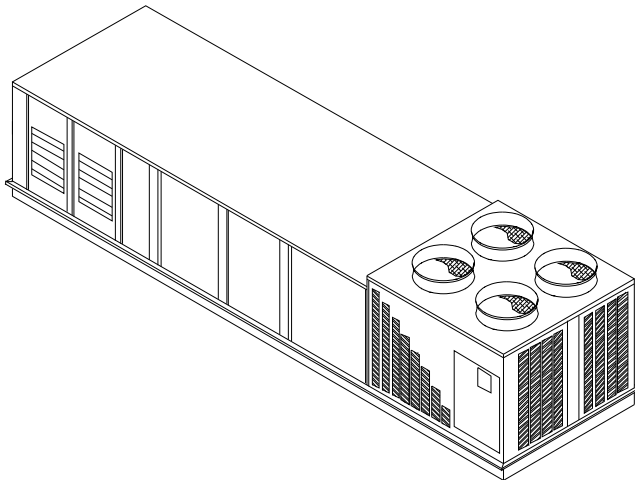




# Installation, Operation, and Maintenance

## IntelliPak™

Commercial Single-Zone Rooftop Air Conditioners  
with CV, VAV, or SZVAV Controls



"A" and later Design Sequence

**SAHL** \*20, \*25, \*30, \*40, \*50, \*55, \*60, \*70, \*75

**SEHL, SFHL, SLHL, SSSL, SXHL** \*20, \*25, \*30, \*40, \*50, \*55, \*60, \*70, \*75,  
\*24, \*29, \*36, \*48, \*59, \*73, \*80, \*89

**SXHK, SEHK, SFHK, SLHK, SSKH** \*90, \*11, \*12, \*13

### ⚠ 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.

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

- |                  |   |
|------------------|---|
| <b>⚠ WARNING</b> | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.   |
| <b>⚠ CAUTION</b> | 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. |
| <b>NOTICE:</b>   | Indicates a situation that could result in equipment or property-damage only accidents.   |
- 

## Important Environmental Concerns!

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

## Responsible Refrigerant Practices!

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

<b>⚠ WARNING</b>
<b>Proper Field Wiring and Grounding Required!</b> All field wiring <b>MUST</b> be performed by qualified personnel. Improperly installed and grounded field wiring poses <b>FIRE</b> and <b>ELECTROCUTION</b> hazards. To avoid these hazards, you <b>MUST</b> follow requirements for field wiring installation and grounding as described in <b>NEC</b> 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

#### Risk of Roof Collapsing!

Confirm with a structural engineer that the roof structure is strong enough to support the combined weight of the roofcurb and the unit. Refer to ["Unit Dimensions & Weight Information," p. 32](#) for typical unit and curb weights. Failure to ensure proper structural roof support could cause the roof to collapse, which could result in death or serious injury and property damage.

## Unit Nameplate

One Mylar unit nameplate is located on the outside upper left corner of the control panel door. It includes the unit model number, serial number, electrical characteristics, weight, refrigerant charge, 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, and a third nameplate is located on the inside of the control panel door.

## Compressor Nameplate

The Nameplate for the Scroll Compressor is located on the compressor lower housing.

### WARNING

#### Fiberglass Wool!

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

#### Precautionary Measures

- Avoid breathing fiberglass dust.
- Use a NIOSH approved dust/mist respirator.



## Warnings, Cautions and Notices

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

### First Aid Measures

**Eye Contact - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.**

**Skin Contact - Wash affected areas gently with soap and warm water after handling.**

### Overview of Manual

This booklet describes proper installation, start-up, operation, and maintenance procedures for 20 through 130 Ton rooftop air conditioners 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.

These units are equipped with electronic Unit Control Modules (UCM) 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 programming manual for CV or VAV applications before attempting to operate or service this equipment.

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

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

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.

### 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.
- 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.
- Remove the protective plastic coverings that shipped over the compressors.

**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 startup.

**Note:** *Do not use the unit's heater for temporary heat without first completing the startup 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.



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# Model Number Descriptions

**S A H L \* 5 0 4 0 A 6 8 A 6 B D 8 0 0 1 0 0 W 0 0 G 0 B 0 0 0 R 0 0 0 8 0 0**  
**1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38**

## DIGIT 1 - UNIT TYPE

S = Self-Contained (Packaged Rooftop)

## DIGIT 2 - UNIT FUNCTION

A = DX Cooling, No Heat  
 E = DX Cooling, Electric Heat  
 F = DX Cooling, Natural Gas Heat  
 L = DX Cooling, Hot Water Heat  
 S = DX Cooling, Steam Heat  
 X = DX Cooling, No Heat, Extended Casing

## DIGIT 3 - UNIT AIRFLOW

H = Single Zone

## DIGIT 4 - DEVELOPMENT SEQUENCE

L = Sixth

## DIGITS 5,6,7 - NOMINAL CAPACITY

\*20 = 20 Tons Air-Cooled  
 \*25 = 25 Tons Air-Cooled  
 \*30 = 30 Tons Air-Cooled  
 \*40 = 40 Tons Air-Cooled  
 \*50 = 50 Tons Air-Cooled  
 \*55 = 55 Tons Air-Cooled  
 \*60 = 60 Tons Air-Cooled  
 \*70 = 70 Tons Air-Cooled  
 \*75 = 75 Tons Air-Cooled  
 \*24 = 24 Tons Evap Condenser  
 \*29 = 29 Tons Evap Condenser  
 \*36 = 36 Tons Evap Condenser  
 \*48 = 48 Tons Evap Condenser  
 \*59 = 59 Tons Evap Condenser  
 \*73 = 73 Tons Evap Condenser  
 \*80 = 80 Tons Evap Condenser  
 \*89 = 89 Tons Evap Condenser

## DIGIT 8 - POWER SUPPLY

### (See Notes)

4 = 460/60/3 XL E = 200/60/3 XL  
 5 = 575/60/3 XL F = 230/60/3 XL

**Note:** SEHL units (units with electric heat) utilizing 208V or 230V require dual power source.

## DIGIT 9 - HEATING CAPACITY

**Note:** When the second digit calls for "F" (Gas Heat), the following values apply: Additionally, please note G and M available ONLY on 50 Ton models and above.

G = Low Heat-Limited Modulation  
 H = High Heat-2-Stage  
 J = High Heat-Limited  
 L = Low Heat-2-Stage  
 M = Low Heat- Full Modulation  
 O = No Heat  
 P = High Heat-Full Modulation

When the second digit calls for "E" (electric heat), the following values apply:

D = 30 kW R = 130 kW  
 H = 50 kW U = 150 kW  
 L = 70 kW V = 170 kW  
 N = 90 kW W = 190 kW  
 Q = 110 kW

**Note:** When the second digit calls for "L" (Hot Water) or "S" (Steam) Heat, one of the following valve size values must be in Digit 9:

High Heat Coil: 1 = .50", 2 = .75", 3 = 1", 4 = 1.25", 5 = 1.5", 6 = 2".  
 Low Heat Coil: A = .50", B = .75", C = 1", D = 1.25", E = 1.5", F = 2".

## DIGIT 10 - DESIGN SEQUENCE

A = First (Factory Assigned)

**Note:** Sequence may be any letter A thru Z, or any digit 1 thru 9.

## DIGIT 11 - EXHAUST/RETURN OPTION

0 = None  
 1 = Barometric  
 2 = 100% Exhaust 1.5 HP w/Statitrac  
 3 = 100% Exhaust 3 HP w/Statitrac  
 4 = 100% Exhaust 5 HP w/Statitrac  
 5 = 100% Exhaust 7.5 HP w/Statitrac  
 6 = 100% Exhaust 10 HP w/Statitrac  
 7 = 100% Exhaust 15 HP w/Statitrac  
 8 = 100% Exhaust 20 HP w/Statitrac  
 A = 50% Exhaust 1.5 HP  
 B = 50% Exhaust 3 HP  
 C = 50% Exhaust 5 HP  
 D = 50% Exhaust 7.5 HP  
 E = 100% Exhaust 1.5 HP w/o Statitrac (CV Only)  
 F = 100% Exhaust 3 HP w/o Statitrac (CV Only)  
 G = 100% Exhaust 5 HP w/o Statitrac (CV Only)  
 H = 100% Exhaust 7.5 HP w/o Statitrac (CV Only)  
 J = 100% Exhaust 10 HP w/o Statitrac (CV Only)

K = 100% Exhaust 15 HP w/o Statitrac (CV Only)  
 L = 100% Exhaust 20 HP w/o Statitrac (CV Only)  
 9 = 100% Return 3 HP w/Statitrac  
 M = 100% Return 5 HP w/Statitrac  
 N = 100% Return 7.5 HP w/Statitrac  
 P = 100% Return 10 HP w/Statitrac  
 R = 100% Return 15 HP w/Statitrac  
 T = 100% Return 20 HP w/Statitrac  
 U = 100% Return 3 HP w/o Statitrac (CV Only)  
 V = 100% Return 5 HP w/o Statitrac (CV Only)  
 W = 100% Return 7.5 HP w/o Statitrac (CV Only)  
 X = 100% Return 10 HP w/o Statitrac (CV Only)  
 Y = 100% Return 15 HP w/o Statitrac (CV Only)  
 Z = 100% Return 20 HP w/o Statitrac (CV Only)

## DIGIT 12 - EXHAUST/RETURN AIR FAN DRIVE

(Exhaust/Return Fan)

0 = None 8 = 800 RPM  
 4 = 400 RPM 9 = 900 RPM  
 5 = 500 RPM A = 1000 RPM  
 6 = 600 RPM B = 1100 RPM  
 7 = 700 RPM  
 (Return Fan only)  
 C = 1200 RPM H = 1700 RPM  
 D = 1300 RPM J = 1800 RPM  
 E = 1400 RPM K = 1900 RPM  
 F = 1500 RPM  
 G = 1600 RPM

## DIGIT 13 - FILTER

A = Throwaway  
 B = Cleanable Wire Mesh  
 C = High-Efficiency Throwaway  
 D = Bag With Prefilter  
 E = Cartridge With Prefilter  
 F = Throwaway Filter Rack Less Filter Media  
 G = Bag Filter Rack Less Filter Media



## Model Number Descriptions

### DIGIT 14 - SUPPLY AIR FAN HP

1 = 3 HP    4 = 10 HP    7 = 25 HP  
 2 = 5 HP    5 = 15 HP    8 = 30 HP  
 3 = 7.5 HP    6 = 20 HP    9 = 40 HP

### DIGIT 15 - SUPPLY AIR FAN DRIVE

5 = 500 RPM    B = 1100 RPM  
 6 = 600 RPM    C = 1200 RPM  
 7 = 700 RPM    D = 1300 RPM  
 8 = 800 RPM    E = 1400 RPM  
 9 = 900 RPM    F = 1500 RPM  
 A = 1000 RPM

### DIGIT 16 - FRESH AIR

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

### DIGIT 17 - SYSTEM CONTROL

1 = CV - Zone Temperature Control  
 2 = CV - Discharge Temperature Control  
 4 = CV - Zone Temperature Control Space Pressure Control w/ Exhaust/Return VFD w/o Bypass  
 5 = CV - Zone Temperature Control Space Pressure Control w/ Exhaust/Return VFD and Bypass  
 6 = VAV Discharge Temperature Control w/ VFD w/o Bypass  
 7 = VAV Discharge Temperature Control w/ VFD and Bypass  
 8 = VAV Discharge Temperature Control Supply and Exhaust/Return Fan w/ VFD w/o Bypass  
 9 = VAV Discharge Temperature Control Supply and Exhaust/Return Fan with VFD and Bypass  
 A = VAV - Single Zone VAV - w/ VFD w/o Bypass  
 B = VAV - Single Zone VAV - w/ VFD w/ Bypass  
 C = VAV - Single Zone VAV - Supply and Exhaust/Return Fan w/ VFD w/o Bypass  
 D = VAV - Single Zone VAV - Supply and Exhaust/Return Fan w/ VFD w/ Bypass

### DIGIT 18 - ZONE SENSOR

0 = None  
 A = Dual Setpoint Manual or Auto Changeover (BAYSENS108\*)  
 B = Dual Setpoint Manual or Auto Changeover w/ System Function Lights (BAYSENS110\*)  
 C = Room Sensor w/ Override and Cancel Buttons (BAYSENS073\*)  
 D = Room Sensor w/ Temperature Adjustment and Override and Cancel Buttons (BAYSENS074\*)  
 L = Programmable Zone Sensor w/ System Function Lights for both CV and VAV (BAYSENS119\*)

**Note:** \*Asterisk indicates current model number digit A, B, C, etc. These sensors can be ordered to ship with the unit.

### DIGIT 19 - AMBIENT CONTROL

0 = Standard  
 1 = 0° Fahrenheit

### DIGIT 20 - AGENCY APPROVAL

0 = None (cULus Gas Heater, see note)  
 1 = cULus

**Note:** Includes cULus classified gas heating section only when second digit of Model No. is a "F"

### DIGITS 21 - 38 - MISCELLANEOUS

21 A = Unit Disconnect Switch  
 22 B = Hot Gas Bypass  
 C = Hot Gas Reheat w/out Hot Gas Bypass  
 D = Hot Gas Reheat and Hot Gas Bypass  
 23 0 = Without Economizer  
 C = Economizer Control w/ Comparative Enthalpy  
 Z = Economizer Control w/ Reference Enthalpy  
 W = Economizer Control w/Dry Bulb  
 24 E = Low Leak Fresh Air Dampers  
 25 F = High Duct Temperature Thermostat  
 26 G = High Capacity  
 27 \* = Air-Cooled Aluminum Condenser Coil  
 J = Corrosion Protected Condenser Coil  
 A = Evap Condenser  
 B = Evap Condenser w/ Sump Heater  
 C = Evap Condenser w/ Dolphin WaterCare System  
 D = Evap Condenser w/ Sump Heater and Dolphin WaterCare System  
 E = Evap Condenser w/ Conductivity Controller  
 F = Evap Condenser w/ Conductivity Controller and Sump Heater

28 B = GBAS 0-10V  
 K = GBAS 0-5V  
 R = Rapid Restart  
 30 M = Remote Human Interface  
 31 N = Ventilation Override Module  
 32 R = Extended Grease Lines  
 33 T = Access Doors  
 34 V = Inter-Processor Communication Bridge  
 35 M = BACnet Communication Interface (BCI) Module  
 Y = Trane Communication Interface (TCI) Module  
 7 = Trane LonTalk Communication Interface (LCI) Module  
 36 8 = Spring Isolators  
 37 6 = Factory-Powered 15A GFI Convenience Outlet/Disconnect Switch  
 38 J = Temperature Sensor

### Tip: EXAMPLE

**Model numbers:**  
 SAHL\*5040A68A6BD800100W00  
 G0B000R000800 describes a unit with the following characteristics:

*DX Cooling Only unit w/ no extended casing, 50 ton nominal cooling capacity, 460/60/3 power supply, 100 percent exhaust with Statitrac, 10 HP exhaust fan motor with drive selection No. 8 (800 RPM), throwaway filters, 20 HP supply fan motor with drive selection No. B (1100 RPM), 0-100% economizer w/ dry bulb control, supply and exhaust VFD w/o bypass, no remote panel, standard ambient control, cULus agency approval. High capacity unit, extended grease lines and spring isolators.*

*The service digit for each model number contains 38 digits; all 38 digits must be referenced.*



## Model Number Descriptions

S X H K \* 1 1 4 0 A H 8 C E C D 8 0 0 1 \* \* Z \* \* \* \* \* \* \* \* \* \* \* \* \* \* \* \*  
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38

### DIGIT 1 - UNIT TYPE

S = Self-Contained (Packaged Rooftop)

### DIGIT 2 - UNIT FUNCTION

E = DX Cooling, Electric Heat  
 F = DX Cooling, Natural Gas Heat  
 L = DX Cooling, Hot Water Heat  
 S = DX Cooling, Steam Heat  
 X = DX Cooling, No Heat, Extended Casing

### DIGIT 3 - UNIT AIRFLOW

H = Single Zone

### DIGIT 4 - DEVELOPMENT SEQUENCE

K = R-410A Development Sequence

### DIGITS 5,6,7 - NOMINAL CAPACITY

\*90 = 90 Tons Air-Cooled  
 \*11 = 105 Tons Air-Cooled  
 \*12 = 115 Tons Air-Cooled  
 \*13 = 130 Tons Air-Cooled

### DIGIT 8 - POWER SUPPLY (See Notes)

4 = 460/60/3 XL  
 5 = 575/60/3 XL

### DIGIT 9 - HEATING CAPACITY

0 = No Heat  
 H = High Heat - 2-Stage  
 J = High Heat - Limited Modulation  
 P = High Heat - Full Modulation

**Note:** When the second digit calls for "E" (electric heat), the following values apply in the ninth digit:

W = 190 kW

**Note:** When the second digit calls for "L" (Hot Water) or "S" (Steam) Heat, one of the following valve size values must be in Digit 9:

High Heat Coil: 3 = 1", 4 = 1.25", 5 = 1.5", 6 = 2", 7 = 2.5"  
 Low Heat Coil: C = 1", D = 1.25", E = 1.5", F = 2", G = 2.5"

### DIGIT 10 - DESIGN SEQUENCE

A = First (Factory Assigned)

**Note:** Sequence may be any letter A thru Z, or any digit 1 thru 9.

### DIGIT 11 - EXHAUST/RETURN OPTION

0 = None  
 7 = 100% Exhaust 15 HP w/Statitrac  
 8 = 100% Exhaust 20 HP w/Statitrac  
 9 = 100% Exhaust 25 HP w/Statitrac  
 F = 50% Exhaust 15 HP  
 H = 100% Exhaust 30 HP w/ Statitrac  
 J = 100% Exhaust 40 HP w/ Statitrac  
 K = 100% Exhaust 15 HP w/o Statitrac (CV Only)  
 L = 100% Exhaust 20 HP w/o Statitrac (CV Only)  
 M = 100% Exhaust 25 HP w/o Statitrac (CV Only)  
 N = 100% Exhaust 30 HP w/o Statitrac (CV Only)  
 P = 100% Exhaust 40 HP w/o Statitrac (CV Only)

### DIGIT 12 - EXHAUST AIR FAN DRIVE

(Exhaust Fan)

0 = None  
 5 = 500 RPM  
 6 = 600 RPM  
 7 = 700 RPM  
 8 = 800 RPM

### DIGIT 13 - FILTER

A = Throwaway  
 C = High-Efficiency Throwaway  
 D = Bag With Prefilter  
 E = Cartridge With Prefilter  
 F = Throwaway Filter Rack Less Filter Media  
 G = Bag Filter Rack Less Filter Media

### DIGIT 14 - SUPPLY AIR FAN HP

C = 30 HP (2-15 HP)  
 D = 40 HP (2-20 HP)  
 E = 50 HP (2-25 HP)  
 F = 60 HP (2-30 HP)  
 G = 80 HP (2-40 HP)

### DIGIT 15 - SUPPLY AIR FAN DRIVE

A = 1000 RPM  
 B = 1100 RPM  
 C = 1200 RPM  
 D = 1300 RPM  
 E = 1400 RPM  
 F = 1500 RPM  
 G = 1600 RPM

### DIGIT 16 - FRESH AIR

D = 0-100% Economizer (Std.)

### DIGIT 17 - SYSTEM CONTROL

1 = CV - Zone Temperature Control  
 2 = CV - Discharge Temperature Control  
 4 = CV - Zone Temperature Control Space Pressure Control w/ Exhaust VFD w/o Bypass  
 5 = CV - Zone Temperature Control Space Pressure Control w/ Exhaust VFD and Bypass  
 6 = VAV Discharge Temperature Control w/ VFD w/o Bypass  
 7 = VAV Discharge Temperature Control w/ VFD and Bypass  
 8 = VAV Discharge Temperature Control Supply and Exhaust Fan w/ VFD w/o Bypass  
 9 = VAV Discharge Temperature Control Supply and Exhaust Fan w/ VFD and Bypass  
 A = VAV - Single Zone VAV - w/ VFD w/o Bypass  
 B = VAV - Single Zone VAV - w/ VFD w/ Bypass  
 C = VAV - Single Zone VAV - Supply and Exhaust/Return Fan w/ VFD w/o Bypass  
 D = VAV - Single Zone VAV - Supply and Exhaust/Return Fan w/ VFD w/ Bypass

### DIGIT 18 - ZONE SENSOR

0 = None  
 A = Dual Setpoint Manual or Auto Changeover (BAYSSENS108\*)  
 B = Dual Setpoint Manual or Auto Changeover w/ System Function Lights (BAYSSENS110\*)  
 C = Room Sensor w/ Override and Cancel Buttons (BAYSSENS073\*)  
 D = Room Sensor w/ Temperature Adjustment and Override and Cancel Buttons (BAYSSENS074\*)  
 L = Programmable Zone Sensor w/ System Function Lights for both CV and VAV (BAYSSENS119\*)

**Note:** \*Asterisk indicates current model number digit A, B, C, etc. These sensors can be ordered to ship with the unit.

### DIGIT 19 - AMBIENT CONTROL

0 = Standard

### DIGIT 20 - AGENCY APPROVAL

0 = None (cULus Gas Heater, see note)  
 1 = cULus

**Note:** Includes cULus classified gas heating section only when second digit of Model No. is a "F"



## Model Number Descriptions

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### DIGITS 21 - 38 - MISCELLANEOUS

- 21 A = Unit Disconnect Switch
- 22 B = Hot Gas Bypass
- 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 G = High Capacity Evap. Coil  
(90 & 105 Ton)
- H = High Cap. Evap. Coil and High  
    Eff. Cond. Coil (90 Ton)
- 27 K = Generic B.A.S Module
- R = Rapid Restart
- 29 M = Remote Human Interface
- 30 N = Ventilation Override Module
- 31 R = Extended Grease Lines
- 32 T = Access Doors
- 33 V = Inter-Processor  
Communication Bridge
- 34 W = BCI with Wireless  
Communications Interface  
(WCI)
- Y = Trane Communication Interface  
(TCI) Module
- 34 M = BACnet Communication  
Interface (BCI) Module
- 34 7 = Trane LonTalk Communication  
Interface (LCI) Module
- 35 6 = Factory-Powered 15A GFI  
Convenience Outlet

**Tip: EXAMPLE**

*Model numbers:  
SXHK\*1140AH8CECD8001\*\*Z  
describes a unit with the following  
characteristics:*

*DX cooling with extended casing,  
no heat, 105 ton nominal cooling  
capacity, 460/60/3 power supply,  
100 percent exhaust with Statitrac,  
30 h.p. exhaust fan motor with  
drive selection No. 8 - (800 RPM),  
high-efficiency throwaway filters,  
50 hp supply fan motor with 1200  
RPM, economizer, w/ reference  
enthalpy control, Supply and  
Exhaust with VFD but no bypass,  
cULus agency approval.*

*The service digit for each model  
number contains 36 digits; all 36  
digits must be referenced.*

# General Information

## Commonly Used Acronyms

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

- AC = Air Cooled Condenser
- BAS = Building automation systems
- BCI = BACnet Communication Interface module
- CFM = Cubic-feet-per-minute
- CKT. = Circuit
- CLV = Cooling valve (reheat only)
- CV = Constant volume
- CW = Clockwise
- CCW = Counterclockwise
- E/A = Exhaust air
- EC = Evaporative Condenser
- ECEM = Exhaust/comparative enthalpy module
- F/A = Fresh air
- GBAS = Generic building automation system
- HGBP = Hot gas bypass
- HGRH = Hot gas reheat
- 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
- MCHE = Microchannel Coil
- MCM = Multiple compressor module
- MDM = Modulating Dehumidification Module
- MPM = Multipurpose module
- MWU = Morning warm-up
- NSB = Night setback
- O/A = Outside air
- psig = Pounds-per-square-inch, gauge pressure
- PTFE = Polytetrafluoroethylene (Teflon®)
- R/A = Return air
- RAH = Return air humidity
- RH = Right-hand
- RHP = Reheat pumpout solenoid valve
- RHV = Reheat valve
- 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
- WCI = Wireless Communication Interface

## Unit Description

Each Trane commercial, single-zone rooftop air conditioner ships fully assembled and charged with the proper refrigerant quantity from the factory.

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

Trane Commercial Rooftop Units are controlled by a microelectronic control system that consists of a network of modules and are referred to as Unit Control 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 Standard on all units)

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, return fan, return damper, variable frequency drive output, and economizer operation based on that information.



## General 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 Modules

### (SCM & MCM - 1U49 standard on all units)

The compressor modules, (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 standard on all units)

The Human Interface module enables the operator to adjust the operating parameters for the unit using it's 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.

## **Modulating Dehumidification Module MDM**

### **(Optional 1U107 - used with Dehumidification Control)**

The MDM supports specific control inputs and outputs for Modulating Dehumidification control including Modulating Reheat and Cooling valve control as well as the Reheat Pumpout Relay output. The Modulating Dehumidification control Algorithm provides control requests to the MDM to accomplish proper Dehumidification control.

## **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 Optional Remote Human Interface)**

The Interprocessor Communication Board expands communications from the rooftop unit 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".

## **LonTalk/BACnet Communication Interface Module**

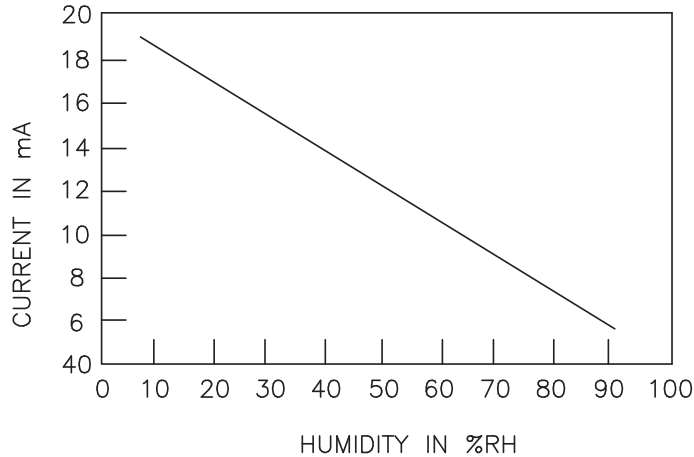
### **(LCI/BCI - Optional 1U54/1U104 - used on units with Trane ICSTM or 3rd party Building Automation Systems)**

The LonTalk or 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 setpoint and configuration adjustment 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. 16](#) for the Humidity vs. Voltage input values.

**Figure 1. Humidity vs. Voltage**


## Ventilation Control Module

### VCM

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. The following table lists the Minimum Outside Air CFM vs. Input Voltage.

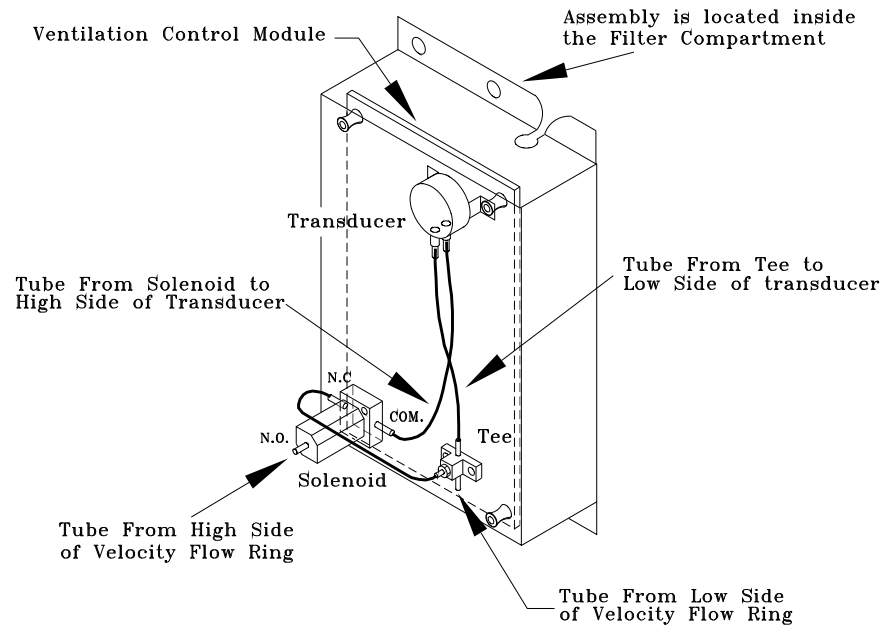
**Table 3. Minimum Outside Air Setpoint w/VCM Module and Traq Sensing**

Unit (AC/EC)	Input Volts	CFM
20 & 25, 24 & 29 Ton	0.5-4.5 VDC	0-14000
30/36 Ton	0.5-4.5 VDC	0-17000
40/48 Ton	0.5-4.5 VDC	0-22000
50/59, 55 Ton	0.5-4.5 VDC	0-28000
60-75, 73-89 Ton	0.5-4.5 VDC	0-33000
90-130 Ton	0.5-4.5 VDC	0-46000

The velocity pressure transducer/solenoid assembly is illustrated below. Refer to the "Traq Sensor Sequence of Operation" section for VCM operation.



**Figure 2. Velocity Pressure Transducer/Solenoid Assembly**



## Generic Building Automation System Module

**(GBAS - Optional 1U51 used with non-Trane building control systems; 0-5 or 0-10 VDC)**

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 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.

### Phase Monitor (1U3)

Continuously monitors line voltage to protect against phase, loss, imbalance and reversal. If a fault is found with the supply voltage a LED on the phase monitor will indicate a fault and a unit External Auto Stop is activated through the controls.

## Multipurpose Module

### MPM (1U105)

The Multipurpose Module (MPM) receives information from the Return Plenum Pressure sensor and provides for Return Fan control to maintain this pressure to the Active Return Plenum Pressure Setpoint and Deadband. The liquid line pressure sensor inputs for the refrigeration circuits are received through the MPM in support of head pressure control on Evaporative condenser units.

## 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 (CV), Single Zone Variable Air Volume (SZVAV) & Variable Air Volume (VAV) Sensors and Controls**

### **Supply Air Temperature Sensor (3RT9)**

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

### **Return Air Temperature Sensor (3RT6)**

This analog input device is used with a return humidity sensor 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 to monitor 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)**

This binary input device 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.  $\pm$  0.05" w.c.

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

3S68 is a binary input device used 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/return fan. It is located in the exhaust/return 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/return 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).

### **Lead-Lag**

Is a selectable mode of operation on 20 thru 130 Ton units within the Human Interface. It alternates the starting between the first compressor of each refrigeration circuit. On 40 - 89 Ton units only the compressor banks will switch, not the order the compressors within a bank, providing the first compressor in each circuit had been activated during the same request for cooling.

### **Supply and Exhaust/Return Fan Circuit Breakers (with 1CB1 and 1CB2)**

The supply fan and exhaust fan motors are protected by circuit breakers 1CB1 and 1CB2 respectively for 208 -230 V applications. They will trip and interrupt the power supply to the motors if the current exceeds the breaker's "must trip" value. For 460 -575 V applications, fan motors will be protected with manual motor protectors. The rooftop module (RTM) will shut all system functions "Off" when an open fan proving switch is detected.

### **Manual Motor Protectors (380V through 575V Only)**

Manual motor protectors will be used as branch circuit protection for compressors and supply fan motors. These devices are capable of providing both overload and short-circuit protection. Before operating, the manual motor protector must be switched with the rotary on/off switch to the "ON" position and the overload setpoint dial must be set to the appropriate rating of the motor.

**Important:** *In order to avoid nuisance trips, the overload setpoint dial must be adjusted to the following calculated value:*

$$\text{Overload Setting} = (\text{Motor FLA})$$

$$\text{Overload Setting} = (\text{Compressor RLA}) \times 1.12$$

### **Return Plenum Pressure High Limit**

The Return Plenum Pressure High Limit Setpoint has a non-adjustable value of 3.5 iwc. When the return plenum pressure exceeds the Return Plenum Pressure High Limit for more than 1 second, a "Return Pressure shutdown" signal is sent, and an automatically resetting diagnostic is set. After the return fan is off, the Return Pressure Shutdown signal is cancelled. The unit will not be allowed to restart within 15 seconds of shutdown. Three consecutive occurrences of the Return Plenum Pressure exceeding the Return Plenum Pressure Limit will cause a manual reset diagnostic. The occurrence counter will be reset every time the unit goes through a reset, transitions from Stop to Auto, or transitions into and out of Occupied or Unoccupied control.

### **Low Pressure Control (LPC)**

LPC is accomplished using a binary input device. LP cutouts are located on the suction lines near the scroll compressors. The LPC contacts are designed to close when the suction pressure exceeds  $41 \pm 4$  psig. If the LP control is open when a compressor is requested to start, none of the compressors on that circuit will be allowed to operate. They are locked out and a manual reset diagnostic is initiated.

The LP cutouts are designed to open if the suction pressure approaches  $25 \pm 4$  psig. If the LP cutout opens after a compressor has started, all compressors operating on that circuit will be turned off immediately and will remain off for a minimum of three minutes. If the LP cutout trips four consecutive times during the first three minutes of operation, the compressors on that circuit will be locked out and a manual reset diagnostic is initiated.

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

These analog input devices are 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. For evaporative condensers, this value is determined by the MPM which converts a pressure to a temperature value that is sent to the MCM to be used for head pressure control.

### **Head Pressure Control**

This is accomplished using two saturated refrigerant temperature sensors. During a request for compressor operation, when the condensing temperature rises above the “lower limit” of the control band, the Compressor Module (SCM/MCM) starts sequencing condenser fans “On”. If the operating fans can not bring the condensing temperature to within the control band, more fans are turned on.

As the saturated condensing temperature approaches the lower limit of the control band, fans are sequenced “Off”. The minimum “On/Off” time for condenser fan staging is 5.2 seconds. If the system is operating at a given fan stage below 100% for 30 minutes and the saturated condensing temperature is above the “efficiency check point” setting, a fan stage will be added. If the saturated condensing temperature falls below the “efficiency check point” setting, the fan control will remain at the present operating stage. If a fan stage cycles four times within a 10 minute period, the control switches from controlling to the “lower limit” to a temperature equal to the “lower limit” minus the “temporary low limit suppression” setting. It will utilize this new “low limit” temperature for one hour to reduce condenser fan short cycling.

For Evaporative Condensing units, Head pressure is monitored with pressure transducers attached to the Saturated Condensing line and converted to a temperature by the MPM. This temperature is used to control the variable speed fan and control the sump pump. When the temperature rises above the Upper Limit (120F) the Sump Pump is energized. If the Condensing Temperature drops below the Lower Limit (70F) the Sump Pump is de-energized.

### **High Pressure Controls**

High Pressure controls are located on the discharge lines near the scroll compressors. They are designed to open when the discharge pressure approaches  $650 \pm 10$  psig. The controls reset automatically when the discharge pressure decreases to approximately  $550 \pm 10$  psig. However, the compressors on that circuit are locked out and a manual reset diagnostic is initiated after the fourth occurrence of a high pressure condition.

### **Outdoor Air Humidity Sensor (3U63)**

This is an analog input device used on 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)**

This is an analog input device used on 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).

### **Space/Duct Humidity Sensor (5U108)**

Analog input device used on applications with modulating dehumidification option and/or humidification field installed option. It is used to monitor the humidity level in the space and for comparison with the dehumidification and humidification setpoints to maintain space humidity requirements. It is field mounted in the space and connected to the RTM or ECEM (1TB16).

### **Low Ambient Control**

The low ambient modulating output on the compressor module is functional on all units with or without the low ambient option. When the compressor module has staged up to it’s highest stage (stage 2 or 3 depending on unit size), the modulating output will be at 100% (10 VDC). When the control is at stage 1, the modulating output (0 to 10 VDC) will control the saturated condensing temperature to within the programmable “condensing temperature low ambient control point”.

### **Status/Annunciator Output**

This is an internal function within the RTM (1U48) module that provides;

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

### **Low Ambient Compressor Lockout**

Utilizes an analog input device. When the system is configured for low ambient compressor lockout, the compressors are not allowed to operate if the temperature of the outside air falls below the lockout setpoint. When the temperature rises 5°F above the lockout setpoint, the compressors are allowed to operate. The setpoint for units without the low ambient option is 50°F. For units with the low ambient option, the setpoint is 0°F. The setpoints are adjustable at the Human Interface inside the unit control panel.

### **Space Pressure Transducer (3U62)**

This is an analog input device that modulates the exhaust dampers to keep the space pressure within the building to a customer designated control band. 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 (not SZVAV)**

When a system changes from an unoccupied to an occupied mode, or switches from STOPPED to AUTO, or power is applied to a unit with the MWU option, the heater in the unit or external heat 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. If the unit is VAV, then the VAV box/unocc relay will continue to stay in the unoccupied position and the VFD output will stay at 100% during the MWU mode. When the MWU setpoint is reached and the heat mode is terminated, then the VAV box/unocc relay will switch to the occupied mode and the VFD output will be controlled by the duct static pressure. During Full Capacity MWU the economizer damper is held closed for as long as it takes to reach setpoint. During Cycling Capacity MWU the economizer damper is allowed to go to minimum position after one hour of operation if setpoint has not been reached.

### **Compressor Motor Winding Thermostats**

#### ***CSHD compressors (20-70 Ton) Air-Cooled and (24-80 Ton) Evaporative Condensers***

The compressors contains an internal line break overload which stops the compressors under a number of operating conditions that cause excessive motor temperature. These include rapid cycling, loss of charge, abnormally high suction temperatures, excessive amperage, phase loss and low voltage

#### ***CSHN Compressors (75 - 130 Ton) Air-Cooled and (89 Ton) Evaporative Condensers***

PTC sensors are embedded in the motor windings of each Scroll compressor. These sensors are wired to the protection module which protects the motor from over temperature that can occur under a number of abnormal operating conditions. These include rapid cycling, loss of charge, abnormally high suction temperatures, low voltage and excessive amperage.

During a request for compressor operation, if the Compressor Module (SCM) detects a problem outside of it's normal parameters, it turns any operating compressor(s) in that circuit "Off", locks out all compressor operation for that circuit, and initiates a manual reset diagnostic.

### **Discharge Line Thermostat**

The first compressor on each circuit is equipped with a Discharge Line Thermostat. If the temperature of the line exceeds 210°F the thermostat interrupts the 115V circuit for the compressors and both of the compressors on that circuit will be de-energized. Once the temperature drops below 170°F the thermostat will close and allow the compressor to be energized.

## General Information

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### Freeze Avoidance

Freeze Avoidance is a feature which helps prevent freezing of hydronic heat coils and avoiding nuisance hydronic heat freeze-STAT trips. This is accomplished by opening inactive hydronic heat valve(s) at low ambient temperatures.

Typically, when the unit is in a mode where the supply fan is off, the OA temperature is monitored. If it falls below 45 °F (5 degrees above the freeze-STAT), the hydronic heat valve(s) are opened to the Standby Freeze Avoidance Position. When the OA temperature rises above 47 °F, occupied mode is requested, or the supply fan is requested ON the hydronic heat valve(s) release to normal control.

When the supply fan is commanded on, the OA dampers will remain closed for one minute to remove the heat from the hydronic heating coil. This prevents freeze-STAT trips and falsely loading the supply air temperature causing premature compressor operation. This function is disabled if the Standby Freeze Avoidance Position is set to 0%.

### 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.

### Freeze-STAT (4S12)

This is a binary input device used on 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 freeze-STAT closes signalling the Heat Module (1U50) and the Rooftop Module (RTM) to:

- 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 "Freeze-STAT" diagnostic to the Human Interface.

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

These are binary input devices used 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.

### Compressor Circuit Breakers (1CB8, 1CB9, 1CB10, 1CB11)

The Scroll Compressors are protected by circuit breakers for 208 - 230 volt units which interrupt the power supply to the compressors if the current exceeds the breakers "must trip" value. For 460 - 575 volt units the Scroll compressors will be protected with Manual Motor protectors. During a request for compressor operation, if the Compressor Module detects a problem outside of it's normal parameters, it turns any operating compressor(s) on that circuit "Off", locks out all compressor operation for that circuit, and initiates a manual reset diagnostic.

## 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 Zone Temperature Control units, if the supply air temperature falls 10°F below the zone temperature setpoint up to half of the available heat capacity will be brought on until the supply air temperature reaches 10°F above zone temperature setpoint.

## **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.

## General Information

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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.

### 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  $\pm \frac{1}{2}$  discharge air target deadband.

## **Constant Volume (CV), Single Zone Variable Air Volume (SZVAV), & Variable Air Volume (VAV) Units**

### **Occupied Heating - Supply Air Temperature**

When a Discharge Temperature Control 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 Discharge Temperature Control unit is in the occupied mode, the supply air temperature will be controlled to the customer's 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 (CV & VAV Only)**

On Discharge Temperature Control 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 full airflow. During this mode, the VAV box/unocc relay, RTM K3, will be energized (this is to signal the VAV boxes to go to 100%). After the VAV box max stroke time has elapsed (factory set at 6 minutes), the VFD output will be set to 100%. The airflow will be at 100% and the heat will be turned 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, the K3 relay will be de-energized, releasing the VAV boxes, the VFD output will go back to duct static pressure control and the unit will return to discharge air control. If the occ zone heating setpoint is less than the DWU terminate setpoint, the heat will turn off when the occ zone heat setpoint is reached, but it will stay in DWU mode and cycle the heat to maintain setpoint.

### **Unoccupied Heating - Zone Temperature**

When a Discharge Temperature Control unit is equipped with gas, electric, or hydronic heat and is in the unoccupied mode, the zone temperature will be controlled to within the customer's specified setpoint deadband. During an unoccupied mode for a VAV unit, the VAV box/unocc relay will be in the unoccupied position and the VFD output will be at 100%. This means that if there is a call for heat (or cool) and the supply fan comes on, it will be at full airflow and the VAV boxes in the space will need to be 100% open as signaled by the VAV box/unocc relay.

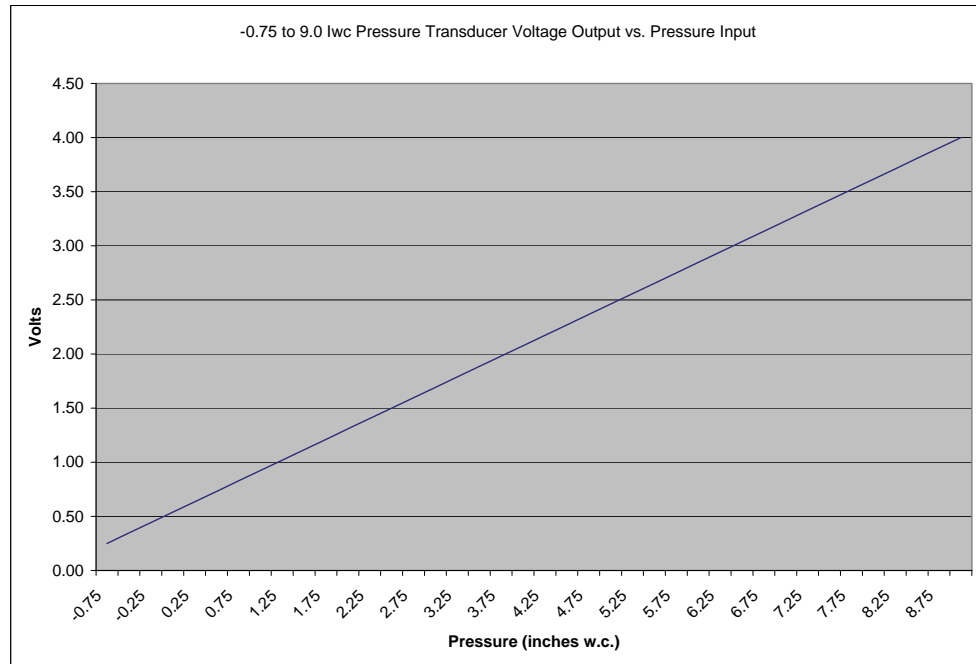
### **Supply Air Tempering**

On Discharge Temperature Control 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 or a Variable Frequency Drive to position to set the supply fan speed to maintain the supply duct static pressure to within the static pressure setpoint deadband. See [Figure 3](#) below.

**Figure 3. Transducer Voltage Output vs. Pressure Input**



## Single Zone Variable Air Volume (VAV) Units

### Occupied Heating - Supply Air Temperature

When a Discharge Temperature Control 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 Discharge Temperature Control unit is in the occupied mode, the supply air temperature will be controlled to the customers 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 Discharge Temperature Control 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 full airflow. During this mode, the VAV box/unocc relay, RTM K3, will be energized (this is to signal the VAV boxes to go to 100%). After the VAV box max stroke time has elapsed (factory set at 6 minutes), the VFD/IGV output will be set to 100%. The airflow will be at 100% and the heat will be turned on to control to the occupied heating setpoint. When the zone temperature reaches the daytime warmup termination setpoint, the heat will be turned off, the K3 relay will be de-energized, releasing the VAV boxes, the VFD/IGV output will go back to duct static pressure control and the unit will return to discharge air control. If the occ zone heating setpoint is less than the DWU

terminate setpoint, the heat will turn off when the occ zone heat setpoint is reached, but it will stay in DWU mode and cycle the heat to maintain setpoint.

### **Unoccupied Heating - Zone Temperature**

When a Discharge Temperature Control unit is equipped with gas, electric, or hydronic heat and is in the unoccupied mode, the zone temperature will be controlled to within the customers specified setpoint deadband. During an unoccupied mode for a VAV unit, the VAV box/unocc relay will be in the unoccupied position and the VFD/IGV output will be at 100%. This means that if there is a call for heat (or cool) and the supply fan comes on, it will be at full airflow and the VAV boxes in the space will need to be 100% open as signaled by the VAV box/unocc relay.

### **Supply Air Tempering**

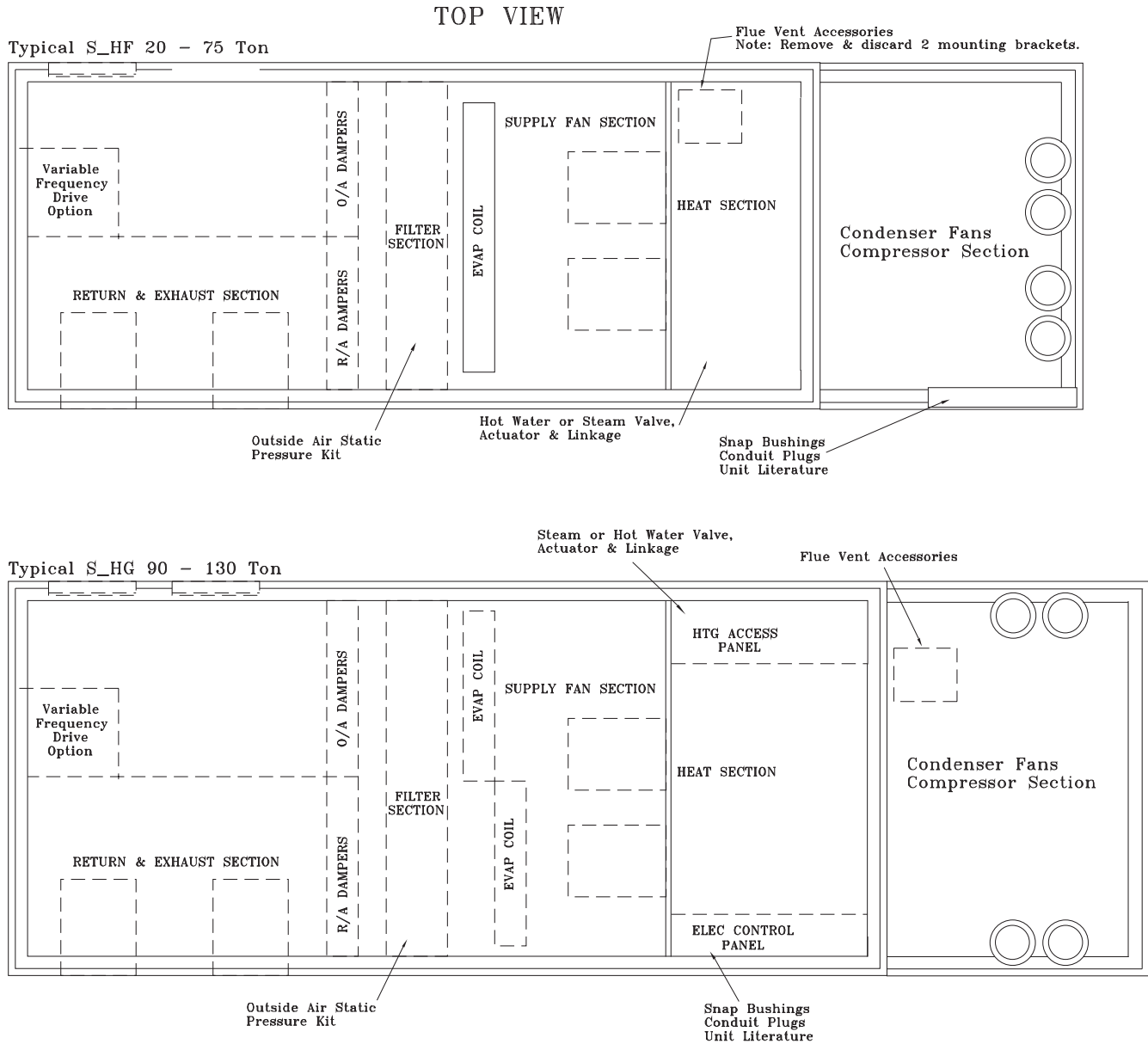
On Discharge Temperature Control units equipped with “Modulating Heat”, if the supply air temperature falls 10°F below the supply air temperature setpoint, the hydronic heat valve will modulate to maintain the supply air temperature to within the low end of the setpoint deadband.

### **Supply Duct Static Pressure Control (Occupied)**

The RTM relies on input from the duct pressure transducer when a unit is equipped with Inlet Guide Vanes or a Variable Frequency Drive to position the Inlet Guide Vanes or set the supply fan speed to maintain the supply duct static pressure to within the static pressure setpoint deadband. See [Figure 3, p. 26](#).

## General Information

**Figure 4. Unit Component Layout and "Ship with" Locations**



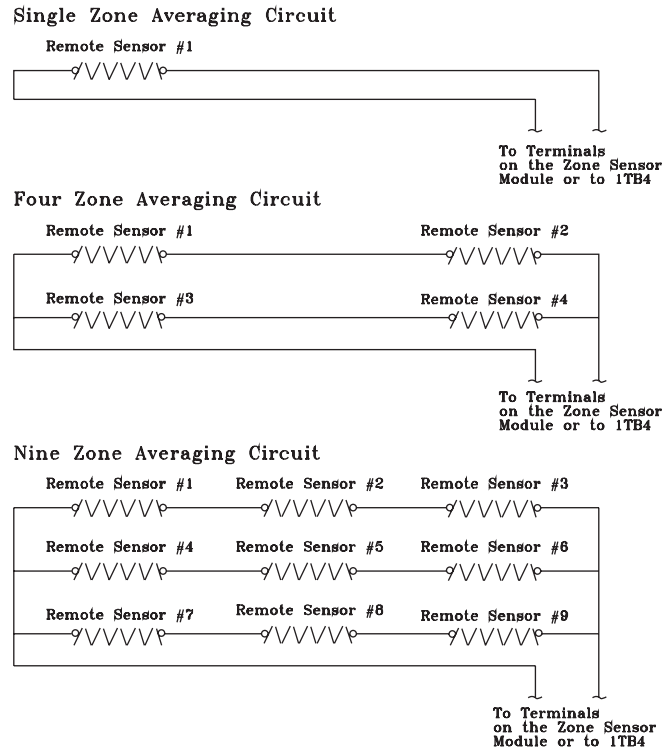
## Space Temperature Averaging

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

The fewest number of sensors required to accomplish space temperature averaging is four. The Space Temperature Averaging with Multiple Sensors figure illustrates a single sensor circuit (Single Zone), four sensors wired in a series/parallel circuit (Four Zone), nine sensors wired in a series/parallel circuit (Nine Zone). Any number squared, is the number of remote sensors required.

Wiring termination will depend on the type of remote panel or control configuration for the system. Refer to the wiring diagrams that shipped with the unit.

