TRANE®

Installation, Operation, and Maintenance

IntelliPak™ 1 with Symbio™ 800

Commercial Packaged Rooftop Air Conditioners with VAV or SZVAV Controls and eFlex™/eDrive™

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

February 2025

RT-SVX090B-EN

TRANE TECHNOLOGIES™

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

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

Important Environmental Concerns

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

Important Responsible Refrigerant Practices

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

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

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

⚠ WARNING

Follow EHS Policies!

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

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠ WARNING

R-454B Flammable A2L Refrigerant!

Failure to use proper equipment or components as described below could result in equipment failure, and possibly fire, which could result in death, serious injury, or equipment damage.

The equipment described in this manual uses R-454B refrigerant which is flammable (A2L). Use ONLY R-454B rated service equipment and components. For specific handling concerns with R-454B, contact your local representative.

Overview of Manual

Note: *This document is customer property and must be retained by the unit owner for use by maintenance personnel.*

This unit is equipped with Symbio 800 controls. Refer to the “Start-Up” and “Manual Override” procedures within this Installation, Operation, and Maintenance manual and the latest edition of the appropriate programming manual for Variable Air Volume (VAV), or Single Zone Variable Air Volume (SZVAV) applications before attempting to operate or service this equipment.

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

This booklet describes proper installation, start-up, operation, and maintenance procedures for 20 through 130 ton rooftop air conditioners designed for Single Zone VAV (SZVAV) 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.

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.

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.

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Factory Training

Factory training is available through Trane University™ to help you learn more about the operation and maintenance of your equipment. To learn about available training opportunities, contact Trane University™.

Online: www.trane.com/traneuniversity

Email: traneuniversity@trane.com

Revision History

- Updated the Compressor electrical service sizing data (20 to 130 tons) table in the installation chapter.
- Updated A2L chapter.

Table of Contents

Model Number Description

20 to 75 Tons, Air Cooled

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 — System Type

H = Single Zone

Digit 4 — Development Sequence

P = R-454B

Digit 5, 6, 7 — Nominal Capacity

***20** = 20 Ton Air Cooled
***25** = 25 Ton Air Cooled
***30** = 30 Ton Air Cooled
***40** = 40 Ton Air Cooled
***50** = 50 Ton Air Cooled
***55** = 55 Ton Air Cooled
***60** = 60 Ton Air Cooled
***70** = 70 Ton Air Cooled
***75** = 75 Ton Air Cooled

Digit 8 — Voltage Selection

4 = 460/60/3 XL
5 = 575/60/3 XL
C = 380/50/3 XL
D = 415/50/3 XL
E = 200/60/3 XL
F = 230/60/3 XL

Note: *SEH units (units with electric heat) utilizing 200V or 230V require dual power source.*

Digit 9 — Heating Capacity

Note: *When the second digit is “F” (Gas Heat), the following applies: (M and T are available ONLY on 50 ton and above).*

H = High Heat — 2-Stage
K = Low Heat — Ultra Modulating
L = Low Heat — 2-Stage
M = Low Heat — Modulating
0 = No Heat
P = High Heat — Modulating
T = High Heat — Ultra Modulating

Note: *When the second digit is “E” (Electric Heat), the following applies:*

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

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

High Heat Coil
1 = 0.50 inch
2 = 0.75 inch
3 = 1.00 inch
4 = 1.25 inches
5 = 1.50 inches
6 = 2.00 inches

Low Heat Coil
A = 0.50 inch
B = 0.75 inch
C = 1.00 inch
D = 1.25 inches
E = 1.50 inches
F = 2.00 inches

Digit 10 — Design Sequence

***** = Current

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

Digit 11— Relief/Return Option

0 = None
1 = Barometric
3 = Relief 3 HP with Statitrac
4 = Relief 5 HP with Statitrac
5 = Relief 7.5 HP with Statitrac
6 = Relief 10 HP with Statitrac
7 = Relief 15 HP with Statitrac
8 = Relief 20 HP with Statitrac
9 = Return 3 HP with Statitrac
M = Return 5 HP with Statitrac
N = Return 7.5 HP with Statitrac
P = Return 10 HP with Statitrac
R = Return 15 HP with Statitrac
T = Return 20 HP with Statitrac

Digit 12— Relief/Return Air Fan Drive

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

Digit 13 — Filter (Pre DX/Final)

A = Throwaway
B = Cleanable Wire Mesh
C = High Efficiency Throwaway
D = Bag with Prefilter
E = Cartridge with Prefilter
F = Throwaway Filter Rack (Filter not included)
G = Bag Filter Rack (Filter Not Included)
H = Standard Throwaway Filter/Cartridge Final Filters
J = High Efficiency Throwaway Filter/Cartridge Final Filters

Digit 13 — Filter (Pre DX/Final) (continued)

K = Bag Filters with 2–inch Throwaway Prefilters/ Cartridge Final Filters
L = Cartridge Filters with 2–inch Throwaway Prefilters /Cartridge Final Filters
M = Standard Throwaway Filter/Cartridge Final Filters with 2"Throwaway Prefilters
N = High Efficiency Throwaway Filters/Cartridge Final Filters with 2"Throwaway Prefilters
P = Bag Filters with Prefilters/Cartridge Final Filters with 2–inch Throwaway Prefilters
Q = Cartridge Filters with Prefilters/Cartridge Final Filters with 2–inch Throwaway Prefilters
R = High Efficiency Throwaway/Final filter rack (no filters)
T = 2 inch and 1 inch Vertical Filter Rack (no filters) /Final Filter Rack (no filters)

Digit 14 — Supply Air Fan HP

1 = 3 HP FC
2 = 5 HP FC
3 = 7.5 HP FC
4 = 10 HP FC
5 = 15 HP FC
6 = 20 HP FC
7 = 25 HP FC
8 = 30 HP FC
9 = 40 HP FC
A = 50 HP FC
B = 3 HP DDP 80W
C = 3 HP DDP 120W
D = 5 HP DDP 80W
E = 5 HP DDP 120W
F = 7.5 HP DDP 80W
G = 7.5 HP DDP 120W
H = 10 HP DDP 80W (60-75T = 2 x 5 HP)
J = 10 HP DDP 100 or 120W (60-75T = 2 x 5 HP)
K = 15 HP DDP 80W (60-75T = 2 x 7.5 HP)
L = 15 HP DDP 100 or 120W (60-75T = 2 x 7.5 HP)
M = 20 HP DDP 80W (60-75T = 2 x 10 HP)
N = 20 HP DDP 100 or 120W (60-75T = 2 x 10 HP)
P = 25 HP DDP 80W
R = 25 HP DDP 120W
T = 30 HP DDP 80W (60-75T = 2 x 15 HP)
U = 30 HP DDP 120W (60-75T = 2 x 15 HP)
V = 40 HP DDP 80W(60-75T = 2 x 20 HP)
W = 40 HP DDP 100 or 120W (60-75T = 2 x 20 HP)
X = 50 HP DDP 80W (70-75T = 2 x 25 HP)
Y = 50 HP DDP 100 or 120W (70–75T = 2 x 25 HP)
Z = 30 HP DDP 100W (60-75T = 2 x 15 HP)

Digit 15 — Supply Air Fan RPM

4 = 400 RPM
5 = 500 RPM
6 = 600 RPM
7 = 700 RPM
8 = 800 RPM
9 = 900 RPM
A = 1000 RPM
B = 1100 RPM
C = 1200 RPM
D = 1300 RPM
E = 1400 RPM
F = 1500 RPM
G = 1600 RPM
H = 1700 RPM
J = 1800 RPM
K = 1900 RPM
L = 2000 RPM
M = 2100 RPM
N = 2200 RPM
P = 2300 RPM
R = 2400 RPM

Digit 16 — Outside Air

A = No Fresh Air
B = 0-25% Manual
D = 0-100% Economizer
E = 0-100% Economizer with Traq/DCV
F = 0-100% Economizer with DCV

Note: *Must install CO_2 sensor(s) for DCV to function properly.*

Digit 17 — System Control

6 = VAV Discharge Temp Control with VFD without Bypass
7 = VAV Discharge Temp Control with VFD and Bypass
8 = VAV Discharge Temp Control Supply and Relief/Return Fan with VFD without Bypass
9 = VAV Discharge Temp Control Supply and Relief/Return Fan with VFD and Bypass
A = VAV - Single Zone VAV - with VFD without Bypass
B = VAV - Single Zone VAV - with VFD and Bypass
C = VAV - Single Zone VAV - Supply and Relief/ Return Fan with VFD without Bypass
D = VAV - Single Zone VAV - Supply and Relief/ Return Fan with VFD with Bypass

Digit 18 — Zone Sensor

0 = None
A = Dual Setpoint Manual or Auto Changeover (BAYSENS108*)
C = Room Sensor w/ Override/Cancel Buttons (BAYSENS073*)
D = Room Sensor w/ Temp Adjustment/Override/ Cancel Buttons (BAYSENS074*)
L = Programmable Zone Sensor w/ System Function Modes for SZVAV/VAV (BAYSENS800*)

Note: **Asterisk indicates current model number digit. 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 is a “F.”*

Digit 21 — Miscellaneous Options

0 = Unit Mounted Terminal Block
A = Unit Mounted Disconnect Switch
B = Unit Mounted Disconnect Switch with High Fault SCCR
D = Unit Mounted Disconnect Switch with Convenience Outlet
E = Unit Mounted Disconnect Switch with High Fault SCCR and Convenience Outlet

Digit 22 — Refrigeration Options

0 = Without Hot Gas Bypass
B = Hot Gas Bypass
C = Hot Gas Reheat without Hot Gas Bypass
D = Hot Gas Reheat and Hot Gas Bypass

Digit 23 — Economizer Control Options

0 = Without Economizer
C = Economizer Control with Comparative Enthalpy
D = Economizer with Differential Dry Bulb
Z = Economizer Control with Reference Enthalpy
W = Economizer Control with Dry Bulb

Digit 24 — Damper Options

0 = Standard Damper or No damper
E = Low Leak Economizer Dampers
U = Ultra Low Leak Economizer Dampers and Ultra Low Leak motorized relief dampers when relief/ return option includes motorized dampers

Digit 25 — Power Meter

0 = None
P = Power Meter

Digit 26 — Efficiency Options

0 = Standard Efficiency Unit
H = High Efficiency Unit
V = eFlex™ Variable Speed Compressor

Digit 27 — Condenser Options

0 = Standard Aluminum Condenser Coil
J = Corrosion Protected Condenser Coil

Digit 28 — Rapid Restart

0 = Standard Restart
R = Rapid Restart

Digit 29 — Miscellaneous Options

0 = Motors without Internal Shaft Grounding
A = Motors with Internal Shaft Grounding

Digit 30 — Expansion Module

0 = None
E = Expansion Module

Digit 31 — Miscellaneous Options

N = Ventilation Override Module

Digit 32 — Service Options

0 = None
R = Extended Grease Lines
3 = Stainless Steel Sloped Drain Pan
4 = Stainless Steel Sloped Drain Pan with Grease Lines

Digit 33 — Cabinet Options

0 = Standard Panels
1 = Standard Panels with Double Wall
T = Hinged Access Doors
2 = Hinged Access Doors with Double Wall
U = IRU - with Standard Panels
3 = IRU - with Standard Panels with Double Wall
W = IRU - with Hinged Access Doors
4 = IRU - with Hinged Access Doors with Double Wall
Y = IRU with SST - with Standard Panels
5 = IRU with SST - with Standard Panels with Double Wall
Z = IRU with SST - with Hinged Access Doors
6 = IRU with SST - with Hinged Access Doors with Double Wall

Digit 34 — Filter Monitor

0 = None
1 = Pre-Evaporator
2 = Pre-Evaporator and Final Filter

Digit 35 — BAS/Communication Options

0 = None
7 = Trane LonTalk Communication Interface Module
8 = Modbus®
M = BACNet® Communications Interface
W = Air-Fi® Wireless

Digit 36 — Isolators

8 = Spring Isolators

Digit 37 —Airflow

A = Downflow Supply/Upflow Return
B = Horizontal Right Supply/ Horizontal End Return
C = Horizontal Right Supply/Upflow Return
E = Downflow Supply/Horizontal End Return

Digit 38 — Miscellaneous Options

A = Supply Fan Piezometer
B = Supply Isolation damper
C = Return Isolation damper
D = Both Supply and Return Isolation damper
E = Piezometer with Supply Isolation damper
F = Piezometer with Return Isolation damper
G = Piezometer with both Supply and Return Isolation damper

90 to 130 Tons, Air Cooled

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 — System Type

H = Single Zone

Digit 4 — Development Sequence

R = R-454B Development Sequence

Digit 5, 6, 7 — Nominal Capacity

***90** = 90 Ton Air Cooled
***11** = 105 Ton Air Cooled
***12** = 115 Ton Air Cooled
***13** = 130 Ton Air Cooled

Digit 8 — Power Supply

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

Digit 9 — Heating Capacity

Note: *When Digit 2 is "F" (Gas Heat), the following values apply in Digit 9:*

H = High Heat – 2-stage
O = No Heat
P = High Heat — Modulation
T = High Heat—Ultra Modulation

Note: *When the second digit calls for "E" (electric heat), the following values apply in Digit 9:*

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

***** = Current

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

Digit 11 — Relief Option

0 = None
7 = 100% Relief 15 HP with Statitrac
8 = 100% Relief 20 HP with Statitrac
9 = 100% Relief 25 HP with Statitrac
H = 100% Relief 30 HP with Statitrac
J = 100% Relief 40 HP with Statitrac

Digit 12 — Relief Fan

(Relief Fan)
0 = None
5 = 500 RPM
6 = 600 RPM
7 = 700 RPM
8 = 800 RPM

Digit 13 — Filter (Pre DX/Final)

A = Throwaway
C = High Efficiency Throwaway
D = Bag with Prefilter
E = Cartridge with Prefilter
F = Throwaway Filter Rack (filter not included)
G = Bag Filter Rack (Filter Not Included)
H = StandardThrowaway Filter/Cartridge Final Filters
J = High Efficiency Throwaway Filter/Cartridge Final Filters
K = Bag Filters with 2"Throwaway Prefilters/ Cartridge Final Filters
L = Cartridge Filters with 2"Throwaway Prefilters /Cartridge Final Filters
M = StandardThrowaway Filter/Cartridge Final Filters with 2–inch Throwaway Prefilters
N = High EfficiencyThrowaway Filters/Cartridge Final Filters with 2–inch Throwaway Prefilters
P = Bag Filters with Prefilters Cartridge Final Filters with 2–inch Throwaway Prefilters
Q = Cartridge Filters with Prefilters/Cartridge Final Filters with 2–inch Throwaway Prefilters

Digit 14 — Supply Air Fan HP

C = 30 HP (2x15 HP)
D = 40 HP (2x20 HP)
E = 50 HP (2x25 HP)
F = 60 HP (2x30 HP)
G = 80 HP (2x40 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 — Outside Air

D = 0-100% Economizer (Std.)
E = 0-100% Economizer with Traq with DCV
F = 0-100% Economizer with DCV

Note: *Must install CO_2 sensor(s) for DCV to function properly.*

Digit 17 — System Control

6 = VAV Discharge Temperature Control with VFD without Bypass
7 = VAV Discharge Temperature Control with VFD and Bypass
8 = VAV Discharge Temperature Control Supply and ReliefFan with VFD without Bypass
9 = VAV Discharge Temperature Control Supply and Relief Fan with VFD and Bypass
A = VAV – Single Zone VAV – with VFD without Bypass
B = VAV – Single Zone VAV – with VFD with Bypass
C = VAV – Single Zone VAV – Supply and Relief/ Return Fan with VFD without Bypass
D = VAV – Single Zone VAV – Supply and Relief/ Return Fan with VFD with Bypass

Digit 18 — Zone Sensor

0 = None
A = Dual Setpoint Manual or Auto Changeover (BAYSENS108*)
C = Room Sensor with Override and Cancel Buttons (BAYSENS073*)
D = Room Sensor with Temperature Adjustment and Override and Cancel Buttons (BAYSENS074*)
L = Programmable Zone Sensor with System Function Modes for VAV (BAYSENS800*)

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."*

Digit 21 — Miscellaneous

0 = Unit Mounted Terminal Block
A = Unit Mounted Disconnect Switch
B = Unit Mounted Disconnect Switch with High Fault SCCR
D = Unit Mounted Disconnect Switch with Convenience Outlet
E = Unit Mounted Disconnect Switch with High Fault SCCR and Convenience Outlet

Digit 22 — Refrigeration Options

0 = Without Hot Gas Bypass
B = Hot Gas Bypass

Digit 23 — Economizer Control Options

C = Economizer Control with Comparative Enthalpy
D = Economizer with Differential Dry Bulb
Z = Economizer Control with Reference Enthalpy
W = Economizer Control with Dry Bulb

Digit 24 — Damper Options

0 = Standard Dampers
E = Low Leak Economizer Dampers
U = Ultra Low Leak Economizer Dampers and Ultra Low Leak motorized relief dampers

Digit 25 — Power Meter

0 = None
1 = Power Meter

Digit 26 — Efficiency Options

0 = Standard Efficiency Unit
H = High Efficiency Unit

Digit 27 — Condenser Coil Options

0 = Air Cooled Aluminum Condenser Coil
J = Corrosion-Protected Condenser Coil

Digit 28 — Rapid Restart

0 = Non-Rapid Restart
R = Rapid Restart

Digit 29 — Miscellaneous

0 = Motors without Internal Shaft Grounding
A = Motors with Internal Shaft Grounding

Digit 30 — Expansion Module

0 = None
E = Expansion Module

Digit 31 — Miscellaneous

N = Ventilation Override Module

Digit 32 — Service Options

0 = None
R = Extended Grease Lines
3 = Stainless Steel Sloped Drain Pan
4 = Stainless Steel Sloped Drain Pan with Grease Lines

Digit 33 — Cabinet Options

0 = Standard Panels
1 = Standard Panels with Double Wall
T = Hinged Access Doors
2 = Hinged Access Doors with Double Wall
U = IRU - with Standard Panels
3 = IRU - with Standard Panels with Double Wall
W = IRU - with Hinged Access Doors
4 = IRU - with Hinged Access Doors with Double Wall
Y = IRU with SST - with Standard Panels
5 = IRU with SST - with Standard Panels with Double Wall
Z = IRU with SST - with Hinged Access Doors
6 = IRU with SST - with Hinged Access Doors with Double Wall

Digit 34 — Filter Monitor

0 = None
1 = Pre-Evaporator
2 = Pre-Evaporator and Final Filter

Digit 35 — BAS/Communication Options

0 = None
7 = Trane LonTalk Communication Interface Module
8 = ModBus®
M = BACnet® Communication Interface Module
W = Air-Fi® Wireless

Digit 36 — Isolators

8 = Spring Isolators

Digit 37 —Airflow

A = Downflow Supply/Upflow Return
B = Horizontal Right Supply/ Horizontal End Return
C = Horizontal Right Supply/Upflow Return
E = Downflow Supply/Horizontal End Return

General Information

Unit Nameplate

One Mylar unit nameplate is located on the outside of enclosure. It includes the unit model number, serial number, electrical characteristics, weight, refrigerant charge, unit wiring diagram numbers, 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. Max amps is listed on the nameplate and is the absolute highest amp load on the compressor at any operating condition (does not include locked rotor amps or inrush). This value should never be exceeded.

Gas Heat Nameplate

The nameplate for the Gas Heater is located on the inside of the gas heat enclosure. Allowable operating values of Min and Max input rate, manifold pressure, and air temperature rise for the heater is listed on the nameplate.

Unit Description

Each 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 units is available from Trane. The roof curb kit must be field assembled and installed according to the latest edition of the roof curb installation manual.

Trane Commercial Rooftop Units are controlled by a Symbio 800 control system that consists of a network of modules and are referred to as Low Level Intelligent Devices (LLID). The acronym (LLID) 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.

Note: *The Symbio™ 800 coin cell tray should never be taken out unless the Symbio 800 is powered on or the Symbio 800 needs to be powered on shortly after replacing the battery. Failure to do this may shorten the battery life.*

Pre-Installation

Unit Inspection

To protect against loss due to damage incurred in transit, perform inspection immediately upon receipt of the unit.

Exterior Inspection

If the job site inspection reveals damage or material shortages, file a claim with the carrier immediately. Specify the type and extent of the damage on the bill of lading before signing. Notify the appropriate sales representative.

Important: *Do not proceed with installation of a damaged unit without sales representative's approval.*

- Visually inspect the complete exterior for signs of shipping damages to unit or packing material.
- Verify that the nameplate data matches the sales order and bill of lading.
- Verify that the unit is properly equipped and there are no material shortages.
- Verify that the power supply complies with the unit nameplate and electric heater specifications.

Inspection for Concealed Damage

Visually inspect the components for concealed damage as soon as possible after delivery and before it is stored.

Do NOT walk on the sheet metal base pans. Bridging between the unit's main supports may consist of multiple 2 by 12 boards or sheet metal grating.

⚠ WARNING

No Step Surface!

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

Do not walk on the sheet metal drain pan. Walking on the drain pan could cause the supporting metal to collapse and result in the operator/technician falling.

If concealed damage is discovered:

- Notify the carrier's terminal of the damage immediately by phone and by mail.
- Concealed damage must be reported within 15 days.
- Request an immediate, joint inspection of the damage with the carrier and consignee.
- Stop unpacking the unit.
- Do not remove damaged material from receiving location.
- Take photos of the damage, if possible.
- The owner must provide reasonable evidence that the damage did not occur after delivery.

Repair

Notify the appropriate sales representative before arranging unit installation or repair.

Important: *Do not repair unit until the damage has been inspected by the carrier's representative.*

Storage

Store unit in a level and dry location. Use adequate blocking under the base rail. If unit is not level and supported adequately, damage may occur when removing screws and opening doors.

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

- The unit is stored before it is installed; or,
- The unit is set on the roof curb and temporary auxiliary heat is provided in the building.

Isolate all side panel service entrances and base pan openings (e.g., conduit holes, S/A and R/A openings, and flue openings) to minimize ambient air from entering the unit until it is ready for startup.

Note: *Do not use the unit heater as temporary heat without completing the startup procedures detailed under Startup information.*

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

Unit Clearances

Minimum Required Clearance (see Dimensional Data chapter) illustrates the minimum operating and service clearances for either a single or multiple unit installation.

These clearances are the minimum distances necessary for adequate service, cataloged unit capacity, and peak operating efficiency. Providing less than the recommended clearances may result in condenser coil starvation, "short-circulating" of relief and economizer airflows, or recirculation of hot condenser air.

Unit Dimensions and Weight Information

Table 1. Unit dimensions and weight information

Description	Reference
Air-Cooled Condenser	
Unit dimensions, 20–75 ton (SAH_)	, , ,
Unit dimensions, 90–130 ton	
Roof curb weights	Table 12, p. 29
Center-of-gravity illustration and related dimensional data	

Factory Warranty Information

Compliance with the following is required to preserve the factory warranty:

All Unit Installations

Startup MUST be performed by Trane, or an authorized agent of Trane, to VALIDATE this WARRANTY. Contractor must provide a two-week startup notification and true start date to Trane (or an agent of Trane specifically authorized to perform startup).

On all IntelliPak 1 units, a Trane factory startup is an option and provides maximized unit reliability and overall unit performance in addition to preserving the standard factory warranty.

Additional Requirements for Units Requiring Disassembly

When a new fully assembled IntelliPak is shipped and received from our Trane manufacturing location, and, for any reason, it requires disassembly or partial disassembly, which could include but is not limited to the evaporator, condenser, control panel, compressor/motor, factory mounted starter, or any other components originally attached to the fully assembled unit, compliance with the following is required to preserve the factory warranty:

- Trane, or an agent of Trane specifically authorized to perform start-up and warranty of Trane® products, will perform or have direct on-site technical supervision of the disassembly and reassembly work.
- The installing contractor must notify Trane, or an agent of Trane specifically authorized to perform start-up and warranty of Trane® products, two weeks in advance of the scheduled disassembly work to coordinate the disassembly and reassembly work.
- Start-up must be performed by Trane or an agent of Trane specifically authorized to perform start-up and warranty of Trane® products.

Trane, or an agent of Trane specifically authorized to perform startup and warranty of Trane® products, will provide qualified personnel and standard hand tools to perform the disassembly work at a location specified by the contractor. The contractor shall provide the rigging equipment, such as chain falls, gantries, cranes, forklifts, etc., necessary for the disassembly and reassembly work and the required qualified personnel to operate the necessary rigging equipment. See “Warranty and Liability Clause,” p. 205 for additional details.

Installation Checklist

General Checklist (Applies to all units)

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.

Important: *This checklist 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 relief/return fans ordered with rubber or spring isolators.
- ☐ Check all optional supply and relief/return fan spring isolators for proper adjustment.
- ☐ Verify all discharge line service valves (one per circuit) are back seated.

Electric Heat Units

- ☐ Inspect the heater junction box and control panel; tighten any loose connections.
- ☐ Check electric heat circuits for continuity.
- ☐ Two piece units only: Route power wiring to high side junction box.

Main Electrical Power Requirements

- ☐ Verify that the power supply to the unit complies with the unit nameplate specification. Refer to Main Unit Power Wiring in the Installation chapter.
- ☐ Properly ground the unit.
- ☐ Inspect all control panel components and tighten any loose connections.
- ☐ Connect properly sized and protected power supply wiring to a field supplied/installed disconnect and the unit (copper wiring only to the unit).
- ☐ Verify that phasing to the unit is correct (ABC).
- ☐ Turn the 1S1 fused switch inside the control panel off to prevent accidental unit operation. (20-75T units only).
- ☐ Turn the 1S1 and 1S20 fused switches inside the control panel off to prevent accidental unit operation. (90-130T units only).
- ☐ Turn on power to the unit.
- ☐ Press the STOP button on the User Interface (2P1).
- ☐ Allow compressor crankcase heaters to operate for 8 hours prior to starting the refrigeration system.

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

Field Installed Control Wiring

- ☐ Complete the field wiring connections for the variable air volume controls as applicable. Refer to unit diagrams for guidelines.

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

Requirements for Electric Heat Units

SEH_ Units (460–575V)

- ☐ 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.

SEH_ Units with 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 3XD5, or to an optional unit-mounted disconnect switch 3QB4.

Requirements for Gas Heat Units

- ☐ Gas supply line properly sized and connected to the unit gas train.
- ☐ Properly sized unit gas regulator installed to regulate pressure from supply.
- ☐ 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–inch 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 stub-out 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.
- ☐ (Units with StatiTrac) 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.

Requirements for Modulating Reheat

- ☐ Install space humidity and temperature sensors. Refer to unit diagrams for guidelines.

Dimensional Data

Figure 1. Heating/cooling unit dimensions - 20 to 75 tons air-cooled

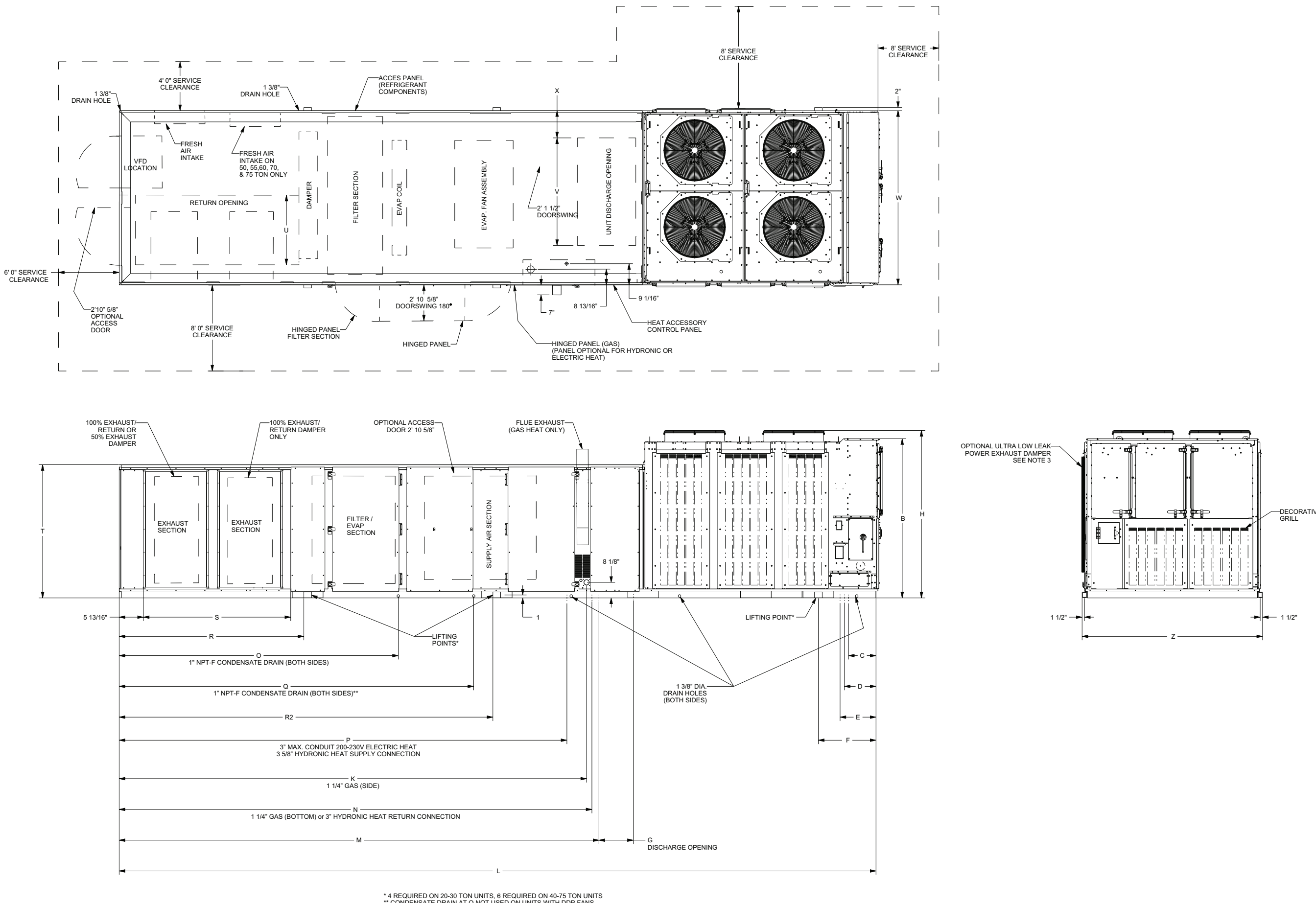


Table 2. Heating/cooling unit dimensions (ft. in.) - air-cooled - SEH_, SFH_, SSH_, SLH_, SXH_

Nom. Tons	H	L	W	B	C	D	E	F	G
20, 25	7-3	24-1 3/8	7-6 1/2	6-9	0-9 1/2	1-3 5/8	1-7 9/16	1-3 1/2	2-2 1/2
30	7-3	24-1 3/8	7-6 1/2	6-9	0-9 1/2	1-3 5/8	1-7 9/16	1-3 1/2	2-2 1/2
40	7-3	32-10 1/2	7-6 1/2	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-5	2-5
50, 55	7-3	32-10 1/2	7-6 1/2	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-5	2-5
60	7-3 1/4	32-10 1/2	9-8	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-5	2-5
70, 75	7-3 1/4	32-10 1/2	9-8	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-5	2-5

Nom. Tons	J	K	M	N	O	P	Q	R	R2
20, 25	16-9 3/4	16-6	16-3 13/16	16-7	10-7	15-5 5/16	13-3	7-0	N/A
	16-9 3/4	16-6							
30	16-9 3/4	16-6	16-3 13/16	16-7	10-7	18-11 11/16	15-4 15/16	8-0	N/A
	16-9 3/4	16-6							
40	20-1 3/4	19-6	19-10 5/16	19-7	12-1	18-11 11/16	15-4 15/16	8-0	16-2 5/16
	20-6 3/4	20-3							
50, 55	20-1 3/4	19-6	19-10 5/16	19-7	12-1	15-5 5/16	13-3	7-0	16-2 5/16
	20-6 3/4	20-3							
60	20-1 3/4	19-6	19-10 5/16	19-7	12-1	18-11 11/16	15-4 15/16	8-0	16-2 5/16
	20-6 3/4	20-3							
70, 75	20-1 3/4	19-6	19-10 5/16	19-7	12-1	18-11 11/16	15-4 15/16	8-0	16-2 5/16
	20-6 3/4	20-3							

Nom. Tons	S		T	U		V	X	Z
	w/Exh Fan	w/ Ret Fan		w/Exh Fan	w/ Ret Fan			
20, 25	6-6 15/16	3-0	3-9 5/16	3-4 3/8	2-9 15/16	5-7	0-5 13/16	7-9 1/2
30	6-6 15/16	3-0	4-9 5/16	3-4 3/8	2-9 15/16	5-7	0-5 13/16	7-9 1/2

Table 2. Heating/cooling unit dimensions (ft. in.) - air-cooled - SEH_, SFH_, SSH_, SLH_, SXH_ (continued)

Nom. Tons	S		T	U		V	X	Z
	w/Exh Fan	w/ Ret Fan		w/Exh Fan	w/ Ret Fan			
40	7-8 3/16	3-4	5-9 5/16	3-4 3/8	3-1½	5-7	0-5 13/16	7-9 1/2
50, 55	7-8 3/16	3-4	6-9 3/8	3-4 3/8	3-1½	5-7	0-5 13/16	7-9 1/2
60	7-8 3/16	4-5	5-9 5/16	4-5 3/8	4-2½	7-8½	0-5 13/16	9-11
70, 75	7-8 3/16	4-5	5-9 5/16	4-5 3/8	4-2½	7-8½	0-5 13/16	9-11

Notes:

1. In columns J and K: top dimension = high gas heat, bottom dimension = low gas heat.
2. Unit drawing is representative only and may not accurately depict all models.
3. Use high gas heat J dimension for all hydronic heat connections.
4. Optional Ultra Low Leak Power Exhaust extends beyond lifting lug and increases overall "Z" dimension by 0.65".

Figure 2. Unit dimensions, SAH_ cooling only units (20 to 75 ton)

Note: *Use the table that follows.*

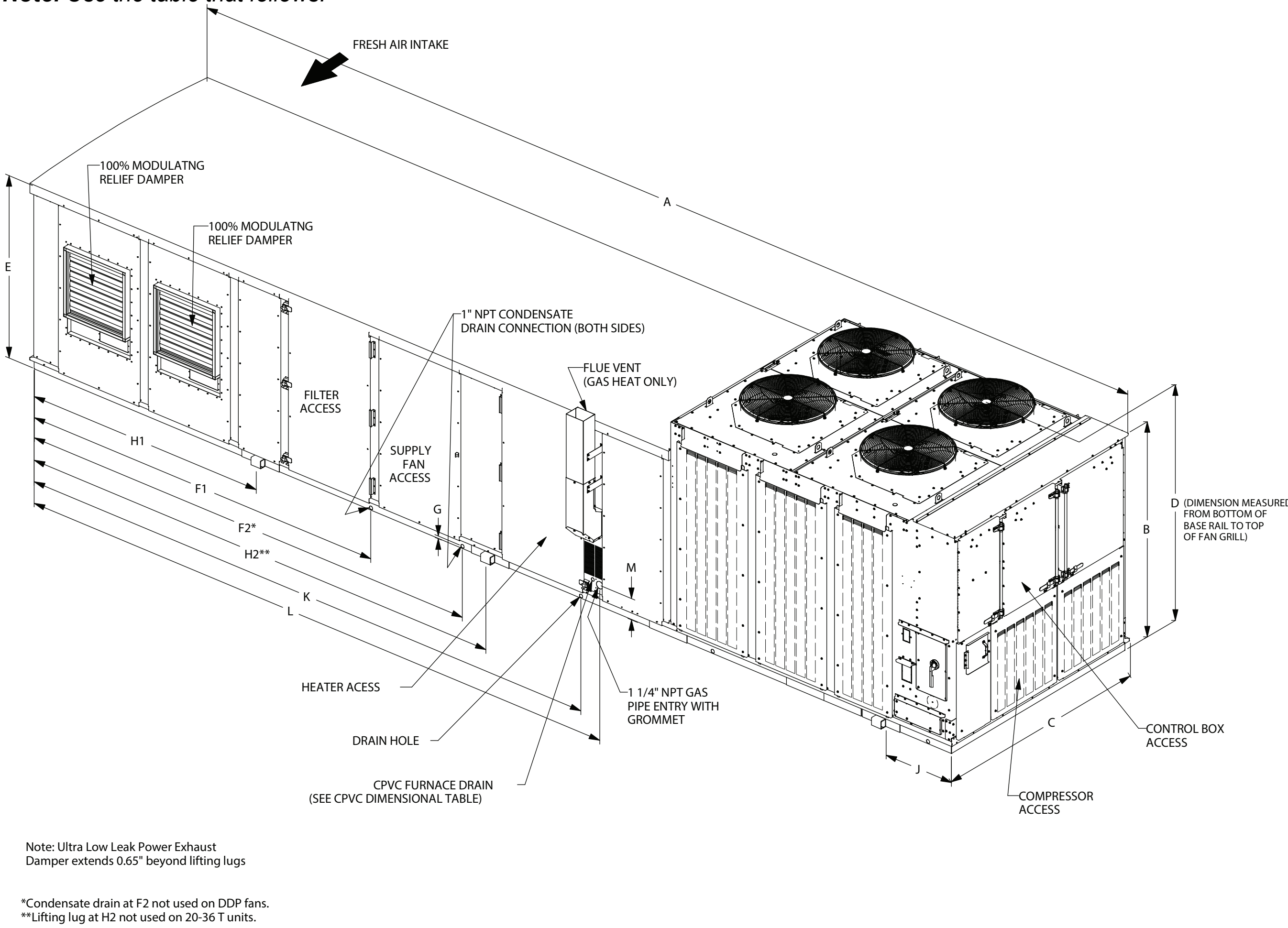


Table 3. Unit dimensions, SAH_ cooling only units (20 to 75 ton)

Nom. Tons	A	B	C	D	E	F1	F2	G	H1	H2	J
20, 25	21'–9 3/4"	6'–9"	7'–6 1/2"	7'–3 1/4"	3'–9 5/16"	10'–7"	12'–6"	1"	7'	N/A	1'–3 1/2"
30	21'–9 3/4"	6'–9"	7'–6 1/2"	7'–3 1/4"	4'–9 5/16"	10'–7"	12'–6"	1"	7'	N/A	1'–3 1/2"
40	29'–8"	6'–9"	7'–6 1/2"	7'–3 1/4"	5'–9 5/16"	12'–1 1/4"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"
50, 55	29'–8"	6'–9"	7'–6 1/2"	7'–3 1/4"	6'–9 5/16"	12'–1 1/4"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"
60	29'–8"	6'–9"	9'–8"	7'–3 1/4"	5'–9 5/16"	12'–1 1/4"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"
70, 75	29'–8"	6'–9"	9'–8"	7'–3 1/4"	5'–9 5/16"	12'–1 1/4"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"

Figure 3. Unit base dimensions, SAH_ cooling only units (20 to 75 ton)

Note: *Use table that follows.*

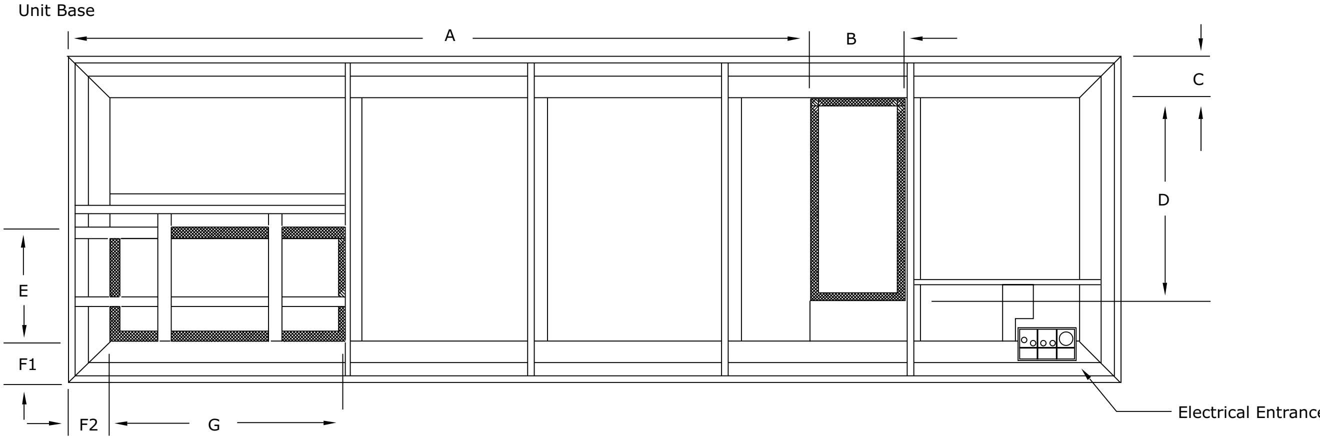


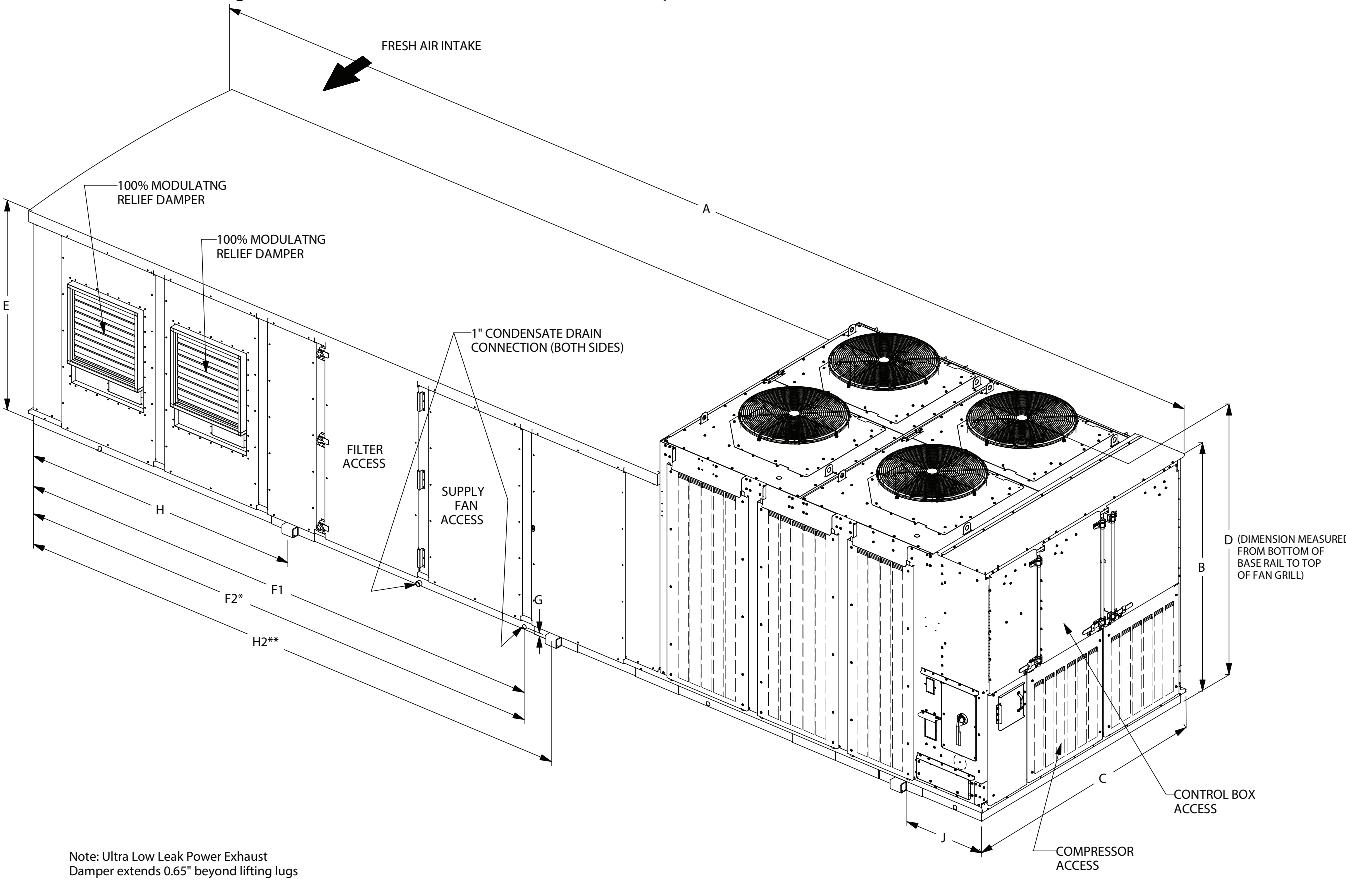
Table 4. Unit base dimensions, SAH_ cooling only units (20 to 75 ton)

Nom. Tons	A	B	C	D	E	
					Fan Type	
					Relief	Return
20–30	14'–30 1/4"	2'–32 1/2"	11 3/4"	5'–7"	3'–4 3/8"	2'–9 15/16"
40–50	16'–31 13/16"	2'–5"	11 3/4"	5'–7"	3'–4 3/8"	3'–1 1/2"
60	16'–31 13/16"	2'–5"	1'–4 9/16"	6'–10 7/8"	4'–5 3/8"	4'–2 1/2"
70–75	16'–31 13/16"	2'-5"	1'–4 9/16"	6'–10 7/8"	4'–5 3/8"	4'–2 1/2"

F1		F2		G	
Fan Type					
Relief	Return	Relief	Return	Relief	Return
5 13/16"	8 1/4"	5 13/16"	28 5/8"	6'–6 15/16"	3'
5 13/16"	8 1/4"	5 13/16"	32 15/16"	7'–8 3/16"	3'–4"
5 13/16"	8 1/4"	5 13/16"	26 7/16"	7'–8 3/16"	4'–5"
5 13/16"	8 1/4"	5 13/16"	26 7/16"	7'–8 3/16"	4'–5"

Figure 4. Unit dimensions, SEH_, SFH_, SLH_, SSH_, SXH_ units (20 to 75 ton)

Note: *Use the following two table for dimensions. Use* *Table 6, p. 21* *for CPVC furnace drain dimensions.*



*Condensate drain at F2 not used on DDP fans.
**Lifting lug at H2 not used on 20-36 T units.