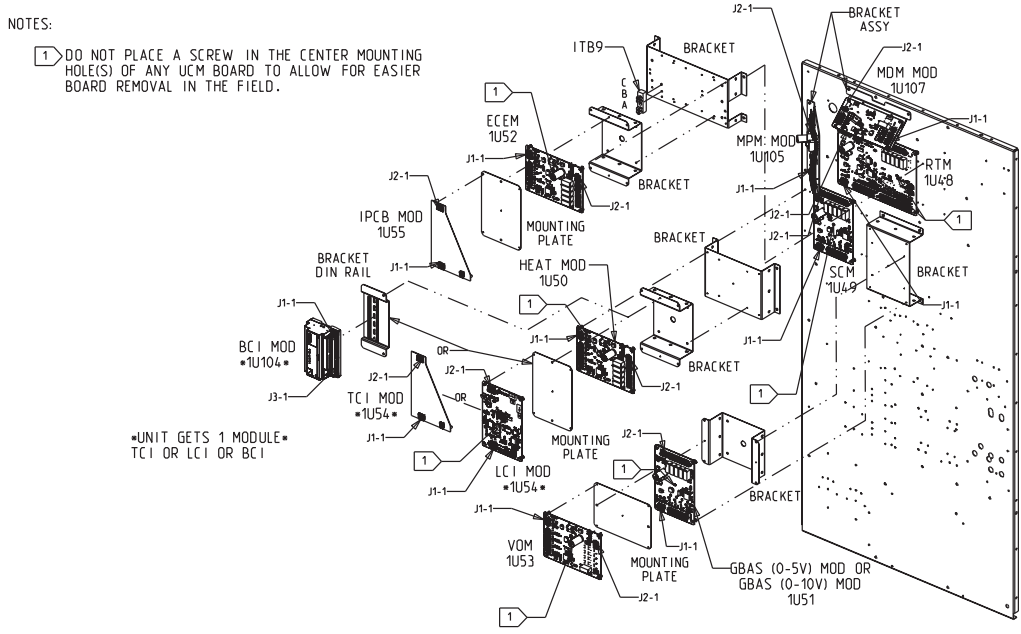
**Figure 5. Space Temperature Averaging**



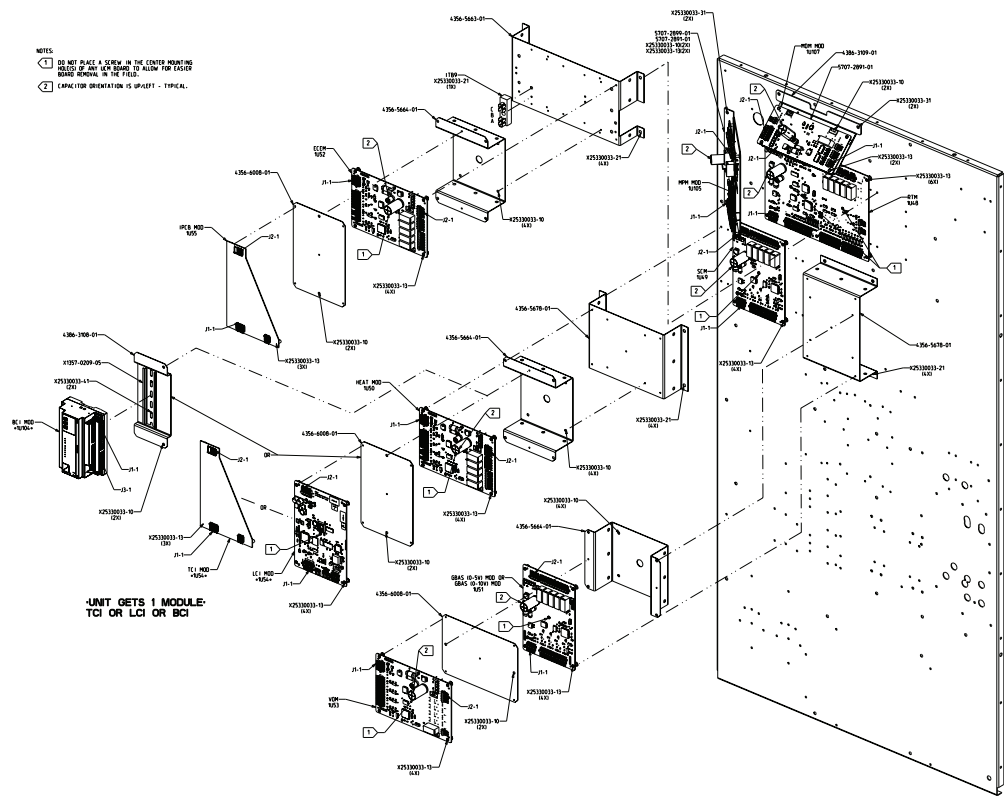
**Space Temperature Averaging with Multiple Sensors Unit Control Modules (UCM)**

Unit control modules are microelectronic circuit boards designed to perform specific unit functions. These modules through Proportional/Integral control algorithms 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. Figure 9 below illustrates the typical location of each "1U" designated module.

**Figure 6. Control Module Locations for S\_HL 20-36 Ton Units**



**Figure 7. Control Module Locations for S\_HL 40 - 89 Ton Units**



# 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.

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!**

**FOR ACCESS TO COMPONENTS, THE BASE SHEET METAL SURFACE MUST BE 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 severe personal injury from falling.**

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:

1. the unit is stored before it is installed; or,
2. 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 startup.

**Note:** *Do not use the unit's heater for temporary heat without first completing the startup 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 8 illustrates the minimum operating and service clearances for either a single or multiple unit installation. These clearances are the minimum distances necessary to assure adequate serviceability, cataloged unit capacity, and peak operating efficiency.

Providing less than the recommended clearances may result in condenser coil starvation, “short-circuiting” of exhaust and economizer airflows, or recirculation of hot condenser air.

### Unit Dimensions & Weight Information

Description	Reference
<b>Air-Cooled Condenser</b>	
Unit dimensions, 20-75 Ton (SAHL)	Figure 9, p. 34, Table 4, p. 34, Table 5, and Table 6, p. 35,
Unit dimensions, 90-130 Ton	Figure 12, p. 40
Typical unit and operation weights	Table 12, p. 42
Center-of-Gravity illustration and related dimensional data	Figure 13, p. 41
<b>Evaporative Condenser</b>	
Unit dimensions, 20-89 Ton (SEH_, SFH_, SLH_, SSH_, and SXH_)	Figure 10, p. 36, Table 7, p. 36, Table 8, p. 37, and Table 9, p. 39
Typical unit and operation weights <sup>(a)</sup>	Table 13, p. 43
Center-of-Gravity illustration and related dimensional data	Figure 13, p. 41

(a) Weights shown represent approximate operating weights. Actual weights are stamped on the unit nameplate.

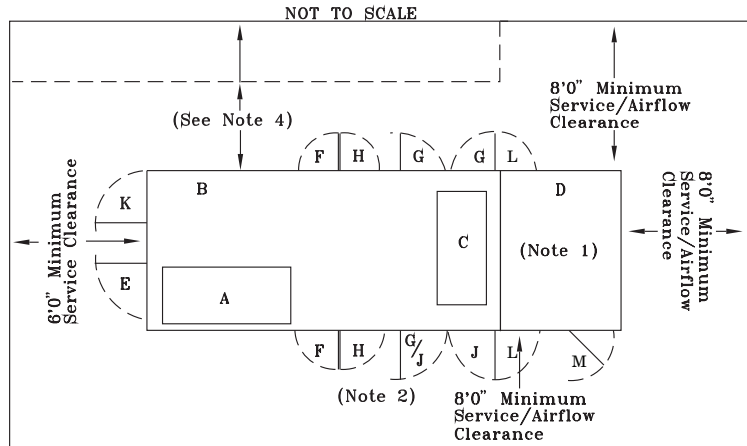


**Figure 8. Minimum operation and service clearances for single and multiple unit installation**

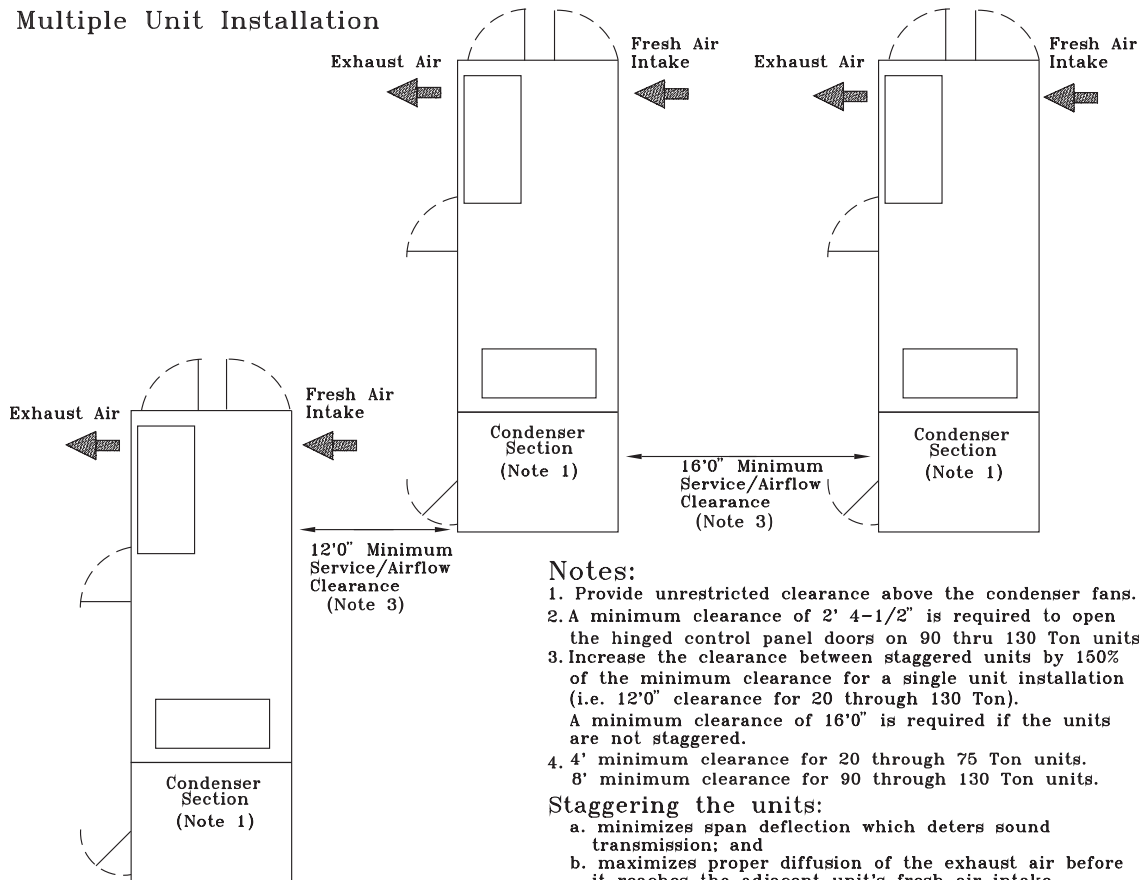
### Single Unit Installation

#### Legend

- A = Return Air Opening
- B = Fresh Air Intake
- C = Supply Air Opening
- D = Condenser Section
- E = Optional 2'10-3/4" Exhaust/Return 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) (90-130 ton)
- J = Hinged 2'4-1/2" Control Panel Door (180° swing) (90-130 ton)
- K = Hinged 2'10-3/4" VFD Access Door (180° swing)
- L = Hinged 2'10-3/4" Evap Condenser Access Door (180° swing)
- M = Hinged 2'8" Control Panel Door (180° swing) (20-36 ton)  
Hinged 3'6" Control Panel Door (180° swing) (40-89 ton)



### Multiple Unit Installation



#### Notes:

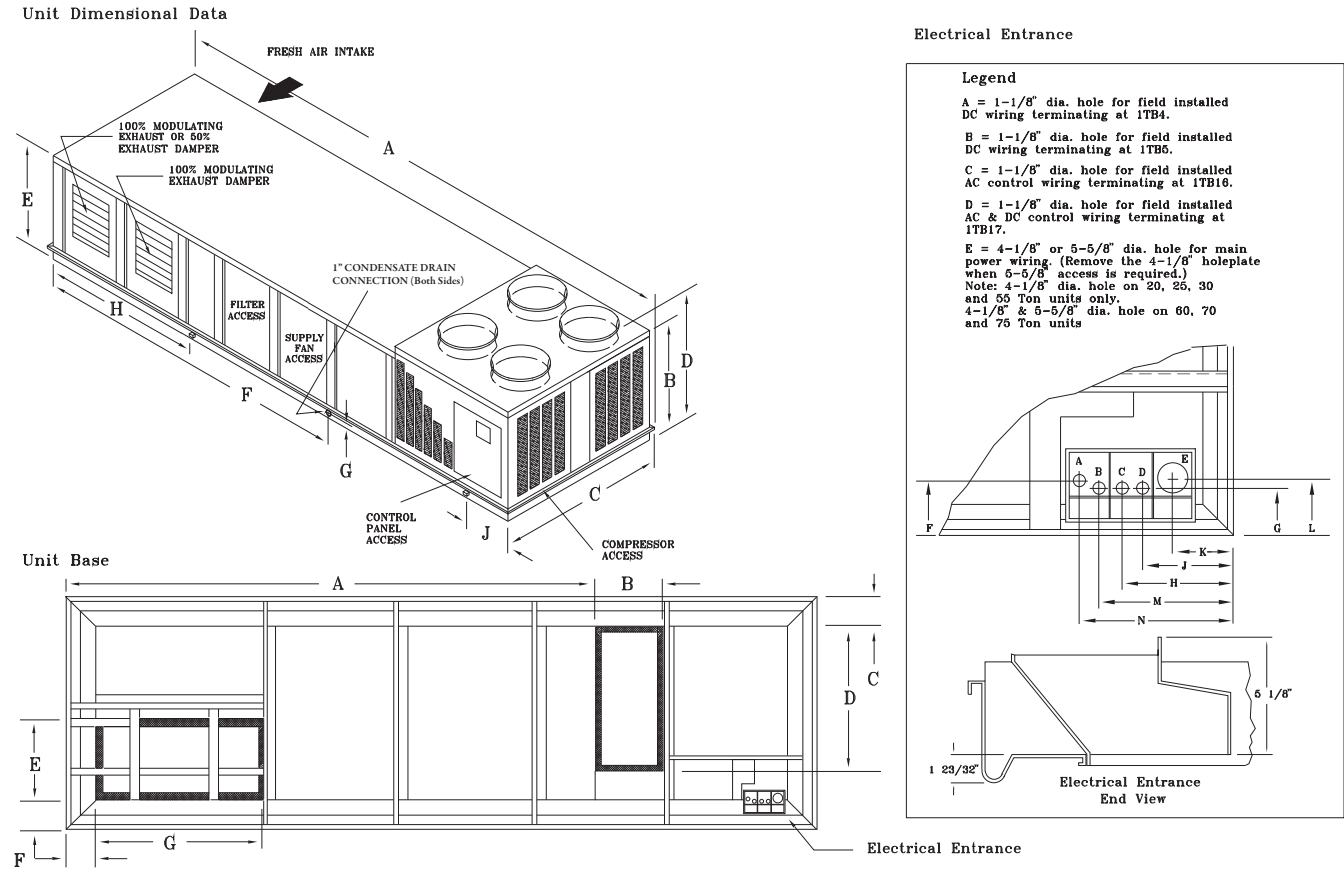
1. Provide unrestricted clearance above the condenser fans.
2. A minimum clearance of 2' 4-1/2" is required to open the hinged control panel doors on 90 thru 130 Ton units.
3. Increase the clearance between staggered units by 150% of the minimum clearance for a single unit installation (i.e. 12'0" clearance for 20 through 130 Ton).  
A minimum clearance of 16'0" is required if the units are not staggered.
4. 4' minimum clearance for 20 through 75 Ton units.  
8' minimum clearance for 90 through 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.

# Installation

**Figure 9. SAHL cooling-only units (20 - 75) Use Table 4, Table 5 and Table 6**



**Table 4. Unit dimensional data**

Unit Size	Dimensions								
	A	B	C	D	E	F	G	H	J
20 & 25 Ton	21'-9 3/4"	6'-9"	7'-6 1/2"	7'-3 1/4"	3'-9 5/16"	12'-6"	1"	7'	1'-3 1/2"
30 Ton	21'-9 3/4"	6'-9"	7'-6 1/2"	7'-3 1/4"	4'-9 5/16"	12'-6"	1"	7'	1'-3 1/2"
40 Ton	29'-8"	6'-9"	7'-6 1/2"	7'-3 1/4"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
50 Ton	29'-8"	6'-9"	7'-6 1/2"	7'-3 1/4"	6'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
60 Ton	29'-8"	6'-9"	9'-8"	7'-3 1/4"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
70 & 75 Ton	29'-8"	6'-9"	9'-8"	7'-3 1/4"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"

**Table 5. Unit base dimensional data**

Unit Size	Dimensions									
	A	B	C	D	E		F		G	
					w/exhaust fan	w/return fan	w/exhaust fan	w/return fan	w/exhaust fan	w/return fan
20 - 30 Ton	14'-0 1/4"	2'-2 1/2"	11 3/4"	5'-7"	3'-4 3/8"	2'-9 15/16"	5 13/16"	28 5/8"	6'-6 15/16"	3'
40 - 50 Ton	16'-1 13/16"	2'-5"	11 3/4"	5'-7"	3'-4 3/8"	3' - 1 1/2"	5 13/16"	32 15/16"	7'-8 3/16"	3'-4"
60 Ton	16'-1 13/16"	2'-5"	1'-4 9/16"	6'-10 7/8"	4'-5 3/8"	4' - 2 1/2"	5 13/16"	26 7/16"	7'-8 3/16"	4'-5"
70 - 75 Ton	16'-1 13/16"	2'-5"	1'-4 9/16"	6'-10 7/8"	4'-5 3/8"	4' - 2 1/2"	5 13/16"	26 7/16"	7'-8 3/16"	4'-5"

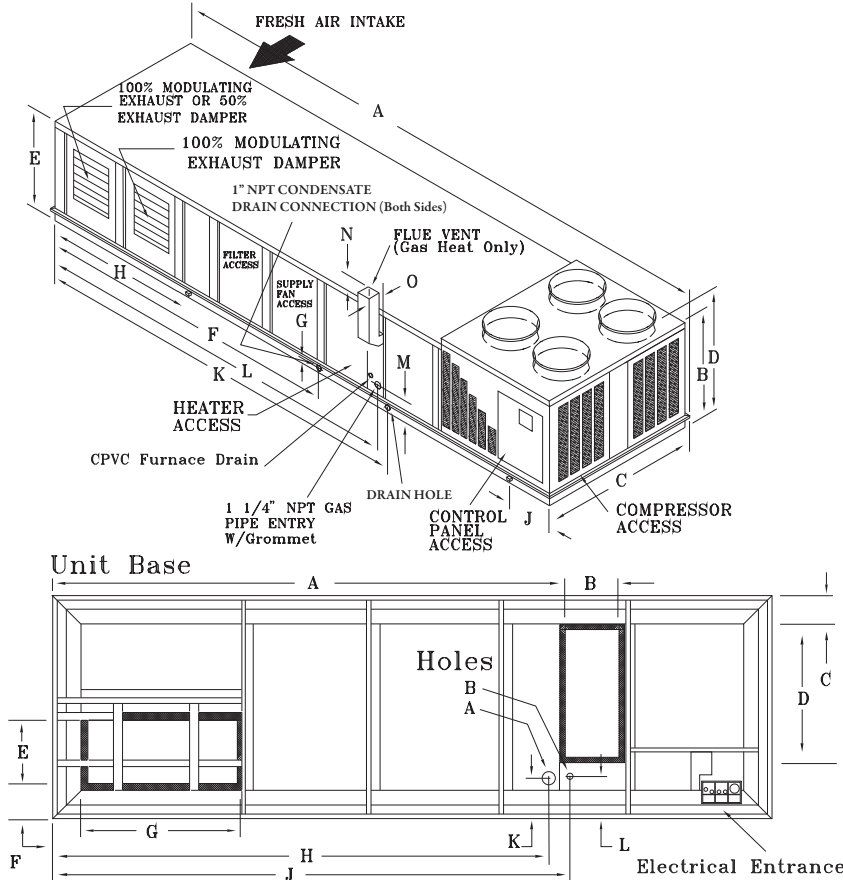
**Table 6. Electrical entrance data**

Unit Size	Dimensions							
	F	G	H	J	K	L	M	N
20, 25, 30 & 50 Ton	8 7/32"	6 31/32"	15 21/32"	13 21/32"	9 17/32"	8 1/2"	18 1/16"	19 9/16"
40, 60, 70 & 75 Ton	8 3/4"	7 3/4"	17 7/8"	15 7/8"	9 29/32"	10 1/16"	20 13/32"	22 5/32"

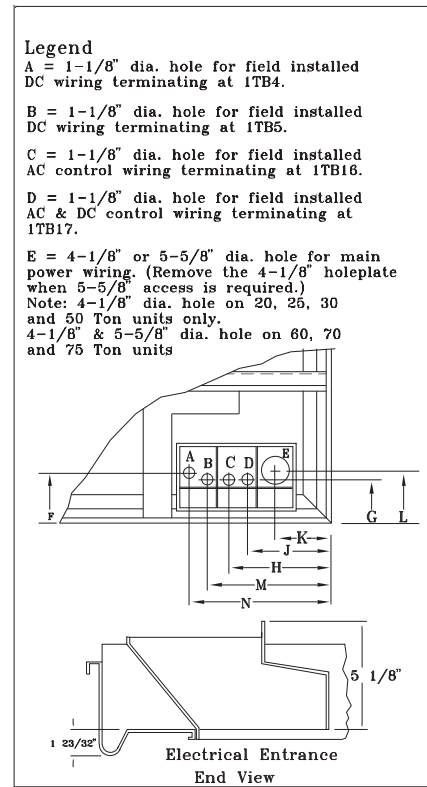
# Installation

Figure 10. SEHL, SFHL, SLHL, SSSL, SXHL units (20 - 89 ton) Use [Table 7](#), [Table 8](#) and [Table 9](#).

### Unit Dimensional Data



### Electrical Entrance



**Legend**  
 A = 1-1/8" dia. hole for field installed DC wiring terminating at ITB4.  
 B = 1-1/8" dia. hole for field installed DC wiring terminating at ITB5.  
 C = 1-1/8" dia. hole for field installed AC control wiring terminating at ITB6.  
 D = 1-1/8" dia. hole for field installed AC & DC control wiring terminating at ITB17.  
 E = 4-1/8" or 5-5/8" dia. hole for main power wiring. (Remove the 4-1/8" holeplate when 5-5/8" access is required.)  
 Note: 4-1/8" dia. hole on 20, 25, 30 and 50 Ton units only.  
 4-1/8" & 5-5/8" dia. hole on 60, 70 and 75 Ton units

**Unit Base Notes:**  
 SEHL - For 208/230 volt electric heat units, use hole "A" (3-5/8" Dia.).  
 SFHL - For Gas Heat units, use hole "B" (1-1/4" Dia.).  
 SLHL & SSSL - For steam or hot water heat units, use holes "A" (3-5/8" Steam or Hot Water Supply) & "B" (3" Steam or Hot Water Return).  
 SXHL - Extended cabinet cooling only units, the holes are omitted.

Table 7. Unit Dimensional Data

Unit Size	Air-Cooled Unit Dimensions													
	A	B	C	D	E	F	G	H	J	K	L	M	N	O
20 & 25 Ton	24'-1 3/8"	6'-9"	7'-6 1/2"	7'-3 1/4"	3'-9 5/16"	13'-3"	1"	7'	1'-3 1/2"	16'-7"	16'-6"	8 1/8"	6 1/4"	9"
30 Ton	24'-1 3/8"	6'-9"	7'-6 1/2"	7'-3 1/4"	4'-9 5/16"	13'-3"	1"	7'	1'-3 1/2"	16'-7"	16'-6"	8 1/8"	6 1/4"	9"
40 Ton	32'-10 1/2"	6'-9"	7'-6 1/2"	7'-3 1/4"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
50 Ton	32'-10 1/2"	6'-9"	7'-6 1/2"	7'-3 1/4"	6'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
60 Ton	32'-10 1/2"	6'-9"	9'-8"	7'-3 1/4"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
70 & 75 Ton	32'-10 1/2"	6'-9"	9'-8"	7'-3 1/4"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
Unit Size	Evaporative Condensing Unit Dimensions													
	A	B	C	D	E	F	G	H	J	K	L	M	N	O
24 & 39 Ton	26'5 1/2"	6'-9"	7'-6 1/2"	8'-4 3/4"	3'-9 5/16"	13'-3"	1"	7"	1'-3 1/2"	16'-7"	16'-6"	8 1/8"	6 1/4"	9"
36 Ton	26'5 1/2"	6'-9"	7'-6 1/2"	8'-4 3/4"	4'-9 5/16"	13'-3"	1"	7"	1'-3 1/2"	16'-7"	16'-6"	8 1/8"	6 1/4"	9"

**Table 7. Unit Dimensional Data**

Unit Size	Evaporative Condensing Unit Dimensions													
	A	B	C	D	E	F	G	H	J	K	L	M	N	O
48 Ton	32'-10 1/2"	6'-9"	7'-6 1/2"	8'-4 3/4"	5'-9 5/16"	15'-11 1/8"	1"	8"	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
59 Ton	32'-10 1/2"	6'-9"	7'-6 1/2"	8'-4 3/4"	6'-9 5/16"	15'-11 1/8"	1"	8"	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
73 Ton	32'-10 1/2"	6'-9"	9'-8"	8'-4 3/4"	5'-9 5/16"	15'-11 1/8"	1"	8"	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"
80 & 89 Ton	32'-10 1/2"	6'-9"	9'-8"	8'-4 3/4"	5'-9 5/16"	15'-11 1/8"	1"	8"	2'-5"	19'-7"	See Note	8 1/8"	6 1/4"	9"

**Note:** 19'-6" for SFHL "High Heat" units or 20'-3" for SFHL "Low Heat" units.

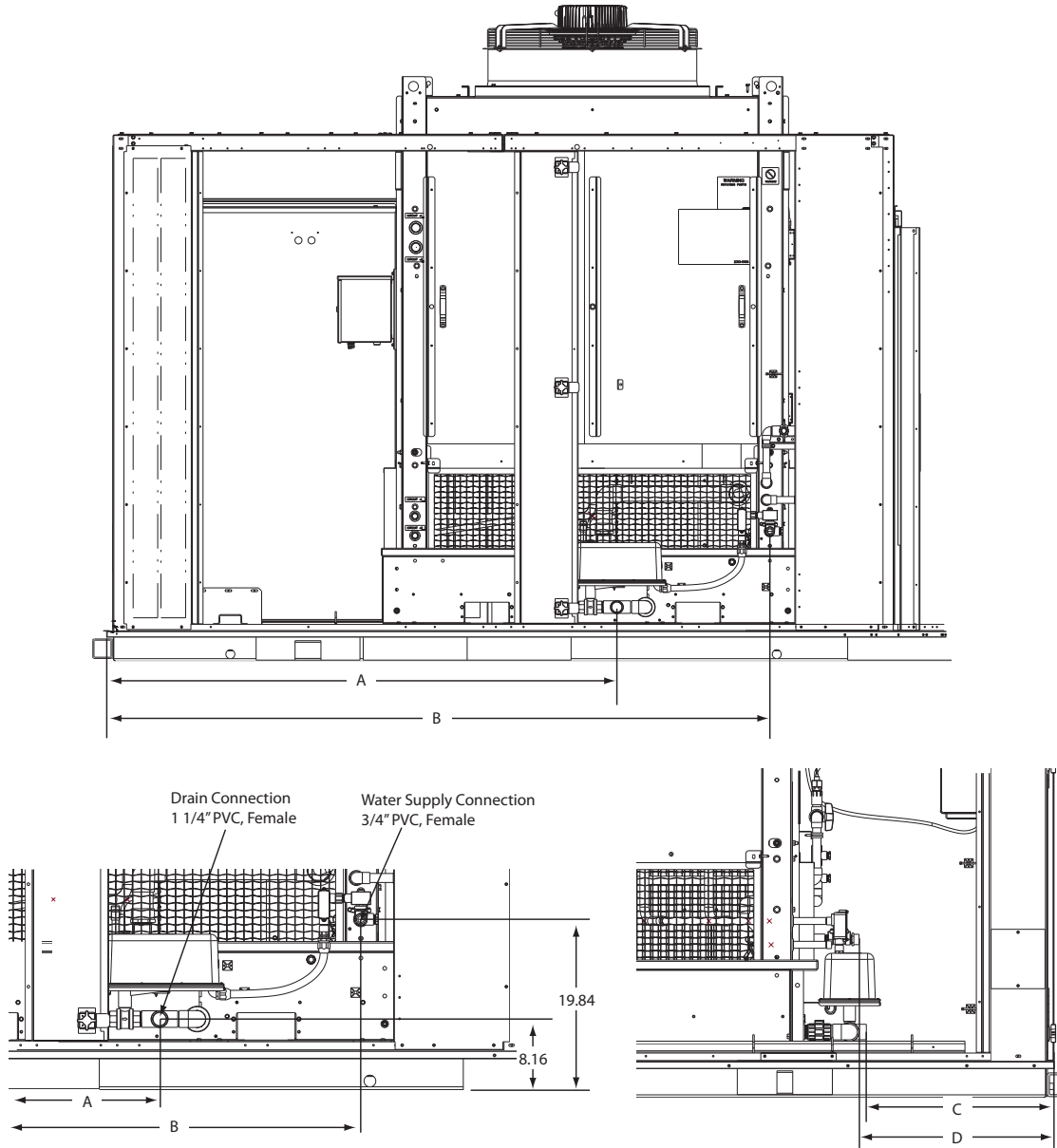
**Table 8. Unit Base Dimensional Data - Air Cooled and Evaporative Condenser**

Unit Size (AC/EC)	Dimensions										
	A	B	C	D	E		F	G		F	
					w/ exhaust fan	w/ return fan		w/ exhaust fan	w/ return fan	w/ exhaust fan	w/ return fan
20-30 /24-36 Ton	16'-3 3/16"	2'-2 1/2"	5 13/16"	5'-7"	3'-4 3/8"	2'-9 15/16"	5 13/16"	6'-6 15/16"	3'	5 13/16"	28 5/8"
40 & 50 /48 & 59 Ton	19'-10 5/16"	2'-5"	7 1/16"	5'-7"	3'-4 3/8"	3'-1 1/2"	5 13/16"	7'-8 3/16"	3'-4"	5 13/16"	32 15/16"
60/73 Ton	19'-10 5/16"	2'-5"	6 1/16"	Note 1	4'-5 3/8"	4'-2 1/2"	5 13/16"	7'-8 3/16"	4'-5"	5 13/16"	26 7/16"
70-75 /80-89 Ton	19'-10 5/16"	2'-5"	6 1/16"	Note 1	4'-5 3/8"	4'-2 1/2"	5 13/16"	7'-8 3/16"	4'-5"	5 13/16"	26 7/16"
	H	J	K	L							
20-30 /24-36 Ton	15'-5 5/16"	16'-9 3/4"	8 13/16"	9 1/16"							
40 & 50 /48 & 59 Ton	18'-11 11/16"	Note 2	8 3/16"	9 1/16"							
60/73 Ton	18'-11 11/16"	Note 2	8 3/16"	9 1/16"							
70-75 /80-89 Ton	18'-11 11/16"	Note 2	8 3/16"	9 1/16"							

**Notes:**

- 5'-5 15/16" for SEHL units or 7'-8 1/2" for SFHL, SLHL, SSSL, SXHL units.
- 20'-1 3/4" for SFHL "High Heat" units or 20'-6 3/4" for SFHL "Low Heat" units.

Figure 11. Evaporative condenser water connection locations



Tons (EC)	Drain Connection		Inlet Water Connection	
	A	B	C	D
24, 29 & 36 Ton	60.03	79.31	12.01	12.94
48 & 59 Ton	82.86	102.14	12.01	12.94
73, 80 & 89 Ton	78.56	102.14	23.71	24.64

**Table 9. Electrical entrance data**

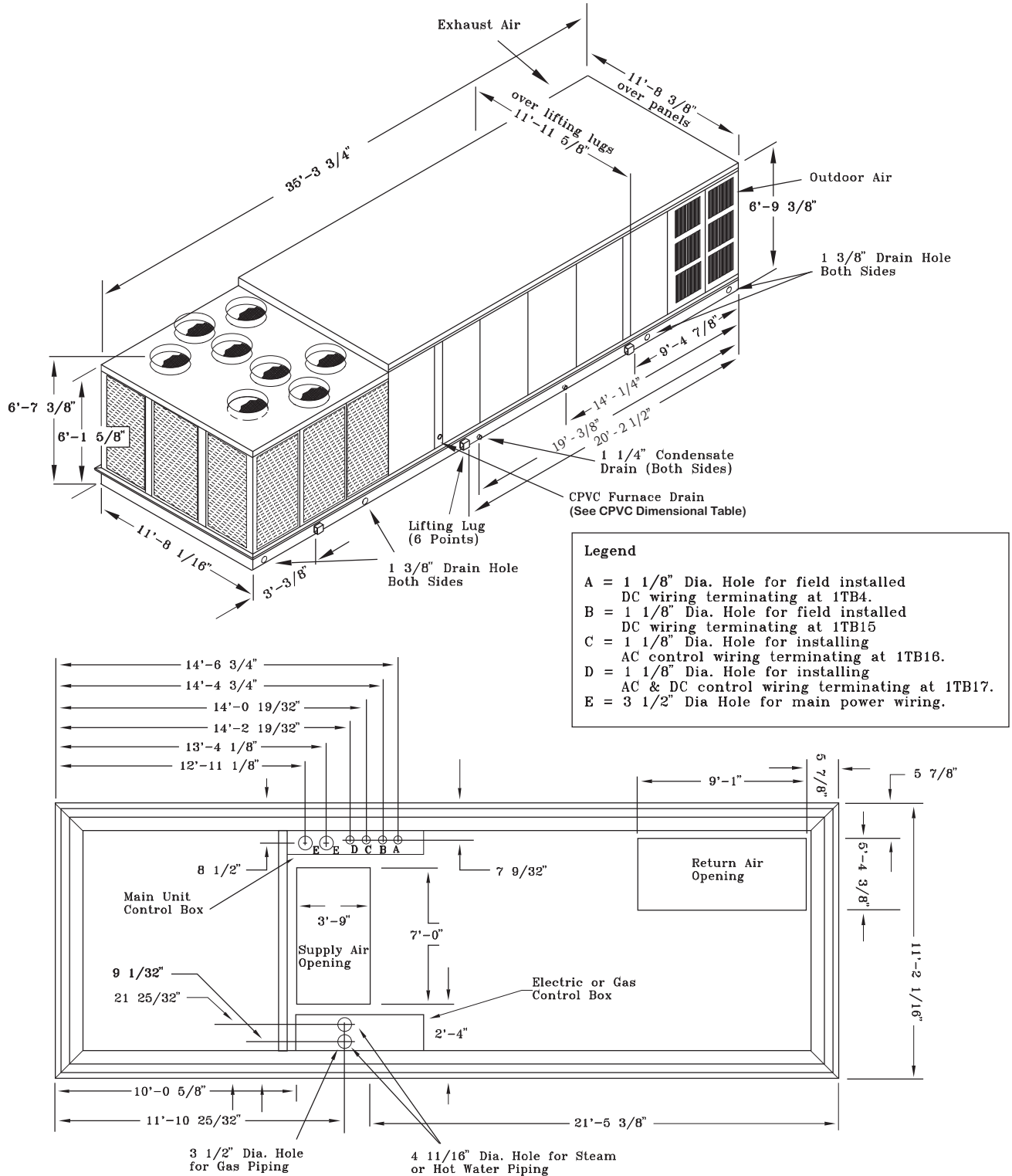
Unit Size (AC/EC)	Dimensions							
	F	G	H	J	K	L	M	N
20, 25 & 30 Ton	8 7/32"	6 31/32"	15 21/32"	13 21/32"	9 17/32"	8 1/2"	18 1/16"	19 9/16"
40-75 / 24-89 Ton	8 15/16"	7 15/16"	17 7/8"	15 7/8"	9 29/32"	10 3/16"	20 13/32"	22 5/32"

**Table 10. CPVC dimensional data**

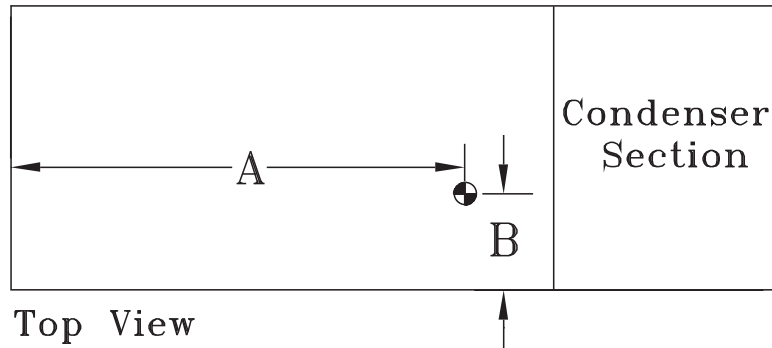
Unit Size (AC/EC)	Furnace Size/MBH	Dimensions (Note)	
		Length	Height
20 & 25, 24 & 29 Ton	Low = 235	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"
30, 36 Ton	Low = 350	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"
40, 48 Ton	Low = 350	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"
50-75, 59-89 Ton	Low = 500	240-1/8"	9-5/32"
	High = 850	231-1/8"	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 12. S\_HK cooling and heating units (90-130 ton)





**Figure 13. Center of gravity data**

**Table 11. Center of gravity data**

Unit Model	Unit Size	Units without 100% Exhaust/Return Fan		Units with Exhaust/Return Fan		Units with Supply & Exhaust/Return VFD	
		Dim. A	Dim. B	Dim. A	Dim. B	Dim. A	Dim. B
SAHL	20	13' 6"	4' 10"	13' 10"	4' 9"	12' 4"	4' 10"
	25	14' 6"	4' 10"	13' 11"	4' 9"	12' 4"	4' 10"
	30	13' 11"	4' 10"	12' 1"	4' 9"	12'-8"	4' 10"
	40	17' 4"	4' 0"	16' 2"	4' 11"	16' 7"	4' 11"
	50	18' 6"	4' 0"	16' 4"	4' 11"	16' 9"	4' 11"
	55	18' 6"	4' 0"	16' 5"	4' 11"	16' 9"	4' 11"
	60	17' 0"	5' 10"	16' 9"	5' 8"	15' 2"	5' 9"
	70	17' 0"	5' 10"	16' 10"	5' 8"	15' 3"	5' 9"
75	18' 6"	5' 10"	16' 4"	5' 8"	16' 9"	5' 9"	
SEHL, SLHL, SSHL, SXHL	20	15' 8"	4' 9"	14' 0"	4' 8"	13' 5"	4' 9"
	25	15' 8"	4' 9"	14' 0"	4' 8"	13' 6"	4' 9"
	30	14' 1"	4' 9"	13' 3"	4' 8"	13' 8"	4' 9"
	40	18' 4"	4' 11"	17' 2"	4' 10"	17' 6"	4' 10"
	50	19' 1"	4' 0"	18' 11"	4' 11"	17' 2"	4' 11"
	55	19' 1"	4' 0"	18' 11"	4' 11"	17' 3"	4' 0"
	60	18' 6"	5' 9"	17' 2"	5' 7"	17' 6"	5' 8"
	70	18' 3"	5' 10"	17' 11"	5' 8"	16' 4"	5' 9"
75	19' 2"	5' 10"	18' 10"	5' 8"	17' 2"	5' 9"	
SFHL	20	15' 9"	4' 10"	14' 1"	4' 9"	14' 7"	4' 10"
	25	15' 10"	4' 9"	14' 2"	4' 8"	14' 7"	4' 9"
	30	14' 2"	4' 9"	13' 4"	4' 8"	13' 10"	4' 9"
	40	19' 6"	4' 11"	17' 4"	4' 10"	17' 9"	4' 10"
	50	19' 1"	4' 11"	18' 0"	4' 10"	17' 4"	4' 11"
	55	19' 2"	4' 11"	18' 0"	4' 10"	17' 4"	4' 11"
	60	19' 7"	5' 9"	17' 4"	5' 7"	17' 8"	5' 9"
	70	18' 3"	5' 9"	17' 0"	5' 7"	16' 5"	5' 8"
75	19' 2"	5' 9"	18' 10"	5' 7"	17' 3"	5' 9"	
SXHK, SEHK, SLHK, SSHK	90	18' 9"	5' 10"	20' 4"	6' 2"	17' 9"	5' 10"
	105	19' 1"	5' 11"	20' 7"	6' 2"	18' 1"	6' 0"
SFHK	90	18' 11"	6' 0"	20' 6"	6' 3"	17' 10"	5' 11"
	105	19' 3"	6' 0"	20' 9"	6' 4"	18' 4"	6' 7"
SXHK, SEHK, SLHK, SSHK	115	19' 2"	5' 10"	20' 8"	6' 2"	18' 1"	6' 0"
	130	19' 5"	5' 10"	20' 11"	6' 2"	18' 6"	6' 0"
SFHK	115	19' 4"	6' 0"	20' 9"	6' 3"	18' 3"	6' 1"
	130	19' 6"	6' 0"	21' 10"	6' 3"	18' 8"	6' 0"

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



## Installation

**Table 12. Air-cooled condenser - approximate operating weights (Lbs./Kg)**

Unit		Without Exhaust Fan					With Exhaust Fan				
		SA	SX	SE	SF	SL/SS	SA	SX	SE	SF	SL/SS
20	Lb	4092	4422	4712	4422	4312	4390	4720	5010	4720	4610
	Kg	1856	2006	2137	2006	1956	1991	2141	2272	2141	2091
25	Lb	4181	4521	4791	4521	4391	4485	4825	5095	4825	4695
	Kg	1896	2050	2173	2050	1992	2034	2188	2311	2188	2129
30	Lb	4572	4932	5202	4932	4812	5029	5389	5659	5389	5269
	Kg	2074	2237	2359	2237	2183	2281	2444	2567	2444	2390
40	Lb	6433	6737	7217	6737	6577	7103	7407	7887	7407	7247
	Kg	2918	3056	3273	3056	2983	3222	3360	3577	3360	3287
50	Lb	7175	7725	8185	7725	7555	7894	8444	8904	8444	8274
	Kg	3255	3504	3713	3504	3427	3581	3830	4039	3830	3753
55	Lb	7425	7975	8455	7975	7815	8144	8694	9174	8694	8534
	Kg	3368	3617	3835	3617	3545	3694	3944	4161	3944	3871
60	Lb	8338	8658	9118	8658	8498	9282	9602	10062	9602	9442
	Kg	3782	3927	4136	3927	3855	4210	4355	4564	4355	4283
70	Lb	8604	8666	9146	8666	8516	9547	9609	10089	9609	9459
	Kg	3903	3931	4148	3931	3863	4330	4358	4576	4358	4290
75	Lb	8843	9173	9653	9173	9023	9786	10116	10596	10116	9966
	Kg	4011	4161	4379	4161	4093	4439	4589	4806	4589	4521
90	Lb.	N/A	13100	13250	13890	13370	N/A	14440	14590	15230	14710
	Kg	N/A	5955	6023	6314	6077	N/A	6564	6632	6923	6686
105	Lb.	N/A	13710	13860	14500	13980	N/A	15050	15200	15840	15320
	Kg	N/A	6232	6300	6591	6355	N/A	6841	6909	7200	6964
115	Lb.	N/A	13900	14080	14740	14100	N/A	15240	15420	16080	15440
	Kg	N/A	6318	6400	6700	6409	N/A	6927	7009	7309	7018
130	Lb.	N/A	14350	14510	15150	14540	N/A	15690	15850	16490	15880
	Kg	N/A	6523	6595	6886	6609	N/A	7132	7205	7495	7218

**Notes:**

- Weights shown for air-cooled units include the following features: standard coils, 100% economizer, throwaway filters, maximum motor sizes, 460V XL, high heat.
- Weights shown represent approximate operating weights and have a ±5% accuracy. To calculate weight for a specific unit configuration, utilize TOPSS™ or contact the local Trane sales representative. ACTUAL WEIGHTS ARE STAMPED ON THE UNIT NAMEPLATE.

**Table 13. Evaporative condenser - approximate operating weights (lbs/kg)**

Unit		Without Exhaust Fan				With Exhaust Fan			
		SX	SE	SF	SL/SS	SX	SE	SF	SL/SS
24	lbs	6549	6679	6944	6763	6907	7037	7302	7121
	kg	2971	3030	3150	3068	3133	3192	3312	3230
29	lbs	6599	6729	6994	6813	6963	7093	7358	7177
	kg	2993	3052	3172	3090	3158	3217	3338	3255
36	lbs	7121	7251	7513	7335	7538	7668	7933	7752
	kg	3230	3289	3409	3327	3419	3478	3598	3516
48	lbs	9001	9156	9631	9359	9585	9740	10215	9943
	kg	4083	4153	4369	4245	4348	4418	4633	4510
59	lbs	9213	9368	9843	9571	9856	10011	10486	10214
	kg	4179	4249	4465	4341	4471	4541	4756	4633
73	lbs	11303	11458	11933	11691	12128	12283	12758	12516
	kg	5127	5197	5413	5303	5501	5571	5787	5677
80	lbs	11430	11585	12060	11818	12255	12410	12885	12643
	kg	5185	5255	5470	5361	5559	5629	5845	5735
89	lbs	11820	11975	12450	12208	12645	12800	13275	13033
	kg	5361	5432	5647	5537	5736	5806	6021	5912

**Notes:**

- Weights shown for evaporative condensing units include the following features: high capacity evaporative coil. Add 520 lbs for 24, 29, 36, 48 and 59 units and 680 lbs for 73, 80 and 89 units for installed sump base water weight for evaporative condenser total operating weight.
- Weights shown represent approximate operating weights and have a  $\pm 5\%$  accuracy. To calculate weight for a specific unit configuration, utilize TOPSS or contact the local Trane sales representative. ACTUAL WEIGHTS ARE STAMPED ON THE UNIT NAMEPLATE.

**Table 14. Roof curb max weight<sup>(a)</sup>**

Unit	Roof Curb Max. Weight		Unit	Roof Curb Max. Weight	
	SAHL	S*HL		SAHL	S*HL
20/24	490	510	70/80	610	640
	222	231		277	290
25/29	490	510	75/89	610	640
	222	231		277	290
30/36	490	510	90	N/A	770
	222	231		N/A	349
40/48	515	550	105	N/A	770
	234	249		N/A	349
50/55/59	515	550	115	N/A	770
	234	249		N/A	349
60/73	515	550	130	N/A	770
	234	249		N/A	349

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

## Trane Roof Curb and Ductwork

The roof curbs for 20 through 130 Ton units consists of two main components; a pedestal to support the unit's condenser section and a "full perimeter" enclosure to support the unit's air handler section.

Before installing any roof curb, verify;

1. That it is the correct curb for the unit,
2. That it includes the necessary gaskets and hardware,
3. 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. 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, excluding SSH\_'s, is 4" end-to-end and 2" side-to-side. Units with steam coils (SSH\_'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.

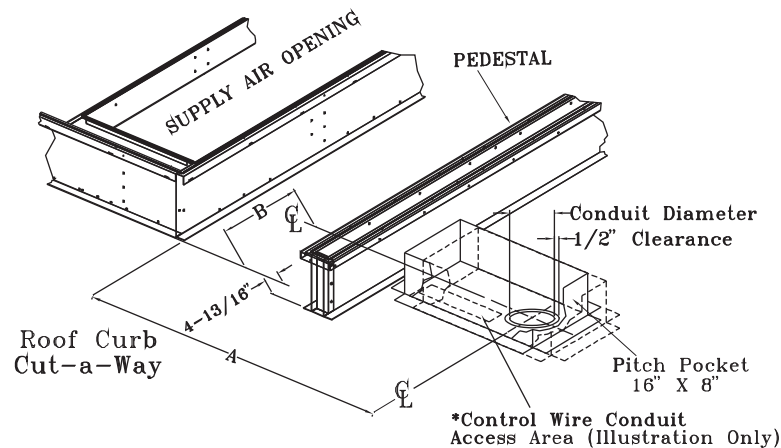
Recommendations for installing the Supply Air and Return Air ductwork joining the roof curb are included in the curb instruction booklet. Curb ductwork must be fabricated and installed by the installing contractor before the unit is set into place.

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

## Pitch Pocket Location

The location of the main supply power entry for S\_HL 20 through 89 Ton rooftop units is located at the bottom right-hand corner of the control panel. [Figure 9](#) and [Figure 10](#) illustrate the location for the electrical entrance through the base in order to enter the control panel. If the power supply conduit penetrates the building's roof beneath this opening, it is recommended that a pitch pocket be installed before the unit is placed onto the roof curb. The center line dimensions shown in the illustration below indicates the center line of the electrical access hole in the unit base when it is positioned on the curb,  $\pm 3/8$  inch. The actual diameter of the hole in the roof should be at least 1/2 inch larger than the diameter of the conduit penetrating the roof. This will allow for the clearance variable between the roof curb rail and the unit base rail illustrated in [Figure 14](#).

The pitch pocket dimensions listed are recommended to enhance the application of roofing pitch after the unit is set into place. The pitch pocket may need to be shifted as illustrated to prevent interference with the curb pedestal.

**Figure 14. Pitch pocket location**

**Table 15. Pitch pocket dimensions**

Unit	Tonnage	"A" Dimension	"B" Dimension
S*HL	20, 25 & 30	4' 5-9/16"	5-9/16"
S*HL	24, 29, & 36	6' 9-11/16"	5-1/2"
S*HL	40 - 89	9' 5-11/16"	5-1/2"

\* = All unit functions (SAHL, SEHL, SFHL, SSSL, SLHL and SXHL)

**Notes:** For design special evaporative-cooled condensing units, please see the curb installers guide for proper pitch pocket locations.

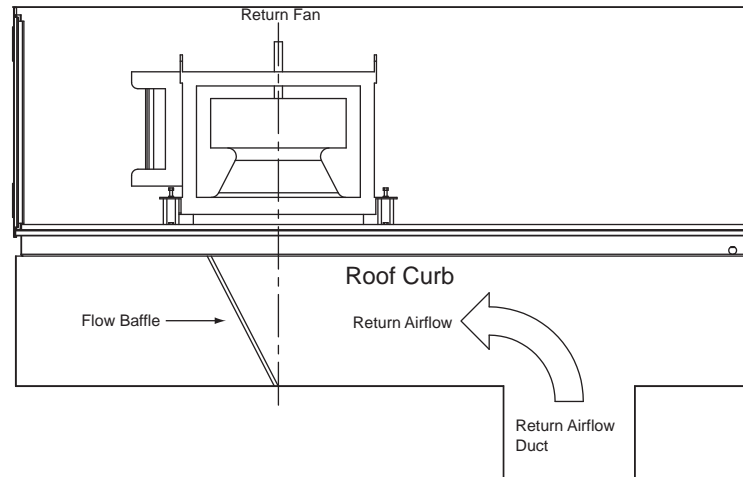
### If a Trane Curb Accessory Kit is Not Used:

- 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.

#### Notes:

- If a "built-up" curb is provided by others, keep in mind that these commercial rooftop units do not have base pans in the condenser section.
- If this is a REPLACEMENT UNIT keep in mind that the CURRENT DESIGN commercial rooftop units do not have base pans in the condenser section.
- Trane roof curbs are recommended. If using a non-Trane roof curb with right-angle return airflow approaches to a return fan inlet, a rigid, solid flow baffle wall should be installed across the full width of the roof curb return airflow path in the position shown in [Figure 15, p. 46](#) to reduce potential airflow disturbances at the return fan inlet that could contribute to unusual return fan noise.

**Figure 15. Solid flow baffle wall installation for non-Trane roof curbs**



## 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 the diagram. Refer to the Installation manual or nameplate for the unit weight. Refer to the Installation Instructions located inside the side control panel for further rigging information.

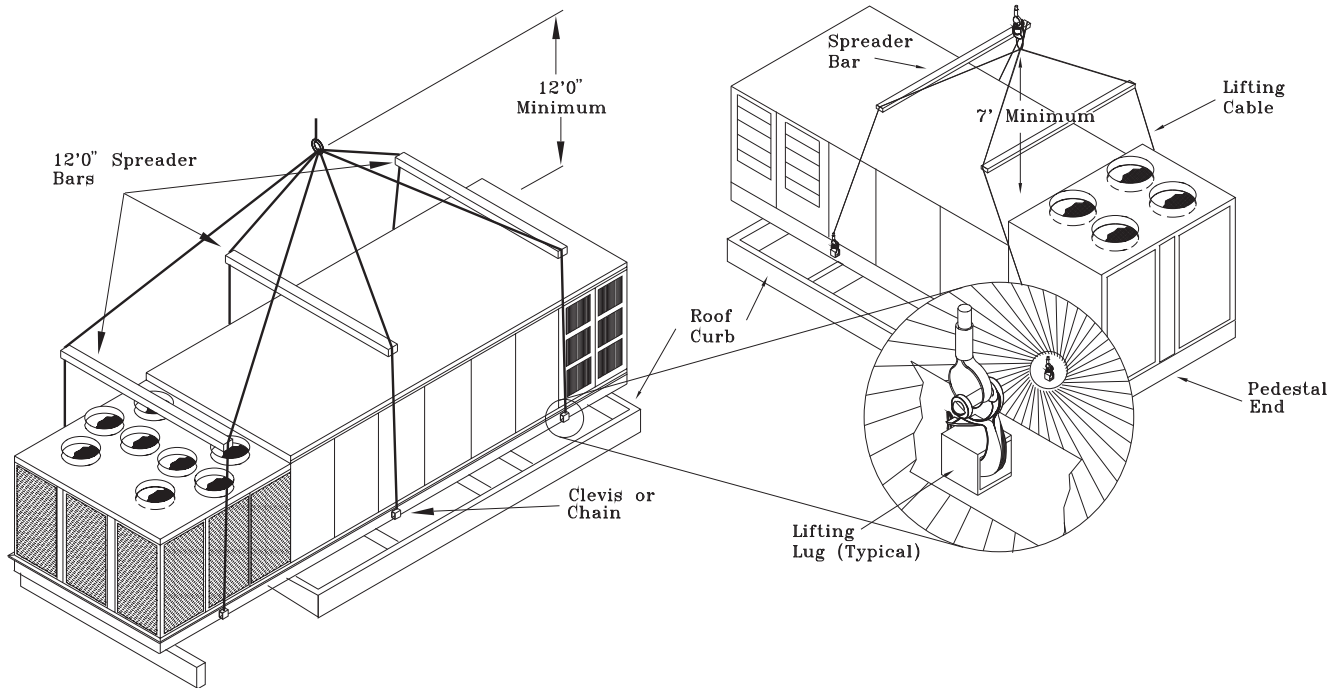
1. A Center-of-Gravity illustration and the dimensional data is shown in [Figure 13, p. 41](#).
2. Attach adequate strength lifting slings to all four lifting lugs on 20 through 75 Ton units. The minimum distance between the lifting hook and the top of the unit should be 7 feet for 20 through 75 Ton units. [Figure 16, p. 47](#) illustrates the installation of spreader bars to protect the unit and to facilitate a uniform lift. [Table 12, p. 42](#) lists the typical unit operating weights.
3. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
4. 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.
5. Align the base rail of the unit's air handler section 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. (The pedestal simply supports the unit's condenser section)

A cross section of the juncture between the unit and the roof curb is shown in [Figure 17, p. 47](#).

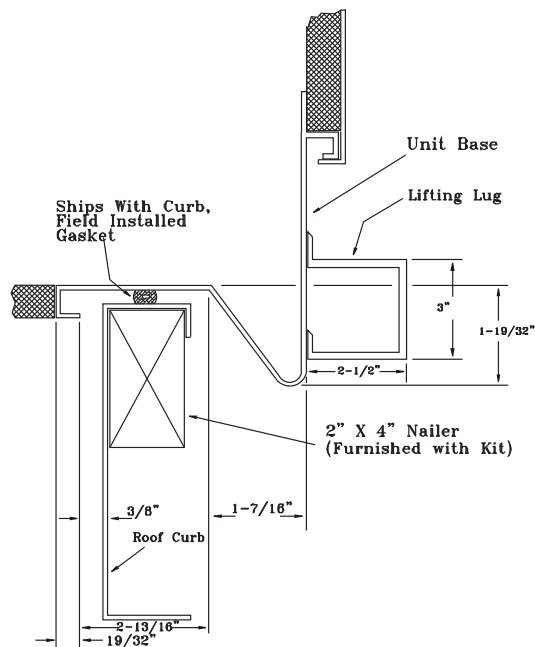
**Figure 16. Unit rigging**

Typical 90 through 130 Ton Unit

Typical 20 through 75 Ton Unit



**Figure 17. Typical unit base and roof curb cross section**



## General Unit Requirements

### **⚠ WARNING**

#### **Live Electrical Components!**

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

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

- 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 per the current edition of the curb installation guide.
- Fabricate and install ductwork; secure ductwork to curb.
- Install pitch pocket for power supply through building roof. (If applicable)
- Rigging the unit.
- Set the unit onto the curb; check for levelness.
- Ensure unit-to-curb seal is tight and without buckles or cracks.
- Install and connect condensate drain lines to each evaporator drain connection.
- Remove the shipping hold-down bolts and shipping channels from the supply and exhaust/return fans ordered with rubber or spring isolators.
- Check all optional supply and exhaust/return fan spring isolators for proper adjustment.
- Verify all discharge and liquid line service valves (one per circuit) are back seated.

## Main Electrical Power Requirements

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

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

## Field Installed Control Wiring

- 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 SEHL 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.

### SEHL 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 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 (SLH\_)

- 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 (SSH\_)

- 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.

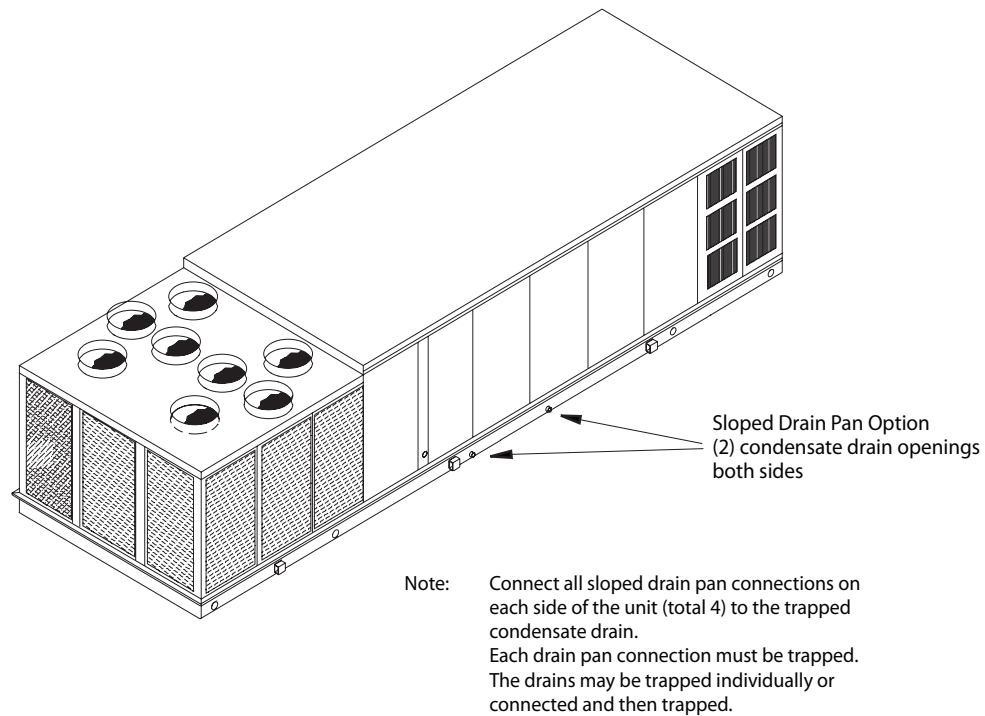
## O/A Pressure Sensor and Tubing Installation (All units with Statitrac or Return Fans)

- 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 (Statitrac only).

## Requirements for Modulating Reheat Dehumidification

- Install (5U108) humidity sensor in space or return duct
- Complete field wiring of humidity sensor to ECEM (1TB16). Refer to “Field Installed Control wiring” for guidelines.

**Figure 18. Condensate Drain Locations**



## Condensate Drain Connections

Each S\_HL and S\_HK unit is provided with four 1" evaporator condensate drain connections (two on each side of the unit).

Due to the size of these units, all condensate drain connections must be connected to the evaporator drain connections. Refer to the appropriate illustration in [Figure 9](#) and [Figure 10](#) for the location of these 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 19](#).

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

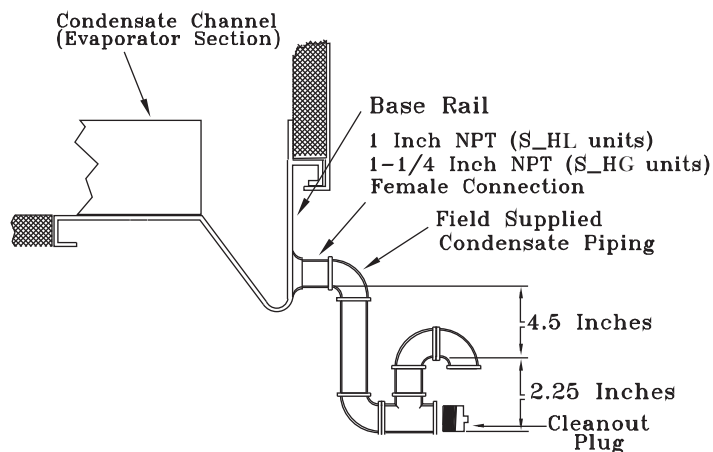
Units equipped with a gas furnace have a 3/4" CPVC drain connection stubbed out through the vertical support in the gas heat section. It is extremely important that the condensate be piped to a proper drain. Refer to the appropriate illustration in [Figure 9](#) and [Figure 10](#) for the location of 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 19. Condensate Trap Installation**



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

Each supply fan assembly and exhaust fan assembly for S\_HL units shipped with a motor larger than 5 HP is equipped with rubber isolators (as standard) or optional spring isolators. Each return fan assembly for S\_HL units shipped with a motor larger than 5 HP 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 20](#) and [Figure 21](#), and use the following procedures:

#### Rubber Isolators:

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.

#### Spring Isolators:

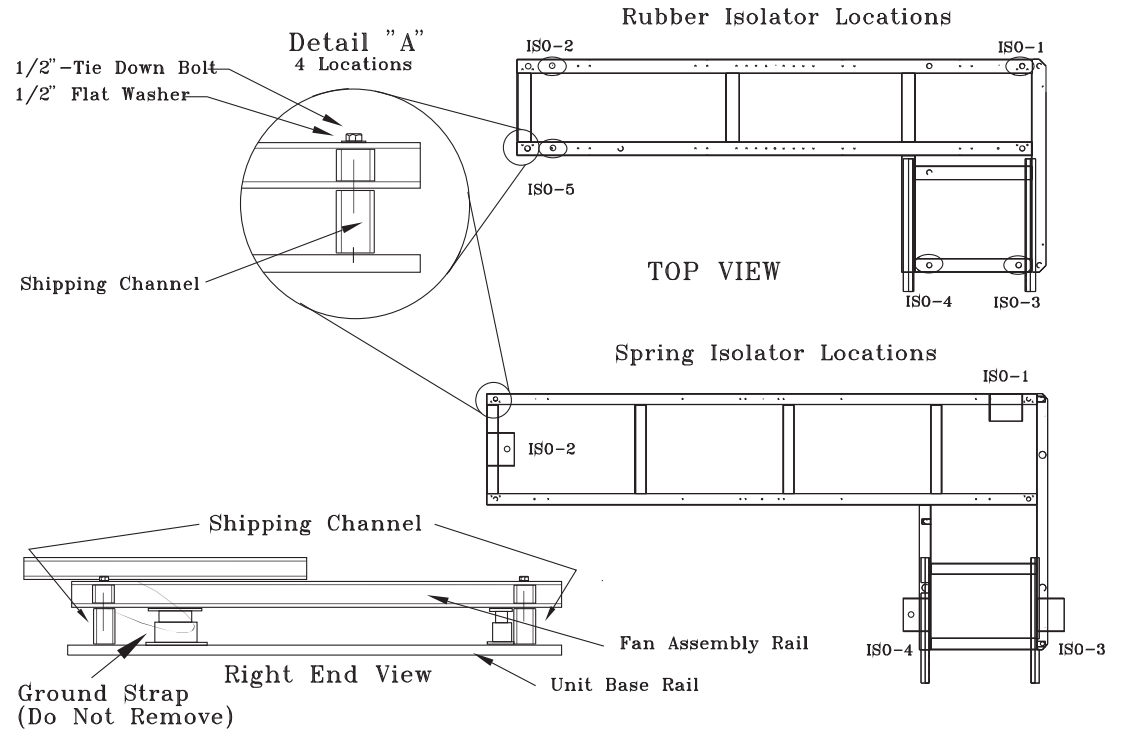
See [Figure 20](#) and [Figure 21](#) for spring isolator locations.

1. Remove and discard the shipping tie down bolts.
2. Remove the shipping channels and discard.

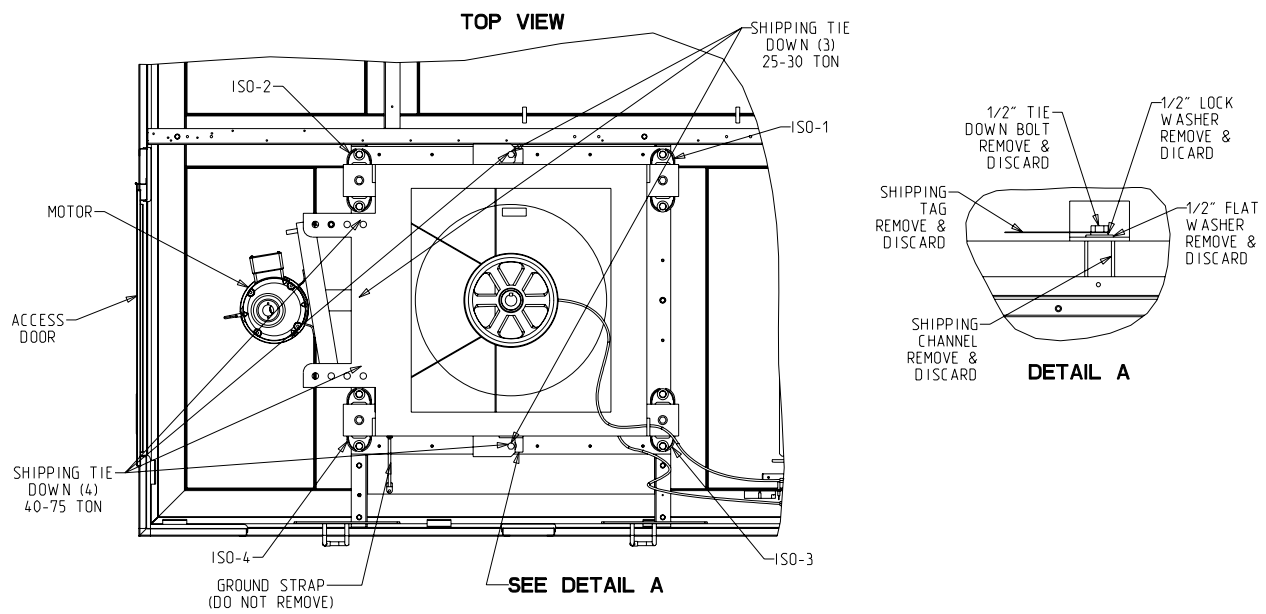
**Note:** Fan assemblies not equipped with rubber or spring isolators have mounting bolts at the same locations and must not be removed.

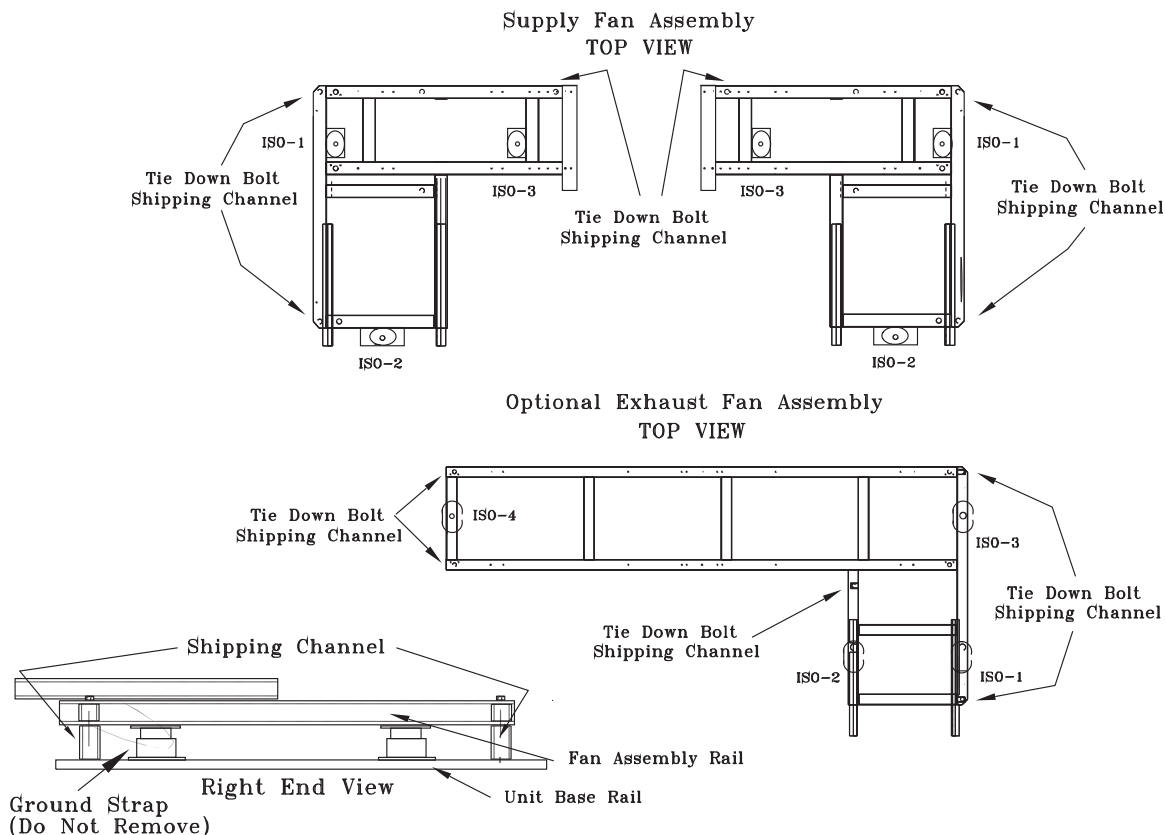
**Note:** If return fan backside spring isolator repair/replacement is required, access the backside of the return fan by entering the unit filter section. Remove the top pivot bearings from the three fixed-position return damper blades (bolted together as a single section with an angle brace). Lift the three-blade section as a single unit from the return damper assembly and set aside or lean in against the return fan frame. Then enter the return fan compartment from the filter section to perform service work on the rear isolators.

**Figure 20. Removing Supply and Exhaust Fan Assembly Shipping Hardware (20-89 Ton)**



**Figure 21. Removing Return Fan Assembly Shipping Hardware (20-89 Ton)**



**Figure 22. Removing supply and exhaust fan assembly shipping hardware (90-130 Ton)**


## O/A Sensor & Tubing Installation

An Outside Air Pressure Sensor is shipped with all units designed to operate on variable air volume applications, units equipped with a return fan, 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.

On units equipped with a return fan, a return pressure transducer (3U106) is connected to the O/A sensor for comparison with return plenum pressure.

Refer to [Figure 23, p. 56](#) 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;
  - O/A static pressure sensor with sensor mounting
  - Bracket
  - 50' of 3/16" O.D. pneumatic tubing
  - Mounting hardware

2. Using two #10-32 x 1-3/4" screws provided, install the sensor's mounting bracket to the factory 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 50' x 3/16" O.D. factory provided pneumatic tubing to the sensor's top port, and the other end of the tubing to the connector in the vertical support. Discard any excess tubing.

**Units with Statitrac:**

6. Open the filter access door, and locate the DSP control devices illustrated in [Figure 23](#). 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.

**Remove Evaporative Condenser Fan Shipping Brackets*****To remove shipping brackets***

**Important:** *Remove fan shipping brackets before startup. Failure to remove brackets could result in fan damage.*

Evaporative condensers are shipped with fan shipping brackets to reduce damage caused by vibration during shipment. The fan shipping brackets must be removed prior to unit startup. To remove the shipping brackets start from the side opposite to the drain actuator (see [Figure 60, p. 141](#)):

1. Loosen the screw for the bracket that holds the inlet louvers below the door side.
2. Remove inlet louvers and set to the side.

**Note:** *Service technician may need to step on the horizontal surface of FRP coated base. Step with care.*

3. Unscrew the bolt in the middle of the door. Keep the bolt in a safe place.
4. Lift one door with handle until it touches the top. Swivel bottom of door to remove it from the door opening and set it to the side.
5. Slide and remove the middle mist eliminator section so that the shipping bracket is visible.
6. Use screw gun to unscrew the two screws that hold the fan shipping bracket. The bracket should drop down but still remain engaged with a hook on the bracket.
7. Go to the other side of the unit and follow the procedure for inlet louver and door removal (see steps 1 - 6).
8. Hold the bracket with one hand and remove remaining two screws.
9. Remove the bracket and all the removed screws from the unit.

**Important:** *Make sure there are no screws remaining in the coil area.*

10. Reinstall inlet louvers, mist eliminators and louvers.

Check that the direction of arrow on the inlet louver is correct.

## Evaporative Condenser Make-up Water and Drain Line Installation

### Make-up Water and Drain Lines

#### ***Water Supply Source***

The supply line should be designed to provide a minimum supply of water within customary domestic supply pressures, 35 to 60 psig; dynamic pressure (measured with the valve open) which will allow approximately 30 GPM to enter the sump through the makeup water valve, when the sump is empty. The unit uses about 2-4 GPM. Attach a hand valve at the inlet for use during inspection and maintenance; an inlet strainer is recommended as well. Make-up water inlet connection is a 3/4" PVC slip connector. Care must be taken to ensure the water line upstream of the water solenoid valve will not freeze. Insulating the line and utilizing heat tape is recommended if ambient temperatures below 32° F are expected.

#### ***Water Quality***

Overall performance of any water-cooled device can be affected by suspended particulates, mineral concentration, trash and debris resulting in clogging and heat transfer loss. The evaporative-cooled condenser is designed to greatly minimize problems with these impurities. However, float valves and solenoid valves are used to control the incoming water. If the incoming water contains contaminants, sand or other objects, an incoming line strainer with a 80 to 100 mesh screen is required. The inlet line should be flushed prior to connection to the unit, whether or not there is a strainer.

**Note:** *Backflow preventer to be field provided and installed by others.*

Water Drain Schedule 80 PVC pipe of 1 1/4" is normally adequate for sump water drain. Periodically, the sump is emptied and flushed to eliminate accumulated dirt, debris, and minerals.

Concentration of these foreign substances will increase as the system operates. The evaporative process releases essentially pure water vapor into the atmosphere, leaving the impurities behind that accumulate in the sump. Although these impurities are present in the original make-up water, their concentration will be higher in the sump discharge. Care and judgment should be exercised when selecting a discharge site.

#### ***Local Site Discharge***

Rooftop or simple storm sewer discharge is generally acceptable. Do not routinely direct the sump discharge onto an area where these higher concentrations will adversely affect that area, i.e. continued sump discharge into a flower bed for example, where the input water contains CaCO<sub>3</sub> (lime) will eventually decrease the pH of the soil.

#### ***Sewer Discharge***

The quantities of mineral and debris flushed are actually very small, and do not cause problems when diluted in normal sewer flow. However, local, state or federal standards and restrictions must be followed in any given locality

#### ***Make Up Water Solenoid Valve***

This valve is controlled by the UCM based on water level in the sump, as well as whether a call for mechanical cooling exists. During low ambient temperatures, the solenoid valve will be de-energized preventing water from further filling sump. The sump drain valve opens to empty sump of water. Operation can be extended to 10 deg by providing an optional sump heater.

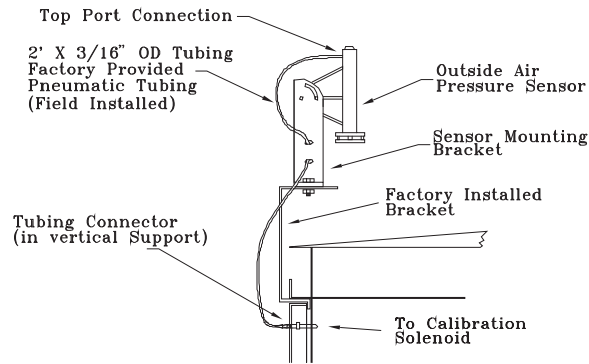
#### ***Drain Valve***

The drain valve is shipped to "drain during power loss conditions". If "hold during power loss conditions" is desired, refer to "Evaporative Condenser Drain Valve Setup" on page 98.

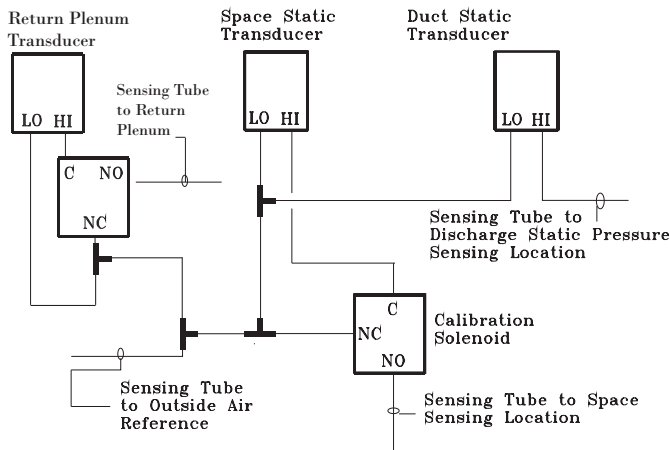
# Installation

**Figure 23. Pressure sensing**

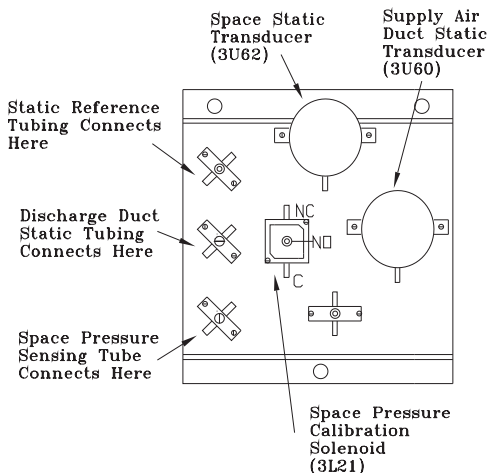
### Outside Air Sensing Kit



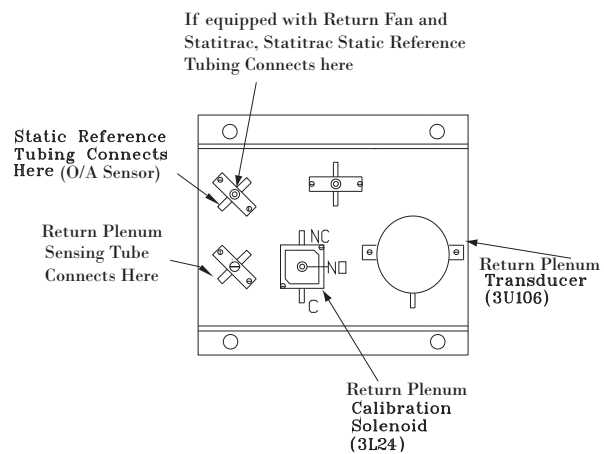
### Duct, Space and Return Plenum Pressure Transducer Tubing Schematic



### Duct and Space Static Pressure Control Component Layout



### Return Fan Plenum Pressure Control Component Layout





## Gas Heat Units (SFH\_)

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 compartments.

### **⚠ WARNING**

#### **Hazardous Gases and Flammable Vapors!**

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

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

Access holes are provided on the unit as illustrated in [Figure 10, p. 36](#) to accommodate a side or bottom pipe entry on 20 through 89 Ton units and in [Figure 12, p. 40](#) on 90-130 Ton units. Following the guidelines listed below will enhance both the installation and operation of the furnace.

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

1. To assure sufficient gas pressure at the unit, use [Table 16](#) 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.
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.

### 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 24](#) through [Figure 27](#) 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.

**Table 16. Sizing Natural Gas Pipe Mains and Branches**

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

\* Table is based on a specific gravity of 0.60. Use [Table 17](#) for the specific gravity of the local gas supply.

**Table 17. Specific Gravity Multipliers**

Specific Gravity	Multiplier
0.50	1.10
0.55	1.04
0.60	1.00
0.65	0.96

**Table 18. 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 19. Gas Heating Capacity Altitude Correction Factors**

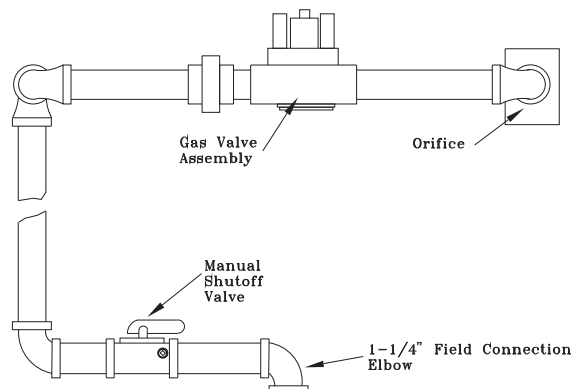
Capacity Multiplier	Altitude (Ft.)						
	Sea Level - 2000	2001 - 2500	2501 - 3500	3501 - 4500	4501 - 5500	5501 - 6500	6501 - 7500
	1.00	.92	.88	.84	.80	.76	.72

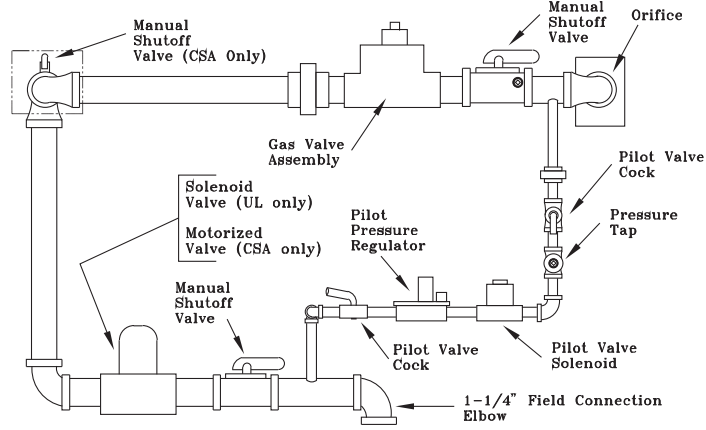
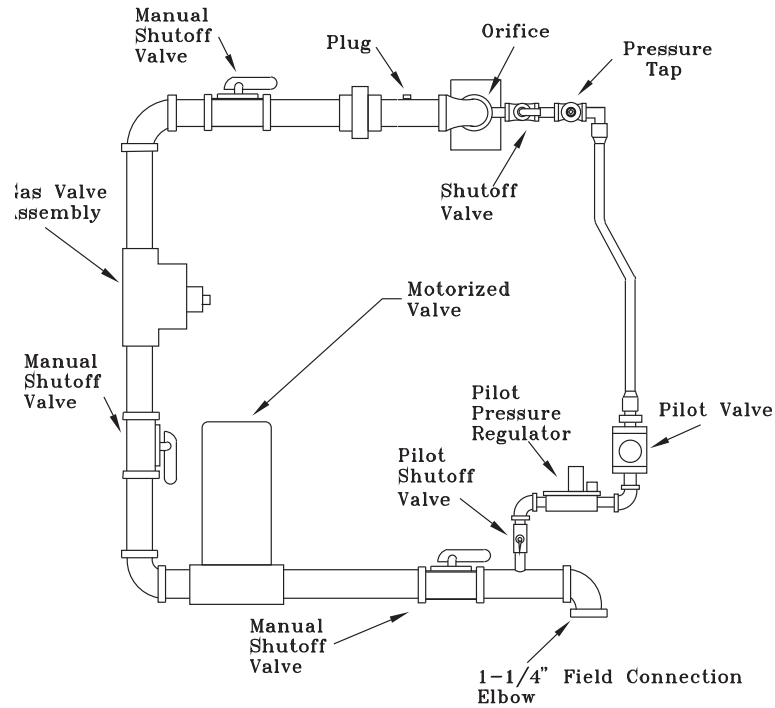
**Note:** Correction factors are per AGA Std. 221.30 - 1964, Part VI, 6.12. Local codes may supersede.

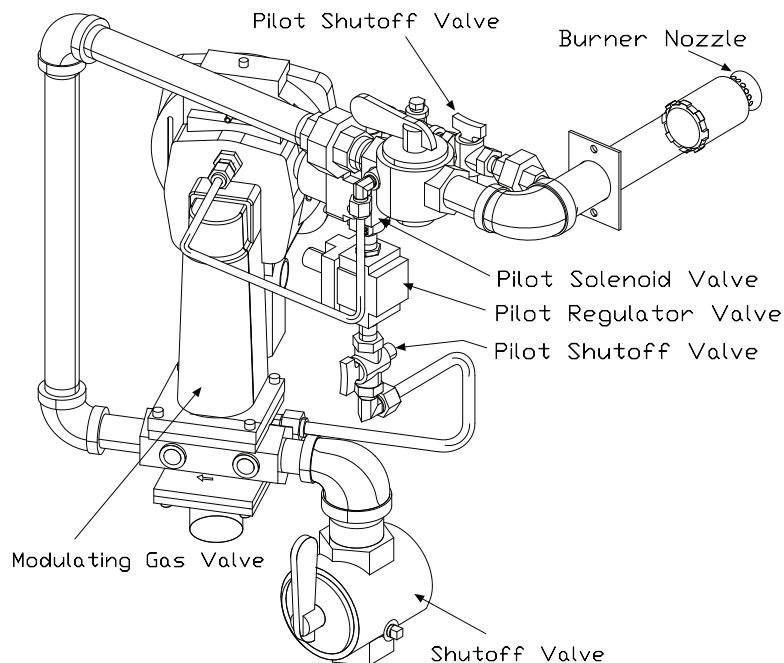
**Notes:**

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  
 $\text{Cu.Ft./Hour} = \text{Furnace MBH Input} \times \text{Gas BTU/Cu.Ft.} \times \text{Multiplier (Table 17)}$   
 $\text{Cu.Ft./Hour} = 500$
4. Table 16 indicates that a 1-1/4" pipe is required.

**Figure 24. Unit Gas Trains (Natural Gas) 235 and 350 MBH**

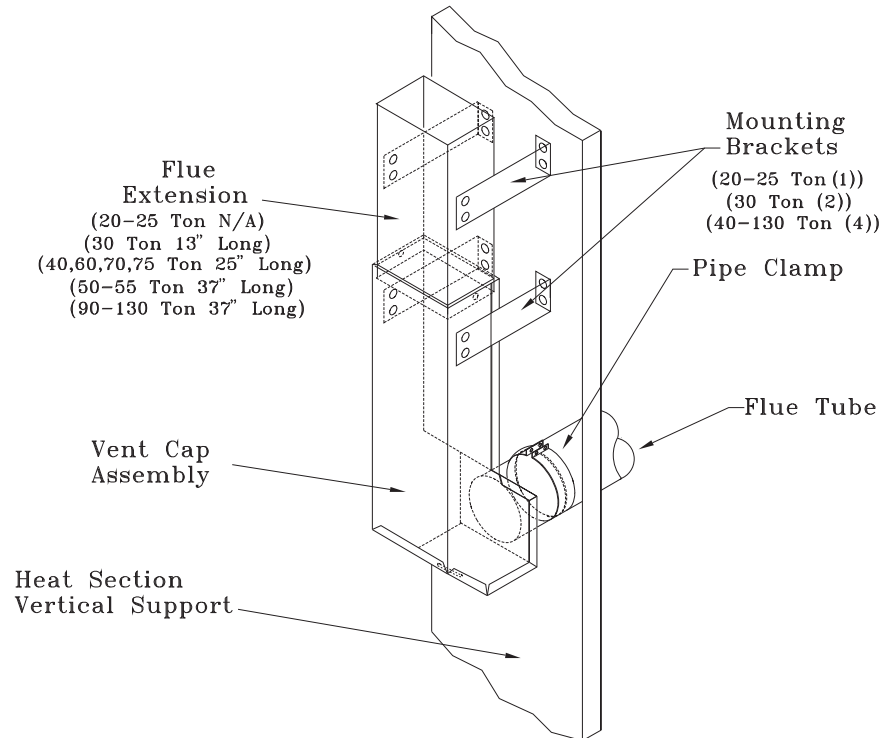


**Figure 25. Unit Gas Trains (Natural Gas) 500 and 850 MBH**

**Figure 26. Unit Gas Trains (Natural Gas) 1000 MBH**


**Figure 27. Modulating 500 - 1000 MBH**


## Flue Assembly Installation

1. Locate the flue assembly and the extension (refer to [Figure 28](#) for extension usage) in the ship with section of the unit.
2. Install the flue extension onto the flue assembly as shown in [Figure 28](#).
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-punch holes in the flue assembly, extension, and the vertical support, install the appropriate number of mounting brackets. Refer to [Figure 28](#) for details.

**Figure 28. Flue Assembly**


## Hot Water Heat Units (SLH\_)

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 factory provided three way modulating valve 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 illustrated in [Figure 10, p. 36](#).

Following the guidelines listed below will enhance both the installation and operation of the "wet heat" system.

[Figure 29](#) and [Figure 31](#) illustrate the recommended piping configuration for the hot water coil. [Table 20](#) 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 line 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 29](#) and [Figure 38](#).

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 SLHL 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 29](#) and [Figure 38](#).

**Table 20. Connection Sizes for Hot Water and Steam Coil<sup>(a)</sup>**

Unit Model and Size	Heat Section Capacity <sup>(b)</sup>	Coil Connections (diameter in inches)	
		Supply	Return
SLH*-20 to 130	High or Low Heat	2-1/2"	2-1/2"
SSHL-20 to 36	High or Low Heat	3"	1-1/4"
SSHL-40 to 89 <sup>(c)</sup>	High Heat Low Heat	3"	1-1/2"
SSHK-90 to 130	Low Heat <sup>(c)</sup>	1-1/2"	1"

(a) Type W coils—with center offset headers—are used in SLH\_ units; Type NS coils are used in SSH\_ units.

(b) See Digit 9 of the unit model number to determine the heating capacity.

(c) SSH\_ - 40 to 89 Ton units have multiple headers.

## Steam Heat Units (SSH\_)

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. To maintain the designed degree of pitch for the coil, the unit must be level.

Once the unit is set into place, the steam piping and the factory provided two way modulating valve 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 illustrated in [Figure 10, p. 36](#).

Following the guidelines listed below will enhance both the installation and operation of the "wet heat" system.

[Figure 31](#) and [Figure 32](#) illustrate the recommended piping configurations for the steam coil. [Table 20](#) 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. 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.

## Installation

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.

### 40 through 130 Ton 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 32](#) illustrates the recommended piping configuration for the steam coils.

**Figure 29. Hot Water Piping (20 - 75 Ton)**

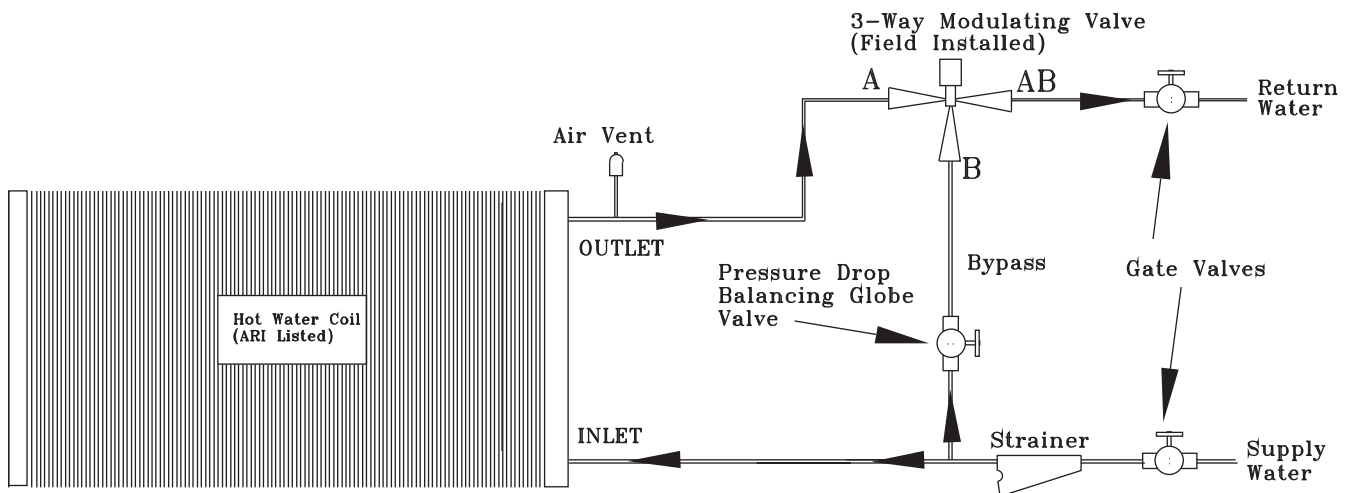




Figure 30. Hot Water Piping (90 - 130 Ton)

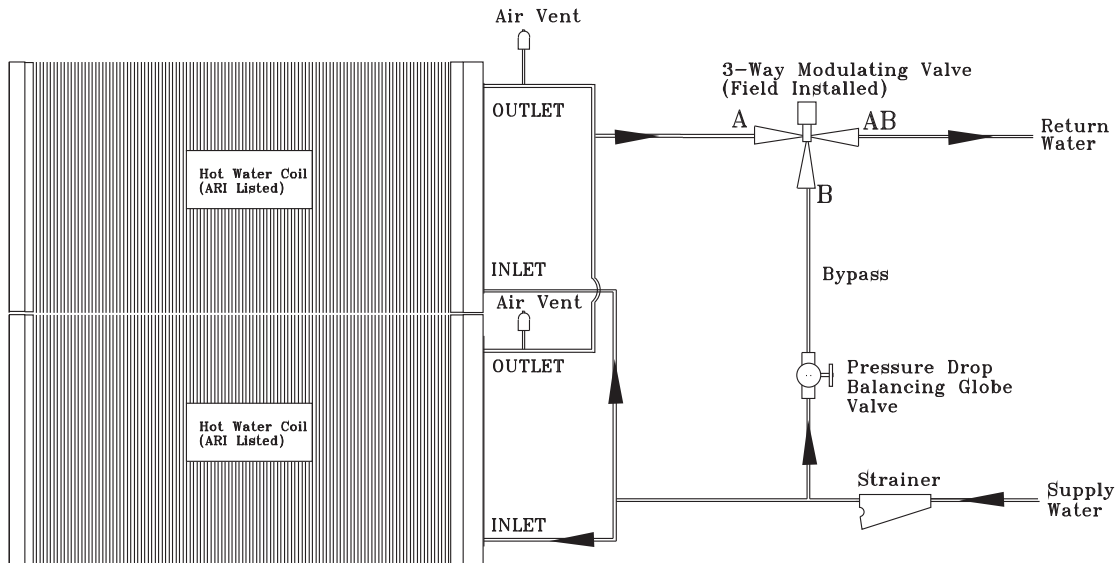
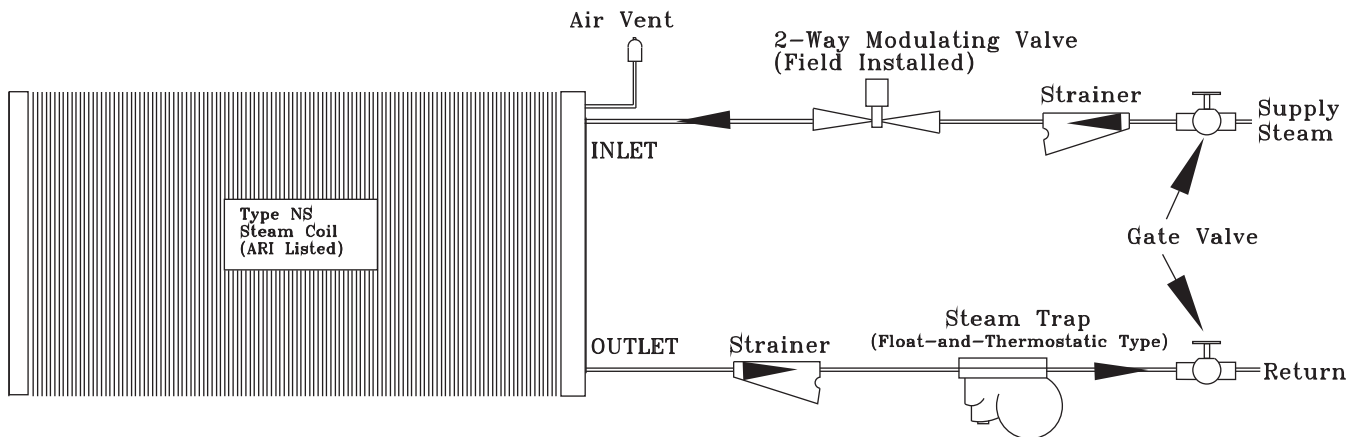
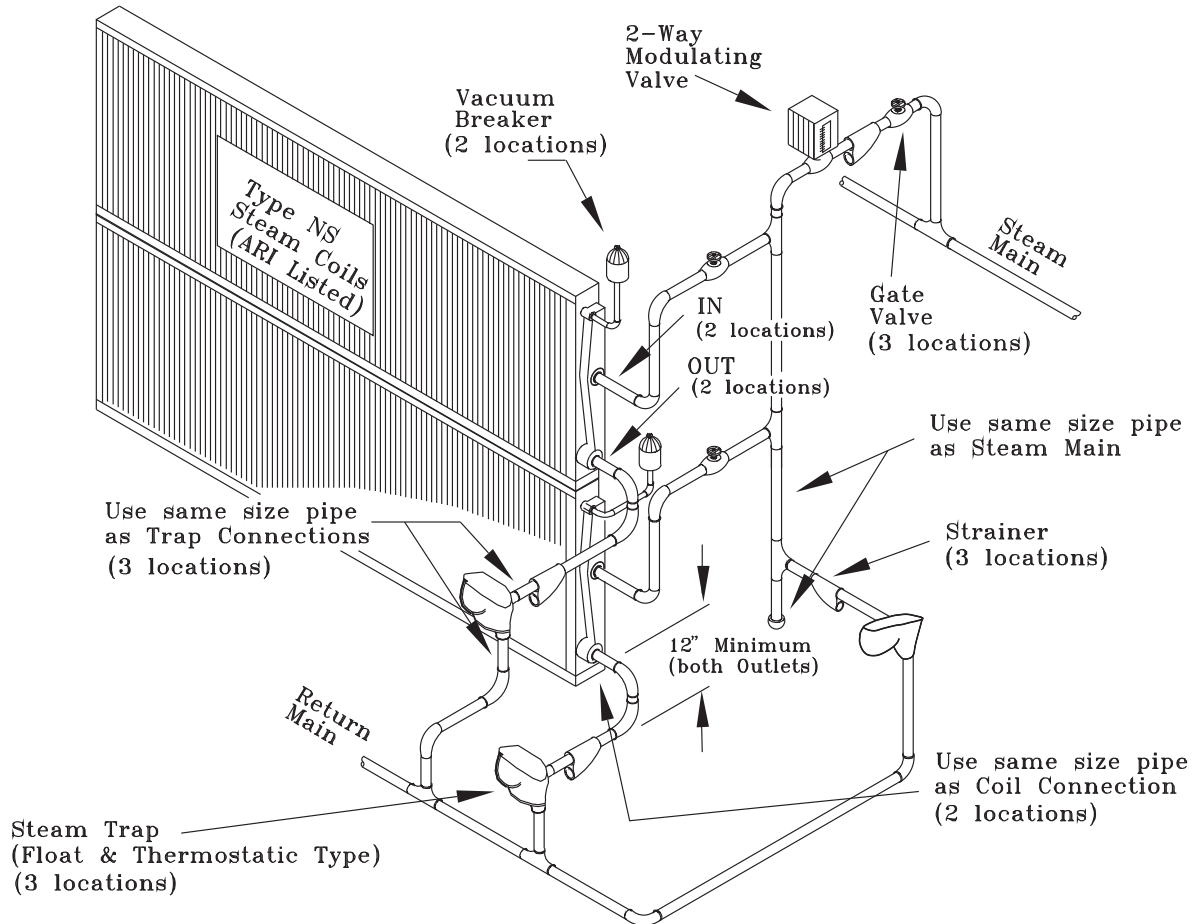


Figure 31. Steam Coil Piping (20 - 36 Ton)



**Figure 32. Steam Coil Piping (40 - 130 Ton)**


## 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.

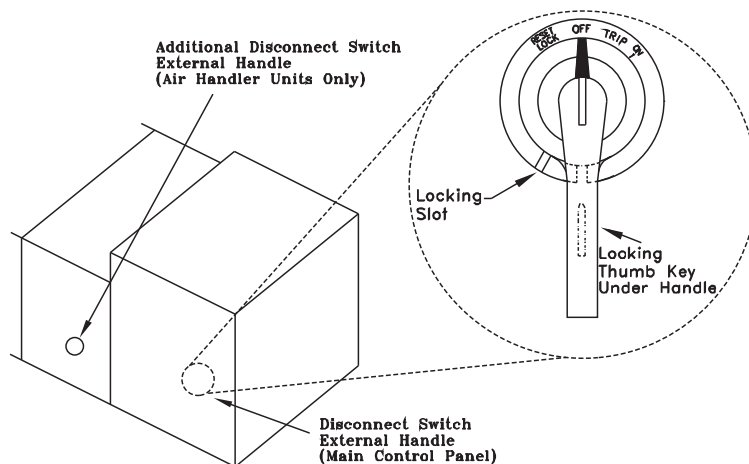
“OPEN COVER/RESET” - Turning the handle to this position releases the handle from the disconnect switch, allowing the control panel door to be opened.

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. See [Figure 33](#).

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 34](#). To ensure the unit's supply power wiring is properly sized and installed, follow the guidelines outlined below.

**Figure 33. Disconnect Switch Handle Positions**



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

## WARNING

### Live Electrical Components!

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

Verify that the power supply available is compatible with the unit's nameplate rating 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.

## CAUTION

### Hot Surface!

Surface temperatures may exceed 300°F (150°C) on condensing unit and carbon tank. To avoid possible skin burns, stay clear of these surfaces. If servicing is required allow surfaces to cool or wear protective gear. Failure to do so could result in minor to moderate injury.

## 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 (SEH\_)

### **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.**

SEHL (20 through 89 Ton) electric heat units operating on 200/230 volts require two power supplies as illustrated in [Figure 34](#). Unless the unit was ordered with the optional factory mounted non-fused disconnect switches, two field-supplied disconnect switches must be installed. 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 illustration in [Figure 10, p. 36](#), (Unit Base layout and Electrical Entrance diagram), for dimensional data.

On 20-130 ton units operating on 460/575 volts, only one power entry is required, as illustrated in [Figure 34](#).

Use the information provided in [Table 21, p. 71](#) and the "Power Wire Sizing & Protection Device Equations"; 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.**

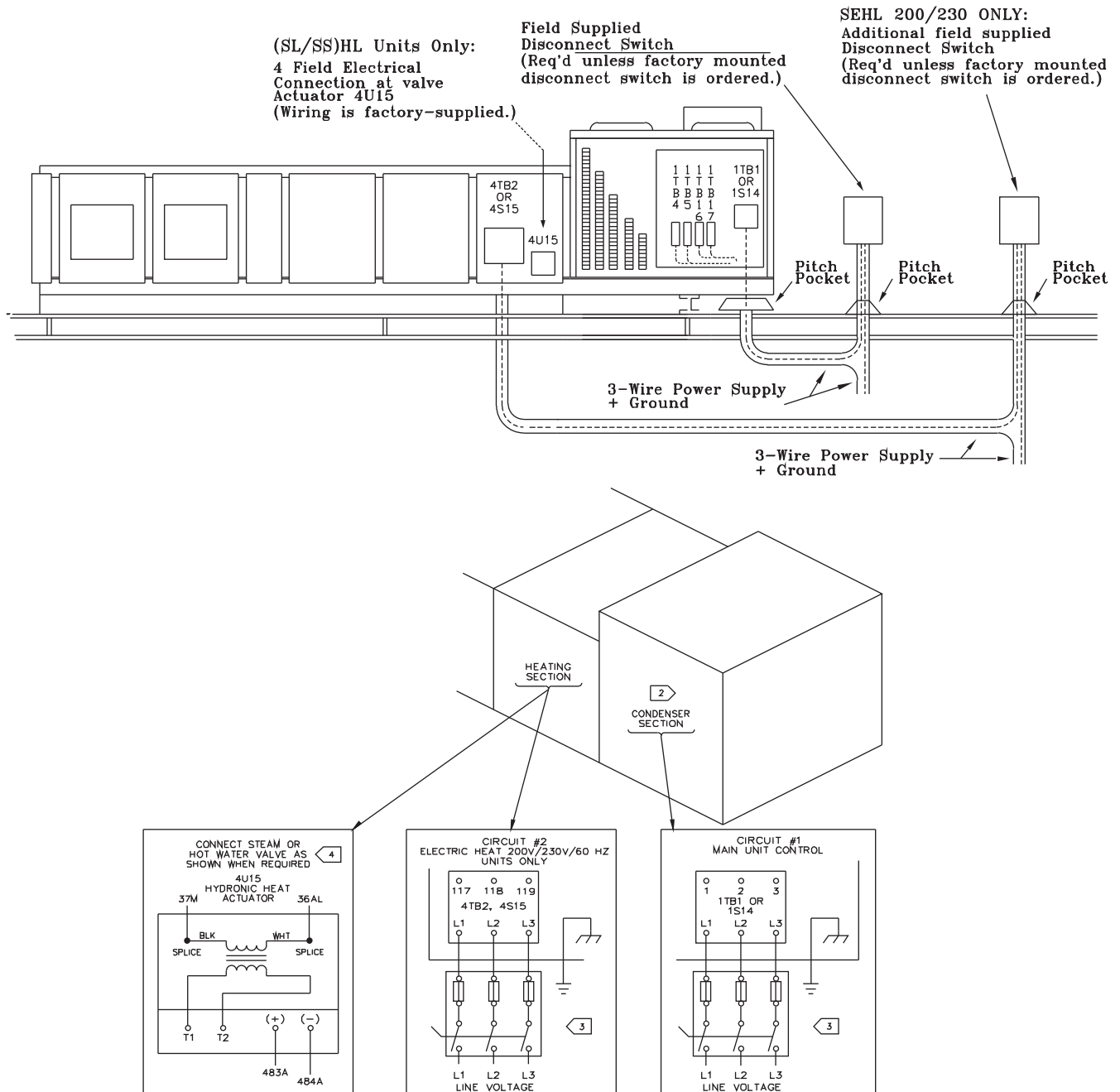
[Figure 37, p. 84](#) lists the field connection wire ranges for both the main power terminal block 1TB1 and the optional main power disconnect switch 1S14. [Table 21, p. 71](#) lists the component electrical data for 20 through 130 ton units. The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements. Protection devices must be sized according to the electrical data on the nameplate. Refer to the "Power Wire Sizing & Protection Device 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).
1. 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 the "Power Wire Sizing & Protection Device Equations" (DSS calculation), for determining the correct size.
  2. Location for the electrical service entrance is illustrated in [Figure 10, p. 36](#). 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.

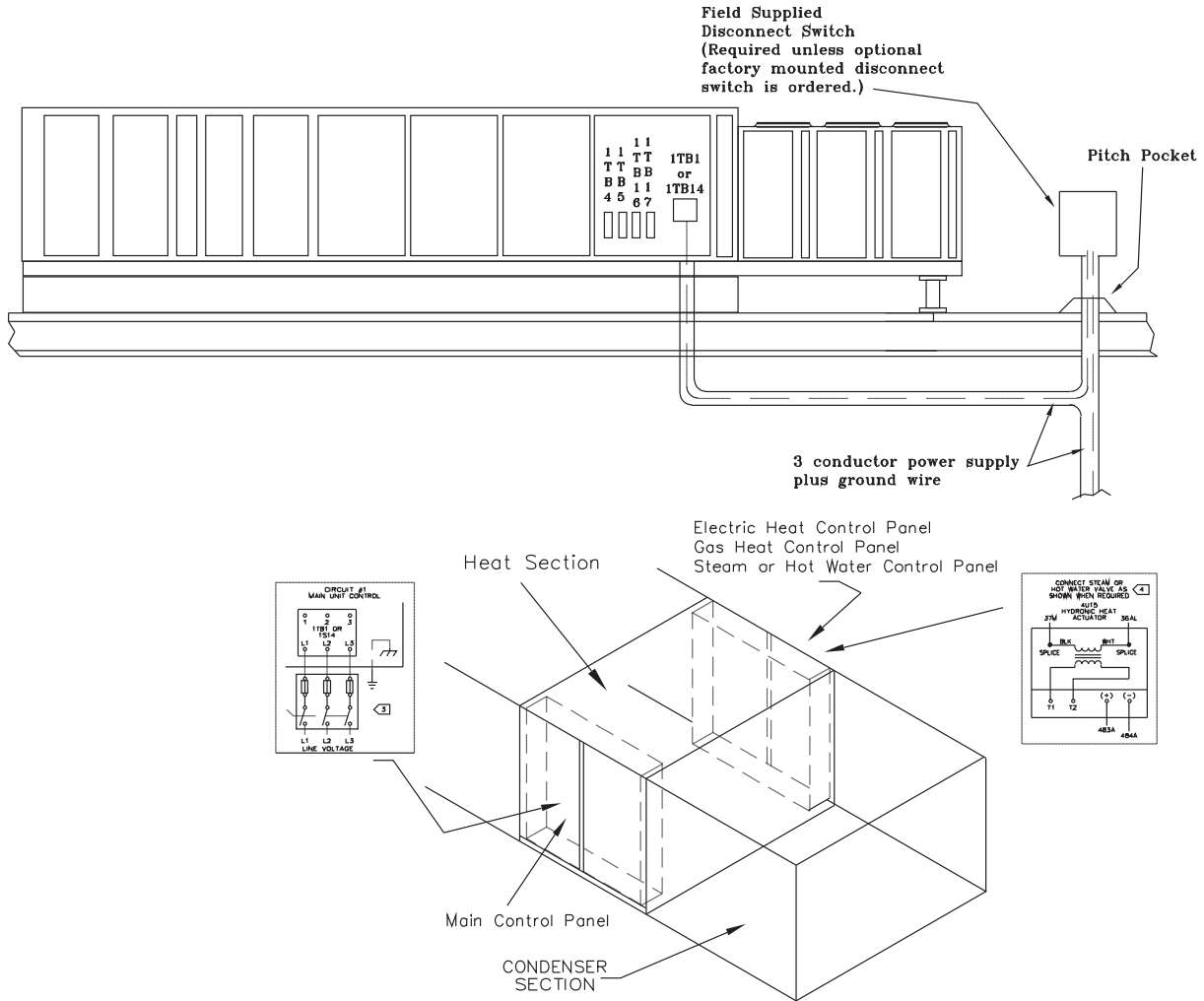
3. Provide proper grounding for the unit in accordance with local and national codes.