Table 5. Unit dimensions, SEH_, SFH_, SLH_, SSH_, SXH_ units (20 to 75 ton)—air cooled

Nom. Tons	A	B	C	D	E	F1	F2	G	H1	H2	J	K	L	M	N	O
20, 25	24'–1 3/8"	6'–9"	7'–6 1/2"	7'–3 1/4"	3'–9 5/16"	10'–7"	13'–3"	1"	7'	N/A	1'–3 1/2"	16'–7"	16'–6"	8 1/8"	6 1/4"	9"
30	24'–1 3/8"	6'–9"	7'–6 1/2"	7'–3 1/4"	4'–9 5/16"	10'–7"	13'–3"	1"	7'	N/A	1'–3 1/2"	16'–7"	16'–6"	8 1/8"	6 1/4"	9"
40	32'–10 1/2"	6'–9"	7'–6 1/2"	7'–3 1/4"	5'–9 5/16"	12'–1 1/8"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"	19'–7"	See Note	8 1/8"	6 1/4"	9"
50, 55	32'–10 1/2"	6'–9"	7'–6 1/2"	7'–3 1/4"	6'–9 5/16"	12'–1 1/8"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"	19'–7"	See Note	8 1/8"	6 1/4"	9"
60	32'–10 1/2"	6'–9"	9'–8"	7'–3 1/4"	5'–9 5/16"	12'–1 1/8"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"	19'–7"	See Note	8 1/8"	6 1/4"	9"
70, 75	32'–10 1/2"	6'–9"	9'–8"	7'–3 1/4"	5'–9 5/16"	12'–1 1/8"	15'–4 5/16"	1"	8'	16'–2 5/16"	2'–5"	19'–7"	See Note	8 1/8"	6 1/4"	9"

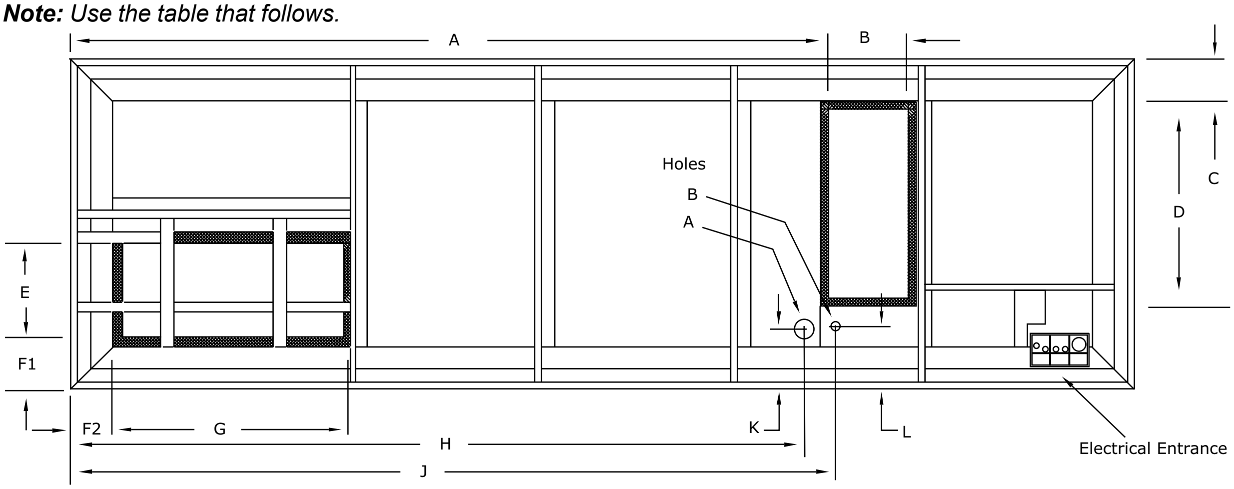
Table 6. CVPC furnace drain dimensions

Nom. Ton (AC/EC)	Furnace Size/MBh	Dimensions (Note)	
		Length	Height
20 & 25	Low = 235	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"
30	Low = 350	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"
40	Low = 350	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"
50-75	Low = 500	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"

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

Figure 5. Unit base dimensions, SEH_, SFH_, SLH_, SSH_, SXH_ units (20 to 75 ton)

Note: *Use the table that follows.*



Unit Base Notes:
1. SEH_ — For 200/230 volt electric heat units, use hole "A" (3⅝" diameter).
2. SFH_ — For gas heat units, use hole "B" (1¼" diameter).
3. SLH_ and SSH_ — For steam or hot water heat units, use holes "A" (3⅝" steam or hot water supply) and "B" (3" steam or hot water return).
4. SXH_ — In extended cabinet cooling only units, the holes are omitted

Table 7. Unit base dimensions, SEH_, SFH_, SLH_, SSH_, SXH_ units (20 to 75ton)—air cooled

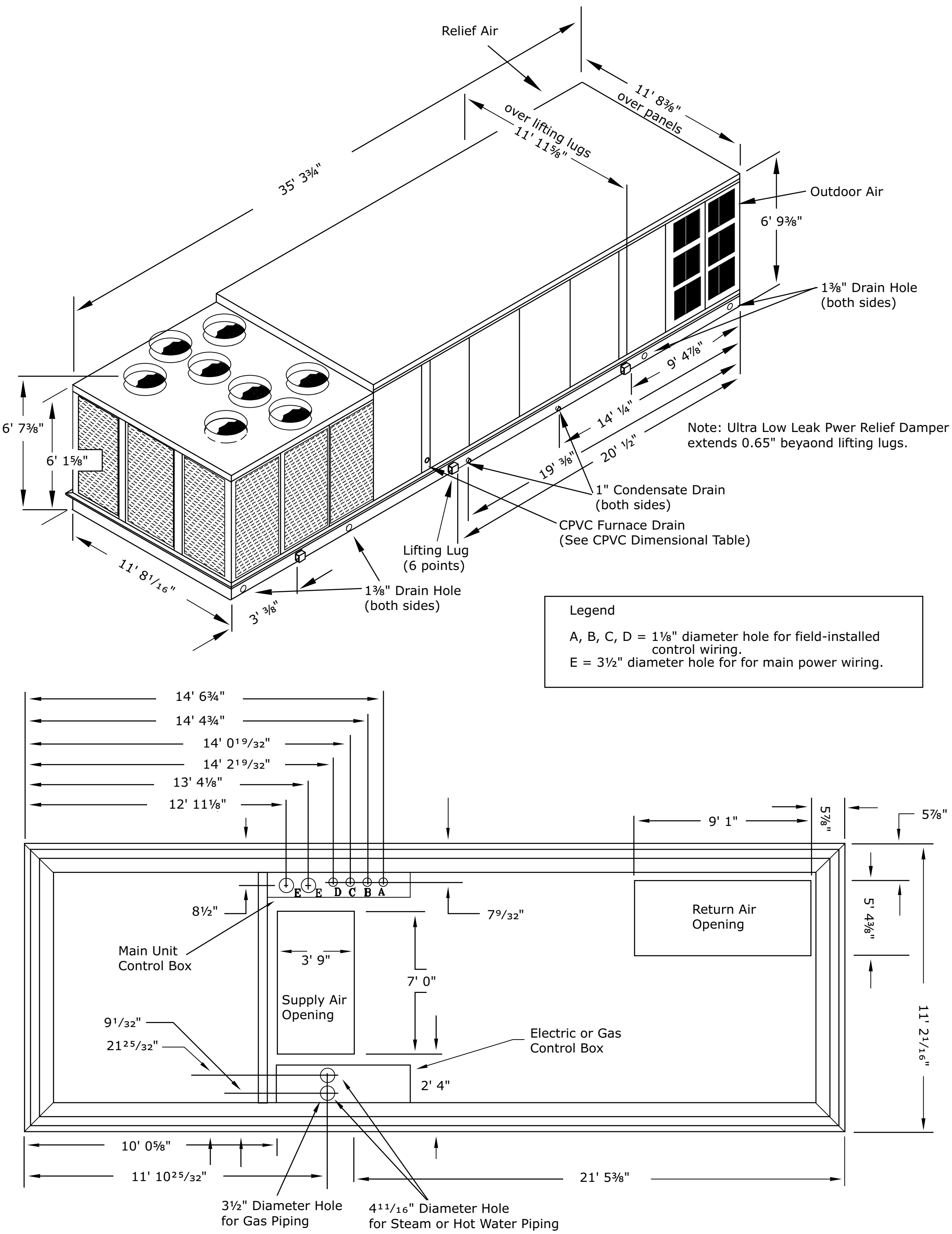
Nom. tons	A	B	C	D	E		F1		G		F2	
					Fan Type							
					Relief	Return	Relief	Return	Relief	Return	Relief	Return
20–30	16'–3 3/16"	2'–2 1/2"	5 13/16"	5'–7"	3'–4 3/8"	2'–9 15/16"	5 13/16"	8 1/4"	6'–6 15/16"	3'	5 13/16"	28 5/8"
40 & 50	19'–10 5/16"	2'–5"	7 1/16"	5'–7"	3'–4 3/8"	3'–1 1/2"	5 13/16"	8 1/4"	7'–8 3/16"	3'–4"	5 13/16"	32 15/16"
60	19'–10 5/16"	2'–5"	6 1/16"	Note 1	4'–5 3/8"	4'–2 1/2"	5 13/16"	8 1/4"	7'–8 3/16"	4'–5"	5 13/16"	26 7/16"
70–75	19'–10 5/16"	2'–5"	6 1/16"	Note 1	4'–5 3/8"	4'–2 1/2"	5 13/16"	8 1/4"	7'–8 3/16"	4'–5"	5 13/16"	26 7/16"

H	J	K	L
15'–5 5/16"	16'–9 3/4"	8 13/16"	9 1/16"
18'–11 11/16"	Note 2	8 3/16"	9 1/16"
18'–11 11/16"	Note 2	8 3/16"	9 1/16"
18'–11 11/16"	Note 2	8 3/16"	9 1/16"

Notes:

1. 5'–5 15/16" for SEH_ units or 7'–8 1/2" for SFH_, SLH_, SSH_, SXH_ units.
2. 20'–1 3/4" for SFH_ "High Heat" units or 20'–6 3/4" for SFH_ "Low Heat" units. Either is selectable in field for SL and SS Return.

Figure 6. S_H_ cooling and heating units (90-130 ton)



Center of Gravity

Figure 7. Center of gravity dimensional data

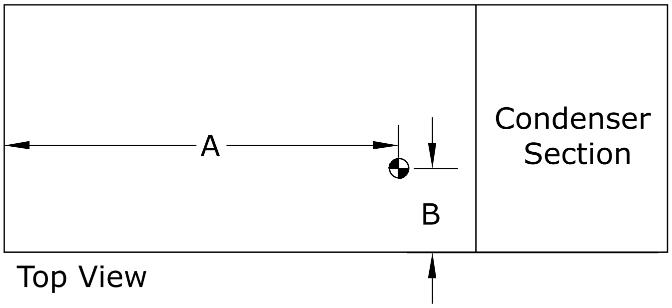


Table 8. Center of gravity dimensional data

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
SAH_	20	13' 5"	3' 10"	12' 9"	3' 9"	12' 3"	3' 10"
	25	13' 6"	3' 10"	12' 10"	3' 9"	12' 3"	3' 10"
	30	12' 10"	3' 10"	12' 0"	3' 9"	11' 6"	3' 10"
	40	17' 4"	4' 0"	16' 2"	3' 11"	15' 6"	3' 11"
	50	17' 6"	4' 0"	16' 4"	3' 11"	15' 8"	3' 11"
	55	17' 6"	4' 0"	16' 4"	3' 11"	15' 9"	3' 11"
	60	16' 11"	4' 10"	15' 9"	4' 8"	15' 2"	4' 9"
	70	16' 12"	4' 10"	15' 9"	4' 8"	15' 3"	4' 9"
	75	17' 6"	4' 10"	16' 3"	4' 8"	15' 8"	4' 9"
SHE_, SLH_, SSH_, SXH_	20	14' 7"	3' 9"	13' 11"	3' 8"	13' 4"	3' 9"
	25	14' 7"	3' 9"	13' 11"	3' 8"	13' 5"	3' 9"
	30	13' 12"	3' 9"	13' 1"	3' 8"	12' 7"	3' 9"
	40	18' 9"	3' 11"	17' 7"	3' 10"	16' 11"	3' 10"
	50	19' 1"	4' 0"	17' 10"	3' 11"	17' 2"	3' 11"
	55	19' 1"	4' 0"	17' 11"	3' 11"	17' 3"	3' 12"
	60	18' 5"	4' 9"	17' 1"	4' 7"	16' 5"	4' 8"
	70	18' 7"	4' 10"	17' 3"	4' 8"	16' 8"	4' 9"
	75	19' 1"	4' 10"	17' 9"	4' 8"	17' 2"	4' 9"
SFH_	20	14' 8"	3' 10"	14' 0"	3' 9"	13' 6"	3' 10"
	25	14' 9"	3' 9"	14' 1"	3' 8"	13' 6"	3' 9"
	30	14' 1"	3' 9"	13' 3"	3' 8"	12' 9"	3' 9"
	40	18' 11"	3' 11"	17' 9"	3' 10"	17' 2"	3' 10"
	50	19' 1"	3' 11"	17' 11"	3' 10"	17' 3"	3' 11"
	55	19' 1"	3' 11"	18' 0"	3' 10"	17' 4"	3' 11"
	60	18' 6"	4' 9"	17' 3"	4' 7"	16' 8"	4' 9"
	70	18' 7"	4' 9"	17' 4"	4' 7"	16' 9"	4' 8"
	75	19' 1"	4' 9"	17' 10"	4' 7"	17' 3"	4' 9"
SHE_, SLH_, SSH_, SXH_	90	19’ 11”	6’ 3”	18’ 5”	5’ 10”	17’ 5”	5’ 10”
	105	20’ 4”	6’ 3”	18’ 10”	5’ 11”	17’ 10”	6’ 0”
	115	20’ 0”	6’ 3”	18’ 6”	5’ 11”	17’ 7”	6’ 0”
	130	19’ 11”	6’ 3”	18’ 6”	5’ 11”	17’ 7”	6’ 0”
SFH_	90	19’ 11”	6’ 4”	18’ 6”	6’ 0”	17’ 6”	5’ 11”
	105	20’ 4”	6’ 4”	18’ 11”	6’ 0”	18’ 0”	6’ 1”
	115	20’ 0”	6’ 4”	18’ 7”	6’ 0”	17’ 8”	6’ 1”
	130	20’ 0”	6’ 4”	18’ 7”	6’ 0”	17’ 8”	6’ 0”

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

Electrical Entry Details

Figure 8. Electrical entrance dimensions, SAH_ cooling only units (20 to 75 ton)

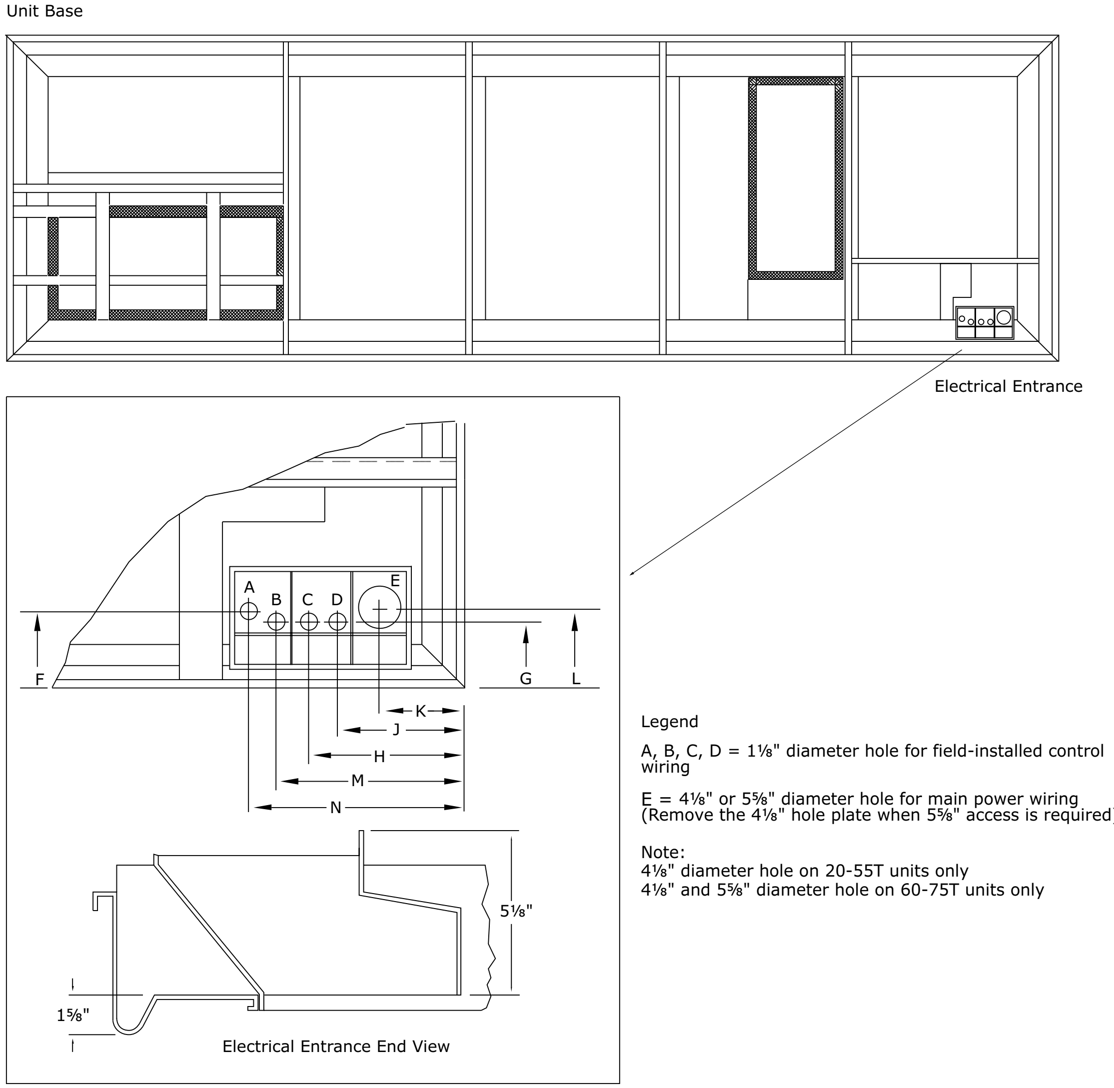


Table 9. Electrical entrance dimensions, SAH_ cooling only units (20 to 75 ton)

Nom. Tons	F	G	H	J	K	L	M	N
20 - 30	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	8 7/8"	7 7/8"	17 7/8"	15 7/8"	9 29/32"	10 3/16"	20 13/32"	22 5/32"

Figure 9. Electrical entrance dimensions, SEH_, SFH_, SLH_, SXH_ units (20 to 75 tons)

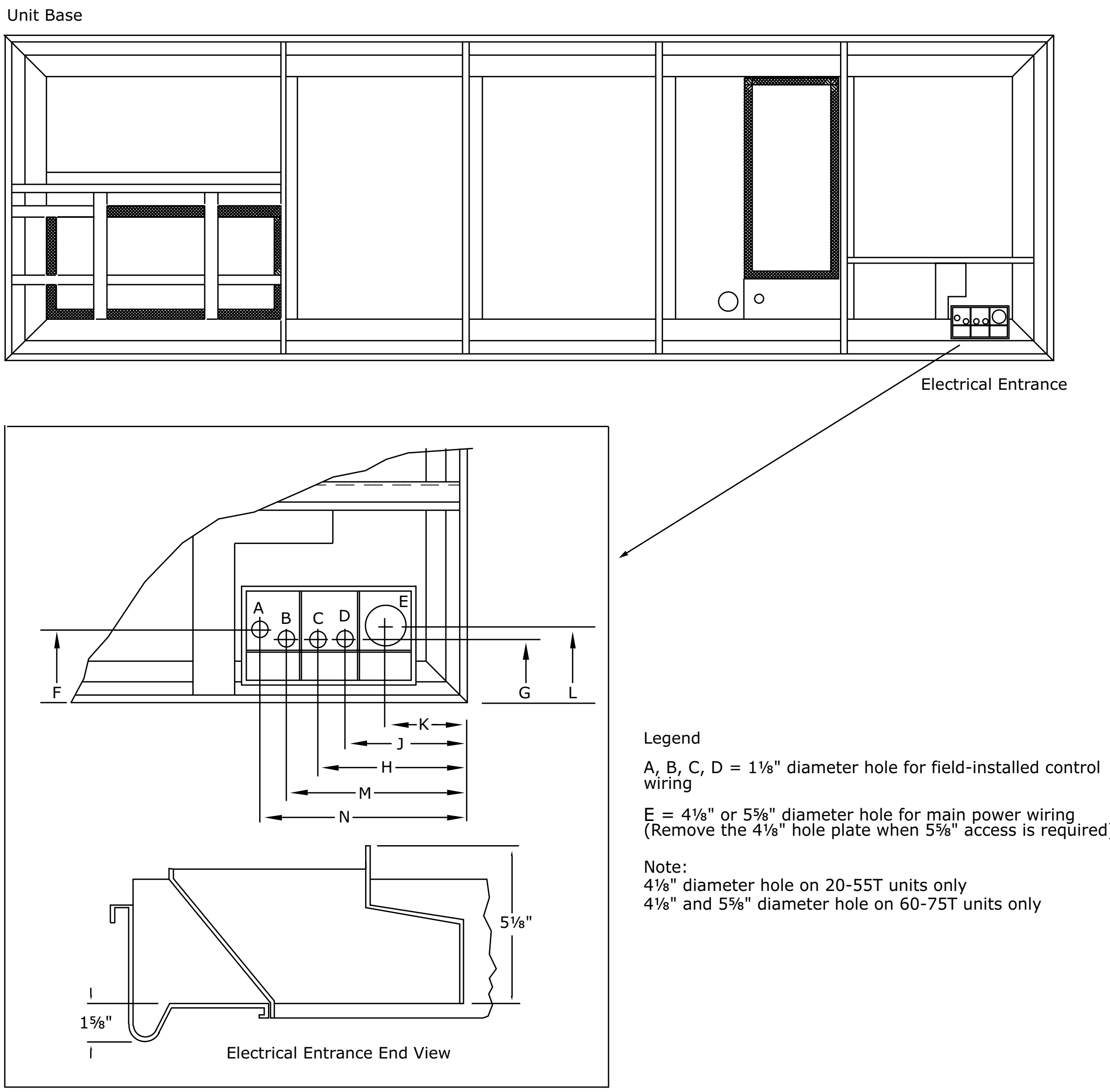
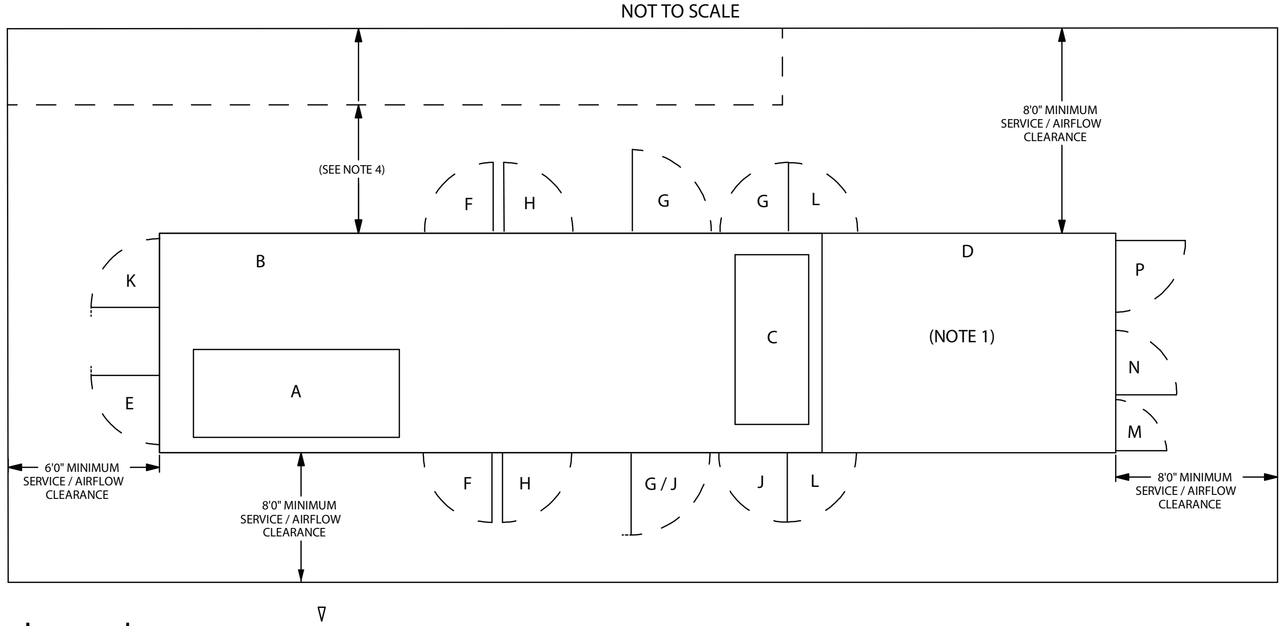


Table 10. Electrical entrance dimensions, SEH_, SFH_, SLH_, SSH_, SXH_ units (20 to 75 ton)

Nom. Tons	F	G	H	J	K	L	M	N
20 - 30	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	8 7/8"	7 7/8"	17 7/8"	15 7/8"	9 29/32"	10 3/16"	20 13/32"	22 5/32"

Minimum Required Clearance

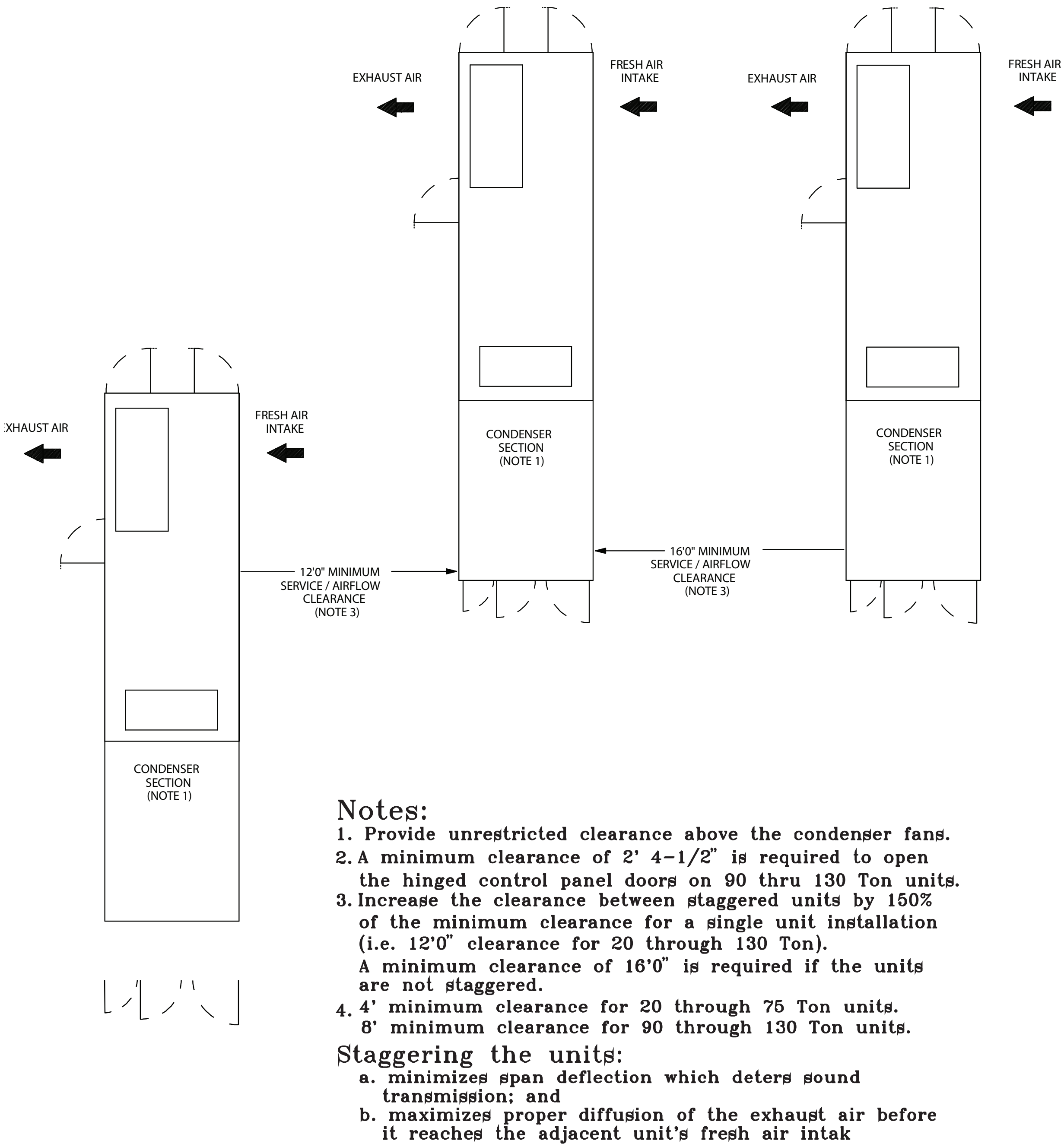
Figure 10. Minimum operation and service clearances for single unit installation



Legend

A = Return Air Opening
B = Outside 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" optional Heater or Final Filter 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 20.5"Control Panel Door (180 deg swing) (20-75 ton)
N = Hinged 26.5"Control Panel Door (180 deg swing) (20-75 ton)
P = Hinged 32"Control Panel Door (180 deg swing) (20-75 ton)

Figure 11. Minimum operation and service clearances for multiple unit installation



Weights

Table 11. Air-cooled condenser - approximate operating weights (lbs.)

Unit	Without Exhaust Fan						With Exhaust Fan					
	SA	SX	SE	SF	SL	SS	SA	SX	SE	SF	SL	SS
20	4599	4919	5184	5439	5309	5473	4897	5217	5482	5737	5607	5771
25	4602	4922	5187	5442	5312	5576	4906	5226	5491	5746	5616	5880
30	5035	5381	5646	5901	5771	5933	5492	5838	6103	6358	6228	6390
40	7130	7485	7810	8200	8020	7700	7800	8155	8480	8870	8690	8370
50	7554	8004	8329	8719	8539	8270	8273	8723	9048	9438	9258	8989
55	7560	8004	8329	8719	8539	8270	8279	8723	9048	9438	9258	8989
60	8835	9481	9806	10296	10291	10464	9778	10424	10749	11239	11234	11407
70	9018	9663	9988	10478	10473	10646	9961	10606	10931	11421	11416	11589
75	9350	9999	10324	10814	10809	10982	10293	10942	11267	11757	11752	11925
90	X	13167	13322	13967	14042	14017	X	14505	14660	15305	15380	15355
105	X	13800	13955	14600	14675	14650	X	15138	15293	15938	16013	15988
115	X	14004	14159	14804	14879	14854	X	15342	15497	16142	16217	16192
130	X	14942	14445	15090	15165	15140	X	16280	15783	16428	16503	16478

Notes:

1. Weights shown are for air-cooled units with standard efficiency and include the following features: FC fans, Supply Fan VFD, standard scroll compressors, 100% economizer, throwaway filters, maximum motor sizes, 460V XL start, high capacity heat, and access doors.
2. Weights shown represent approximate operating weights and have a ±10% accuracy. To calculate weight for a specific unit configuration, utilize Trane Select Assist or contact the local Trane® sales representative. ACTUAL WEIGHTS ARE STAMPED ON THE UNIT NAMEPLATE.

Table 12. Roof curb max weight (lbs./kg.)

Unit	Roof Curb Max. Weight	
	SAH_	SEH_, SFH_, SLH_, SSH, SXH_
20, 25, 30	490	510
40, 50, 55	515	550
60, 70, 75	610	640
90-130	N/A	770

Note: Roof curb weights include the curb and pedestal.

A2L Information and Installation Requirements

Installation/Code Compliance Requirements

Building level controls may need to be upgraded/modified to demand leak mitigation actions as described in "Leak Detection System (Refrigerant charge greater than 3.91 lb per circuit)," p. 34. Those actions include, but are not limited to, fully opening damper and VAV boxes (if present), and disabling electric heat in VAV boxes (if present).

Verify the equipment refrigerant charge is in accordance with the room area limitation as described in Minimum Room Area Limits section.

Ensure that there are labels on the equipment stating it contains a flammable refrigerant.

A2L Work Procedures

⚠ WARNING

Risk of Fire — Flammable Refrigerant!

Failure to follow instructions below could result in death or serious injury, and equipment damage.

- **To be repaired only by trained service personnel.**
- **Do not puncture refrigerant tubing.**
- **Dispose of properly in accordance with federal or local regulations.**
- **The equipment shall be stored in a room without continuously operating ignition sources.**

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.
System contains 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.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

The units described in this manual use R-454B refrigerant. Use ONLY R-454B rated service equipment or components with these units. For specific handling concerns with R-454B, contact your local Trane representative.

Installation, repair, removal, or disposal should be performed by trained service personnel.

At all times, Trane's maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

Servicing

Prior to initiating work on equipment, check the area with an appropriate refrigerant detector. Ensure the service personnel are properly trained regarding work in potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed, or intrinsically safe. Be aware that the refrigerant does not contain an odor.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry powder or CO_2 fire extinguisher should be located adjacent to the charging area.

At all times, Trane's maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

All maintenance staff and others working in the local area shall be instructed on the nature of the work being carried out. Work in confined spaces shall be avoided.

Ignition Source Mitigation

Do not use any sources of ignition when working on the refrigeration system.

Keep all ignition sources, including cigarette smoking, away from the site of installation, repair, removal or disposal, during which refrigerant can potentially be released to the surrounding space.

Survey the area around the equipment before initiating work to ensure no flammable hazards or ignition risks are present.

"No Smoking" signs shall be displayed.

Do not use devices that can be a source of ignition to accelerate defrosting of components. Use only defrost and cleaning procedures recommended by Trane. Do not pierce or burn.

Ventilation

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere. If present, check that the ventilation system, including outlets, are operating adequately and are not obstructed.

Refrigerating Equipment

Refrigerant piping or components should not be installed in locations where substances which may corrode them are present.

Check that equipment hazard markings are visible and legible. Replace them if they are not.

For equipment using secondary fluids, like water or glycol, check that refrigerant is not present in the secondary fluid loop before conducting any hot work.

Electrical Devices

Do not apply power to the circuit if a fault exists which compromises safety. If the fault cannot be corrected immediately, but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

Initial safety checks shall include:

- Cabling is not subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. Account for the effects of aging or continual vibration from sources such as compressors or fans.
- Capacitors are discharged. This shall be done in a safe manner to avoid possibility of sparking.
- No live electrical components and wiring are exposed while charging, recovering, or purging the system.
- Verify continuity of earth bonding.
- Replace electrical components with Trane replacement parts, or those meeting the same ratings and qualified for flame arrest protection, UL LZGH2 category.

Leak Detection

Never use an open flame to detect leaks. A halide torch should not be used. Use only approved leak detection methods per this instruction manual.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL gas (25% maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/ extinguished.

If a refrigerant leak is found which requires brazing, all refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

Refrigerant Removal and Evacuation

Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (special cylinders for the recovery of refrigerant, for example). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

1. Safely remove refrigerant following local and national regulations.
2. Evacuate.
3. Purge the circuit with inert gas.
4. Evacuate (optional for A2L).
5. Continuously flush or purge with inert gas when using flame to open circuit.
6. Open the circuit.

Prior to refrigerant removal, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

The recovery equipment shall be in good working order with instructions available. Equipment shall be suitable for the recovery of the flammable refrigerant. For specific handling concerns, contact the manufacturer. Ensure all hose connections are checked for tightness to avoid refrigerant leaks.

In addition, a set of calibrated weighing scales shall be available and in good working order.

The refrigerant shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. Do not mix refrigerants in recovery unit and especially not in cylinders.

Refrigerant recovery unit should be purged with an inert gas after each use or before using with a different refrigerant Class – for example, A2L to A1.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

The system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

The system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Refrigerant Charging

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Prior to refrigerant charging, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

Verify the equipment refrigerant charge is in accordance with the room area limitation as described in Minimum Room Area Limits section.

Decommissioning

Before carrying out the decommissioning procedure, it is essential that the trained service personnel is completely familiar with the equipment and all its details. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
    a. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
    b. All personal protective equipment is available and being used correctly.
    c. The recovery process is supervised at all times by a competent person.
    d. Recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.
12. When equipment has been decommissioned, attach a signed and dated label stating it has been decommissioned and emptied of refrigerant.
13. Ensure that there are labels on the equipment stating it contains flammable refrigerant.

A2L Application Considerations

This product is listed to UL standard 60335-2-40, Household and Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers, which defines safe design and use strategies for equipment using A2L refrigerants. This standard limits the refrigerant concentration in a space in the event of a refrigerant leak. To meet the requirements, the UL standard defines minimum room area, refrigerant charge limit, minimum circulation airflow and/or ventilation airflow requirements, and limits the use of ignition sources in spaces. The standard may require a unit refrigerant leak detection system.

For equipment with R-454B and charge amounts less than or equal to 3.91 lbs per circuit, this UL standard does not prescribe a room area limit and does not require a refrigerant leak detection system or any circulation airflow or ventilation airflow mitigation strategies. However, ignition sources in ductwork must be evaluated.

Depending on the application, a specific requirement of ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems, could be more stringent than UL 60335-2-40 requirements. See *Refrigeration Systems and Machinery Rooms Application Considerations for Compliance with ASHRAE® Standard 15-2022 Application Engineering Manual* (APP-APM001*-EN) for more information.

Ignition Sources in Ductwork

Do not install open flames in the ductwork. Hot surfaces exceeding 700°C (1290°F) should not be installed in the ductwork unless the average airflow velocity is not less than 1.0 m\s (200 ft\min) across the heater and proof of airflow is verified before system is energized.

Electric heaters can exceed the surface temperature limit if airflow distribution is poor, or insufficient airflow is provided over the heater.

Surface temperatures of most gas heaters do not exceed the surface temperature limits due to ANSI construction requirements.

Ignition Sources in Unit

This unit does not contain any ignition sources. All potential ignition sources, (including factory or field installed accessory electric heaters, gas heaters, relays, and contactors) were evaluated during product UL listing.

Minimum Room Area Limits (Refrigerant charge greater than 3.91 lb per circuit)

Equipment with R–454B charge amounts greater than 3.91 lb per circuit may require additional circulation or ventilation airflow mitigation strategies. In this case, two minimum room area (A_{min}) thresholds:

- The first threshold defines when equipment serving a single room is required to provide circulation airflow, either continuous or activated by a leak detection system. A ducted system requires circulation airflow unless the smallest room it serves is larger than the adjusted A_{min} threshold. This product contains a leak detection system if a circuit charge is greater than 3.91 lbs. As a result, no further leak detection system evaluation is required.
- The second threshold defines when additional ventilation airflow is required. If the room area, A or TA, is below the adjusted A_{min} or TA_{min} threshold, additional ventilation is required to remove refrigerant in the event of a leak. Refer to UL 60335-2-40 Clause GG.8 and ANSI\ASHRAE Standard 15 Section 7 for natural and mechanical ventilation requirements.

Table 13. Minimum room area

		Minimum Room Area[a]	
Tonnage	Eff	m2	ft2
20	S	40	427
20	H	42	450
20	V	42	457
25	S	46	491
25	H	49	532
25	V	47	510
30	S	50	536
30	H	57	611
30	V	50	543
40	S	71	765
40	H	73	791
40	V	73	787
50	S	84	900
50	H	100	1072
50	V	101	1083
55	S	81	873
55	H	96	1038
55	V	99	1061
60	S	100	1072
60	H	115	1233
60	V	116	1248
70	S	104	1121
70	H	133	1428
70	V	139	1499
75	S	130	1398
75	H	127	1372
75	V	126	1361
90	S	158	1705
90	H	194	2091
105	S	178	1919
115	S	187	2009
130	S	169	1822

(a) Based 2.2M installation height and maximum refrigerant charge

Minimum Room Area (A_{min}) Adjustments

Use equation below to adjust the minimum room area, as applicable, based on the unit's installation height, altitude, and occupancy level it serves.

$$A_{min.adj} = \text{Nameplate } A_{min} \times \text{Altitude Adj} \times \text{Height Adj} \times F_{occ}$$

Multiply the altitude adjustment factor in the table below by A_{min} listed on the unit nameplate or in the Installation, Operation, and Maintenance (IOM) manual.

Table 14. Altitude adjustment factor

Altitude (ft)	Sea Level to 2000	2001 to 4000	4001 to 6000	6001 to 8000	8001 to 10000	10001 to 12000	12001 to 14000	14001 to 15000	Over 15000
A_{min} Adjustment	1	1.05	1.11	1.17	1.24	1.32	1.41	1.51	1.57

In addition, A_{min} can be adjusted if the unit is installed in a room at a height that is higher than the minimum height shown on the unit. To adjust A_{min}, multiply by the ratio of the unit minimum release height (in meters) / actual release height (in meters). Use 0.6 m in the ratio for unit minimum installation heights less than or equal to 0.6 m.

For institutional occupancies, ASHRAE Standard 15 applies an additional adjustment factor F_{occ} to the amount of a charge allowed in a space. To calculate the adjusted A_{min} for institutional occupancies, multiply the A_{min} on the nameplate by two.

EXAMPLE 1: 20 Ton Packaged Rooftop Multi-Zone VAV System Serving an Institutional Occupancy Space

The packaged unit serves 7600 ft^2 of a nursing home located at an attitude of 4000 ft. The unit has two equally charged 10 ton refrigeration circuits. Each circuit has 12 lbs of refrigerant with a minimum room area requirement of 180 ft^2 with a 2.2 m release height.

$$TA_{min.adj} = 180\ ft^2 \times 1.05 \times 2 = 378\ ft^2$$

No additional ventilation is required.

EXAMPLE 2: 10 Ton Split System Serving a Single Commercial Occupancy Space

The split system serves a 1500 ft^2 manufacturing space at 5000 ft altitude. The final installed charge of the single circuit 10 ton unit is 20 lb. The unit has an open return with a release height of 1 m and ducted supply air. The unit A_{min} is 660 ft^2.

$$A_{min.adj} = 660\ ft^2 \times 1.11 = 733\ ft^2$$

No additional ventilation is required.

Determining Room Area (A or TA)

The room area (A) is the room area enclosed by the projection to the floor of the walls, partitions, and doors of the space that the equipment serves. For ducted systems, total room area (TA) of all rooms connected by ducts, may be used instead of A.

Rooms connected by drop ceilings only are not considered a single room.

Rooms on the same floor of the building, and connected by an open passageway, can be considered part of the same room if the passageway is a permanent opening, extends to the floor and is intended for people to walk through.

Adjacent rooms on the same floor of the building and connected by permanent openings in the walls and/or doors between rooms (including gaps between the wall and the floor), can be considered part of the same room if the openings meet the following criteria.

- The opening is permanent and cannot be closed.
- Openings extending to the floor, such as door gaps, need to be at least 20 mm above the floor covering surface.
- Natural ventilations opening areas must meet the requirements of ANSI\ASHRAE Standard 15-2022, Section 7.2.3.2.

Rooms that are connected by a mechanical ventilation system can be considered a single room area if the mechanical ventilation system meets the requirements of ANSI\ASHRAE Standard 15-2022, Section 7.6.4.

Leak Detection System (Refrigerant charge greater than 3.91 lb per circuit)

The leak detection system consists of one or more refrigerant detection sensors. When the system detects a leak, the following mitigation actions will be initiated until refrigerant has not been detected for at least 5 minutes:

- Energize the supply fan(s) to deliver a required minimum amount of circulation airflow.
- Disable compressor operation.
- Provide an output signal that can be used to fully open zone dampers and/or VAV boxes and disable electric heat in VAV boxes.
- Provide an output signal that can be used to energize additional mechanical ventilation (if needed).
- Units without airflow proving will disable electric heat sources.

Building fire and smoke systems may override this function.

If the refrigerant sensor has a fault, is at the end of its life, or is disconnected, the unit will initiate the mitigation actions. Mitigation actions may be verified by disconnecting the sensor.

The refrigerant sensors do not need service. Use only manufacturer-approved sensors when replacement is required.

Installation

Roof Curb and Ductwork

The roof curbs consist of two main components: a pedestal to support the unit condenser section and a “full perimeter” enclosure to support the unit’s air handler section.

Before installing any roof curb, verify the following:

- It is the correct curb for the unit.
- It includes the necessary gaskets and hardware.
- The purposed installation location provides the required clearance for proper operation.
- 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 applicationsexcluding 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 is located at the bottom right-hand corner of the control panel. illustrates the location for the electrical entrance through the base in order to enter the control panel. If the power supply conduit penetrates the building 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, ±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 12, p. 36.

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.

If a Trane Curb Accessory Kit is not used:

- The ductwork can be attached directly to the factory-provided flanges around the unit 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.
- If a “built-up” curb is provided by others, it should NOT be made of wood.
- 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 without the IRU option, 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 18, p. 43 to reduce potential airflow disturbances at the return fan inlet that could contribute to unusual return fan noise.
- If a full perimeter curb is used, make sure the IRU option was added to the unit to ensure stability in the condenser section

Figure 12. Pitch pocket location

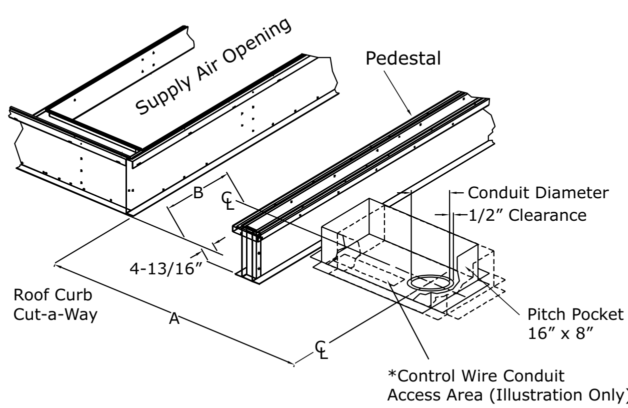


Table 15. Pitch pocket dimensions — S*HL

Tonnage	"A" Dimension	"B" Dimension
20, 25 & 30	4' 5–9/16"	5–9/16"
24, 29, & 36	6' 9–11/16"	5–1/2"
40–75	9' 5–11/16"	5–1/2"

Note: For all unit functions (SAH_, SEH_, SFH_, SLH_, SSH_, and SXH_).

Unit Rigging and Placement

⚠ WARNING

Heavy Object!

Failure to follow instructions below could result in unit dropping which could result in death or serious injury, and equipment or property-only damage. 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.

Note: *Use spreader bars as shown in the diagram. Refer to "Weights," p. 29 or the unit nameplate for the unit weight. Refer to the Installation Instructions located inside the side control panel for further rigging information.*

1. To configure the unit Center-of-Gravity, utilize Trane Select Assist or contact the local Trane sales office.
2. Attach adequate strength lifting slings to all four lifting lugs on 20-30 ton units and all six lifting lugs on the 40-130 ton units. The minimum distance between the lifting hook and the top of the unit should be 7 feet for 20-30 ton units and 12 feet for 40-130 ton units. Figure 13, p. 38 illustrates the installation of spreader bars to protect the unit and to facilitate a uniform lift. lists the typical unit operating weights.
3. Test lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments. Slightly pitch the unit (no more than 1 ft) so the condenser end is above the return end of the unit. This will aid in aligning the unit with the roof curb described in Step 5Installation_Unit Rigging and Placement.
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.

   Important: *For replacements, remove old gasket from the roof curb and place new gasket material on curb. See "Installation of New Units," p. 74 to determine gasket material length using roof curb dimensions.*
5. Align the base rail of the unit 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 condenser section)

   A cross section of the juncture between the unit and the roof curb is shown below.

Figure 13. Unit rigging

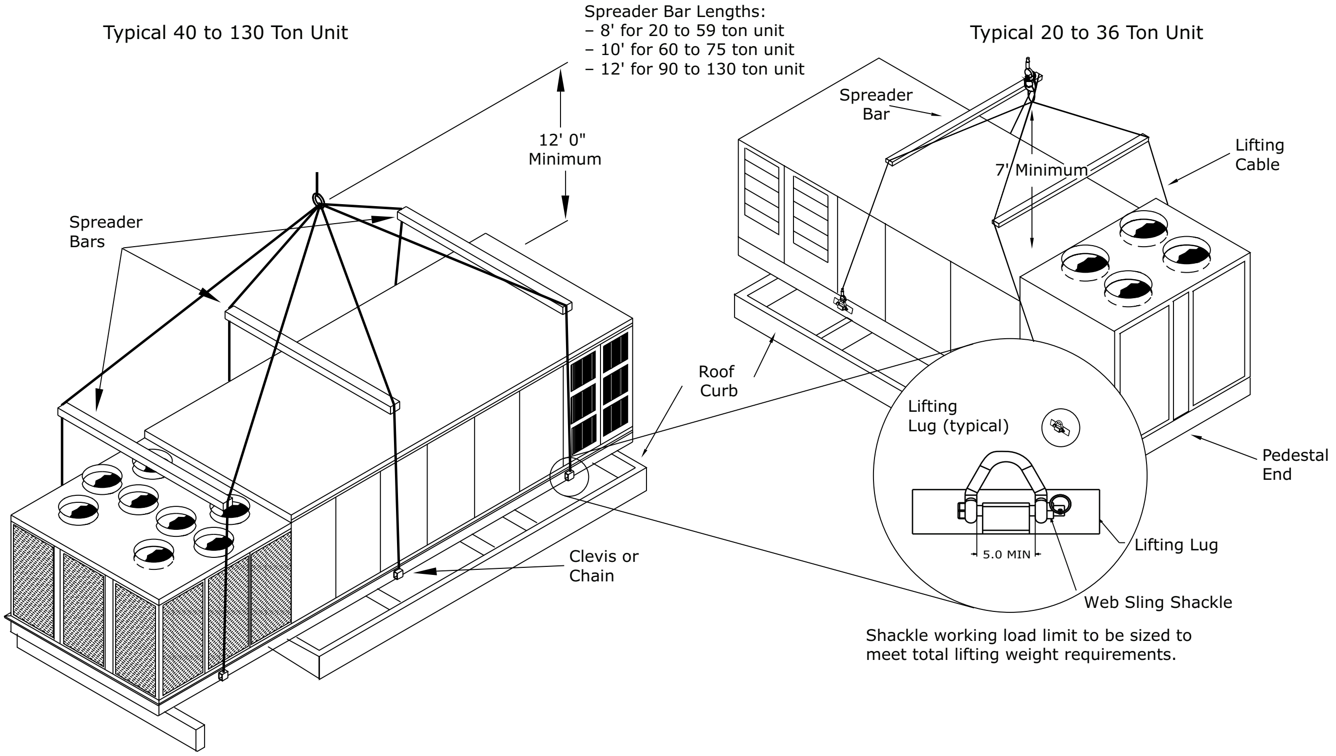
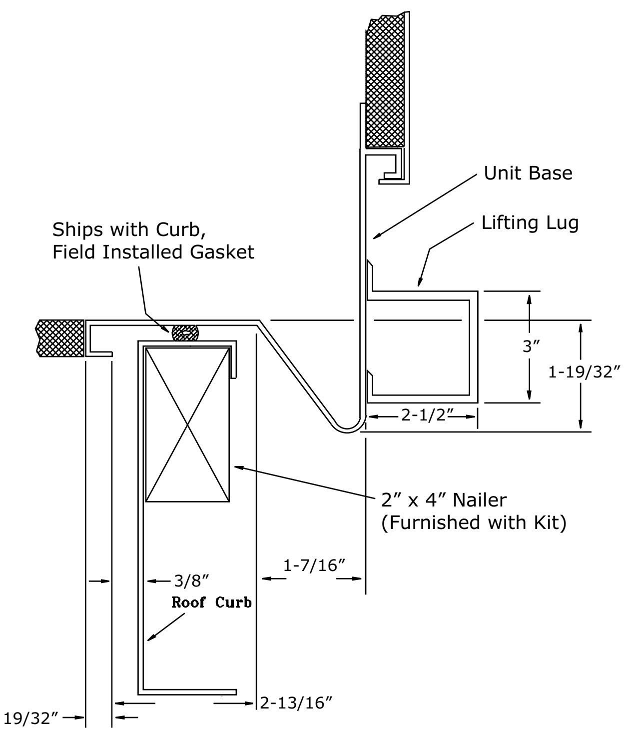


Figure 14. Typical unit base and roof curb cross section



General Installation Requirements

The checklist 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.

- ☐ Complete “Unit Inspection,” p. 14 checklist.
- ☐ Verify that the installation location of the unit will provide the required clearance for proper operation.
- ☐ Assemble and install the roof curb. Refer to the current edition of the roof curb installer’s guide.
- ☐ Fabricate and install ductwork; secure ductwork to curb. Do not use the unit to support the weight of the ducting.
- ☐ 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 hardware from each compressor assembly.

- ☐ Remove the shipping hold-down bolts and shipping channels from the supply and relief /return fans with rubber or spring isolators.
- ☐ Check all supply and relief/return fan spring isolators for proper adjustment.
- ☐ Verify that all plastic coverings are removed from the compressors.
- ☐ Verify all discharge line service valves (one per circuit) are back seated.

Main Electrical Power

- ☐ Verify that the power supply complies with the unit nameplate specifications. Refer to Main Unit Power Wiring in the Installation chapter.
- ☐ 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.
- ☐ All field-installed wiring must comply with NEC and applicable local codes.

Field Installed Control Wiring

- ☐ Complete the field wiring connections for the variable air volume controls as applicable.

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

Electric Heat Units

- ☐ 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.
- ☐ On SEH_L units with 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 3XD5, or to an optional unit-mounted disconnect switch 3QB4.

Gas Heat (SFH_)

- ☐ Gas supply line properly sized and connected to the unit gas train.
- ☐ Properly sized unit gas regulator installed to regulate pressure from supply.
- ☐ 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.
- ☐ LP (Propane) kit parts installed (if required).
- ☐ Connect the 3/4" CPVC furnace drain stubout to a proper condensate drain. Provide heat tape or insulation for condensate drain as needed.