**Figure 34. Typical Field Power Wiring (20 - 89 Ton)**



# Installation

**Figure 35. Typical Field Power Wiring (90 - 130 Ton)**



**Figure 36. Customer Connection Wire Range**

NOTES:	CUSTOMER CONNECTION WIRE RANGE					
	UNITS WITH MAIN POWER TERMINAL BLOCK (ALL VOLTAGES)			UNITS WITH MAIN POWER DISCONNECT SWITCH (ALL VOLTAGES)		
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.	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 (2)	#1 - 600 kcmil OR #1 - 250 kcmil
				600 AMP	(2)	250 - MCM
				1000 AMP	(3)	3/0 - 500 kcmil

**Table 21. Compressor electrical service sizing data (20 - 130 ton)<sup>(a)</sup>**

Tonnage (AC/EC)	No. of Compressors	200V		230V		460V		575V	
		RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA
20 (Std)	2	41.4	267	35.5	267	18.6	142	15.8	103
20/24 (Hi)	2	41.4	267	35.5	267	18.6	142	15.8	103
25 (Std)	1	41.4	267	35.5	267	18.6	142	15.8	103
	1	47	304	42.3	304	20.2	147	17.1	122
25/29 (Hi)	1	41.4	267	35.5	267	18.6	142	15.8	103
	1	51.9	315	47	315	22.2	158	19.2	136
30 (Std)	2	51.9	315	47	315	22.2	158	19.2	136
30/36 (Hi)	1	51.9	315	47	315	22.2	158	19.2	136
	1	56.9	351	48.8	351	25.5	197	23.1	135
40 (Std)	2	31.3	203	30.4	203	13.1	98	11.9	84
	2	37.3	267	31.8	267	15.9	142	14.5	103
40/48 (Hi)	4	37.3	267	31.8	267	15.9	142	14.5	103
50 (Std)	4	41.4	267	35.5	267	18.6	142	15.8	103
50(Hi)	2	41.4	267	35.5	267	18.6	142	15.8	103
	2	47	304	42.3	304	20.2	147	17.1	122
55 (Std)/59 (Hi)	4	47	304	42.3	304	20.2	147	17.1	122
60 (Std)	2	47	304	42.3	304	20.2	147	17.1	122
	2	51.9	315	47	315	22.2	158	19.2	136
60/73 (Hi)	4	51.9	315	47	315	22.2	158	19.2	136
70/80(Std)	4	56.9	351	48.8	351	25.5	197	23.1	146
75 (Std)	2	60.5	320	52	320	25.4	160	20.3	135
	2	83.9	485	74.5	485	37.2	215	29.8	175
75/89 (Hi)	2	60.5	320	52	320	25.4	160	20.3	135
	2	83.9	485	74.5	485	37.2	215	29.8	175
90 (Std & High)	4	N/A	N/A	N/A	N/A	36	215	29	175
105 (Hi)	2	N/A	N/A	N/A	N/A	36	215	29	175
	2	N/A	N/A	N/A	N/A	45	260	36	210
115 (Std)	2	N/A	N/A	N/A	N/A	36	215	29	175
	2	N/A	N/A	N/A	N/A	45	260	36	210
130 (Std)	4	N/A	N/A	N/A	N/A	45	260	36	210

(a) Evaporative Condenser Units only available in 460V

**Table 22. Electrical service sizing data – motors – 20-130 tons**

Nominal Tons	Nominal Voltage			
	200 FLA	230 FLA	460 FLA	575 FLA
	Air-Cooled Condenser Fan Motor			
20	8.2	8.2	3.6	2.8
25	12.3	12.3	5.4	4.2
30	12.3	12.3	5.4	4.2
40	16.4	16.4	7.2	5.6
50, 55	24.6	24.6	10.8	8.4
60	24.6	24.6	10.8	8.4
70	24.6	24.6	10.8	8.4
75	24.6	24.6	10.8	8.4
90	N/A	N/A	14.4	11.2
105	N/A	N/A	18.0	14.0
115	N/A	N/A	18.0	14.0
130	N/A	N/A	21.6	16.8
Motor Horsepower	Supply/Exhaust/Return <sup>2</sup> 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>	N/A	N/A	47.6	39.0

**Note:** Return fan motors are available in 3-20 Hp.

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



**Table 23. Electrical service sizing data – electric heat module (electric heat units only) – 20-130 tons**

Module kW	Voltage			
	200 FLA	230 FLA	460 FLA	575 FLA
30	83.3	72.2	36.1	28.9
50	138.8	120.3	60.1	48.1
70	194.3	168.4	84.2	67.4
90	249.8	216.5	108.3	86.6
110	305.3	264.6	132.3	105.9
130			156.4	125.1
150			180.4	144.3
170			204.5	163.6
190			228.5	182.8

**Note:** Electric heat FLA are determined at 208, 240, 480 and 600 volts.

**Table 24. Electrical service sizing data evaporative condenser - All tonnages (24-89T)**

Condenser Fan			Sump Pump			Sump Heater	
Qty	HP	FLA	Qty	HP	FLA	kW	FLA
1	5.4	5.9	1	0.5	1.55	3	3.8

**Table 25. Electrical service sizing data – control power transformer heating and cooling modes – 20-130 tons**

Nominal Tons (Air-cooled/ Evaporative condensing)	Digit 2 Unit Function	Voltage			
		200	230	460	575
20,25,30/24,29,36	A,E,L,S,X	1	1	1	1
20,25,30/24,29,36	F	4	3	2	1
40,50,55,60/48,59,73	A,E,L,S,X	3	2	1	1
40,50,55,60/48,59,73	F	5	4	2	2
70,75/80,89	A,E,L,S,X	5	4	2	2
70,75/80,89	F	8	7	3	3
90,105,115,130	E,L,S,X	5	4	2	2
90,105,115,130	F	8	7	3	3

**Table 26. Electrical service sizing data – crankcase heaters (heating mode on 460/575 volt only) – 20-130 tons**

Nominal Tons (Air-cooled/ Evaporative condensing)	(Add) FLA
20-30/24-36	1
40-60/48-73	2
70-75/80-89	3
90-105	3
115-130	4

**Table 27. Voltage utilization range**

Unit Voltage	Voltage Utilization Range
200/60/3	180-220
230/60/3	207-253
380/50/3	342-418
415/50/3	373-457
460/60/3	414-506
575/60/3	517-633

### Power Wire Sizing and Protection Device 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 SAH\_ (Cooling Only) units, SXH\_ (Extended Casing) units, SLH\_ and SSH\_ (Cooling with Wet Heat) units, and SFH\_ (Cooling with Gas Heat) units Use Calculation #2 for SEH\_ (Cooling with electric Heat) units.

Load Definitions:

LOAD 1 = CURRENT OF THE LARGEST MOTOR (COMPRESSOR OR FAN MOTOR)

LOAD 2 = SUM OF THE CURRENTS OF ALL REMAINING MOTORS

LOAD 3 = CURRENT OF ELECTRIC HEATERS

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

#### **CONTROL POWER TRANSFORMER FOR ALL MODES**

20 - 40 Ton Units, add 3 FL Amps

50 - 75 Ton Units, add 6 FL Amps

90 - 130 Ton Units, add 8 FL Amps

#### **CRANKCASE HEATERS FOR HEATING MODE 460/575V ONLY**

20 - 30 Ton Units, Add 1 Amp

40 - 60 Ton Units, Add 2 Amps

70 - 75 Ton Units, Add 3 Amps

90 - 130 Ton Units, Add 4 Amps

- Calculation #1 - SAH\_, SXH\_, SLH\_, SSH\_, and SFH\_ Units.

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

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

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.

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

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 (SEH\_ 20 - 130 Tons)
  - 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:  $MCA = 1.25 \times (LOAD\ 1 + LOAD\ 2 + LOAD\ 4) + (1.25 \times LOAD\ 3)$

For units using heaters equal to or greater than 50 Kw:  $MCA = 1.25 \times (LOAD\ 1 + LOAD\ 2 + LOAD\ 4) + LOAD\ 3$

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

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

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.*

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

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.*

#### 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 (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.

$MCA = (1.25 \times LOAD\ 3)$                        $MOP = (1.25 \times LOAD\ 3)$

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.*

$RDE = LOAD\ 3$

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 - SX, SF, SA, SL, or SS Single Power Source Units

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

- Calculation #2 - All SEH\_ Single Power Source Units

$DSS = 1.15 \times (LOAD\ 3 + Supply\ Fan\ FLA + Exhaust\ Fan\ FLA)$

## Installation

PLUS

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

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

- Calculation #3 - SEHL (200/230 Volt) 20 - 75 Ton Dual Power Source Units

$$DSS = 1.15 \times \text{LOAD3 for the Electric heater AND Calculation \#1 for the Refrigeration Components}$$

## Field Installed Control Wiring

### 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.

### WARNING

#### Proper Field Wiring and Grounding Required!

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

The 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 34, p. 69](#). [Figure 37, p. 85](#) 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.

## Controls Using 24 VAC

Before installing any connecting wiring, refer to [Figure 9, p. 34](#) and [Figure 10, p. 36](#) for the electrical access locations provided on the unit and [Table 28](#) for AC conductor sizing guidelines, and;

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

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

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

**Table 28. 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

- 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 the appropriate illustration in [Figure 9, p. 34](#) - [Figure 10, p. 36](#) for the electrical access locations provided on the unit and

[Table 29](#) 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.

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

**Table 29. 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

- 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 30](#) for the Temperature vs. Resistance coefficient.

### Zone Temperature Control Zone Panel (5U68) - (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 and Constant Volume System Controls

### Remote Panel w/o NSB (5U59) - (BAYSENS021\*)

The remote panel w/o Night setback has a system switch as well as a S/A temperature setpoint indicator, a local sensor, and four LED's. These features allow the operator to control system operation, and monitor unit operating status from a remote location. Use the installation instructions that shipped with the panel to install it, and the unit's field wiring diagram to connect it to the unit.

### **Discharge Temperature Control Changeover Contacts (5K87)**

These contacts are connected to the RTM when daytime heating on Discharge Temperature Control units with internal or external hydronic heat is required. Daytime (occupied) heating switches the system to a Zone Temperature Control 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.

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

The remote Human Interface module enables the operator to set or modify the operating parameters of the unit using its 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 34, p. 69](#) or [Figure 41, p. 89](#) to connect it to the unit.

### **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 30](#) 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 30](#) for the Temperature vs. Resistance coefficient.

### **Remote Zone Sensor (5RT16, 5U57, and 5U69) (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 supply air temperature 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 30](#) for the Temperature vs. Resistance coefficient.

### **Remote Zone Sensor (5RT16, 5U57, and 5U69) (BAYSENS077\*)**

This electronic analog sensor can be used with BAYSENS119\* or 021A Remote Panels. When this sensor is wired to a BAYSENS119\* Remote Panel, wiring must be 18 AWG Shielded Twisted Pair (Belden 8760 or equivalent). Refer to the specific Remote Panel for wiring details.

### **Remote Panel w/ NSB - (BAYSENS119\*)**

This 7 day programmable sensor features four periods for Occupied\Unoccupied programming per day. 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 six programming keys located on the front panel allows selection of four system modes (Heat, Cool, Auto, and Off), two fan modes (On and Auto). It has dual temperature selection with programmable start time capability.

The occupied cooling setpoint ranges between 40° and 80° Fahrenheit. The warm-up setpoint ranges between 50° and 90° Fahrenheit with a 2 degrees deadband. The Unoccupied cooling setpoint ranges between 45 and 98 degrees Fahrenheit. The heating setpoint ranges between 43 and 96 degrees Fahrenheit. Two liquid crystal displays (LCD) display 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 CFM override during unoccupied status, Fahrenheit or Centigrade, Supply air tempering, Remote zone temperature sensor, 12/24 hour time display, Smart fan, and Computed recovery.

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. See [Table 30](#) for the Temperature vs. Resistance coefficient.

### **Remote Minimum Position Potentiometer (5U70) (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 34, p. 69](#) or [Figure 41, p. 89](#) 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 34, p. 69](#) or [Figure 41, p. 89](#) 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), 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/Return, (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 ICSTM output. The switch must be rated for 12 ma @ 24 VDC minimum. The following preset sequences can be modified by the customer;

- VOM Mode "A" Priority 1 - Unit Off:
  - Supply fan - OFF
  - Inlet vanes/VFD - 0% (if equipped)
  - Exhaust/Return fan - OFF, Exhaust/Return dampers Closed
  - O/A dampers - Closed
  - Heat - All stages OFF, Modulating Heat output at 0 VDC
  - Occupied/Unoccupied output - De-energized (Occupied)
  - VO Relay - Energized
  - Pre-heater State - Off (if equipped)
- VOM Mode "B" Priority 2 - Pressurize:
  - Supply fan - ON
  - Inlet Vanes/VFD - 100% (if equipped)
  - Exhaust/Return fan - OFF, Exhaust/Return dampers - Closed
  - O/A dampers - Open
  - Heat - All stages OFF, Modulating Heat output at 0 VDC
  - Occupied/Unoccupied output - Energized (Unoccupied)
  - VO Relay - Energized
  - Pre-heater State - Off (if equipped)
- VOM Mode "C" Priority 3 - Exhaust/Return:

## Installation

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- Supply fan - OFF
- Inlet Vanes/VFD - 0% (if equipped)
- Exhaust/Return fan - ON, Exhaust/Return dampers - Open
- O/A dampers - Closed
- Heat - All stages OFF, Modulating Heat output at 0 VDC
- Occupied/Unoccupied output - De-energized (Occupied)
- VO Relay - Energized
- Pre-heater State - Off (if equipped)
- VOM Mode "D" Priority 4 - Purge:
  - Supply fan - ON
  - Inlet Vanes/VFD - 100% (if equipped)
  - Exhaust/Return fan - ON, Exhaust/Return dampers - Open
  - O/A dampers - Open
  - Heat - All stages OFF, Modulating Heat output at 0 VDC
  - Occupied/Unoccupied output - Energized (Unoccupied)
  - VO Relay - Energized
  - Pre-heater State - Off (if equipped)
- VOM Mode "E" Priority 5 - Purge with duct pressure control:
  - Supply fan - ON
  - Inlet Vanes/VFD - (if equipped) Controlled by S/A Pressure Control with supply air pressure high limit disabled.
  - Exhaust/Return fan - ON, Exhaust/Return dampers - Open
  - O/A dampers - Open
  - Heat - All stages OFF, Modulating Heat output at 0 VDC
  - Occupied/Unoccupied output - Energized (Unoccupied)
  - VO Relay - Energized
  - Pre-heater 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 34, p. 69](#) or [Figure 41, p. 89](#) 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
- Inlet Vanes - Open (if equipped)
- Exhaust/Return Fan - Off (if equipped)
- Exhaust/Return 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
- Inlet Vanes - Closed (if equipped)
- Exhaust/Return Fan - On (if equipped)
- Exhaust/Return 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
- Inlet Vanes - Open (if equipped)
- Exhaust/Return Fan - On (if equipped)
- Exhaust/Return 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
- Inlet Vanes - Closed (if equipped)
- Exhaust/Return Fan - Off (if equipped)

## Installation

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- Exhaust/Return 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
- Inlet Vanes - Closed (if equipped)
- Exhaust/Return Fan - Off (if equipped)
- Exhaust/Return 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)

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 30. Temperature vs. resistance coefficient**

Temperature (°F)	Resistance (in. 1000 Ohms)	Temperature (°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

### **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 34, p. 69](#) or [Figure 41, p. 89](#) for the proper connection terminals in the unit control panel. The switch must be rated for 12 ma @ 24 VDC minimum.

### **Occupied/Unoccupied Contacts (5K86)**

To provide Night Setback control if a remote panel with NSB (5U58) 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 @ 24 VDC minimum. Refer to the appropriate illustrations in [Figure 34, p. 69](#) or [Figure 41, p. 89](#) for the proper connection terminals in the unit control panel.

### **Demand Limit Relay (5K89)**

If the unit is equipped with a Generic BAS Module (1U51), (i.e. unit model number digit 21+ is a "K"), a normally open (N.O.) switch may be used to limit the electrical power usage during peak periods. When demand limit is initiated, the mechanical cooling and heating operation is limited to either 50% or 100%. Demand limit can be initiated by a toggle switch closure, a time clock, or an ICSTM control output. These contacts must be rated for 12 ma @ 24 VDC minimum.

### **Outside Air Sensor (3RT3) - (BAYSENS016\*)**

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 34, p. 69](#) or [Figure 41, p. 89](#) for the proper connection terminals in the unit control panel. Refer to [Table 30, p. 82](#) 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 0-5 VDC) - 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 41](#) 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.

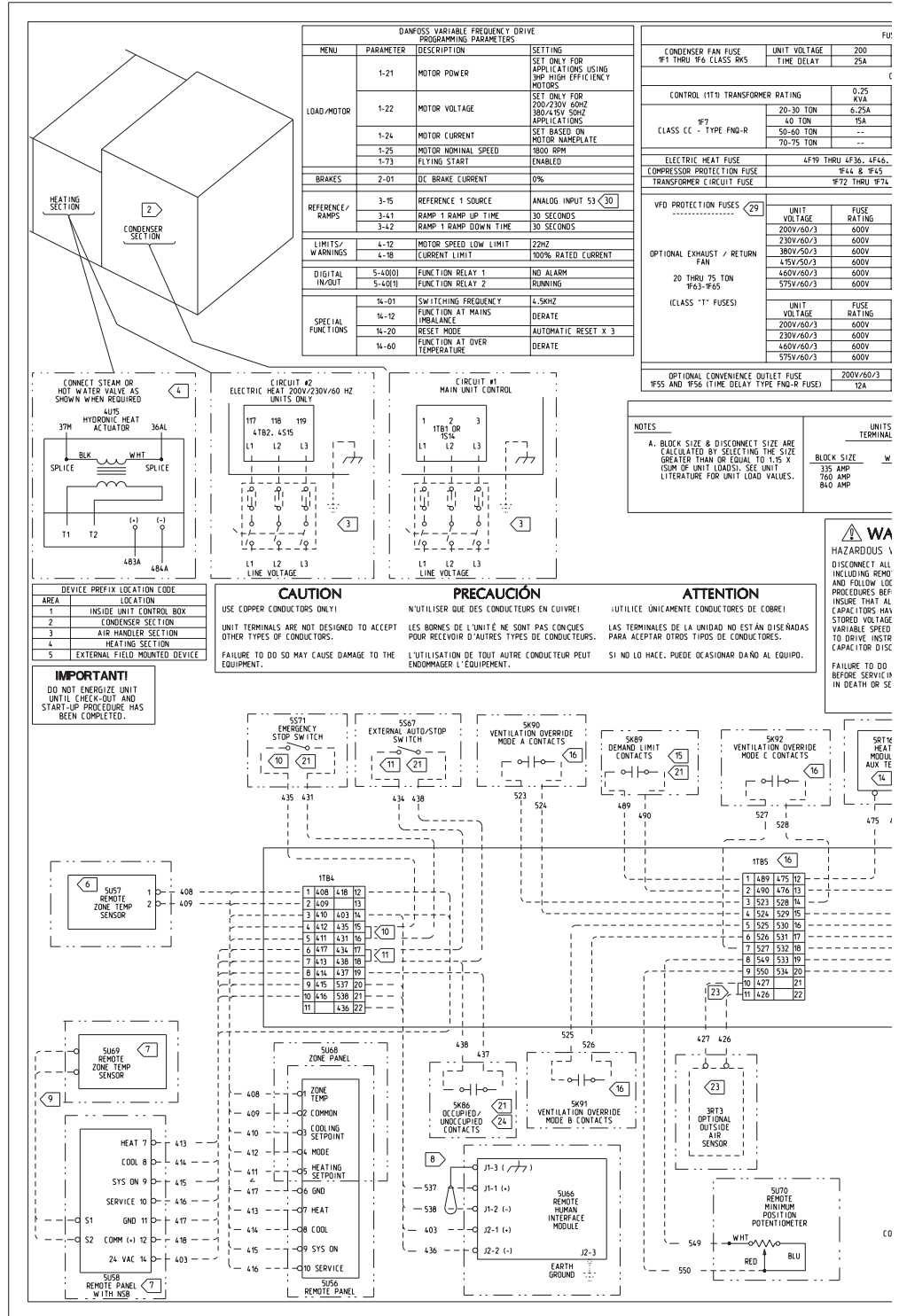
For complete application details of the module, refer to Engineering Bulletin UN-PRB001-EN.

### **Wall or Duct Mount Humidity Sensor (5U108) - (BAYSENS036\*)**

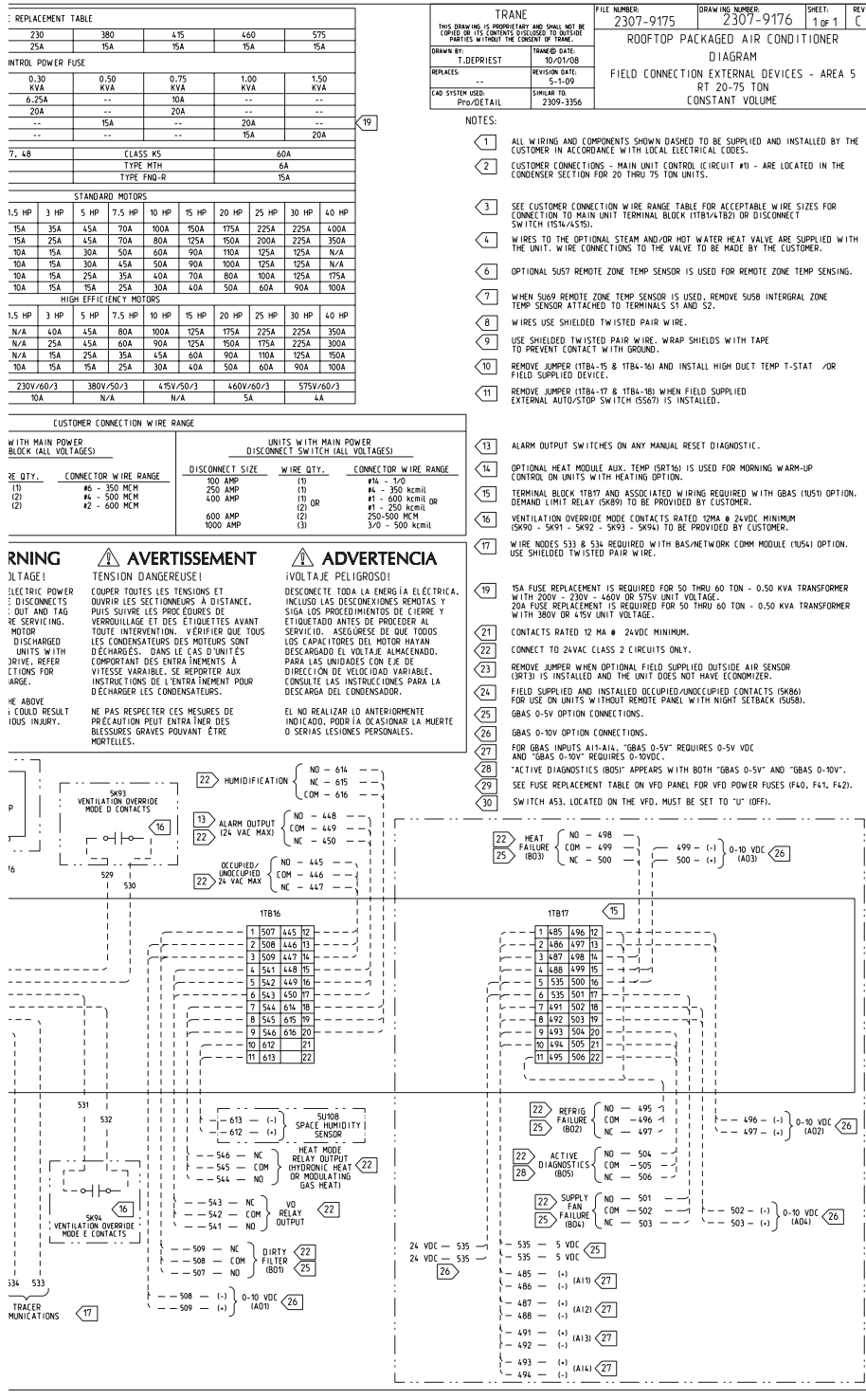
This field-installed humidity sensor is mounted in the space or in the return air duct, sending an analog input to the RTM or ECEM. It must be ordered/installed for dehumidification control with modulating hot gas reheat, but can also be used for humidification applications.

# Installation

**Figure 37. Typical ventilation override binary output wiring diagram for 20-89 ton CV control options.**  
Refer to wiring notes on **Figure 38**.



**Figure 37. (continued from previous page) Typical ventilation override binary output wiring diagram for 20-89 ton CV control options. Refer to wiring notes on Figure 38.**



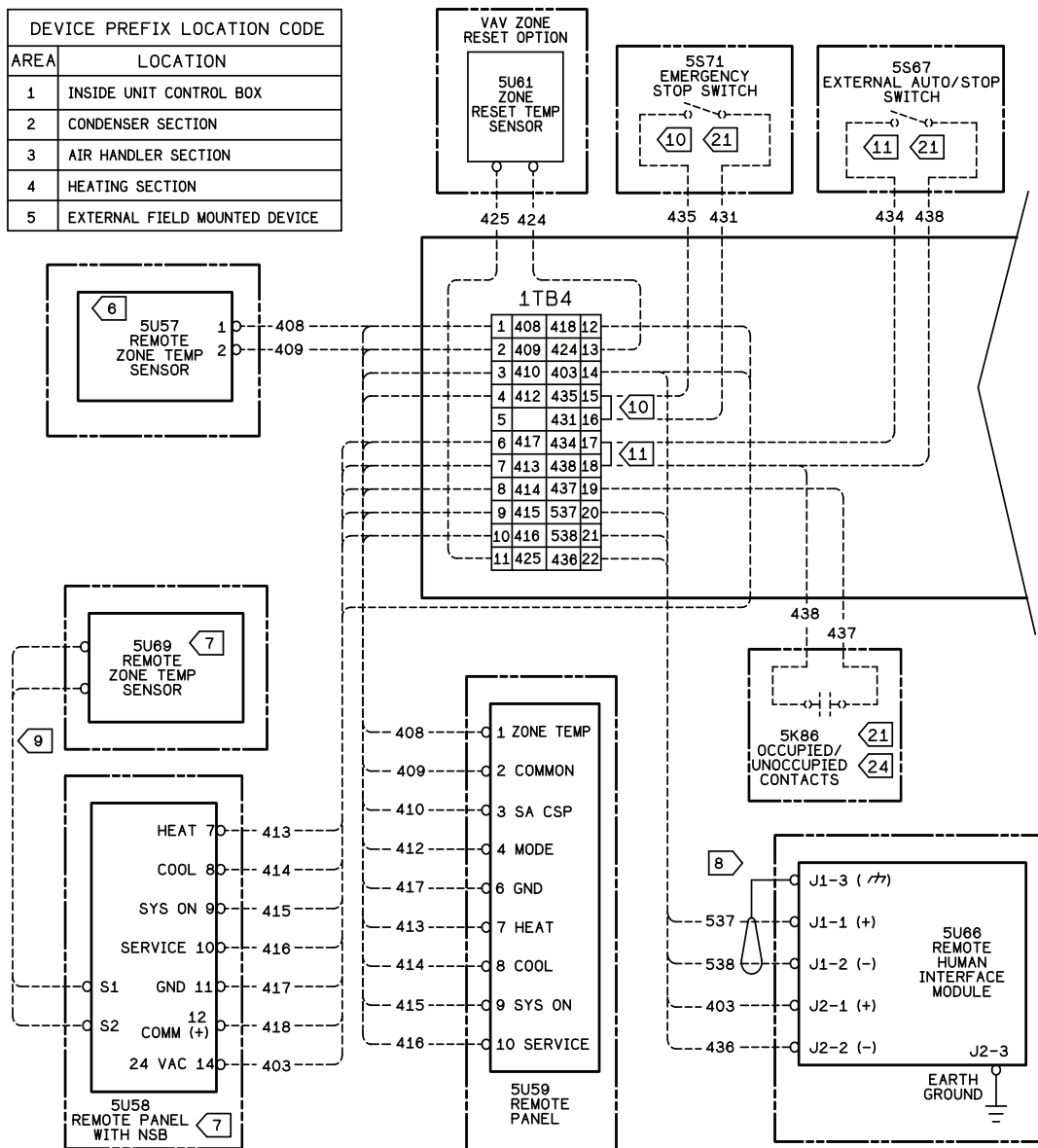
**Figure 38. Field connection diagram notes for 20 - 89 ton CV or VAV applications**

## 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 INTEGRAL 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 CHANGEOVER (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.
- 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.
- 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".

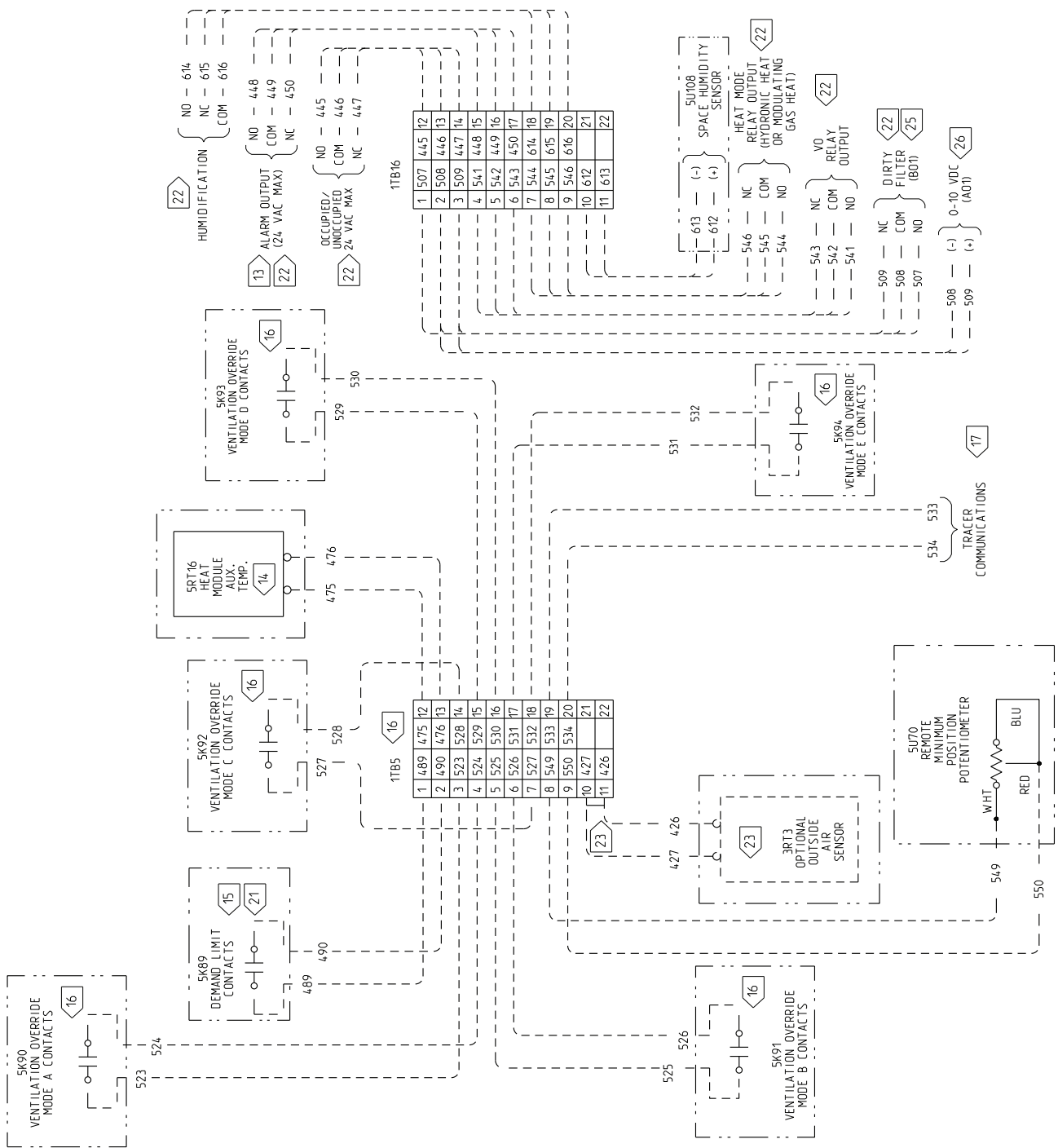
**Figure 39. Typical field wiring diagram for 20-89 ton VAV control option**

<p style="text-align: center;"><b>⚠ WARNING</b></p> <p>HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.</p>	<p style="text-align: center;"><b>⚠ AVERTISSEMENT</b></p> <p>VOLTAGE HASARDEUX! DECONNECTEZ TOUTES LES SOURCES ELECTRIQUES INCLUANT LES DISJONCTEURS SITUES A DISTANCE AVANT D'EFFECTUER L'ENTRETIEN. FAUTE DE DECONNECTER LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRETIEN PEUT ENTRAINER DES BLESSURES CORPORELLES SEVERES OU LA MORT.</p>	<p style="text-align: center;"><b>⚠ CAUTION</b></p> <p>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.</p>
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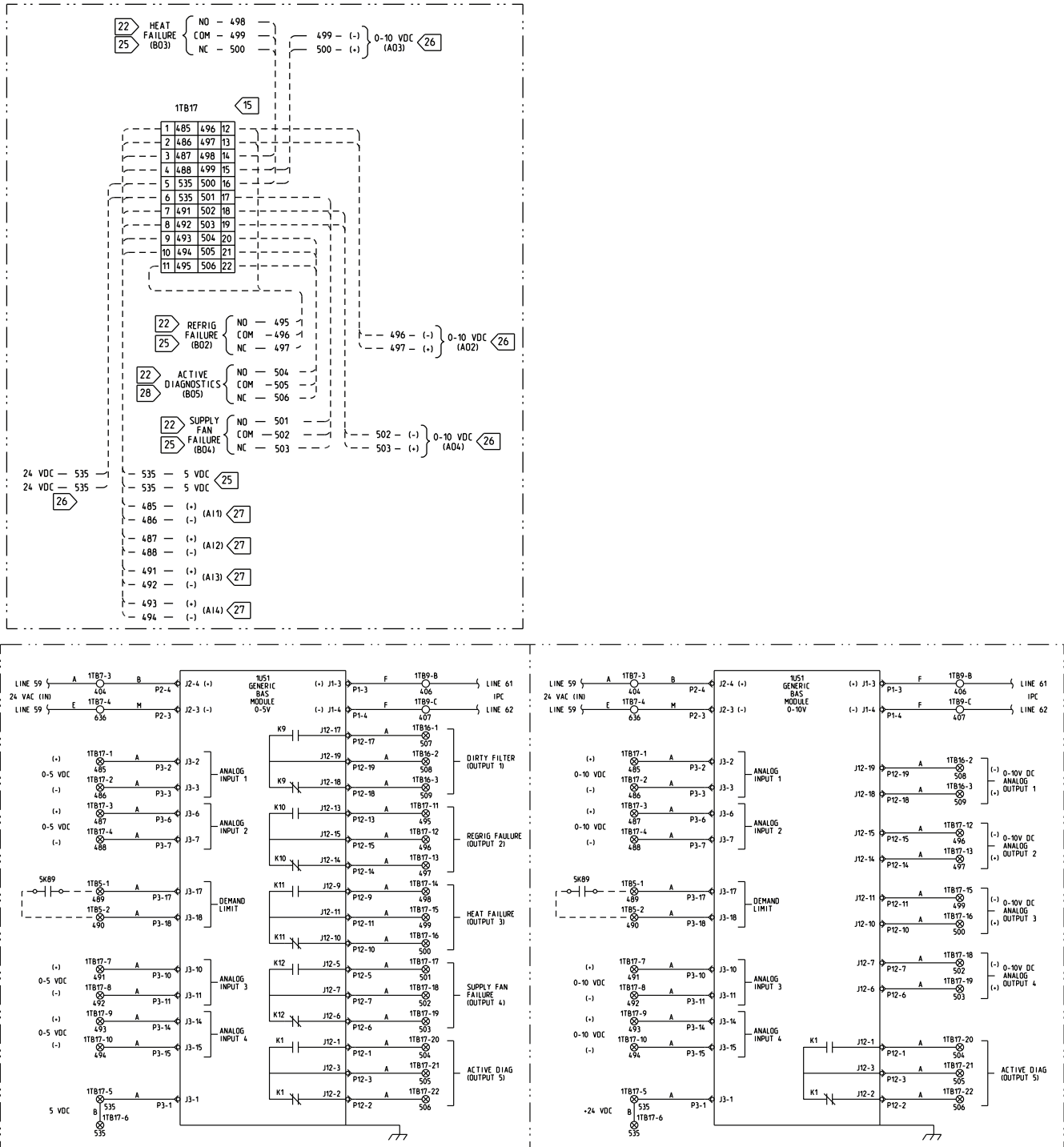
2307-9177

Figure 40. Typical field wiring diagram for 20-89 ton VAV control option





**Figure 41. Typical GBAS analog input wiring diagram for 20-89 ton CV & VAV control options**



## Installation

**Table 31. 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
Zone/Return Critical Temperature Setpoint (RR only)	0.5 to 4.5 VDC	0.5 to 9.5 VDC	75 to 95°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 32. GBAS 0-10 VDC output range**

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



# Installation Checklist

## 20-130 Ton, Air-Cooled and Evaporative Condensing

The checklist listed below is a summary of the steps required to successfully install a commercial rooftop unit. This checklist is intended to acquaint the installing personnel with what is required in the installation process.

**Important:** *This checklist does not replace the detailed instructions called out in the applicable sections of this manual.*

**Table 33. Installation Checklist**

	Task Completed
<b>General Unit Requirements</b>	
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 per the current edition of the curb installation guide.	
Fabricate and install ductwork; secure ductwork to curb.	
Install pitch pocket for power supply through building roof. (If applicable)	
Rigging the unit.	
Set the unit onto the curb; check for levelness.	
Ensure unit-to-curb seal is tight and without buckles or cracks.	
Install and connect condensate drain lines to each evaporator drain connection.	
Remove the shipping hold-down bolts and shipping channels from the supply and exhaust/return fans ordered with rubber or spring isolators.	
Check all optional supply and exhaust/return fan spring isolators for proper adjustment.	
Verify all discharge and liquid line service valves (one per circuit) are back seated.	
<b>Main Electrical Power Requirements</b>	
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.	
<b>Note:</b> All field-installed wiring must comply with NEC and applicable local codes.	
<b>Field Installed Control Wiring</b>	
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.	
<b>Note:</b> All field-installed wiring must comply with NEC and applicable local codes.	
<b>Requirements for Electric Heat Units</b>	
<b>All SEHL Units (380 minimum voltage)</b>	
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.	
<b>SEHL Units w/200V or 230V Electric Heat: (Requires Separate Power Supply to Heater)</b>	
Connect properly sized and protected power supply wiring for the electric heat from a dedicated, field-supplied/installed disconnect to terminal block 4TB2, or to an optional unit mounted disconnect switch 4S15.	

**Continued on next page**



## Installation Checklist

**Table 33. Installation Checklist (continued)**

	Task Completed
<b>Requirements for Gas Heat</b>	
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.	
<b>Requirements for Hot Water Heat (SLH_)</b>	
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.	
<b>Requirements for Steam Heat (SSH_)</b>	
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.	
<b>O/A Pressure Sensor and Tubing Installation (All units with Statitrac or Return Fans)</b>	
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 (Statitrac only).	
<b>Requirements for Modulating Reheat Dehumidification</b>	
Install (5U108) humidity sensor in space or return duct	
Complete field wiring of humidity sensor to ECEM (1TB16). Refer to "Field Installed Control wiring" for guidelines.	
<b>Evaporative Condenser</b>	
Remove fan bracket	
Hookup inlet and drain piping	
Install Heat tape if needed	
Setup drain hold or drain on power loss	
Setup Mechanical Float	
Setup drain time	
Setup water quality management (3rd party or Trane factory-installed Dolphin Water Care™ System)	
Options setup	
Calibrate Conductivity Controller	
Setup blowdown set points on the conductivity sensor	

# Unit Start Up

## Cooling Sequence of Operation

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

### **NOTICE:**

#### **Compressor Failure!**

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

### **Compressor Crankcase Heaters**

Each compressor is equipped with a crankcase heater controlled by a 600 volt auxiliary switch on the compressor contactor. The proper operation of the crankcase heater is important to maintain an elevated compressor oil temperature during the "Off" cycle to reduce oil foaming during compressor starts.

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

When power has been "Off" for an extended period, allow the crankcase heater to operate a minimum of 24 hours before starting the unit.

### **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%.

### Rapid Restart

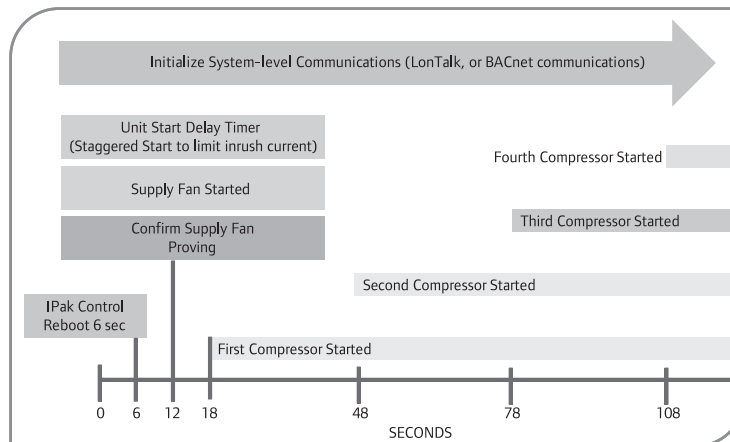
This feature will occur after every power cycle. Once power is restored (e.g., via a backup generator), the RTM will maximize cooling capacity within 3-5 minutes. Once the space has returned to its Zone Temperature Setpoint, the RTM controls the load using normal capacity control algorithms. The supply fan will be turned on immediately after a power cycle, module initialization, or after the Unit Start Delay has timed out. The supply fan proving switch input must be closed prior to continuing with Rapid Restart.

Once the supply fan proving switch input has closed, the unit will consider the outside air temperature to determine whether economizing or DX mechanical cooling will be utilized to provide the necessary cooling. If the outside air temperature is less than 50°F and economizing is enabled, the outside air damper will be utilized. If the outside air temperature is above 50°F, the outside air damper will remain closed and DX mechanical cooling will occur for the duration of Rapid Restart.

### Supply Fan Operation – Speed Control:

- VAV: The supply fan speed will ramp to 50%, then release to normal discharge static pressure control, limited only by the high duct static limit functionality.
- CV: The supply fan speed will turn on full airflow.
- SZVAV: The supply fan speed will ramp to full airflow.

**Figure 42. Typical rapid restart timeline**



### 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 Return Fan**

The return fan is started once the supply fan is verified ON by the supply fan proving function. If equipped, the variable speed return fan is modulated to control return plenum pressure to the Return Plenum Pressure Setpoint and Return Plenum Pressure Deadband.

For the first two minutes of return fan operation, the outside air damper control and if equipped, building space pressure control are disabled so that the exhaust damper remains closed. After the two minute delay, the outside air damper is released to normal ventilation requests, and exhaust damper control will either track the outside air damper or if equipped, the exhaust damper control is released to normal space pressure control.

### **Units with Traq Sensor**

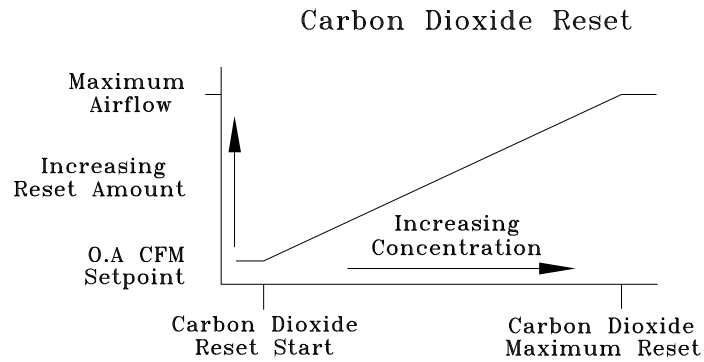
The fresh air enters the unit through the Traq Sensor assembly and is measured by velocity pressure flow rings. The velocity pressure flow rings are connected to a pressure transducer/solenoid assembly. The solenoid is used for calibration purposes to compensate for temperature swings that could affect 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.

**Figure 43. CO<sub>2</sub> Reset**



### Low Charge Protection

For each refrigeration circuit, the entering and leaving evaporator temperatures are used to calculate superheat. When the calculated superheat exceeds the Evaporator Temperature Differential Setpoint minus 5°F but not the Evaporator Temperature Differential Setpoint, an information only, auto-reset, High Superheat diagnostic is initiated. If the calculated superheat exceeds the Evaporator Temperature Differential Setpoint, a manual reset, low refrigerant charge diagnostic is initiated and all compressors on the circuit are locked out.

### Frostat™ Control

The compressor module utilizes an evaporator temperature sensor (3RT14 & 15), mounted on the suction line of each circuit, to protect the evaporator from freezing. If the evaporator temperature approaches the specified setpoint, adjustable between 25°F and 35°F, the compressor(s) will be cycled "off". The compressors will not be allowed to restart until the evaporator temperature has risen 10°F above the specified cutout temperature and the compressor(s) have been off for a minimum of three minutes.

### Lead-Lag Operation

When Lead-Lag is enabled, each time the system cycles after having stages 1 and 2 "On", "Stage 2" (K11 on SCM or K3 on MCM) and the corresponding condenser fan output "2A" will start first. The compressor module cycles the compressors "On" and "Off" to keep the zone temperature within the cooling setpoint deadband. The condenser fans are cycled "On" and "Off" to maintain the saturated refrigerant temperature within the specified controlband.

### Units Equipped with 100% Modulating Exhaust Dampers

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

### Units equipped with Hot Gas Reheat (Modulating Dehumidification)

When space humidity exceeds setpoint and the unit is loaded 50% or less, the modulating dehumidification function activates the reheat mode, providing dehumidification of the space.

The reheat valve and cooling valve are modulated to control the discharge air temperature to the reheat discharge air temperature setpoint. In reheat mode, the reheat valve is commanded to control the discharge air (15 to 85%) to the reheat setpoint; the cooling valve mirrors the reheat valve position (85 to 15%). The reheat coil pumpout valve is energized when the unit is in active cooling, and de-energized during all other times - including reheat mode.



## Units with Evaporative Condenser Sequence of Operation

Upon a power up without water in the sump, the condenser sump drain will be controlled to allow the sump to hold water. The fill relay will be energized if there is a call for mechanical cooling and if the outdoor air temperature is greater than 10°F on units with a sump heater installed or greater than 40°F on units without sump heat.

Once the fill solenoid is energized, the sump will begin to fill. The minimum water level switch will close and the fill relay will be de-energized. The sump water temperature sensor is invalid unless the minimum water level switch is closed.

If the sump water temperature is less than the setpoint (default is 38°F), the sump heater will be energized until the water temperature reaches the setpoint plus 5 degrees (43°F for default). The fill solenoid will remain closed for 20 minutes or until the water temperature is greater than 35°F. Once a water temperature of 35°F or greater is achieved, the fill solenoid is energized, the sump will continue to fill, and a five minute timer is started.

When the timer expires, the compressor lockout will be released and mechanical cooling will be allowed. Head pressure control will be regulated by a variable speed fan until the liquid line pressure from either circuit reaches the upper limit, which is set on the Human Interface under the setup menu 120°F default. The liquid line pressure is converted to a temperature for display at the Human Interface. When the temperature exceeds the upper limit, the condenser sump pump will be energized. When the sump pump is energized, water is pumped from the sump and sprayed over the condenser coil. If the liquid line pressure from either circuit falls below the lower limit the sump pump will be de-energized.

When the sump pump is energized or de-energized a change in state is observed from an auxiliary contactor to ensure proper sump pump operation. A change in states must be observed by the auxiliary contactor within 6 seconds of the command to change states or mechanical cooling will be locked out on a sump pump failure causing a manual reset diagnostic to be set.

The fill solenoid will remain energized and the water level will be controlled by the mechanical float valve. If the maximum level float ever closes, an information-only diagnostic is set and the fill solenoid is de-energized. This is an indication that the mechanical float is not adjusted properly or a failure of the mechanical float valve has occurred. If the maximum level input is open for two continuous minutes, the diagnostic will be cleared and the fill solenoid will be energized.

If the sump water temperature ever drops below 35°F, the drain actuator will be controlled in order to drain the water from the sump. If there is a call for mechanical cooling and the outdoor air temp is greater than 10°F on units with sump heat installed or greater than 40°F on units without sump heat, the unit will be allowed to refill the sump.

The drain control can be configured via the Human Interface, and by the drain actuator installation, to hold or drain water on power loss; the default is set to drain. Periodic purge is a cyclic opening of the drain to remove debris and buildup from the sump and add additional fresh water to the sump. Periodic purge has an adjustable interval from the setup menu on the Human Interface with a range of 1-12 hours or can be set to disabled - the default position if periodic purge is not required. The duration of the blowdown, or the time that the drain valve is opened, is adjustable to a range of 5 - 255 seconds, with 60 seconds being the default.

The optional conductivity controller also uses this timer to open the drain, when required, based on water quality. During this purge, the fill solenoid will remain energized to provide fresh water to the sump to replace water being released during the blowdown. Water treatment blowdown is provided by shorting the designated input on the customer-supplied terminal strip. This gives the customer more flexibility in determining water conditions via external controls. Once the input is detected closed, the drain valve will be opened for a time equal to the Human Interface adjustable periodic purge duration.

Once the duration timer expires, or if the minimum level switch opens, the drain valve will be closed and the water treatment blowdown input will be ignored for 15 minutes. During this blowdown the fill relay will remain open to provide fresh water to the sump. The adjustable duration time period should be set so that during drain operation 1 inch of water is drained from the sump with the fill

solenoid valve closed. If the minimum water level switch opens during a blowdown cycle, the unit will de-energize the sump pump in order to protect the compressors and sump heater from insufficient water levels. Once the water level reaches the minimum level input and this input closes for 10 seconds, the compressors and sump heater operations will be allowed to restart.

### Evaporative Condenser Drain Valve Setup

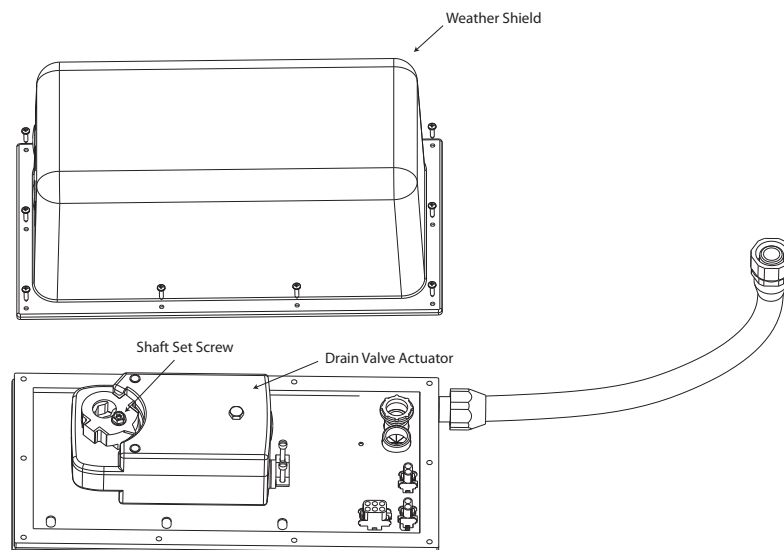
The drain valve is shipped to “Drain During Unit Power Loss Conditions.” This means that when the unit disconnect is turned off, the 1S2 toggle switch is turned off, or the unit loses power, the drain will open. The valve is spring loaded and will travel from fully closed to fully open in approximately 25 seconds.

This is desirable in cold climates where a risk of freezing exists. In milder climates it may be desirable to keep the water in the sump when unit power is off to avoid unnecessarily wasting water whenever the unit disconnect is turned off.

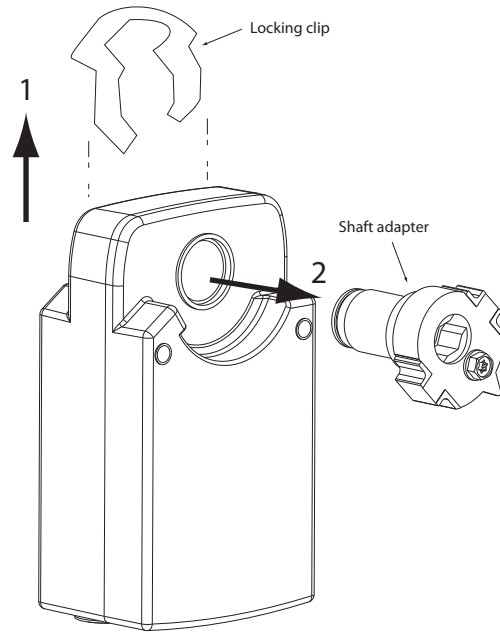
To convert the unit to “Hold During Unit Power Loss Conditions”:

1. Remove power from the unit.
2. Remove the weather shield cover (Figure 44, p. 98).
3. Loosen the shaft set screw (Figure 44), remove the locking clip, and remove the shaft adapter (Figure 45, p. 99).
4. Lift the drain valve actuator and rotate it to the “hold during power loss” position (Figure 46, p. 99).
5. Reinstall the shaft adapter and locking clip and reinstall the actuator onto the base. Make sure the arrow on the shaft adapter is set to 0°.
6. Make sure the valve is in the fully closed position, then tighten the shaft set screw.
7. Reinstall the weather shield cover.
8. Restore power to the unit.
9. At the Human Interface, press SETUP, NEXT until 'Head Pressure Control Setup Submenu' is seen. Press ENTER.
10. Change the “Sump Drain Valve Relay Control” from Drain to Hold

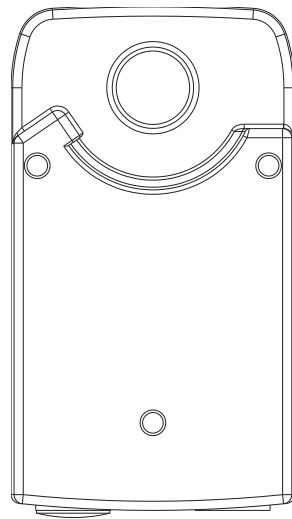
**Figure 44. Drain valve actuator with weather shield**



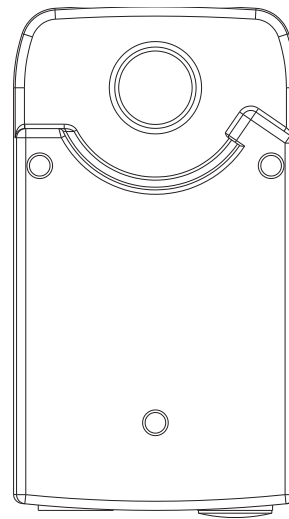
**Figure 45. Actuator shaft adapter removal/assembly**



**Figure 46. Actuator is shipped in “drain during power loss” configuration**



To drain during power loss,  
set shaft adapter to 0 degrees



To hold during power loss,  
set shaft adapter to 90 degrees

### Set Drain Duration Timer

Enter service test mode from unit Human Interface. Navigate to the compressor condenser fan submenu. Under head pressure control, use manual control.

Close drain valve and energize water inlet solenoid valve until water reaches nominal level. Once level is achieved, de-energize fill solenoid. Open drain valve and time how long it takes for the water level to drop one inch, make sure to take into account the closing time of the valve.

### Chemical Water Treatment Tree

The Trane evaporative condenser comes with a PVC tree to allow easier inputs for third party water treatment. The tee labeled A is a 3/4 inch NPT threaded input, see Figure 47. Tees B and C are 1/2 inch NPT threaded inputs. The ball valve can be used to stop the water flow through the tree to allow the customer to add hookup of water treatment, or to change and update water treatment with the unit running.

Units with Dolphin WaterCare or conductivity sensor will have the conductivity sensor installed into the 3/4 inch tee with the other tees plugged. For all other units, A, B and C will be plugged, see Figure 47. Ensure the ball valve is in the open position when water treatment is being operated in the system to make sure water flows through the tree and transports treatment to the unit sump.

### Conductivity Controller

Upon startup, the conductivity controller must be calibrated and setup for operation. Below are the necessary steps to accomplish those tasks. The controller has two setpoints that control two relays. Both of these setpoints will need to be set by Dolphin or a local water treatment expert.

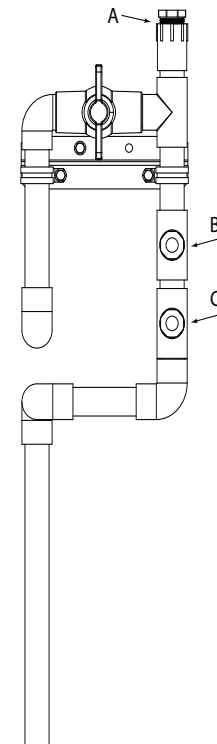
- The first setpoint is the standard point blowdown point.
  - When the setpoint is exceeded the relay (K1) will be energized and a blowdown request will close the Water treatment request binary input on the MCM.
  
- The second setpoint will be the emergency point
  - The second setpoint will open the normally closed K2 relay which will interrupt the sump proving circuit which will generate a manual lockout. This second setpoint will be used to protect the unit from extremely high conductivity that would indicate a failure in the system.
  
- Inside the enclosure for the controller, there will be a thermostat and strip heater that will protect LCD from cracking at low ambient conditions. The thermostat closes at 15°F and opens at 25°F.

### Procedure to calibrate conductivity

**Note:** Visit this webpage for additional documentation: <<http://www.gfsignettools.com/products/pdf/8860eng.pdf>>

- Use a calibrated thermometer and a known conductivity rating
- There are two different options for having a liquid with known conductivity
- Purchase a liquid with known conductivity rating
- Purchase a handheld conductivity reader
- Close the ball valve on the chemical treatment tree and remove the conductivity sensor from the tree
- Enter service test mode on the unit and turn the pump on, ensuring the compressors are set to Off
- With the conductivity controller connected to the sensor and power, enter the CALIBRATE menu by holding down the enter key for 2 seconds
- When asked for the calibration key code, hit the UP-UP-UP-DOWN arrow keys in sequence

**Figure 47. Chemical Water Treatment Tree**



- Using the UP and DOWN arrows go to Chan 1 Cell: Standard. Ensure this channel is set to standard
- If not press the RIGHT arrow key and set to standard then press the ENTER key to return to the CALIBRATION menu
- Using the UP and DOWN arrows go to Chan 1 Cell. Ensure that the cell constant is set to 1.0
- If not press the RIGHT arrow key and set the cell constant to 1.0 then press the ENTER key to return to the CALIBRATION menu
- Using the UP and DOWN arrows go to Chan 1 Set: Temperature and press the RIGHT arrow key to enter the edit mode
- Adjust the temperature on the controller to match the actual temperature
- Press the ENTER key to save the input and return to the CALIBRATE menu
- Using the UP and DOWN arrows, go to the Chan 1 Set: Conductivity and press the RIGHT arrow key to enter the edit mode
- Adjust the conductivity on the controller to match the actual conductivity rating of the liquid
- Press the ENTER key to save the conductivity rating and return to the CALIBRATE menu
- When finished calibrating the controller, press the UP and DOWN key simultaneously to return to normal operating mode

### ***Procedure to set purge setpoints on the conductivity controller***

**Note:** Visit this webpage for additional documentation: <<http://www.gfsignettools.com/products/pdf/8860eng.pdf>>

- Work with local water treatment expert to identify nominal purge and emergency purge conductivity value.
- Close the ball valve on the chemical treatment tree and remove the conductivity sensor from the tree.
- Enter Service test mode on the unit HI and energize the sump pump, ensuring the compressors are set to "OFF"
- With the conductivity controller connected to the sensor and power, enter the CALIBRATE menu by holding down the enter key for 2 seconds
- When asked for the calibration key code, hit the UP-UP-UP-DOWN arrow keys in sequence
- Using the UP and DOWN arrows, go to Relay 1 Setpoint: and press the RIGHT arrow key to enter edit mode (K1)
- Adjust the set point to the nominal blowdown conductivity value
- Press the ENTER key to return to the CALIBRATE menu
- Using the UP and DOWN arrows, go to Relay 2 Setpoint: and press the RIGHT arrow key to enter edit mode (K2)
- Adjust the set point to the emergency conductivity value
- Press the ENTER key to return to the CALIBRATE menu
- When finished setting the values, press the UP and DOWN key simultaneously to return to normal operating mode

## Gas Heating Sequence of Operation

### Standard Two Stage Gas Furnace

The control system for the rooftop units are wired to ensure that the heating and cooling do not occur simultaneously. Refer to the wiring diagram that shipped with the unit 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 pre-purge timing cycle. At the end of the pre-purge 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.

On Discharge Temperature Control 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 pre-purge 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

The control system for the rooftop units are wired to ensure that the heating and cooling do not occur simultaneously. Refer to the modulating heat wiring diagram that shipped with the unit while reviewing the following sequence of operation. As you review the sequence of operations, keep the following in mind:

- The furnace will not light unless the manual gas valves are open and the control circuit switch 4S24 is closed.
- The control systems are wired to ensure that heating and cooling cannot occur simultaneously.
- The unit supply fans must run continuously so air flow switch 4S38 will stay closed.
- 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 pre-purge time delay. When the pre-purge 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).

**Note:** *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.*

### Electric Heat Sequence of Operation

The control system for the rooftop units are wired to ensure that the heating and cooling do not occur simultaneously. Refer to the electric heat wiring diagrams that shipped with the unit while reviewing the following sequence of operation. As you review the sequence of operations, 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.

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

- 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.
- 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 59, p. 174](#) 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 do not 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 SLH\_ and SSH\_ 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 59, p. 174](#).

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.

- Turn the field supplied disconnect switch, located upstream of the rooftop unit, to the "Off" position.



**⚠ 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 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.
- Verify that the condenser airflow will be unobstructed.
- Check the compressor crankcase oil level. Oil should be visible in the compressor oil sight glass. The oil level should be 1/2 to 3/4 high in the sight glass with the compressor "Off".
- Verify that the compressor discharge service valve and the liquid line service valve is back seated on each circuit.

**NOTICE:****Compressor Damage!**

**Do not allow liquid refrigerant to enter the suction line. Excessive liquid accumulation in the liquid lines may result in compressor damage. Compressor service valves must be fully opened before start-up (suction, discharge, liquid line, and oil line).**

Do not start the unit in the cooling mode if the ambient temperature is below the following minimum recommended operating temperatures:

Standard unit with or without HGBP -

+55 F for 20 & 40 Ton

+50 F for 25 & 30 Ton

+45 F for 70 thru 130 Ton

+35 F for 50 Ton

+30 F for 60 Ton

Units with Low Ambient option without HGBP - 0°F

Units with Low Ambient option with HGBP - +10°F

**Note:** *To prevent compressor damage due to no refrigerant flow, do not pump the system down with the compressor(s) below 25 PSIG under any circumstance.*

- 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**

Unlike traditional reciprocating compressors, scroll compressors are phase sensitive. Proper phasing of the electrical supply to the unit is critical for proper operation and reliability. Color paint dots on the terminal block should match that of the associated wire attached to the lug.

## Unit Start Up

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The compressor motor is internally connected for clockwise rotation with the incoming power supply phased as A, B, C.

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

### **⚠ WARNING**

#### **Hazardous Voltage!**

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

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

**Table 34.**

<b>Phase sequence leads</b>	<b>Unit power terminal</b>
Black (Phase A)	L1
Red (Phase B)	L2
Yellow (Phase C)	L3

### **⚠ WARNING**

#### **Live Electrical Components!**

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

- 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.

#### **HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT 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:

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

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

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 35. Service test guide for component operation — Part I of II

Component Being Tested	COMPONENT CONFIGURATION										
	Condenser Fans		Exhaust Fan		Return Fan		Heat Stages		Compressor Stage		
	Supply Fan	Return Fan	Exhaust Fan	1	2	3	1	2	3	4	
<b>COMPRESSOR</b>											
<b>20 - 30 Ton</b>											
A	OFF	OFF	OFF	A-Off/B-On	OFF	OFF	OFF	K10-On	K11-Off	N/A	N/A
B	OFF	OFF	OFF	A-On/B-Off	OFF	OFF	OFF	K10-Off	K11-On	N/A	N/A
<b>40 - 60 Ton</b>											
1A	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	K11-On	K3-Off	K12-Off	K4-Off
				2A-Off/2B-Off	OFF	OFF	OFF				
1B	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	K11-Off	K3-Off	K12-On	K4-Off
				2A-Off/2B-Off	OFF	OFF	OFF				
2A	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	K11-Off	K3-On	K12-Off	K4-Off
				2A-Off/2B-On	OFF	OFF	OFF				
2B	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	K11-Off	K3-Off	K12-Off	K4-On
				2A-On/2B-Off	OFF	OFF	OFF				
<b>70 - 105 Ton</b>											
1A	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	K11-On	K3-Off	K12-Off	K4-Off
				2A-Off/2B-Off	OFF	OFF	OFF				
1B	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	K11-Off	K3-Off	K12-On	K4-Off
				2A-Off/2B-Off	OFF	OFF	OFF				
2A	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	K11-Off	K3-On	K12-Off	K4-Off
				2A-Off/2B-On	OFF	OFF	OFF				
2B	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	K11-Off	K3-Off	K12-Off	K4-On
				2A-On/2B-Off	OFF	OFF	OFF				
<b>115 - 130 Ton</b>											
1A & 1B	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	K11-Off	K3-Off	K12-On	K4-Off
				2A-Off/2B-Off	OFF	OFF	OFF				
2A & 2B	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	K11-Off	K3-Off	K12-Off	K4-On
				2A-Off/2B-On	OFF	OFF	OFF				
<b>CONDENSER FANS</b>											
<b>20 Ton - Air Cooled</b>											
A-2B1	OFF	OFF	OFF	A-On/B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
B-2B2	OFF	OFF	OFF	A-Off/B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>25 - 30 Ton - Air Cooled</b>											
A-2B1	OFF	OFF	OFF	A-On/B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
B-2B2/2B3	OFF	OFF	OFF	A-Off/B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>40 Ton - Air Cooled</b>											
1A-2B1	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-Off/2B-Off	OFF	OFF	OFF				
1B-2B2	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-Off/2B-Off	OFF	OFF	OFF				
2A-2B4	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-On/2B-Off	OFF	OFF	OFF				
2B-2B5	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-Off/2B-On	OFF	OFF	OFF				
<b>50 Ton - Air Cooled</b>											
1A-2B1	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-Off/2B-Off	OFF	OFF	OFF				
1B-2B2/2B3	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-Off/2B-Off	OFF	OFF	OFF				
2A-2B4	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-On/2B-Off	OFF	OFF	OFF				
2B-2B5/2B6	OFF	OFF	OFF	1A-Off/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
				2A-Off/2B-On	OFF	OFF	OFF				

**Table 35. Service test guide for component operation — Part I of II (continued)**

Component Being Tested	COMPONENT CONFIGURATION										
	Condenser Fans			Heat Stages				Compressor Stage			
	Supply Fan	Return Fan	Exhaust Fan	1	2	3	1	2	3	4	
<b>60 - 75 Ton - Air Cooled</b>											
1A-2B1	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1B-2B2/2B3	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2A-2B4	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2B-2B5/2B6	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>90 Ton - Air Cooled</b>											
1A-2B3/2B14	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1B-2B1/2B2	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2A-2B6/2B13	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2B-2B4/2B5	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>105 &amp; 115 Ton - Air Cooled</b>											
1A-2B3/2B14	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1B-2B1/2B2/2B19	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2A-2B6/2B13	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2B-2B4/2B5/2B15	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>130 Ton - Air Cooled</b>											
1A-2B3/2B14	OFF	OFF	OFF	1A-On/1B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1B-2B1/2B2/2B19/2B20	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2A-2B6/2B13	OFF	OFF	OFF	1A-Off/1B-On	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2B-2B4/2B5/2B15/2B21	OFF	OFF	OFF	2A-Off/2B-Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>24, 29, 36, 48, 59, 73, 80, 89 Ton - Evaporative Condensing</b>											
1A	OFF	OFF	OFF	1A On 100%	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>SUPPLY FAN</b>	ON	ON	OFF	ALL OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>RETURN FAN</b>	ON	ON	N/A	ALL OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>EXHAUST FAN</b>	OFF	N/A	ON	ALL OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>GAS HEAT</b> (Full Capacity)	ON	ON	OFF	ALL OFF	ON	ON	N/A	OFF	OFF	OFF	OFF
STAGE 1	ON	ON	OFF	ALL OFF	ON	ON	N/A	OFF	OFF	OFF	OFF
STAGE 2 (High Fire Adjustment)	ON	ON	OFF	ALL OFF	ON	ON	N/A	OFF	OFF	OFF	OFF
<b>FULL MODULATING</b> (Low Fire Adjustment)	ON	ON	OFF	ALL OFF	ON	ON	N/A	5% Select	OFF	OFF	OFF

Table 35. Service test guide for component operation — Part I of II (continued)

Component Being Tested	COMPONENT CONFIGURATION												
	Return Fans			Exhaust Fan			Condenser Fans			Heat Stages			
	Supply Fan	Return Fan	Exhaust Fan	1	2	3	1	2	3	1	2	3	4
<b>LIMITED MODULATING</b> (High Fire Adjustment)	ON	ON	OFF	ALL OFF	90% Select		OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>LIMITED MODULATING</b> (Low Fire Adjustment)	ON	ON	OFF	ALL OFF	33% Select		OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>ELECTRIC HEAT</b> Stage 1	ON	ON	OFF	ALL OFF		ON	ON	ON	ON	OFF	OFF	OFF	OFF
Stage 2	ON	ON	OFF	ALL OFF		ON	ON	ON	ON	OFF	OFF	OFF	OFF
Stage 3	ON	ON	OFF	ALL OFF		ON	ON	ON	ON	OFF	OFF	OFF	OFF
<b>HYDRONIC HEAT</b>	OFF	OFF	OFF	ALL OFF	100% Select		OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>PRE-HEATER</b>	OFF	OFF	OFF	ALL OFF	N/A		OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>FRESH AIR DAMPERS</b>	OFF	OFF	OFF	ALL OFF	100% Select		OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>EXHAUST DAMPERS</b>	OFF	OFF	OFF	ALL OFF	100% Select		OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>REHEAT</b> Cooling Valve	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Reheat Valve	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Pumpout Solenoid	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
<b>EVAP COND</b> Sump Pump	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Sump Heater	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

**Notes:**

- Compressors for the 20 thru 60 Ton units can operate individually or together and in any order while in the SERVICE TEST mode.
- Compressors 1A & 1B and compressors 2A & 2B operate simultaneously within their respective circuits on the 70 thru 75 Ton units.
- Condenser fan outputs can operate individually or together and in any order while in the SERVICE TEST mode.
- Once the unit has started, refer to the Status Menu in the Human Interface for the OA CFM.
- 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%.

**Important:** Do not operate the compressors for extended periods of time without the condenser fans; high head pressure will develop.

**Table 36. Service test guide for component operation – Part II of II**

Component Being Tested	Component Configuration			Occ Unocc Relay	Reheat	Sump Pump	Sump Heater	Dolphin
	Econo Damper	Exhaust Damper	VFD Output					
<b>COMPRESSOR</b>								
<b>20 - 30 Ton</b>								
A	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>40 - 60 Ton</b>								
1A	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>70 - 105 Ton</b>								
1A	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>115 - 130 Ton</b>								
1A & 1B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A & 2B	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>CONDENSER FANS</b>								
<b>20 Ton</b>								
A-2B1	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
B-2B2	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>25 - 30 Ton</b>								
A-2B1	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
B-2B2/2B3	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>40 Ton</b>								
1A-2B1	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B-2B2	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A-2B4	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B-2B5	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>50 Ton</b>								
1A-2B1	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B-2B2/2B3	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A-2B4	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B-2B5/2B6	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>60 - 75 Ton</b>								
1A-2B1	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B-2B2/2B3	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A-2B4	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B-2B5/2B6	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>90 Ton</b>								
1A-2B3/2B14	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B-2B1/2B2	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A-2B6/2B13	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B-2B4/2B5	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>105 &amp; 115 Ton</b>								
1A-2B3/2B14	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B-2B1/2B2/2B19	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A-2B6/2B13	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B-2B4/2B5/2B15	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>130 Ton</b>								
1A-2B3/2B14	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
1B-2B1/2B2/2B19/2B20	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2A-2B6/2B13	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
2B-2B4/2B5/2B15/2B21	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>24, 29, 36, 48, 59, 73, 80, 89 Ton</b>								
1A	Closed	Closed	100%	Default	OFF	OFF	OFF	OFF
<b>SUPPLY FAN</b>	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
<b>RETURN FAN</b>	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
<b>EXHAUST FAN</b>	Closed	Closed	100%	Default	OFF	OFF	OFF	OFF

## Unit Start Up

**Table 36. Service test guide for component operation – Part II of II (continued)**

Component Being Tested	Component Configuration			Occ Unocc Relay	Reheat	Sump Pump	Sump Heater	Dolphin
	Econo Damper	Exhaust Damper	VFD Output					
<b>GAS HEAT</b> (Full Capacity)	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
STAGE 1	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
STAGE 2	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
(High Fire Adjustment)								
<b>FULL MODULATING</b> (Low Fire Adjustment)	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
<b>LIMITED MODULATING</b> (High Fire Adjustment)	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
<b>LIMITED MODULATING</b> (Low Fire Adjustment)	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
<b>ELECTRIC HEAT</b>	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
Stage 1	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
Stage 2	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
Stage 3	Closed	Closed	100%	Unocc	OFF	OFF	OFF	OFF
<b>HYDRONIC HEAT</b>	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>PRE-HEATER</b>	Closed	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>FRESH AIR DAMPERS</b>	100% Open	Closed	0%	Default	OFF	OFF	OFF	OFF
<b>EXHAUST DAMPERS</b>	100%	100% Open	0%	Default	OFF	OFF	OFF	OFF
<b>REHEAT</b>								
Cooling Valve	Closed	Closed	0%	Default	100-0	OFF	OFF	OFF
Reheat Valve	Closed	Closed	0%	Default	0-100	OFF	OFF	OFF
Pumpout Solenoid	Closed	Closed	0%	Default	ON	OFF	OFF	OFF
<b>EVAP COND</b>								
Sump Pump	Closed	Closed	0%	Default	OFF	ON	OFF	ON
Sump Heater	Closed	Closed	100%	Default	OFF	OFF	ON	OFF

**Note:** See Service test guide notes, p. 110.

**Important:** Do not operate the compressors for extended periods of time without the condenser fans; high head pressure will develop.

**Table 37. Service test guide component operation—evaporative condenser**

Component Being Tested	Requirements (ON)	Requirements (OFF)
Compressors	Sump minimum level switch must be closed for a minimum of five minutes	No Requirements
Sump Pump	Sump minimum level switch must be closed for a minimum of five minutes	No Requirements
Condenser Fans	No Requirements	No Requirements
Fill Valve Relay	No Requirements	No Requirements
Drain Valve Actuator	No Requirements	No Requirements
Sump Heater	No Requirements	No Requirements

**Notes:**

1. Sump freeze protection is active during AUTO but is inactive in service test modes (head pressure control set to MANUAL).
2. Water treatment drain request will be ignored in service test.



## Verifying Proper Fan Rotation

### WARNING

#### **Hazardous Service Procedures!**

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

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 the appropriate programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use [Table 35, p. 108](#) to program the unit Fans for operation by scrolling through the displays. All of the Fans (Supply, Exhaust, and Condenser fans) can be programmed to be "On", if desired. Verify proper fan rotation for VFDs with bypass.

Refer to [Figure 48, p. 115](#) for the condenser fan locations and the Human Interface designator.

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.
7. Press the TEST START key to start the test. Remember that the delay designated in step 6 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.

## Unit Start Up

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- 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 individual 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;

- 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.**

- Open the field supplied disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the open position while working at the unit.
- 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!**

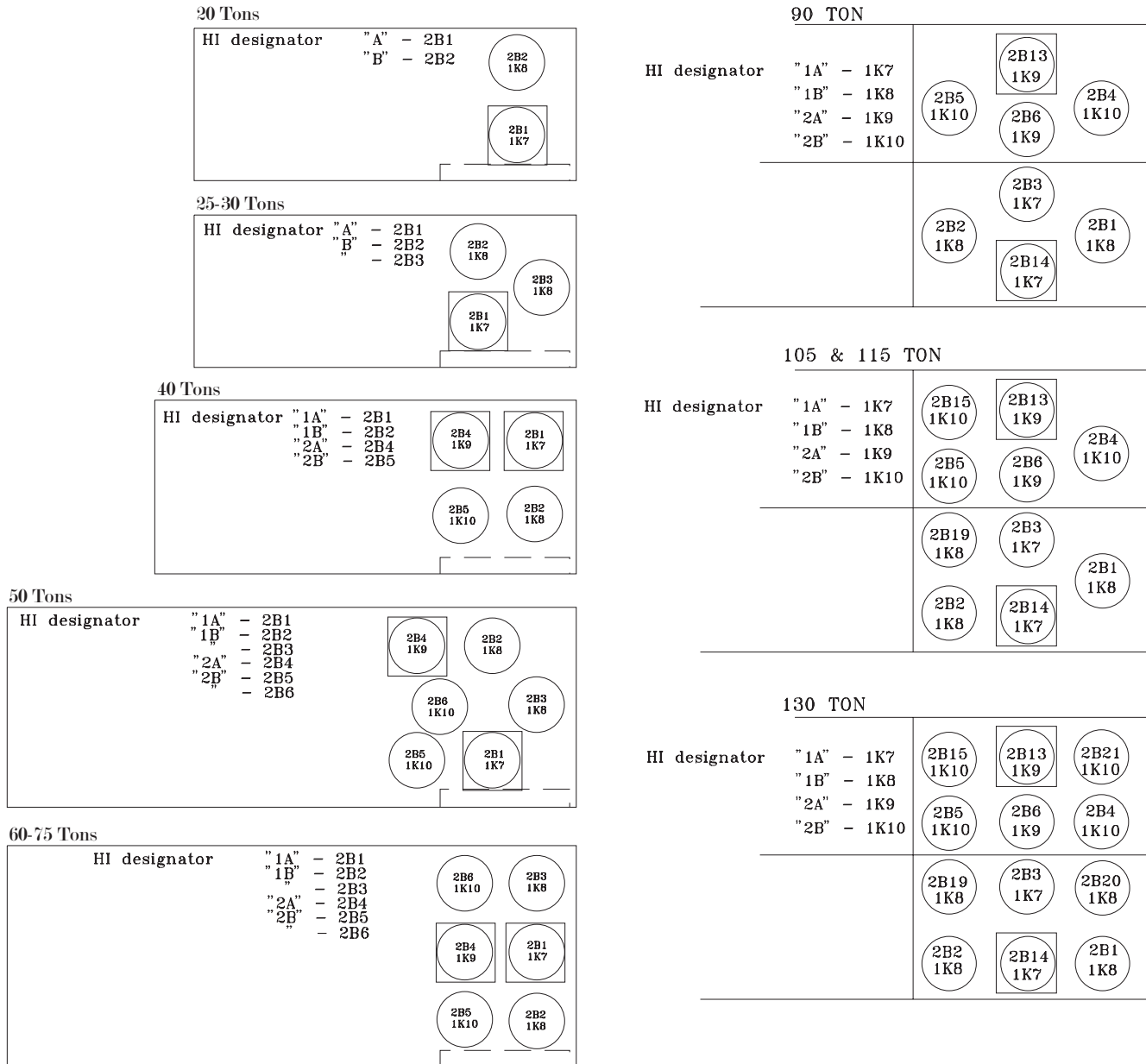
**Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.**

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.

#### **HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT 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 programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.

**Figure 48. Condenser fan location with human interface designator**



5. Use [Table 35, p. 108](#) 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.
7. Press the TEST START key to start the test. Remember that the delay designated in step 6 must elapse before the fans will begin to operate.

**⚠ WARNING**

**Live Electrical Components!**

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

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 (additional contactor for 90 thru 75 Ton units). 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 (± 5%);
  - a. Measure the actual fan RPM
  - b. Calculate the Theoretical BHP

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

- c. Plot this data onto the appropriate Fan Performance Curve in [Figure 49](#). 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;

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

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

- ii. Measure the difference between the pressures at both locations.
  - iii. Plot this value onto the appropriate pressure drop curve in [Figure 54](#). Use the data in [Table 38](#) (Component Static Pressure Drops) to assist in calculating a new fan drive if the CFM is not at design specifications.
  - iv. 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**

**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. 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.

**HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT 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 the appropriate programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
4. Use [Table 35, p. 108](#) 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.
6. Press the TEST START key to start the test. Remember that the delay designated in step 5 must elapse before the fans will begin to operate.

### ⚠ WARNING

#### **Live Electrical Components!**

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

7. With the exhaust dampers open and the exhaust/return 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

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

Use [Table 41 - Table 43](#) 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 of the appropriate programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
2. Use [Table 35, p. 108](#) to program the following system components for Economizer operation by scrolling through the displays;
  - Supply Fan (On)
  - Fresh Air dampers (Selected % Open)

## Unit Start Up

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- 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.
  4. Press the TEST START key to start the test. Remember that the delay designated in step 3 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.

### Return Plenum Pressure Control (Units equipped with Return Fan)

“Return Plenum Pressure Max Setpoint” determination:

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 of the appropriate programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
2. If not already STOPPED, press the STOP key on the Human Interface (HI)
3. Under HI Service Menu, insure all outputs are OFF or CLOSED.
4. Press the Start Service Test key.
5. Adjust the Exhaust Damper Position to approx. 85%.
6. Start the Supply Fan and Return Fan.
7. Adjust the Supply Fan and Return Fan speeds to 100%.
8. Slowly adjust the Outside Air Damper to approx. 100%.
9. While measuring the building static pressure, slowly adjust the Return Fan Speed down until the building pressure reaches design conditions.
10. Make note of the return plenum pressure reading on the HI.
11. Set the “Return Plenum Pressure Max Setpoint” parameter on the HI to the value noted in the previous step.

“OA Normalization” determination (Units equipped with TRAQs):

1. Perform a normal airflow balance of the unit.
2. Insure Exhaust Damper is approx. 85%, and the Supply Fan and Return Fan speed is 100%, and the Outdoor Air Damper is approx. 100%.
3. Make note of the total TRAQ airflow reading on the Human Interface (HI).
4. Set the “OA Normalization” parameter on the HI to the value noted in the previous step.

### Fan Performance Tables

Figure 49. 20 & 25 / 24 & 29 Ton supply fan performance

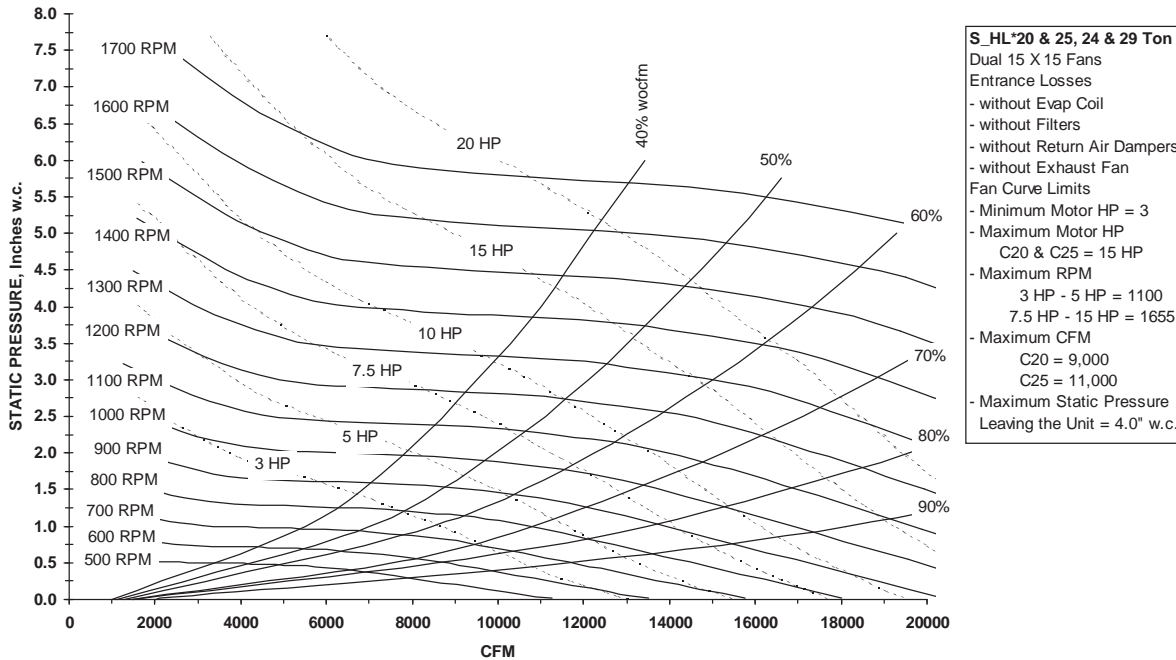
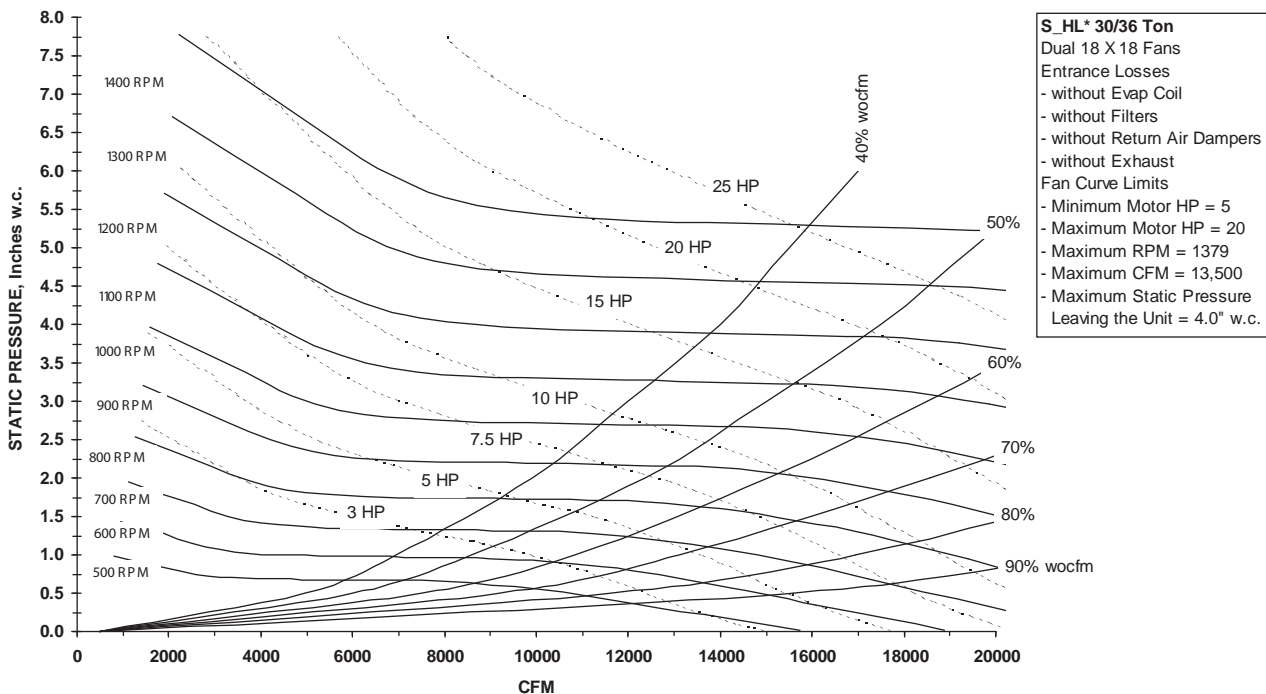
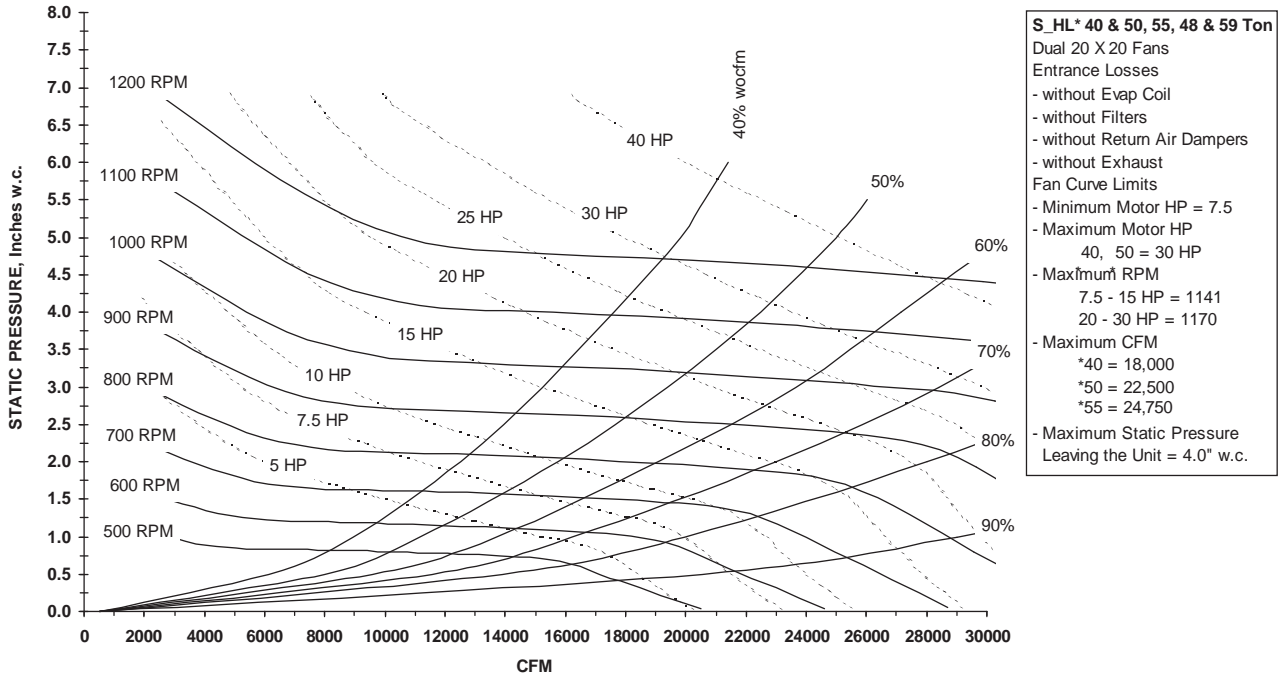


Figure 50. 30/36 ton supply fan performance



# Unit Start Up

**Figure 51. 40 & 50, 55 / 48 & 59 ton supply fan performance**



**Figure 52. 60-75, 73-89 ton supply fan performance**

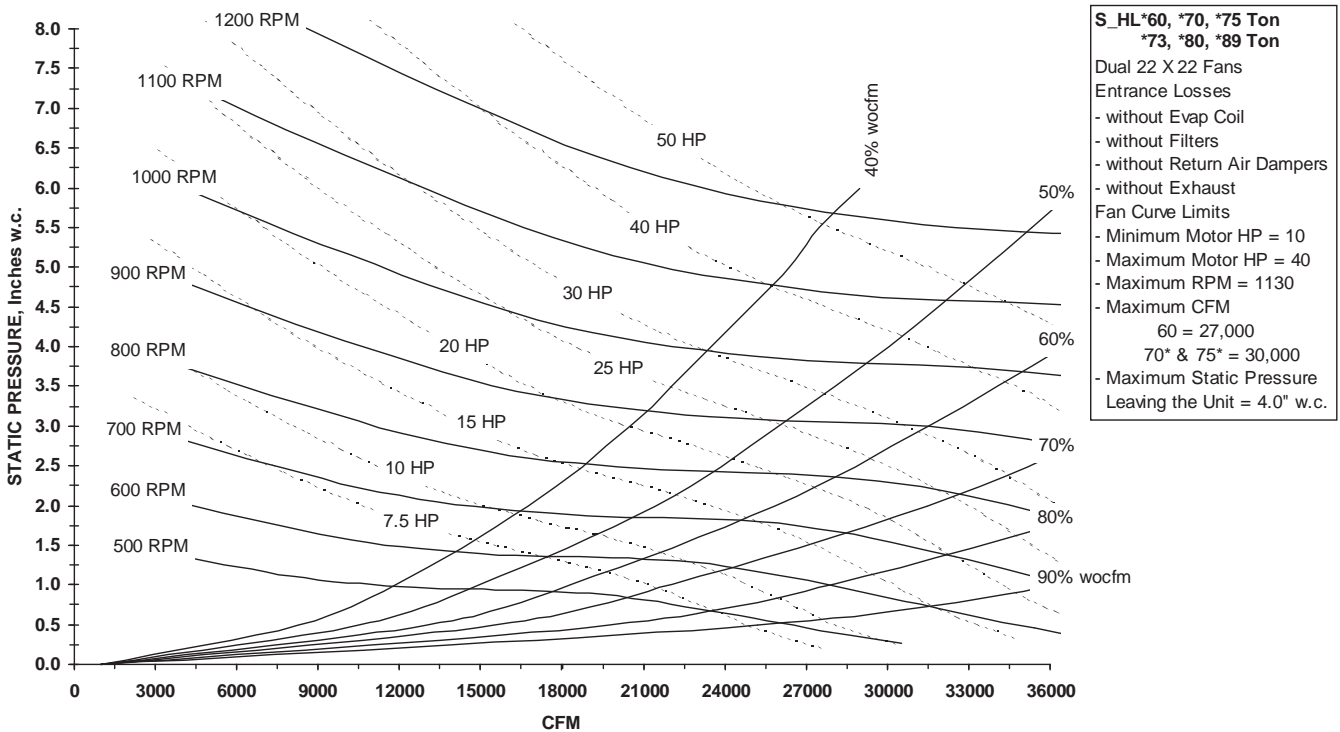
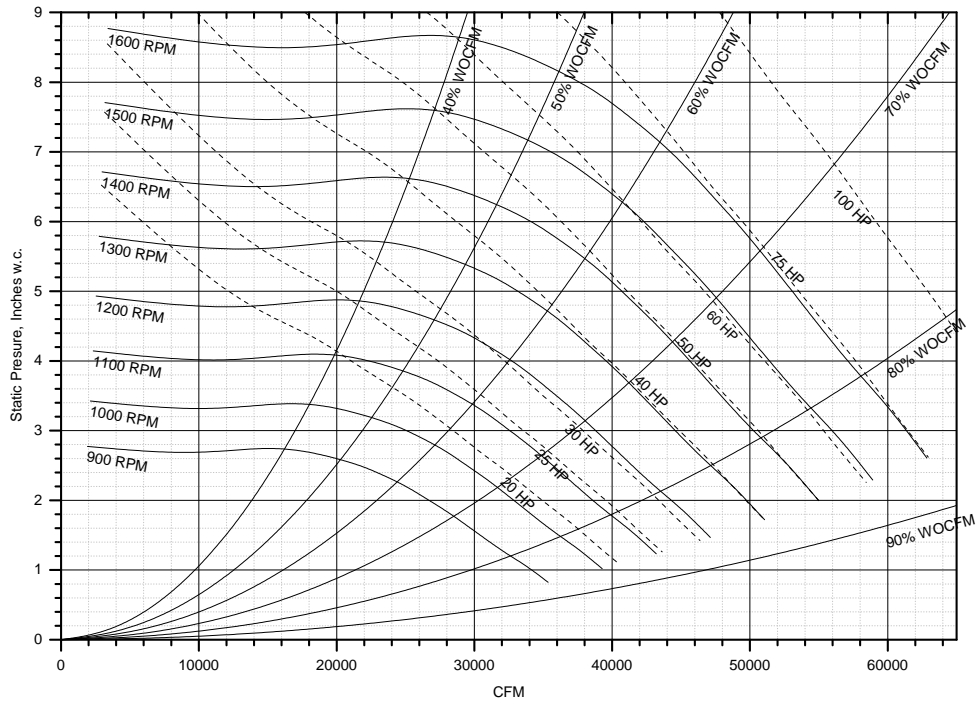




Figure 53. 90, 105, 115 and 130 ton supply fan performance



## Unit Start Up

### Pressure Drop Tables

Figure 54. Wet airside pressure drop at 0.075 lb/cu.ft. 20 - 89 ton evaporator coil

Wet Evaporator Airside Pressure Drop at 0.075 lb/cu.ft. 20-75 Ton

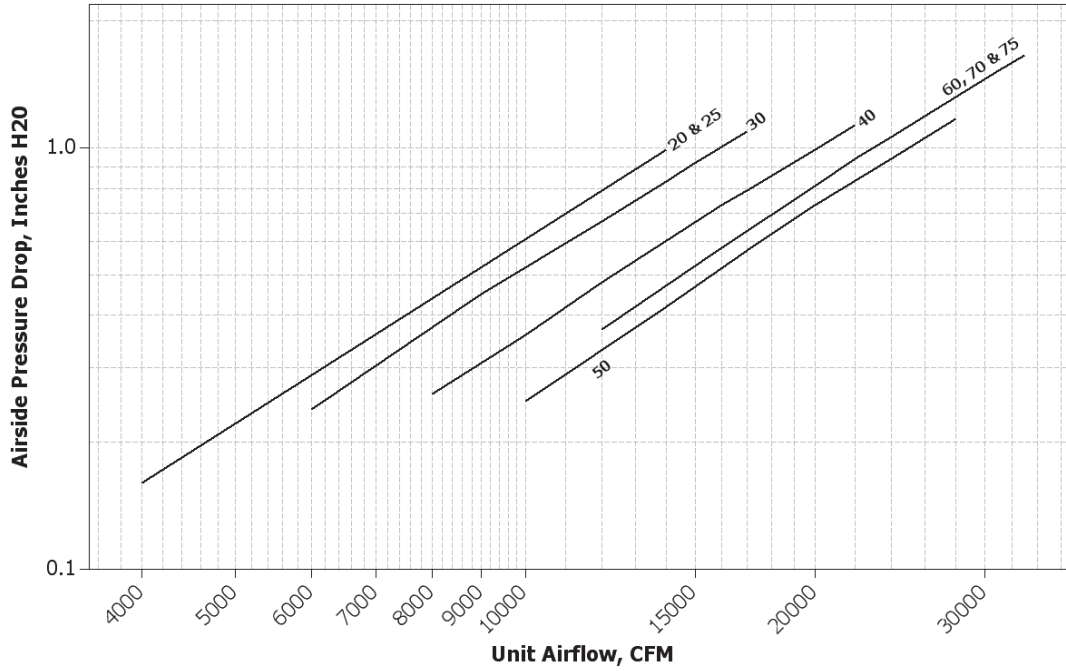


Figure 55. Dry airside pressure drop at 0.075 lb/cu.ft. 20 - 89 ton evaporator coil

Dry Evaporator Airside Pressure Drop at 0.075 lb/cu.ft. 20-75 Ton

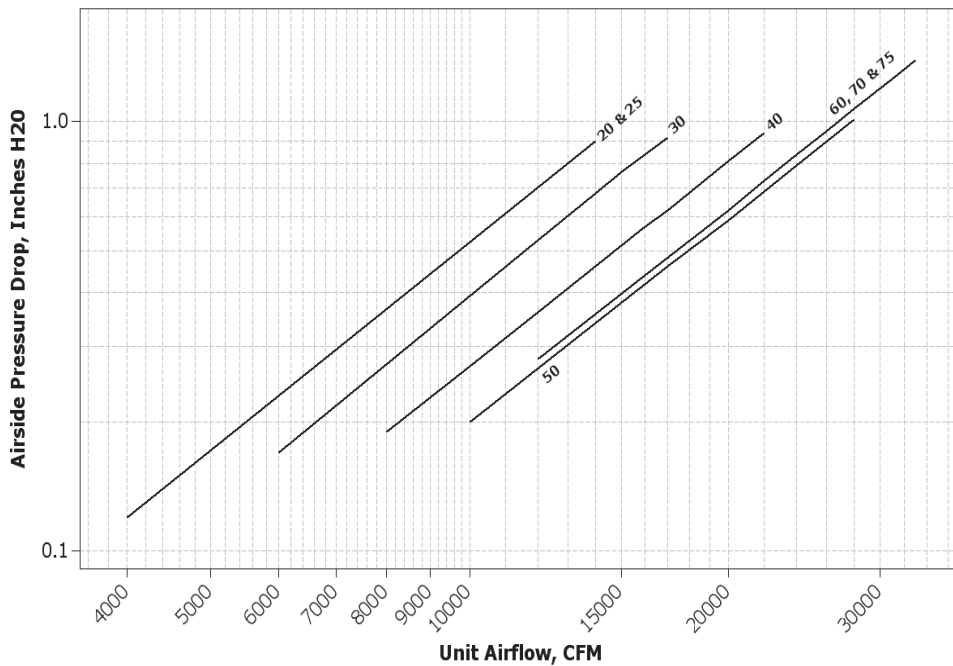


Figure 56. Wet airside pressure drop at 0.075 lb/cu.ft. 90 - 130 ton evaporator coil

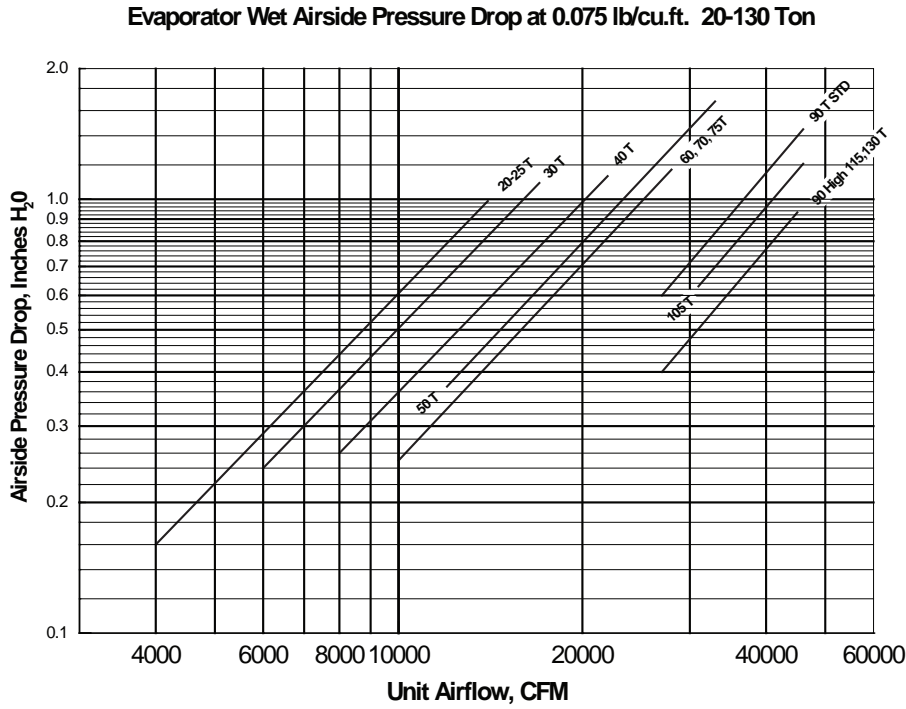
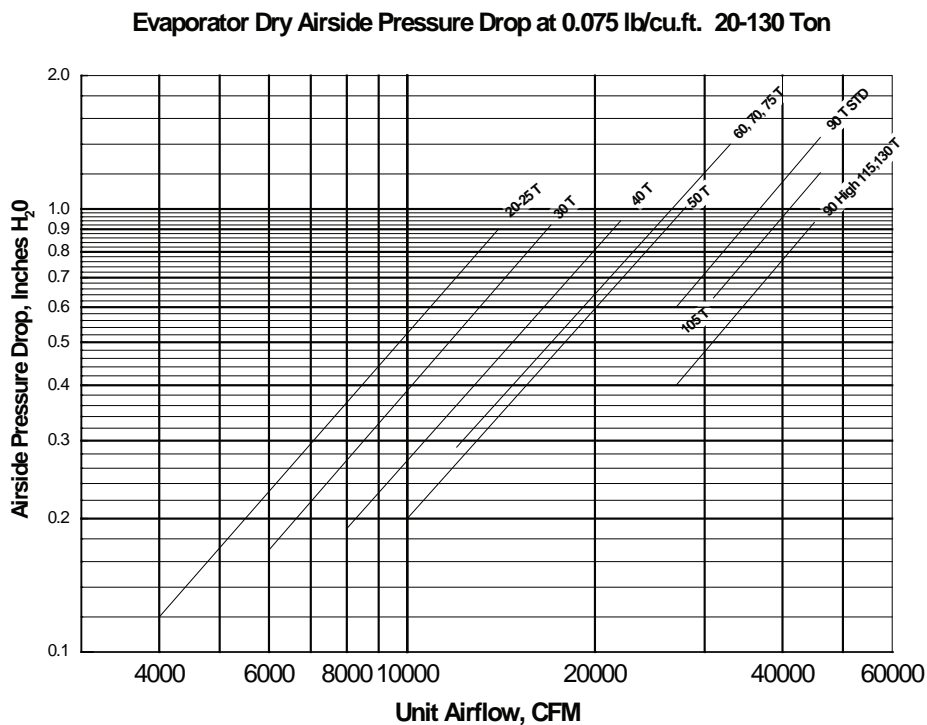


Figure 57. Dry airside pressure drop at 0.075 lb/cu.ft. 90 - 130 ton evaporator coil