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.
- ☐ Refer to the schematic to complete the valve actuator wiring.

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).

Modulating Reheat (S_H_)

- ☐ Install space humidity and temperature sensors. Refer to unit diagrams for guidelines.

Condensate Drain Connections

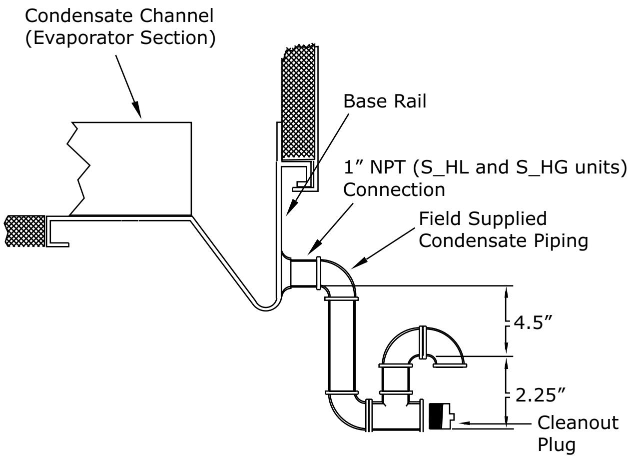
Each unit is provided with 1" evaporator condensate drain connections (two on each side of the unit for FC supply fans and one on each side of the unit for DDP supply fans).

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 for the location of these drain connections.

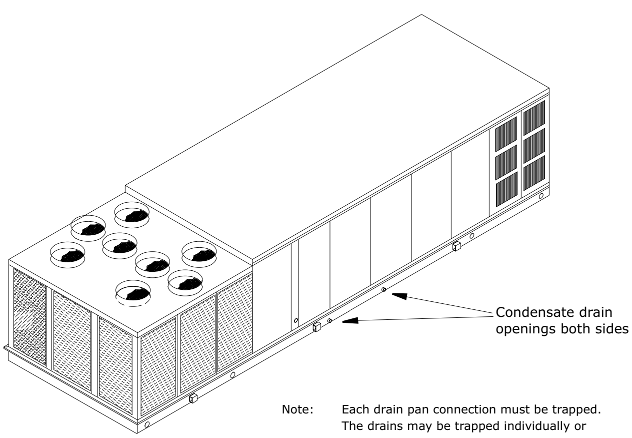
A condensate trap must be installed due to the drain connection being on the "negative pressure" side of the fan. Install the P Traps at the unit using the guidelines in Figure 15, p. 40.

Figure 15. Condensate trap installation



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

Figure 16. Condensate drain locations



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 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.

Note: *Installation on gas heat units will require addition of heat tape to the condensate drain.*

Removing Supply and Relief/ Return Fan Shipping Channels (motors >5 Hp)

Each FC supply fan assembly and relief fan assembly for S_H_ units shipped with a motor larger than 5 HP is equipped with rubber isolators (as standard) or optional spring isolators. Each DDP supply fan assembly for SAH_ and SXH_ units is equipped with spring isolators. Each return fan assembly for 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 18, p. 43 and Figure 20, p. 45, and use the following procedures:

Spring Isolators

See Figure 18, p. 43 through Figure 20, p. 45 for spring isolator locations.

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

   Notes:

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

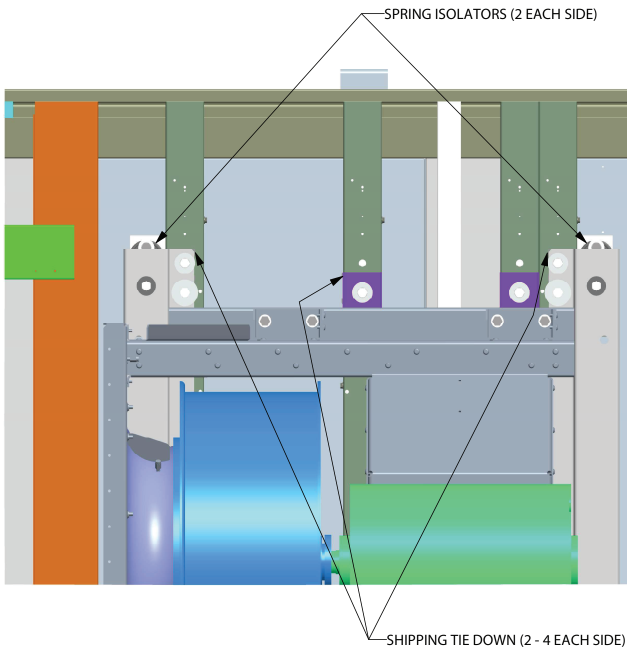
Optional DDP Supply Fan Shipping Channel Removal and Isolator Spring Adjustment

Shipping Tie Down and Isolator Spring Adjustment

Remove shipping tie down bolt and washer (4—20 to 30 ton, 6—40 to 55 ton, 8—60 to 75 ton). **Leave shipping channels in place.** Verify spring height is 0.1" to 0.2" above shipping channel. Spring height is factory set but verify and adjust as needed as follows:

1. Back off ALL spring isolator jam nuts (4) at top of assembly (adjusting one spring effects all others)
2. Turn adjustment bolt (make small adjustments; again each change effects all other springs. Clockwise raises; counter clockwise lowers).
3. When correctly adjusted re-tighten jam nuts and **remove shipping channels. Do NOT remove electrical ground wire strap between isolation base and unit base.**

Figure 17. DDP shipping channel removal, isolator spring adjustment



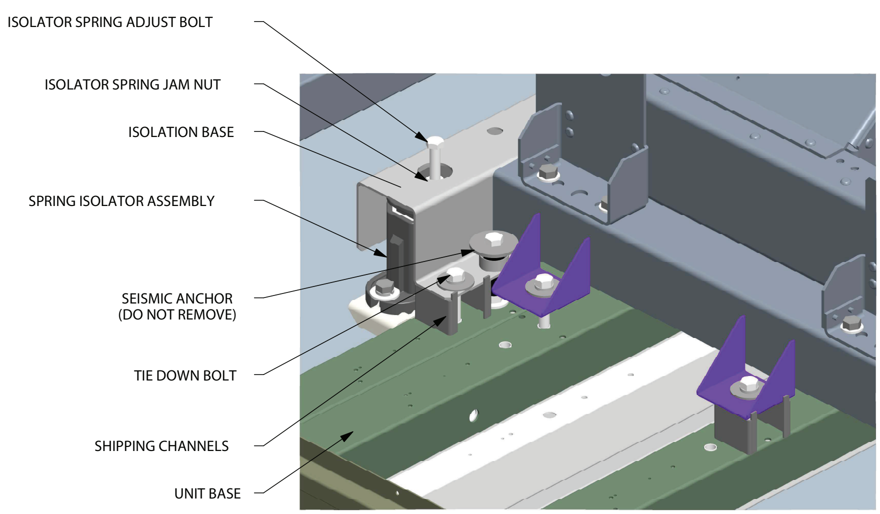


Figure 18. Removing supply and relief fan assembly shipping hardware (20 to 75 ton)

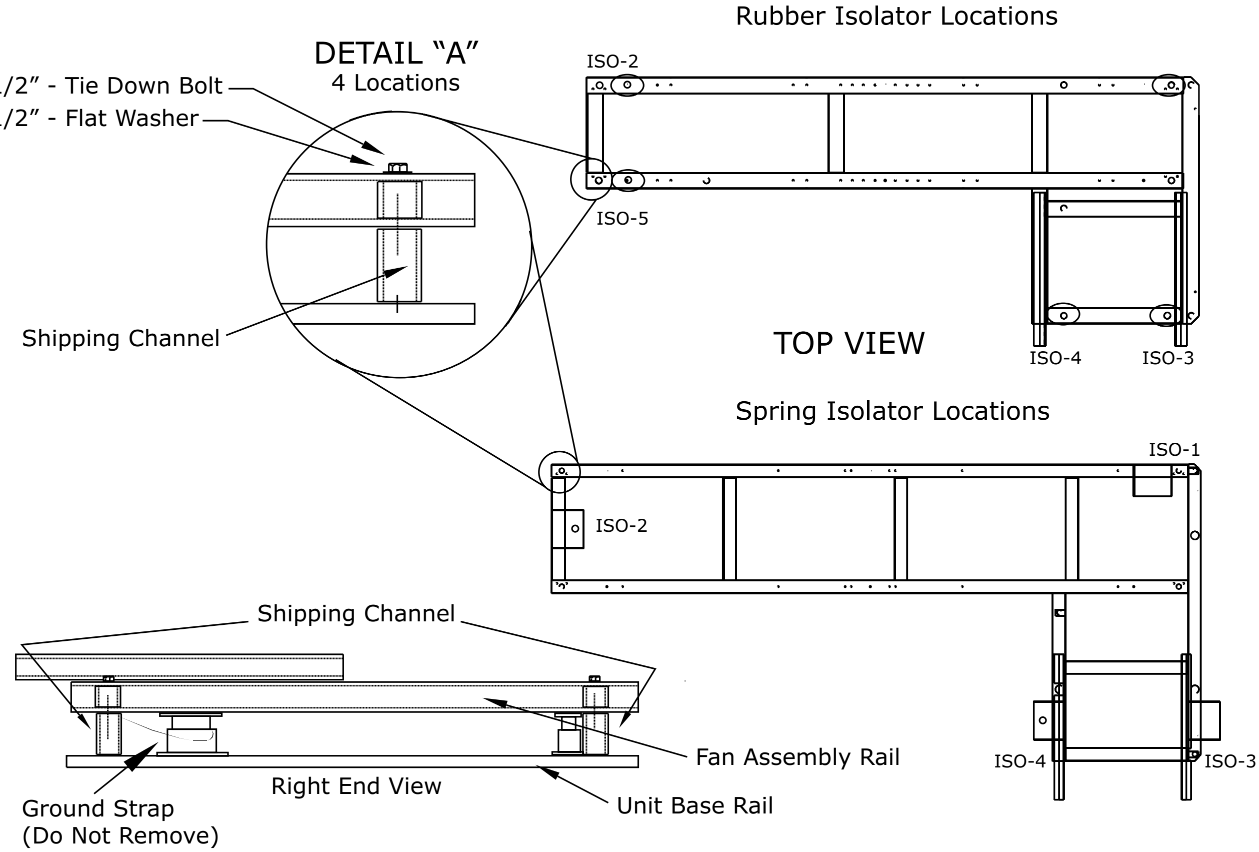


Figure 19. Removing supply and relief fan assembly shipping hardware (90 to130 ton)

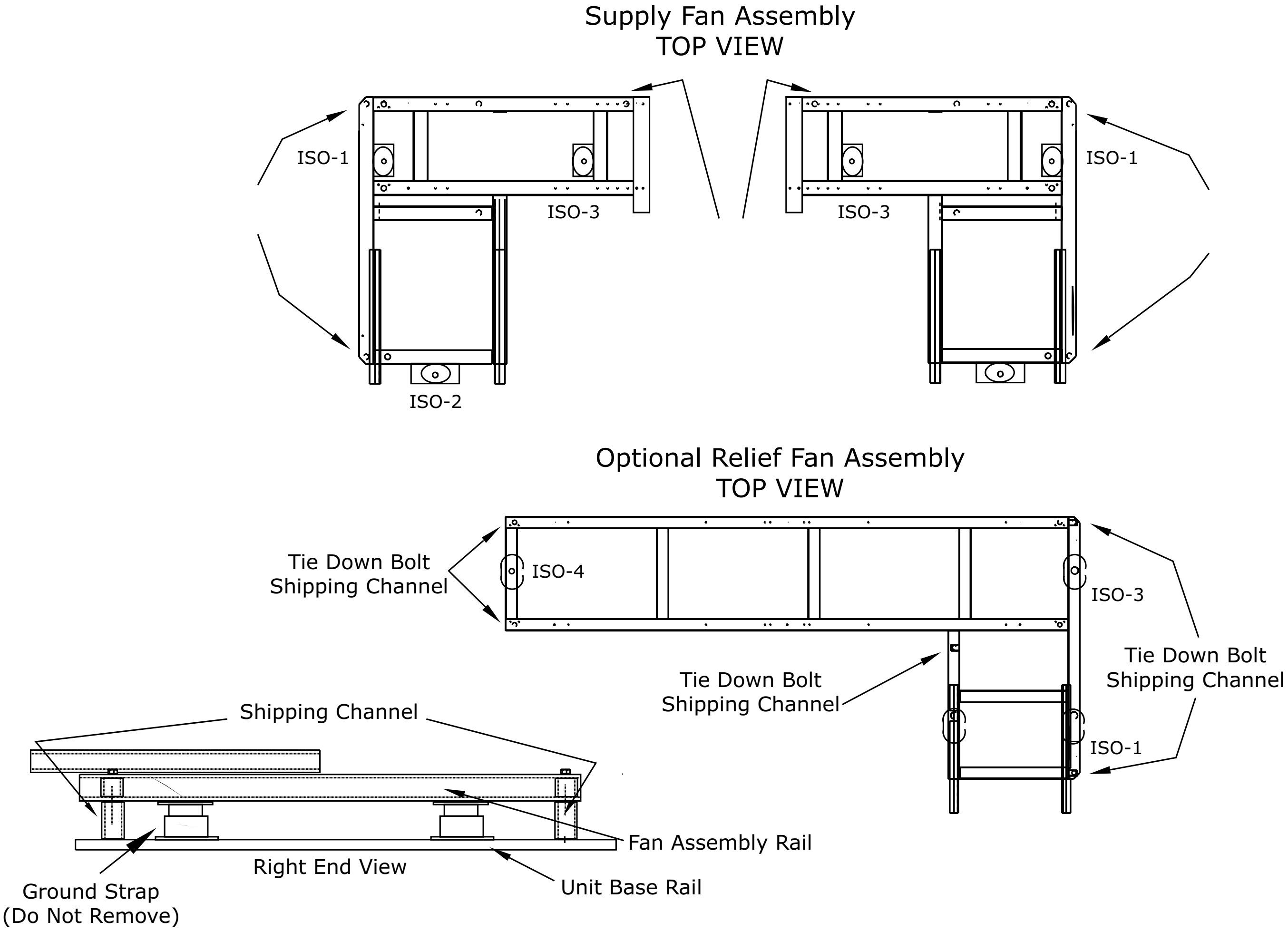
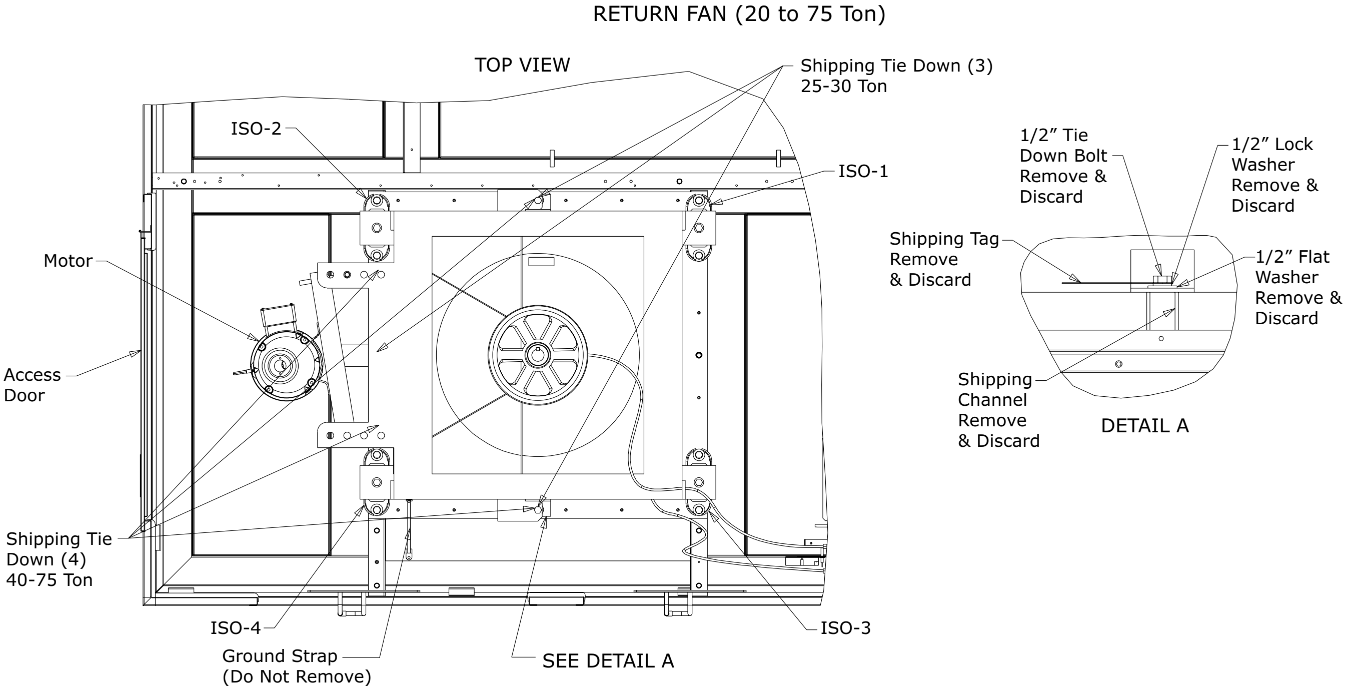


Figure 20. Removing return fan assembly shipping hardware (20 to 75 ton)



Wireless Communication Interface (WCI)

The wireless communication interface is located in the return section of the unit when a return fan is not installed. This provides wireless access to the building through the return duct work.

O/A Sensor and 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 units with 100% modulating relief with Statitrac.

On VAV systems, a duct pressure transducer and the outside air sensor is used to control the discharge duct static pressure to within a customer-specified parameter. On VAV units equipped with 100% modulating relief with Statitrac, a space pressure transducer (3U62) and the outside air sensor is used to control the relief 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.

Use the following steps and images 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:
   a. O/A static pressure sensor with slotted mounting bracket
   b. 50 ft. 3/16" O.D. pneumatic tubing
   c. Mounting hardware
2. Using two #10-32 x 1¾" screws provided, install the sensor's mounting bracket to the factory-installed bracket (near the filter section).
3. Using the #10-32 x ½" 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 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. Note that most of the tubing is not needed.

   Note: *Use only what is required and discard excess tubing.*

Figure 21. Outside air tubing schematic

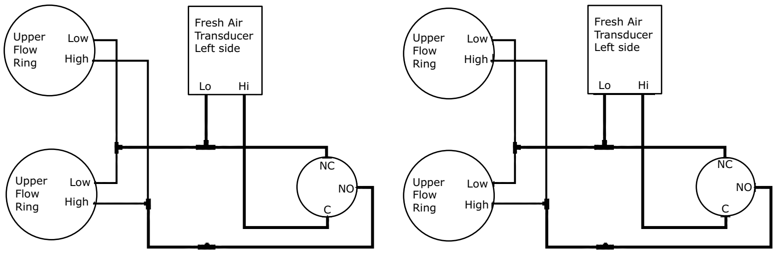
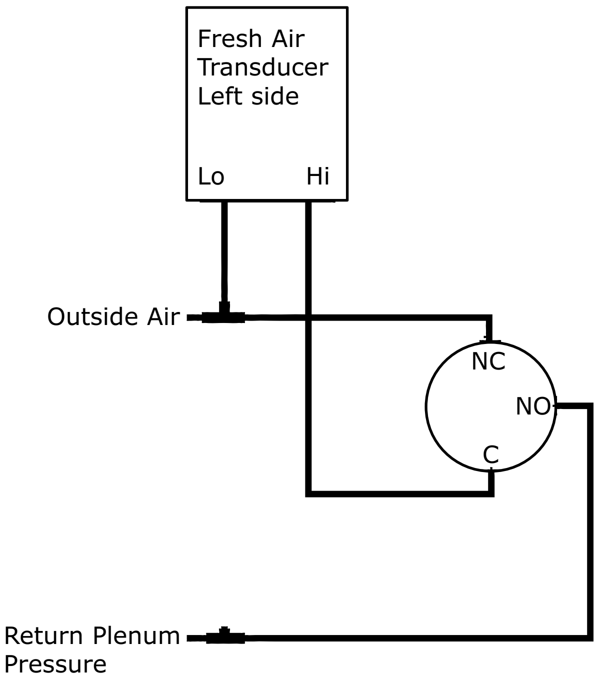


Figure 22. Return air pressure tubing schematic

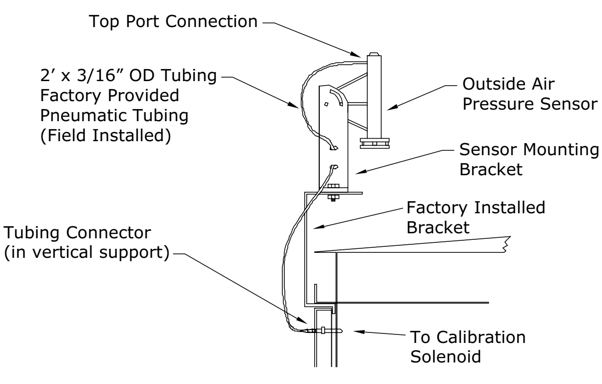


Units with Statitrac

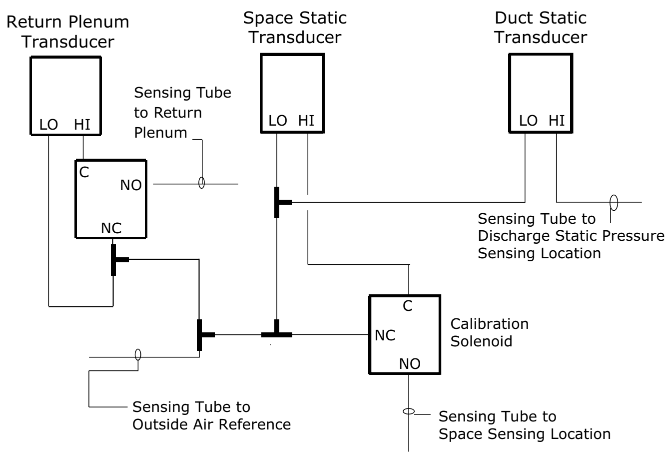
1. Open the filter access door and locate the Space Pressure and Duct Supply Pressure control devices, see the following image for specific location. There are three tube connectors mounted on the left of the solenoid and transducers.
2. Connect one end of the field provided 3/16” O.D. pneumatic tubing for the space pressurization control to the bottom fitting.
3. Route the opposite end of the tubing to a suitable location inside the building. This location should be the largest open area that will not be affected by sudden static pressure changes.

Figure 23. Pressure sensing

Outside Air Sensing Kit

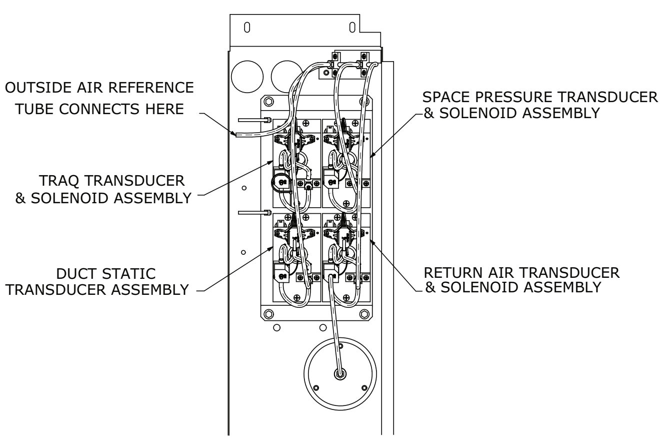


Duct, Space and Return Plenum Pressure Transducer Tubing Schematic



Pressure Tubing Description	Tubing Color
High pressure Pre-Evap filter	Blue
Low Pressure Pre-Evap filter	Green
High Pressure Final Filter	White
Low Pressure Final Filter	Black
High Pressure Traq	Purple
Low Pressure Traq	Yellow
Supply air High	Red
Return Air High	Clear
Reference (wind bird) Pressure	Orange

Duct Staic Pressure Control



Gas Heat Unit (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!

Failure to observe the following instructions could result in exposure to hazardous gases, fuel substances, or substances from incomplete combustion, which could result in death or serious injury. The state of California has determined that these substances may cause cancer, birth defects, or other reproductive harm.

Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures or lead to excessive carbon monoxide. To avoid hazardous gases and flammable vapors follow proper installation and setup of this product and all warnings as provided in this manual.

⚠ WARNING

Explosion Hazard!

Failure to properly regulate pressure could result in a violent explosion, which could result in death, serious injury, or equipment or property-only-damage.

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.

Access holes are provided on the unit as illustrated in to accommodate a side or bottom pipe entry on 20–75 ton units and in 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 as a guide to determine the appropriate gas pipe size for the unit heating capacity listed on the unit nameplate.
2. If a gas line already exists, 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 unit gas pressure regulator at the unit that is adequate to maintain 7–inch w.c. for natural gas while the furnace is operating at full capacity.

Important: *Gas pressure in excess of 14–inch w.c. or 0.5 psig will damage the gas train.*

NOTICE

Gas Valve Damage!

Failure to follow instructions below could result in gas valve damage from incorrect gas pressures, irregular pulsating flame patterns, burner rumble, and potential flame outages.

Use a pressure regulator to properly regulate gas pressure. DO NOT oversize the regulator.

Not using a pressure regulating device can lead to incorrect gas pressure, resulting in erratic operation and potential damage to the gas valve. Oversizing the regulator can cause irregular flame patterns, burner rumble, flame outages, and gas valve damage. When multiple rooftop units are served by a single pressure regulator, it should be sized to ensure that gas pressure remains between 7-inch w.c. at full capacity and 14-inch w.c. when the furnaces are off.

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

⚠ WARNING

Explosion Hazard!

Failure to follow safe leak test procedures below could result in death or serious injury or equipment or property-only-damage.

Never use an open flame to detect gas leaks. Use a leak test solution for leak testing.

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–inch 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, p. 52 through Figure 28, p. 56, 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. Confirm that the gas pressure to the unit from the supply is adjusted to the recommended 7–inch to 14–inch w.c. parameter for natural gas.

3. Confirm that the piping is adequately supported to avoid gas train stress.

Table 16. Sizing natural gas pipe mains and branches

Gas SupplyPipe Run (ft)	Gas Input (Cubic Feet/Hour)					
	1¼" Pipe	1½" Pipe	2" Pipe	2½" Pipe	3" Pipe	4" Pipe
10	1,060	1,580	3,050	4,860	8,580	17,500
20	726	1,090	2,090	3,340	5,900	12,000
30	583	873	1,680	2,680	4,740	9,660
40	499	747	1,440	2,290	4,050	8,270
50	442	662	1,280	2,030	3,590	7,330
60	400	600	1,160	1,840	3,260	6,640
70	368	552	1,060	1,690	3,000	6,110
80	343	514	989	1,580	2,790	5,680
90	322	482	928	1,480	2,610	5,330
100	304	455	877	1,400	2,470	5,040
125	269	403	777	1,240	2,190	4,460
150	244	366	704	1,120	1,980	4,050
175	224	336	648	1,030	1,820	3,720
200	209	313	602	960	1,700	3,460

Notes:

1. Table is based upon specific gravity of 0.60. Refer to the latest edition of the National Fuel Gas Code, Z223.1, unless superseded by local gas codes.
2. 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.
3. Obtain the Specific Gravity and BTU/Cu.Ft. from the gas company.
4. 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 850 MBH furnace to a natural gas supply having a rating of 1,000 BTU/Cu.Ft. and a specific gravity of 0.60
   Cu.Ft/Hour = Furnace MBH Input
   Gas BTU/Cu.Ft. X Multiplier
   Cu.Ft/Hour = 850
   The above table indicates that a 2" pipe is required.

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. Gas heating capacity altitude correction factors

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

Note: Correction factors are per ANSI Z223.1/NFPA 54. Local codes may supersede.

Table 19. Natural gas – two-stage and modulating gas heat settings

Natural Gas							
Burner Size	Low Fire			High Fire		Shutter Setting	Ratio Regulator Turns (a) (b)
	VDC Input Signal (c)	P0	P1	VDC Input Signal (c)	P2		
235 MBH 2-stg	n/a	2030	2030	n/a	3300	0.5	2.5 - 3 CW
350 MBH 2-stg	n/a	2130	2130	n/a	3500	2 - 2.5	3.5 - 4 CW
500 MBH 2-stg	n/a	2800	2800	n/a	5000	1	3.5 - 4 CW
500 MBH Mod	0	2000	2000	10	5000	1	4 - 5 CW
800 MBH 2-stg(d)	n/a	2500	2500	n/a	4570	4	3.5 CW
800 MBH Mod(d)	0	2000	1200	10	4570	4	3.5 CW
850 MBH 2-stg(d)	n/a	2510	2510	n/a	4600	4	1.75 - 2 CW
850 MBH Mod(d)	0	2000	1130	10	4600	4	1.75 - 2 CW
1000 MBH 2-stg	n/a	2800	2800	n/a	5350	3.5	1.5 - 1.75 CW
1000 MBH Mod	0	2000	1130	10	5350	3.5	1.75 - 2 CW

Notes:

- *P0, P1, and P2 are fan speed settings in the Siemens controller. The default speeds have been preset at the factory and normally do not need field adjustment.*
- *The gas switches will be preset at 1-inch W.C. for the low and 4-inch W.C. for the high.*

(a) Number of clockwise (CW) turns for ratio regulator is counted from starting position of all the way out.
(b) On 235/350/500MBh heaters, the ratio regulator cap must be reinstalled after adjustment to ensure measurement accuracy.
(c) Binary input for 2-stage.
(d) For Horizontal MBH, refer to gas heat rating plate for actual capacity.

Table 20. LP gas – two-stage and modulating gas heat settings

Propane								
Burner Size	Low Fire			High Fire		Shutter Setting	Ratio Regulator Turns (a) (b)	Orifice Size
	VDC Input Signal (c)	P0	P1	VDC Input Signal (c)	P2			
235 MBH 2-stg	n/a	1950	1950	n/a	3250	2 - 2.5	4.5 - 4.75 CW	0.302
350 MBH 2-stg	n/a	2100	2100	n/a	3300	1 - 1.5	3.5 - 3.75 CW	0.396
500 MBH 2-stg	n/a	2580	2580	n/a	4350	0.5 - 1	3.5 - 3.75 CW	0.396
500 MBH Mod	0	1800	1800	10	4350	0.5 - 1	3.5 - 3.75 CW	0.396
800 MBH 2-stg(d)	n/a	2100	2100	n/a	4050	2	2.5 CW	0.516
800 MBH Mod(d)	0	2000	1150	10	4050	2	2.5 CW	0.516
850 MBH 2-stg(d)	n/a	2470	2470	n/a	4320	1.5	2.5 CW	0.516
850 MBH Mod(d)	0	2000	1150	10	4320	1.5 - 2	2.5 CW	0.516
1000 MBH 2-stg	n/a	2800	2800	n/a	4950	1	1.875 - 2 CW	0.516
1000 MBH Mod	0	2000	1120	10	4950	1	1.875 - 2 CW	0.516

Notes:

- *P0, P1, and P2 are fan speed settings in the Siemens controller. The default speeds have been preset at the factory and normally do not need field adjustment.*
- *The gas switches will be preset at 1-inch W.C. for the low and 4-inch W.C. for the high.*

(a) Number of clockwise (CW) turns for ratio regulator is counted from starting position of all the way out.
(b) On 235/350/500MBh heaters, the ratio regulator cap must be reinstalled after adjustment to ensure measurement accuracy.
(c) Binary input for 2-stage.
(d) For Horizontal MBH, refer to gas heat rating plate for actual capacity.

Table 21. Natural gas – ultra modulating gas heat settings

Natural Gas					
Heater Size	VDC Signal		Ratio Regulator Turns(a)	FHi Fan Speed(b)	
	Low Fire	High Fire		EBM	Fasco
500 MBH	2	10	10 – 12 CCW	41%	41%
800 MBH(c)	2	10	10 – 12 CCW	48%	47%
850 MBH(c)	2	10	10 – 12 CCW	50%	49%
1000 MBh	2	10	10 – 12 CCW	72%	55%

(a) Number of counterclockwise (CCW) turns for ratio regulator is counted from starting position of all the way in.
(b) FHi and FLo Fan speed is adjustable by calling Technical Support. The default speed keeps the fan furnace from over-firing. FLo is 10% for EBM and 15% for Fasco.
(c) For Horizontal MBH, refer to gas heat rating plate for actual capacity.

Table 22. LP gas – ultra modulating gas heat settings

Propane					
Heater Size	VDC Signal		Ratio Regulator Turns[a]	FHi Fan Speed[b]	
	Low Fire	High Fire		EBM	Fasco
500 MBH	2	10	10 – 12 CCW	34%	TBD
800 MBH[c]	2	10	10 – 12 CCW	46%	TBD
850 MBH[c]	2	10	10 – 12 CCW	48%	TBD
1000 MBH	2	10	10 – 12 CCW	61%	TBD

(a) Number of counterclockwise (CCW) turns for ratio regulator is counted from starting position of all the way in.
(b) FHi and FLo Fan speed is adjustable by calling Technical Support. The default speed keeps the fan furnace from over-firing. FLo is 10% for EBM and 15% for Fasco.
(c) For Horizontal MBH, refer to gas heat rating plate for actual capacity.

***Note:** The FHi fan speed setting on the SCEBM is set to the default Natural Gas settings. Fan speed is adjustable by calling Technical Support.*

Figure 24. Two-stage and Mod gas train for 235 to 500 MBh

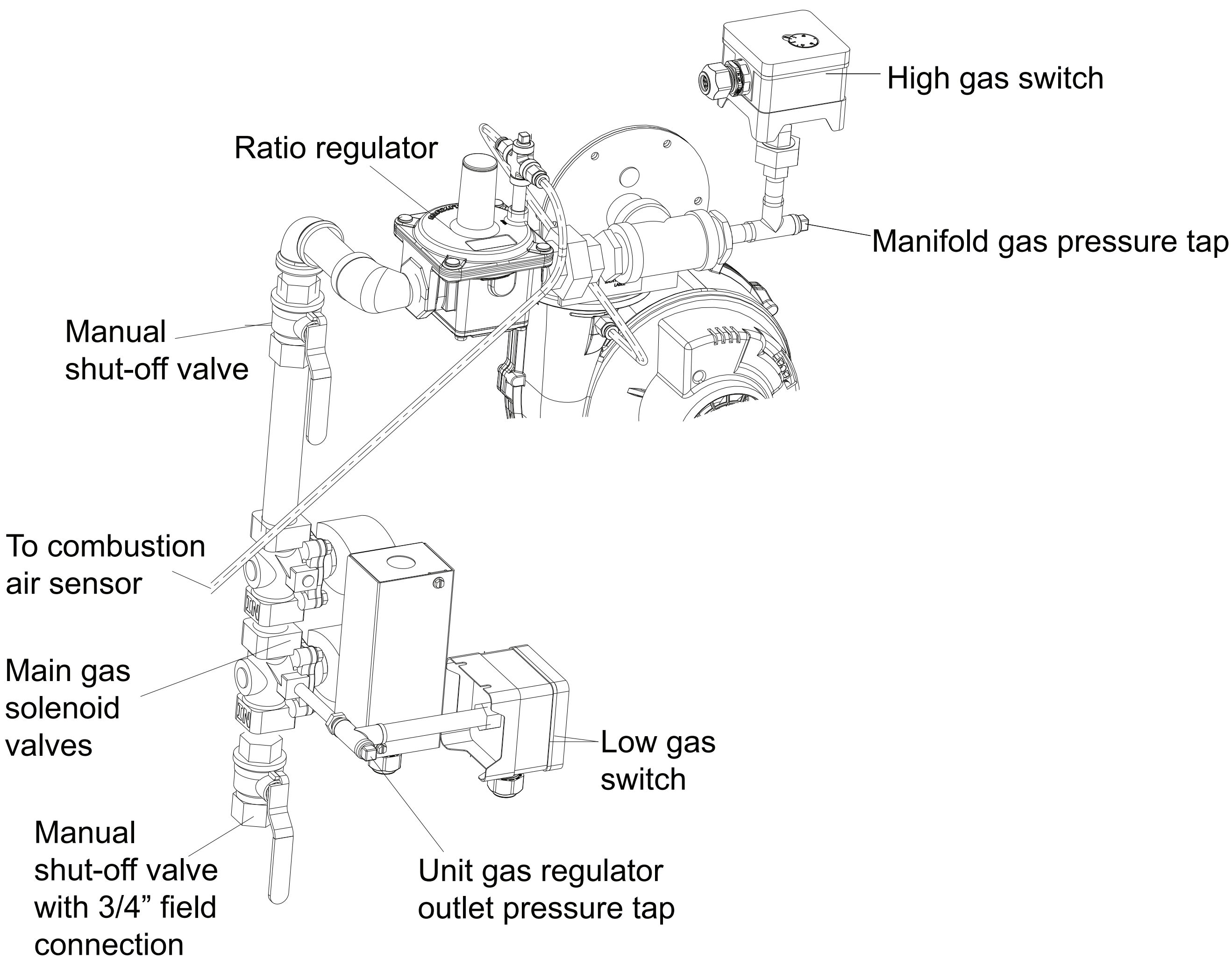


Figure 25. Two-stage and Mod gas train for 850 MBh

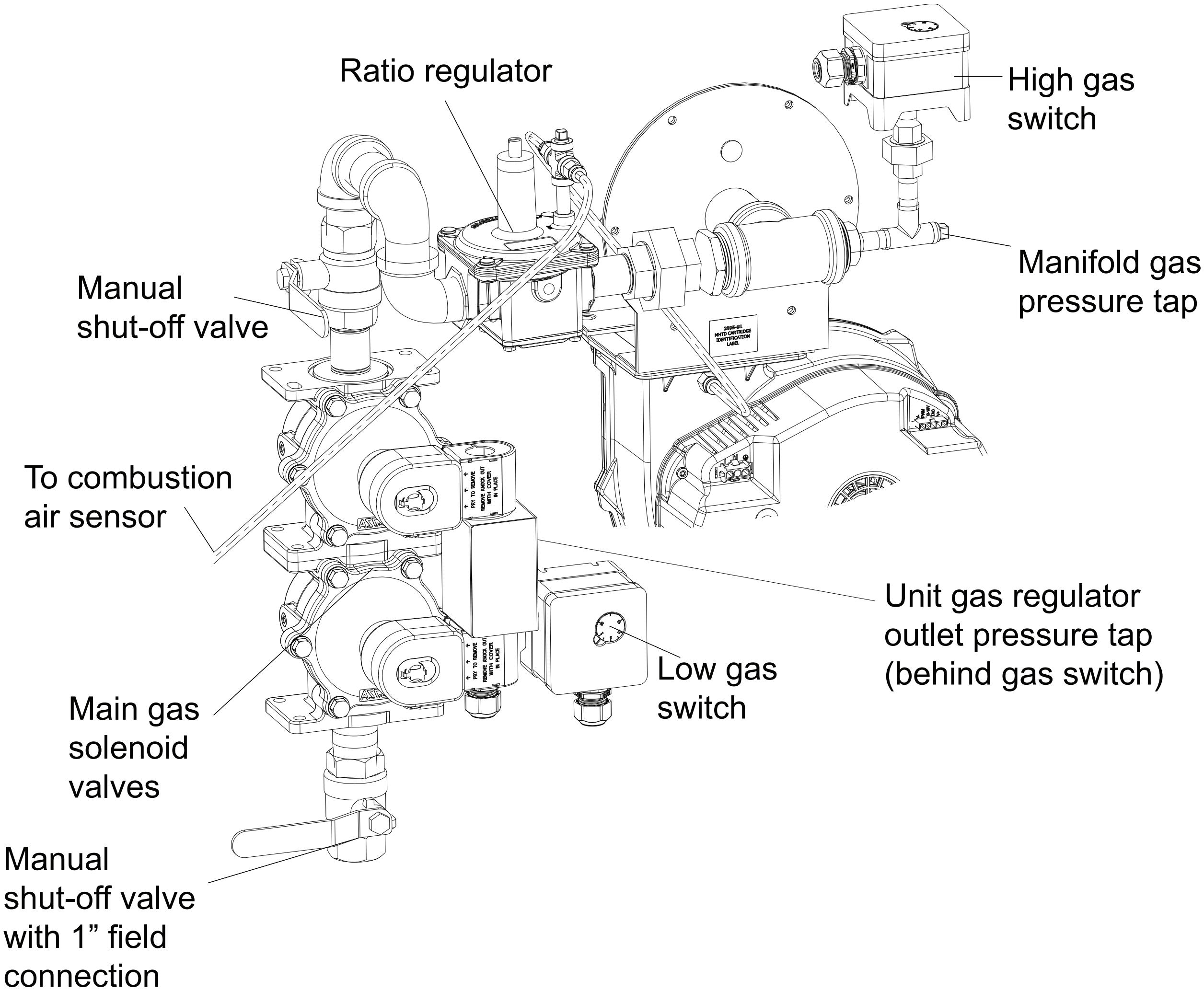


Figure 26. Two-stage and Mod gas train for 1000 MBh

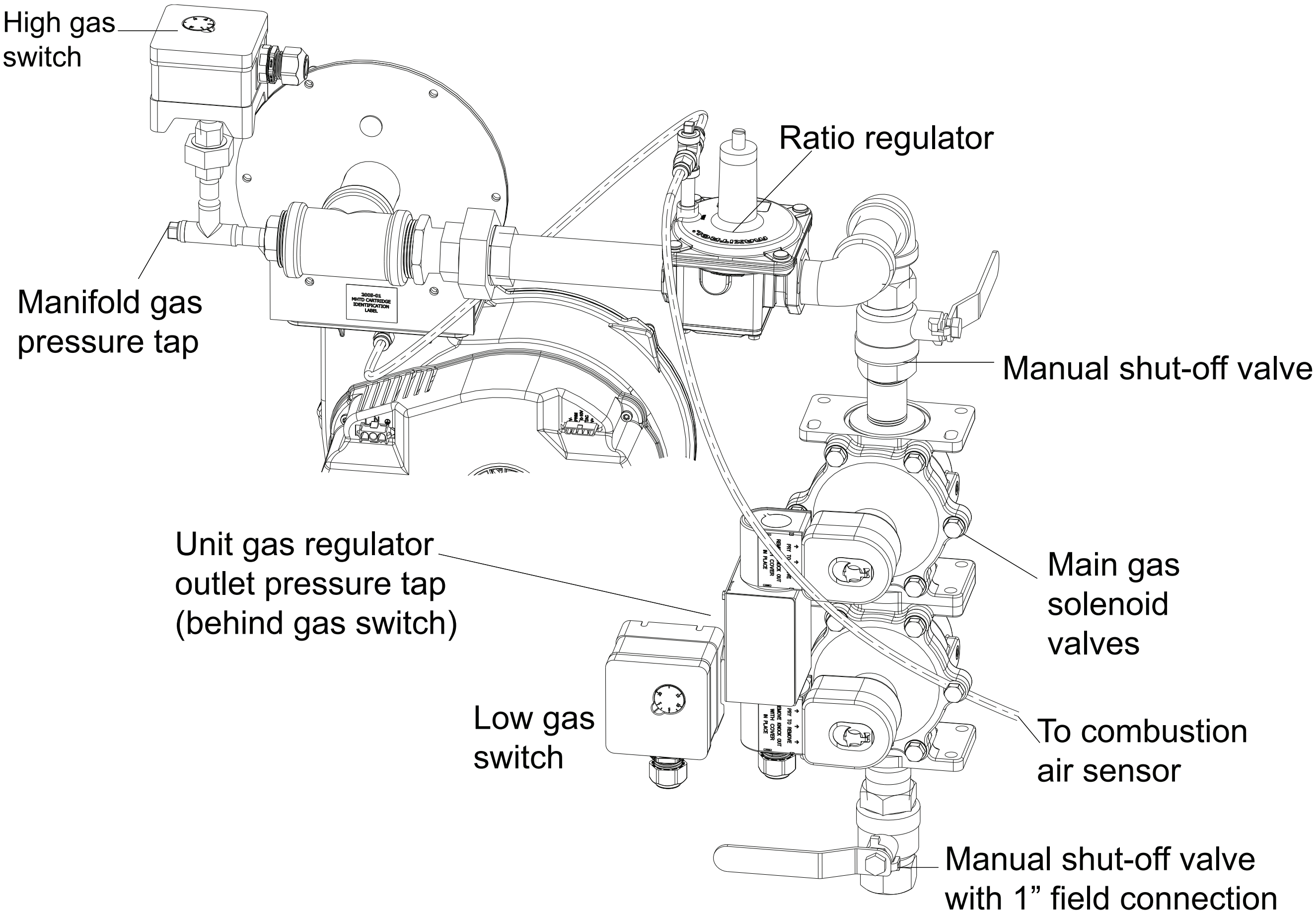


Figure 27. Ultra modulating gas train for 500 to 850 MBh

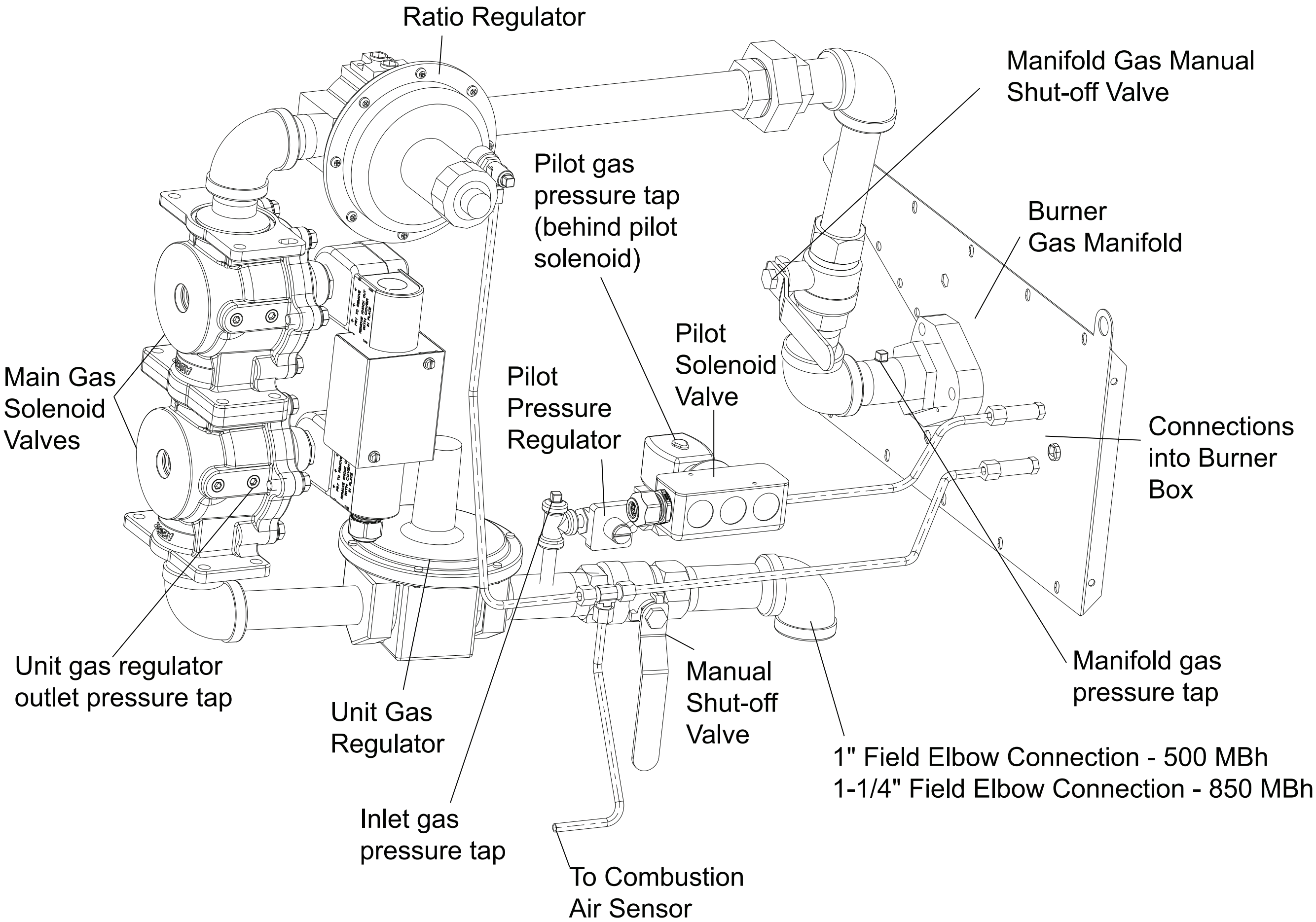
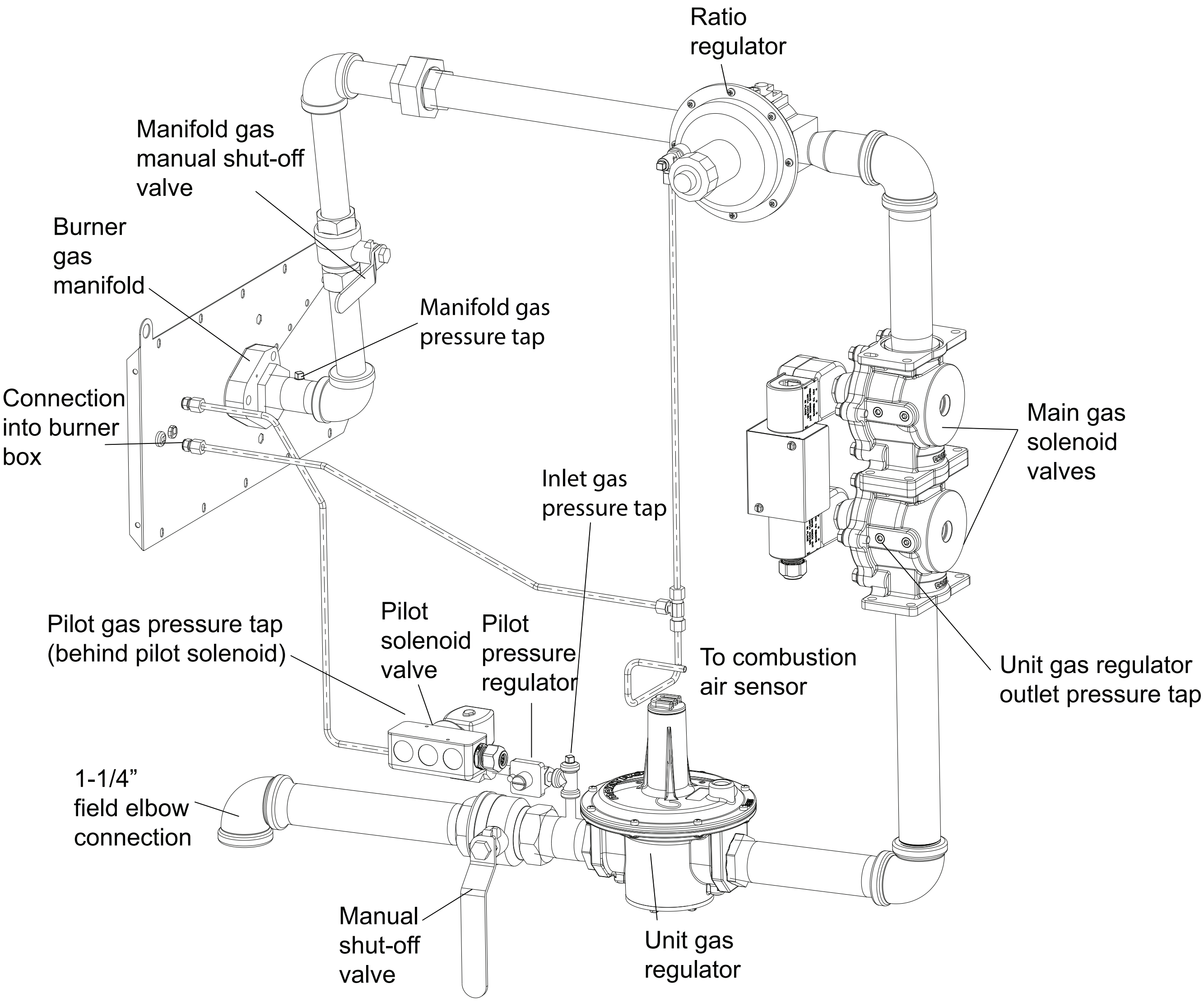


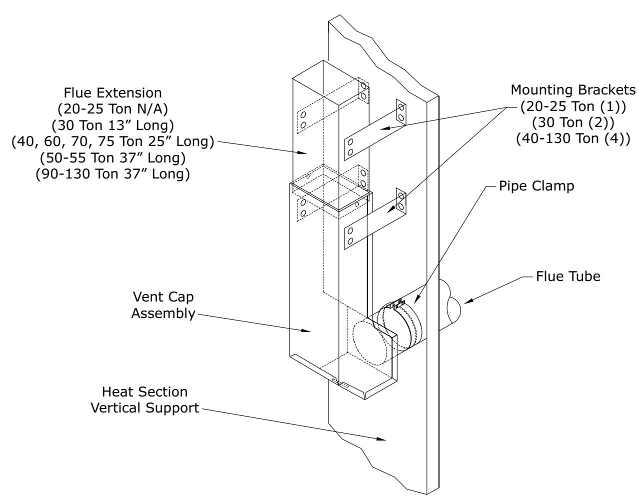
Figure 28. Ultra modulating gas train for 1000 MBh



Flue Assembly Installation

1. Locate the flue assembly and the extension (refer to Figure 29, p. 56 for extension usage) in the ship with section of the unit.
2. Install the flue extension onto the flue assembly as shown in Figure 29, p. 56.
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 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 the installation instructions that ship with the flue assembly.)

Figure 29. Flue assembly



General Coil Piping and Connection Recommendations

Proper installation, piping, and trapping is necessary to ensure satisfactory coil operation and to prevent operational damage:

Note: *The contractor is responsible for supplying the installation hardware.*

- ☐ Support all piping independently of the coils.
- ☐ Provide swing joints or flexible fittings on all connections that are adjacent to heating coils to absorb thermal expansion and contraction strains.
- ☐ Install factory supplied control valves (valves ship separately).

NOTICE

Connection Leaks!

Failure to follow instructions below could result in damage to the coil header and cause connection leaks.

Use a backup wrench when attaching piping to coils with copper headers. Do not use brass connectors because they distort easily.

- ☐ When attaching the piping to the coil header, make the connection only tight enough to prevent leaks. Maximum recommended torque is 200 foot-pounds.

NOTICE

Over Tightening!

Failure to follow instructions below could result in damage to the coil header.

Do not use teflon-based products for any field connections because their high lubricity could allow connections to be over tightened.

- ☐ Use pipe sealer on all thread connections.

NOTICE

Leakage!

Failure to follow instructions below could result in equipment damage.

Properly seal all penetrations in unit casing from inner to outer panel in order to prevent unconditioned air from entering the module, as well as prevent water from infiltrating the insulation.

- ☐ After completing the piping connections, seal around pipe from inner panel to outer panel.

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 3–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 .

Use the following guidelines to enhance both the installation and operation of the “wet heat” system.

Figure 30, p. 59 illustrates the recommended piping configuration for the hot water coil. Table 23, p. 58 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 30, p. 59.
7. Install the 3-way valve in an upright position, piped for valve seating against the flow. Ensure that the valve location lends itself to serviceability.
8. The Type “W” hot water coil used in SLH_ 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 30, p. 59.

Steam Heat Units

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 2–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 .

Use the following guidelines to enhance both the installation and operation of the "wet heat" system. Figure 32, p. 60 and Figure 33, p. 60 illustrates the recommended piping configurations for the steam coil. 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 that the coil "outlet" diameter, reduce the pipe size between the strainer and the steam trap connections only.
6. Install a 1/2" 15 degree swing-check vacuum breaker at the top of the return coil header using the tapped pipe connection. Position the vacuum breaker as close to the coil as possible.

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

7. Install a "Gate" type valve in the supply branch line as close as possible to the steam main and upstream of any other device.
8. Install a "Gate" type valve in the return branch line as close as possible to the condensate return main and downstream of any other device.
9. Install a strainer as close as possible to the inlet of the control valve and steam trap(s). Steam trap selection should be based on the maximum possible condensate flow and the recommended load factors.
10. Install a Float-and-Thermostatic (FT) type trap to maintain proper flow. It provides gravity drains and continuous discharge operation. FT type traps are required if the system includes either of the following:
    a. an atmospheric pressure/gravity condensate return or
    b. a potentially low pressure steam supply.
11. 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 to 130 ton units

    If two steam coils are stacked together, they must be piped in a parallel arrangement. The steps listed below should be used in addition to the previous steps.Figure 33, p. 60 illustrates the recommended piping configuration for the steam coils.

    a. Install a strainer in each return line before the steam trap.
    b. Trap each steam coil separately as described in Step 10Installation_Steam Heat Units and Step 11Installation_Steam Heat Units to prevent condensate backup in one or both coils.
    c. In order to prevent condensate backup in the piping header supplying both coil sections, a drain must be installed utilizing a strainer and a steam trap as illustrated in Figure 33, p. 60.

Table 23. Connection sizes for hot water and steam coil

Unit Model and Size	Heat Section Capacity	Coil Connections (diameter in inches)	
		Supply	Return
SLH_-20 to 130	High or Low Heat	2½"	2½"
SSH_-20 to 30	High or Low Heat	3"	1¼"
SSH_-40 to 75	High Heat Low Heat	3"	1½"
SSH_-90 to 130	Low Heat(c)	1½"	1"

Notes:
1. Type W coils, with center offset headers, are used in SLH* units; type NS coils are used in SSH* units
2. See Digit 9 of the unit model number to determine the heating capacity.
3. SSH*—40 to 75 ton units have multiple headers.

Figure 30. Hot water piping (20 to 75 ton)

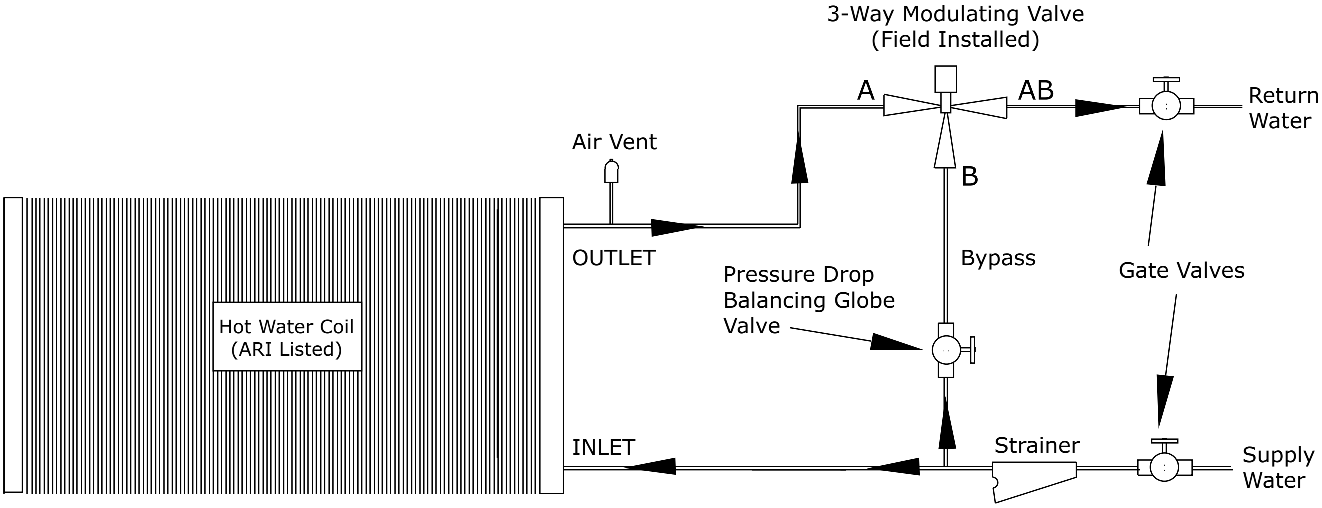


Figure 31. Hot water piping (90 to 130 ton)

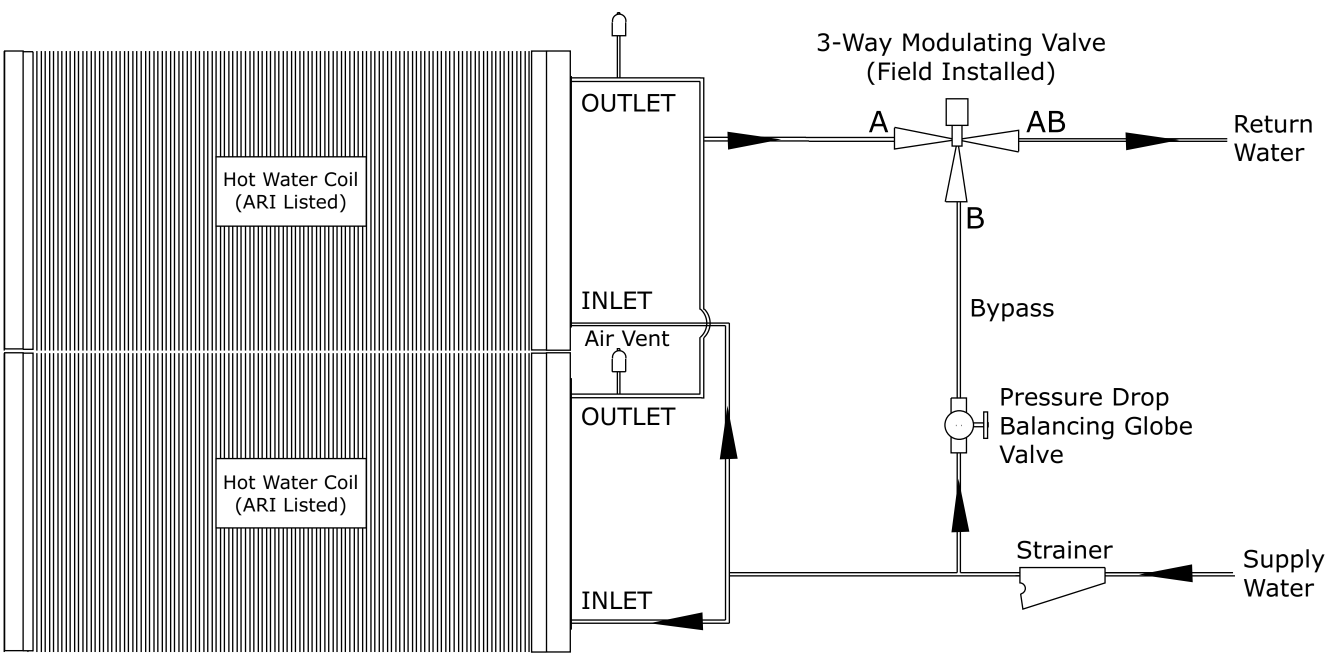


Figure 32. Steam coil piping (20 to 36 ton)

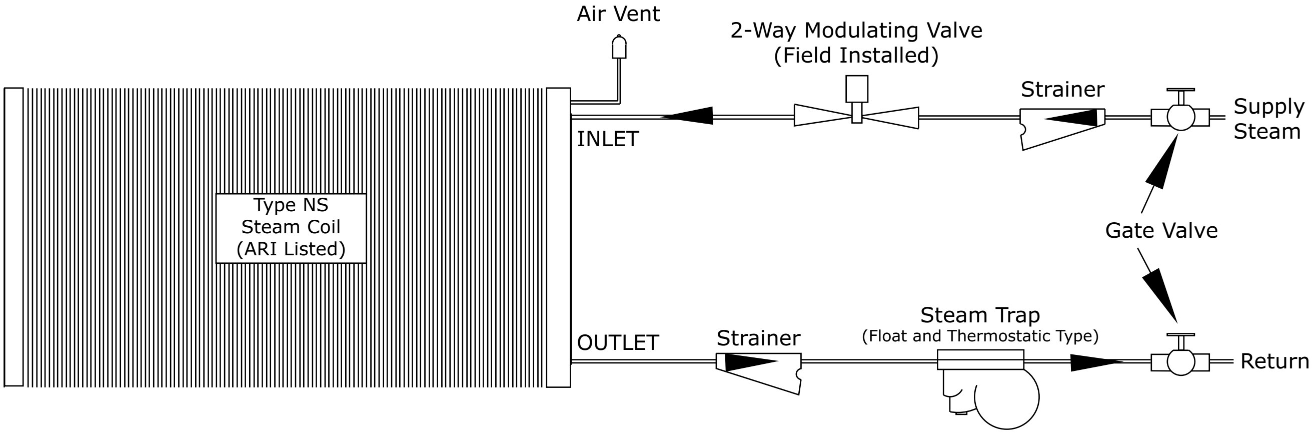
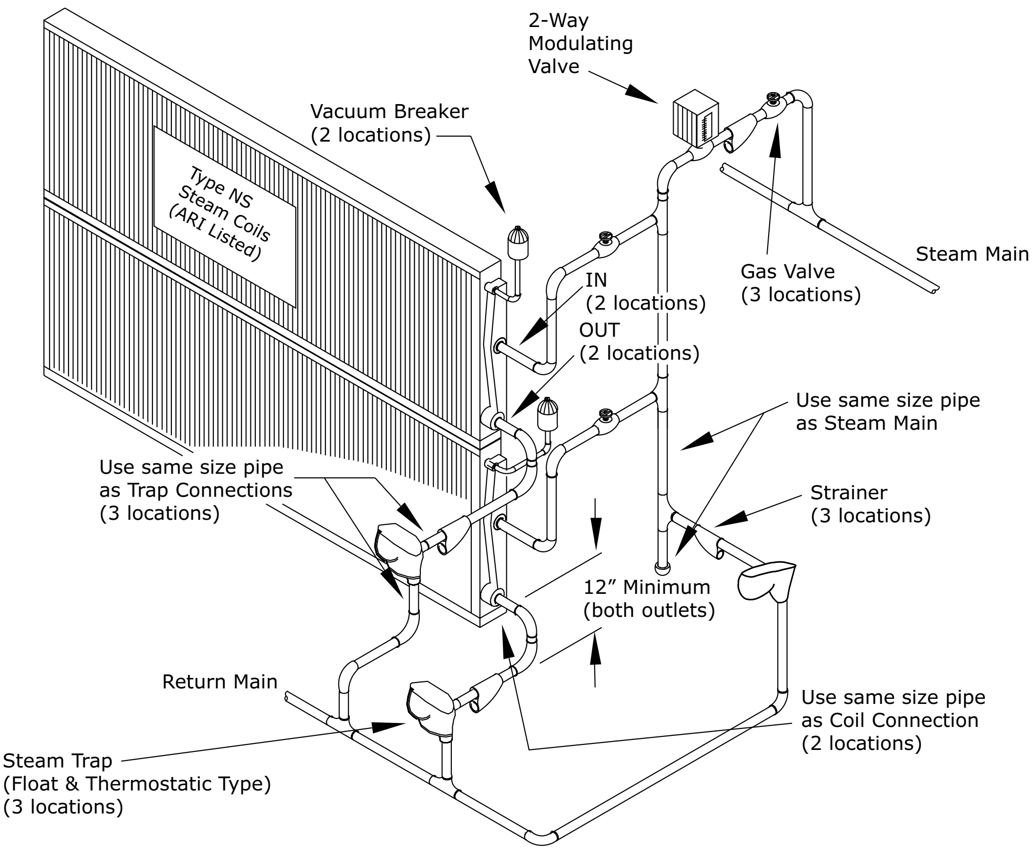


Figure 33. Steam coil piping (40 to 130 ton)



Disconnect Switch with External Handle

Units ordered with a 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 has three positions:

- “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.
- “RESET/LOCK” - Turning the handle to this position resets or disconnects the device. To disconnect, the handle must be turned to the Reset/Lock position. Pulling the spring-loaded thumb key out, so the lock shackle can be placed between the handle and the

thumb key, locks the handle so the unit cannot be energized. Turning the handle to this position also releases the handle from the disconnect switch, allowing the control panel door to be opened.

⚠ WARNING

Hazardous Voltage w/Capacitors!

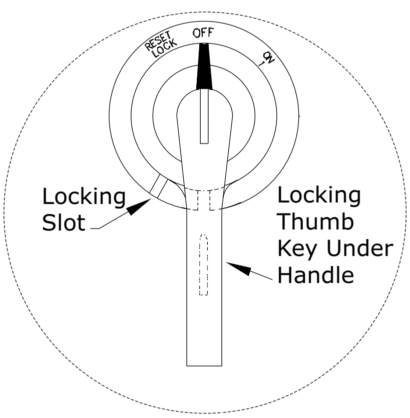
Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

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 a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

The handle can be locked in the "OFF" position by completing the following steps (see Figure 34, p. 61):

1. While holding the handle in the "OFF" position, push the spring loaded thumb key, attached to the handle, into the base slot.
2. Place the lock shackle between the handle and the thumb key. This will prevent it from springing out of position.

Figure 34. Disconnect switch external handle



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

An overall layout of the field required power wiring is illustrated in . To ensure that the unit supply power wiring is properly sized and installed, follow these guidelines:

⚠ WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

When it is 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.

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

⚠ WARNING

Hot Surface!

Failure to follow instructions below could result in severe burns.

Do not touch the heat exchanger board with bare hands while disassembling the pan. Allow to cool and put on proper Personal Protective Equipment (PPE) before servicing.

- Verify that the power supply available is compatible with the unit 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.

Electric Heat Units (SEH_)

SEH_ (20-75 ton) electric heat units operating on 200/230 volts require two power supplies as illustrated in . Unless the unit was ordered with the optional factory mounted, non-fused disconnect switches, two field-supplied disconnect switches must be installed per NEC requirements. The power wires for the electric heat are routed into the electric heat control panel using the through-the-base access provided in the heating section. Refer to the appropriate illustration in , (unit base layout and electrical entrance diagram), for dimensional data. For 20-130 ton units operating on 460/575 volts, only one field installed disconnect switch is required, as illustrated in and .

Use the information provided in Service Sizing data 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

to lists the field connection wire ranges for both the main power terminal block (2XD1 on 20-75T units / 1XD1 on 90-130T units) and the optional main power disconnect switch (2QB1 on 20-75T units / 1QB1 on 90-130T units). Service Sizing Data lists the component electrical data.

The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements. Protection devices must be sized according to the electrical data on the nameplate. Refer to the equations listed in the product catalog to determine the following:

- the appropriate electrical service wire size based on "Minimum Circuit Ampacity" (MCA)
- the "Maximum Over Current Protection" (MOP) device
- the "Recommended Dual Element fuse size" (RDE)

⚠ WARNING

Proper Field Wiring and Grounding Required!

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

⚠ WARNING

Electrical Shock Hazard!

Failure to follow instructions below could result in death or serious injury.
Properly connect the system's oversized protective earthing (grounding) terminal(s).

The location of the electrical service entrance is illustrated in . It is important to complete the unit power wiring connections onto either the main terminal block (2XD1 on 20-75T units / 1XD1 on 90-130T units) or the factory mounted, non-fused disconnect switch (2XD1 on 20-75T units / 1XD1 on 90-130T units). . Refer to the diagrams that shipped with the unit for specific termination points.

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

Figure 35. Typical field power wiring (20 to 75 ton)

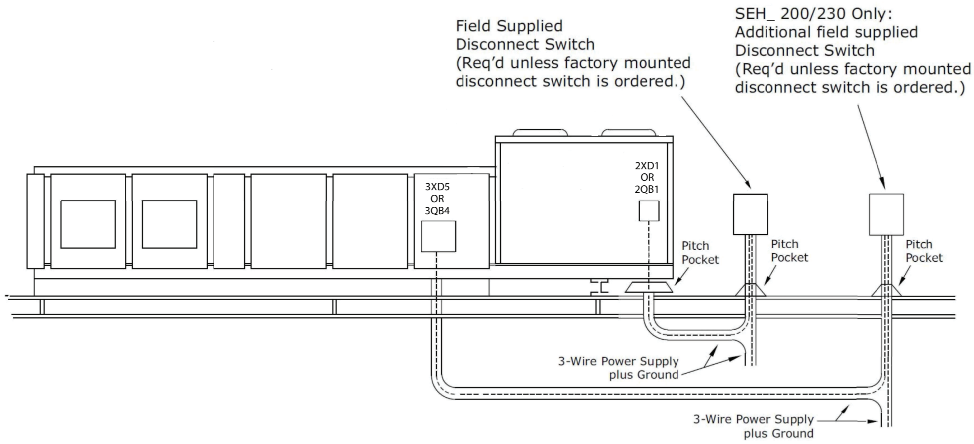


Figure 36. Typical field power wiring (90 to 130 ton)

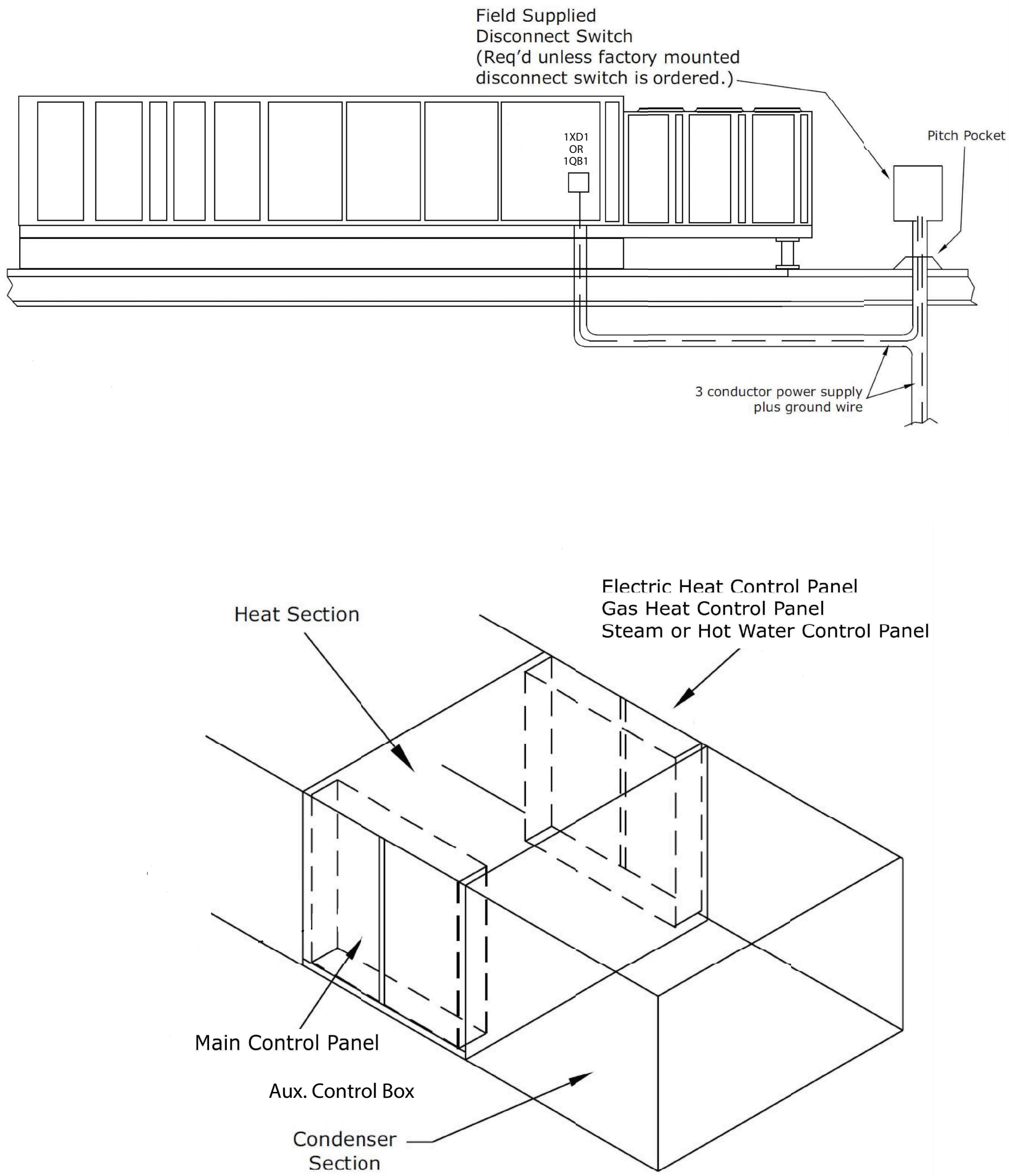


Table 24. Customer connection wire range

Notes	Component type/size	Wire qty per phase	Wire range
Terminal block and STD SCCR disconnect switch sizes 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.	510A terminal block	2	6 AWG - 250 kcmil
	760A terminal block	2	4 AWG - 500 kcmil
	150A disconnect switch (Std SCCR)	1	14 AWG - 1/0 AWG
	250A disconnect switch (Std SCCR)	1	4 AWG - 350 kcmil [(a)]
	400A disconnect switch (Std SCCR)	2	2/0 AWG - 500 kcmil
	600A disconnect switch (Std SCCR)	2	2/0 AWG - 500 kcmil
High SCCR disconnect switch sizes are calculated by selecting the size greater than or equal to 1.25 X (sum of unit loads). See unit literature for unit load values.	150A disconnect switch (High SCCR)	1	14 AWG - 1/0 AWG
	250A disconnect switch (High SCCR)	1	4 AWG - 350 kcmil[(a)]
	400A disconnect switch (High SCCR)	2	2/0 AWG - 500 kcmil
	600A disconnect switch (High SCCR)	2	2/0 AWG - 500 kcmil

(a) 250A Components may require lug kit S1A59551 to be installed to allow for connection to 4 - 2/0 AWG wires. When needed, this kit is provided with the unit.

250A Disconnect switch wire binding screws

The 250A disconnect switch (standard and high SCCR) installed for main power connection accommodates 4 AWG – 350 kcmil wires on the "OFF" side. As shipped from the factory, the wire binding screws only accommodate 3/0 AWG – 350 kcmil wires. If 4 AWG – 2/0 AWG field power wiring is used, then the factory installed wire binding screws must be replaced with those that are provided with the kit installed near the disconnect switch (these screws should have a blue top surface). See the kit for instructions on changing the wire binding screws.

Service Sizing Data

Table 25. Compressor electrical service sizing data (20 to 130 tons)

Tonnage	No. of Compres-sors	200 V		230 V		460 V		575 V	
		RLA/MRC[(a)] (ea.)	LRA (ea.)	RLA/MRC[(a)] (ea.)	LRA (ea.)	RLA/MRC[(a)] (ea.)	LRA (ea.)	RLA/MRC[(a)] (ea.)	LRA (ea.)
20 Variable Speed	1[(b)]	47.7	N/A	41.4	N/A	20.7	N/A	16.6	N/A
	1	40.3	267	40.3	267	19.1	142	15.8	103
25 Standard	1	27.8	203	27.7	203	14.5	98	12.5	84
	2	40.3	267	40.3	267	19.1	142	15.8	103
25 High Efficiency	1	59.6	386	51.8	386	25.9	182	20.7	131
	1	38.5	255	33.5	255	16.7	140	13.4	108
25 Variable Speed	1[(b)]	52.7	N/A	45.9	N/A	22.9	N/A	18.3	N/A
	1	46.0	304	42.3	304	21.8	147	17.2	103
30 Standard	1	27.8	203	27.7	203	14.5	98	12.5	84
	2	45.0	304	42.3	304	20.6	142	17.2	122
30 High Efficiency	1	27.8	203	27.7	203	14.5	98	12.5	84
	2	40.3	267	40.3	267	19.1	142	15.8	103
30 Variable Speed	1[(b)]	57.6	N/A	50.4	N/A	25.6	N/A	20.1	N/A
	1	52.4	315	47.9	315	24	158	19.2	136
40 Standard	2	38.0	267	34.8	267	17.8	142	15.2	103
	2	40.3	267	40.3	267	19.1	142	15.8	103
40 High Efficiency	2	30.0	203	28.4	203	14.5	98	11.9	84
	2	38.0	267	34.8	267	17.8	142	15.2	103
40 Variable Speed	1[(b)]	57.6	N/A	50.4	N/A	25.6	N/A	20.1	N/A
	2	40.3	267	40.3	267	19.1	142	15.8	103
50 Standard	2	40.3	267	40.3	267	19.1	142	15.8	103
	2	46.0	304	42.3	304	21.8	147	17.2	122
50 High Efficiency	1	40.3	267	40.3	267	19.1	142	15.8	103
	3	46.0	304	42.3	304	21.8	147	17.2	122
50 Variable Speed	1[(b)]	79.4	N/A	73.1	N/A	36.5	N/A	29.2	N/A
	2	46.0	304	42.3	304	21.8	147	17.2	122

Table 25. Compressor electrical service sizing data (20 to 130 tons) (continued)

Tonnage	No. of Compres-sors	200 V		230 V		460 V		575 V	
		RLA/MRC[(a)] (ea.)	LRA (ea.)	RLA/MRC[(a)] (ea.)	LRA (ea.)	RLA/MRC[(a)] (ea.)	LRA (ea.)	RLA/MRC[(a)] (ea.)	LRA (ea.)
55 Standard	1	46.0	304	42.3	304	21.8	147	17.2	122
	3	52.4	315	47.9	315	24.0	158	19.2	136
55 High Efficiency	3	46.0	304	42.3	304	21.8	147	17.2	122
	1	52.4	315	47.9	315	24.0	158	19.2	136
55 Variable Speed	1[(b)]	83.6	N/A	73.1	N/A	36.5	N/A	29.2	N/A
	2	52.4	315	47.9	315	24.0	158	19.2	136
60 Standard	3	52.4	315	47.9	315	24.0	158	19.2	136
	1	59.8	345	54.8	345	27.4	155	23.1	126
60 High Efficiency	2	52.4	315	47.9	315	24.0	158	19.2	136
	2	59.8	345	54.8	345	27.4	155	23.1	126
60 Variable Speed	1[(b)]	86.8	N/A	75.5	N/A	37.7	N/A	30.2	N/A
	1	52.4	315	47.9	315	24.0	158	19.2	136
	1	59.8	345	54.8	345	27.4	155	23.1	126
70 Standard	2	59.8	345	54.8	345	27.4	155	23.1	126
	1	56.5	308	51.5	308	25.0	160	20.8	135
	1	78.8	528	69.8	528	34.9	215	27.9	175
70 High Efficiency	4	59.8	345	54.8	345	27.4	155	23.1	126
70 Variable Speed	1[(b)]	91.3	N/A	79.4	N/A	39.7	N/A	31.8	N/A
	2	76.2	528	69.3	528	33.7	215	27.1	175
75 Standard	2	56.5	308	51.5	308	25.0	160	20.8	135
	2	78.8	528	69.8	528	34.9	215	27.9	175
75 High Efficiency	1	56.5	308	51.5	308	25.0	160	20.8	135
	3	78.8	528	69.8	528	34.9	215	27.9	175
75 Variable Speed	1[(b)]	94.0	N/A	81.7	N/A	40.9	N/A	33.1	N/A
	1	56.5	308	51.5	308	25.0	160	20.8	135
	2	59.8	345	54.8	345	27.4	155	23.1	126
90 Standard and High Efficiency	4	N/A	N/A	N/A	N/A	34.9	215	27.9	175
105 Standard	2	N/A	N/A	N/A	N/A	34.9	215	27.9	175
	2	N/A	N/A	N/A	N/A	47.5	260	35.6	210
115 Standard	1	N/A	N/A	N/A	N/A	34.9	215	27.9	175
	3	N/A	N/A	N/A	N/A	47.5	260	35.6	210
130 Standard	2	N/A	N/A	N/A	N/A	47.5	260	35.6	210
	2	N/A	N/A	N/A	N/A	53.5	320	42.9	235

(a) RLA (Rated Load Amps) applies to fixed speed compressors; MRC (Max Rated Current) applies to variable speed compressors.
(b) Variable Speed Compressor.

Table 26. Electrical service sizing data — condenser fan motors — 20 to 130 tons

Tonnage, Type	No. of Motors	200 V	230 V	460 V	575 V
		FLA/MOC[(a)] (ea.)	FLA/MOC[(a)] (ea.)	FLA/MOC[(a)] (ea.)	FLA/MOC[(a)] (ea.)
20S, 20H	2	5.4	5.4	2.7	2.2
20S, 20H Low Ambient	1	5.4	5.4	2.7	2.2
	1[(b)]	4.4	4.4	2.1	2.0
20V	2[(b)]	4.4	4.4	2.1	2.0
25S	2	5.4	5.4	2.7	2.2
25S Low Ambient	1	5.4	5.4	2.7	2.2
	1[(b)]	4.4	4.4	2.1	2.0
25H, 25V	2[(b)]	4.4	4.4	2.1	2.0
30S, 30H	2	5.4	5.4	2.7	2.2
30S, 30H Low Ambient	1	5.4	5.4	2.7	2.2
	1[(b)]	4.4	4.4	2.1	2.0
30V	2[(b)]	4.4	4.4	2.1	2.0
40S	4	5.4	5.4	2.7	2.2
40S Low Ambient	2	5.4	5.4	2.7	2.2
	2[(b)]	4.4	4.4	2.1	2.0

Table 26. Electrical service sizing data — condenser fan motors — 20 to 130 tons (continued)

Tonnage, Type	No. of Motors	200 V	230 V	460 V	575 V
		FLA/MOC[(a)] (ea.)	FLA/MOC[(a)] (ea.)	FLA/MOC[(a)] (ea.)	FLA/MOC[(a)] (ea.)
40H, 40V	4[(b)]	4.4	4.4	2.1	2.0
50S, 55S	4	5.4	5.4	2.7	2.2
50S, 55S Low Ambient	2 2[(b)]	5.4 4.4	5.4 4.4	2.7 2.1	2.2 2.0
50H, 50V, 55H, 55V	4[(b)]	4.4	4.4	2.1	2.0
60S, 60H, 70S, 70H, 75S, 75H	6	4.4	4.4	2.2	1.5
60S, 60H, 70S, 70H, 75S, 75H Low Ambient	4 2[(b)]	4.4 3.0	4.4 3.0	2.2 1.5	1.5 1.4
60V, 70V, 75V	6[(b)]	3.0	3.0	1.5	1.4
90S	8	N/A	N/A	2.2	1.5
90S Low Ambient	6 2[(b)]	N/A N/A	N/A N/A	2.2 2.2	1.5 1.5
90H, 105S, 115S	10	N/A	N/A	2.2	1.5
90H, 105S, 115S Low Ambient	8 2[(b)]	N/A N/A	N/A N/A	2.2 2.2	1.5 1.5
130S	12	N/A	N/A	2.2	1.5
130S Low Ambient	10 2[(b)]	N/A N/A	N/A N/A	2.2 2.2	1.5 1.5

(a) FLA (Full Load Amps) applies to fixed speed motors; MOC (Max Operating Current) applies to variable speed motors.
(b) Variable speed motor.

Table 27. Electrical service sizing data — supply/relief/return motors WITH bypass option — 20 to 130 tons

	200 V	230 V	460 V	575 V
	FLA (ea.)	FLA (ea.)	FLA (ea.)	FLA (ea.)
Motor Horsepower	**Supply/Relief/Return Fan Motor (4 pole)**			
3	9.7	8.4	4.2	3.4
5	15.3	13.2	6.6	5.3
7.5	22.8	19.6	9.8	7.8
10	29.5	25.2	12.6	10.1
15	43.0	36.0	18.0	15.0
20	56.1	49.4	24.7	19.5
25	72.0	61.0	30.5	24.8
30	84.0	73.2	36.6	29.0
40	N/A	N/A	49.0	39.0
50	N/A	N/A	59.0	47.2
Motor Horsepower	**Supply Fan Motor (6 pole)**			
3	10.1	9.0	4.5	3.6
5	17.0	14.8	7.4	5.6
7.5	25.0	22.0	11.0	9.0
10	32.0	28.6	14.3	11.9
15	47.0	41.0	20.5	16.3
20	63.0	54.0	27.0	20.8

Notes:
1. FLA is for individual motors by HP, not total unit supply fan HP.
2. Return fan motors are available in 3-20 Hp
3. 40 and 50 Hp motor available as standard in 460 and 575 volt only
4. DDP fans selected under 1,700 RPM will have 6-pole motors
5. 60-75T units with DDP supply fan motors have 1 VFD and 2 motors.
6. 90-130T units have 2 VFDs and 2 motors.

Table 28. Electrical service sizing data — single supply/relief/return motors WITHOUT bypass option — 20 to 130 tons

	200 V	230 V	460 V	575 V
	MOC (ea.)	MOC (ea.)	MOC (ea.)	MOC (ea.)
Motor Horsepower	**Supply/Relief/Return Fan Motor (4 pole)**			
3	8.8	7.6	3.8	3.1
5	13.9	12.0	6.0	4.8
7.5	20.7	17.8	8.9	7.1
10	26.8	22.9	11.5	9.2
15	39.1	32.7	16.4	13.6
20	51.0	44.9	22.5	17.7

Table 28. Electrical service sizing data — single supply/relief/return motors WITHOUT bypass option — 20 to 130 tons (continued)

	200 V	230 V	460 V	575 V
	MOC (ea.)	MOC (ea.)	MOC (ea.)	MOC (ea.)
25	65.5	55.5	27.7	22.5
30	76.4	66.5	33.3	26.4
40	N/A	N/A	44.5	35.5
50	N/A	N/A	53.6	42.9
Motor Horsepower	**Supply Fan Motor (6 pole)**			
3	9.2	8.2	4.1	3.3
5	15.5	13.5	6.7	5.1
7.5	22.7	20.0	10.0	8.2
10	29.1	26.0	13.0	10.8
15	42.7	37.3	18.6	14.8
20	57.3	49.1	24.5	18.9

Notes:

1. MOC (Max Operating Current) is VFD Input Current when fan motor is operating at FLA
2. MOC is for individual motors by HP, not total unit supply fan HP.
3. Return fan motors are available in 3-20 Hp.
4. 40 and 50 Hp motor available as standard in 460 and 575 volt only.
5. DDP fans selected under 1,700 RPM will have 6-pole motors.
6. 90-130T units have 2 VFDs and 2 motors.

Table 29. Electrical service sizing data — dual DDP supply fan motors WITHOUT bypass option — 60 to 75 tons

	200 V	230 V	460 V	575 V
	MOC	MOC	MOC	MOC
Motor Horsepower	**2x Supply Fan Motors (4 pole)**			
2x 7.5HP	41.5	35.6	17.8	14.2
2x 10HP	53.6	45.8	22.9	18.4
2x 15HP	78.2	65.5	32.7	27.3
2x 20HP	N/A	N/A	44.9	35.5
2x 25HP	N/A	N/A	55.5	45.1
Motor Horsepower	**2x Supply Fan Motors (6 pole)**			
2x 5HP	30.9	26.9	13.5	10.2
2x 7.5HP	45.5	40.0	20.0	16.4
2x 10HP	58.2	52.0	26.0	21.6
2x 15HP	85.5	74.5	37.3	29.6
2x 20HP	N/A	N/A	49.1	37.8

Notes:

1. MOC (Max Operating Current) is VFD Input Current when fan motors are operating at FLA
2. MOC for dual DDP supply fans without bypass represents the total VFD input current for both supply fan motors.
3. Dual DDP fans selected under 1,700 RPM will have 6-pole motors

Table 30. Electrical service sizing data —electric heat module (electric heat units only) — 20 to 130 tons

Module kW	Electric Heat FLA			
	200V	230V	460V	575V
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 31. Voltage utilization range

Unit Voltage	Voltage Utilization Range
200/60/3	180-220
230/60/3	207-253

Table 31. Voltage utilization range (continued)

Unit Voltage	Voltage Utilization Range
460/60/3	414-506
575/60/3	517-633

Field Installed Control Wiring

The IntelliPak rooftop has many operating modes. The flexibility of having several system modes depends upon the type of sensor and/or remote panel selected to interface with the The Symbio™ 800. An overall layout of the various control options available for a Single Zone application, with the required number of conductors for each device, is illustrated beginning with . Figure 36, p. 63 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.*

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.
All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical 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 , and .for the electrical access locations provided on the unit, and Table 32, p. 68 for AC conductor sizing guidelines. Then check the following:

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

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

Table 32. 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

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

Transformer for Expansion Module

When the expansion module is installed, a 115Vac primary - 24Vac secondary - 75VA transformer is provided for customer use. However, the 20T standard efficiency, 20T high efficiency, and 25T standard efficiency units utilize this transformer to power a compressor solenoid so the available VA for customer use is limited to 70VA.

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 and for the electrical access locations provided on the unit and Table 33, p. 69 for conductor sizing guidelines. Then check the following:

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

1. Use standard copper conductor thermostat wire unless otherwise specified.
2. Ensure that the wiring between the controls and the unit 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 33. 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

3. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires. Units wired for a BACnet® Communication, LonTalk® communication Interface, or Modbus option which utilizes a serial communication link must:

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

Variable Air Volume System Controls

Discharge Temperature Control Changeover Contacts

These contacts are connected to the customer connection 1KF10 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 Zone Sensor (BAYSENS073*)

This electronic analog sensor features remote zone sensing and timed override with override cancellation. It is used as the source for zone temperature control. Refer to 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 for the Temperature vs. Resistance coefficient.

Equipment Stop

A field-supplied single pole single throw switch can be used to shut down the unit operation. This switch is a binary input wired to the customer connection, wired to 1XD24 (see unit diagrams). Ensure the appropriate jumper wire at 1XD24 is removed when this switch is installed. When opened, the unit shuts down immediately and can be canceled by closing the switch. The switch must be rated for 12 ma @ 24 VDC minimum.

Ventilation Override Mode (VOM) Contacts

Ventilation Override Modes (VOM) give the building controller the ability to override normal unit operation and provide special ventilation operation. VOM is initiated only at the provided five binary inputs (Mode A, Mode B, Mode C, Mode D, Mode E). When any of the normally open contacts are closed, VOM initiates specified functions such as space pressurization, relief, purge, purge with supply air pressure control, and unit off when any one of the corresponding binary inputs are activated. The compressors and condenser fans, and all other components not directly controlled via VOM events, are disabled during the ventilation operation. If more than one ventilation sequence is activated, Mode A has highest priority, Mode E has lowest.

This function gives the customer the ability to override normal unit operation via a supervisory controller. Typically, these requests originate from a fire control panel. Flexibility is provided by allowing the customer to re-define each of the five responses at the front panel, along with allowing each individual response to be ‘Locked’ to insure expected operation is not changed. See Programming Guide for more information.

This feature is optional. When configured VOM has priority over Emergency Override, System Mode Off, and normal unit operation. The following overrides will prevent or terminate VOM operation.

- Local Stop
- Equipment Stop
- Emergency Stop
- Manual Control

When any VOM Mode (A, B, C, D, E) input is activated or closed, the VOM mode of operation will begin in less than 10 seconds, and a VOM Relay binary output will energize/close. Heating capacity, cooling capacity, and Rapid Restart will be disabled/terminated.

Refer to Table 34, p. 70summarizing the unit operation in response to VOM binary inputs Modes. VOM inputs are fully configurable; therefore, Table 34, p. 70 provides the factory default settings.

If one or more of the 5 VOM inputs are closed, the unit will enter the VOM mode with the highest priority (A highest, E lowest). Should the unit be in an active VOM mode and a VOM input of higher priority is closed, the unit will immediately transition to the higher priority mode. Should the unit be in an active VOM mode and a VOM input of lower priority is closed, the unit will not change to this lower priority mode until the current (higher priority) VOM mode binary input is opened.

When all VOM inputs are open, within 15 seconds, VOM terminates. All unit components will be reset OFF or CLOSED, and after Unit Power Up Delay is honored, the unit will start normal operation.

These functions are controlled by binary inputs wired to the VOM. They can be initiated by a toggle switch, or a time clock. The switch must be rated for 12 ma @ 24 VDC minimum.

Table 34. VOM

VOM Input	OUTPUT	OPERATION	Heat Cool Mode Status
Mode A (Unit Off)	Supply fan	Off/0%	Off
	Outdoor air damper	Closed	
	Relief fan / Relief damper	Off/Closed	
	Return Fan / Relief Damper	Off/Closed	
	VAV Box Relay	De-Energized	
	Discharge Isolation Damper[(a)]	0% / Closed	
	Return Isolation Damper[(a)]	0% / Closed	
	Ventilation Override Relay	Energized	
Mode B (Pressurize)	Supply fan	On/100%[(b)]	Fan Only
	Outdoor air damper	100%	
	Relief fan / Relief damper	Off/Closed	
	Return Fan / Relief Damper	Off / Closed	
	VAV Box Relay	Energized	
	Discharge Isolation Damper[(a)]	100% / Open	
	Return Isolation Damper[(a)]	100% / Open	
	Ventilation Override Relay	Energized	
Mode C (Depressurize)	Supply fan	Off/0%	Fan Only
	Outdoor air damper	0%	
	Relief fan / Relief damper	On/Open	
	Return Fan / Relief Damper	On / Open	
	VAV Box Relay	De-energized	
	Discharge Isolation Damper [(a)]	100% / Open	
	Return Isolation Damper[(a)]	100% / Open	
	Ventilation Override Relay	Energized	

Table 34. VOM (continued)

VOM Input	OUTPUT	OPERATION	Heat Cool Mode Status
Mode D (Purge)	Supply fan	On/100%[b]	Fan Only
	Outdoor air damper	Open	
	Relief fan / Relief damper	On/Open	
	Return Fan / Relief Damper	On / Open	
	VAV Box Relay	Energized	
	Discharge Isolation Damper[a]	100% / Open	
	Return Isolation Damper[a]	100% / Open	
	Ventilation Override Relay	Energized	
Mode E (Purge with Duct Static Pressure Control)	Supply fan	On/Duct Static Pressure Control	Fan Only
	Outdoor air damper	Open	
	Relief Fan / Relief Damper	On / Open	
	Return Fan / Relief Damper	On / Open	
	VAV Box Relay	Energized	
	Discharge Isolation Damper	100% / Open	
	Return Isolation Damper	100% / Open	
	Ventilation Override Relay	Energized	

Table 34. VOM (continued)

(a) Any active VOM mode that commands the Supply Fan, Relief Fan or Return Fan On requires that all installed isolation dampers must be Open >= to the Isolation Damper Position Fan Start Setpoint before the fans are allowed to start.
(b) Supply fan will operate at full speed or a limited speed not to exceed duct static pressure high limit.

Refer to the appropriate Programming, Troubleshooting Guide (PTG latest edition) for programming instructions.

Emergency Stop Switch

A normally closed (N.C.) switch wired to the customer connection (1KF11) and 1XD24 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 user interface. The switch must be rated for 12 ma @ 24 VDC minimum.

Occupied/Unoccupied Contacts

This binary input provides the Occupied/Unoccupied status information of the building to the Symbio 800. 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.

Wall or Duct Mount Humidity Sensor (BAYSENS036* or BAYSENS037*)

This field-installed humidity sensor is mounted in the space or in the return air duct, sending an analog input to the customer connection (1KF10) and 1XD26. It must be ordered/installed with modulating hot gas reheat, but can also be used for humidification applications.

Unit Replacement

This section covers the removal and preparation necessary for setting the R-454B replacement unit in place. For more detailed information, please see the *IntelliPak™ Rooftop 20 to130 Tons, R-410A – Engineering Bulletin* (RT-PRB027*–EN).

⚠ WARNING

R-454B Flammable A2L Refrigerant!

Failure to use proper equipment or components as described below could result in equipment failure, and possibly fire, which could result in death, serious injury, or equipment damage.

The equipment described in this manual uses R-454B refrigerant which is flammable (A2L). Use ONLY R-454B rated service equipment and components. For specific handling concerns with R-454B, contact your local representative.

⚠ WARNING

Fiberglass Wool!

Exposure 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. Disturbing the insulation in this product during installation, maintenance or repair will expose you to airborne particles of glass wool fibers and ceramic fibers known to the state of California to cause cancer through inhalation.

You MUST wear all necessary Personal Protective Equipment (PPE) including gloves, eye protection, a NIOSH approved dust/mist respirator, long sleeves and pants when working with products containing fiberglass wool.

Precautionary Measures:

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

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.**

Electrical Connection

⚠ WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

When it is 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.

Main Electrical Power

Lock and tag out unit main electric power and remove power supply wiring from installed disconnect/terminal block of unit. See for locations.