# Unit Start Up

**Table 38. Component static pressure drops (in. W.G.)**

Nom (AC/EC)	Cfm Std	Evaporator Coil		Heating System						Filters				Economizer With or Without Exhaust	Reheat Option Pressure Drop				
		Dry	Wet	SFHL		SEHL All kW		SLHL		SSHL		Throwaway				Per Wire	Bag and Prefilter	Cartridge and Prefilter	Std Roof
				Low	High	Low	High	Low	High	Low	High	Std.	High						
20/24	4000	0.12	0.16	.02	N/A	0.02	0.02	.05	.06	.02	.06	.03	.03	.01	.3	.24	.01	.03	0.01
	6000	0.24	0.29	.05	.05	0.04	0.04	.09	.12	.05	.12	.06	.06	.02	.5	.44	.02	.06	0.02
	8000	0.37	0.44	.09	.09	0.07	0.07	.15	.19	.10	.20	.09	.09	.03	.71	.68	.05	.12	0.04
	10000	0.45	0.52	.12	.12	0.09	0.09	.19	.24	.12	.22	.11	.11	.04	.83	.81	.07	.15	0.05
25/29	10000	0.53	0.6	.14	.15	0.11	0.11	.23	.28	.15	.29	.13	.13	.05	.95	.95	.10	.19	0.06
	11000	0.62	0.71	.17	.18	0.13	0.13	.29	.33	.19	.35	.15	.15	.06	1.06	1.11	.12	.23	0.07
	12500	0.75	0.85	.22	.23	0.18	0.18	.33	.42	.24	.42	.19	.19	.08	1.29	1.34	.19	.30	0.09
	14000	0.9	0.99	.28	.29	0.21	0.21	.41	.53	.30	.53	.24	.24	.10	-	-	.24	.39	0.11
30/36	6000	0.17	0.24	.05	.05	0.04	0.04	.09	.12	.05	.12	.04	.04	.01	.34	.26	.02	.06	0.02
	9000	0.33	0.45	.11	.12	0.09	0.09	.19	.24	.12	.22	.07	.07	.02	.54	.48	.07	.15	0.04
	12000	0.53	0.67	.20	.21	0.16	0.16	.31	.39	.22	.41	.11	.11	.04	.75	.75	.16	.27	0.07
	14000	0.68	0.83	.26	.29	0.22	0.22	.40	.51	.30	.50	.14	.14	.06	.95	.95	.25	.39	0.09
40/48	15000	0.76	0.92	.30	.33	0.25	0.25	.45	.57	.33	.52	.16	.16	.07	1.03	1.06	.30	.43	0.11
	17000	0.92	1.09	.39	.42	0.35	0.35	.58	.73	.42	.67	.21	.21	.09	1.20	1.30	.39	.59	0.14
	8000	0.19	0.26	.09	N/A	0.07	0.07	.09	.11	.05	.11	.04	.04	.02	.37	.31	.01	.03	0.02
	10000	0.27	0.36	.14	.11	0.11	0.11	.13	.16	.08	.16	.06	.06	.02	.49	.43	.02	.03	0.03
50/55/59	12000	0.36	0.48	.20	.15	0.15	0.15	.17	.22	.11	.21	.08	.08	.03	.61	.56	.04	.07	0.05
	16000	0.57	0.73	.34	.26	0.29	0.29	.28	.36	.20	.36	.12	.12	.05	.88	.87	.10	.09	0.08
	17000	0.62	0.79	N/A	.29	0.32	0.32	.31	.39	.22	.41	.13	.13	.06	.95	.95	.12	.11	0.10
	20000	0.81	0.99	N/A	.41	0.44	0.44	.42	.52	.30	.51	.17	.17	.08	1.17	1.22	.19	.17	0.13
60/73	22000	0.94	1.13	N/A	.50	0.53	0.53	.51	.63	.36	.62	.21	.21	.10	-	-	.20	.20	0.16
	10000	0.2	0.25	.12	.10	0.11	0.11	.13	.16	.07	.15	.04	.04	.01	.37	.30	.03	.05	0.03
	14000	0.34	0.42	.26	.20	0.22	0.22	.22	.28	.15	.28	.07	.07	.03	.56	.50	.07	.08	0.05
	17000	0.46	0.57	.39	.29	0.32	0.32	.31	.40	.22	.41	.10	.10	.04	.72	.68	.12	.11	0.08
70/80	20000	0.59	0.73	.58	.41	0.44	0.44	.42	.52	.30	.51	.12	.12	.05	.88	.88	.19	.17	0.11
	24000	0.79	0.94	.73	.58	0.62	0.62	.48	.72	.45	.75	.16	.16	.07	1.11	1.17	.30	.23	0.15
	28000	1.06	1.28	.88	.63	0.84	0.84	.62	.98	.61	.99	.20	.20	.10	-	-	.30	.30	0.17
	30000	1.19	1.41	.99	.79	0.84	0.84	.62	.98	.61	.99	.20	.20	.10	-	-	.34	.34	0.20
30/36	12000	0.27	0.37	.10	.08	0.06	0.06	.10	.13	.06	.11	.05	.05	.01	.44	.37	.02	.07	0.03
	16000	0.43	0.58	.18	.14	0.11	0.11	.17	.21	.11	.19	.07	.07	.02	.63	.58	.05	.10	0.06
	20000	0.62	0.81	.27	.21	0.17	0.17	.24	.31	.16	.27	.10	.10	.03	.84	.82	.10	.16	0.09
	22000	0.73	0.94	.33	.25	0.2	0.2	.29	.37	.19	.33	.12	.12	.04	.95	.95	.13	.20	0.11
30/36	24000	0.84	1.06	.40	.30	0.24	0.24	.33	.42	.22	.39	.11	.11	.04	1.06	1.08	.16	.23	0.13
	26000	0.95	1.19	.47	.32	0.28	0.28	.39	.49	.27	.45	.16	.16	.05	1.17	1.23	.23	.26	0.15
	28000	1.07	1.32	.54	.33	0.32	0.32	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	.30	.30	0.17
	31000	1.26	1.52	.60	.40	0.4	0.4	.49	.61	.39	.55	.21	.21	.07	-	-	.37	.36	0.21
33000	1.39	1.66	.65	.46	0.45	0.45	.52	.67	.44	.60	.24	.24	.08	-	-	.42	.40	0.24	

continued on next page

**Table 38. Component static pressure drops (in. W.G.)**

Nom (AC/EC)	Cfm Std	Evaporator Coil		Heating System						Filters				Economizer With or Without Exhaust	Reheat Option Pressure Drop			
		Dry	Wet	SFHL		SEHL		SXLH		Throwaway		Cartridge and Prefilter				Std Roof		
				Low	High	All kW	SEHL	Low	High	SSHL	Low	High	Perm Wire				Bag and Prefilter	
75/89	12000	0.28	0.38	.10	.08	0.06	.10	.13	.06	.11	.05	.05	.01	.44	.37	.02	.07	0.03
	16000	0.44	0.58	.18	.14	0.11	.17	.21	.11	.19	.07	.07	.02	.63	.58	.05	.10	0.06
	20000	0.63	0.82	.27	.21	0.17	.24	.31	.16	.27	.10	.10	.03	.84	.82	.10	.16	0.09
	22000	0.73	0.94	.33	.25	0.2	.29	.37	.19	.33	.12	.12	.04	.95	.95	.13	.20	0.11
	24000	0.84	1.07	.40	.30	0.24	.33	.42	.22	.39	.14	.14	.04	1.06	1.08	.16	.23	0.13
	26000	0.95	1.2	.47	.32	0.28	.39	.49	.27	.45	.16	.16	.05	1.17	1.23	.23	.26	0.15
28000	1.07	1.33	.54	.33	0.32	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	.30	.30	0.17	
31000	1.27	1.54	.60	.40	0.4	.49	.61	.39	.55	.21	.21	.07	-	-	.37	.36	0.21	
33000	1.4	1.68	.65	.46	0.45	.52	.67	.44	.60	.24	.24	.08	-	-	.42	.40	0.24	

**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 SXHL.

**Table 39. Component static pressure drops, 90-130 ton (in. W.G.)**

Nom	Cfm Std	Evaporator Coil		High Cap Evap		Heating System						Filters				Econ. w/ or w/out Exhaust	
		Dry	Wet	Dry	Wet	SFHL		SEHL		SXLH		Throwaway		Cartridge and Prefilter			Std Roof
						Low	High	All kW	SEHL	Low	High	SSHL	Low	High	Perm Wire		
90	27000	0.40	0.53	0.60	0.80	-	0.25	0.13	0.26	0.31	0.22	0.32	0.11	0.13	0.65	-	0.2
	32000	0.53	0.70	0.80	1.03	-	0.31	0.16	0.35	0.41	0.3	0.43	0.14	0.16	0.84	-	0.31
	37000	0.67	0.88	1.01	1.32	-	0.39	0.23	0.45	0.52	0.4	0.55	0.17	0.19	1.04	-	0.41
	42000	0.83	1.08	1.25	1.62	-	0.46	0.29	0.56	0.65	0.5	0.68	0.21	0.22	1.06	-	0.52
105	45000	0.93	1.20	1.40	1.80	-	0.52	0.32	0.63	0.73	0.58	0.76	0.24	0.24	-	-	0.63
	31000	-	0.63	0.83	1.01	-	0.28	0.17	0.33	0.39	0.29	0.4	-	0.13	0.82	-	0.22
	35000	-	0.77	1.01	1.20	-	0.36	0.21	0.41	0.48	0.36	0.5	-	0.16	0.96	-	0.32
	39000	-	0.92	1.20	1.40	-	0.42	0.26	0.49	0.57	0.44	0.6	-	0.19	1.09	-	0.44
115/130	43000	-	-	1.08	1.40	-	0.45	0.3	0.57	0.66	0.53	0.71	-	0.22	1.22	-	0.54
	46000	-	-	1.21	1.56	-	0.55	0.34	0.65	0.75	0.61	0.79	-	0.24	-	-	0.64
	31000	0.76	1.00	-	-	-	0.28	0.17	0.33	0.39	0.29	0.4	-	0.13	0.82	-	0.22
	35000	0.92	1.21	-	-	-	0.36	0.21	0.41	0.48	0.36	0.5	-	0.16	0.96	-	0.32
43000	39000	1.10	1.44	-	-	-	0.42	0.26	0.49	0.57	0.44	0.6	-	0.19	1.12	-	0.44
	43000	1.30	1.68	-	-	-	0.45	0.3	0.57	0.66	0.53	0.71	-	0.22	1.3	-	0.54
46000	43000	1.45	1.86	-	-	-	0.55	0.34	0.65	0.75	0.61	0.79	-	0.24	-	-	0.64
	46000	1.45	1.86	-	-	-	0.55	0.34	0.65	0.75	0.61	0.79	-	0.24	-	-	0.64

**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 SXHF.



## Unit Start Up

**Table 40. Component static pressure drops (in. W.G.)—exhaust damper for return fan**

Nom Tons (AC/EC)	Cfm	Exhaust Damper for Return Fan	Nom Tons	Cfm	Exhaust Damper for Return Fan
20/24	4000	0.08	50/55/59	10000	0.28
	6000	0.19		14000	0.56
	8000	0.35		17000	0.75
	9000	0.44		20000	1.15
	10000	0.55		24000	1.66
	12000	0.79		28000	2.26
25/29	5000	0.13	60/73	12000	0.31
	6000	0.19		16000	0.56
	7500	0.3		20000	0.88
	10000	0.55		24000	1.27
	11000	0.67		28000	1.73
	12500	0.85		30000	1.99
	14000	1.08			
30/36	6000	0.19	70/80	12000	0.31
	9000	0.44		16000	0.56
	12000	0.79		20000	0.88
	14000	1.08		22000	1.05
	15000	1.2		24000	1.27
	17000	1.6		26000	1.47
40/48	8000	0.18	75/89	28000	1.73
	10000	0.28		31000	-
	12000	0.41		33000	-
	16000	0.73		12000	0.31
	17000	0.82		16000	0.56
	20000	1.15		20000	0.88
22000	1.39	22000	1.05		
			24000	1.27	
			26000	1.47	
			28000	1.73	
			31000	-	
			33000	-	

**Notes:**

1. Exhaust Damper drop is only added when Return Fan is ordered.
2. Use Return CFM for exhaust damper drop add on return fan selections.

**Table 41. 20-89 tons - modulating 100% exhaust fan performance**

Nominal Tons (AC/EC)	Cfm Std	Negative Static Pressure																	
		0.250		0.500		0.750		1.000		1.250		1.500		1.750		2.000			
Air	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	
20/24	4000	399	0.38	538	0.75	640	1.08	730	1.45	811	1.87	882	2.34	947	2.88				
	6000	453	0.74	570	1.17	675	1.65	765	2.22	845	2.78								
	8000	547	1.59	619	1.81	711	2.48	797	3.01										
	10000	640	2.79																
25/29	4000	399	0.38	538	0.75	640	1.08	730	1.45	811	1.87	822	2.34	947	2.88	1017	3.55		
	6000	453	0.74	570	1.17	675	1.65	765	2.22	845	2.78	912	3.27	975	3.77	1036	4.30		
	8000	547	1.59	619	1.81	711	2.48	797	3.01	876	3.66	947	4.40						
	10000	640	2.79	712	3.25	767	3.48	837	4.26	911	5.04								
	12000	737	4.44																
30/36	4000	399	0.38	538	0.75	640	1.08	730	1.45	811	1.87	882	2.34	947	2.88	1017	3.55		
	6000	453	0.74	570	1.17	675	1.65	765	2.22	845	2.78	912	3.27	975	3.77	1036	4.30		
	8000	547	1.59	619	1.81	711	2.48	797	3.01	876	3.66	947	4.40	1013	5.18	1075	5.94		
	10000	640	2.79	712	3.25	767	3.48	837	4.26	911	5.04	980	5.70	1045	6.46	1106	7.31		
	12000	737	4.44	806	5.22	860	5.64	905	5.89	956	6.49								
	14000	837	6.67																
40/48	7500	334	0.75	438	1.21	535	1.77	616	2.35	686	2.98	750	3.64	809	4.34	864	5.06		
	9000	362	1.09	449	1.57	536	2.16	618	2.84	689	3.52	753	4.24	812	4.99	867	5.77		
	12000	435	2.19	496	2.70	563	3.35	628	4.04	693	4.83	757	5.71	817	6.63	873	8.53		
	14000	486	3.22	542	3.86	594	4.47	653	5.25	707	6.04	763	6.91	819	7.86	874	8.89		
	16000	537	4.55	592	5.35	636	6.00	683	6.74	735	7.64	783	8.53	831	9.47	880	10.48		
50/55/59	9000	362	1.09	449	1.57	536	2.16	618	2.84	689	3.52	753	4.24	812	4.99	867	5.77		
	12000	435	2.19	496	2.70	563	3.35	628	4.04	693	4.83	757	5.71	817	6.63	873	7.53		
	15000	511	3.85	567	4.56	614	5.18	667	5.96	720	6.80	771	7.66	824	8.60	876	9.63		
	18000	590	6.21	642	7.16	685	7.97	724	8.69	766	9.54	812	10.54	856	11.55	898	12.56		
	20000	644	8.26	692	9.35	735	10.33	772	11.17	807	11.97	844	12.91	885	14.00	926	15.13		
60/73	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	754	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	547	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		
70/75 80/89	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	754	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	547	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 indicate non-standard drive selections. These drive selections must be manually factory selected.

## Unit Start Up

**Table 42. 90-130 Tons modulating 100% exhaust fan performance**

Nominal Tons	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
90-130	28000	516	11.42	551	12.41	586	13.70	622	15.25	657	16.71	690	18.16	723	19.90	754	21.74	785	23.60	815	25.45
	30000	550	13.94	579	14.86	614	16.25	646	17.72	680	19.45	712	20.93	743	22.54	773	24.41	803	26.38	832	28.36
	32000	583	16.82	609	17.68	642	19.12	672	20.58	704	22.34	735	24.12	764	25.67	793	27.42	822	29.41	850	31.50
	34000	617	20.09	640	20.92	670	22.30	700	23.87	728	25.53	759	27.51	788	29.30	815	30.96	842	32.82	869	34.93
	36000	650	23.76	672	24.58	699	25.86	728	27.55	755	29.19	782	31.11	811	33.21	838	35.05	864	36.81	889	38.77
	38000	684	27.86	704	28.68	728	29.87	757	31.60	783	33.33	808	35.14	834	37.30	861	39.48	887	41.38	911	43.23
	40000	718	32.41	737	33.24	758	34.36	785	36.02	811	37.91	835	39.71	859	41.74	885	44.08	910	46.33	934	48.32

**Notes:**

1. Shaded areas indicate non-standard drive selections. These drive selections must be manually factory selected.
2. Refer to General Data Table for minimum and maximum hp's.

**Table 43. 20-89 tons - 50% exhaust fan performance**

Nominal Tons (AC/EC)	Cfm Std Air	Negative Static Pressure (In. W.G.)													
		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
20/25 24/29	2000	364	0.17	487	0.30	582	0.45	658	0.58	731	0.73	797	0.90	856	1.08
	3000	435	0.36	522	0.51	614	0.67	694	0.88	765	1.11	830	1.34	886	1.54
	4000	529	0.76	592	0.86	654	1.03	728	1.29	797	1.51	861	1.77	919	2.05
	5000	623	1.32	687	1.56	735	1.67	778	1.79	836	2.13	896	2.45	953	2.72
	6000	722	2.13	779	2.47	830	2.72	870	2.86	905	2.96				
30/36	2000	364	0.17	487	0.30	582	0.45	658	0.58	731	0.73	797	0.90	856	1.08
	3000	435	0.36	522	0.51	614	0.67	694	0.88	765	1.11	830	1.34	886	1.54
	4000	529	0.76	592	0.86	654	1.03	728	1.29	797	1.51	861	1.77	919	2.05
	5000	623	1.32	687	1.56	735	1.67	778	1.79	836	2.13	896	2.45	953	2.72
	6000	722	2.13	779	2.47	830	2.72	870	2.86	905	2.96	944	3.16	994	3.59
7000	824	3.23	874	3.64	922	4.02	965	4.30	1000	4.48	1032	4.59	1062	4.72	
40/48	3000	288	0.22	393	0.38	477	0.55	547	0.74	611	0.94	668	1.16	721	1.39
	5000	372	0.66	430	0.83	495	1.05	557	1.29	621	1.57	680	1.87	732	2.16
	7000	472	1.55	522	1.82	563	2.04	606	2.29	653	2.59	698	2.91	742	3.24
	9000	578	3.06	621	3.41	661	3.76	695	4.06	725	4.34	758	4.65	794	5.01
	11000	688	5.36	725	5.80	760	6.24	793	6.66	823	7.06	850	7.42	875	7.76
50/55/59	3000	288	0.22	393	0.38	477	0.55	547	0.74	611	0.94	668	1.16	721	1.39
	5000	372	0.66	430	0.83	495	1.05	557	1.29	621	1.57	680	1.87	732	2.16
	7000	472	1.55	522	1.82	563	2.04	606	2.29	653	2.59	698	2.91	742	3.24
	9000	578	3.06	621	3.41	661	3.76	695	4.06	725	4.34	758	4.65	794	5.01
	11000	688	5.36	725	5.80	760	6.24	793	6.66	823	7.06	850	7.42	875	7.76
60/73	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	668	4.37	707	4.87
	12000	612	4.84	633	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				



**Table 43. 20-89 tons - 50% exhaust fan performance**

	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
70/75	8000	425	1.55	460	1.73	497	1.96	542	2.30	591	2.72	639	3.20	684	3.73
80/89	10000	517	2.88	543	3.13	571	3.34	600	3.59	632	3.94	668	4.37	707	4.87
	12000	612	4.84	633	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 indicate non-standard drive selections. These drive selections must be manually factory selected.

**Table 44. 90-130 Tons - 50% exhaust fan performance**

Cfm		Negative Static Pressure (In. W.G.)																			
Nom	Std	0.250		0.500		0.750		1.000		1.250		1.500		1.750		2.000		2.250		2.500	
Tons	Air	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	12000	452	3.68	495	4.21	536	4.85	576	5.46	614	6.17	651	6.95	687	7.73	722	8.55	759	9.46	797	10.45
	14000	516	5.71	551	6.21	586	6.85	622	7.63	657	8.36	690	9.09	723	9.96	754	10.88	785	11.79	815	12.72
90-130	16000	583	8.41	609	8.85	643	9.57	672	10.29	704	11.18	735	12.07	764	12.84	793	13.72	822	14.72	850	15.76
	18000	650	11.88	672	12.29	699	12.94	729	13.79	755	14.59	782	15.56	811	16.62	838	17.53	864	18.41	889	19.39
	20000	718	16.20	737	16.62	758	17.18	785	18.03	811	18.97	835	19.86	859	20.87	885	22.05	910	23.18	934	24.17

**Note:** Shaded areas indicate non-standard drive selections. These drive selections must be manually factory selected.



## Unit Start Up

**Table 45. Return fan performance—20, 25, 30 tons AC; 24, 29, 36 tons EC (24.5")**

CFM Std. Air	Negative Static Pressure															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4000	557	0.29	638	0.48	710	0.68	776	0.89	838	1.10	899	1.32	969	1.60	1038	1.89
4500	605	0.36	682	0.57	749	0.79	811	1.02	869	1.25	926	1.49	980	1.73	1033	1.99
5000	654	0.44	727	0.67	790	0.91	850	1.16	905	1.41	957	1.67	1007	1.93	1057	2.20
5500	704	0.53	773	0.79	834	1.04	889	1.30	943	1.58	992	1.86	1040	2.15	1087	2.44
6000	756	0.64	821	0.92	879	1.20	932	1.47	982	1.77	1030	2.06	1076	2.38	1121	2.70
6500	808	0.76	868	1.06	925	1.36	976	1.66	1024	1.97	1070	2.29	1114	2.61	1157	2.95
7000	861	0.90	917	1.21	972	1.55	1021	1.87	1067	2.19	1112	2.53	1154	2.87	1195	3.22
7500	913	1.06	968	1.39	1019	1.74	1068	2.10	1112	2.44	1155	2.79	1196	3.15	1235	3.51
8000	967	1.24	1019	1.58	1068	1.96	1115	2.34	1158	2.71	1199	3.08	1238	3.45	1277	3.84
8500	1021	1.44	1071	1.80	1116	2.19	1162	2.60	1204	3.00	1244	3.39	1283	3.79	1320	4.19
9000	1075	1.67	1123	2.04	1166	2.45	1210	2.88	1252	3.30	1290	3.72	1327	4.14	1363	4.56
9500	1130	1.92	1175	2.31	1217	2.73	1258	3.17	1299	3.62	1337	4.07	1373	4.52	1408	4.96
10000	1186	2.20	1228	2.60	1269	3.04	1307	3.50	1347	3.97	1384	4.45	1419	4.91	1454	5.38
10500	1241	2.50	1280	2.92	1321	3.37	1357	3.85	1395	4.34	1432	4.85	1466	5.33	1500	5.84
11000	1297	2.84	1334	3.27	1373	3.74	1409	4.23	1443	4.74	1480	5.26	1515	5.79	1546	6.29
11500	1353	3.20	1387	3.64	1425	4.13	1460	4.64	1493	5.16	1528	5.71	1561	6.25	1594	6.79
12000	1408	3.60	1441	4.06	1477	4.56	1512	5.08	1544	5.62	1576	6.18	1610	6.75	1642	7.32
12500	1464	4.03	1496	4.50	1530	5.01	1565	5.56	1596	6.11	1626	6.68	1658	7.28	1689	7.87
13000	1520	4.49	1551	4.98	1583	5.51	1617	6.06	1648	6.64	1677	7.22	1707	7.84	1737	8.44
13500	1576	4.99	1606	5.50	1636	6.03	1669	6.60	1700	7.20	1728	7.80	1756	8.42	1785	9.06
14000	1633	5.52	1661	6.05	1690	6.60	1721	7.19	1752	7.79	1780	8.42	1807	9.05	1834	9.70

**Notes:**

1. Max fan RPM 1715 for 24.5" Class I Fan
2. Max motors Available are as follows: 20T: 3HP, 25T: 5HP, 30T: 7.5 HP
3. Max CFM available is as follows; 20T: 9000, 25T: 11000, & 30T: 13500
4. Min CFM is 4000 for 20T, 25T, & 30T
5. Return fan belt drive RPM selections will be available to cover 500-1600 RPM range +/- 50 RPM
6. Performance data includes cabinet and rain hood effect. Damper pressure drop must be added to the return duct static per [Table 40, p. 126](#)
7. Shaded area indicates nonstandard BHP or RPM selections. Contact a local Trane representative for more information.

**Table 46. Return fan performance—40, 50, 55 tons AC; 48, 59 tons EC (27")**

CFM Std. Air	Negative Static Pressure															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7500	709	0.82	766	1.16	815	1.50	861	1.85	906	2.22	949	2.60	991	2.99	1033	3.39
8000	748	0.95	803	1.31	851	1.67	895	2.04	938	2.43	979	2.82	1018	3.22	1058	3.64
8500	788	1.09	840	1.47	887	1.86	930	2.24	971	2.64	1010	3.05	1049	3.48	1087	3.92
9000	827	1.24	878	1.64	924	2.05	965	2.46	1005	2.88	1043	3.31	1080	3.75	1115	4.19
9500	867	1.41	916	1.83	961	2.27	1001	2.70	1040	3.14	1076	3.58	1112	4.03	1146	4.50
10000	908	1.60	955	2.04	999	2.50	1038	2.95	1075	3.41	1111	3.88	1145	4.34	1179	4.83
10500	948	1.81	994	2.27	1036	2.75	1075	3.23	1111	3.70	1145	4.18	1179	4.68	1212	5.18
11000	989	2.04	1033	2.51	1074	3.01	1112	3.51	1147	4.01	1181	4.51	1213	5.02	1245	5.53
11500	1030	2.28	1072	2.78	1112	3.29	1149	3.82	1184	4.33	1216	4.86	1248	5.38	1279	5.92
12000	1071	2.55	1112	3.06	1151	3.59	1187	4.14	1221	4.69	1253	5.24	1284	5.78	1314	6.33
12500	1112	2.83	1152	3.37	1189	3.92	1225	4.48	1258	5.06	1290	5.62	1320	6.19	1349	6.76
13000	1153	3.14	1192	3.70	1228	4.27	1263	4.86	1296	5.45	1327	6.04	1356	6.63	1385	7.23
13500	1194	3.47	1232	4.05	1267	4.63	1301	5.24	1333	5.85	1364	6.47	1393	7.08	1421	7.70
14000	1236	3.83	1272	4.42	1307	5.03	1340	5.66	1371	6.29	1401	6.94	1430	7.57	1457	8.20
14500	1277	4.21	1313	4.82	1346	5.45	1379	6.10	1410	6.75	1439	7.42	1467	8.08	1494	8.73
15000	1319	4.62	1353	5.25	1386	5.90	1417	6.55	1448	7.23	1477	7.92	1504	8.61	1531	9.29
15500	1361	5.05	1394	5.71	1426	6.37	1457	7.05	1486	7.74	1514	8.44	1542	9.16	1569	9.87
16000	1402	5.51	1435	6.18	1466	6.87	1496	7.57	1525	8.28	1553	9.01	1580	9.74	1606	10.47
16500	1444	6.00	1476	6.69	1506	7.40	1535	8.12	1564	8.85	1591	9.58	1617	10.34	1643	11.10
17000	1486	6.52	1517	7.23	1547	7.96	1575	8.70	1603	9.44	1629	10.20	1655	10.97	1681	11.75
17500	1528	7.07	1558	7.80	1587	8.55	1615	9.30	1642	10.07	1668	10.85	1694	11.64	1718	12.43
18000	1570	7.65	1599	8.40	1627	9.17	1655	9.94	1681	10.73	1707	11.53	1732	12.33	1757	13.15
18500	1612	8.26	1640	9.03	1668	9.81	1695	10.62	1721	11.43	1746	12.23	1771	13.07	1794	13.89
19000	1654	8.91	1682	9.70	1709	10.50	1735	11.31	1760	12.14	1785	12.97	1809	13.82	1833	14.67
19500	1696	9.59	1723	10.40	1749	11.22	1775	12.06	1800	12.90	1825	13.76	1848	14.62	1872	15.50
20000	1738	10.30	1765	11.13	1790	11.97	1816	12.83	1840	13.69	1864	14.56	1888	15.46	1910	16.34
20500	1780	11.05	1806	11.90	1831	12.76	1856	13.63	1880	14.52	1903	15.41	1926	16.31	1949	17.22
21000	1822	11.84	1848	12.71	1872	13.59	1897	14.48	1920	15.39	1943	16.29	1966	17.23	1988	18.14
21500	1864	12.66	1889	13.55	1914	14.45	1937	15.36	1960	16.29	1983	17.22	2005	18.16	2027	19.11
22000	1899	13.05	1926	14.11	1952	15.16	1977	16.20	2001	17.23	2024	18.24	2047	19.27	2069	20.28
22500	1941	13.91	1967	14.98	1992	16.05	2017	17.12	2041	18.19	2064	19.23	2086	20.27	2108	21.31

**Notes:**

1. Max fan RPM 1981 For 27" Class II Fan
2. Max Motor Available 15 HP For 27" Fan Size
3. Max motors Available are as follows: 40T: 10 HP & 50/55T: 15 HP
4. Max CFM is as follows: 40T: 18000, 50/55T: 22500)
5. Min CFM is as follows: 40T: 7500 & 50/55T: 9000
6. Return fan belt drive RPM selections will be available to cover 700-1900 RPM range +/- 50 RPM
7. Performance data includes cabinet and rain hood effect. Damper pressure drop will have to be added to the return duct static per [Table 40, p. 126](#)
8. Shaded area indicates nonstandard BHP or RPM selections. Contact a local Trane representative for more information.

## Unit Start Up

**Table 47. Return fan performance—60, 70, 75 tons AC; 73, 80, 89 tons EC (36.5" fan)**

CFM Std. Air	Negative Static Pressure															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	459	1.07	502	1.59	541	2.13	578	2.71	613	3.31	647	3.91	681	4.54	713	5.20
13000	490	1.27	530	1.83	567	2.40	603	3.01	636	3.65	668	4.29	700	4.94	731	5.64
14000	520	1.49	560	2.09	595	2.70	628	3.34	660	3.99	691	4.69	721	5.38	751	6.10
15000	552	1.73	590	2.38	623	3.03	655	3.70	686	4.39	715	5.11	744	5.85	771	6.59
16000	583	2.00	619	2.70	652	3.39	682	4.09	712	4.82	740	5.57	767	6.34	794	7.14
17000	615	2.30	650	3.05	681	3.78	710	4.52	739	5.28	766	6.06	792	6.85	818	7.67
18000	646	2.64	680	3.43	711	4.20	739	4.98	766	5.78	792	6.60	817	7.41	842	8.27
19000	678	3.01	711	3.85	741	4.67	768	5.48	794	6.31	819	7.16	844	8.03	867	8.89
20000	711	3.42	742	4.30	771	5.17	797	6.02	823	6.90	847	7.77	871	8.66	894	9.59
21000	743	3.87	773	4.78	801	5.70	827	6.60	852	7.51	875	8.41	898	9.36	920	10.30
22000	775	4.36	805	5.31	832	6.28	857	7.22	881	8.17	904	9.11	926	10.09	947	11.06
23000	808	4.89	836	5.88	863	6.90	887	7.89	911	8.88	933	9.87	954	10.86	975	11.88
24000	840	5.46	868	6.49	894	7.56	918	8.60	941	9.63	962	10.67	983	11.71	1004	12.75
25000	873	6.08	900	7.15	925	8.26	948	9.35	970	10.42	992	11.49	1012	12.59	1032	13.67
26000	906	6.75	931	7.86	956	9.00	979	10.16	1001	11.28	1021	12.37	1041	13.49	1061	14.63
27000	939	7.47	963	8.62	987	9.79	1010	11.01	1031	12.18	1052	13.33	1071	14.47	1090	15.65

**Notes:**

1. Max fan RPM 1151 for 36.5" Class I Fan
2. Max motor available 20 HP for 36.5" fan size
3. Max motor available 20 HP for 60, 70 & 75T/ 73, 80 & 89T
4. Max CFM is 27000 for 60, 70 & 75T/ 73, 80 & 89T
5. Min CFM is 12000 for 60, 70 & 75T/ 73, 80 & 89T
6. Return fan belt drive RPM selections will be available to cover 500-1100 RPM range +/- 50 RPM
7. Performance data includes cabinet and rain hood effect. Damper pressure drop will have to be added to return duct static per table [Table 40, p. 126](#)

## Economizer Damper Adjustment

### Exhaust Air Dampers

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 48](#) for the appropriate linkage position for the unit and operating airflow (CFM).

### ⚠ 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.

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 48, p. 134](#) for the equivalent return air duct losses that correspond to each of the holes illustrated in [Figure 56, p. 123](#).

### 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!**

**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.**

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

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 applicable programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use [Table 35, p. 108](#) to program the following system components for operation by scrolling through the 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 step 6 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.

**⚠ WARNING**

**Rotating Components!**

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

10. Open the field supplied main power disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the "Open" position while working on the dampers.
11. Compare the static pressure reading to the static pressure ranges and linkage positions in [Table 48, p. 134](#) 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 17.
12. Remove the drive rod and swivel from the crank arm(s). If only one hole requires changing, loosen only that end.
13. Manually open the return air dampers to the full open position.
14. Manually close the fresh air dampers.
15. Reattach 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 may need to be adjusted.
16. Tighten the lock nut against the swivel(s).
17. Plug the holes after the proper CFM has been established.

**Table 48. F/A Damper travel adjustment**

Position of Connecting Rod ( <a href="#">Figure 56, p. 123</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.

Use [Table 49, p. 135](#) to select the appropriate crank arm hole configuration based on the;

- a. specific unit
- b. operating CFM
- c. and return static pressure.

**Table 49. Fresh air damper pressure drop (inches w.c.) – Air-Cooled and Evaporative Condensing**

<b>(20, 25 Ton and 24, 29 Ton) Units</b>						
<b>CFM</b>	<b>Damper Position</b>					
	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>#6</b>
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	-

<b>(50, 55 and 59 Ton) Units</b>						
<b>CFM</b>	<b>Damper Position</b>					
	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>#6</b>
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	-

<b>(30, 36 Ton) Units</b>						
<b>CFM</b>	<b>Damper Position</b>					
	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>#6</b>
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	-

<b>(60, 70, 75 Ton and 73, 80, 89 Ton) Units</b>						
<b>CFM</b>	<b>Damper Position</b>					
	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>#6</b>
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	-	-

<b>(40, 48 Ton) Units</b>						
<b>CFM</b>	<b>Damper Position</b>					
	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>#6</b>
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	-

<b>(90 - 130 Ton) Units</b>						
<b>CFM</b>	<b>Damper Position</b>					
	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>#6</b>
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	-	-	-

**NOTICE:**

**Compressors Failure!**

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

### Compressor Start-Up (All Systems)

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position.
2. Before closing the disconnect switch, ensure that the compressor discharge service valve and the liquid line service valve for each circuit is back seated.

#### **NOTICE**

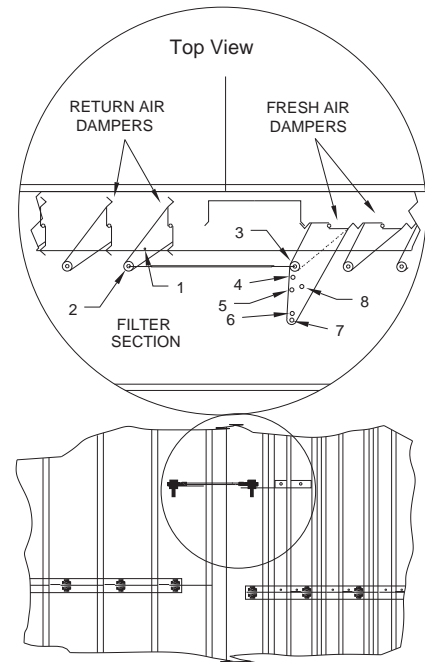
#### **Compressor Damage!**

**Do not allow liquid refrigerant to enter the suction line. Excessive liquid accumulation in the liquid lines could result in compressor damage.**

COMPRESSOR SERVICE VALVES MUST BE FULLY OPENED BEFORE START-UP (SUCTION, DISCHARGE, AND LIQUID LINE).

3. 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 to allow the crankcase heater to operate a minimum of 8 hours before continuing.

**Figure 58. Fresh air and return air linkage adjustment**



**Note:** Compressor Damage could occur if the crankcase heater is not allowed to operate the minimum of 8 hours before starting the compressor(s).

4. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
5. 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-SVP01\*-EN for CV applications or RT-SVP02\*-EN for VAV applications for the SERVICE TEST screens and programming instructions.
6. Use [Table 35, p. 108](#) to program the following system components for operation by scrolling through the displays;
  - 20 to 36 Ton
    - Compressor 1A (On)
    - Compressor 1B (Off)
    - Condenser Fans
  - 40 through 130 Ton
    - Compressor 1A (On)
    - Compressor 1B (Off)
    - Compressor 2A (Off)
    - Compressor 2B (Off)
    - Condenser Fans
7. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. Refer to [Figure 59, p. 139](#) for the various compressor locations.



8. 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.
9. Press the TEST START key to start the test. Remember that the delay designated in step 8 must elapse before the system will begin to operate.
10. It is very important to review and follow the Electrical Phasing procedure described in the startup procedure of the IOM. If the compressors are allowed to run backward for even a very short period of time, internal compressor damage may occur and compressor life may be reduced. If a scroll compressor is rotating backwards, it will not pump, make a loud rattling sound and low side shell gets hot. Immediately shut off the unit. If the phasing is incorrect, interchange any two compressor leads to correct the motor phasing.
11. Press the STOP key at the Human Interface Module in the unit control panel to stop the compressor operation.
12. Repeat steps 5 through 11 for each compressor stage and the appropriate condenser fans.

### Refrigerant Charging

1. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. Refer to [Figure 59, p. 139](#) for the various compressor locations.
2. 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 programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
3. Use [Table 35, p. 108](#) to program the following system components for the number 1 refrigeration circuit by scrolling through the displays;

### Supply Fan (On)

- OCC/UNOCC Relay (Unoccupied for VAV units)
  - All Compressors for each circuit (On)
  - Condenser Fans for each circuit (On)
4. 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.
  5. Press the TEST START key to start the test. Remember that the delay designated in step 4 must elapse before the system will begin to operate.
  6. After all of the compressors and condenser fans for the number 1 circuit have been operating for approximately 30 minutes, observe the operating pressures. Use the appropriate pressure curve in "[Pressure Curves,](#)" p. 142 - p. 149 to determine the proper operating pressures. For superheat and subcooling guidelines, refer to "Thermostatic Expansion Valves and Charging by Subcooling" at the end of this section.
- Note:** Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all Federal, State and local laws. Refer to general service bulletin MSCU-SB-1 (latest edition).
7. Verify that the oil level in each compressor is correct.
  8. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.
  9. Repeat steps 1 through 8 for the number 2 refrigeration circuit.

### Compressor Crankcase Heaters

20 - 73 and 80 ton units are equipped with 90 watt heaters installed on each compressor. 75 and 89 - 130 ton units are equipped with 160 watt heaters per compressor.

### Compressor Operational Sounds

#### At Low Ambient Start-Up

When the compressor starts up under low ambient conditions, the initial flow rate of the compressor is low due to the low condensing pressure. Under this condition, it is not unusual to hear the compressor rattle until the suction pressure climbs and the flow rate increases.

#### Compressor – Blink Codes

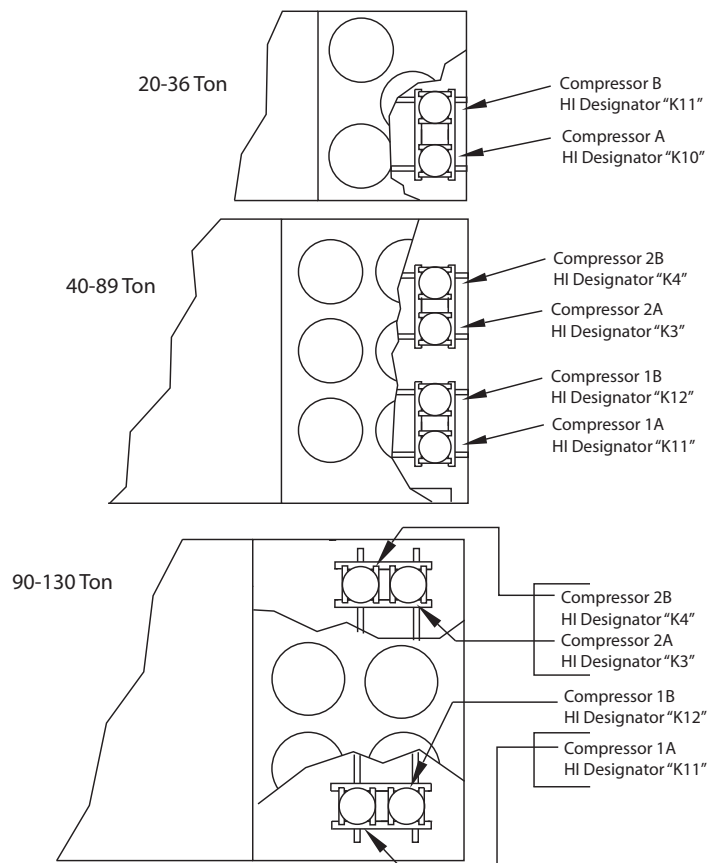
The CSHN\*\*\* compressors come equipped with a compressor protection device capable of detecting phase reversal, phase loss, and phase unbalance. The compressor protection device uses a Green and Red LED to indicate the compressor status. A solid Green LED denotes a fault free condition; a blinking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

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

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

**Table 50. CPM Blink Codes**

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

**Figure 59. Compressor locations**


## Evaporative Condenser Startup

**Important:** Water treatment by a qualified water treatment expert is required to ensure proper equipment life and product performance. Dolphin Water Care is an option offered by Trane that is NOT a substitute for regular water treatment by a qualified water treatment professional. If a water treatment system is not operating on the unit, do not proceed.

Startup for evaporative and air-cooled condensers is initially the same. In addition, the following is required for evaporative condensers prior to startup:

- All water and drain connections must be checked and verified
- Evaporative condensers will ship with a fan support bracket to reduce damage caused by vibration during shipment. The shipping support brackets must be removed prior to unit startup. See ["To remove shipping brackets,"](#) p. 140 and [Figure 60,](#) p. 141 for removal instructions.
- Verify that inlet water pressure is 35-60 PSIG, dynamic pressure (measured with the valve open)
- Verify that drain valve is set to "drain during power loss" or "hold during power loss" per job specification
- Upon a call for cooling, the sump will fill with water. Verify that the sump fills to a level within the slot on the max float bracket as shown in [Figure 61,](#) p. 141.

**To remove shipping brackets**

**Important:** Remove fan shipping brackets before startup. Failure to remove brackets could result in fan damage.

Evaporative condensers are shipped with fan shipping brackets to reduce damage caused by vibration during shipment. The fan shipping brackets must be removed prior to unit startup. To remove the shipping brackets start from the side opposite to the drain actuator:

1. Loosen the screw for the bracket that holds the inlet louvers below the door side.
2. Remove inlet louvers and set to the side.

**Note:** Service technician may need to step on the horizontal surface of FRP coated base. Step with care.

3. Unscrew the bolt in the middle of the door. Keep the bolt in a safe place.
4. Lift one door with handle until it touches the top. Swivel bottom of door to remove it from the door opening and set it to the side.
5. Slide and remove the middle mist eliminator section so that the shipping bracket is visible.
6. Use screw gun to unscrew the two screws that hold the fan shipping bracket. The bracket should drop down but still remain engaged with a hook on the bracket.
7. Go to the other side of the unit and follow the procedure for inlet louver and door removal (see steps 1 - 6).
8. Hold the bracket with one hand and remove remaining two screws.
9. Remove the bracket and all the removed screws from the unit.

**Important:** Make sure there are no screws remaining in the coil area.

10. Reinstall inlet louvers, mist eliminators and louvers.
11. Check that the direction of arrow on the inlet louver is correct.

Figure 60. Fan shipping bracket removal

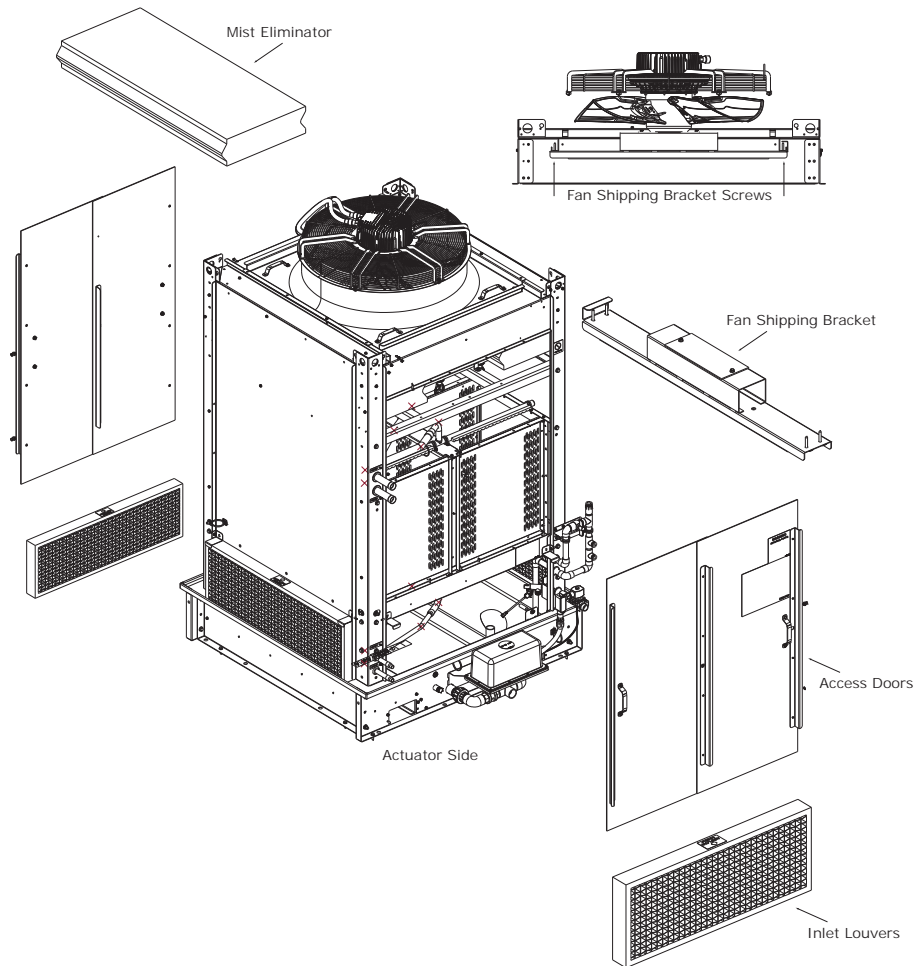
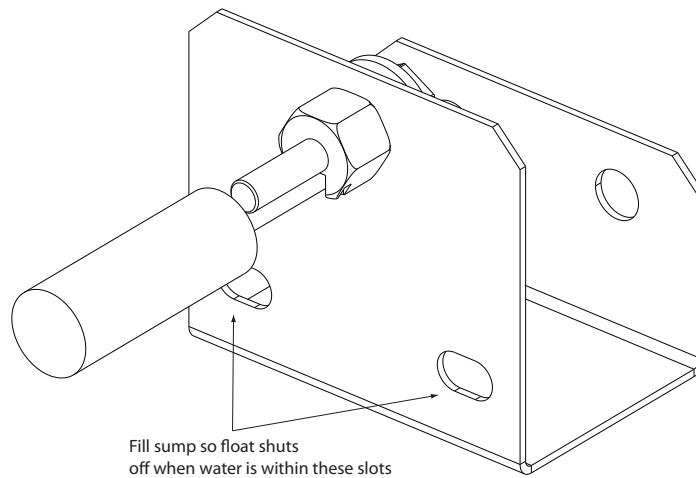


Figure 61. Float bracket setting



## Pressure Curves

### To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.

**Note:** If unit includes the Modulating Dehumidification Control option, pressure curves apply to the cooling mode only.

2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within  $\pm 7$  psig of the graph.

**Note:** To check operating pressure, see instructions [p. 142](#).

**Figure 62. 20 ton standard operating pressure curve (all compressors and condenser fans "On")**

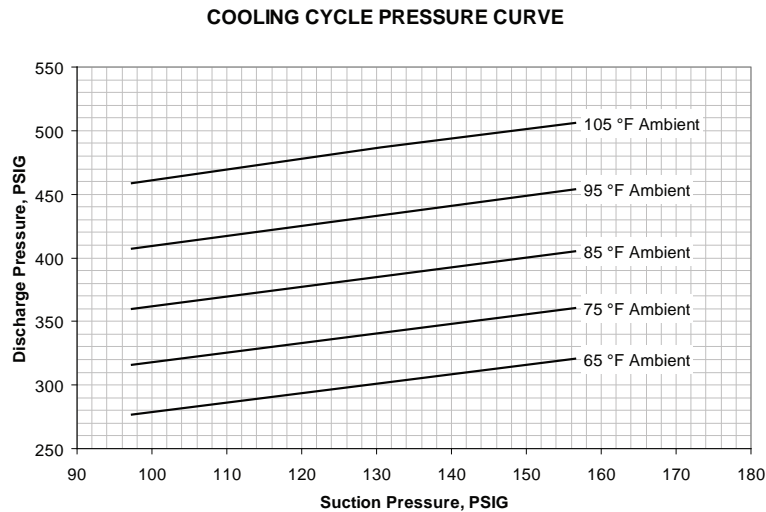
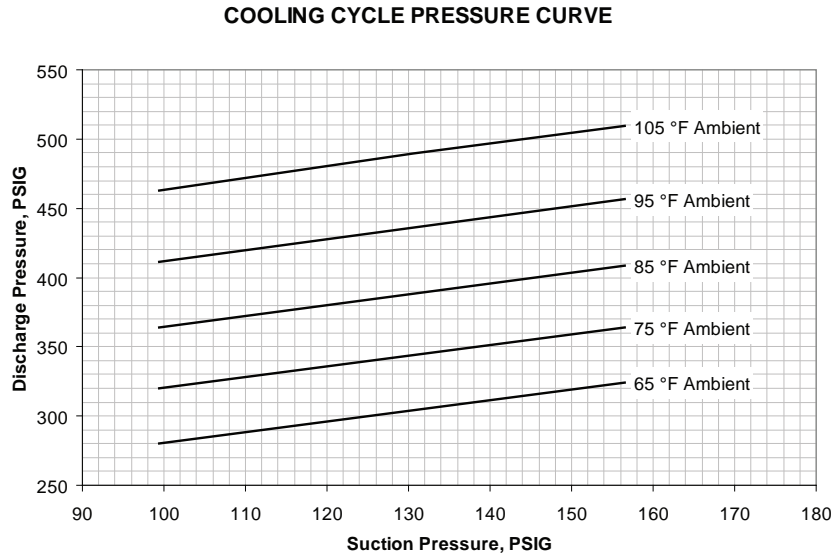
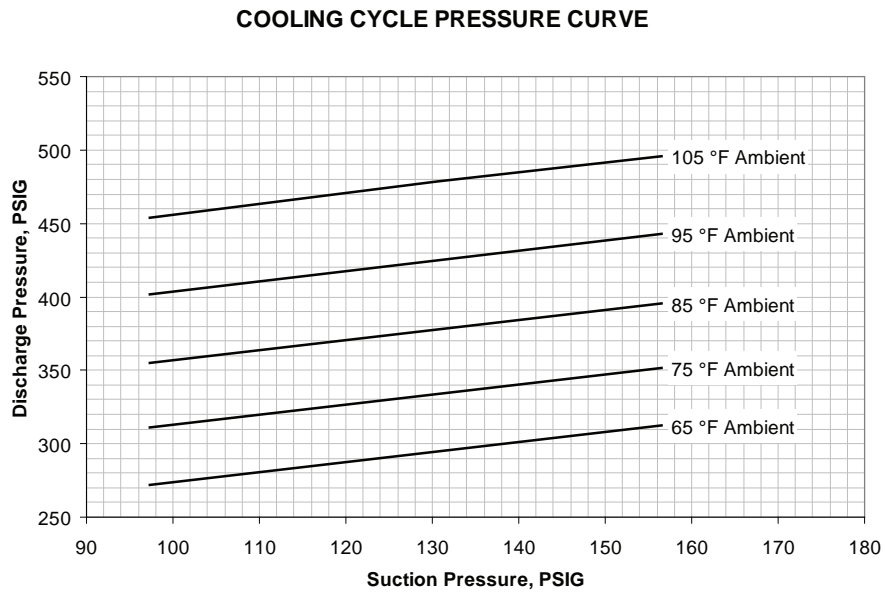


Figure 63. 20 ton high operating pressure curve (all compressors and condenser fans "On")

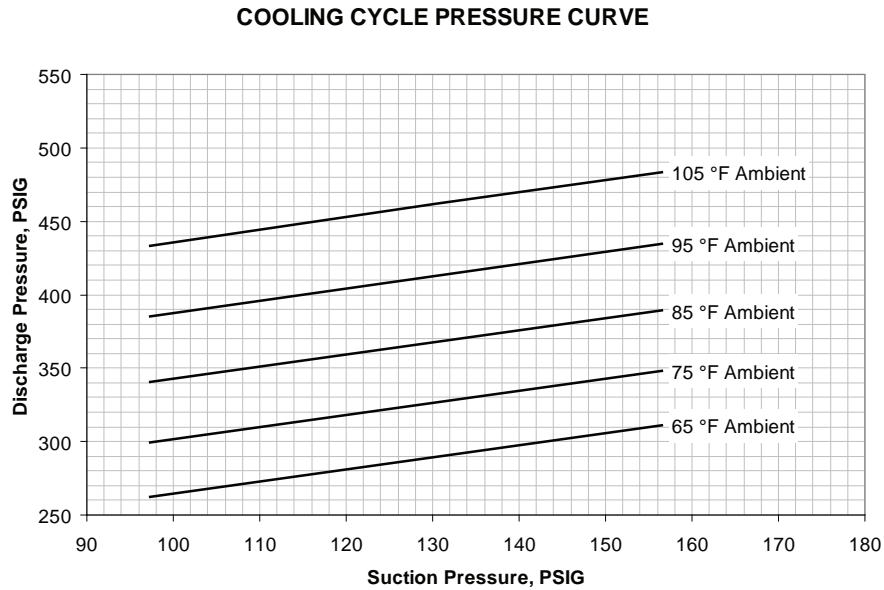


**Note:** To check operating pressure, see instructions [p. 142](#).

Figure 64. 25 ton standard operating pressure curve (all compressors and condenser fans "On")



**Figure 65. 25 ton high operating pressure curve (all compressors and condenser fans "On")**



**Note:** To check operating pressure, see instructions [p. 142](#).

**Figure 66. 30 ton standard operating pressure curve (all compressors and condenser fans "On")**

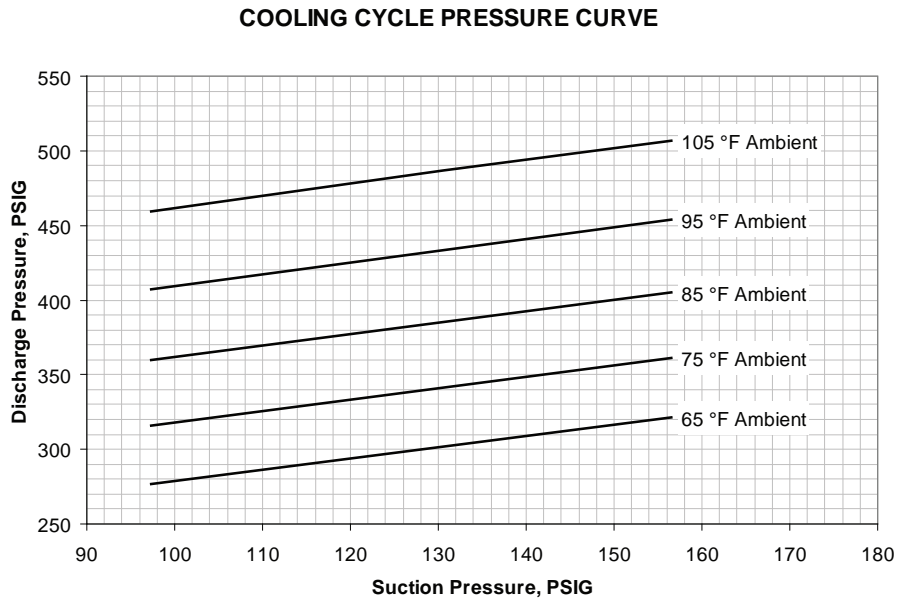
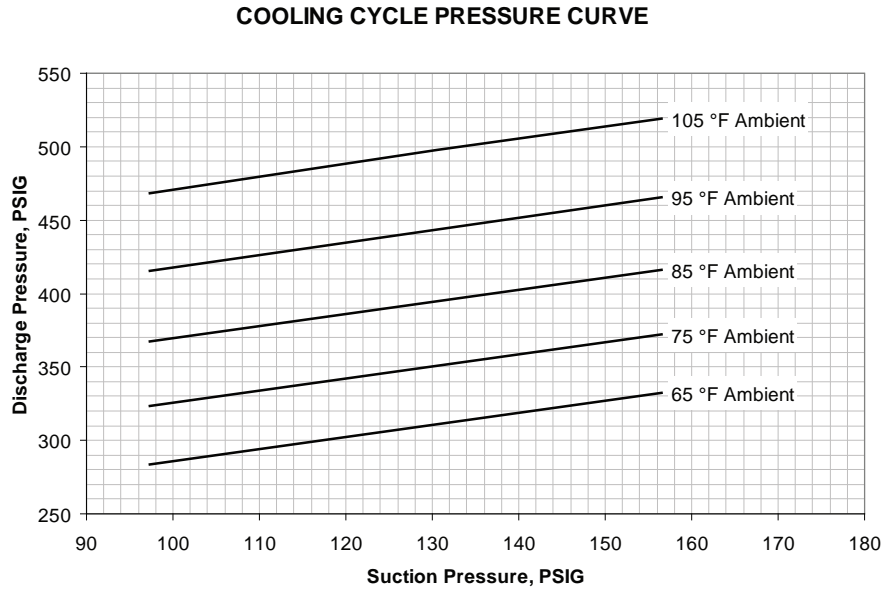


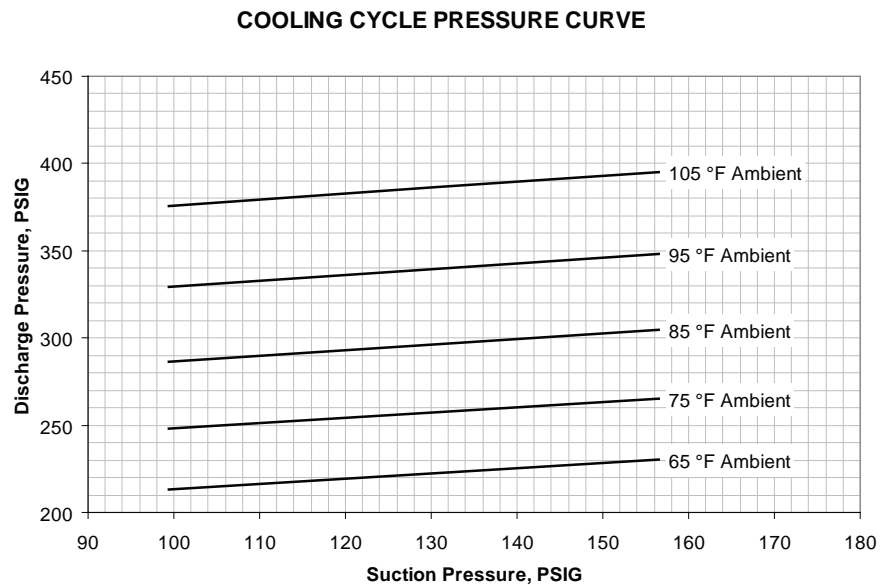


Figure 67. 30 ton high operating pressure curve (all compressors and condenser fans “On”)



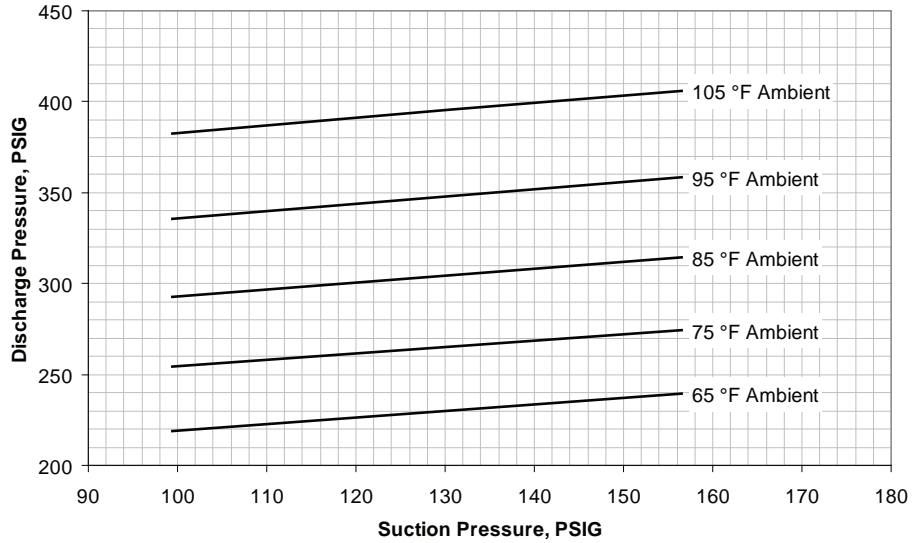
**Note:** To check operating pressure, see instructions [p. 142](#).