Note: *Inspect wiring to ensure that all field-installed wiring complies with NEC and applicable local codes.*

SEH Units with 200V or 230V Electric Heat

(Requires separate power supply to heater)

Lock and tag out unit main electric power and remove power supply wiring for the electric heat from a dedicated, field- supplied/installed disconnect to terminal block, or to an optional unit-mounted disconnect switch. See for locations.

Field-installed Control Wiring

Note: *Inspect wiring to ensure that all field-installed wiring complies with NEC and applicable local codes.*

Remove the field wiring connections for the variable air volume controls as applicable.

Note: *Label wiring to save time when reconnecting wiring is necessary.*

Remove ground wire from the unit.

Note: *The electrical connection for 40, 60, 70 and 75 ton is 32 inches further down the unit than older (pre-2010) style units. On full perimeter curbs, this also means the incoming electrical will be outside the curb area. The electrician should be informed of both points.*

See for typical field wiring for 20-75 ton units. See Figure 36, p. 63 for typical field power wiring for 90-130 ton units.

Requirements for Gas Heat

⚠ WARNING

Hazardous Gases and Flammable Vapors!

Failure to observe the following instructions could result in exposure to hazardous gases, fuel substances, or substances from incomplete combustion, which could result in death or serious injury. The state of California has determined that these substances may cause cancer, birth defects, or other reproductive harm.

Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures or lead to excessive carbon monoxide. To avoid hazardous gases and flammable vapors follow proper installation and setup of this product and all warnings as provided in this manual.

1. Remove and isolate gas supply from the unit gas train.
2. Ensure gas supply line piping joints are properly sealed.
3. Remove drip leg Installed in the gas piping near the unit.
4. Remove factory-supplied flue assembly installed on the unit.
5. Remove the 3/4" CPVC furnace drain stub out that was used for condensate drain.

Requirements for Hot Water Heat (SLH*)

1. Remove and isolate water piping that comes into the heating section from the base of the unit.
2. Remove the installed, 3-way modulating valve, if necessary, to remove unit.
3. Remove the valve actuator wiring.

Requirements for Steam Heat (SSH*)

1. Remove and isolate steam piping that comes into the heating section from the base of the unit.
2. Remove, 2-way modulating valve if necessary.
3. Remove the valve actuator wiring.

Space Pressure Sensor and Tubing Installation

(All units with Statitrac)

Remove field-supplied pneumatic tubing connected to the space pressure transducer located in the filter section (see Figure 37, p. 73).

Figure 37. Duct static pressure control layout

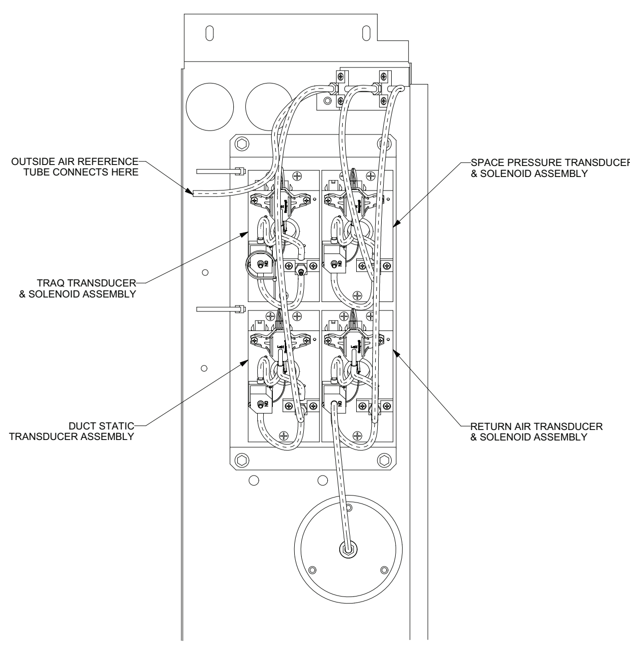
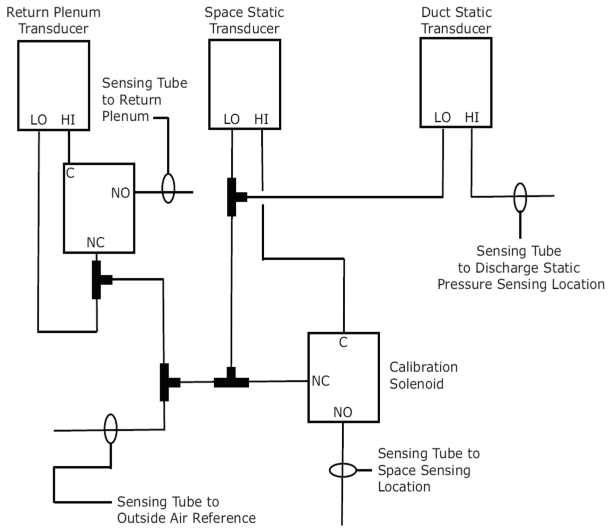


Figure 38. Duct, space, and return plenum pressure transducer

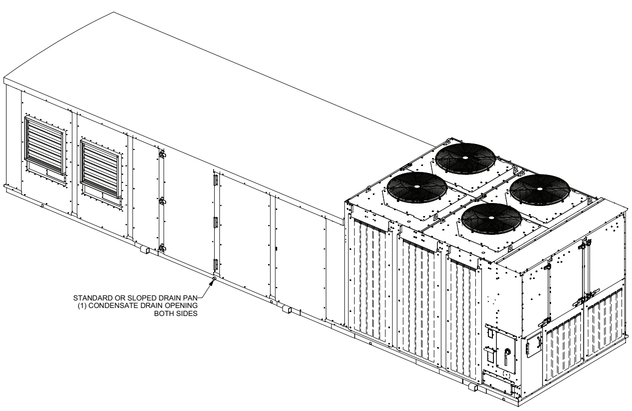


Condensate Drain Connections

Each S*HP or R unit is provided with two 1" evaporator condensate drain connections (one on each side of the unit).

Remove all 1" condensate drain connections from unit, see .

Figure 39. Condensate drain locations



Supply and Return Duct Connections

Ensure supply and return duct connections were installed to the roof curb supply and return areas of roof curb, rather than to the unit itself.

Remove supply and return duct work if it was directly connected to the unit.

Installation of New Units

See unit IOM and appropriate programming guide for installation operation and programming requirements. For Lifting Procedures, see "Unit Rigging and Placement," p. 37.

Table 35. Approximate roof curb and S*HC unit operating weights (units built prior to 1991)

Unit Size	Typical Unit Operating Weight			Roof Curb Max Weight	
	SAHC	SE,SL, SS, SXHC	SB, SFHC	SAHC	S*HF
C20	4,600	4,950	5,250	445	470
C25	4,700	5,050	5,300	445	470
C30	5,500	6,050	6,200	445	470
C40	7,500	8,200	8,500	505	540
C50	8,350	9,100	9,200	530	560
C55	8,500	9,200	9,350	530	560
C60	9,600	10,300	10,400	545	575
C70	10,500	11,200	11,300	545	575
C75	10,700	11,400	11,500	545	575

Note: Weight shown in this table represents the maximum unit operating weight for S*HC units with heating/cooling functions indicated and includes economizer and relief fan options. Actual unit weight is on the unit nameplate.

Table 36. Approximate operating weights, 90 to 100 ton, "E" style cabinet (units built prior to 1991)

Unit Size/ Tons	Rooftop w/o Relief Fans	Rooftop with Relief Fans	Curb
SEHE C90	13,150	14,500	600
SFHE C90	13,820	15,150	600
SXHE C90	13,000	14,340	600
SEHE D11	13,700	15,050 600	600
SFHE D11	14,360	15,700	600
SXHE D11	13,550	14,880	600

Figure 40. Perimeter gasket material

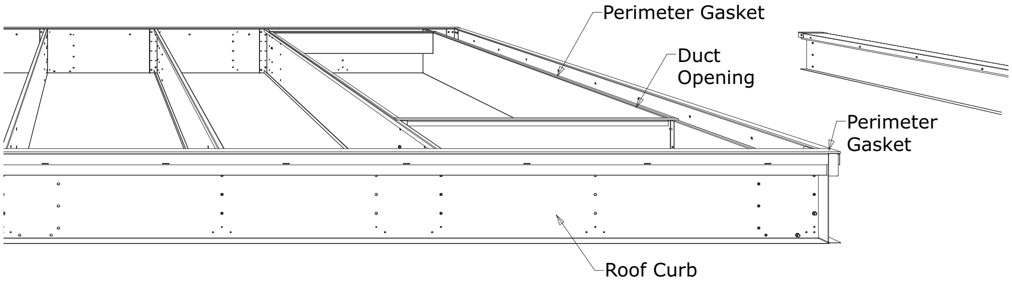


Figure 41. Typical partial perimeter curb with pedestal illustration for 20- 75 ton standard units

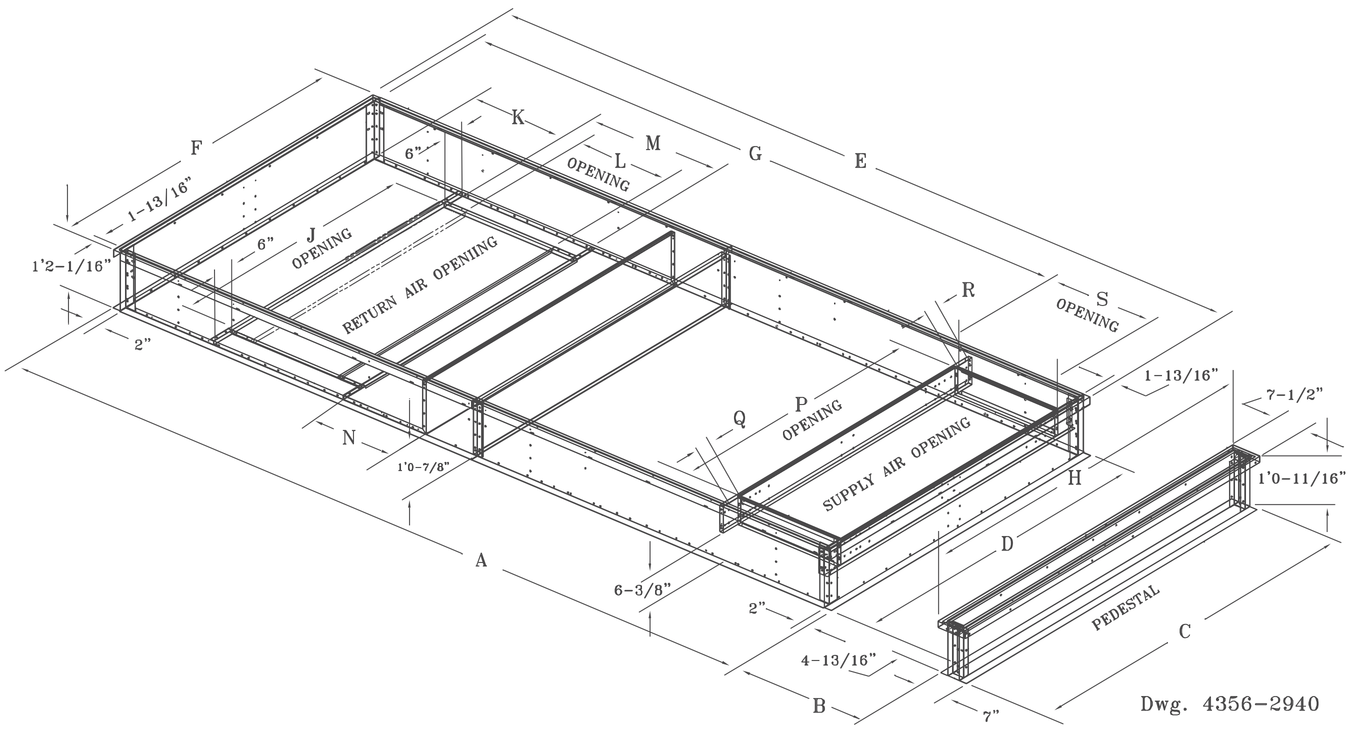


Table 37. Typical curb dimensions for 20 to 75 ton SAHF units with air-cooled condensers

Curb Dimensions	SAHF-C20,C25, C30	SAHF-C40	SAHF-C50, C55	SAHF-C60, C70, C75
A	16' 3-7/8"	19' 1-15/16"	19' 1-15/16"	19' 1-15/16"
B	2' 10-1/16"	7' 10-1/16"	7' 10-1/16	7' 10-1/16"
C	7' 10-7/16"	7' 10-7/16"	7' 10-7/16"	9' 11-15/16"
D	7' 0-13/16"	7' 0-13/16"	7' 0-13/16"	9' 2-5/16"
E	16' 3-9/16"	19' 1-5/8"	19' 1-5/8"	19' 1-5/8"
F	7' 0-1/2"	7' 0-1/2"	7' 0-1/2"	9' 2"
G	13' 6-15/16"	16' 2-9/16"	16' 2-9/16"	16' 2-9/16"
H	7' 11-15/16"	7' 11-15/16"	7' 11-15/16"	10' 1-7/16"
J	5' 8-13/16"	5' 8-13/16"	5' 8-13/16"	7' 10-5/16"
K	2' 0"	2' 0"	2' 0"	2' 0"
L	2' 5-5/16"	3' 6"	3' 6"	3' 6"

Table 37. Typical curb dimensions for 20 to 75 ton SAHF units with air-cooled condensers (continued)

Curb Dimensions	SAHF-C20,C25, C30	SAHF-C40	SAHF-C50, C55	SAHF-C60, C70, C75
M	2' 11-5/16"	4' 0"	4' 0"	4' 0"
N	1' 10-5/8"	1' 10-5/8"	1' 10-5/8"	1' 10-5/8"
P	5' 9-1/2"	5' 9-1/2"	5' 91/2"	6' 11-7/8"
Q	0' 5-11/16"	0' 5-11/16"	0' 5-11/16"	0' 11-3/16"
R	0' 5-11/16"	0' 5-11/16"	0' 5-11/16"	0' 11-3/16"
S	2' 3-5/16"	2' 5-15/16"	2' 5-15/16"	2' 5-15/16"

Table 38. Typical curb dimensions for SEHF, SFHF, SLHF, SSHF, SXHF, 20 to 75 ton units with air-cooled condensers

Curb Dimensions	S_HF-C20,C25, C30	S_HF-C40	S_HF-C50, C55	S_HF-C60,C70, C75
A	18' 7-1/2"	22' 4-1/2"	22' 4-1/2" 22'	4-1/2"
B	2' 10-1/16"	7' 10-1/16"	7' 10-1/16"	7' 10-1/16
C	7' 10-7/16"	7' 10-7/16"	7' 10-7/16"	9' 11-15/16"
D	7' 0-13/16"	7' 0-13/16"	7' 0-13/16"	9' 2-5/16"
E	18' 7-3/16"	22' 4-1/8"	22' 4-1/8"	22' 4-1/8"
F	7' 0-1/2"	7' 0-1/2"	7' 0-1/2"	9' 2"
G	15' 10-9/16"	19' 5"	19' 5"	19' 5"
H	7' 11-15/16"	7' 11-15/16"	7' 11-15/16"	10' 1-7/16"
J	5' 8-13/16"	5' 8-13/16"	5' 8-13/16"	7' 10-5/16"
K	2' 0"	2' 0"	2' 0"	2' 0"
L	2' 5-5/16"	3' 6"	3' 6"	3' 6"
M	2' 11-5/16"	4' 0"	4' 0"	4' 0"
N	1' 10-5/8"	1' 10-5/8"	1' 10-5/8"	1' 10-5/8"
P	5' 7-3/8"	5' 7-3/8"	5' 7-3/8"	7' 8-3/4"
Q	1' 0-7/16"	0' 11-3/16"	0' 11-3/16"	0' 11-3/16"
R	0' 1 "	0' 2-1/4"	0' 2-1/4"	0' 2-3/8"
S	2' 3-5/16"	2' 5-5/16"	2' 5-5/16"	2' 5-5/16"

Figure 42. Full perimeter curb with pedestal (20 to 75 ton units built prior to 1991)

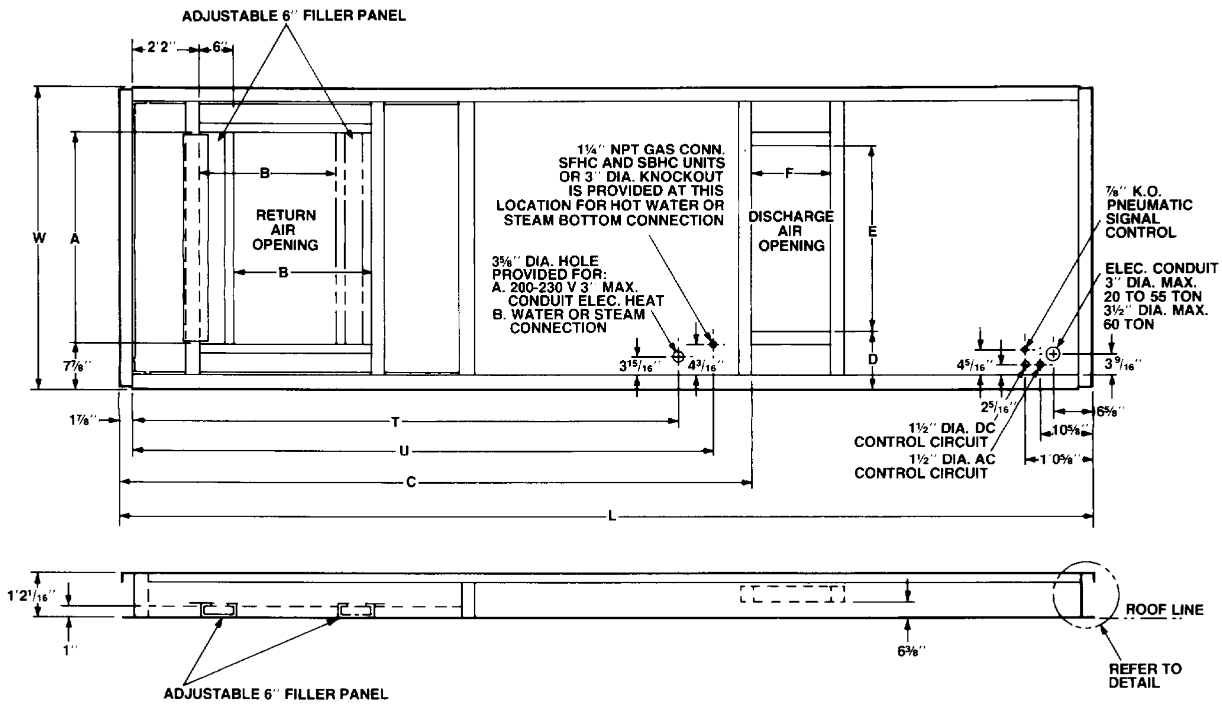


Table 39. 20 to 75 ton roof curb dimensions, downflow (units built prior to 1991)

Model	Unit Size	W	L	A	B	C	D	E	F	T	U
SAHC	20, 25, 30	7'–1/2"	21'–3 3/4"	5'–8 3/4"	2'–5 5/16"	13'–8 13/16"	7 1/2"	5'–9 1/2"	2'–3 5/16"	NA	NA
	40	7'–1/2"	26'–6"	5'–8 3/4"	3'–6"	16'–4 3/8"	7 1/2"	5'–9 1/2"	2'–5 15/16"	NA	NA
	50, 55	7'–1/2"	29'–1 15/16"	5'–8 3/4"	3'–6"	16'–4 5/16"	7 1/2"	5'–9 1/2"	2'–5 15/16"	NA	NA
	60	9'–2"	26'–6"	7'–10 1/4"	3'–6"	16'–4 3/8"	1'–1 1/16"	6'–11 7/8"	2'–5 15/16"	NA	NA
	75	9'–2"	26'–6"	7'–10 1/4"	3'–6"	16'–4 3/8"	1'–1 1/16"	6'–11 7/8"	2'–5 15/16"	NA	NA
SEHC	20, 25, 30	7'–1/2"	23'–7 3/8"	5'–8 3/4"	2'–5 5/16"	16'–0 7/16"	1'–2 5/16"	5'–7 3/8"	2'–3 5/16"	15'–7/16"	16'–4 7/8"
SFHC	40	7'–1/2"	29'–8 1/2"	5'–8 3/4"	3'–6"	19'–6 7/8"	1'–2 5/16"	5'–7 3/8"	2'–5 15/16"	18'–6 13/16"	20'–1 7/8" 19'–8 7/8"
SLHC SSHC	50, 55	7'–1/2"	32'–4 1/2"	5'–8 3/4"	3'–6"	19'–6 13/16"	1'–2 5/16"	5'–7 3/8"	2'–5 15/16"	18'–6 13/16"	20'–1 7/8" 19'–8 7/8"
SXHC	60	9'–2"	29'–8 1/2"	7'–10 1/4"	3'–6"	19'–6 7/8"	1'–2 5/16"	7'–8 7/8"	2'–5 15/16"	18'–6 13/16"	20'–1 7/8" 19'–8 7/8"
	75	9'–2"	29'–8 1/2"	7'–10 1/4"	3'–6"	19'–6 7/8"	1'–2 5/16"	7'–8 7/8"	2'–5 15/16"	18'–6 13/16"	20'–1 7/8" 19'–8 7/8"

Note: The return opening of the roof curb is provided with an adjustable filler panel 6" wide. This panel allows adjustment of the return air opening in order to clear roof members of all standard roof constructions with both supply and return openings. The return air opening of the curb is at a 90 degree angle as compared to the rooftop return air opening to allow this placement flexibility. The curb acts as a plenum between the ductwork and the unit return opening. A retainer clip is used to secure the adjustable filler piece to the roof curb.

Unit Start-up

Sequence of Operation

NOTICE

Compressor Failure!

Failure to follow instruction below could result in compressor failure.

Unit must be powered and crankcase heaters energized at least 8 hours BEFORE compressors are started.

Stop/Off/Auto

There are a number of reasons the Symbio 800 controller will have the IntelliPak unit stopped or off. The user interface home screen displays unit mode of Stopped or Auto. Stopped is indicated when an override is preventing operation such as: Local Stop, Emergency Stop or External Stop input is active. Auto is indicated when in automatic control but is currently off in modes such as: Unoccupied, Ventilation Override, Emergency Override or the like.

When Heat Cool Mode Status is Off, unit operation will be prevented; whereas, all other modes allow operation.

Power-Up Start Delay

Anytime power is applied to the unit or the controller is reset, and the unit is able to run, a user adjustable Power-Up Start Delay setting is enforced to allow staggered starts of multiple units. The user interface home screen displays Run Inhibit when active. Power Up Delay Inhibit, with remaining minutes and seconds, will be displayed on user interface operating modes screen. Power-Up Start Delay is also applies to Rapid Restart, or when the controller exits Ventilation Override or Emergency Override modes.

Normal Unit Starting

When Local Stop, Stop modes, overrides, and diagnostic shutdowns are removed, the controller will start unit operation. The supply fan starts and increases to the minimum Hz setting and must prove On. Unit mode Running is displayed on the user interface. The supply fan will run for one minute, with the outdoor air damper closed, before transitioning into an active heat or cool mode.

Rapid Restart Operation

The purpose of rapid restart is to confirm the space temperature recovers from high heating loads once the unit has recovered from a power outage. This is accomplished by utilizing aggressive economizing and/or compressor staging in a user adjustable amount of time. After a Rapid Restart event, the unit can subsequently manage the load using normal capacity control. A typical application is a data center.

The unit configuration must have Rapid Restart configured as “Installed” and the Rapid Restart Enable feature setting must be set to “True” to allow this function to operate.

Mechanical cooling (DX) is available for Rapid Restart if the Outdoor Air Temperature is above the Low Ambient Lockout setpoint.

After power-up start delay is satisfied, the unit will override all other forms of time delays (i.e. ICS, VAV Box Stroke Time, Outdoor Air Damper Stroke Time) and allow the Supply Fan to start. Once the Supply Fan has proven, the unit will determine the proper staging sequence by processing outdoor air temperature and return air temperature. The unit will generate a Rapid Restart mode annunciation on the user interface, operating modes screen.

VOM and Emergency Override have higher priority than Rapid Restart. If either occur, Rapid Restart will be terminated and the VOM or Emergency Override will be performed. Demand limit also has priority over Rapid Restart.

The unit will terminate Rapid Restart and will de-energize the VAV Box Relay (if installed), and release to normal unit control when the Cooling Capacity Status meets or exceeds the Rapid Restart Capacity Target or when the Rapid Restart Termination Time expires.

Occupancy

There are many sources and types of occupancy. These have an effect on the operation of the IntelliPak unit. All sources are arbitrated (prioritized) into a final occupancy status.

Sources of Occupancy

- Occupancy Request is a communicated value from a Building Automation System (BAS) schedule.
- Occupancy Input is a local input from the space served by the equipment. These are typically optional local time clocks or occupancy sensors. This is a physical input to the Symbio controller and is field installed.
- Bypass Timer starts because of a user requested occupancy override (also known as Occupied Bypass). The occupant requests temporary occupied comfort heating or cooling during unoccupied scheduled time periods. An example of this would be the Timed Override (TOV) button on the zone sensor. See “Timed Override,” p. 79 for more information.

Occupancy Status Definitions

Occupied Operation: The IntelliPak unit is running in a Normal mode providing temperature and ventilation control to the normal occupied setpoints and comfort demands of the occupants.

Unoccupied Operation: The IntelliPak unit is typically shut down and is not providing temperature control to the normal occupied setpoints. No ventilation is required or provided. Temperature control is determined by energy conservation and building protection thresholds.

Occupied Bypass Operation: The IntelliPak unit is temporarily in an Occupied state for some period of time and will automatically return to unoccupied operation when the bypass timer expires. The Occupied Bypass Timer is a user-adjustable field. However setting the timer to 0 minutes effectively disables Timed Override at the equipment controller.

Occupied Standby Operation: Standby does not apply to a discharge air controller (VVDA, CVDA unit type). These units treat Standby as Occupied. Space temperature control units in an Occupied-Standby state are controlling to occupied standby temperature setpoints. Normal operation will resume when Occupancy Status goes to an Occupied state.

Timed Override

Timed Override (TOV) is a function that allows a user, located in the conditioned space, to temporarily override the IntelliPak operation from unoccupied mode to occupied mode (referred to as Occupied-Bypass). To accomplish this, Trane wired or wireless zone sensor devices are equipped with “On” and “Cancel” push buttons. Some sensors refer to the buttons as “Occupied” and “Unoccupied”. Timed override operation applies, in some way, to all unit types.

On Wired sensors, the timed override request (ON) and timed override cancel (CANCEL) buttons momentary modify the zone temperature thermistor resistance to a value outside the normal zone temperature operating range. The Symbio 800 controller detects this change; however, this momentary button press does not disrupt the space temperature value being used for heating and cooling control. The press duration is 0.5 to 8 seconds.

Wireless sensors process the timed override request/cancel signal at the sensor and communicate the appropriate timed override status (mode).

Service Pin Message Request

A secondary feature of wired zone sensors is Service Pin Message Request, not associated with TOV. An On/Occupied push button press for 8 to 30 seconds can initiate Neuron ID and Program ID message broadcast on a LON network. This function is used to install and troubleshoot LON networks. This feature benefits installation of a LON device by initiating the service pin message from a zone sensor rather than at the equipment.

Sensors

The IntelliPak unit uses many types of sensors. Most sensors are factory installed. Some sensors are field installed and may be wired or wireless. Field installed wired sensors are available from Trane and many other sources. In every case, the correct type of sensor must be used.

All sensors are factory calibrated and require no field re-calibration. See the Product Catalog for more information on sensors.

Heat Cool Mode Status

Heat Cool Mode Status reports the unit mode of operation. The Symbio 800 can receive mode inputs from different external and local input sources that are arbitrated; however, the control active operating mode represents the capacity being delivered to the building and reported via Heat Cool Mode Status.

Heat

In this mode, the controls provide heating capacity per heat type installed, active heat setpoint, and occupancy. Application requirements such as full or modulating air flow are also considered in heating mode. All forms of cooling capacity are effectively disabled.

If Heat is the requested mode when the unit does not have heat capacity configured or heat is disabled, Heat is reported as Heat Cool Mode Status. If the unit cannot provide heat, the supply fan is enabled to operate (as configured) to provide ventilation during occupied modes of operation.

Cool

Cool mode is reported when the control objective is to provide cooling to maintain building comfort. Direct expansion cooling is the primary cooling source. Cool mode is also reported when Economizer cooling, Dehumidification, Pre-Cool, and Night Purge sub-modes of operation are active.

For Discharge Air Control units, heat is allowed (when enabled) to temper cold mixed air conditions to the desired cooling setpoint. See Cool - Tempering sub-mode section for more information.

Fan Only

This mode disables all forms of heating and cooling capacity but operates the fan continuously at minimum speed or modulates to maintain duct static pressure. The outdoor air damper modulates to damper minimum position setpoint or flow setpoint to provide ventilation.

Fan Only is also reported in Emergency Override and Ventilation Override Modes. Heat Cool Mode Request can also command the Fan Only mode.

Maximum Heat

Maximum Heat is a heating mode of operation with the supply fan operating at maximum speed. The controller does not provide maximum heat (as the name infers); instead, the controller provides heat capacity per the Operating Mode and unit type.

- **Multi Zone VAV**

  Multi Zone VAV control units will transition to Maximum Heat operation in heating modes (for example Occupied Heat, Morning Warm Up, Daytime Warm Up) when the installed heating capacity requires full air flow. Maximum Heat can also be a Heat Cool Mode Request command, which Symbio 800 will remain in the mode until the mode is released. On the transition to Maximum Heat the Symbio 800 will reduce the supply fan to minimum speed, energize the VAV Box Relay and wait the duration of the VAV Box Stroke Time (adjustable). The VAV Box Stroke Time allows the VAV boxes in the system to open. The supply fan speed will then increase to 100% or the maximum speed subject to high duct static pressure limit. Once the supply fan reaches its allowed maximum speed, Symbio 800 will enable heating capacity control to Discharge Air Heating Setpoint Active. Ventilation is managed per the operating mode.

The transition from Maximum Heat back to modulating air flow control modes is as follows:

1. Heat capacity terminates (if active), a 5 minute post heat timer begins.
2. Supply fan speed slows to minimum speed, a 3 minute minimum speed timer begins
3. VAV Box Relay de-energizes
4. When the 5 minute post heat and 3 minute minimum speed timer expire, modulating air flow control is enabled, operating mode transitions, and capacity control enables.

- **Single Zone VAV (Space Temperature)**

  Single Zone VAV control units will also accept a Maximum Heat command via Heat Cool Mode Request. On this command the Symbio 800 will transition to a heat mode while operating the supply fan at 100% capacity. Heat Cool Mode Status will report Maximum Heat to indicate the mode is active.

Off

Off is the reported mode when unit operation is shutdown due to diagnostics, equipment protections or normal unit operation.

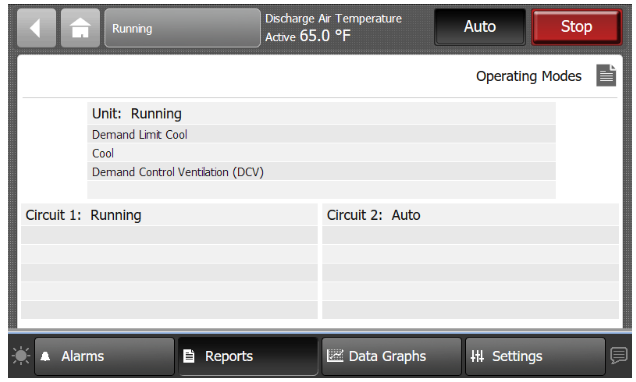
Test

When a Manual Override is Active such that it overrides normal capacity control or limits the ability to provide comfort heating/cooling, Heat Cool Mode Status reports Test. For example, a Manual Override of a relief fan will not be reported as Test. See *IntelliPak™ with Symbio™ 800 – Programming Guide* (RT-SVP011*-EN) for more information.

Operating Modes

The user interface Operating Modes screen provides Unit and Circuit level mode information valuable to understanding the equipment operating state. Each Unit and Circuit mode provide sub-mode information with valuable details to understand active controls and limits that are affecting operation. For more information, see *IntelliPak™ with Symbio™ 800 – Programming Guide* (RT-SVP011*-EN).

Figure 43. Operating Modes



Unit

Unit modes provide a status of the equipment operating state. Each of the Unit modes will have one or more sub-modes that provide more details about the functions active in the mode.

Stopped

Stopped is a Unit mode when control is prevented from running. For example, if Equipment Stop binary input is active, *Equipment Stop* will be listed as a sub-mode.

Run Inhibit

The unit is currently being inhibited from starting and running. For example, if a Power Up Delay timer is preventing the unit startup, *Power Up Delay Inhibit (Min: Sec)* will be listed with the remaining minutes and seconds to expire.

Auto

The unit supply fan is typically running to provide ventilation. *Idle* is listed as a sub-mode on startup when the control is determining an initial heating or cooling demand. Additional sub-modes are listed when gas heat diagnostics are preventing heat operation.

Running

Running is a Unit mode when normal heating, cooling and ventilation control functions are active. The supply fan is running. Up to four Running sub-modes will be listed on the user interface, Operating Modes screen.

Circuit

Circuit modes provide refrigerant circuit level operating state and sub-mode information. When the unit has two circuits, the user interface will provide both Circuit 1 and Circuit 2 mode and sub-mode information.

Stopped

The circuit is not running, and cannot run without removing a condition. For example, *Diagnostic Shutdown – Manual Reset* sub-mode is displayed when a diagnostic has caused a circuit level shutdown and a manual reset is required.

Run Inhibit

The circuit is currently being inhibited from starting (and running), but may be allowed to start if the inhibiting or diagnostic condition is cleared. For example: Start Inhibited by Low Ambient Temp is displayed when outdoor air temperature is below the Low Ambient Lockout Setpoint; the circuit is being inhibited from starting.

Auto

The circuit is not running but expected to start given the proper conditions are satisfied.

Waiting to Start

The circuit is going through the necessary steps to allow the circuit to start; for example, EXV is being commanded to a pre-position prior to starting a compressor.

Running

A compressor on a given circuit is currently running.

Running — Limit

The circuit is currently running; however, the operation of the unit/compressors is actively limited by the controls. Active compressor protection sub-modes will be listed. See Compressor Protections section for more information.

Shutting Down

The circuit is preparing to de-energize the compressor. For example, Diagnostic Shutdown – Manual Reset is displayed when the circuit is shutting down on a latching diagnostic.

Unit Sub-Modes

Morning Warm Up

Morning Warm Up is an optional feature when heat is configured and can be Enabled or Disabled. Morning Warm Up is a mode often used during building unoccupied periods and optimal start applications to rapidly increase the space temperature, as efficiently as possible, before building occupancy. The outdoor air damper minimum position setpoint will be overridden to 0%, ventilation air is not provided during Morning Warm Up.

For Morning Warmup to initiate on a transition from Unoccupied to Occupied, Space temperature control units must be in Heat, Max Heat, or Auto. Discharge air control units can also initiate Morning Warm Up on an Off to Occupied transition.

For all equipment types (Multi Zone-VAV, and Single Zone VAV): On a transition from Unoccupied to Occupied or Occupied-Standby, and with a valid space temperature 1.5° F below the Morning Warmup Setpoint, morning warm up operation initiates. Heat Cool Mode Status reports maximum heat if the heat type requires full airflow and VAV Box Relay binary output will energize (see Maximum Heat for details). Otherwise, heat types that allow modulating airflow will report heat.

The Symbio 800 operates in a discharge air control mode delivering heating capacity per Discharge Air Heating Setpoint Active; this provides flexibility when 100% heat capacity in not desired. Variable air volume discharge air control units will operate the supply fan per Duct Static Pressure Setpoint, if the installed heat type allows. (See Heat Types section for more information).

When 60 minutes expires or when space temperature equals or exceeds the Morning Warmup Setpoint, Morning Warm Up mode will terminate.

Morning Warm Up mode can also be commanded via Heat Cool Mode Request from a building automation system or external control. In this case, the unit remains in Morning Warm Up mode indefinitely until the commanded mode is removed or changed. When the space temperature exceeds the Morning Warmup Setpoint, heating capacity is disabled but the supply fan operation continues to circulate air until the Morning Warm Up command is removed. Heat capacity will re-enable if space temperature falls 1.5°F below Morning Warmup Setpoint.

Pre Cool

Pre Cool is a feature of the unit and can be Enabled, or Disabled. Pre Cool is a mode often used during building unoccupied periods and optimal start applications to rapidly decrease the space temperature, as efficiently as possible, before building occupancy. Ventilation air is not provided during Pre Cool.

Space temperature control units must be in Cool or Auto mode to allow Pre Cool operation. Discharge air control units also evaluate Pre Cool operation on transition from Off/Shutdown to Occupied.

All equipment types, a transition from Unoccupied to Occupied mode, if a valid space temperature input is above the Pre Cool Setpoint + 1.5°F, Pre Cool Mode will initiate. Symbio 800 operates in a discharge air control mode providing discharge air per Discharge Air Cooling Setpoint Active until space temperature drops equal or below the Pre Cool Setpoint. In this cooling mode the outdoor air damper minimum position is 0%, but the controller will use compressor and/or economizer cooling when suitable.

Multi Zone-VAV units will modulate fan speed and manage to the duct static pressure setpoint. All other unit types, the supply fan will operate at max speed.

Pre Cool mode can also be commanded via Heat Cool Mode Request. In this case, the Symbio 800 remains in Pre Cool indefinitely until the commanded mode is removed. When space temperature is equal or less than Pre Cool Setpoint, cooling capacity is disabled but the supply fan continues to circulate air until the Pre Cool command is removed. Cooling capacity control will enable if space temperature rises above Pre Cool Setpoint + 1.5°F.

Night Purge

Night Purge mode is typically applied in building unoccupied periods when conditions are suitable for economizer cooling; all other forms of cooling capacity are disabled. This mode is only supported via a commanded Heat Cool Mode Request. The controller will not use local inputs and assume outdoor air is suitable for economizing. The outdoor air damper minimum position setpoint will be overridden to 0%.

When active, the Symbio 800 operates in a discharge air control mode, modulating the outdoor air damper to provide cooling capacity per Discharge Air Cooling Setpoint Active. Night Purge operation is terminated when the Night Purge, Heat Cool Mode Request is removed.

Daytime Warm Up

Daytime Warm Up is a feature of Multi Zone-VAV Discharge Air Temperature units that can be Enabled, or Disabled. Daytime Warm Up is available with any heat type installed. Daytime Warm Up is a mode used during building occupied periods to recover a critical zone that is too cold. Ventilation air is provided while in Daytime Warm Up mode.

When the Heat Cool Mode Status is Cool (the unit is providing cooling), if a valid space temperature is 3°F below the adjustable Daytime Warmup Setpoint, daytime warm up operation initiates. The unit will operate in a discharge air control mode delivering heating capacity per Discharge Air Heating Setpoint Active. Variable air volume discharge air control units will operate the supply fan to the duct static pressure setpoint and report Heat Cool Mode Status as Heat, if the installed heat type allows modulating air flow. Else if the heat type requires full air flow, Maximum Heat is reported.

When the space temperature rises above the Daytime Warmup Setpoint, daytime warm up operation terminates and the Symbio 800 will transition back to Cool mode. See Maximum Heat for details. If the requested operating mode is no longer Cool, Daytime Warm Up terminates.

Idle

Idle is a sub-mode of Space Temperature Control units configured for supply fan cycling. When there is no demand for heating or cooling the supply fan will cycle off and Idle will be displayed.

Table 40. Summary of heat cool modes and sub modes

Heat Cool Modes	Sub Modes
Heat	Morning Warm Up
Maximum Heat	Morning Warm [(a)] Daytime Warm Up
Cool	Cool – Dehumidification Cool – Economizing Cool – Economizing + DX Cool – Tempering[(a)] Daytime Warm Up[(a)] Pre Cool Night Purge
All modes	Idle Demand Limit Ventilation Override Mode X Emergency Override Mode X External Supply Fan Control External Relief Fan Control Demand Control Ventilation

(a) MZ-VAV Discharge air temperature units only

Supply Fan Control

When IntelliPak units with the Symbio 800 controller have one or more supply fans installed with VFD drives. All fans are controlled identically. The fans are sent the On/Off command at the same time and commanded to the same speed at all times. It is assumed that the VFDs for each fan are setup identically. Supply fan operation will be confirmed via a method of proving airflow which is explained below.

Supply Fan Speed Control

The controller sends a speed command to each VFD as a value from 0-100%. The VFD interprets the commands as 0% = Minimum frequency and 100% = Maximum frequency. See *IntelliPak™ with Symbio™ 800 – Programming Guide* (RT-SVP011*-EN), Manual Overrides for more details.

The supply fan speed requested and commanded value will remain at 0% any time the Active Supply Fan Run Command = OFF. Once the Active Supply Fan Run Command = ON and the unit has transitioned into an active Heat/Cool state, the supply fan speed will be controlled as required by unit type.

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- Multi Zone VAV units modulate the supply fan speed to perform Duct Static Pressure Control after being proved On. During full airflow modes, Adaptive High Duct Static Limit will control supply fan speed to 100% or as high as possible subject to duct static pressure high limit constraints.
- Zone Temperature units can be configured via Supply Fan Configuration Command to cycle the supply fan off when heating or cooling capacity is inactive. A demand for heat or cooling will automatically initiate supply fan operation.
- Single Zone VAV units modulate the supply fan based on capacity control after being proved On.

Supply Fan Proving Operation and Method

Supply Fan Proving is active only after the Supply Fan Run Command is set to ON. Once set to ON, the supply fan is required to prove greater than 90% of minimum fan RPM (VFD minimum Hz setting), within 40 seconds. Fan proving fails anytime the fan is less than 90% of minimum RPM. A diagnostic is generated and operation stops.

Note: *Bypass Mode uses an alternate method of fan proving. See below for more details.*

Supply Fan VFD Bypass Control

All units will have a configurable option to provide Supply Fan VFD Bypass control. Whenever the bypass option is installed, the unit will include all of the necessary components to bypass the VFD assembly and allow the supply fan to operate at line frequency.

Entering VFD Bypass Control

- The supply fan must be off and no-discharge air flow (duct static pressure) detected for 40 continuous seconds to enter or leave Supply Fan VFD Bypass Mode.

- Enabling and disabling Supply Fan VFD Bypass Mode can only take place from the unit user interface.
- Both supply fan VFDs will be bypassed and the fans then operate at line frequency.
- During active Supply Fan VFD Bypass Mode
  – The Modbus communicated command for supply fan will be set to OFF, and the communicated speed command will be set to 0%.
  – All supply fan VFD diagnostics will be masked.
  – A warning only, latching “Supply Fan Bypass Enabled” diagnostic will be generated.
  – A duct static pressure sensor, if installed, will be used to perform Duct Static Pressure High Limit protection if enabled for bypass operation.

See *IntelliPak™ with Symbio™ 800 – Programming Guide* (RT-SVP011*-EN) for more information.

Exiting Supply Fan VFD Bypass Mode

- The user will not be allowed to remove the unit from an active *Supply Fan VFD Bypass Mode* at the user interface until all of the following has occurred:
  – The user has requested *Unit Stop Mode* from the user interface.
  – All components have been commanded OFF or CLOSED.
  – The fan proving mechanism indicates a supply fan no-flow condition has existed for 40 continuous seconds.
- When the user removes the unit from active Supply Fan VFD Bypass Mode at the user interface, all of the following will be enforced:
  – The *Supply Fan Bypass Relay* will remain OFF.
  – The *VAV Box Relay* will be commanded OFF (de-energized) to indicate normal airflow mode to the system, and the *VAV Box Stroke Time* will count down.
  – Once the above conditions have been satisfied, the user will be allowed to request *Unit Auto Mode* at the user interface.
- At all times when the unit is not in an active *Supply Fan VFD Bypass Mode*, the *Supply Fan Bypass Relay* will be commanded OFF (de-energized).

Supply Fan Proving with VFD Bypass

Units configured with Supply Fan VFD Bypass option require two modes of supply fan proving. During non-Bypass unit operation supply fan proving will use the fan’s VFD RPM as is used normally. The enabling and disabling of Supply Fan Bypass Mode, as well as unit operation during an active bypass event, requires Duct Static Pressure to be used for supply fan proving.

Note: *The enabling and disabling of VFD Bypass will be dis-allowed until the Duct Static Pressure indicates no flow per the below option.*

Proving criteria for proof of flow: When Duct Static Pressure rises above the Bypass Duct Static Diff Pressure setting, the supply fan will indicate a Flow condition.

Proving criteria for proof of no flow: If this pressure remains below 30% of the Bypass Duct Static Diff Pressure setting for 40 continuous seconds, the supply fan will indicate a No-Flow condition.

Operation during Manual Override and VOM (Emergency Override) Modes

Manual Override, VOM, and Emergency Override modes will operate as defined except for the following modifications:

1. If the fan is ON it will run at line frequency.
2. The VAV Box Relay will follow the defined operation specified in each VOM Mode user interface setting.
3. External fan control in bypass mode is supported. An external Supply Fan Speed Setpoint value = 0% will turn the fan Off, and any value > 0 will turn the fan On. The Supply Fan Speed Status always reports 100% speed during active supply fan bypass operation.

Minimum Ventilation Control

Symbio 800 provides outdoor air minimum ventilation control via options described below. Traq™ outdoor air flow control is the highest priority when installed and enabled. If Traq becomes disabled or inactive, Outdoor Air Flow Compensation will calculate a damper minimum position setpoint (this option should be disabled on constant volume units). If Outdoor Air Flow Compensation is disabled, Outdoor Air Minimum Position Setpoint will calculate damper minimum position setpoint.

Outdoor Air Flow Control (Traq)

The outdoor air damper is modulated to provide outdoor air flow (cfm) required by Outdoor Air Minimum Flow Setpoint. The outdoor air damper will modulate closed and open to maintain the required outdoor air minimum flow rate. See Table 41, p. 84 for additional information and settings.

The provided air flow measurement capabilities include periodic, automatic calibration; however, air flow gain and offset settings are provided for field adjustment.

Outdoor Air Flow Compensation

The outdoor air damper minimum position is modulated to provide outdoor air based on a variable supply fan speed. When supply fan increases speed the outdoor air damper minimum position is reduced, to prevent over ventilation. When supply fan decreases speed the outdoor air damper minimum position is increased to maintain design outdoor air flow requirements. There are three user editable settings to linearize damper position with the fan curve. See Table 41, p. 84 for additional information.

Outdoor Air Minimum Position Control

This function provides a fixed damper position for minimum outdoor airflow requirements. The damper is controlled to a position determined by Economizer Minimum Position Setpoint Active. This feature is available on all unit types with an outdoor air damper, but commonly used on constant volume units.

Demand Control Ventilation (DCV)

Demand control ventilation reduces energy consumption by reducing the outdoor air damper below minimum ventilation based on space CO_2. Decreasing CO_2 levels will decrease damper position to DCV minimum damper position setpoint. Increasing CO_2 level will increase damper position to design minimum setpoint. DCV requires a valid space CO_2 value.

Demand control ventilation setpoints used in all methods.

- Space CO_2 high limit
- Space CO_2 low limit

DCV when enabled with outdoor airflow control (Traq), DCV resets the outdoor air minimum flow setpoint based on space CO_2. DCV enabled with Outdoor Air Flow Compensation, DCV resets the outdoor air damper minimum position based space CO_2 and supply fan speed. DCV enabled with Outdoor Air Minimum Position Control resets the outdoor air damper minimum position based on space CO_2.

Table below summarizes the settings used for each Minimum Damper Position Control and Demand Control Ventilation.

Table 41. Outdoor air damper minimum ventilation control

Traq	Outdoor Air Flow Compensation	Demand Control Ventilation	Description	Outdoor Air Damper Controlling Setpoints
Enabled/Active	Disabled	Disabled	Damper controls to outdoor air minimum flow setpoint	Setpoint: Outdoor Air Minimum Flow Setpoint Active Outdoor Air Minimum Flow Setpoint Status
Enabled/Active	Disabled	Enabled/Active	Outdoor Air Flow setpoint is reset based on space CO_2.	Setpoint: Outdoor Air Minimum Flow Setpoint Status Settings: Design Min Outdoor Air Flow Setpoint DCV Min Outdoor Air Flow Setpoint
Disabled	Enabled/Active	Disabled	Outdoor Air Damper Minimum Position is reset based on supply fan speed.	Setpoint: Economizer Minimum Position Setpoint Active Settings: Design Min OA Damper Pos Setpoint Max Fan Design Min OA Damper Pos Setpoint Mid Fan Design Min OA Damper Pos Setpoint Min Fan
Disabled	Enabled/Active	Enabled/Active	Outdoor Air Damper Minimum Position is reset based on supply fan speed and space CO2.	Setpoint: Economizer Minimum Position Setpoint Active Settings: Design Min OA Damper Pos Setpoint Max Fan Design Min OA Damper Pos Setpoint Mid Fan Design Min OA Damper Pos Setpoint Min Fan DCV Min Outdoor Air Dampr Pos at Max Fan DCV Min Outdoor Air Dampr Pos at Min Fan

Table 41. Outdoor air damper minimum ventilation control (continued)

Traq	Outdoor Air Flow Compensation	Demand Control Ventilation	Description	Outdoor Air Damper Controlling Setpoints
Disabled	Disabled	Enabled/Active	Outdoor Air Damper Minimum Position is reset based on space CO_2.	Setpoint: Economizer Minimum Position Setpoint Active
				Settings: Design Min OA Damper Position DCV Min Outdoor Air Damper Pos Setpoint
Disabled	Disabled	Disabled	Outdoor air damper position is controlled by cooling	Setpoint: Economizer Minimum Position Setpoint Active

During normal occupied periods of heating and cooling modes of operation, the outdoor air damper maintains ventilation requirements via the minimum position control methods. However, the following modes of operation will override the damper minimum position setpoint to 0%.

- Morning Warm Up
- Pre cool
- Night Purge
- Unoccupied Heat
- Unoccupied Cool
- Off

Relief Fan and Space Static Pressure Control

The primary role of relief fan is to relieve air from the building to control space static pressure. This is common when the unit is economizing and bringing in large quantities of outside air.

Space Static Pressure Control with Statitrac™

Statitrac™ is an option. Space static pressure control operation will become active when the supply fan is On and proven, the outdoor air damper position is greater than the relief enable position setpoint and a valid space static pressure value is greater than the active space static pressure setpoint plus half the deadband.

When the activation conditions have been met, the unit will start the relief fan and control relief damper and fan speed to maintain the space static pressure setpoint. Once the relief fan operation is proven, the fan will modulate to track the relief damper position.

Space pressure control operation terminates when the relief damper is closed and the space static pressure is below setpoint minus half the deadband, or space static pressure is within deadband for 30 minutes.

Space Static Pressure Control without Statitrac™

If Statitrac™ is not enabled, or the space static pressure sensor has failed, space static pressure control without Statitrac™ becomes active. The relief damper will track to the outdoor air damper position and the relief fan speed will track to the relief damper position when the supply fan is proven On and the outdoor air damper position is greater than the relief enable position setpoint.

Space static pressure control operation will be terminated whenever any of the activation conditions are not true, when the outdoor air damper is fully closed or when the outdoor air damper is less than the relief enable point minus 10%.

If the relief fan or damper is in failure, the relief fan will be commanded Off and the relief damper will be commanded Closed.

Discharge Air Temperature Control

Discharge Air Temperature Control uses available heating and cooling capacity to deliver the required temperature at the discharge of the unit. A discharge air temperature sensor is required for operation.

In cooling modes, the control uses cooling sources to deliver air temperature as required by the Discharge Air Cooling Setpoint. In heating modes, the control uses heat sources to deliver air temperature as required by the Discharge Air Heating Setpoint. Primary heat is never used in conjunction with mechanical cooling.

Multi Zone-VAV - Discharge Temperature Units

These unit types provide Discharge Air Temperature Control in all heat, cool, and occupancy modes of operation. The typical operating mode is Cooling delivering conditioned air to multiple zones of a building. Multi Zone-VAV units have duct work to supply VAV terminal units. The VAV units modulate to control space comfort.

These units also change over to provide heat (when installed). A building automation system or VAV Box Relay Output can be used when the heat source requires full airflow. See Heat Types for more information. A valid space temperature input must be provided to perform heating modes such as Daytime Warm Up and Morning Warm Up (when enabled).

Supply Air Tempering

Supply Air Tempering is a function of discharge air control Cool mode when DX cooling is off and the outdoor air damper is at minimum position. This function is typically required when outdoor air intake percentage is high and the outdoor air temperature is low. If discharge air temperature falls below the Discharge Air Cooling Setpoint, the control will temper (warm up) the discharge air by initiating heating capacity. Cool – Tempering is displayed on the user interface Operating Mode screen when this function is active. The control will transition back to normal cooling when heat capacity is no longer required. Supply Air Tempering is disabled by default.

Multi Zone-VAV equipment allows supply air tempering when equipped with Modulating Gas, Ultra Modulating Gas, and SCR Electric Heat. Constant Volume – Discharge Air Temperature equipment allow all forms of heating to provide supply air tempering.

Changeover Input

Multi Zone-VAV and Constant Volume Discharge Temperature units configured with heat include a binary Changeover Input. An open input requests discharge air cooling operation. A closed input will change over to discharge air heating. This local input is arbitrated with building management Heat Cool Mode Request commands to determine the active mode of operation.

VAV Box Relay Output

This binary output is provided by the controller to be optionally wired to VAV units in a Multi Zone-VAV system to coordinate system changeover to full airflow heating. The binary output is de-energized when the controller is operating in cooling modes. The binary output energizes when the heat type installed requires full airflow. See Maximum Heat for more details.

Discharge Air Reset

Discharge Air Reset is a method to save energy by resetting the discharge air temperature as heating and cooling building loads increase and decrease.

When enabled, the controller can independently reset the Discharge Air Heating Setpoint Active and/or Discharge Air Cooling Setpoint Active based on Zone (space temperature) or Outdoor Air temperature. The new target setpoints are reported as Discharge Air Setpoint Heating Status and Discharge Air Cooling Setpoint Status.

The user interface display provides settings for the reset temperature range (Zone or Outdoor Air) and discharge air temperature setpoint reset amount over the specified range. For example: the discharge air temperature cooling setpoint shall increase 5°F over an outdoor air temperature range of 90°F to 70°F. If Discharge Air Cooling Setpoint Active is 50°F and Outdoor Air Temperature is 80°F, the reset function calculates and reports Discharge Air Cooling Setpoint Status = 52.5°F. The controller will provide discharge air at 52.5°F.

Duct Static Pressure Control

Multi Zone-VAV equipment have variable speed supply fans and are often used in Variable Air Volume (VAV) systems consisting of ductwork serving multiple building zones and VAV boxes that control space comfort independent of the rooftop air handler. VAV boxes modulate air volume by a damper that opens and closes to maintain space comfort. In response, duct static pressure increases and decreases. The controller will modulate supply fan speed to maintain Duct Static Pressure relative to the Duct Static Pressure Setpoint

Duct Static Pressure High Limit

The controller operates the supply fan to maintain duct static pressure below the Duct Static Pressure High Limit setpoint. In the event that duct static pressure approaches the high limit setpoint, the controller will reduce and limit the supply fan speed.

Space Temperature Control

Space Temperature Control uses available heating and cooling to deliver comfort to a building space. The control requires a valid space temperature and discharge air sensor value; if either input to the control is invalid, the equipment cannot operate.

Space Temperature Control determines the type of load (heating or cooling) in the space based on active cooling and heating setpoints and space temperature. If space temperature is above the cooling setpoint, this represents a space-cooling load. The control will calculate a Discharge Air Temperature Setpoint to satisfy the cooling demand of the space.

The relationship of the calculated discharge air setpoint and discharge air temperature will drive heating and cooling capacity available to satisfy the discharge air temperature setpoint. For Example: As space temperature cooling load increases, space temperature control will calculate a lower Discharge Air Temperature setpoint and therefore will increase cooling capacity. The calculated discharge air cooling setpoint is bound by Discharge Air Temperature Maximum Cool Limit and Discharge Air Temperature Minimum Cool Limit.

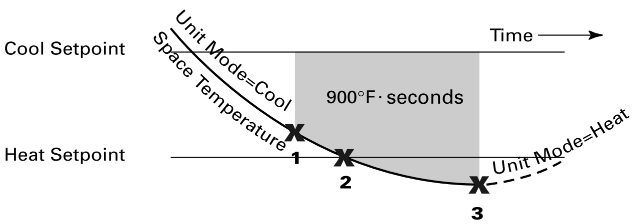
If heat-cool mode input is either not provided or unsupported the mode input is Auto. The controller will automatically determine the appropriate heat or cool mode of operation based on space temperature, setpoints, and heating/cooling configured for the unit. Heat or Cool is reported by Heat Cool Mode Status.

Auto Changeover

When the controller input mode of operation is Auto, the controller will automatically determine space heating and cooling mode, the unit changes from cool to heat or from heat to cool, when the integrated error between the space setpoint and space temperature is 900°F-seconds or greater. The integrated error is calculated once every 10 seconds. See figure below for an example of changing from space cooling to space heating. If Cool is the active mode and space temperature is less than 1°F below the active heating setpoint the system will immediately change to Heat mode. If space temperature is greater than 1°F above the active cooling setpoint, the mode to change to Cool.

Space Dehumidification is a Cool mode sequence of operation if the unit is equipped with hot gas reheat. A unit that has a dehumidification demand will switch from Heat mode to Cool mode if heating capacity is off and space temperature is above the heating setpoint. A unit operating in dehumidification control will inhibit the normal mode transition from Cool mode to Heat mode.

Figure 44. Auto changeover logic



1. This is the point at which the cooling capacity equals 0% and the error integrator starts to add up. Error integration does not begin until the capacity is 0%. The error integrator cannot be less than zero.
2. The Space Temperature must be less than Space Setpoint before the controller can change to Heat. The Space Temperature must rise above the active space Cool Setpoint before the controller can change to Cool.
3. The controller switches to Heat (from cool) after the error integrator exceeds 900°F seconds or Space Temperature <= (Heat Setpoint – 1°F).

Space Temperature Control Units

Single Zone VAV Space Temperature units use the Space Temperature Control sequence of operation in Occupied Heat and Occupied Cool modes of operation; however, the Discharge Air Control method is used for all other modes. The table below summarizes each mode of operation and the control method applied. See Operating Modes section for more details

Table 42. Mode of operation and applied control method

Heat Cool Mode	Control Method	Discharge Air Temperature Setpoint	Space/Discharge Setpoints
Cool	Space Temperature Control	Calculated (cascade)	Space Temperature Setpoint Active Discharge Air Temperature Setpoint Active
Heat	Space Temperature Control	Calculated (cascade)	Space Temperature Setpoint Active Discharge Air Temperature Setpoint Active
Morning Warm Up	Discharge Air Control	Fixed	Morning Warmup Setpoint Discharge Air Heating Setpoint Active
Pre Cool	Discharge Air Control	Fixed	Pre Cool Setpoint Discharge Air Cooling Setpoint Active
Night Purge	Discharge Air Control	Fixed	
Unoccupied Cool	Discharge Air Control	Fixed	Unoccupied Cooling Setpoint Discharge Air Cooling Setpoint Active
Unoccupied Heat	Discharge Air Control	Fixed	Unoccupied Heating Setpoint Discharge Air Heating Setpoint Active

Single Zone VAV

Single Zone VAV equipment is configured with a variable speed supply fan that modulates with Space Temperature Control to minimize fan energy while maintaining space comfort. When there is no demand for heating or cooling the supply fan operates at the minimum speed setting while providing ventilation according to occupancy setpoints. Alternately, the supply fan can be setup to cycle off when there is no demand for heating or cooling.

Single Zone VAV – Cooling

Cool — When there is a space cooling demand, DX cooling will initialize and increase to satisfy space temperature. The supply fan will continue to operate at a low, fixed speed at low cooling capacities until the cooling capacity requires additional airflow to keep compressor operation optimal. The supply fan speed will increase as the demand for cooling capacity increases. The minimum supply fan speed is calculated by DX cooling capacity. As the space requires additional cooling capacity, Space Temperature Control will calculate a lower discharge air temperature setpoint increasing DX cooling which in turn increases the supply fan speed (to prevent coil frost). Cooling capacity and supply fan speed both can increase to 100%.

If the unit discharge air temperature reduces to the Discharge Air Temperature Minimum Cool Limit setting or DX cooling reaches 100% capacity, cooling capacity increases will hold while the supply fan speed will continue to increase to 100% or modulate to manage space comfort cooling.

Cool Economizer — If the unit is configured for a modulating outdoor air damper and conditions are suitable for economizer cooling, the supply fan will operate at minimum speed while the economizer damper modulates between the Outdoor Air Damper Minimum Position (or Flow) Setpoint and 100% to satisfy the discharge air temperature setpoint. If the economizer damper reaches 100% open and additional cooling capacity is required, the supply fan will then modulate between minimum speed and 100% to provide additional cooling to the space.

Cool Economizer + DX —Cool – Economizer + DX is reported as the Unit sub-mode of operation when both economizer and DX cooling are active. If actively economizing, outdoor air damper is 100% and supply fan speed reaches 100% then DX cooling will be added if the unit is not satisfying space cooling requirements.

If DX cooling is active and economizer cooling enables, the control will transition to increase economizer damper above minimum position (or flow setpoint) to 100% to satisfy space cooling while decreasing DX cooling. DX cooling will steadily be removed as long as economizer cooling is able to satisfy the cooling load. The supply fan operates to the lowest speed possible during the transition.

Single Zone VAV – Heating

The supply fan operates at minimum speed (or will cycle off) when the space has no heating demand. When space temperature control calculates an increasing demand for heat in the space, the calculated discharge air temperature setpoint will increase. When heating capacity initiates, the supply fan will operate at the required minimum speed for the heat type installed. The minimum fan speed can be 100%. See Heat Types for more information.

As the Discharge Air Temperature Setpoint increases, the heat capacity increases stages and/or modulates. The control manages heating capacity to deliver a discharge air temperature to the Discharge Air Temperature Setpoint within the control deadband. If the unit discharge air temperature reaches the Discharge Air Temperature Maximum Heat Limit, heating capacity will hold and the supply fan will further increase (if possible) to satisfy the space heating demand.

Compressor Staging and Timers

There are timers associated with compressor staging control to optimize refrigeration system performance:

- Minimum OFF Time
- Minimum ON Time
- Inter-Stage Time

Minimum OFF Time — For each compressor (fixed or variable speed), when the compressor has been turned OFF for any reason, a timer will be started for that compressor(s). The compressor(s) will not be allowed to be turned back ON until their timer has expired.

Minimum ON Time — Once a compressor has been turned ON a timer will be started for that compressor. The compressor will not be allowed to be turned back OFF until its timer has expired. A normal stop request (user interface Stop, normal shutdown diagnostic, Off mode) will honor the Minimum ON Time and keep the compressor on until the timer expires

Important: *Any Immediate stop request or Immediate Shutdown diagnostic will override any minimum on time and shut the compressor off immediately.*

Inter-Stage Time — For normal unit operation the timing between stages will be maintained at a minimum of a fixed Inter-stage Time. The compressor control algorithm may request staging to occur beyond 3 minutes but the time span from one stage turning ON(OFF) until the next compressor stage turning ON(OFF) will be no less than the 3 minute inter-stage time. Rapid Restart and manual compressor control can override this time.

Supply Fan Delay

A 60 second supply fan off delay is enforced after the last compressor de-energizes.

General Compressor Staging

Compressor staging will occur based on the unit's algorithms cooling capacity request and the specific Compressor Staging Table defined per the unit's configuration. When the request is ADD, the next highest stage sequence will identify which compressors will be turned ON, or OFF if a 'Double Swap' is required. When the request is SUBTRACT, the next lowest stage sequence will identify which compressors will be turned OFF, or ON if a 'Double Swap' is required. Capacity Control limits may also affect staging sequence.

Double Swap

To meet efficiency or optimized capacity requirements, it will be necessary on some units, when staging up or down, to turn ON one compressor and, for the same stage, to turn OFF another compressor.

Compressor Proving

- Fixed Speed Compressors: The compressor contactors have an auxiliary contact that is wired to a compressor proving input.
- Variable Speed Compressors: The variable speed compressor VFD has an integrated Run Inhibit binary input wired to a second HPC (High Pressure Cutout) switch. When this HPC switch opens the VFD will be stopped and the run proving status will be communicated back to the controller.

Variable Speed Compressor Optimal Start

This circuit-level feature applies to the variable speed compressor and enforces a maximum speed limit for a fixed time period following startup. During normal operation the speed range limits are determined based on unit type, efficiency, capacity stage and other limit controls. The maximum speed limit applies to every startup to maintain oil quality. When this function is active, an indication will be made to the user interface

Evaporator Coil Surface Utilization (Two Circuit Units Only)

All staging sequences performed by the algorithm energize compressors on each circuit as soon as possible to optimize cooling efficiency. If a circuit 1 compressor starts first, a circuit 2 compressor starts second if it is available. If a circuit 2 compressor starts first, a circuit 1 compressor starts second if it is available.

Compressor Lockout and Inhibit

In all cases of Lockouts, Inhibits, and Limits (Compressor Minimum OFF Time is not considered a lockout or inhibit) Alternate Staging Sequences will be substituted.

Compressor Lockouts

Compressor lockouts are typically non-recoverable and require user interaction at the User Interface to clear associated diagnostics that return the compressor(s) to operation. Other compressor lockouts will recover automatically when the lockout command is removed.

Compressor Inhibits

Inhibits of compressors are typically recoverable without requiring user interaction. The inhibit of a compressor will be immediate once the request is issued. Inhibits originate from undesirable refrigeration operating conditions and may or may not be associated with a diagnostic event. Once the condition has recovered, the compressor will be un-inhibited and will be available for staging sequences.

Alternate Staging Sequence

When one or more compressors are unavailable due to Lockouts and Inhibits, an alternate staging sequence will be determined from a rule-based algorithm which selects the best next stage from the available compressors. Double Swaps will not be performed during Alternate Staging Sequence.

Staging Up

On single circuit units, two circuit units with neither circuit active, or two circuit units with both circuits active, the smallest available compressor will be selected to start.

On two circuit units with one circuit active, the smallest available compressor on the non-active circuit will be chosen to start. If none are available on the non-active circuit the next smallest available compressor on the active circuit will be chosen to start.

Staging Down

On single circuit units, or two circuit units with one circuit running, the largest running compressor will be chosen to stop.

On two circuit units with both circuits active, the largest running compressor that will not cause a circuit to stop will be chosen. If there is only one compressor running per circuit the larger of the two compressors will be chosen to stop.

Transition Out of Alternate Staging

Transition to Normal Staging — When all compressors are available on the next request to add or subtract the current state will be evaluated against the Normal staging table. If a match is found, the next staging decision will be made following the Normal staging rules. If the normal table does not contain a match for the current state, then the Alternate Staging sequences will be used to process the command, and the cycle will continue until a match has been found.

Transition to Balanced Compressor Staging — Balanced Compressor Staging is a feature setting, when enabled balanced staging rules will be used to process the next staging request.

Compressor Staging with Variable Speed Compressors

Units with Variable Speed Compressors will always attempt to start the variable speed compressor first. Subsequent stage increases start the preferred compressor next according to the default factory staging sequence. Special consideration during Alternate Staging Sequences are defined as follows:

VSC Available During Alternate Staging Sequences

During inhibited fixed speed compressor operation, the VSC will be utilized over its full range of designed speed operation prior to a stage change. Stage change logic will be determined based on the available compressors following alternate staging rules.

VSC Inhibited During Alternate Staging Sequences

During inhibited VSC operation, stage change logic will be determined based on the available fixed stage compressors. If the circuit with the inhibited VSC also has fixed stage compressors, (FSC) these compressors will be available for the alternate staging sequence. All FSC must be staged OFF before the non-inhibited VSC will become available. When the VSC becomes available, it will be the first compressor turned ON at the next ADD request.

Balanced Compressor Staging

The Balanced Staging function is a user-defined option for fixed-speed compressor units. To perform Wear Balancing, the Symbio 800 controller will keep track of each installed compressor' number of starts, and run-time. The controller will use this information to equalize wear across all compressors installed in the unit. Double Swaps will not be performed during Balanced Compressor Staging The Balanced Compressor Staging function can be Enabled or Disabled at the user interface. When disabled, compressor staging follows the Normal Staging Sequence.

Wear Balancing Calculation

The wear balancing formula for compressor operation is the number of compressor starts multiplied by a factory determined wear factor, plus all of the normal run time. Starting accounts for a significant amount of normal run time wear and adds quickly to the wear calculation sum.

Single Circuit Units

The lowest wear compressor starts first. Subsequent stage increases start the next lowest wear compressor. The final stage increase starts the last compressor. Each stage decrease de-energizes the highest wear compressor first.

Dual Circuit Units

The lowest wear compressor from either circuit starts first. The second stage increase starts the next lowest wear compressor from the “Off” circuit. Subsequent stage increase requests will start the lowest wear compressor available. Stage decreases with both circuits active, the highest wear running compressor that will not cause a circuit to stop will be chosen. If there is only one compressor running per circuit the compressor with a higher wear calculation will be chosen to stop.

Ties

If multiple compressors with equal wear are available for the next stage, the smallest compressor will start. The largest compressor will stop.

If Balanced Starts is Disabled from the user interface, compressor staging follows the factory staging sequence. The nominal unit size configuration setting maps to the factory staging sequence selection.

Compressor Protections

There are a number of functions which provide protection of the refrigerant systems during compressor operation. These protections typically involve reducing, if not completely removing, one or more compressors from operation on a given refrigeration circuit. There are basically two types. The first are Lockouts which are those associated with diagnostics and are persisted until human intervention or significant unit mode change occurs, The second are Inhibits which are typically temporary, self-correcting, and may not involve a diagnostic.

Working in concert with compressor protection are the general algorithms of compressor staging (timing) as well as refrigeration and electrical capacity control.

Low Ambient Lockout

Low Ambient Lockout prevents compressor operation when Outdoor Air Temperature Active falls below an adjustable setpoint. The low ambient lockout setpoint range and default value is dependent on unit configuration. When the outdoor air temperature rises above the Low Ambient Lockout Setpoint + 5˚F, inhibit will be removed and the compressors will be available.

Low Compressor Suction Pressure Protection

The Low Compressor Suction Pressure diagnostic, Low Compressor Suction Pressure Start Inhibit, and Low Compressor Suction Pressure Limit work together to prevent damage to compressors and suction cooled compressor motors operating with little or no refrigerant charge.

The Low Compressor Suction Pressure diagnostic protects against an inadvertent compressor start when the system is in a vacuum (such as can be produced during service procedures). It also avoids compressor failures and extremely inefficient operation due to total charge loss. The Low Compressor Suction Pressure diagnostic will shut down the affected circuit, if already running, when the circuit’s Compressor Suction Refrigerant Pressure measurement drops below a factory determined pressure threshold value for normal operation (normal threshold value). When the circuit is not running, and for a period of time (in seconds) immediately after the circuit starts running, the effective start-up pressure threshold is lower than the normal threshold value. These values are dependent on unit model.

The Low Compressor Suction Pressure Start Inhibit and Low Compressor Suction Pressure Limit work together to reduce the likelihood of Low Compressor Suction Pressure diagnostic, which will lock out the circuit and force a manual diagnostic reset. When either functions are active, an indication will be made to the user interface.

The Low Compressor Suction Pressure Start Inhibit is designed to prevent a circuit from starting when low compressor suction pressure exists, but will not shut down a circuit that is already running. When the function is in the Active state, the circuit will be prevented from operating (locked out). The threshold value for this function is 1.2 times the normal threshold value.

Low Compressor Suction Pressure Limit only applies to circuits which have more than 1 compressor installed. This function prevents the addition of circuit capacity any time the circuit is running and Compressor Suction Refrigerant Pressure is less than 1.4 times the normal threshold value.

Temperature and Pressure Sensor Failures

Each refrigeration circuit has a number of sensors that are required for proper control of compressors and associated head pressure control components. Should these sensors fail, or exceed operational limits, compressors on the given circuit will be inhibited until the sensor values return to normal operational ranges. An indication will be made to the user interface.

Compressor Discharge Pressure Limit

Compressor Discharge Pressure Limit is a control feature of Adaptive Control. This feature prevents a circuit shutdown when the discharge pressure approaches the high pressure cutout switch setting by decreasing compressor capacity. This is done by staging off fixed speed compressors on circuits with high discharge pressure. This feature will provide maximum capacity while preventing a high pressure cutout.

The discharge pressure limit is based on the discharge pressure percentage relative to the high-pressure cutout setting. This limit is active when the circuit is running.

If the discharge pressure limit is preventing loading, holding or forcing unloading, an indication will be made to the user interface.

Note: *The discharge pressure limit function assumes that all available condenser fans are running and limiting compressor capacity is the only option left.*

Compressor Discharge Saturated Temperature Limit

Compressor Discharge Saturated Temperature Limit is a control feature of Adaptive Control for variable speed compressors only. This circuit-level feature applies when the discharge saturated temperature approaches the compressor operating threshold limit for high discharge saturated temperature. Limit control action modifies the normal capacity modulation to decrease capacity by reducing compressor speed.

Compressor Discharge Saturated Temperature Speed Limit

Compressor Discharge Saturated Temperature Speed Limit is a control feature of Adaptive Control for Danfoss VZH variable speed compressors only. This circuit-level feature applies when the discharge saturated temperature approaches the compressor operating threshold limit for high discharge saturated temperature. Limit control action modifies the allowable compressor speed range.

High Suction Saturated Temperature Inhibit

High Suction Saturated Temperature Inhibit is a control feature of Adaptive Control for variable speed compressors. This circuit-level feature applies when the suction saturated temperature exceeds the compressor operating threshold limit for suction saturated temperature. Inhibit control action de-energizes the variable speed compressor when the suction saturated temperature exceeds the operating threshold design limit.

When this function is Active, an indication will be made to the operator.

Compressor Involute Pressure Differential Protection

Compressor Involute Pressure Differential Protection is a control feature of Adaptive Control for variable speed compressors. Scroll compressors have a limitation on the pressure difference between the opposite sides of the involute tip near the center of the scroll (compression ratio). High values of compressor involute pressure differential may cause compressor fatigue. Its associated limit will attempt to allow the unit to run safely at partial capacity without tripping the circuit on a diagnostic. The compressor must be restricted from running in this condition.

When this function is active, an indication will be made to the user interface. Depending on severity, both instant and delayed shutdowns are possible. Shutdowns may be temporary or require a manual reset.

Loss of Charge Detection

This function detects excessive refrigerant leakage. Units can operate in a low charge condition for an extended period where the loss of charge is not enough to trigger the normal loss of charge protection. If the charge continues to fall slowly, a subsequent start could result in variable speed compressor damage. Loss of Charge Detection works in concert with Superheat High Limit Detection.

Superheat High Limit Detection

A unit may experience refrigerant leakage at any point in its service life. Moderate refrigerant loss reduces capacity and causes low suction saturated temperature but excessive refrigerant loss may lead to compressor damage. Excessive refrigerant loss is detected by a suction superheat condition which exceeds a high limit threshold.

This function detects excessive refrigerant loss by comparing suction superheat to a high limit threshold. The detection method reduces the potential for nuisance trips by providing a startup delay time that is a function of the outdoor air temperature.

This approach helps to mitigate false detection trips because low suction saturated temperature and high superheat is normal following startup at low outdoor air temperature conditions.

When this function is active, an indication will be made to the user interface and the circuit will shutdown.

Variable Speed Compressor Modulating Current Limit

This Adaptive Control action will first reduce variable speed compressor RPM which, in turn, reduces discharge pressure. This will reduce the variable speed compressor motor current thus preventing an A49 Speed Limit VFD trip. This function works in concert with Current Limit Staging Command which can subtract, hold or allow adding compressor capacity. When this function is active, an indication will be made to the user interface.

Compressor Low Suction Saturated Temperature Speed Limit

This is an Adaptive Control feature for variable speed compressors. Low suction saturated temperature can occur following startup at low outdoor air temperature conditions. This circuit-level feature applies to variable speed compressors and enforces a minimum and maximum speed limit.

Coil Frost Protection

This is a circuit level protection and is active whenever one or more compressors on a circuit are running. This feature is always available with all compressor types.

As frost builds on a coil, thermal resistance increases and airflow decreases. Frost buildup on the coil can also cause instabilities in superheat control. If suction saturated temperature drops below a threshold, Frost Protection will inhibit capacity in an attempt to melt the frost and allow the unit to run more efficiently. Once the frost is removed the unit will be returned to normal operation. To avoid nuisance trips at startup, a “ignore” time delay is applied. The delay time is variable and is based on outdoor air temperature

Modulating Coil Frost Limit Control applies to circuits with a variable speed compressor. This function will limit variable speed compressor capacity according to evaporator coil frosting conditions. If the suction saturated temperature (SST) is sufficiently above the Coil Frost Threshold, the Symbio 800 reverts to normal control.

Modulating Coil Frost Limit Control is active following compressor startup and is not subject to the ignore time.

There are no diagnostics for this feature. When this function is active, an indication will be made to the user interface.

Head Pressure Control

The refrigeration system will utilize condenser fan control to maintain the discharge pressure of operating compressors on a given circuit to desirable levels. Pressure sensors will be utilized to provide the control signal. As the pressure of the condenser section increases more stages of fan capacity will be used to prevent excessive operating conditions that could open the High Pressure Cutout switch causing nuisance trips of the refrigeration circuit. Condenser fan capacity will be reduced to prevent excessive low pressures that could cause un-stabilized refrigeration conditions. A unit can have up to two refrigeration systems (circuits) that are completely isolated from each other and are controlled independent from each other.

Low Ambient Operation

Units configured with Low Ambient Operation will utilize a VFD to control the first condenser fan for 90 - 130 ton units. All other tonnages use EC modulating first condenser fan.

Hot Gas Bypass

Hot gas bypass is a unit configuration option that, at some predetermined suction pressure, initiates a modulated flow of hot refrigerant gas from high side to the low pressure portion of the refrigeration system. This adds “false load” to avoid low suction pressures that would otherwise result in coil frosting. This feature can be disabled, but when enabled is transparent to the normal staging control provided by the Symbio 800 controller. Regardless, Hot Gas Bypass operation indirectly places operating constraints on the system that have to be addressed by the unit controls in the areas of EXV superheat control and dehumidification/reheat operation.

Hot Gas Bypass Control

Activation

If a unit is configured with hot gas bypass, the hot gas bypass system is functional whenever circuit 1is operating. The hot gas bypass valve is closed during normal operation. The valve will open, passing the amount of hot gas required to produce a suction pressure that is high enough to prevent coil frosting, when necessary. If Hot Gas Bypass Enable is Disable, the Hot Gas Bypass valve is always closed.

Interaction

Hot Gas Reheat and Hot Gas Bypass options are installed on circuit 1, however, hot gas bypass is not allowed to operate if the “Hot Gas Reheat Valve Reheat” is open (>0%). The hot gas bypass valve will open when suction pressure is lower than the calculated target. In addition, the valve control has interactions with coil defrost protection, EXV control and condenser fan control.

HGBP Valve Calibration

HGBP valve calibration (also known as overdrive closed) procedure is initiated in the following circumstances:

- Whenever the unit controller is power cycled. This is under the control of the unit controller software, as part of the software startup procedure. Note: under the most common scenario when both the HGBP valve electronic controller and unit controller are power cycled, HGBP valve recalibration may occur twice.
- When the circuit cycles off and the circuit has run for at least EXV Recalibration Time since the previous calibration.

  Note: *EXV calibration time is used for both HGBP and EXV valve calibration.*

- Whenever the HGBP valve electronic controller is power cycled. The HGBP valve electronic controller does this automatically.

EXV Control (Electronic Expansion Valve)

Electronic expansion valves (EXVs) control suction superheat to ensure the complete and efficient evaporation of refrigerant in the evaporator. Excess liquid refrigerant in the compressor suction (low suction superheat) can be harmful to the compressor, and a deficit of liquid in the evaporator (high suction superheat) is inefficient. The benefit of EXV control, through controlling suction superheat, suction pressure, suction saturated temperature, or pressure ratio, promotes energy-efficient operation and long-term reliability of the compressor(s).

Suction superheat is the difference between suction temperature and saturated suction temperature. A temperature sensor measures suction temperature. The saturated suction temperature is determined from the measured suction pressure by a refrigerant property calculation. Typically, the EXV control maintains a small, desired amount of suction superheat by opening or closing the EXV(s), which adjusts the refrigerant flow rate into the evaporator.

In situations where the superheat rapidly falls to very low values, special control modes are necessary to dry out excess refrigerant liquid in the evaporator, suction line, and compressor sumps, and transition back to normal control.

Configuration

Electronic Expansion Valves are always installed on DX refrigeration circuits. Configuration is used to specify the EXV selection on each refrigeration circuit. EXV selection allows picking of a correlation between EXV steps or EXV percent open, and the flow coefficient (C_V) at each EXV opening.

Functional Description

EXV Calibration

An EXV Calibration (also known as overdrive closed) procedure will be initiated in the following circumstances:

- Whenever the unit controller is power cycled. This is under the control of the unit controller software, as part of the software startup procedure.

  Note: *Under the most common scenario when both the EXV electronic controller and unit controller are power cycled, EXV Calibration may occur twice.*

- When the circuit cycles off and the circuit has run for at least EXV Recalibration Time since the previous calibration.

  Note: *EXV calibration time is used for both HGBP and EXV valve calibration.*

- Whenever the EXV electronic controller is power cycled. The EXV electronic controller does this automatically.

EXV Manual Override Control

See Programming Guide

EXV Control Sequence of Operation

The EXV control algorithm can be in one of the following states:

Table 43. EXV Control States

Control State	Description
Stopped	EXV closed. Overdrive closed (calibration) performed if criteria are met.
Starting	EXV pre-position is calculated, and the valve arrives at the requested opening before any compressors on the circuit start.
Stopping	EXV commanded to close. Remain in state until EXVs report that they are closed.
Running	EXV operates in pre-start control, or in automatic control after the pre-position hold time expires.
Running Mode Sub-States	**Description**
Running – Wait for Circuit Start	Time after valve arrives at pre-position value, but before a compressor on the circuit starts.
Running – Pre-Position Hold Time	After a compressor on the circuit starts, but before automatic control begins.
Running – Suction Superheat Control	Normal automatic superheat control
Running – Suction Pressure Control	Controlling suction pressure instead of suction superheat, to maintain adequate compressor pressure ratio or to limit high suction saturated temperature.
Running – Evaporator Dryout Control	Special version of suction pressure control, to dry out a flooded evaporator and prepare to control suction superheat or suction pressure again.

Operating Modes

Calibrating_EXV

Circuit submode displayed when EXV is going through the calibration process. Most often active when circuit top-level mode is Stopped, Run Inhibit, or Auto.

Prepositioning_EXV

Circuit submode displayed when EXV(s) are moving toward their commanded pre-position opening prior to starting the first compressor on circuit startup.

Manual_Override_Evaporator

Displayed when performing manual control override on the EXV in the Evaporator position.

Economizing

Symbio 800 supports a common minimum outdoor air and economizer damper (i.e. no separate minimum outdoor air damper). Economizer high-limit decision methods are defined as follows.

When conditions are suitable for economizer operation, the outdoor air damper modulates between Economizer Minimum Position (or Flow) Setpoint and 100% open. Economizing will not allow additional mechanical cooling until the damper position is 100% and supply fan has reached 100% capacity. If economizer cooling becomes disabled, damper will revert to minimum position (or Flow) control, and transition to mechanical cooling.

Given the economizer decision methods above, if Comparative Enthalpy + Fixed Dry Bulb is configured and the return air or humidity sensor goes out of range or fails, a fallback method of Fixed Dry Bulb or Reference Enthalpy + Fixed Dry Bulb is selectable in the user interface Feature Settings screen.

A building automation system can directly command economizer operation via Economizer Airside Enable (auto, enable, disable). If commanded Enable, the controller will start economizer cooling, regardless of outdoor air conditions. If commanded Disable, economizer cooling will be disabled (except if a mode of Night Purge is commanded to the controller). If commanded Auto, the controller will use the configured Economizer high limit method and input values to determine if economizer cooling is available.

Outdoor Air Damper Fault Detection and Diagnostics (FDD)

The outdoor air damper fault will have two fault detection components, faults that are generated when operating in minimum ventilation mode and another set when the damper is being controlled by the economizer:

FDD: Excessive Outdoor Air

In minimum ventilation mode and the damper feedback position is >10% of the damper commanded value for 5 continuous minutes.

FDD: Outdoor Air Damper Not Modulating

In minimum ventilation mode and the damper feedback is <10% of the damper commanded value for 5 continuous minutes.

FDD: Unit Economizing When It Should Not

In economizer cooling mode and the damper feedback is >10% of the damper commanded value for 5 continuous minutes.

FDD: Unit Not Economizing When It Should

In economizer cooling mode and the damper feedback is <10% of the damper commanded value for 5 continuous minutes.

Dehumidification Control - Occupied

Dehumidification control is a sub-mode of Cool when hot gas reheat is configured and the dehumidification feature is enabled. A valid Evaporator Leaving Air Temperature sensor(s) are required. Two circuit, split coil units will have an Evaporator Leaving Air Temperature sensor installed in each airstream. When a valid space relative humidity value is above the Space Dehumidification Setpoint, dehumidification control is invoked. Economizer cooling disables. The sub-mode *Cool – Dehumidification* is reported on the user interface Operating Modes screen.

Dehumidification control disables when space relative humidity is less than Space Dehumidification Setpoint minus the Occupied Dehumidification Offset, Heat Cool Mode Status is not Cool or a sensor required for dehumidification control is invalid.

Relative Humidity

When a valid space relative humidity value is above the Space Dehumidification Setpoint, dehumidification control is invoked. Economizer cooling disables. The sub-mode Cool – Dehumidification is reported on the user interface Operating Modes screen.

Dehumidification control disables when space relative humidity is less than Space Dehumidification Setpoint minus the Occupied Dehumidification Offset, Heat Cool Mode Status is not Cool, or a sensor required for dehumidification control is invalid.

Dew Point

If space dew point is greater than the space dew point setpoint (default = 60F) and outdoor air dew point is greater than the outdoor air dew point threshold (default = 60F), the unit enters dehumidification.

In addition to a space humidity sensor, an outdoor air humidity sensor is also required.

Discharge Air Control Units

When Dehumidification is active, cooling capacity is controlled by Evaporator Leaving Air Temperature relative to Evaporator Leaving Air Temperature Setpoint. This setpoint is suitable to satisfy the space humidity load. Cooling capacity will first load on circuit 1 to provide hot gas reheat capacity. The Hot Gas Reheat valve modulates to manage reheat capacity to satisfy the Discharge Air Temperature Setpoint.

Optionally, a building automation system can set the Discharge Air Reheat Setpoint. This then becomes the target setpoint for hot gas reheat control, when dehumidification is active. Likewise, Evaporator Leaving Air Temperature Setpoint can be written for dehumidification control.

Space Temperature Control Units

Space temperature units internally use dew point to manage space humidity control. When hot gas reheat is inactive, the cooling control calculates a suitable setpoint to manage both space temperature and space humidity. If space temperature falls below the space cooling setpoint minus a fixed differential, the hot gas reheat valve modulates to maintain space temperature control. The evaporator leaving air temperature setpoint is calculated to control humidity independent of space temperature. Optionally, a building automation system can set the Evaporator Leaving Air Temperature Setpoint to control DX cooling capacity.

Dehumidification Control - Unoccupied

When Dehumidification is active, cooling capacity is controlled by Evaporator Leaving Air Temperature relative to Evaporator Leaving Air Temperature Setpoint. This setpoint is suitable to satisfy the space humidity load.

Cooling capacity will stage to satisfy the evaporator cooling demand. The hot gas reheat valve modulates to maintain a space temperature setpoint.

Heat Types

Variable speed supply fan operation is different depending on the heat type installed. Some heat types require the supply fan to be at full speed. Other heat types allow modulating supply fan speeds in specific operating modes. Table 44, p. 95 below summarizes Multi Zone-VAV supply fan operation where Modulating means Duct Static Pressure Control.

Table 44. Multi zone-VAV unit – Supply fan operation

	Staged Gas	Modulating Gas	Hydronic Heat (Hot Water)	Steam Heat	External Heat
Occupied Heat	Full	Modulate	Modulate	Modulate	Modulate
Maximum Heat	Full	Full	Full	Full	Full
Morning Warm Up	Full	Modulate	Modulate	Modulate	Modulate
Daytime Warm Up	Full	Modulate	Modulate	Modulate	Modulate
Unoccupied Heat	Full	Modulate	Modulate	Modulate	Modulate
Occupied Cool Supply Air Tempering	NA – not allowed	Modulate	Modulate	Modulate	NA — not allowed

Single Zone-VAV units have limited supply fan speed modulation in Occupied Heat modes of operation when modulating gas heat or modulating electric heat are configured; otherwise, the supply fan operates at full capacity in all other heat operating mode

All heat types, when the control terminates heating capacity or exists a heating mode; a 5-minute post heat timer is enforced. This keeps supply fan On to remove heat from the unit before transitioning to a cooling mode or cycling the supply fan off.

Gas Heat

There are two types of gas heat available: Staged Gas and Modulating Gas. Burners will not turn on if the heater minimum off timer is active, the heater inter-stage timer (three minutes) is active, or modulating heater is not at maximum rate.

Modulating Gas Heat

A binary heat request starts the heater at minimum fire rate. An analog output of 2-10VDC for Ultra Modulating and 0-10VDC for modulating is the control signal for capacity required. Standard modulating is approximately 4:1 and Ultra Modulating is 20:1.

Staged Gas Heat

A two-stage gas heater, the binary input (relay) is closed to request stage one. The request for the second stage of heat is another binary input. Each binary uses 120V AC.

Sequence

Call for heat initiated.

1. A call for heat initiated by a relay.
2. Inducer pressure switch is open prior to starting the inducer fan.
3. The inducer fan is started, and pressure switch is tested for closure. The supply fan proving switch and inducer fan proving switch must be closed within 10 seconds of energizing the inducer fan to initiate pre-purge for 60 seconds.
4. Ignition speed is reduced to ignition level and trial for 1.5 seconds.
5. Flame is detected and stabilized.
6. Heater is Stage One for staged or minimum fire for modulating.
7. Stage Two Enable, requests the second stage of heat from the gas heat controller.

While heat operation is in progress, the gas heat controller is monitoring the flame, inducer fan, and thermal limit switch. If any of these items open, a lockout code is set.

Unexpected Shutdown

If an unexpected shutdown occurs when the gas heat control reflects standby or homerun without an error code, a three-mintue timer will be started. The heat enable relay will remain energized. If the heater reports Operation, the timer will be terminated. If the three-minute timer expires without Operation being reported, an unexpected shutdown diagnostic is set. This can happen when the 24-hour continuous operation reset timer expires or there is a component failure upstream of the gas heat controller.

Lost Gas Heat Flame

If flame is lost, the gas heat controller shuts down and requires a reset to clear the lockout. After clearing the lockout, the unit controls request a retry for ignition. If after three unsuccessful attempts to re-ignite the heater, a manual lockout is set and diagnostic communicated. This diagnostic will auto reset after 90s, and heat will be allowed to attempt to start again if requested due to temp control.

If gas/flame is not detected, such as air in lines, a failure to start diagnostics is set.

Failure to Start

If pre-purge is not detected within 60 seconds, after request for Stage One or minimum fire, it indicates a problem where the gas heat controller is not receiving the heat enable signal. A diagnostic message of “heater failed to start” is set. No retries are attempted.

“Heater failed to start” diagnostic also sets if starting is not proven within six minutes of closing the enable relay if no other diagnostics occur. This allows for the retries due to failure to prove flame at ignition and covers any unforeseen sequence issues at startup.

If the gas heat controller does not sense a flame after an ignition attempt, it will lockout (NO FLAME AT END OF TRIAL FOR IGNITION) and a corresponding non-latching diagnostic is called out. The diagnostic is reset after 90 seconds and then anther request for ignition is initiated. If after three attempts, a successful ignition is not achieved, heat is locked out and a latching diagnostic set.

- The 90 second delay to auto reset the diagnostic begins when the Symbio controller receives communication for the failed ignition lockout and sets the diagnostic. 90 seconds allows for post purge and other delays.
- The enable relay stays closed throughout the retries and delays.
- At the end of the 90 second delay, a reset command is sent to the gas heat controller through the reset relay output which causes the lockout and diagnostic to clear.
- Check for Failure to Start detection is performed only on first attempt.
- If while in the 90 second delay the diagnostic is reset through user interface or externally, the delay is canceled and retry is attempted.
- The retry count is reset by either: a successful start, removal of call for heat, occurrence of lockout diagnostic, or power cycle of Symbio.

Call for Heat Terminated

When the unit has determined the request for heat is no longer required, the enable signal is removed and the gas heat controller will de-energize the valve and the inducer fan start its 60-second post purge.

Electric Heat - Staged

When staged electric heat is configured in the unit, the controller manages four binary outputs to provide up to 6-stages of heat control; depending on size of the electric heat installed. If four or less electric heat stages are installed, the binary outputs are energized in sequence to add additional heat capacity. If more than four electric heat stages are configured, the binary outputs are energized in combination to provide increasing heating capacity with each stage.

Electric Heat Protection

There are three automatic high temperature limit switches that will trip when exposed to a high temperature. They will reset automatically once the temperature drops into an acceptable range. If any one limit switch trips, all stages of heat are turned off. The limits are mounted vertically on the heater terminal plate and all three have the same temperature trip point.

A manual reset temperature limit is also mounted near the top of the terminal plate and serves as backup protection. When exposed to high temperature, it will turn all stages of heat off until the reset button is manually reset. The electric heat protections operate independently of the controller.

External Heat

The Symbio 800 controller supports external field supplied heat sources. There is no factory wiring or coordination between the controller and external heat. When External Heat is configured, the supply fan operates as required in heat modes and provides ventilation defined by the mode.

Single Zone-VAV units have an External Heat Supply Fan Speed Setpoint (adjustable) that defines the supply fan speed in Occupied Heat modes of operation. The supply fan operates at maximum speed for all other heating modes. Continuous and cycling fan modes are both supported.

Multi Zone-VAV units operate the supply fan under duct static pressure control, unless commanded to go to Maximum Heat.

Hydronic and Steam Heat

Hydronic and Steam Heat use an analog voltage signal (0-10V) to modulate a valve open or closed as needed to meet the heating demand.

A binary input is used to detect situations that can cause freezing in the heat exchanger and allows the controls to take preventative actions to avoid freezing and potential failure of the heat exchanger. Outdoor air temp is also monitored to help avoid freeze stat trips.

Unoccupied Cooling

Unoccupied Cooling mode is used when the building is unoccupied and the space conditions are exceeding temperature limits. The unit is normally off in unoccupied mode. If a valid space temperature input rises above the Unoccupied Cooling Setpoint, unit operation starts unoccupied cooling to manage space temperature. The controller operates in Discharge Air Control with ventilation disabled while DX or economizer cooling capacity increases to satisfy the Discharge Air Cooling Setpoint. Multi Zone VAV units operate the supply fan with duct static pressure control, other units operate the supply fan at maximum speed. Cooling continues until space temperature is 4°F less than the Unoccupied Cooling Setpoint, the unit will then cycle off.

Unoccupied Cooling Mechanical Enable and Unoccupied Cooling Economizing Enable are settings to enable or disable cooling in unoccupied mode.

Unoccupied Heating

When the unit is in unoccupied mode and the valid space temperature input falls below the Unoccupied Heating Setpoint, unit operation starts unoccupied heating to manage space temperature. The controller operates in Discharge Air Control with ventilation disabled while heating capacity increases to satisfy the Discharge Air Heating Setpoint. The supply fan operates according to heat type installed, see Heat Types for more information. Heating continues until space temperature is 4°F greater than the Unoccupied Heating Setpoint, the unit will then cycle off.

Unoccupied Heating Enable is a setting to enable or disable heating in unoccupied mode at the user interface.

External Control

Symbio 800 provides the ability for an external controller or program to control supply fan, exhaust fan, and outdoor air damper. This capability allows for custom programming suited for specific application needs.

External Supply Fan Control

External supply fan control applies to variable volume supply fan equipment. Supply fan operation must prove running and any unit startup timing must expire before external control is allowed. Supply Fan Speed Control Enabled provides an enabled status when Supply Fan Speed Setpoint is in control. The controller will annunciate External Supply Fan Control on the user interface, operating modes screen when active.

Supply Fan Speed Setpoint will only override the controller's fan control in occupied Cool, Heat, and Fan Only modes of operation. All other modes (such as Morning Warm Up, Pre Cool, Daytime Warm Up) the supply fan is operated under Symbio 800 control. Supply fan speed will increase under Symbio 800 control according to heating and cooling capacity requirements; space temperature control unit configurations. Supply fan speed will decreases under Symbio 800 control when high duct static pressure limits are approached; discharge air control unit configurations.

Table 45. External supply fan control points

Object Name	Description
Supply Fan Speed Setpoint Enable	Enables supply fan speed setpoint control
Supply Fan Speed Control Enabled	Supply fan speed is control via Supply Fan Speed Setpoint. If disabled/inactive, speed control is under Symbio 800 control

Table 45. External supply fan control points (continued)

Object Name	Description
Supply Fan Speed Limited	Supply fan speed is being increased or decreased due to a limit control action.
Supply Fan Speed Setpoint	External supplied supply fan speed setpoint value
Supply Fan Speed Setpoint Active	Active setpoint input to supply fan speed control
Supply Fan Speed Status	Indicates the requested speed to the supply fan, 0% when fan is off.

Table 46. Supply fan speed setpoint summary

Supply Fan Speed Setpoint Enable	Supply Fan Speed Setpoint	Supply fan operation
Disable	NA	Fan under Symbio 800 control
Enable	0%	Commands the fan off
Enable	1% to 37%[a]	Fan operates at drive minimum Hz setting
Enable	38% to 100%	Fan ramps between drive min-Hz and max-Hz setting.

(a) For example, if drive setting is 22 min-Hz and 60 max-Hz, it will correlate to 37% reported fan speed.

External Relief Fan Control

External Relief fan control is allowed anytime a relief fan is configured. Supply fan and relief fan operation is proven before external fan control is allowed. Relief fan operation is effectively interlocked with supply fan operation. No other control limits are applied; building static pressure high limit is not enforced.

Important: *A valid space static pressure sensor is not required for external relief fan control; therefore, proper building static pressure control must be considered.*

The controller will annunciate External Relief Fan Control on the user interface, operating modes screen, when active. All modes of operation are supported, except when supply fan is off. If the supply fan cycles off with capacity, the relief fan will also turn off. External relief fan speed is also interlocked with relief damper position and relief damper diagnostics. The relief damper movement will limit relief fan speed changes accordingly. The controller will impose speed limitations as required.

Table 47. External relief fan control points

Object Name[a]	Description	Object States or values
Exhaust Fan Speed Setpoint Enable	Enables Relief fan speed setpoint control	0 = Disable 1 = Enable
Exhaust Fan Speed Control Enabled	Relief fan speed is control via Exhaust Fan Speed Setpoint. If disabled/inactive, speed control is under local control.	0 = Disabled 1 = Enabled
Exhaust Fan Speed Setpoint	External supplied exhaust fan speed setpoint value	0 to 100%
Exhaust Fan Speed Setpoint Active	Active setpoint input to relief fan speed control	0 to 100%
Exhaust Fan Speed Status	Indicates the requested speed to the relief fan, 0% when fan is off.	0 to 100%

(a) Reference Integration Guide ACC-SVP02B (or later)

Table 48. fan speed setpoint summary

Fan Speed Setpoint Enable	Fan Speed Setpoint	fan operation
Disable	NA	Fan under local control
Enable	0%	Commands the fan off
Enable	1% to min speed%	Fan operates at drive minimum setting[a]
Enable	>min speed% to 100%	Fan ramps between motors min-rpm and the Relief Fan Maximum Speed Setpoint (rpm), adjustable at the unit's user interface display, service settings screen.

(a) The drive minimum RPM setting is 10 percent of nameplate rated speed. The min speed% is equal to: 100 x (drive minimum RPM / Relief Fan Maximum Speed Setpoint).