Figure 68. 40 ton standard operating pressure curve (all compressors and condenser fans “On”)



**Figure 69. 40 ton high operating pressure curve (all compressors and condenser fans "On")**

**COOLING CYCLE PRESSURE CURVE**



**Note:** To check operating pressure, see instructions p. 142.

**Figure 70. 50/55 ton standard operating pressure curve (all compressors and condenser fans "On")**

**COOLING CYCLE PRESSURE CURVE**

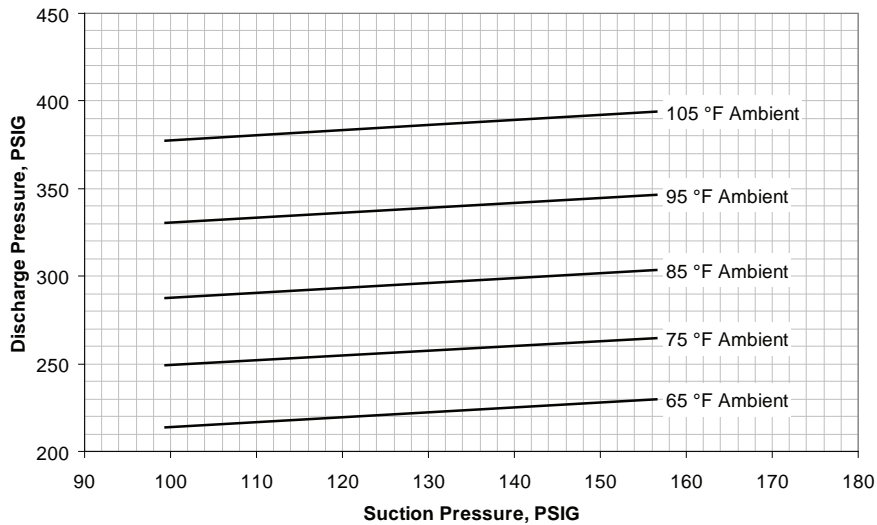
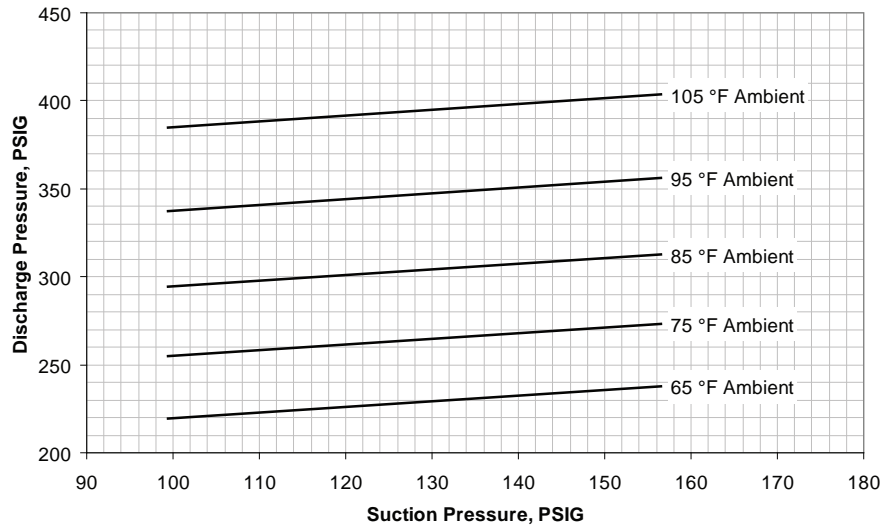


Figure 71. 50/55 ton high operating pressure curve (all compressors and condenser fans "On")

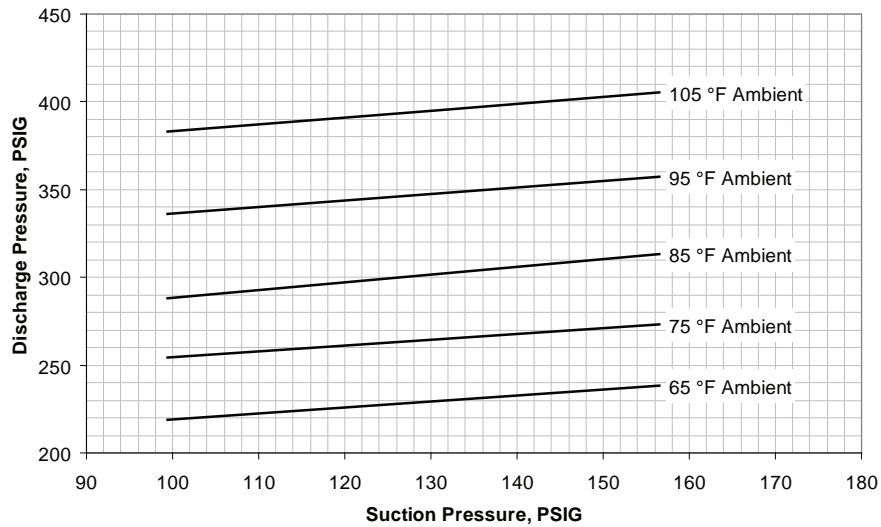
COOLING CYCLE PRESSURE CURVE



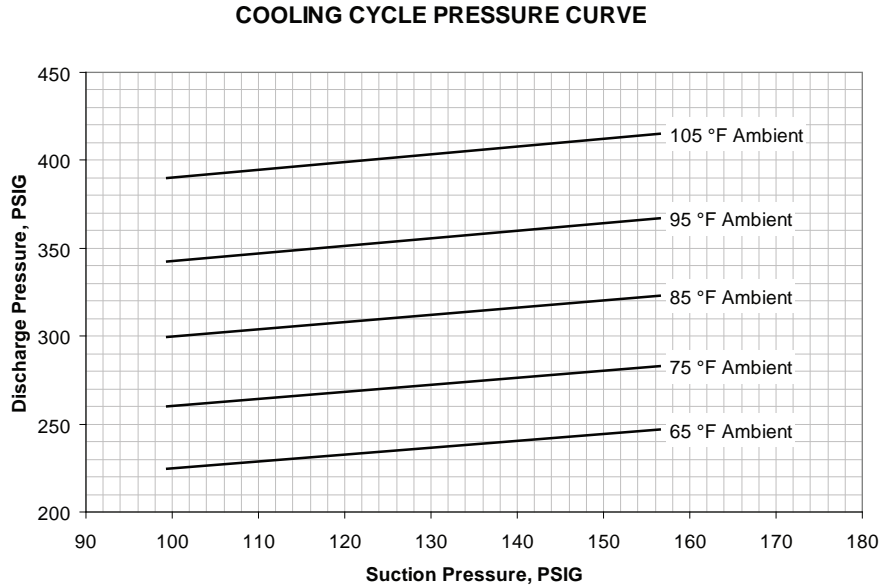
**Note:** To check operating pressure, see instructions [p. 142](#).

Figure 72. 60 ton standard operating pressure curve (all compressors and condenser fans "On")

COOLING CYCLE PRESSURE CURVE



**Figure 73. 60 ton high operating pressure curve (all compressors and condenser fans "On")**



**Note:** To check operating pressure, see instructions [p. 142](#).

**Figure 74. 70 ton standard operating pressure curve (all compressors and condenser fans "On")**

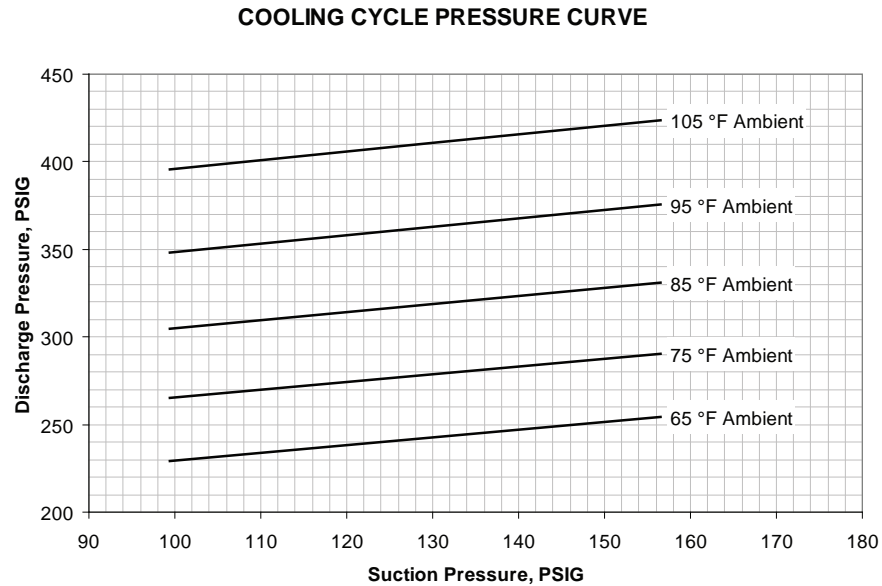
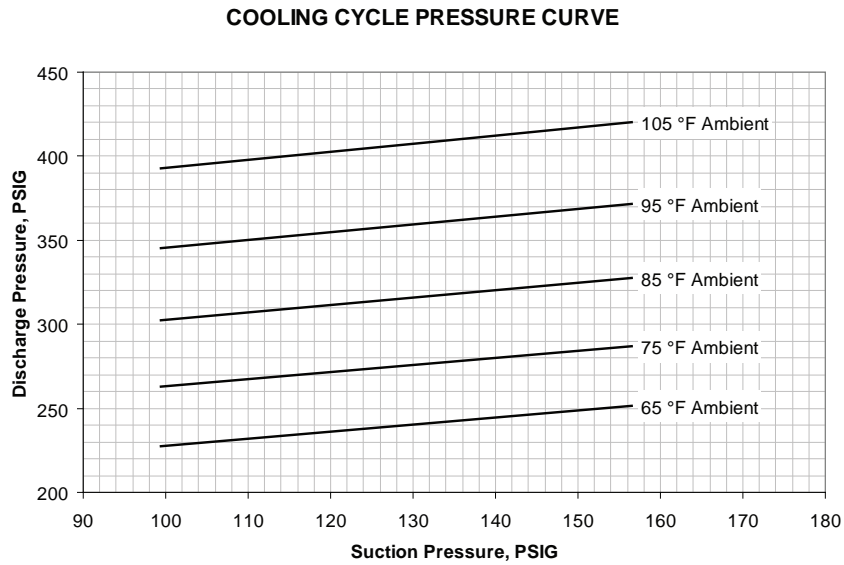
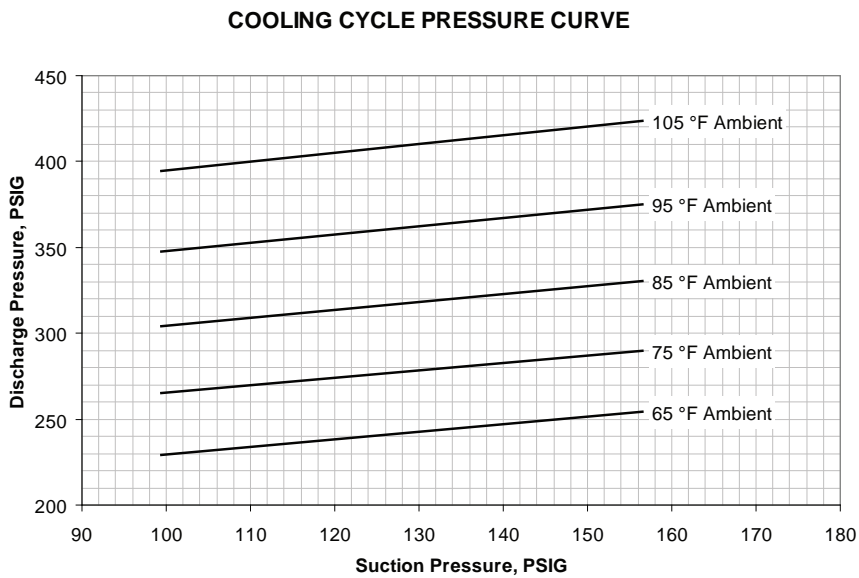


Figure 75. 75 ton standard operating pressure curve (all compressors and condenser fans "On")

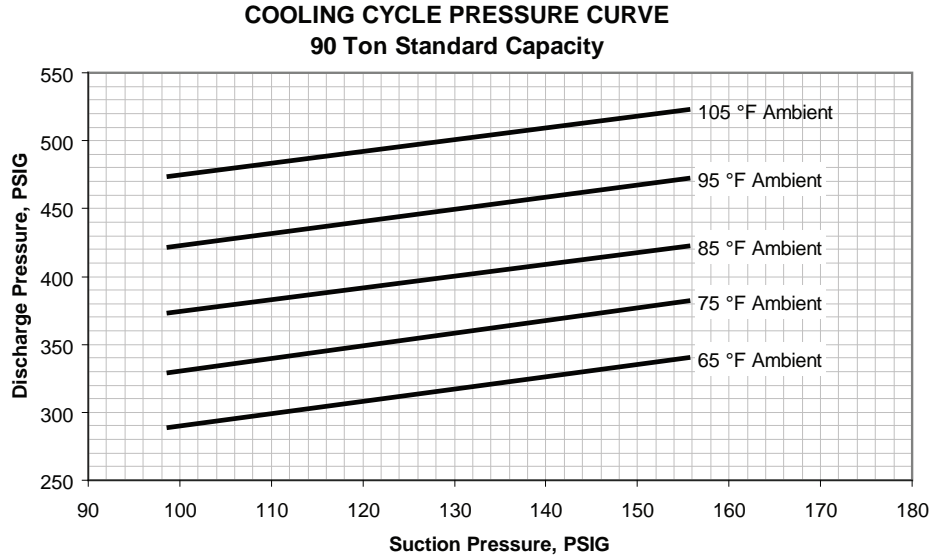


**Note:** To check operating pressure, see instructions [p. 142](#).

Figure 76. 75 ton high operating pressure curve (all compressors and condenser fans "On")

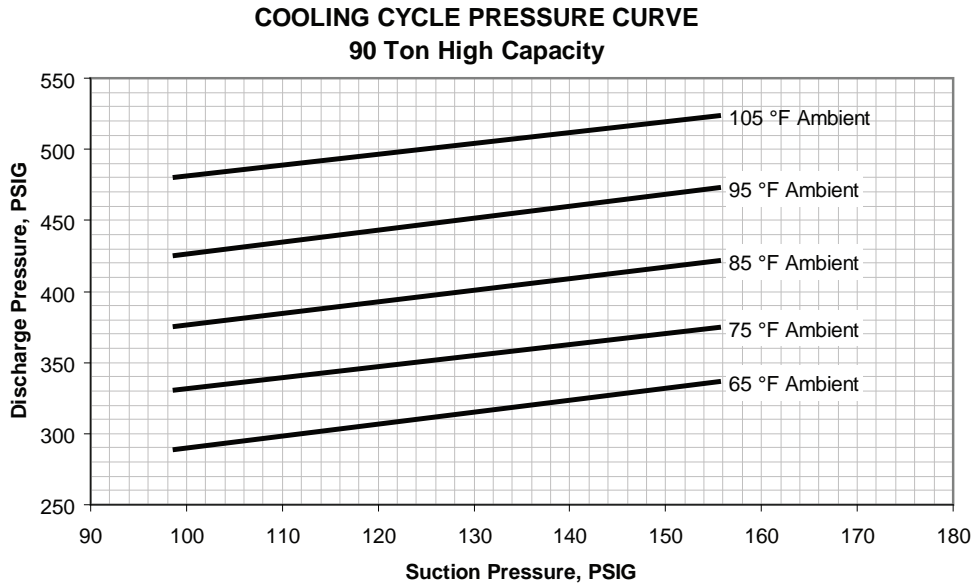


**Figure 77. 90 ton standard operating pressure curve (all compressors and condenser fans "On")**

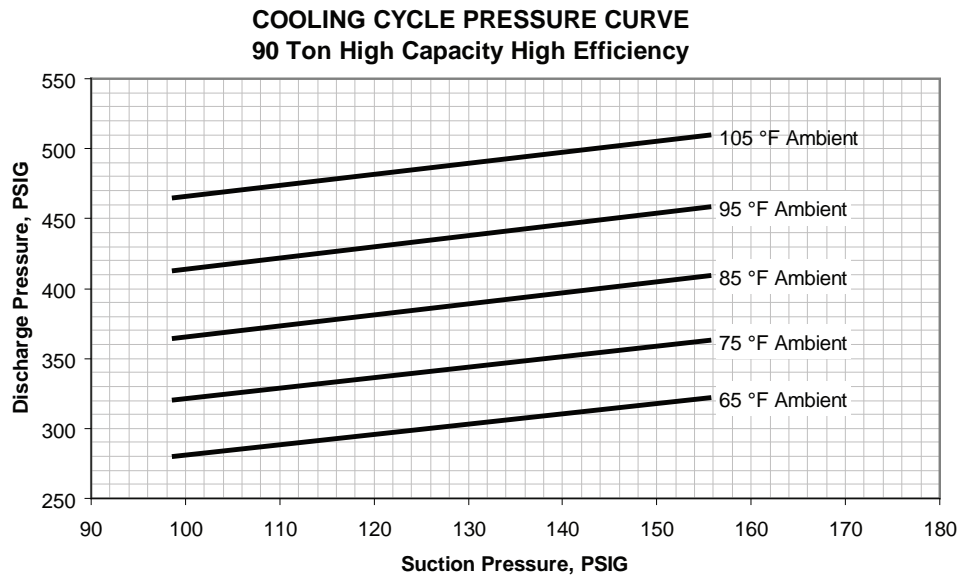


**Note:** To check operating pressure, see instructions [p. 142](#).

**Figure 78. 90 ton high operating pressure curve (all compressors and condenser fans "On")**

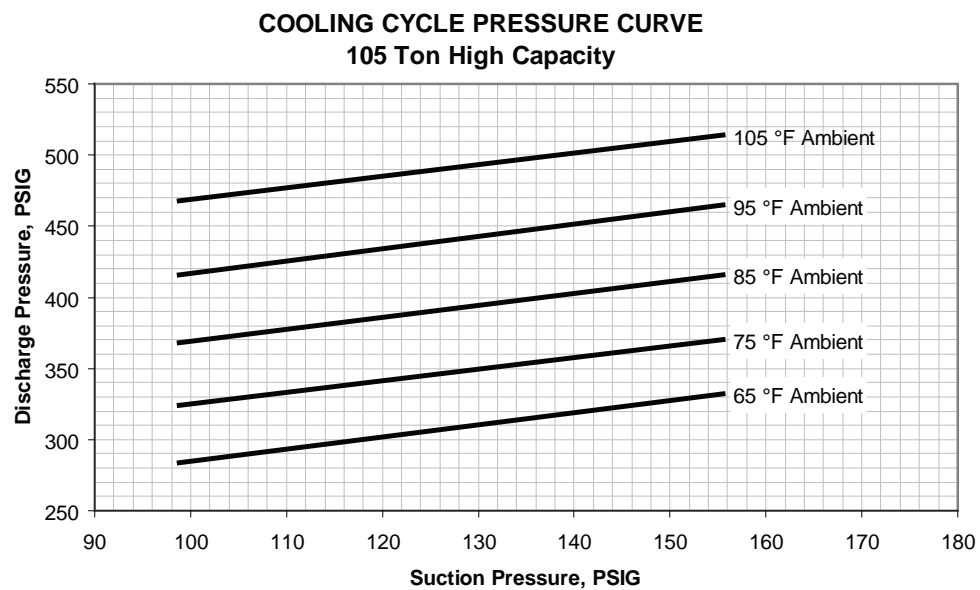


**Figure 79. 90 ton high operating, high efficiency pressure curve (all compressors and condenser fans "On")**

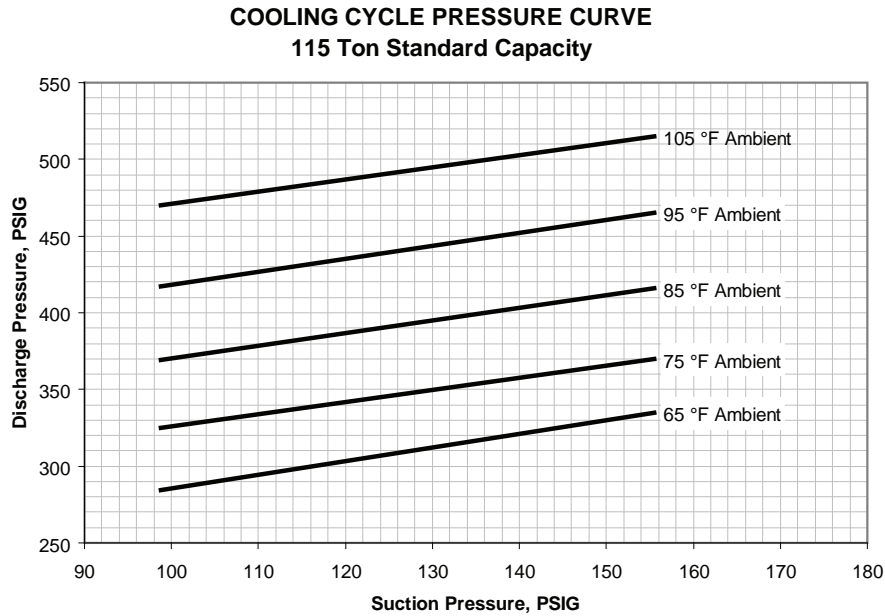


**Note:** To check operating pressure, see instructions [p. 142](#).

**Figure 80. 105 ton high operating pressure curve (all compressors and condenser fans "On")**

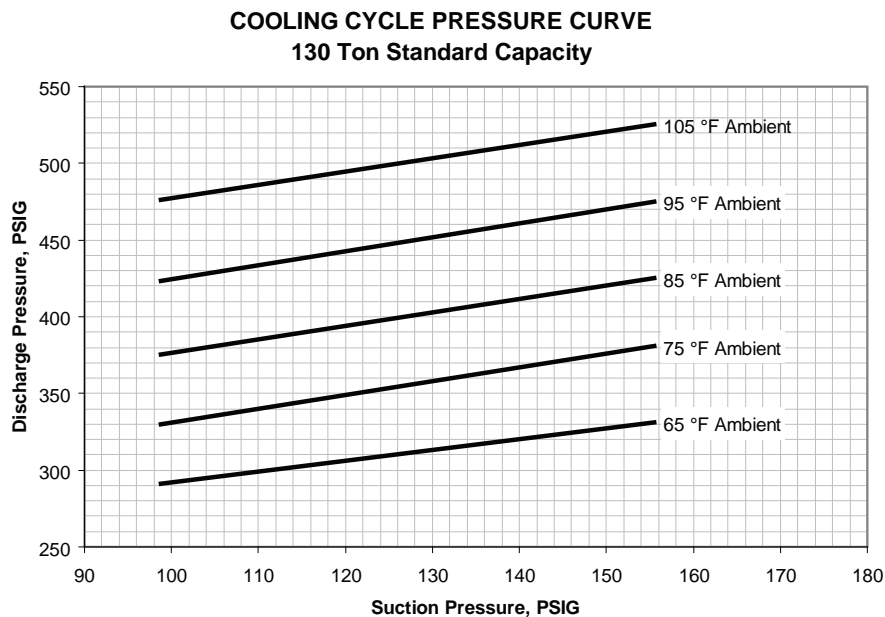


**Figure 81. 115 ton high operating pressure curve (all compressors and condenser fans "On")**



**Note:** To check operating pressure, see instructions [p. 142](#).

**Figure 82. 130 ton high operating pressure curve (all compressors and condenser fans "On")**



## 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. Expansion valves are preset at the factory. In typical applications, field adjustment should not be required unless the valves are replaced or damaged.



On air-cooled units, the expansion valves shipped installed were factory set to control between 14-18°F at the ARI full load rating conditions (approximately 45°/125°F saturated suction/discharge).

On evaporative condenser units, the expansion valves shipped installed were factory set to control between 18-22°F at the ARI full load rating conditions (approximately 45°/105°F saturated suction/discharge). At part load, expect lower superheat. Systems operating with lower superheat could cause serious compressor damage due to refrigerant floodback.

Tables are based on outdoor ambient between 65° & 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".

**Note:** *If unit includes the modulating reheat dehumidification control option, adjust superheat only in the cooling mode of operation.*

### **Charging by Subcooling**

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

Do not attempt to charge the system with the low ambient dampers and/or hot gas bypass operating (if applicable). Disable the low ambient dampers in the "Open" position (refer to the "Low Ambient Damper" section) and de-energize the hot gas bypass valves before taking performance measurements.

With the unit operating at "Full Circuit Capacity", acceptable subcooling range for air-cooled condenser units is between 14°F to 22°F. For evaporative condenser units, acceptable subcooling ranges is between 8°F to 14°F.

**Note:** *If unit includes the modulating reheat dehumidification control option, adjust subcooling only in the cooling mode of operation.*

### **Measuring Subcooling**

1. At the liquid line service valve, measure the liquid line pressure. Using an R-410A pressure/temperature chart, convert the pressure reading into the corresponding saturated temperature.
2. Measure the actual liquid line temperature as close to the liquid line service valve as possible. To ensure an accurate reading, clean the line thoroughly where the temperature sensor will be attached. After securing the sensor to the line, insulate the sensor and line to isolate it from the ambient air. Use a thermocouple type probe for an accurate reading.
3. Determine the system subcooling by subtracting the actual liquid line temperature (measured in step 2) from the saturated liquid temperature (converted in step 1).

## Low Ambient Dampers

### Operation

Low Ambient Dampers are available as a factory installed option on 20 - 75 Ton units or can be field-installed. Dampers are used to extend the operation of these units from the standard operational temperatures to a minimum of 0° F without hot gas bypass or 10° F with hot gas bypass. (These values apply when wind speed across the condenser coil is less than 5 m.p.h. If typical wind speeds are higher than 5 m.p.h., a wind screen around the unit may be required.) By restricting the airflow across the condenser coils, saturated condensing temperatures can be maintained as the ambient temperatures change.

The low ambient modulating output(s) on the compressor module controls the low ambient damper actuator for each refrigerant circuit in response to saturated condensing temperature.

When the head pressure control has staged up to fan stage 2 or 3, the modulating output (0 to 10 VDC) will be at 100% (10 VDC). When the head pressure control is at fan stage 1, the modulating output will control the saturated condensing temperature to within the programmable "condensing temperature low ambient control point"

The following Table gives the minimum starting temperatures for both "Standard" & "Low" Ambient units. Do not start the unit in the cooling mode if the ambient temperature is below the recommended operating temperatures.

**Table 51. Minimum starting temperatures for air-cooled units<sup>(a)</sup>**

Unit Size	Minimum Starting Ambient <sup>(b)</sup>		
	Standard <sup>(c)</sup>	Low Ambient	
		with HGBP	without HGBP
20 & 40	55°	10°	0°
25 & 30	50°	10°	0°
50, 55	35°	10°	0°
60	30°	10°	0°
70-130	45°	10°	0°

(a) Minimum starting temperatures for Evaporative Condenser units is 40°F without a sump heater and 10°F with a sump heater.

(b) Min. starting ambients in °F and is based on unit operating at min. step of unloading & 5 mph wind across condenser.

(c) With or Without HGBP

### Damper Installation

When a unit is ordered with the low ambient option (i.e., Digit 19 is a "1" in the model number), a damper is factory installed over the condenser fans 2B1 & 2B4 (depending on unit size). Refer to the illustration in [Figure 48](#) for the damper locations.

For field installation, mount the dampers over the condenser fans at the locations shown in [Figure 48](#) and connect the actuator for each circuit. (Refer to the Installation Instructions provided with each kit.)

### Damper Adjustment (Factory or Field Installed)

The UCM has a factory default setpoint of 90°F. This setpoint can be adjusted using the Human Interface programming procedures.

Inspect the damper blades for proper alignment and operation. Dampers should be in the closed position during the "Off" cycle. If adjustment is required;

1. Never depress the actuator clutch while the actuator is energized.
2. At the Human Interface, program the actuator for 0% on circuit #1 and/or circuit #2. (The output signal will go to 0.0 VDC.)
3. Loosen the actuator clamp.

4. Firmly hold the damper blades in the closed position.
5. Retighten the actuator clamp.

To check damper operation, program the actuator for 100% on circuit #1 and/or circuit #2. (The output signal will go to 10 VDC and the damper will drive to the full open position.)

### **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**

##### **Live Electrical Components!**

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

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.

#### **HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT 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 programming manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use [Table 35, p. 108](#) to program the following system components for operation by scrolling through the Human Interface displays;
  - 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.

**⚠ 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 step 6 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 carbon dioxide and oxygen levels.

The volume of air supplied by the combustion blower determines the amount of oxygen available for combustion, while the manifold gas pressure establishes fuel input. By measuring the percentage of carbon dioxide produced as a by-product of combustion, the operator can estimate the amount of oxygen 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.

**Two Stage Gas Furnace****⚠ WARNING****Hazardous Gases and Flammable Vapors!**

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

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

**High-Fire Adjustment**

1. Use [Table 35, p. 108](#) 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 step 2 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 52](#) 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 84](#) for the adjustment screw location. Turn the screw clockwise to increase the gas pressure or counterclockwise to decrease the gas pressure.
  6. Use a carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in [Figure 83](#). Take several samples to assure that an accurate reading is obtained. Refer to [Table 52](#) for the proper carbon dioxide levels. A carbon dioxide level exceeding the listed range indicates incomplete combustion due to inadequate air or excessive gas.

### **Combustion Air Adjustment (O<sub>2</sub>)**

7. Use an oxygen analyzer and measure the percentage of oxygen in the flue gas. Take several samples to assure an accurate reading. Compare the measured oxygen level to the combustion curve in [Figure 84, p. 159](#). The oxygen content of the flue gas should be 4% to 5%. If the oxygen 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 87, p. 162](#) for the location of the combustion air damper.
8. Recheck the oxygen and carbon dioxide 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 carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in [Figure 83, p. 158](#). Take several samples to assure that an accurate reading is obtained. Refer to [Figure 84, p. 159](#) for the proper carbon dioxide levels. If the measured carbon dioxide level is within the listed values, no adjustment is necessary. A carbon dioxide level exceeding the listed range 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 [Figure 84](#) 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 84](#) 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.

## Unit Start Up

4. Check the carbon dioxide levels after each adjustment.
5. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

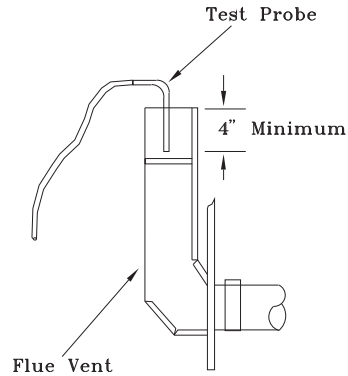
**Table 52. Recommended manifold pressures and CO<sub>2</sub> levels during furnace operation (see notes)**

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	50%	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

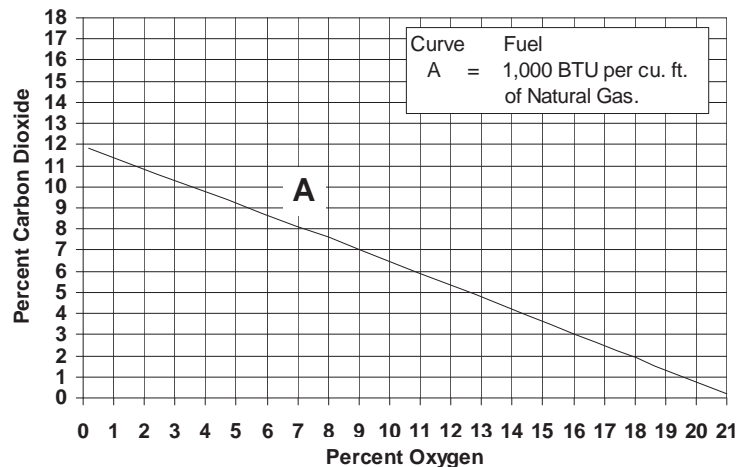
**Note:**

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.

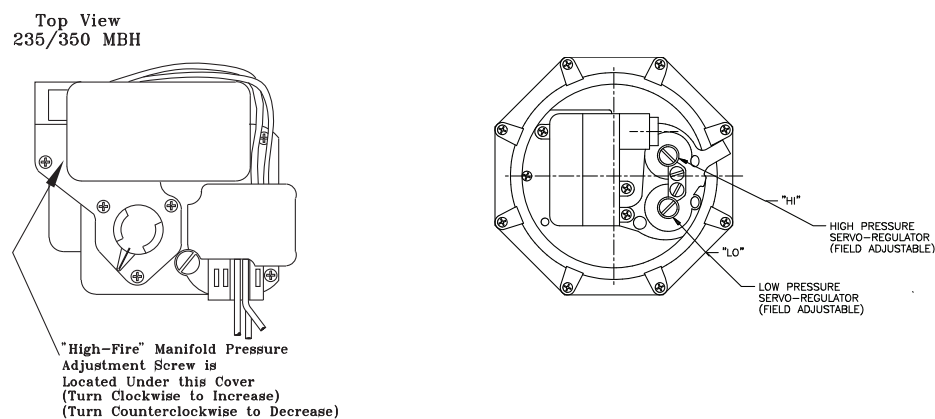
**Figure 83. Flue gas carbon dioxide and oxygen measurements**



**Figure 84. Natural gas combustion curve (ratio of oxygen to carbon dioxide in percent)**



**Figure 85. Gas valve adjustment screw locations**



## 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 Discharge Temperature Control units. Zone Temperature Control 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 -10 VDC. The higher the voltage signal, the lower the call for heat.

The 5 -10 VDC. 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 35, p. 108](#) 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 step 2 must elapse before the system will begin to operate.

### **WARNING**

#### **Rotating Components!**

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

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 carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in [Figure 83, p. 158](#). Take several samples to assure that an accurate reading is obtained. If the measured carbon dioxide 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 86, p. 162](#).

**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 35, p. 108](#) to program the minimum (5%) firing rate. Allow the system to operate for approximately 10 minutes.
9. Use a carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. If the measured carbon dioxide 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 85, p. 159](#) 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 carbon dioxide 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.
13. 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

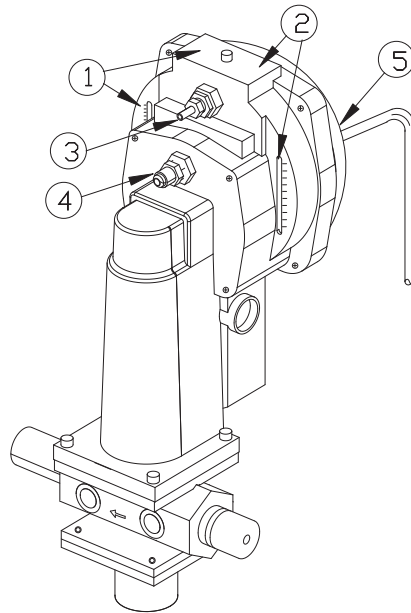
The unit is controlled by a supply air temperature sensor located in the supply air stream for Discharge Temperature Control units. Zone Temperature Control units have two sensors, one located in the supply air stream and the zone sensor. The temperature sensor signal is sent to the Heat module of the 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. To verify and check system optimum combustion, use [Table 35, p. 108](#) to program the limited modulating heat system components for 90% operation by scrolling through the Human Interface displays.
2. Follow the checkout procedures discussed in the previous steps.

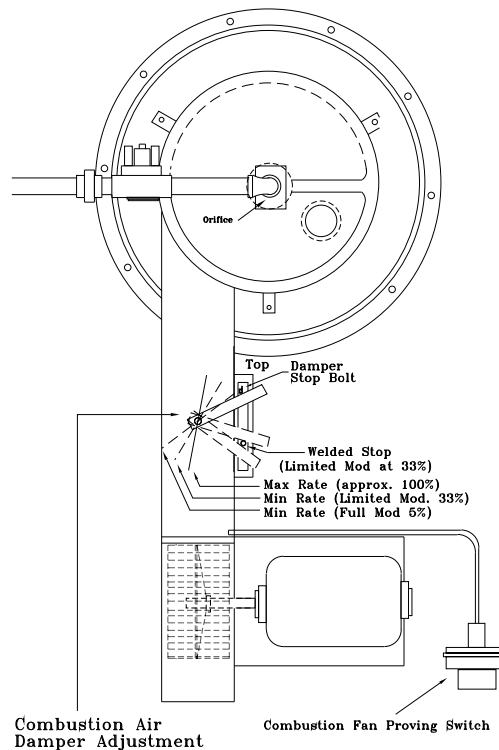
**Note:** *The minimum firing rate for a limited modulating gas furnace in step 8 is 33%. Travel of the combustion air damper is limited by a welded stop.*

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

**Figure 86. Modulating gas regulator**


1. Adjustment and indication of the air to gas ratio.
2. Adjustment and indication of the bias.
3. Connection for the Ambient compensation line.
4. Connection for the gas pressure sensing line.
5. 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 87. Typical gas furnace**


## 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:

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.

### **WARNING**

#### **Live Electrical Components!**

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

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

2. Turn the 115 volt control circuit switch 1S1 "Off".
3. Turn the 24 volt control circuit switch 1S70 to the "On" position.
4. 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 the appropriate programming manual for CV or VAV applications.
5. Program the Night Setback (NSB) panel (if applicable) for proper unoccupied operation. Refer to the programming instructions for the specific panel.
6. Verify that the Remote panel "System" selection switch, "Fan" selection switch, and "Zone Temperature" settings for constant volume systems are correct.
7. Verify that the Remote panel "System" selection switch and the "Supply Air Temperature" settings for Discharge Temperature Control systems are correct.
8. Inspect the unit for misplaced tools, hardware, and debris.
9. Turn the 115 volt control circuit switch 1S1 "On".
10. 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.
11. Verify that all exterior panels including the control panel doors and condenser grilles are secured in place.



# Startup Checklists

## 20-75 Ton — Air-Cooled

This checklist is intended to be a guide for the start up technician. Many of the recommended checks and actions could expose the technician to electrical and mechanical hazards. Refer to the appropriate sections in the unit IOM for appropriate procedures, component specifications and safety instructions.

**Important:** *This checklist is not intended to be a substitution for the contractors installation instruction.*

Job Name		Serial #	
Job Location		Model #	
Sales Order #		Ship Date	
Unit DL # (special units)		Date	
Starting Sales Office		Technician	

**Table 53. Startup checklist — 20-75 ton air-cooled**

	Verify Task Completed
Access/Egress	
Initial Site Inspection	
Unit exterior inspected for damage (dents, bends, missing panels, doors work properly)	
Unit clearances adequate to avoid air recirculation etc.	
Verify crankcase heaters are working and on for 8 hours prior to unit start (may require 480V availability)	
Wear electrical PPE	
Lockout tag out unit	
Verify unit interior is free from debris/obstructions etc.	
All unit drain lines and traps installed properly	
Remove electrical access panel fastened by (9) bolt/screws or open access doors	
Verify unit is grounded. Confirm a ground wire is coming from power source.	
Verify main power feed wire gauge is properly size for current load	
Verify all wiring connections are tight	
Verify all field control wiring for CV or VAV controls complete	
Verify all automation and remote controls installed/wired	
Verify shipping hardware and plastic covers for compressors has been removed	
Verify hold down bolts and channels from fan sections removed	
Fan section spring isolators checked/adjusted (approx ¼" gap above shipping block)	
Verify damper linkages are tight/adjusted and tip seals are in good condition	
Verify compressor oil levels at proper level (½ -¾ high in glass)	
Compressor discharge service valves, oil valves and liquid lines valves open/back seated	
All fan belts tensioned, bearings greased and sheaves in alignment	
Verify supply and exhaust fan pulley bolts are tight	
Verify fans rotate freely	
Verify refrigerant charge on each circuit	
Remove lock out tag out	
Wear electrical PPE	
Verify correct voltage supplied to unit and electric heaters (see IOM for assistance)	
Verify incoming voltage phase balanced	

**Continued on next page**

**Table 53. Startup checklist (continued)— 20-75 ton air-cooled**

	Verify Task Completed
Verify all fans rotate in proper direction	
Verify fan amperages within nameplate specs (Please document on log sheet)	
<b>Unit Configuration and Setup</b>	
Verify model number in the UCM configuration matches unit model number on name plate	
Configure unit using IOM and critical control parameters listed in <a href="#">Table 54, p. 166</a>	
<b>Air Cooled Condenser (Digit 27)</b>	
All coil fins inspected and straightened	
Condenser fans are rotating freely	
Verify the fan blade set-screws to the motor shaft of the condenser fan assemblies are tight	
<b>Electric Heat (If Applicable)</b>	
Electric heat circuits have continuity	
Perform electric heat start-up procedure outlined in IOM	
<b>Gas Heat (If Applicable)</b>	
Gas heat piping includes drip leg previously installed by controlling contractor	
Gas heat flue assembly fully installed	
Gas heat condensate line + heat tape installed where applicable	
Verify heating system matches name plate	
<b>Optional Gas Burner (Digit 9)</b>	
2 Stage Gas Burner Set-up procedure in IOM	
Modulating Burner Set-up procedure in IOM	
<b>Hot Water Heat (If Applicable)</b>	
Verify hot water pipes are proper size, routed through the base and no leaks are present	
Verify swing joints or flexible connectors are installed next to hot water coil	
Verify gate valve is installed in the supply and return branch line	
Verify three way modulating valve is installed with valve seating against the flow	
Verify coil venting is installed if water velocity is less than 1.5 feet per second	
<b>Steam Water Heat (If Applicable)</b>	
Verify steam pipes are proper size, routed through the base and no leaks are present	
Verify steam heat swing check vacuum breakers installed and vented	
Verify 2-way modulating valve has been installed	
Verify steam trap installed properly with discharge 12" below the outlet connection on the coil	
<b>System Checkout</b>	
Verify system airflow	
Verify dampers open and close properly	
Adjust fresh air damper travel	
Verify compressor operation, voltage and amperage matches name plate information (Please document on log sheet)	
Verify superheat and subcooling normal (Please document on log sheet)	
Operating log completed	
All panels/doors secured	
Complete all required documentation	



## Startup Checklists

**Table 54. Critical control parameters**

**Notes:**

1. Using the Human Interface (HI), go to SETUP Menu and input setting for parameters listed below.
2. Use the map shown below to determine region of country based on unit site location.

	Suggested Parameter	Economizer Settings						
		Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
Supply Air Temperature Control Setpoint	8°F							
Supply Air Temperature Deadband	55°F							
Supply Air Pressure Setpoint	1.8" w.c.							
Supply Air Pressure Deadband	0.1" w.c.							
Building Static Pressure Setpoint	0.03" w.c.							
Building Static Pressure Deadband	0.04" w.c.							
Standby Freeze Avoidance	20%							
Exhaust Enable Setpoint	10%							
Economizer Minimum Position Setpoint	10%							
Fixed Dry Bulb Economizer C/O Type a (Moist)*		TOA > 65°F	TOA > 65°F	TOA > 65°F	TOA > 65°F	TOA > 70°F	TOA > 70°F	TOA > 70°F
Fixed Dry Bulb Economizer C/O Type b (Dry)*	TOA > 75°F							
Fixed Dry Bulb Economizer C/O Type c (Marine)*				TOA > 75°F	TOA > 75°F	TOA > 75°F		
Fixed Reference Enthalpy Changeover	HOA > 28 Btu							
Differential Comparative Enthalpy Changeover	HOA > HRA							

**Note:** See map (Figure 88, p. 173) below for dry bulb changeover.

Examples:

- (a) Minneapolis, Minnesota is in "Region 6" and resides in "Moist" subregion, thus designation is 6b. Economizer changeover setting should be 75°F.
- (b) Charleston, South Carolina is in "Region 3" and resides in "Moist" subregion, thus the designation is 3c. Economizer changeover setting should be 65°F.

## 24-89 Ton — Evaporative Condenser

**Important:** Water treatment is required before beginning startup. Failure to do so will damage the unit and result in premature unit degradation.

This checklist is intended to be a guide for the start up technician. Many of the recommended checks and actions could expose the technician to electrical and mechanical hazards. Refer to the appropriate sections in the unit IOM for appropriate procedures, component specifications and safety instructions.

**Important:** This checklist is not intended to be a substitution for the contractors installation instruction.

Job Name		Serial #	
Job Location		Model #	
Sales Order #		Ship Date	
Unit DL # (special units)		Date	
Starting Sales Office		Technician	

**Table 55. Startup checklist – 24-89 ton evaporative cooling**

	Verify Task Completed
Access/Egress	
Initial Site Inspection	
Unit exterior inspected for damage (dents, bends, missing panels, doors work properly)	
Unit clearances adequate to avoid air recirculation etc.	
Verify crankcase heaters are working and on for 8 hours prior to unit start (may require 480V availability)	
Wear electrical PPE	
Lockout tag out unit	
Verify unit interior is free from debris/obstructions etc.	
All unit drain lines and traps installed properly	
Remove electrical access panel fastened by (9) bolt/screws or open access doors	
Verify unit is grounded. Confirm a ground wire is coming from power source.	
Verify main power feed wire gauge is properly size for current load	
Verify all wiring connections are tight	
Verify all field control wiring for CV or VAV controls complete	
Verify all automation and remote controls installed/wired	
Verify shipping hardware and plastic covers for compressors has been removed	
Verify hold down bolts and channels from fan sections removed	
Fan section spring isolators checked/adjusted (approx ¼" gap above shipping block)	
Verify damper linkages are tight/adjusted and tip seals are in good condition	
Verify compressor oil levels at proper level (½ -¾ high in glass)	
Compressor discharge service valves, oil valves and liquid lines valves open/back seated	
All fan belts tensioned, bearings greased and sheaves in alignment	
Verify supply and exhaust fan pulley bolts are tight	
Verify fans rotate freely	
Verify refrigerant charge on each circuit	
Remove lock out tag out	
Wear electrical PPE	
Verify correct voltage supplied to unit and electric heaters (see IOM for assistance)	
Verify incoming voltage phase balanced	
Verify all fans rotate in proper direction	
Verify fan amperages within nameplate specs (Please document on log sheet)	
<b>Unit Configuration and Setup</b>	
Verify model number in the UCM configuration matches unit model number on name plate	
Configure unit using IOM and critical control parameters listed in <a href="#">Table 55, p. 167</a>	
<b>Evaporative Condenser (Digit 27)</b>	
Verify condenser fan shipping bracket has been removed from above mist eliminators in evaporative condenser module	
Verify all water and drain connections are complete	
Verify inlet water pressure is between 35-60 psig, dynamic pressure (measured with valve open) for min. flow rate of 30 GPM	
Verify drain valve function is set to "drain during power loss" or "hold during power loss" per job specification	
Verify that the sump fills to a level within the slot on the max float bracket as shown in <a href="#">Figure 61, p. 141</a>	
Verify water treatment system has been installed/approved - discontinue startup if proof of active water treatment does not exist	
Verify conductivity controller calibration has been documented and min and max setpoints have been setup	

**Continued on next page**



## Startup Checklists

**Table 55. Startup checklist (continued)— 24-89 ton evaporative cooling**

	Verify Task Completed
<b>Electric Heat (If Applicable)</b>	
Electric heat circuits have continuity	
Perform electric heat start-up procedure outlined in IOM	
<b>Gas Heat (If Applicable)</b>	
Gas heat piping includes drip leg previously installed by controlling contractor	
Gas heat flue assembly fully installed	
Gas heat condensate line + heat tape installed where applicable	
Verify heating system matches name plate	
<b>Optional Gas Burner (Digit 9)</b>	
2 Stage Gas Burner Set-up procedure in IOM	
Modulating Burner Set-up procedure in IOM	
<b>Hot Water Heat (If Applicable)</b>	
Verify hot water pipes are proper size, routed through the base and no leaks are present	
Verify swing joints or flexible connectors are installed next to hot water coil	
Verify gate valve is installed in the supply and return branch line	
Verify three way modulating valve is installed with valve seating against the flow	
Verify coil venting is installed if water velocity is less than 1.5 feet per second	
<b>Steam Water Heat (If Applicable)</b>	
Verify steam pipes are proper size, routed through the base and no leaks are present	
Verify steam heat swing check vacuum breakers installed and vented	
Verify 2-way modulating valve has been installed	
Verify steam trap installed properly with discharge 12" below the outlet connection on the coil	
<b>System Checkout</b>	
Verify system airflow	
Verify dampers open and close properly	
Adjust fresh air damper travel	
Verify compressor operation, voltage and amperage matches name plate information (Please document on log sheet)	
Verify superheat and subcooling normal (Please document on log sheet)	
Operating log completed	
All panels/doors secured	
Complete all required documentation	



**Table 56. Critical control parameters**

**Notes:**

1. Using the Human Interface (HI), go to SETUP Menu and input setting for parameters listed below.
2. Use the map shown below to determine region of country based on unit site location.