External Outdoor Air Damper Control

To control the outdoor damper directly, via TGP2 or an external control, a setpoint can be written to Economizer Minimum Position Setpoint BAS. The controller will limit the damper movement. The commanded position reports at Outdoor Air Damper Position.

To have complete damper control, the following functions should be disabled or removed from configuration via Tracer TU or user interface display. However, the controller must be configured with an Economizer damper.

- Economizer Airside Enable Default = Disabled
- Demand Control Ventilation Enable = Disabled
- Traq Enable = Disabled
- Outdoor Air Flow Compensation Enable = Disable

Morning Warm Up, Pre-Cool, Night Purge, Unoccupied, and Off modes of operation will override damper minimum position to 0%.

Overrides

The controller normally provides heating, cooling and ventilation for building comfort. The below control functions can intervene or override normal operation. These functions allow control over the IntelliPak unit as well as a means for the Service Technician to accomplish their tasks.

The order of priorities are listed. For example, an External Stop will prevent the unit from performing Ventilation Override.

1. Local Stop
2. Emergency Stop
3. Equipment Stop
4. Manual Control
5. Ventilation Override
6. Emergency Override
7. Operating Mode Off
8. Normal operating modes

If local stop, emergency stop, or equipment stop request a Stop, the unit will shut down and not resume operation until all inputs allow automatic operation.

Local Stop

Local Stop is performed by the user interface Stop button on the user interface display. The controller will perform a Normal Shutdown process unless, the user additionally selects Immediate Shutdown at the user interface when prompted.

Normal Shutdown Process

In a normal shutdown situation, compressors, fans, and other systems of the unit are allowed to go through an orderly shutdown sequence. For example, compressors continue to run for any remaining Minimum Run time.

If a Service Tool requires the unit to be in user interface Stop for an operation, e.g. binding, configuration, or software download, the Service Tool will send the Symbio 800 a user interface Stop command. A Service Tool screen is displayed giving the user an opportunity to allow or cancel the operation. This executes a user interface Stop command as if it had been done from the user interface including storing through a power cycle. After this occurs the only way the unit can be set back to user interface Auto is through the user interface directly.

Immediate Shutdown Process

If an immediate shutdown is selected, compressors, fans, and all other devices are immediately stopped. A normal shutdown already in progress will be expedited. The use of this feature is discouraged since the normal shutdown cycle is provided for the normal shutdown sequence.

Emergency Stop

Symbio 800 accepts a dry contact closure input suitable for customer connection to request Stop or Auto modes from an external device. The Emergency Stop input is normally closed which represents an Auto request.

Contact opening will perform an Immediate Stop and generate a latching diagnostic. To return to Auto operation, the input must be closed and a manual reset must be performed.

Equipment Stop

Symbio 800 accepts a dry contact closure input suitable for customer connection to request Stop or Auto modes from an external device. The Equipment Stop binary input is normally closed which represents an Auto request.

Contact opening will perform an Immediate Stop. The unit will automatically return to Auto operation when the input is closed.

Manual Control

Manual control is intended for servicing the machine. It provides manual control of all of all valves, dampers, actuators, fans, compressors and heating functions. This can be done while fans, compressors and heating systems are operating. Single or multiple, controls may be overridden. Remaining controls set to Auto will enforce the limits to protect the machine from damage. Diagnostics remain active to protect the machine from damage. See *IntelliPak™ with Symbio™ 800 – Programming Guide* (RT-SVP011*-EN) for further information.

Important: *Manual Control is for experienced service personnel.*

Manual Control can be set from the Manual Control Settings page on the user interface. Manual control varies in design but all have an automatic mode which is the default mode for most unit operation.

Once a manual override is set to manual, it will remain in manual until one of the following occur:

- Manual override is set back to automatic control by setting the individual overrides to Auto.
- Power is cycled.
- A Manual Overrides Timer expires and ALL manual overrides are cleared.
- The operator presses a Clear All Manual Overrides from the operator display or Tracer TU.

Ventilation Override

Ventilation Override Modes (VOM) give the building controller the ability to override normal unit operation and provide special ventilation operation. VOM is initiated only at the provided five binary inputs (Mode A, Mode B, Mode C, Mode D, Mode E). When any of the normally open contacts are closed, VOM initiates specified functions such as space pressurization, exhaust, purge, purge with supply air pressure control, and unit off when any one of the corresponding binary inputs are activated. The compressors and condenser fans, and all other components not directly controlled via VOM events, are disabled during the ventilation operation. If more than one ventilation sequence is activated, Mode A has highest priority, Mode E has lowest.

This function gives the customer the ability to override normal unit operation via a supervisory controller. Typically, these requests originate from a fire control panel. Flexibility is provided by allowing the customer to re-define each of the five responses at the user interface, along with allowing each individual response to be ‘Locked’ to insure expected operation is not changed. See Programming Guide for more information.

This feature is optional. When configured VOM has priority over Emergency Override, System Mode Off, and normal unit operation. The following overrides will prevent or terminate VOM operation.

- Local Stop
- Equipment Stop
- Emergency Stop
- Manual Control

When any VOM Mode (A, B, C, D, E) input is activated or closed, the VOM mode of operation will begin in less than 10 seconds, and a VOM Relay binary output will energize/close. Heating capacity, cooling capacity, and Rapid Restart will be disabled/terminated.

Refer to the table below summarizing the unit operation in response to VOM binary inputs Modes. VOM inputs are fully configurable; therefore, Table 49, p. 100 provides the factory default settings.

If one or more of the 5 VOM inputs are closed, the unit will enter the VOM mode with the highest priority (A highest, E lowest). Should the unit be in an active VOM mode and a VOM input of higher priority is closed, the unit will immediately transition to the higher priority mode. Should the unit be in an active VOM mode and a VOM input of lower priority is closed, the unit will not change to this lower priority mode until the current (higher priority)VOM mode binary input is opened.

When all VOM inputs are open, within 15 seconds, VOM terminates. All unit components will be reset OFF or CLOSED, and after Unit Power Up Delay is honored the unit will start normal operation.

Table 49. Ventilation override mode

VOM Input	OUTPUT	OPERATION	Heat Cool Mode Status
Mode A (Unit Off)	Supply fan	Off/0%	Off
	Outdoor air damper	Closed	
	Relief fan / Relief damper	Off/Closed	
	Return Fan / Relief Damper	Off/Closed	
	VAV Box Relay	De-Energized	
	Discharge Isolation Damper[a]	0% / Closed	
	Return Isolation Damper[a]	0% / Closed	
	Ventilation Override Relay	Energized	
Mode B (Pressurize)	Supply fan	On/100%[b]	Fan Only
	Outdoor air damper	100%	
	Relief fan / Relief damper	Off/Closed	
	Return Fan / Relief Damper	Off / Closed	
	VAV Box Relay	Energized	
	Discharge Isolation Damper[a]	100% / Open	
	Return Isolation Damper[a]	100% / Open	
	Ventilation Override Relay	Energized	
Mode C (Depressurize)	Supply fan	Off/0%	Fan Only
	Outdoor air damper	0%	
	Relief fan / Relief damper	On/Open	
	Return Fan / Relief Damper	On / Open	
	VAV Box Relay	De-energized	
	Discharge Isolation Damper [a]	100% / Open	
	Return Isolation Damper[a]	100% / Open	
	Ventilation Override Relay	Energized	
Mode D (Purge)	Supply fan	On/100%[b]	Fan Only
	Outdoor air damper	Open	
	Relief fan / Relief damper	On/Open	
	Return Fan / Relief Damper	On / Open	
	VAV Box Relay	Energized	
	Discharge Isolation Damper[a]	100% / Open	
	Return Isolation Damper[a]	100% / Open	
	Ventilation Override Relay	Energized	

Table 49. Ventilation override mode (continued)

VOM Input	OUTPUT	OPERATION	Heat Cool Mode Status
Mode E (Purge with Duct Static Pressure Control)	Supply fan	On/Duct Static Pressure Control	Fan Only
	Outdoor air damper	Open	
	Relief Fan / Relief Damper	On / Open	
	Return Fan / Relief Damper	On / Open	
	VAV Box Relay	Energized	
	Discharge Isolation Damper	100% / Open	
	Return Isolation Damper	100% / Open	
	Ventilation Override Relay	Energized	

(a) Any active VOM mode that commands the Supply Fan, Relief Fan or Return Fan On requires that all installed isolation dampers must be Open >= to the Isolation Damper Position Fan Start Setpoint before the fans are allowed to start.
(b) Supply fan will operate at full speed or a limited speed not to exceed duct static pressure high limit.

Emergency Override

Emergency override provides the ability for a Building Automation System to override control of the HVAC equipment to pressurize, depressurize, purge, shutdown ventilation to the space for life safety or smoke control systems. Refer to Table 50, p. 101summarizing the unit operation in response to Emergency Override commands.

Ventilation Override Mode v/s. Emergency Override

Ventilation Override inputs/output directly connect to fire smoke control station (FSCS) panel. UUKL 864 requires that firefighters have the ability to manually override automated smoke control equipment. Manual changes from a FSCS panel will take precedence over Emergency Override from the Building Automation System.

Table 50. Emergency override

Emergency Override	Output	Operation	Heat Cool Mode Status
Shutdown	Supply fan	Off/0%	Off
	Outdoor air damper	Closed	
	Relief fan / Relief damper	Off/Closed	
	VAV Box Relay	De-energized	
Pressurize	Supply fan	On/100%(a)	Fan Only
	Outdoor air damper	100%	
	Relief fan / Relief damper	Off/Closed	
	VAV Box Relay	Energized	
Depressurize	Supply fan	Off/0%	Fan Only
	Outdoor air damper	0%	
	Relief fan / Relief damper	On/Open	
	VAV Box Relay	De-energized	
Purge	Supply fan	On/100%	Fan Only
	Outdoor air damper	Open	
	Relief fan / Relief damper	On/Open	
	VAV Box Relay	Energized	

Table 50. Emergency override (continued)

Emergency Override	Output	Operation	Heat Cool Mode Status
Fire	Supply fan	Off/0%	Off
	Outdoor air damper	Closed	
	Relief fan / Relief damper	Off/Closed	
	VAV Box Relay	De-energized	

(a) Multi Zone-VAV units will perform duct static pressure control.

Operating Mode OFF and Normal Operating Modes

See operating mode off and other normal operating modes in Operating Modes section.

Heat/Cool Capacity Lockouts and Limits

The controller provides the following capabilities to lockout or limit all heat and cool capacity installed in the equipment. These capabilities interact. Capacity Lockouts have highest priority. When Heat Lockout Command and Cool Lockout Command are not locked-out; the control will limit capacity based on active Cooling Capacity Enable, Primary Heat Enable or Demand Limit Setpoint. The lowest commanded value will be honored.

In an example, Heat/Cool Lockouts are not active. Cooling Capacity Enable is 60%, Primary Heat Enable is 50% and Demand Limit Setpoint is 40%; DX cooling and electric heating capacity will be limited to 40%. If the unit had gas heat, heat capacity would be limited to 50%. Review each capability below for details.

Capacity Lockouts

Capacity Lockouts are points available to the building automation network to provide a method to completely disable DX Cooling, Gas Heating and Electric Heating. Cool Lockout Command will disable all DX cooling capacity. Economizer operation is still possible. Heat Lockout Command will disable all gas and electric heating capacity. External heating is not controlled directly by the Symbio800 and will not be locked out with the Heat Lockout Command.

If both points are True (locked out) at the same time, both will be honored. Trane Graphical Programming (TGP2) can be used to control these points.

Cooling Capacity Enable

Cooling Capacity Enable is a building automation interface point used to limit DX cooling capacity of the equipment, it does not limit economizer cooling. The 0-100% value limits the amount of cooling capacity.

Heat Primary Enable

Primary Heat Enable is a building automation interface point used to limit all forms of primary heat installed in the equipment. The 0-100% value limits the amount of heating capacity.

Demand Limit

Demand Limit is a function with building automation interface points used to limit power consumption of both heating and cooling capacities installed in the equipment. Demand Limit does not apply to economizer cooling, gas heat, external heat nor hot gas reheat.

Demand Limit Request BAS enables and disables the demand limit function. When set to Limit, the Demand Limit Setpoint value (0-100%) is applied to the control capacity calculation. The power consumption result will depend on number of heating and cooling stages installed and how each stage maps to the capacity calculation (0-100%).

Condensate Overflow

The Condensate Drain Pan Level Sensing function monitors an optional water level switch(s) mounted to the evaporator(s) condensate pan. If the drain becomes obstructed, the condensate level will begin to rise and the Condensate Overflow input will be activated.

When a high condensate level is detected, the unit shuts down and a non-latching diagnostic is generated. A 72 hour timer is started at this point. If the condensate overflow input returns to normal, the unit is allowed to restart. If a second condensate high level is detected during the 72 hour timer, the unit will shutdown but restart if the condition returns to normal. A third event, within the 72 hour timer, will generate a latching Condensate Overflow Lockout diagnostic and will require a manual reset.

Filter Status

Filter status is provided by differential pressure monitoring across individual filters in the equipment. This is in the form of an analog signal to the Symbio controller which represents pressure drop. Monitoring is available for individual filters installed in the unit. The customer can monitor filter differential pressure for the purpose of filter maintenance.

No manual calibration is necessary as the transducers are factory calibrated.

Note: *This function does not provide a diagnostic or other form of user notification.*

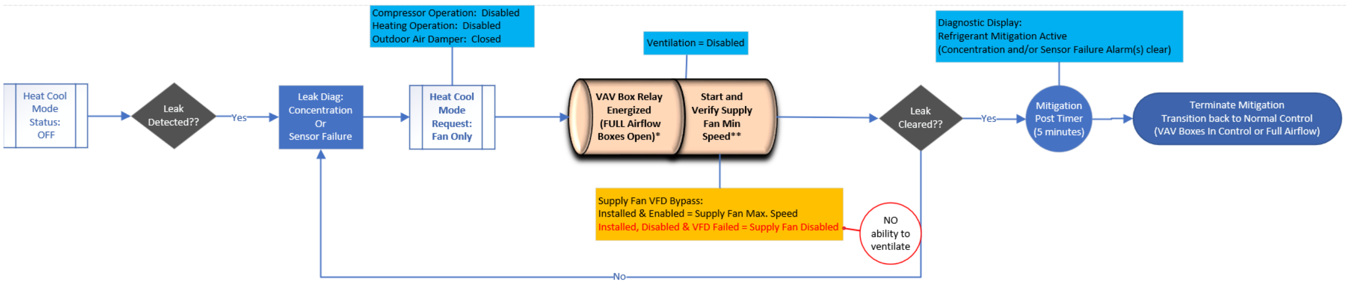
Refrigerant (R–454B) Detection and Mitigation

Equipment with R-454B refrigerant requires a refrigerant detection system based on the refrigerant charge. When the refrigerant detection system is in a normal state, the equipment provides normal heating, cooling, and ventilation.

Heat Cool Mode Status: Off

When the unit is in Off mode and a leak is detected or sensor fails (see the figure below), a diagnostic will trigger.

Figure 45. Heat Cool Mode Status: Off



The VAV Box Relay will be energized for Full Airflow and supply fan will go to minimum speed.

The unit will stay in this state until the leak has cleared, or the failed sensor has been replaced.

VFD bypass is not a requirement for leak detection. This only explains what action will or will not be taken if a leak is detected. If the unit has Supply Fan VFD Bypass Installed and enabled, the supply fan will go to maximum speed. If the Supply Fan VFD Bypass is installed but disabled AND the VFD has failed, the supply fan will not start.

Once the leak is cleared, the unit will continue to mitigate for five minutes. During this five minute mitigation, the concentration or sensor failure diagnostics will clear but the mitigation diagnostic will remain. When the five minute time expires, mitigation will terminate, and the unit will transition back to normal control.

Heat Cool Mode Status: Cool

When the unit is in Cool mode and a leak is detected or sensor fails (see the figure below), the same diagnostics will trigger.

Heat Cool Mode will transition to “Fan Only”. Compressor Operation is disabled, heating operation is disabled, and outdoor air dampers are closed all normal operation for “Off” mode).

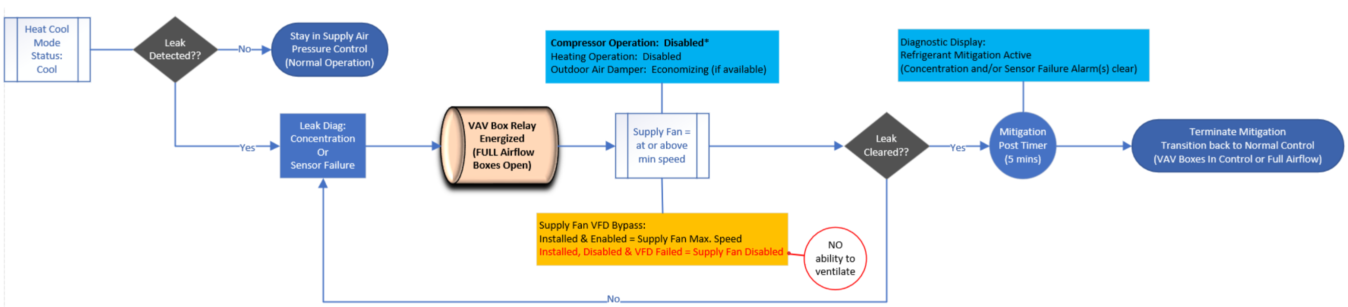
The VAV Box Relay will be energized for Full Airflow and supply fan will stay at the cool mode operating speed which will be at or above minimum speed. DX Cooling will de-energize and compressor operation will be disabled. This is a change to normal operation while in Cool Mode. Heating will remain disabled, and the unit can continue to economize if economizing is installed.

The unit will stay in this state until the leak is cleared, or the failed sensor has been replaced.

VFD bypass is not a requirement for leak detection. This only explains what action will or will not be taken if a leak is detected. If the unit has Supply Fan VFD Bypass Installed and enabled, the supply fan will go to maximum speed. If the Supply Fan VFD Bypass is installed but disabled AND the VFD has failed, the supply fan will not start.

Once the leak is cleared, the unit will continue to mitigate for five minutes. During this five minute mitigation, the concentration or sensor failure diagnostics will clear but the mitigation diagnostic will remain. When the five minute time expires, mitigation will terminate, and the unit will transition back to normal control.

Figure 46. Heat Cool Mode Status: Cool



Heat Cool Mode Status: Heat

When the unit is in Heat mode and a leak is detected or sensor fails (see the figure below), the same diagnostics will trigger.

The VAV Box Relay will be energized for Full Airflow and supply fan will stay at the heat mode operating speed which will be at or above minimum speed. Compressor Operation is disabled, heating operation stays enabled &

outdoor air dampers are at minimum ventilation (all normal operation for Heat mode).

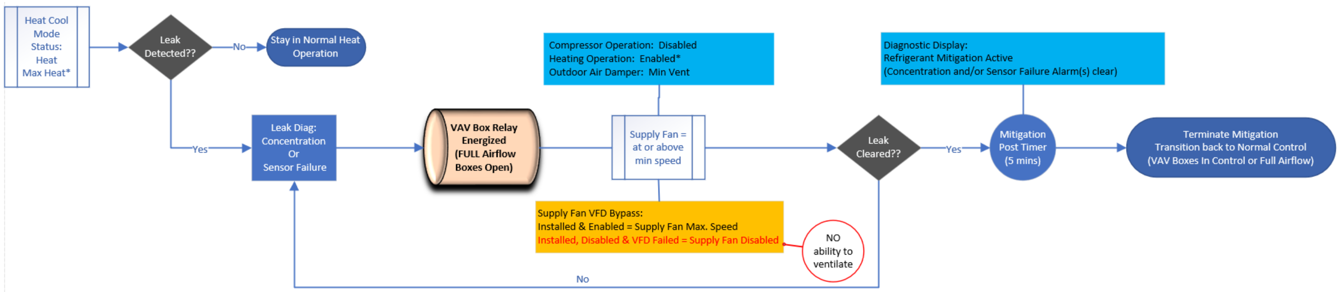
VFD bypass is not a requirement for leak detection. This only explains what action will or will not be taken if a leak is detected. If the unit has Supply Fan VFD Bypass Installed and enabled, the supply fan will go to maximum speed. If the Supply Fan VFD Bypass is installed but disabled AND the VFD has failed, the supply fan will not start.

The unit will stay in this state until the leak is cleared, or the failed sensor has been replaced.

Once the leak is cleared, the unit will continue to mitigate for five minutes. During this five minute mitigation, the concentration or sensor failure diagnostics will clear but the mitigation diagnostic will remain. When the five minute time expires, mitigation will terminate, and the unit will transition back to normal control.

Figure 47. Heat Cool Mode Status: Heat

Note: *Refrigerant leak detection and mitigation actions are defined by UL requirements. Therefore, Supply Fan minimum speed is recommended to remain as defined by factory defaults.*



Note: *Refrigerant leak detection and mitigation actions are defined by UL requirements. Therefore, Supply Fan minimum speed is recommended to remain as defined by factory defaults.*

Refrigerant Evacuation - Charge Operation

The Refrigerant Evacuation Charge button can be found in Manual Control Settings on the TD7. This feature provides service technicians a single per circuit button that will override all the valves and relays to maintain open refrigerant paths on the given circuit.

When the operation is enabled and applied, the manual override indicator will be present at the top of the TD7 as well as on the Refrigerant Evacuation/Charge button and the corresponding valves that are being manually overridden as a part of the evacuation/charge process.

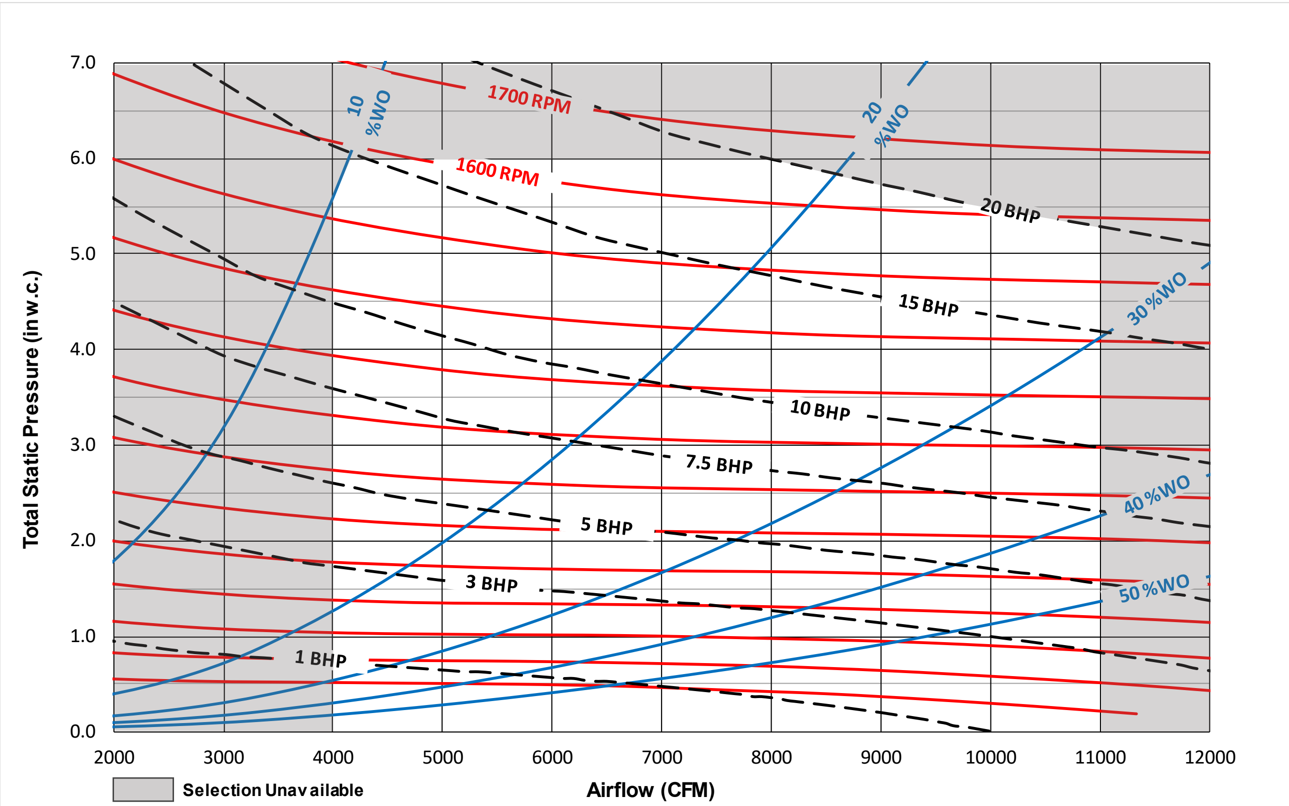
To enable the function, the technician MUST press the **Refrigerant Evacuation/Charge CktX** button. The function is disabled by default. EXV, HGBP, Condenser Reheat valves will be commanded to a 50% position when Refrigerant Evacuation/Charge CktX manual override is enabled.

Reheat Pumpout Relay cannot be commanded off during evacuation/charge operation. If selected in manual override control and attempt to turn off, control will keep the relay on. While in Evacuation / Charge, circuit level compressors are locked out, but other components can still be overridden (such as Supply Fan), through the normal override process as a technician would do today. All compressor safeties are still honored when Evacuation/ Charge operating is enabled; therefore, all minimum on timers will be honored. The function will persist through power off-on cycles. When power is cycled all valves after calibration will go back to the 50% position. The only way to remove the valves from manual override is by disabling the Refrigerant Evacuation/Charge operation.

Performance Data

Supply Fan Performance

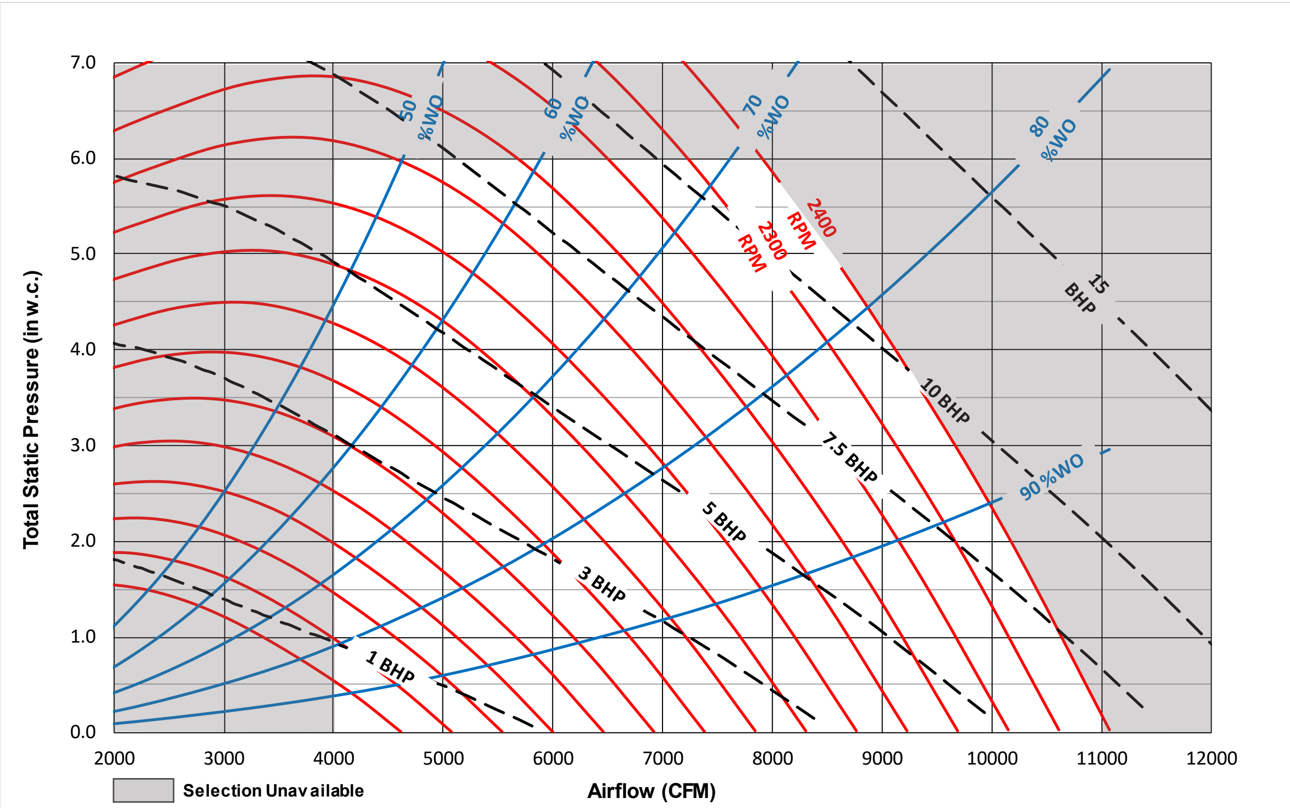
Figure 48. Supply fan performance 20 and 25 tons - forward curved



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

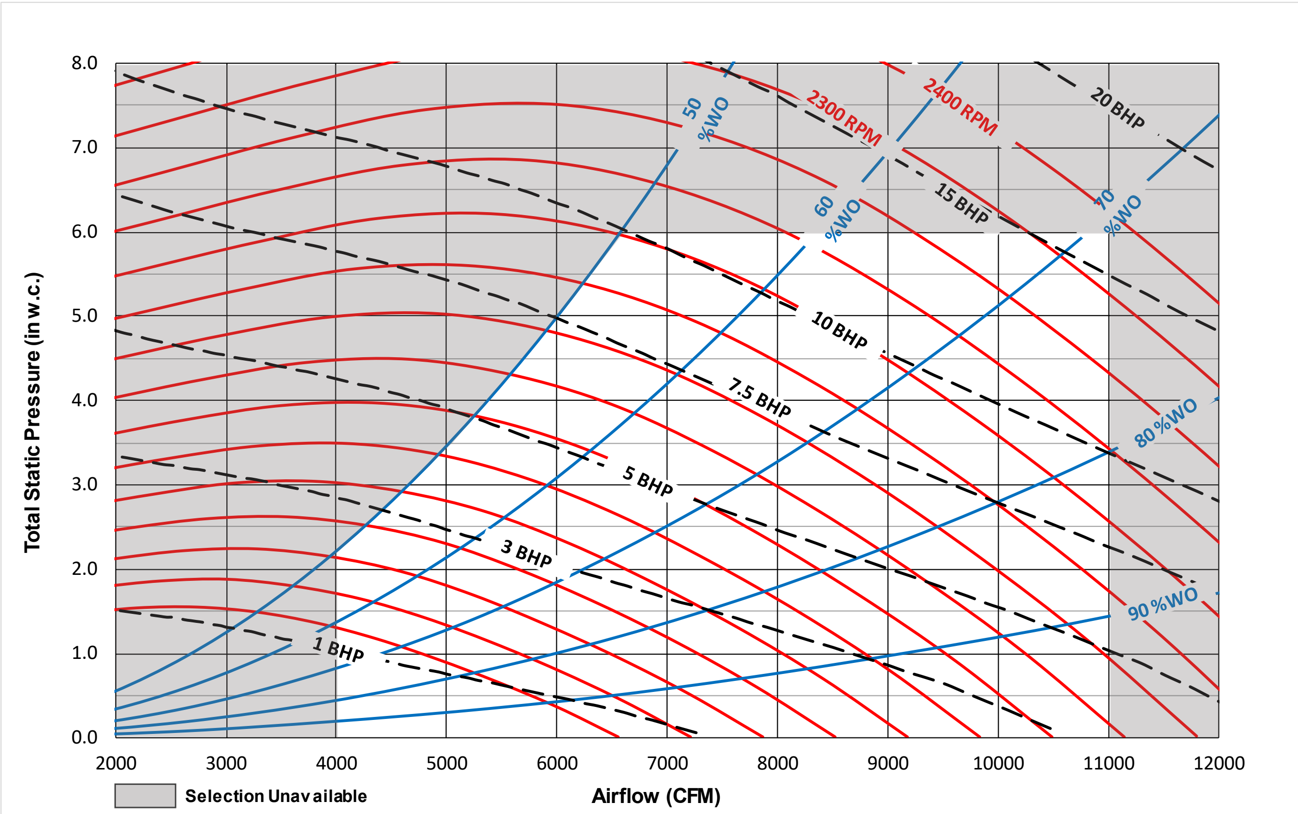
Figure 49. Supply fan performance - 20 and 25 tons cooling only - direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

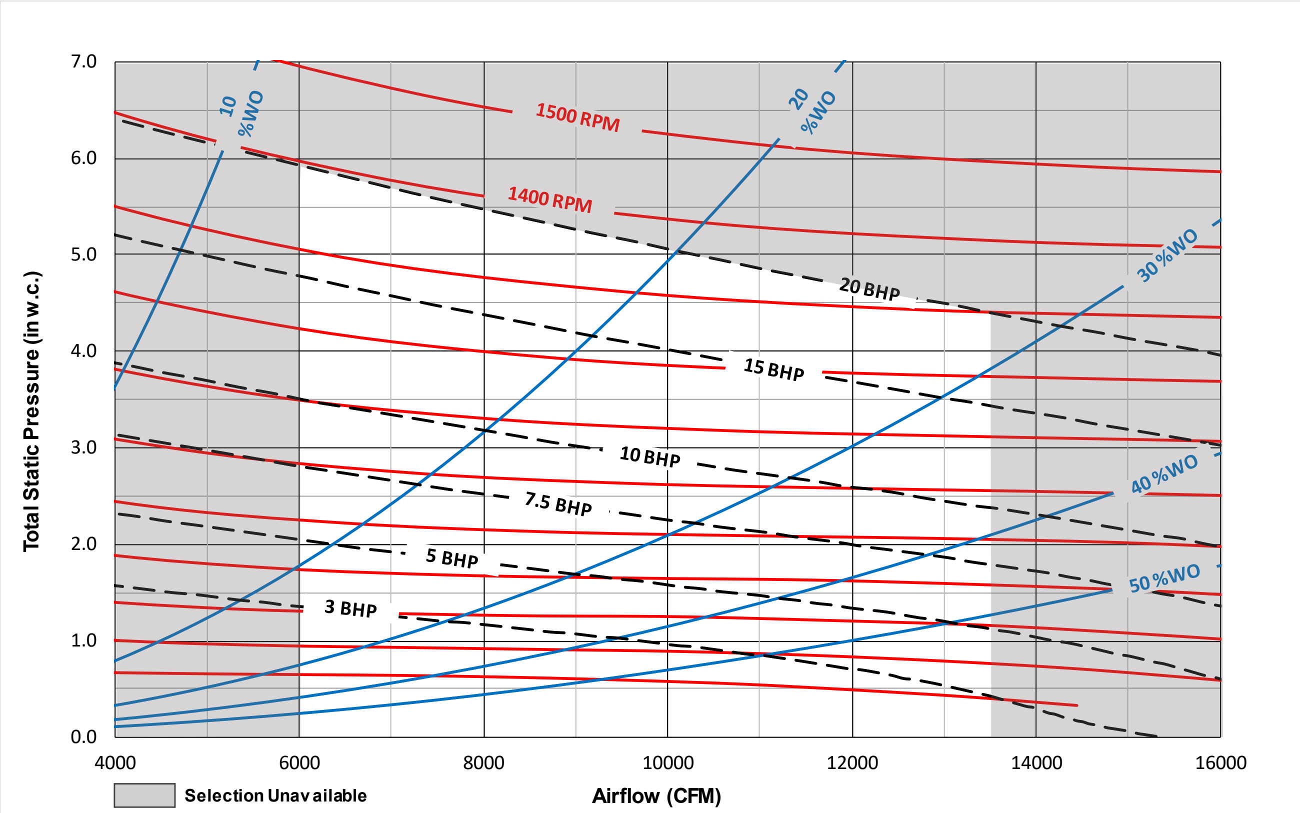
Figure 50. Supply fan performance - 20 and 25 tons cooling only - direct drive plenum, 120% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

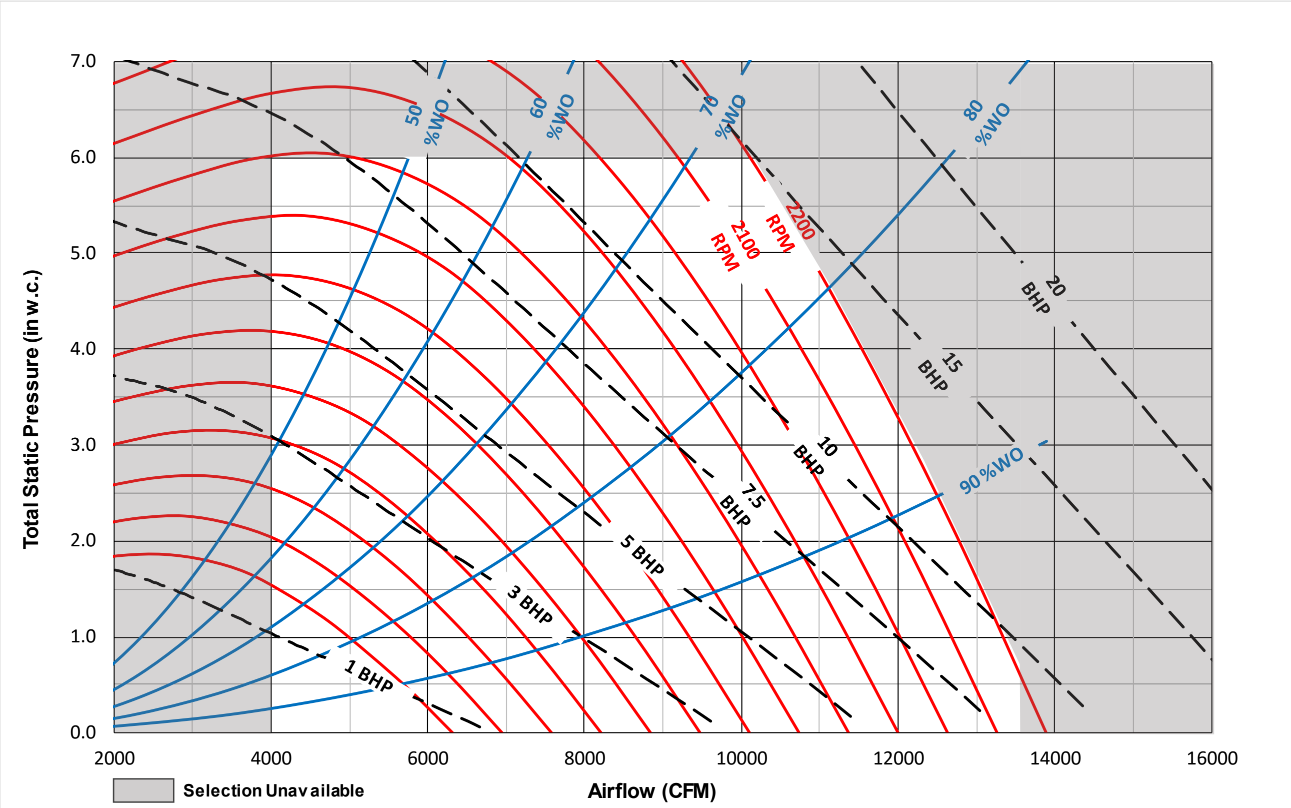
Figure 51. Supply fan performance - 30 ton - forward curved



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

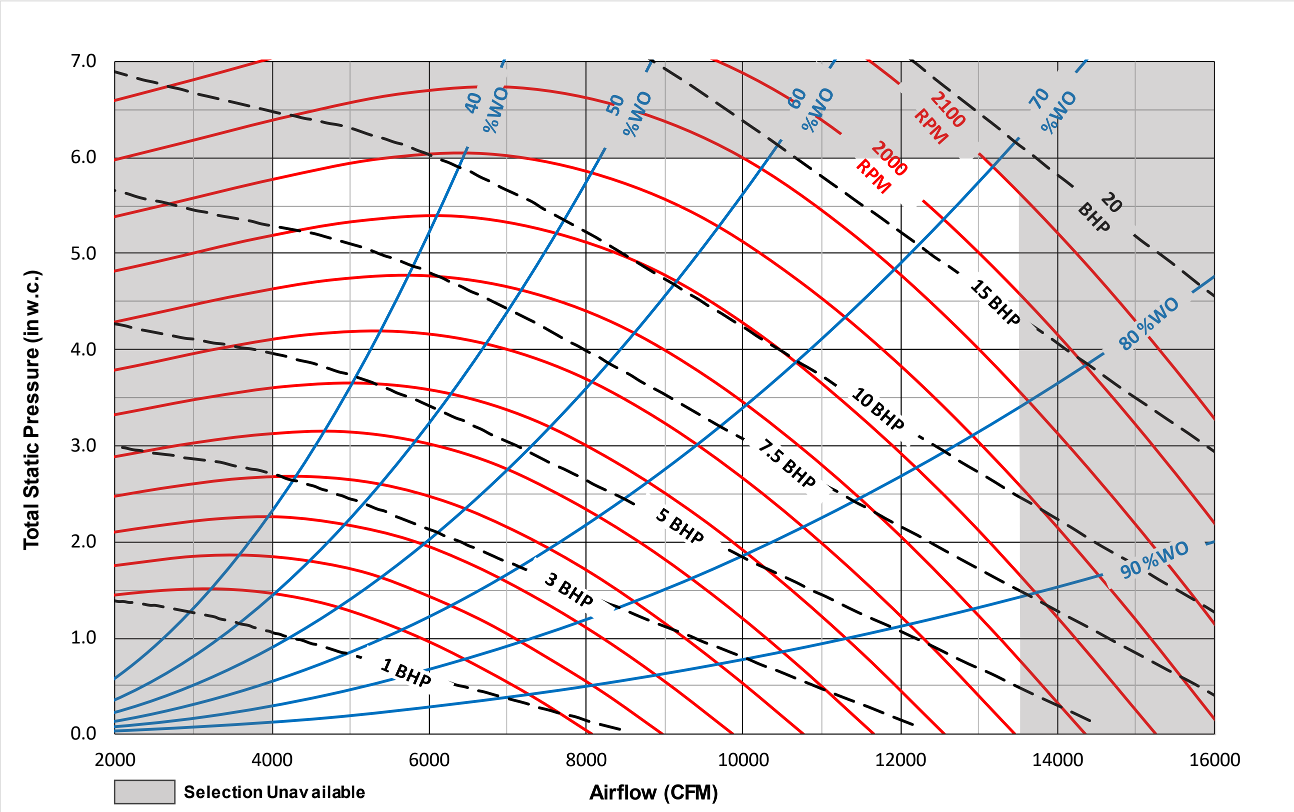
Figure 52. Supply fan performance - 30 ton cooling only, 20/25 ton gas heat- direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

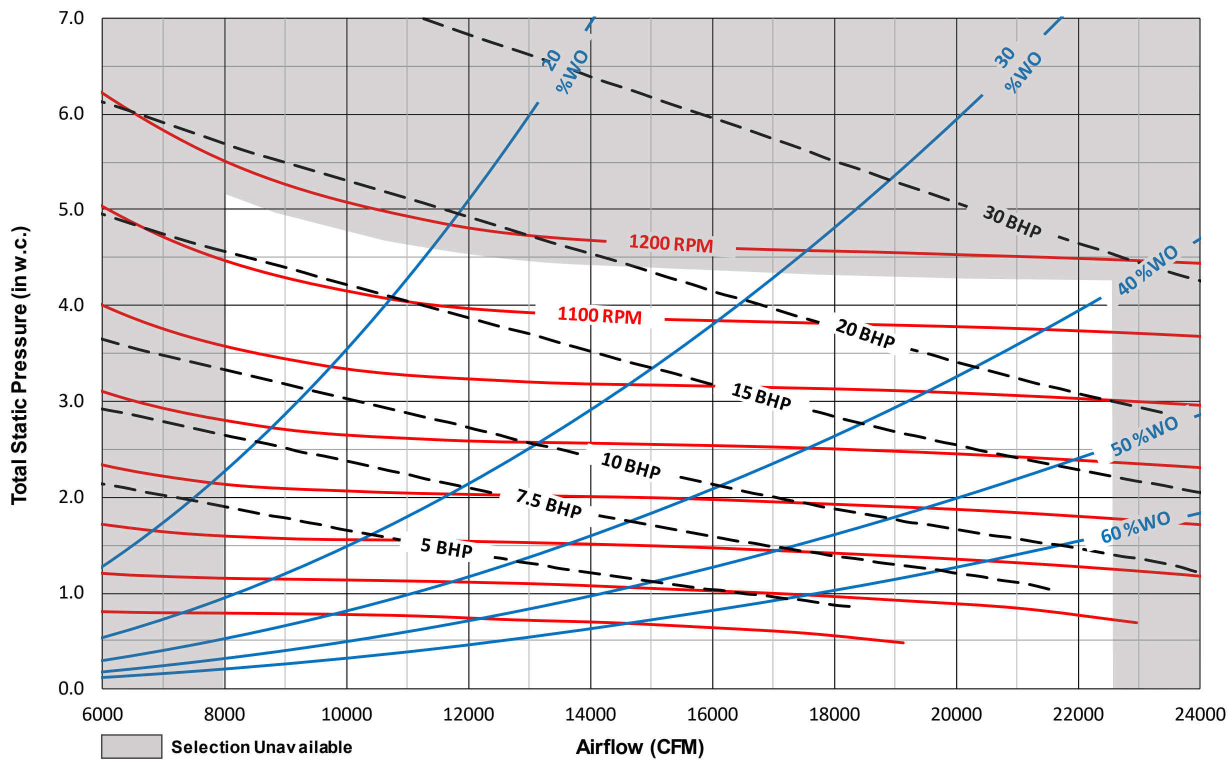
Figure 53. Supply fan performance - 30 ton cooling only, 20/25 ton gas heat- direct drive plenum, 120% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

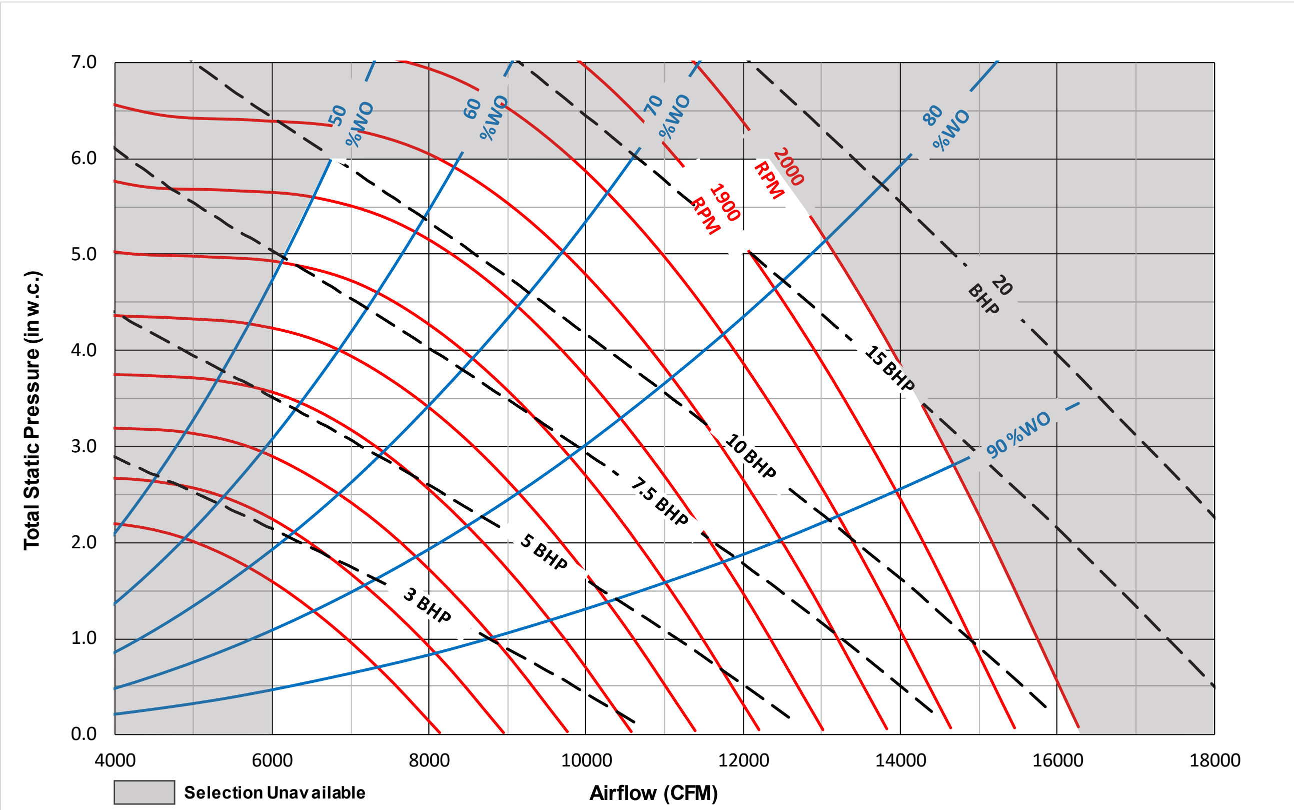
Figure 54. Supply fan performance - 40, 50, and 55 tons - forward curved