	Suggested Parameter	Economizer Settings						
		Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
Supply Air Temperature Control Setpoint	8 °F							
Supply Air Temperature Deadband	55 °F							
Supply Air Pressure Setpoint	1.8" w.c.							
Supply Air Pressure Deadband	0.1" w.c.							
Building Static Pressure Setpoint	0.03" w.c.							
Building Static Pressure Deadband	0.04" w.c.							
Standby Freeze Avoidance	20%							
Exhaust Enable Setpoint	10%							
Economizer Minimum Position Setpoint	10%							
Fixed Dry Bulb Economizer C/O Type a (Moist)*		ToA > 65°F	ToA > 65°F	ToA > 65°F	ToA > 65°F	ToA > 70°F	ToA > 70°F	ToA > 70°F
Fixed Dry Bulb Economizer C/O Type b (Dry)*	ToA > 75°F							
Fixed Dry Bulb Economizer C/O Type c (Marine)*				ToA > 75°F	ToA > 75°F	ToA > 75°F		
Fixed Reference Enthalpy Changeover	HOA > 28 Btu							
Differential Comparative Enthalpy Changeover	HOA > HRA							

**Note:** See map (Figure 88, p. 173) below for dry bulb changeover.

Examples:

- (a) Minneapolis, Minnesota is in "Region 6" and resides in "Moist" subregion, thus designation is 6b. Economizer changeover setting should be 75°F.
- (b) Charleston, South Carolina is in "Region 3" and resides in "Moist" subregion, thus the designation is 3c. Economizer changeover setting should be 65°F.



## Startup Checklists

### 90-130 Ton — Air Cooled

**Important:** Verify water treatment is functional before beginning startup.

This checklist is intended to be a guide for the start up technician. Many of the recommended checks and actions could expose the technician to electrical and mechanical hazards. Refer to the appropriate sections in the unit IOM for appropriate procedures, component specifications and safety instructions.

**Important:** This checklist is not intended to be a substitution for the contractors installation instruction.

Job Name		Serial #	
Job Location		Model #	
Sales Order #		Ship Date	
Unit DL # (special units)		Date	
Starting Sales Office		Technician	

**Table 57. IntelliPak startup checklist — 90-130 ton air cooled**

	Verify Task Completed
Access/Egress	
Initial Site Inspection	
Unit exterior inspected for damage (dents, bends, missing panels, doors work properly)	
Unit clearances adequate to avoid air recirculation etc.	
Verify crankcase heaters are working and on for 8 hours prior to unit start (may require 480V availability)	
Wear electrical PPE	
Lockout tag out unit	
Verify unit interior is free from debris/obstructions etc.	
All unit drain lines and traps installed properly	
Remove electrical access panel fastened by (9) bolt/screws or open access doors	
Verify unit is grounded. Confirm a ground wire is coming from power source.	
Verify main power feed wire gauge is properly size for current load	
Verify all wiring connections are tight	
Verify all field control wiring for CV or VAV controls complete	
Verify all automation and remote controls installed/wired	
Verify shipping hardware and plastic covers for compressors has been removed	
Verify hold down bolts and channels from fan sections removed	
Fan section spring isolators checked/adjusted (approx ¼" gap above shipping block)	
Verify damper linkages are tight/adjusted and tip seals are in good condition	
Verify compressor oil levels at proper level (½ -¾ high in glass)	
Compressor discharge service valves, oil valves and liquid lines valves open/back seated	
All fan belts tensioned, bearings greased and sheaves in alignment	
Verify supply and exhaust fan pulley bolts are tight	
Verify fans rotate freely	
Verify refrigerant charge on each circuit	
Remove lock out tag out	
Wear electrical PPE	
Verify correct voltage supplied to unit and electric heaters (see IOM for assistance)	
Verify incoming voltage phase balanced	

**Table 57. IntelliPak startup checklist (continued)— 90-130 ton air cooled**

	Verify Task Completed
Verify all fans rotate in proper direction	
Verify fan amperages within nameplate specs (Please document on log sheet)	
<b>Unit Configuration and Setup</b>	
Verify model number in the UCM configuration matches unit model number on name plate	
Configure unit using IOM and critical control parameters listed in <a href="#">Table 55, p. 167</a>	
<b>Air Cooled Condenser (Digit 27)</b>	
All coil fins inspected and straightened	
Condenser fans are rotating freely	
Verify the fan blade set-screws to the motor shaft of the condenser fan assemblies are tight	
<b>Electric Heat (If Applicable)</b>	
Electric heat circuits have continuity	
Perform electric heat start-up procedure outlined in IOM	
<b>Gas Heat (If Applicable)</b>	
Gas heat piping includes drip leg previously installed by controlling contractor	
Gas heat flue assembly fully installed	
Gas heat condensate line + heat tape installed where applicable	
Verify heating system matches name plate	
<b>Optional Gas Burner (Digit 9)</b>	
2 Stage Gas Burner Set-up procedure in IOM	
Modulating Burner Set-up procedure in IOM	
<b>Hot Water Heat (If Applicable)</b>	
Verify hot water pipes are proper size, routed through the base and no leaks are present	
Verify swing joints or flexible connectors are installed next to hot water coil	
Verify gate valve is installed in the supply and return branch line	
Verify three way modulating valve is installed with valve seating against the flow	
Verify coil venting is installed if water velocity is less than 1.5 feet per second	
<b>Steam Water Heat (If Applicable)</b>	
Verify steam pipes are proper size, routed through the base and no leaks are present	
Verify steam heat swing check vacuum breakers installed and vented	
Verify 2-way modulating valve has been installed	
Verify steam trap installed properly with discharge 12" below the outlet connection on the coil	
<b>System Checkout</b>	
Verify system airflow	
Verify dampers open and close properly	
Adjust fresh air damper travel	
Verify compressor operation, voltage and amperage matches name plate information (Please document on log sheet)	
Verify superheat and subcooling normal (Please document on log sheet)	
Operating log completed	
All panels/doors secured	
Complete all required documentation	



## Startup Checklists

**Table 58. Critical control parameters**

**Notes:**

1. Using the Human Interface (HI), go to SETUP Menu and input setting for parameters listed below.
2. Use the map shown below to determine region of country based on unit site location.

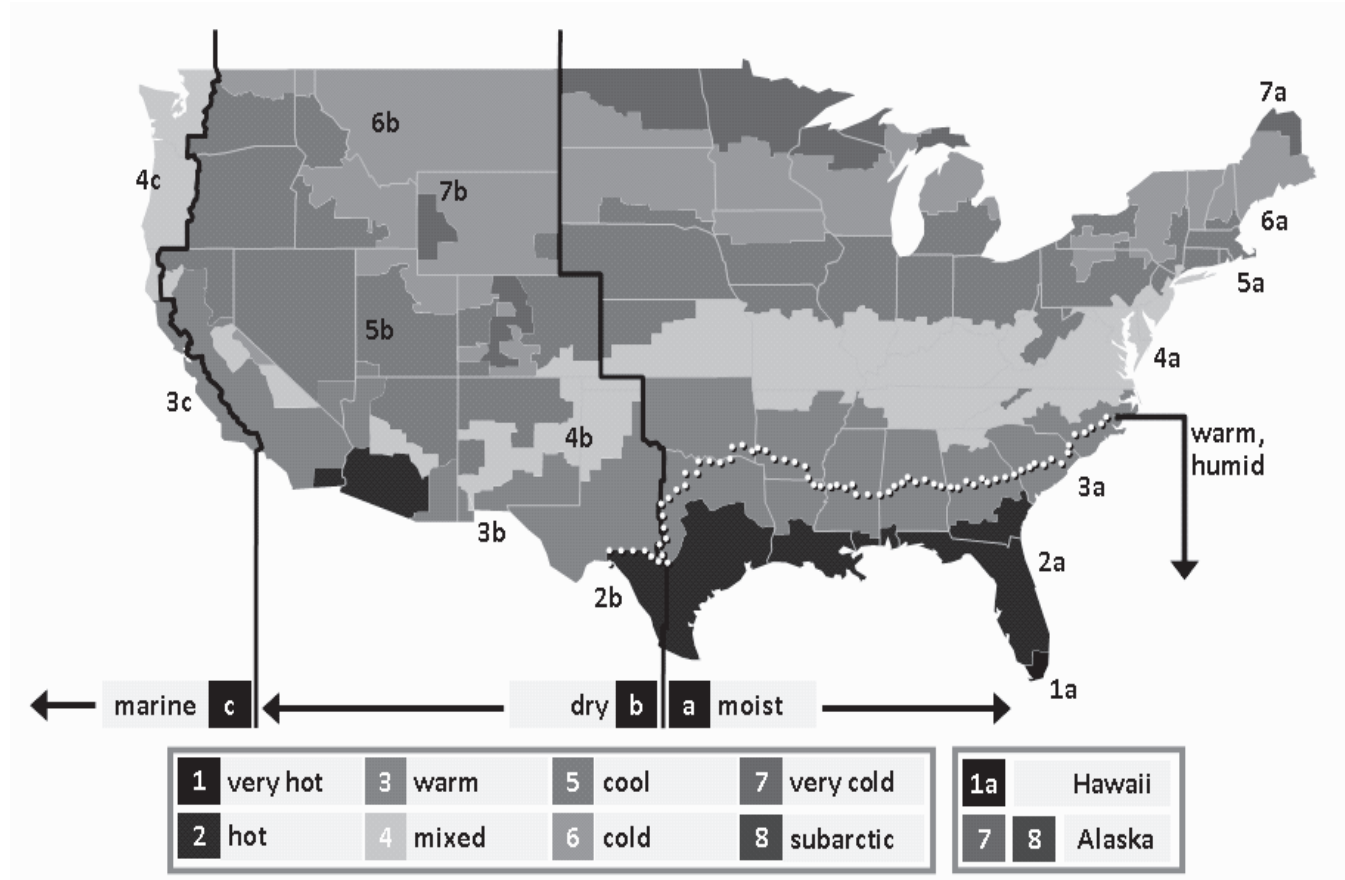
	Suggested Parameter	Economizer Settings						
		Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
Supply Air Temperature Control Setpoint	8 °F							
Supply Air Temperature Deadband	55 °F							
Supply Air Pressure Setpoint	1.8" w.c.							
Supply Air Pressure Deadband	0.1" w.c.							
Building Static Pressure Setpoint	0.03" w.c.							
Building Static Pressure Deadband	0.04" w.c.							
Standby Freeze Avoidance	20%							
Exhaust Enable Setpoint	10%							
Economizer Minimum Position Setpoint	10%							
Fixed Dry Bulb Economizer C/O Type a (Moist)*		ToA > 65°F	ToA > 65°F	ToA > 65°F	ToA > 65°F	ToA > 70°F	ToA > 70°F	ToA > 70°F
Fixed Dry Bulb Economizer C/O Type b (Dry)*	ToA > 75°F							
Fixed Dry Bulb Economizer C/O Type c (Marine)*				ToA > 75°F	ToA > 75°F	ToA > 75°F		
Fixed Reference Enthalpy Changeover	HOA > 28 Btu							
Differential Comparative Enthalpy Changeover	HOA > HRA							

**Note:** See map (Figure 88, p. 173) below for dry bulb changeover.

Examples:

- (a) Minneapolis, Minnesota is in "Region 6" and resides in "Moist" subregion, thus designation is 6b. Economizer changeover setting should be 75°F.
- (b) Charleston, South Carolina is in "Region 3" and resides in "Moist" subregion, thus the designation is 3c. Economizer changeover setting should be 65°F.

Figure 88. Dry bulb changeover map





# Maintenance

**Table 59. Control settings and time delays**

Control Description	Elec. Designation	Contacts Open	Contacts Closed
Compressor Circuit Breakers 20 - 130	1CB8 thru 1CB11	See Table 60, p. 174	See Table 60, p. 174
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./UL)	145 F (std./UL)
		165 F + 10 F (CSA)	125 F (CSA)
Freezestat (Hydronic Heat Only)	4S12	(N.O.) Auto Reset	40 F
Gas Heat Units			
Prepurge Timer: Fenwall	4DL5	N.C. - timed to close internal timing function	60 seconds
Honeywell	4U18		60 seconds
Sequencing Time Delay Relay	4DL6		60 seconds + 20%

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

**Table 60. Compressor circuit breakers (1CB8 - 1CB11) electrical characteristics**

Unit Size	Comp Designation	200 V		230 V	
		Must Hold	Must Trip	Must Hold	Must Trip
20	1A,1B	50.4	58	43.2	49.7
	Hi Cap.	50.4	58	43.2	49.7
25	1A	50.4	58	43.2	49.7
	1B	57.1	65.7	51.4	59.2
Hi Cap.	1A	50.4	58	43.2	49.7
	1B	63.1	72.5	57.1	65.7
30	1A,1B	63.1	72.5	57.1	65.7
	Hi Cap	1A	63.1	72.5	69.3
	1B	57.1	65.7	59.4	68.3
40	1A,2A	38.1	43.8	37	42.5
	1B,2B	45.5	52.3	38.7	44.5
Hi Cap	1A,1B,2A,2B	45.5	52.3	38.7	44.5
50	1A,2A, 1B,2B	50.4	58	43.3	49.7
	Hi Cap	1A,2A,	50.4	58	43.3
	1B,2B	57.2	65.7	51.4	59.2
55	1A,1B,2A,2B	57.2	65.7	51.4	59.2
60	1A,2A	57.1	65.7	51.4	59.2
	1B,2B	63.1	72.5	57.1	65.7
Hi Cap	1A,1B,2A,2B	63.1	72.5	57.1	65.7
70	1A,1B,2A,2B	69.3	79.7	59.4	68.3
75	1A,2A	73.7	84.7	63.1	72.5
	1B,2B	105.2	121	90.7	104.3
Hi Cap	1A,2A	73.7	84.7	63.1	72.5
	1B,2B	105.2	121	90.7	104.3

Figure 89. Unit internal fuse replacement data for air handling units

TRANE		FILE NUMBER: 2313-1107	DRAWING NUMBER: 2313-1108	SHEET: 1 of 1	REV B
THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS DISCLOSED TO OUTSIDE PARTIES WITHOUT THE CONSENT OF TRANE.		ROOFTOP PACKAGED AIR CONDITIONER DIAGRAM			
DRAWN BY: D. SHANNON	TRANE® DATE: 2-22-11	FIELD CONNECTION EXTERNAL DEVICES - AREA 5 20-130 TON CONSTANT VOLUME & SINGLE ZONE VAV			
REPLACES: 2307-9176	REVISION DATE: 15-Aug-11				
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 RK5	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						
VFD PROTECTION FUSES		STANDARD MOTORS											
OPTIONAL SUPPLY FAN 20 THRU 130 TON 1F57-1F62	UNIT VOLTAGE	FUSE RATING	3 HP	5 HP	7.5 HP	10 HP	15 HP	20 HP	25 HP	30 HP	40 HP		
	200V/60/3	600V	40A	45A	80A	100A	125A	175A	225A	225A	350A		
	230V/60/3	600V	25A	45A	60A	90A	125A	150A	175A	225A	300A		
	380V/50/3	600V	15A	30A	45A	50A	90A	100A	125A	150A	N/A		
	415V/50/3	600V	15A	30A	45A	50A	90A	100A	125A	150A	N/A		
OPTIONAL EXHAUST / RETURN FAN 20 THRU 130 TON 1F63-1F65 (CLASS "T" FUSES)	460V/60/3	600V	15A	25A	35A	45A	60A	90A	100A	125A	150A		
	575V/60/3	600V	15A	15A	25A	35A	50A	70A	80A	90A	125A		
OPTIONAL CONVENIENCE OUTLET FUSE 1F55 AND 1F56 (TIME DELAY TYPE FNQ-R FUSE)		200V/60/3 12A	230V/60/3 10A	380V/50/3 N/A	415V/50/3 N/A	460V/60/3 5A	575V/60/3 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					

## Maintenance

**Table 61. Filter data**

Unit Model (AC/EC)	Panel-Type Filters <sup>(a)</sup>		Bag-Type Filters <sup>(b)</sup>		Cartridge Filters (box-type) <sup>(b)</sup>		Panel-Type Prefilters <sup>(c)</sup>	
	Qty	Size of each	Qty.	Size of each	Qty.	Size of each	Qty.	Size of each
20 & 25 / 24 & 29 Ton	12	20 X 20 X 2	4	12 X 24 X 19	4	12 X 24 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
30/36 Ton	16	20 X 20 X 2	2	12 X 24 X 19	2	12 X 24 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
40/48 Ton	16	20 X 25 X 2	5	12 X 24 X 19	5	12 X 24 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
50, 55 / 59 Ton	20	20 X 25 X 2	3	12 X 24 X 19	3	12 X 24 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
60, 70 & 75 / 73, 80 & 89 Ton	35	16 X 20 X 2	6	12 X 24 X 19	6	12 X 24 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
90-130	25	24 X 24 X 2	3	12 X 24 X 19	3	12 X 24 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) S\_HL 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 62. "Wet heat" coil fin data**

Unit Model (AC/EC)	Coil Type	Coil Rows	Total Coil Face Area (sq. ft.)	Fins per Foot	Fins per Foot
20, 25, 30 / 24, 29, 36 Ton	WC Prima Flo (hot water)	2	13.75	80	110
40, 50, 55 / 48, 59 Ton	WC Prima Flo (hot water)	2	19.25	80	110
60, 70, 75 / 73, 80, 89 Ton	WC Prima Flo (hot water)	2	26.25	80	110
40, 50 / 48, 59 Ton	NS (steam)	1	13.75 (1) 5.5 (1)	42	96
90-130 Ton	NS (steam)	1	17.5 (2)	52	96

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

**Table 63. Grease recommendations**

Recommended Grease	Recommended Operating Range
Exxon Unirex #2 Mobil 532 Mobil SHC #220 Texaco Premium	-20°F to 205°F

**Table 64. Refrigerant coil fin data**

Tonnage	Evaporator Coil			Condenser Coil				
	Size (ft2)	Rows/Fin Series	Tube Diameter/ Surface	Size (ft2)	Aluminum Fins		Copper Fins	
					Rows/Fin Series	Tube Diameter/ Surface	Rows/Fin Series	Tube Diameter/ Surface
20	20.3	4/168	1/2/Enhanced	58	3/252	5/16/Enhanced	3/156	5/16/Enhanced
25	20.3	4/168	1/2/Enhanced	58	3/252	5/16/Enhanced	3/156	5/16/Enhanced
30	25.5	5/168	3/8"/Enhanced	58	4/252	5/16/Enhanced	4/156	5/16/Enhanced
40	32.5	5/168	3/8"/Enhanced	116	3/252	5/16/Enhanced	3/156	5/16/Enhanced
50, 55	38	4/168	1/2/Enhanced	116	4/252	5/16/Enhanced	4/156	5/16/Enhanced



**Table 64. Refrigerant coil fin data (continued)**

Tonnage	Evaporator Coil			Condenser Coil				
	Size (ft2)	Rows/Fin Series	Tube Diameter/Surface	Size (ft2)	Aluminum Fins		Copper Fins	
					Rows/Fin Series	Tube Diameter/Surface	Rows/Fin Series	Tube Diameter/Surface
60	43	6/168	3/8"/Enhanced	136	3/252	5/16/Enhanced	3/156	5/16/Enhanced
70	43	6/168	3/8"/Enhanced	136	3/252	5/16/Enhanced	4/156	5/16/Enhanced
75	43	6/168	3/8"/Enhanced	136	3/252	5/16/Enhanced	4/156	5/16/Enhanced
90 Std	59.3	4/148	1/2 / Enhanced	152	3/144	3/8 Smooth	NA	NA
90 Hi Cap	59.3	6/148	1/2 / Enhanced	152	3/144	3/8 Smooth	NA	NA
90 Hi EER	59.3	6/148	1/2 / Enhanced	152	4/144	3/8 Smooth	NA	NA
105 Hi Cap	59.3	5/148	1/2 / Enhanced	152	4/144	3/8 Smooth	NA	NA
115 Std Cap	59.3	6/148	1/2 / Enhanced	152	4/144	3/8 Smooth	NA	NA
130 Std Cap	59.3	6/148	1/2 / Enhanced	152	4/144	3/8 Smooth	NA	NA

## 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 below; adjust the belt tension as follows;

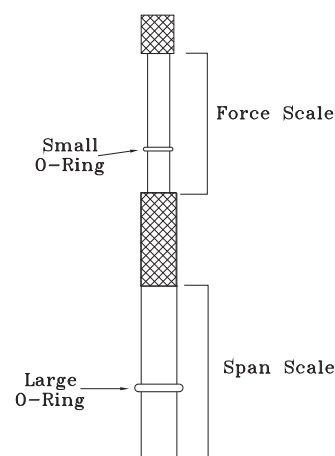
**⚠ WARNING**

**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. To determine the appropriate belt deflection;
  - a. Measure the center-to-center shaft distance (in inches) between the fan and motor sheaves.
  - b. Divide the distance measured in Step 1a by 64; the resulting value represents the amount of belt deflection that corresponds to the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in Step 1b.
3. Set the small O-ring at zero on the force scale of the gauge plunger.
4. Place the large end of the gauge at the center of the belt span; then depress the gauge plunger until the large O-ring is even with the top of the next belt—or even with a straightedge placed across the fan and motor sheaves. Refer to [Figure 91](#).

**Figure 90. Browning (or gates) tension gauge**



5. Remove the belt tension gauge. The small O-ring now indicates a number other than zero on the plunger's force scale. This number represents the force (in pounds) required to give the needed deflection.
6. Compare the "force" scale reading (Step 5) with the appropriate "force" value listed in [Figure 91](#). 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 [Figure 91](#).

7. Recheck the belt tension at least twice during the first 2 to 3 days of operation. Belt tension will decrease rapidly until the new belts are "run in".

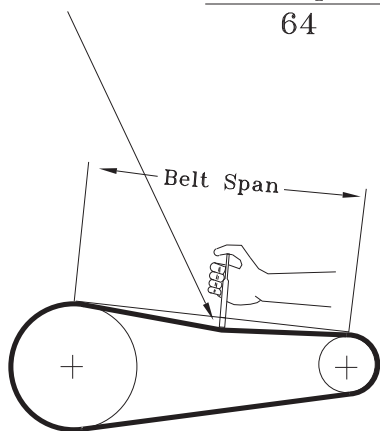
**Table 65. Belt tension measurement and deflection ranges**

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

Belts Cross Section	Small P.D. Range	Deflection Force (lbs.)			
		358 Gripbelts		358 Gripnotch	
		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 91. Belt deflection**

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



## Scroll Compressor Replacement

The compressor manifold system was purposely designed to provide proper oil return to each compressors. The refrigerant manifold system must not be modified in any way.

**Note:** *Altering the compressor manifold piping may cause oil return problems and compressor failure.*

Should a compressor replacement become necessary and a suction line filter drier is to be installed, install it a minimum of 16 or 25 inches upstream of the oil separator tee. See [Figure 96, p. 183](#).

**Note:** *Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all Federal, State and local laws. Refer to general service bulletin MSCU-SB-1 (latest edition).*

## Refrigeration System

### **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.

### **WARNING**

#### **Refrigerant under High Pressure!**

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

## Refrigerant Evacuation and Charging

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

### Charge Storage

Due to the reduced capacity of the microchannel condenser coil compared to the round tube plate fin evaporator coil, pumping refrigerant into the condenser coil to service the refrigerant system is no longer an option.

**NOTICE:**

**Compressor Damage!**

In order to prevent compressor damage, you **MUST** follow recommendations below:

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

- To prevent cross contamination of refrigerants and oils, use only dedicated R-410A service equipment.
- Disconnect unit power before evacuation and do not apply voltage to compressor while under vacuum. Failure to follow these instructions will result in compressor failure.
- Due to the presence of POE oil, minimize system open time. Do not exceed 1 hour.
- When recharging R-410A refrigerant, it should be charged in the liquid state.
- For the initial charging with the compressors off; charging to the liquid line is required to minimize starting the compressors with liquid refrigerant in the compressor oil sump.
- If suction line charging is needed to complete the charging process, only do so with the compressor operating.
- Allow the crankcase heater to operate a minimum of 8 hours before starting the unit.

**Compressor Oil**

The appropriate oil charge for a 7.5 ton scroll compressor is 6.3 pints. For 9 through 15 ton light commercial scroll compressors is 7 pints. For a 15, 20 and 25 ton large commercial scroll compressors (75 ton units), use 14.2 pints.

**Scroll Compressor Replacements**

Discoloration of the oil indicates that an abnormal condition has occurred. If the oil is dark and smells burnt, it has overheated because of: compressor operating at extremely high condensing temperatures; high superheat; a compressor mechanical failure; or, occurrence of a motor burnout.

If a motor burnout is suspected, use an acid test kit (KIT15496) to check the condition of the oil. Test results will indicate an acid level has exceeded the limit if a burnout occurred. Oil test kits must be used for POE oil (OIL00079 for a quart container or OIL00080 for a gallon container) to determine whether the oil is acidic. If a motor burnout has occurred, change the oil in both compressors in a tandem set.

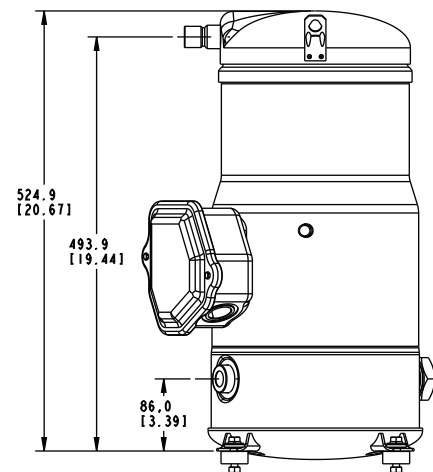
**CSHD Compressors (20-70 & 80 Ton)**

For CSHD compressors this will require that the oil be removed using a suction or pump device through the oil equalizer Rotolock fitting, see [Figure 92](#). Use a dedicated device for removing oil. It is good practice to flush the suction device with clean oil prior to use.

Place a catch pan under the oil equalizer Rotolock connection fitting on the compressor to catch the oil that will come out of the compressor when the oil equalizer tube is removed from the compressor.

Prior to reinstalling the oil equalizer line to each compressor, replace the PTFE gasket on the oil equalizer Rotolock fitting on each compressor. See [Figure 93](#), p. 181. Torque Rotolock nut to the values listed in [Table 67](#), p. 181.

**Figure 92. CSHD**



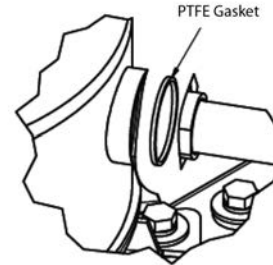
Charge the new oil into the Schrader valve on the shell of the compressor. Due to the moisture absorption properties of POE oil, do not use POE oil from a previously opened container. Also discard any excess oil from the container that is not used.

**CSHN Compressors (75 & 89-130 Ton)**

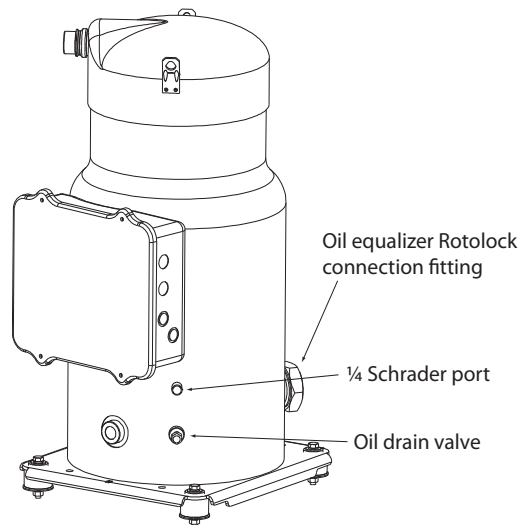
CSHN compressors have an oil drain valve, See [Figure 94](#), which allows the oil to be drained out of the compressor. After the refrigerant has been recovered, pressurize the system with nitrogen to help remove the oil from the compressor.

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

**Figure 93. PTFE gasket**



**Figure 94. CSHN**



**Table 66. Oil charge per compressor**

Compressor	Pints
CSHD 092	6.3
CSHD 110 thru 183	7.0
CSHN 176 thru 315	14.2

**Table 67. Torque requirements for rotolock fittings**

CSHD*	64 +/- 12 ft-lbs
CSHN*	100 +/- 10 ft-lbs

**Note:** Always replace gasket when reassembling oil equalizer lines.

**Electrical Phasing:**

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

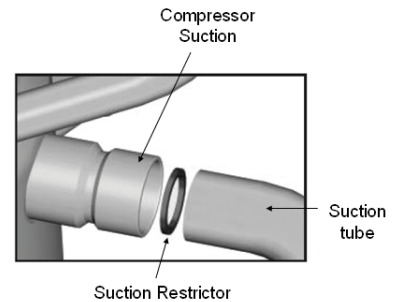
If the compressors are allowed to run backward for even a very short period of time, internal compressor damage may occur and compressor life may be reduced. If allowed to run backwards for an extended period of time the motor windings can overheat and cause the motor winding thermostats to open. This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

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

**Precision Suction Restrictor:**

Tandem manifold compressors that have unequal capacity sizes utilize a precision suction restrictor to balance the oil levels in the compressors. For tandem manifold compressors in Intellipak units, this restrictor is placed in the compressor indicated in [Table 68](#). When replacing this compressor, it is imperative that the proper restrictor is selected from those provided with the replacement compressor.

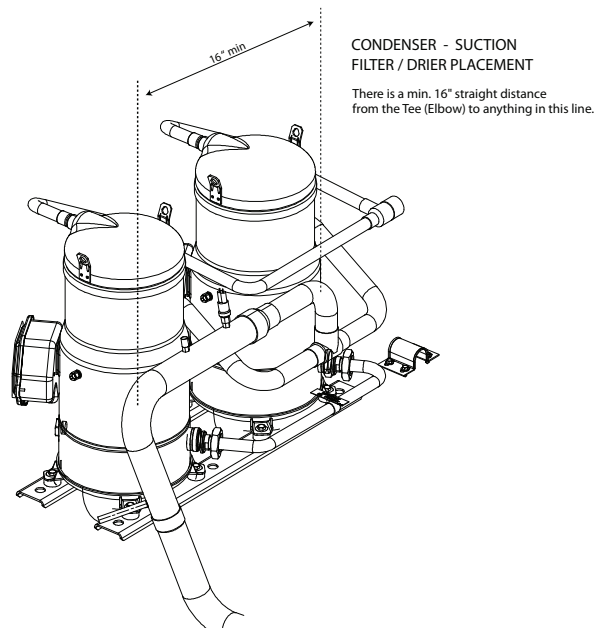
When the compressors are restarted verify that correct oil levels are obtained with both compressors operating.

**Figure 95. Precision suction restrictor**

**Table 68. Suction restrictor location (AC/EC)**

25 Ton Standard Capacity	CSHD125	60 Ton Standard Capacity	CSHD142
25 & 29 Ton High Capacity	CSHD125	75 Ton Standard Capacity	CSHN176
30 & 36 Ton High Capacity	CSHD161	75 & 89 Ton High Capacity	CSHN184
40 Ton Standard Capacity	CSHD110	105 Ton High Capacity	CSHN250
50 Ton Standard Capacity	CSHD120	115 Ton High Capacity	CSHN250

### Suction Line Filter/Drier

**Figure 96. Suction line filter/drier installation**



**Table 69. Supply and exhaust/return fan VFD programming parameters**

Menu	Parameter	Description	Setting	Description
Load & Motor	1-21	Motor Power	Set Based on Motor Nameplate	Set only for applications using 3hp motors Set to 2.2kW/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	215	Current Limit	100% Rated Current	Limits the maximum current to motor

**Note:** These parameters are motor specific and the actual motor nameplate rating must be used. Do not use the unit nameplate values.

### **⚠ 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.**

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

## 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 69](#) have been set before replacing the drive.

**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 [▼] button to scroll down to Load & Motor, press OK, use the [▼] button to select 1-2, press OK, and finally use the [▼] button until parameter 1-23 is displayed. Parameter 1-23 can then be modified by pressing OK button and using [▲] and [▼] buttons. When the desired selection has been made, press the OK button.

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

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

1. At the unit, turn the 115 volt control circuit switch 1S70 to the "Off" position.
2. Turn the 24 volt control circuit switch to the "Off" position.

### **WARNING**

#### **Live Electrical Components!**

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

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

3. To modify parameters:
  - a. Press Main Menu button (press [Back] button if the main menu does not display)
  - b. Use the [▲] and [▼] buttons to find the parameter menu group (first part of parameter number)
  - c. Press [OK]
  - d. Use [▲] and [▼] buttons to select the correct parameter sub-group (first digit of second part of parameter number)
  - e. Press [OK]
  - f. Use [▲] and [▼] buttons to select the specific parameter
  - g. Press [OK]
  - h. To move to a different digit within a parameter setting, use the [<] and [>] buttons (Highlighted area indicates digit selected for change)
  - i. Use [▲] and [▼] buttons to adjust the digit
  - j. Press [Cancel] button to disregard change, or press [OK] to accept change and enter the new setting
4. Repeat step (3) for each menu selection setting in [Table 69](#).
5. To reset programming parameters back to the factory defaults:
  - a. Go to parameter 14-22 Operation Mode
  - b. Press [OK]
  - c. Select "Initialization"
  - d. Press [OK]



- e. Cut off the mains supply and wait until the display turns off.
- f. Reconnect the mains supply - the frequency converter is now reset.
- g. Ensure parameter 14-22 Operation Mode has reverted back to "Normal Operation"

**Notes:**

- *Item 5 resets the drive to the default factory settings. The program parameters listed in [Table 69](#) will need to be verified or changed as described in Item 3 and 4.*
  - *Some of the parameters listed in the Table 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/return Airflow Measurement" start-up procedures for the exhaust/return 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.

## Monthly Maintenance

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

### **WARNING**

#### **Hazardous Voltage!**

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

#### **Filters**

- Inspect the return air filters. Clean or replace them if necessary. Refer to the [Table 61, p. 176](#) for filter information.

#### **Cooling Season**

- Check the unit's drain pans and condensate piping to ensure that there are no blockages.
- Inspect the evaporator and condenser coils for dirt, bent fins, etc. If the coils appear dirty, clean them according to the instructions described in "Coil Cleaning" later in this section.
- Manually rotate the condenser fans to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.
- 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 63, p. 176](#) for recommended greases.

**Note:** *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.*

## Maintenance

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- 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.
- With the unit running, check and record the:
  - ambient temperature;
  - compressor oil level (each circuit);
  - compressor suction and discharge pressures (each circuit);
  - superheat and subcooling (each circuit);

Record this data on an “operator’s maintenance log” like the one shown in [Table 71, p. 193](#). If the operating pressures indicate a refrigerant shortage, measure the system superheat and system subcooling. For guidelines, refer to “Charging by Subcooling”.

**Important:** Do NOT release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state and local laws. Refer to general service bulletin MSCU-SB-1 (latest edition).

### Heating Season

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 63, p. 176](#) for recommended greases.
- Note:** 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

### **NOTICE:**

#### **Coil Cleaners!**

**Coil cleaners can damage roofs, surrounding buildings, vehicles, etc. Cleaning substances should be checked to ensure that they will not cause damage to surroundings. Coils and roof (if applicable) should be rinsed thoroughly. Do not spray coil cleaners in windy conditions.**

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

To clean refrigerant coils, use a soft brush and a sprayer.

**Important:** *DO NOT use any detergents with microchannel condenser coils. Pressurized water or air ONLY.*

For evaporator and reheat coil cleaners, contact the local Trane Parts Center for appropriate detergents.

1. Remove enough panels from the unit to gain safe access to coils.

### **⚠ WARNING**

#### **No Step Surface!**

**Do not walk on the sheet metal base. Walking on the base 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.**

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

2. Straighten any bent coil fins with a fin comb.

3. For accessible areas, remove loose dirt and debris from both sides of the coil. For dual row microchannel condenser coil applications, seek pressure coil wand extension through the local Trane Parts Center.
4. When cleaning evaporator and reheat coils, 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.

**Important:** *DO NOT use any detergents with microchannel coils. Pressurized water or air ONLY.*

5. Pour the cleaning solution into the sprayer. If a high-pressure sprayer is used:
  - a. The minimum nozzle spray angle is 15 degrees.
  - b. Do not allow sprayer pressure to exceed 600 psi.
  - c. Spray the solution perpendicular (at 90 degrees) to the coil face.
  - d. For evaporator and reheat coils, maintain a minimum clearance of 6" between the sprayer nozzle and the coil. For microchannel condenser coils, optimum clearance between the sprayer nozzle and the microchannel coil is 1"-3"
6. Spray the leaving-airflow side of the coil first; then spray the opposite side of the coil. For evaporator and reheat coils, allow the cleaning solution to stand on the coil for five minutes.
7. Rinse both sides of the coil with cool, clean water.
8. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 6 and 7.
9. Reinstall all of the components and panels removed in Step 1; then restore power to the unit.
10. For evaporator and reheat coils, use a fin comb to straighten any coil fins which were inadvertently bent during the cleaning process.

### **Microchannel Condenser Coil Repair and Replacement**

If microchannel condenser coil repair or replacement is required, seek HVAC Knowledge Center information or Service Guide document RT-SVB83\*-EN for further details.

### **Steam or Hot Water Coils**

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

#### **⚠ 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. 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 62, p. 176](#) 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.

## **Evaporative Condenser Coil**

### ***Sump Water Management***

#### ***Water Supply***

Overall performance of any water-cooled device can be affected by suspended particulates, mineral concentration, trash and debris resulting in clogging and heat transfer loss. The unit is designed to greatly minimize problems with these impurities, however, float valves and solenoid valves are used to control the incoming water.

If the incoming water contains contaminants, sand or other objects, it is best to insert an incoming line strainer having a mesh of 80 to 100. The inlet line should be flushed prior to connection to the unit, whether or not there is a strainer.

There is an air gap between the water inlet float valve and sump water level to prevent back flow; however, if local code dictates, a backflow prevention valve may be required (field-provided and installed by others).

#### ***Water Drain***

Local Site Discharge: Rooftop or simple storm sewer discharge is generally acceptable. Do not routinely direct the sump discharge onto an area that will be adversely affected. For example, continued sump discharge into a flower bed where the input water contains CaCO<sub>3</sub> (lime) will eventually decrease the pH of the soil.

Sewer Discharge: The quantities of mineral and debris flushed are actually very small and do not cause problems when diluted in normal sewer flow. However, local, state or federal standards and restrictions must be followed in any given locality.

#### ***Traditional Bleed Method***

ASHRAE recommendation for continuous bleed rates:

With good, quality makeup water, the bleed rates (0.8 - 2 GPH/ton) may be as low as one-half the evaporation rate (1.6 - 2 GPH), and the total water consumption would range from 2.4 GPH/ton for air conditioning to 3 GPH/ton for refrigeration (Chapter 36.17 of ASHRAE's "Systems and Equipment Handbook")

#### ***Operation and Care***

The sump should be inspected at least every 6 months for possible build up of scale pieces that has been shed from the coils. The sump flush frequency or bleed rate should be increased if large amounts of scale are present.

If the water has a "milky or cloudy" appearance, then minerals are concentrating in the sump and the number of flushes should be increased.

If the water remains clear between flushes, then the number of flushes can be decreased. Through field trials, the optimum flush frequency can be determined. Please note that in some areas, water quality can vary during different times of the year. The sump water clarity should be checked periodically.

The evaporative condenser has several design features to reduce the possibility of biological growth in the sump. These features include:

- Air inlets constructed to eliminate direct sunlight in the sump
- The sump flush sequence replenishes the sump with fresh water 1 to 12 times per day depending on the flush setting
- The copper tubing in the coils is a natural biocide

***Important:*** Do not use chlorine tablets directly on stainless steel surface as it can adversely affect its corrosion resistance.

## Maintenance

Always consult local codes for water treatment and waste water removal requirements. Consult a water treatment expert for water analysis and chemical treatment methods and recommendations for specific applications.

If deemed necessary after consultation with local water experts, there are various means of water treatment available which can be field installed.

### **Copper Coil Cleaning**

With proper water treatment, scale should not form on the coil, and coil cleaning should not be required. In the event that scale starts to form on the coil, it is imperative that it is removed immediately. The formation of scale can greatly reduce the performance and reliability of the coil.

To remove any scale that forms use only 100% citric acid based cleaners such as "Now" or other pure citric acid products.

**Important:** Do not use HCL-, muriatic acid, or ammonia-based cleaners as they can adversely affect copper.

Do not power wash condenser fan. See RT-SVB83\*-EN for additional information.

**Table 70. Evaporative Condenser Models—Maintenance and Troubleshooting**

Maintenance Schedule			
Component	Action	Frequency	Comments
Fan Motor	None Required		Non-grease bearings
Sump Pump	Inspect/Clean	1 – 2 times per year	Clean inlet openings to pump
Sump	Inspect/Clean	1 – 2 times per year depending on water hardness and unit run time	Sump can be drained and hosed out using hose bib provided at water fill solenoid valve. Vacuuming scale out is an alternate method.
Sump Float Switch	Inspect	1 – 2 times per year	Float should be free for full float travel
Sump Float Make Up Valve	Inspect for proper water level	1 – 2 times per year	
Spray Nozzles	Inspect/Clean	1 – 2 times per year	Inspection through access panel
Conductivity Sensor	Inspect/Clean	1 – 2 times per year	Clean sensor to ensure accurate readings
Conductivity Controller	Inspect/Recalibrate	1 – 2 times per year	Recalibrate controller
Troubleshooting			
Component	Problem	Check	Fix
Fan Motor	Does not run	Condenser Fan Relay closure and control voltage indicating a call from compressor control panel for the condenser fan to operate. Sump Pump Overload Trip. Fan Motor Overload Trip. Fan fuse trip.	Check each motor overload and reset if necessary. Check amp draw for each leg.
Sump Pump	Does not run	Sump Pump Overload Trip Low Water Level or faulty float switch. Unit in 'Dry Mode' Operation	Reset – check amps on each leg to determine if faulty motor. Check and clean debris around float switch. Check Ambient thermostat setting and mode of operation (close on rise). See section 2 for T'stat setup instructions.
Sump Pump	Low Flow	Pump may be operating backwards or impeller inlet may be slightly blocked.	Change pumping direction by changing any two legs to the pump motor. Disconnect Power and remove pump to inspect for possible impeller obstruction.
Spray Nozzle	Dry area on coil	Check for proper spray pattern over each quadrant.	Remove debris from clogged nozzle.

## Fall Restraint

**⚠ WARNING**

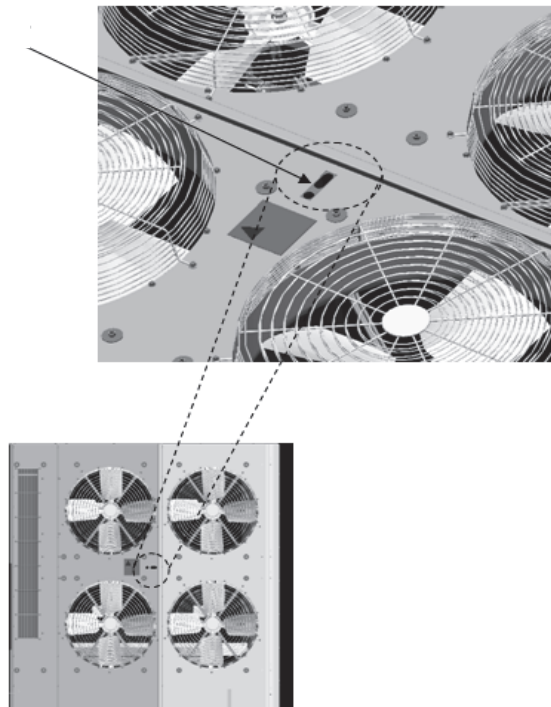
**Falling Off Equipment!**

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

The fall restraint is located approximately 3 feet from the unit edge. [Figure 97, p. 191](#)

**Figure 97. Fall restraint**

Fall restraint





## Maintenance

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### Final Process

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

Complete Model Number:

---

Unit Serial Number:

---

Unit "DL" Number ("Design special" units only):

---

Wiring diagram numbers (from unit control panel):

-schematic(s)

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---

-connections

---

---

---

Unit Address (TCI)

---

Network ID (LCI or BCI)

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# Unit Wiring Diagram Numbers

**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.

**Table 72. Unit Wiring Diagram Numbers**

Diagram Number	Tons	Description
2307-9105	20, 30, 75	Power Schematic - Standard
2307-9179	90-130	Power Schematic - Standard
2307-9106	20, 30, 75	Power Schematic - w/ Supply Fan VFD
2307-9180	90-130	Power Schematic - w/ Supply Fan VFD
2307-9107	20, 30, 75	Power Schematic - w/ Exhaust/Return VFD
2307-9181	90-130	Power Schematic - w/ Exhaust VFD
2307-9108	20, 30, 75	Power Schematic - w/ Supply & Exhaust/Return VFD
2307-9182	90-130	Power Schematic - w/ Supply & Exhaust VFD
2307-9128	25	Power Schematic - Standard
2307-9129	25	Power Schematic - w/ Supply Fan VFD
2307-9130	25	Power Schematic - w/ Exhaust/Return VFD
2307-9131	25	Power Schematic - w/ Supply & Exhaust/Return VFD
2313-1002	24/36-89	Power Schematic - Evap Cooled Standard
2313-1003	24/36-89	Power Schematic - Evap Cooled w/ Exh/Ret VFD
2313-1004	24/36-89	Power Schematic - Evap Cooled w/ Sup VFD
2313-1005	24/36-89	Power Schematic - Evap Cooled w/ Sup & Exh/Ret VFD
2313-1007	29	Power Schematic - Evap Cooled Standard
2313-1008	29	Power Schematic - Evap Cooled w/ Sup VFD
2313-1009	29	Power Schematic - Evap Cooled w/ Exh/Ret VFD
2313-1010	29	Power Schematic - Evap Cooled w/ Sup & Exh/Ret VFD
2307-9110	20-75	Schematic Rooftop Module - Standard
2307-9184	90-130	Schematic Rooftop Module - Standard
2307-9111	20-75	Schematic Rooftop Module - w/ Supply Fan VFD
2307-9185	90-130	Schematic Rooftop Module - w/ Supply Fan VFD
2307-9112	20-75	Schematic Rooftop Module - w/ Exhaust/Return VFD
2307-9186	90-130	Schematic Rooftop Module - w/ Exhaust VFD
2307-9113	20-75	Schematic Rooftop Module - w/ Supply Fan & Exhaust/Return VFD
2307-9187	90-130	Schematic Rooftop Module - w/ Supply Fan & Exhaust VFD
2307-9114	20-30	Schematic Single Circuit Compressor Module
2307-9115	40-75	Schematic Multiple Circuit Compressor Module
2307-9188	90-130	Schematic Standard Compressor or w/ Supply Fan or w/ Exhaust VFD
2313-1016	24-89	Schematic Evap Cooled
2307-3891	20-130	Schematic - Heat & GBAS Modules Electric, 2-Stage Gas, Hydronic Heat
2307-3892	20-130	Schematic Heat & GBAS Modules - w/ Supply VFD or w/ Supply & Exhaust/Return VFD, Elec, 2-Stage Gas, Hydronic Heat
2307-3955	20-130	Schematic - Standard or w/ Exhaust/Return VFD, Modulating Gas Heat
2307-3956	20-130	Schematic and Connection Wiring 500, 850 & 1000MBH 2 Stage Natural Gas Heat
2307-3894	20-130	Schematic Wiring Diagram ECE, VOM, TCI, IPCB, HI & RHI Modules
2307-3895	20-130	Schematic Wiring Diagram ECE, VOM, TCI, IPCB, HI & RHI Modules- w/ Exhaust/Return VFD
2307-9148	20-30	Connection Control Box - Standard

Continued on next page

## Unit Wiring Diagram Numbers

**Table 72. Unit Wiring Diagram Numbers**

Diagram Number	Tons	Description
2307-9153	40-75	Connection Control Box - Standard
2307-9190	90-130	Connection Control Box - Standard
2307-9149	20-30	Connection Control Box - w/ Supply Fan VFD
2307-9154	40-75	Connection Control Box - w/ Supply Fan VFD
2307-9191	90-130	Connection Control Box - w/ Supply Fan VFD
2307-9150	20-30	Connection Control Box - w/ Exhaust/Return VFD
2307-9155	40-75	Connection Control Box - w/ Exhaust/Return VFD
2307-9192	90-130	Connection Control Box - w/ Exhaust VFD
2307-9151	20-30	Connection Control Box - w/ Supply & Exhaust/Return VFD
2307-9156	40-75	Connection Control Box - w/ Supply & Exhaust/Return VFD
2307-9193	90-130	Connection Control Box - w/ Supply & Exhaust VFD
2313-1023	24-89	Connection Control Box Evap Cooled Standard
2313-1024	24-89	Connection Control Box Evap Cooled w/ Sup VFD
2313-1025	24-89	Connection Control Box Evap Cooled w/ Exh/Ret VFD
2313-1026	24-89	Connection Control Box Evap Cooled w/ Sup & Exh/Ret VFD
2307-9158	20-30	Connections Common Control Modules - Standard
2307-9162	40-75	Connection Unit Control Modules -Standard
2307-9199	90-130	Connections Common Control Modules - Standard
2307-9159	20-30	Connections Common Control Modules- w/ Supply Fan VFD
2307-9163	40-75	Connection Unit Control Modules - w/ Supply Fan VFD
2307-9200	90-130	Connections Common Control Modules- w/ Supply Fan VFD
2307-9160	20-30	Connections Common Control Modules - w/ Exhaust/Return VFD
2307-9164	40-75	Connection Unit Control Modules - w/ Exhaust/Return VFD
2307-9201	90-130	Connections Common Control Modules - w/ Exhaust VFD
2307-9161	20-30	Connections Common Control Modules - w/ Supply & Exhaust/Return VFD
2307-9165	40-75	Connection Unit Control Modules - w/ Supply & Exhaust/Return VFD
2307-9202	90-130	Connections Common Control Modules - w/ Supply & Exhaust VFD
2313-1028	24-89	Connection Module Evap Cooled Standard
2313-1029	24-89	Connection Module Evap Cooled w/ Sup VFD
2313-1030	24-89	Connection Module Evap Cooled w/ Exh/Ret VFD
2313-1031	24-89	Connection Module Evap Cooled w/ Sup & Exh/Ret VFD
2307-9167	20-30	Connections Raceway- Standard
2307-9171	40-75	Connections Raceway- Standard
2307-9204	90-130	Connections Raceway- Standard
2307-9168	20-30	Connections Raceway - w/ Supply Fan VFD
2307-9172	40-75	Connections Raceway - w/ Supply Fan VFD
2307-9205	90-130	Connections Raceway - w/ Supply Fan VFD
2307-9169	20-30	Connections Raceway - w/ Exhaust/Return VFD
2307-9173	40-75	Connections Raceway - w/ Exhaust/Return VFD
2307-9206	90-130	Connections Raceway - w/ Exhaust VFD
2307-9170	20-30	Connections Raceway - w/ Supply & Exhaust/Return VFD
2307-9174	40-75	Connections Raceway - w/ Supply & Exhaust/Return VFD
2307-9207	90-130	Connections Raceway - w/ Supply & Exhaust VFD
2313-1033	24-89	Connection Raceway Evap Cooled Standard



## Unit Wiring Diagram Numbers

**Table 72. Unit Wiring Diagram Numbers**

Diagram Number	Tons	Description
2313-1034	24-89	Connection Raceway Evap Cooled w/ Sup VFD
<b>Continued on next page</b>		
2313-1035	24-89	Connection Raceway Evap Cooled w/ Exh/Ret VFD
2313-1036	24-89	Connection Raceway Evap Cooled w/ Sup & Exh/Ret VFD
2307-9176	20-75	Field Connection - Constant Volume
2307-9177	20-75	Field Connection - Variable Air Volume
2313-1038	24-89	Field Connection - Evap Cooled CV
2313-1039	24-89	Field Connection - Evap Cooled VAV
2313-1011	20-130	Schematic/Connection - 2-Stage Natural Gas Heat 235 & 1000 MBH
2307-4327	20-40	Schematic/Connection - 2-Stage Natural Gas Heat 235 & 350 MBH
2307-9102	20-130	Schematic/Connection - 2-Stage Natural Gas Heat 500, 850 & 1000 MBH
2307-9103	20-130	Schematic/Connection - Modulating Natural Gas Heat 500, 850 & 1000 MBH
2306-8932	20-75	Schematic - Electric Heat - 460/575V - 2 Circuit
2306-8933	20-75	Schematic - Electric Heat All Voltages - 3 Circuit
2306-8934*	30-75	Schematic - Electric Heat All Voltages - 6 Circuit
2307-2175	90-130	Connection - Electric Heat - 460/575V - 6 Circuit - 190 KW
2306-8935	30-75	Schematic - Electric Heat - 200V - 7 Circuit
2306-8934*	90-130	Schematic - Electric Heat - 460/575V - 6 Circuit - 190 KW
2307-2171	20-75	Connection - Electric Heat - 460/575V - 2 Circuit - 3 or 1 Step
2307-2172	20-75	Connection - Electric Heat - All Voltages - 3 Circuit - 3 or 1 Step
2307-2173	20-75	Connection - Electric Heat - All Voltages - 6 Circuit - 3 or 1 Step
2307-2174	30-75	Connection - Electric Heat - 200V - 7 Circuit - 3 or 1 Step
2309-3199	20-75	Schematic/Connection - Supply VFD - w/ ByPass
2309-3576	20-89	Schematic/Connection - Supply VFD - w/ ByPass
2309-3577	90-130	Schematic/Connection - Supply VFD #1 - w/ ByPass
2309-3579	90-130	Schematic/Connection - Supply VFD #2 - w/ ByPass
2309-3203	20-75	Schematic/Connection - Supply VFD - w/o ByPass
2309-3580	20-89	Schematic/Connection - Supply VFD - w/o ByPass
2309-3581	90-130	Schematic/Connection - Supply VFD #1 - w/o ByPass
2309-3583	90-130	Schematic/Connection - Supply VFD #2 - w/o ByPass
2309-3201	20-130	Schematic/Connection - Exhaust/Return VFD - w/ ByPass
2309-3578	20-130	Schematic/Connection - Exhaust/Return VFD - w/ ByPass
2309-3205	20-130	Schematic/Connection - Exhaust/Return VFD - w/o ByPass
2309-3582	20-130	Schematic/Connection - Exhaust/Return VFD - w/o ByPass



# Warranty

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

**PRODUCTS COVERED - This warranty\* is extended by Trane Inc. and applies only to commercial equipment rated 20 Tons and larger and related accessories.**

The Company warrants for a period of 12 months from initial 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.

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Manager - Product Service  
Trane Inc.  
Clarksville, Tn 37040-1008

PW-215-2688

\*A 10 year limited warranty is provided on optional Full Modulation Gas Heat Exchanger.

\*Optional Extended Warranties are available for compressors and heat exchangers of Combination Gas-Electric Air Conditioning Units.

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