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

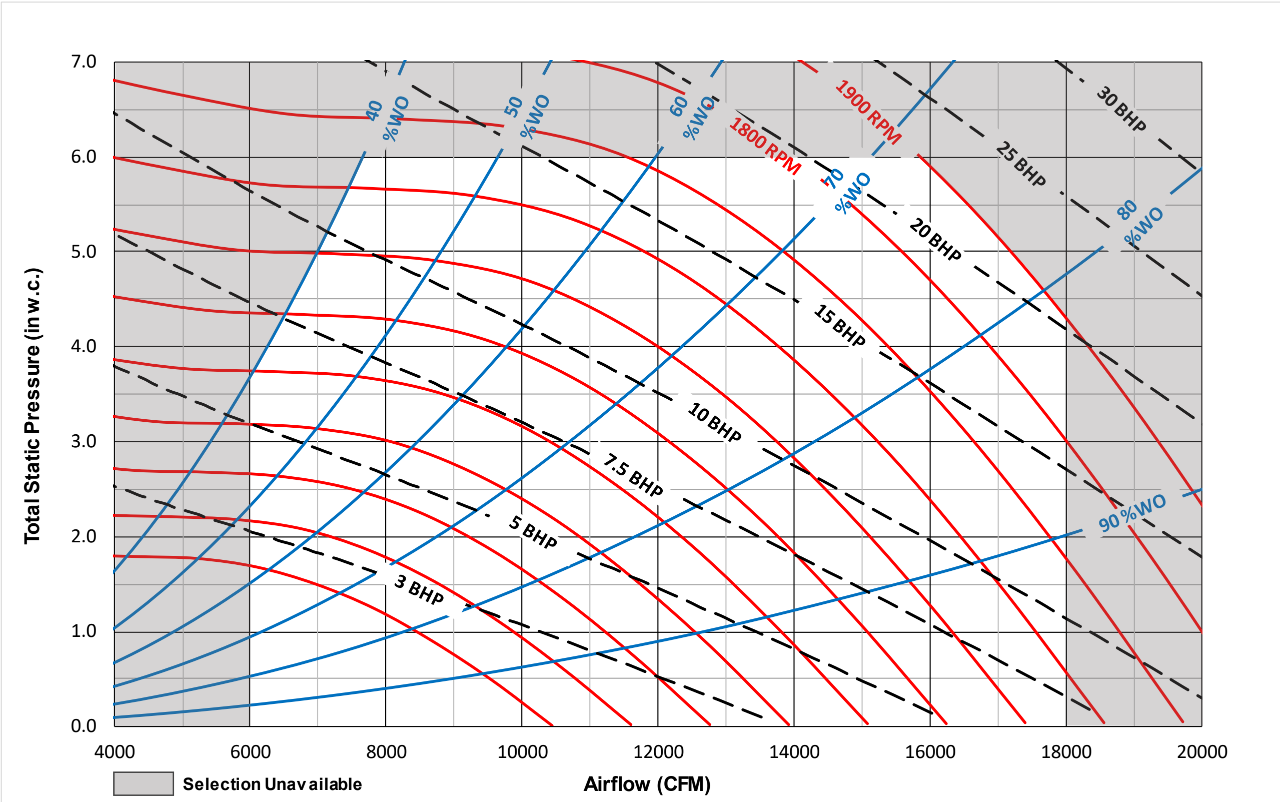
Figure 55. Supply fan performance - 40 ton cooling only, 30 ton gas heat - direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

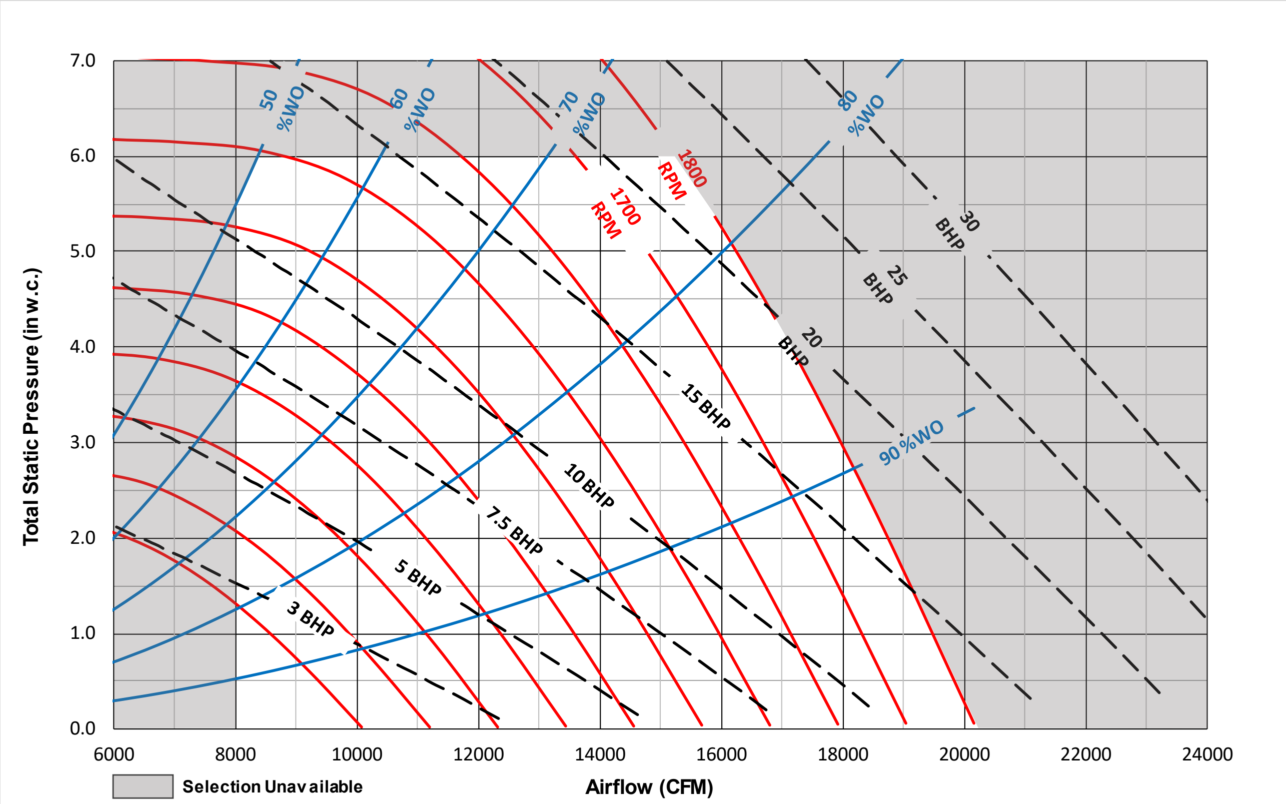
Figure 56. Supply fan performance - 40 ton cooling only - direct drive plenum, 120% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

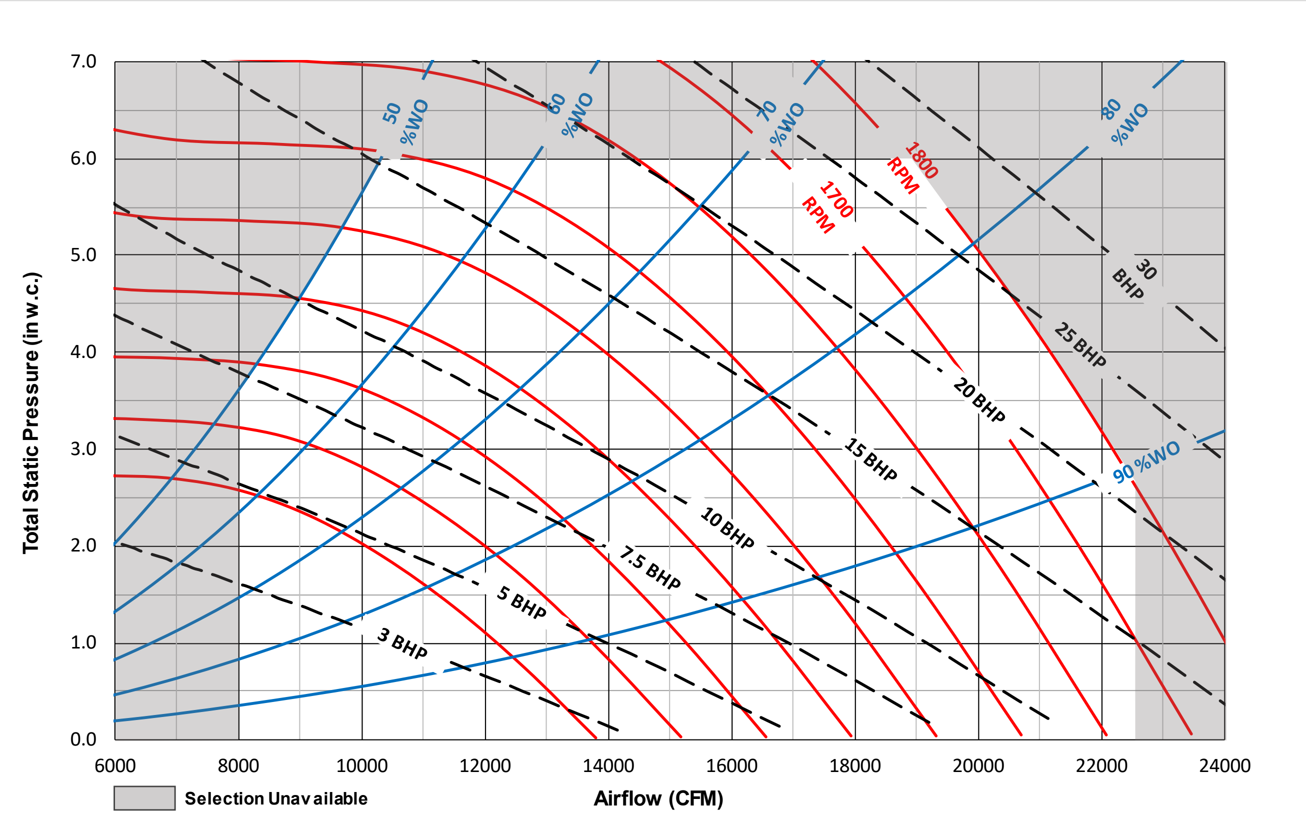
Figure 57. Supply fan performance - 50, 55 tons, 40 ton gas heat - direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

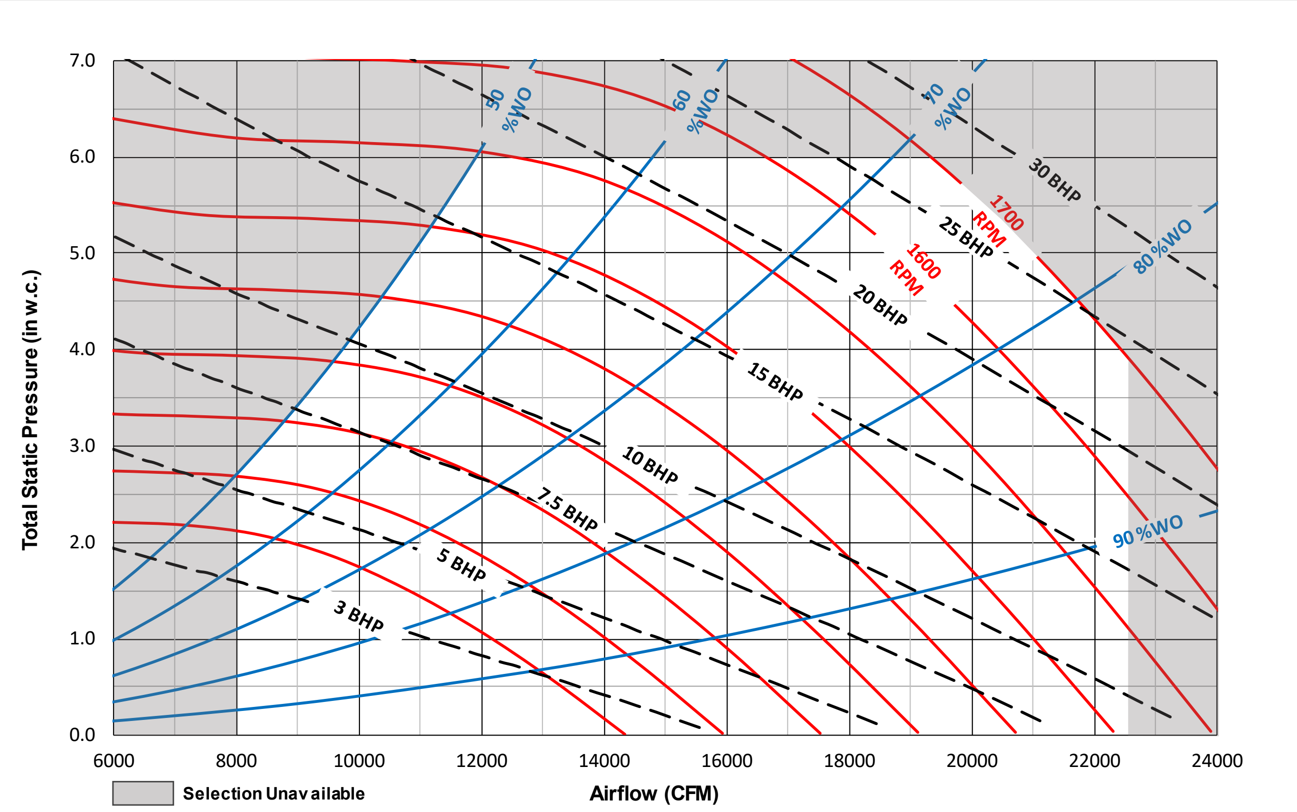
Figure 58. Supply fan performance - 50, 55 tons, 40 ton gas heat - direct drive plenum, 100% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

Figure 59. Supply fan performance - 50, 55 tons, 40 ton gas heat - direct drive plenum, 120% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
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- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
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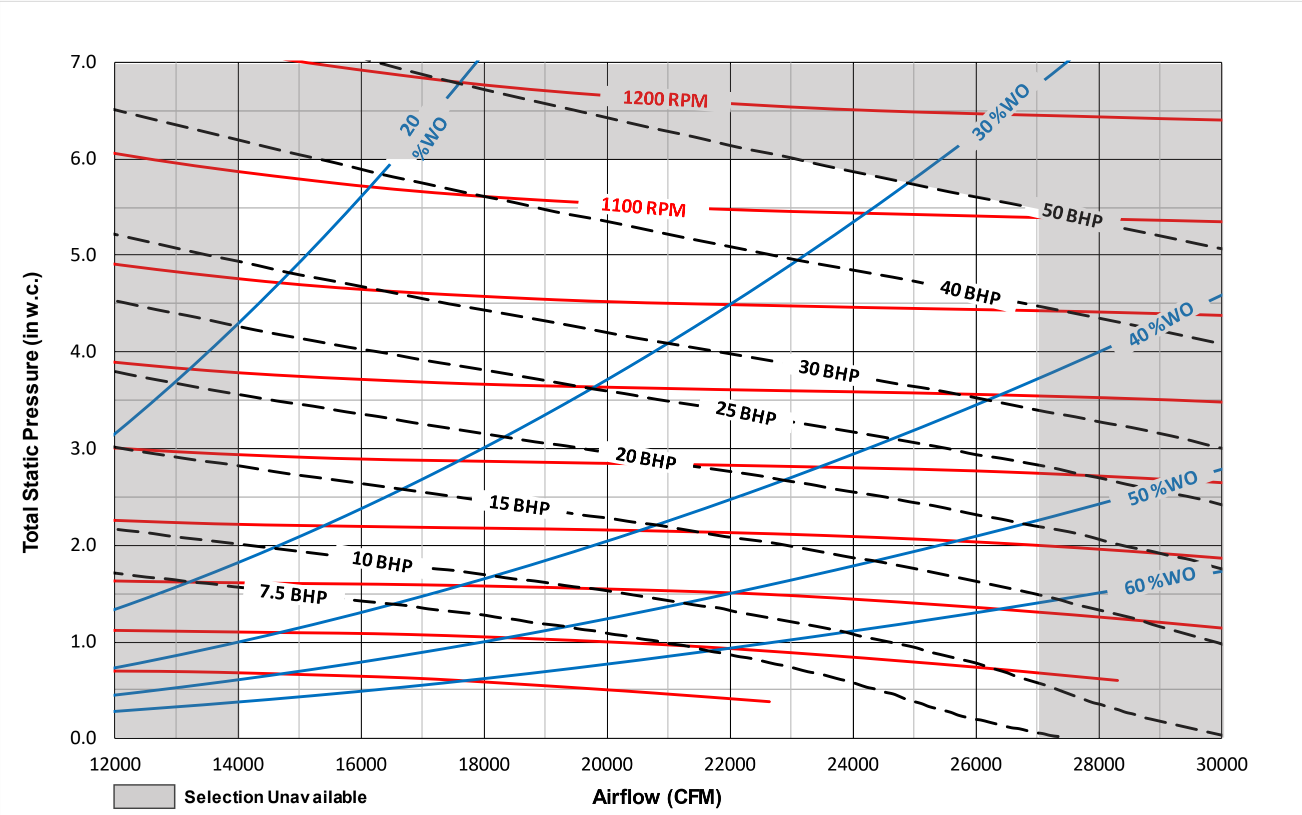
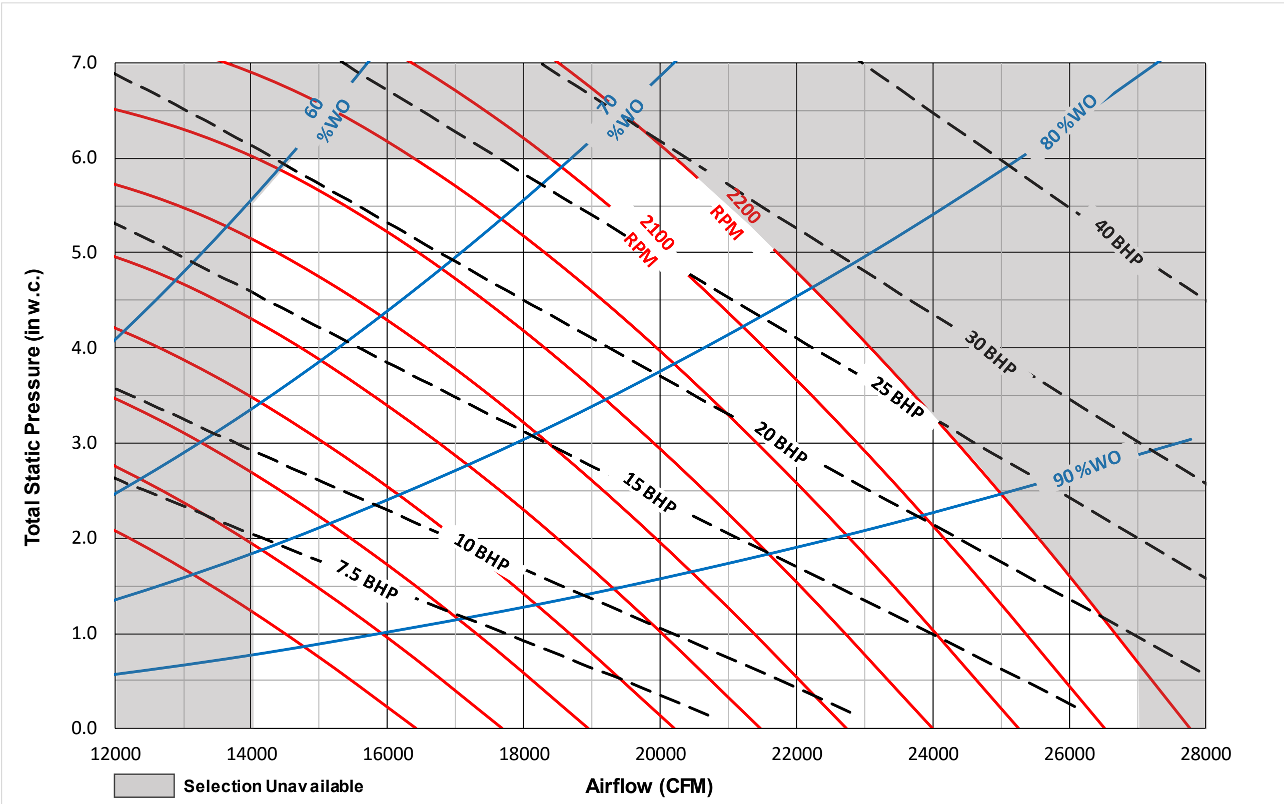
Figure 60. Supply fan performance - 60, 70, and 75 tons - forward curved



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

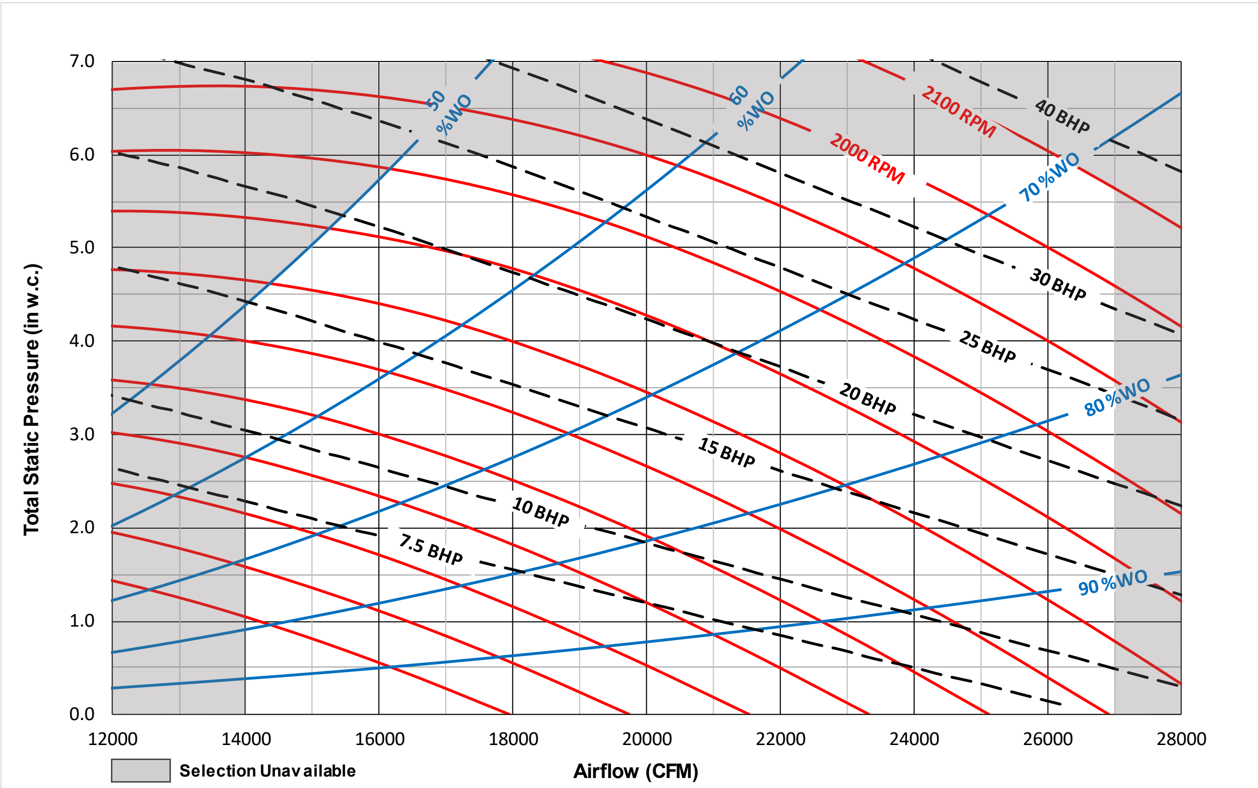
Figure 61. Supply fan performance - 60 ton cooling only- direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

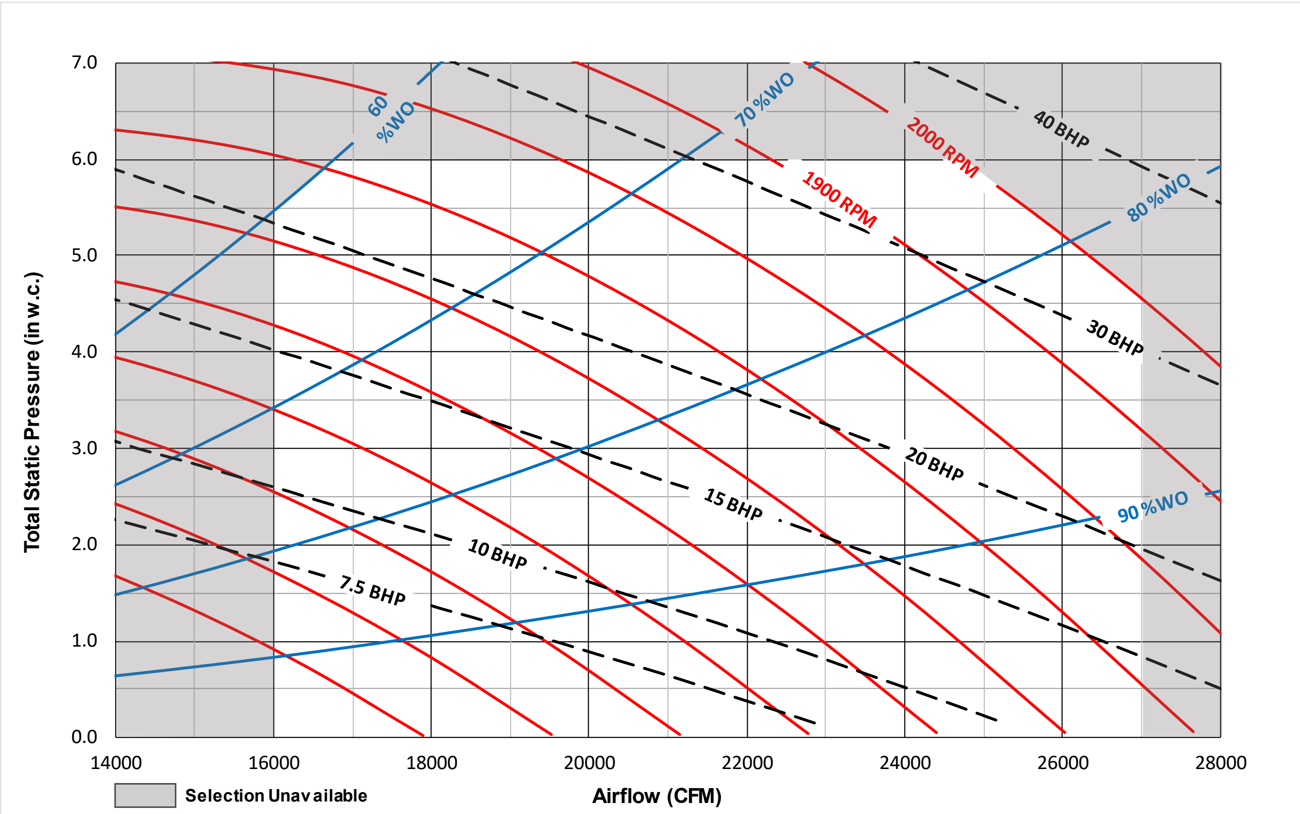
Figure 62. Supply fan performance - 60 ton cooling only- direct drive plenum, 120% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

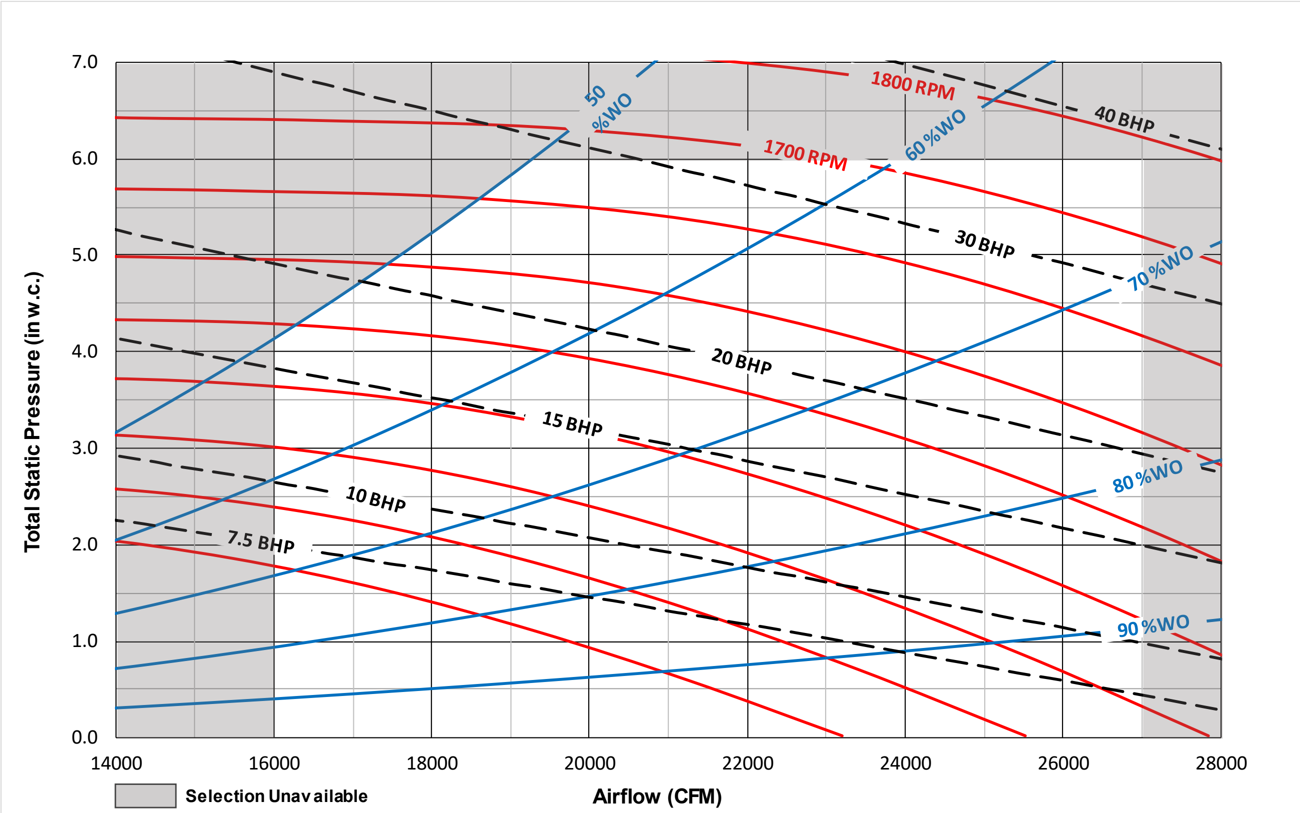
Figure 63. Supply fan performance - 70 and 75 tons cooling only- direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

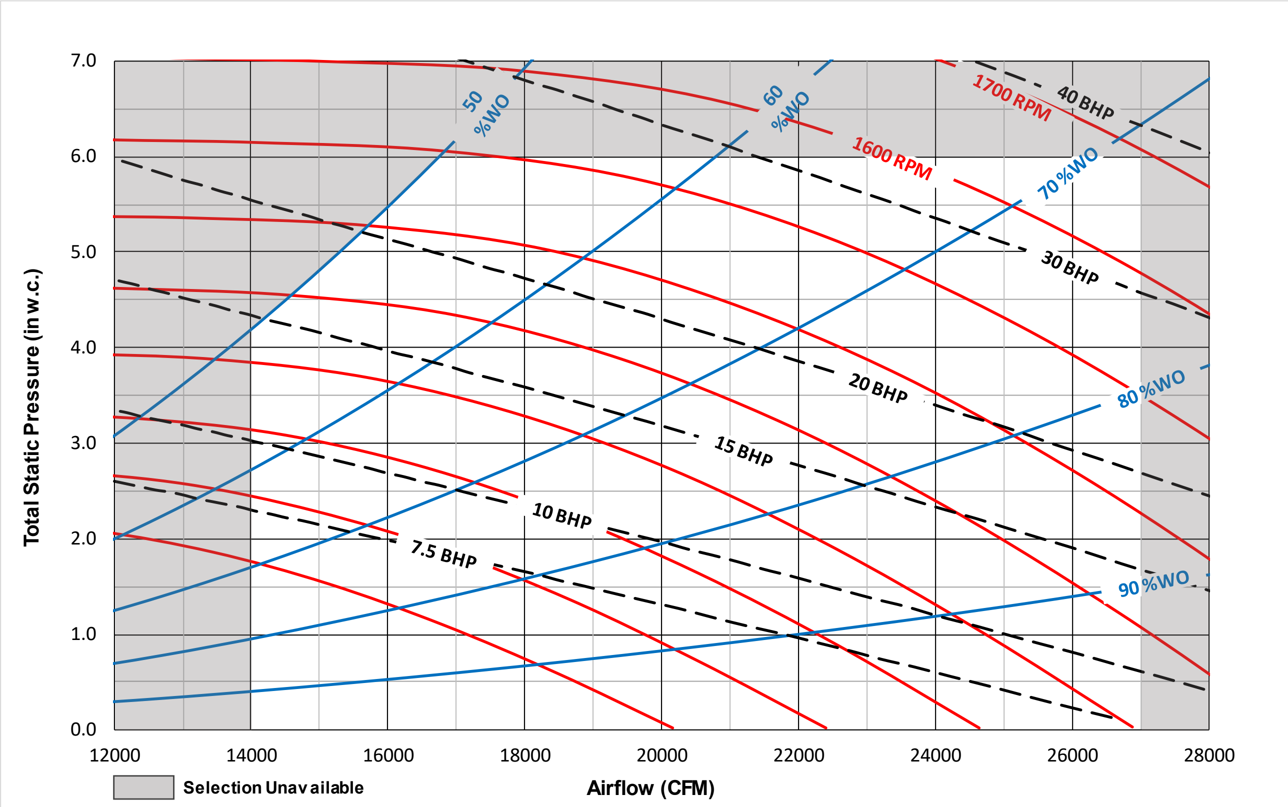
Figure 64. Supply fan performance - 70 and 75 tons cooling only- direct drive plenum, 120% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

Figure 65. Supply fan performance - 60, 70, and 75 tons gas heat - direct drive plenum, 80% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
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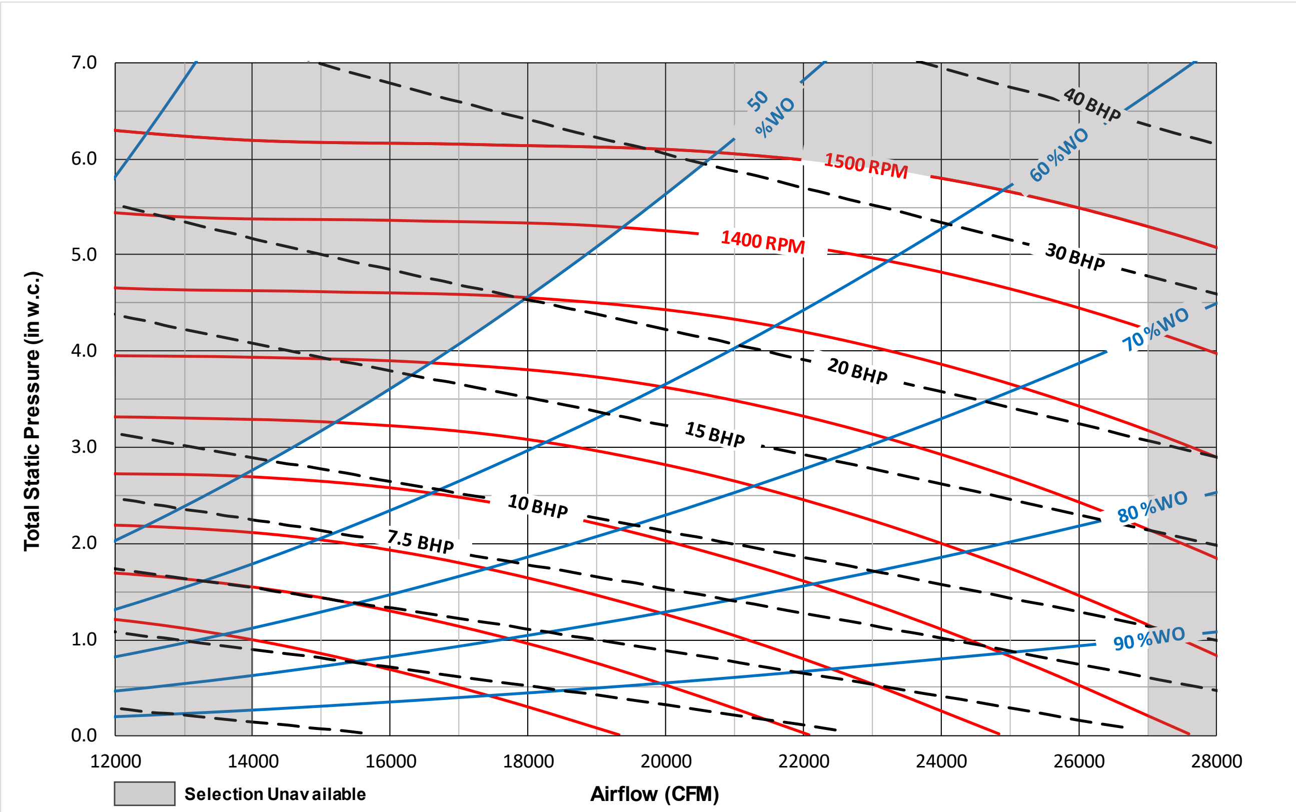
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

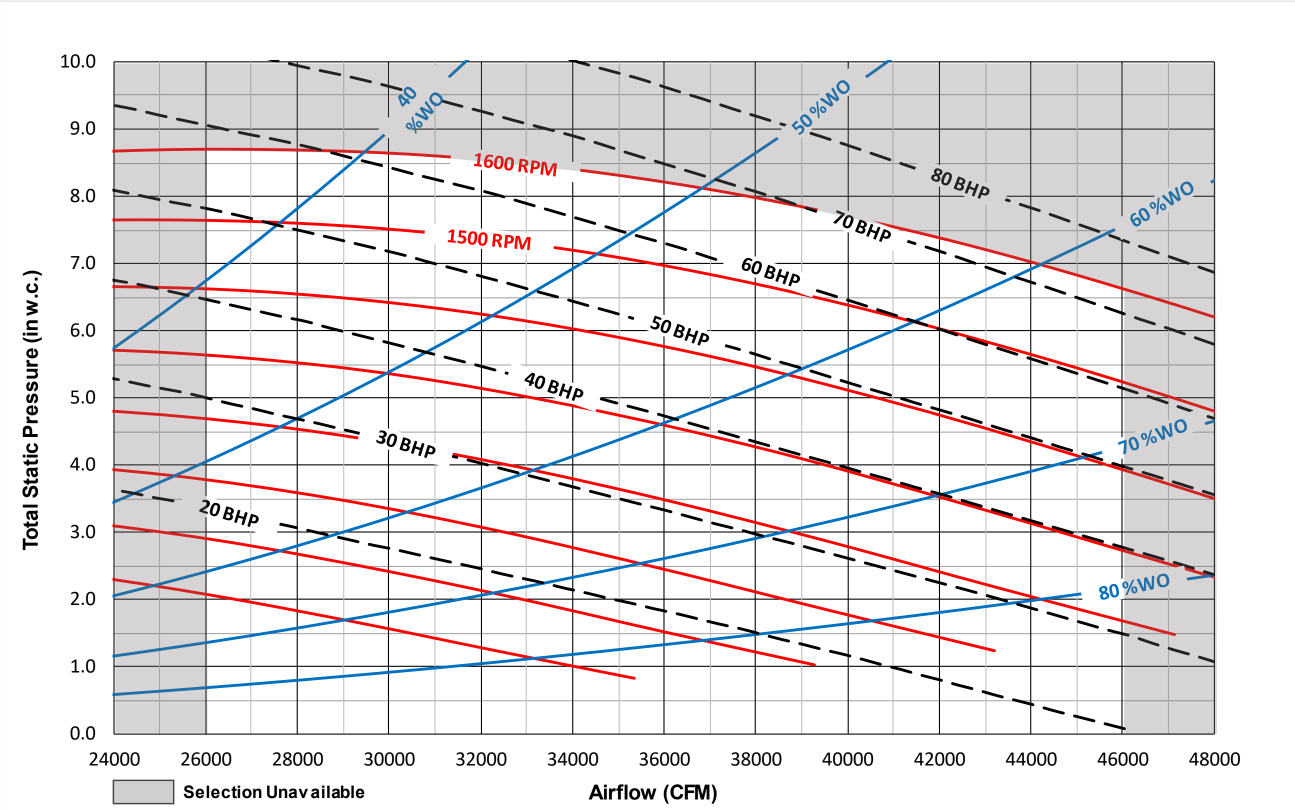
Figure 66. Supply fan performance - 60, 70, and 75 tons gas heat - direct drive plenum, 100% width



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

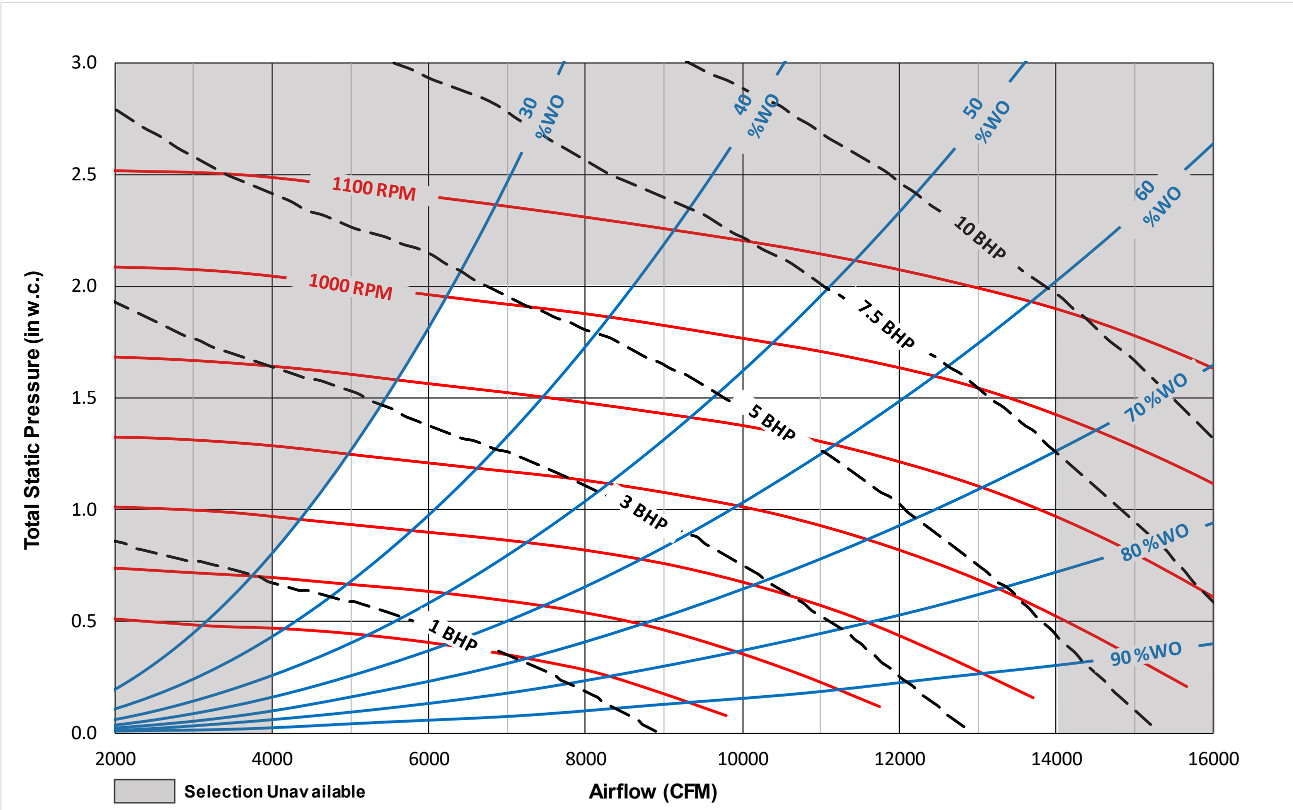
Figure 67. Supply fan performance - 90, 105, 115, and 130 ton



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
- *Shaded areas represent unavailable selections. Contact your local Trane representative for more information on selections in these shaded regions.*
- *Max RPM is indicated on curve and RPM values are in increments of 100RPM unless otherwise shown.*
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

Figure 68. Relief fan performance - 20, 25, and 30 tons



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
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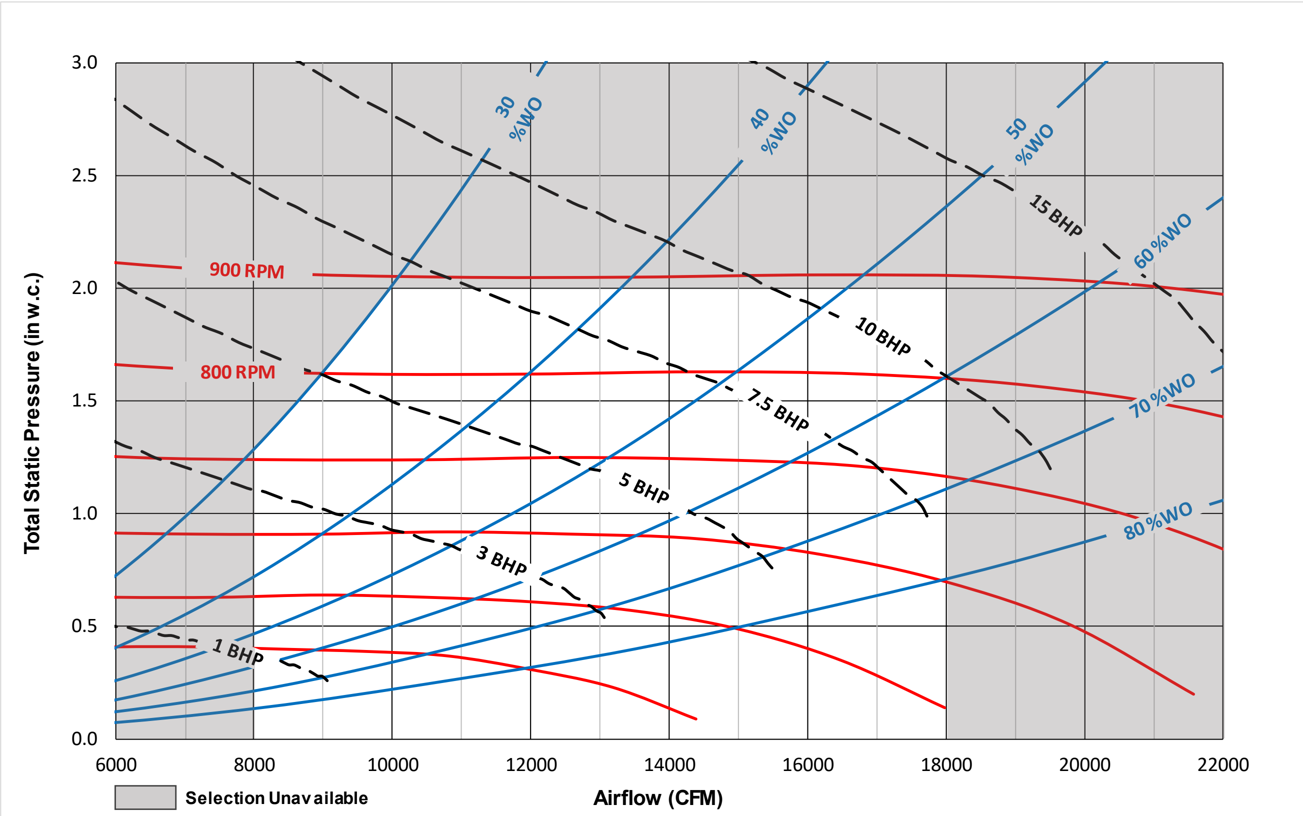
Figure 69. Relief fan performance - 40, 50, and 55 tons



Notes:

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- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
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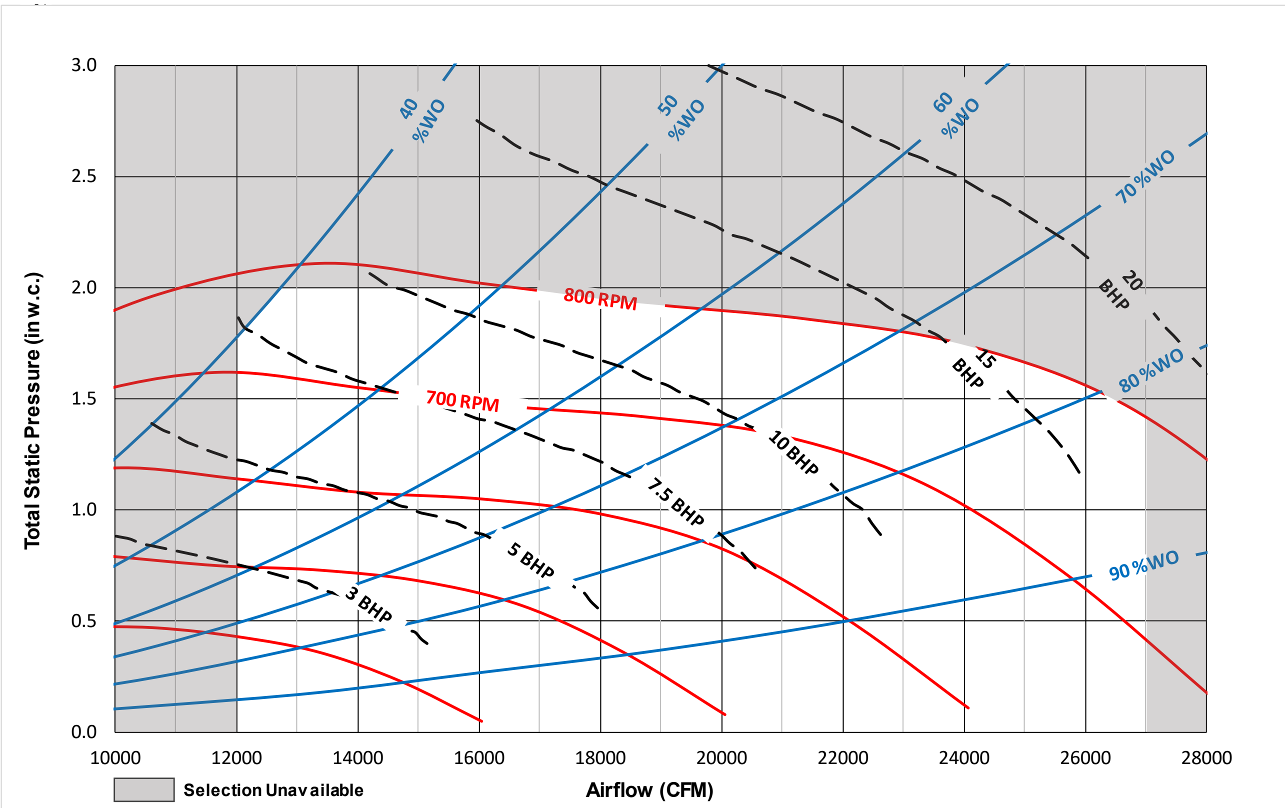
Figure 70. Relief fan performance - 60, 70, and 75 tons



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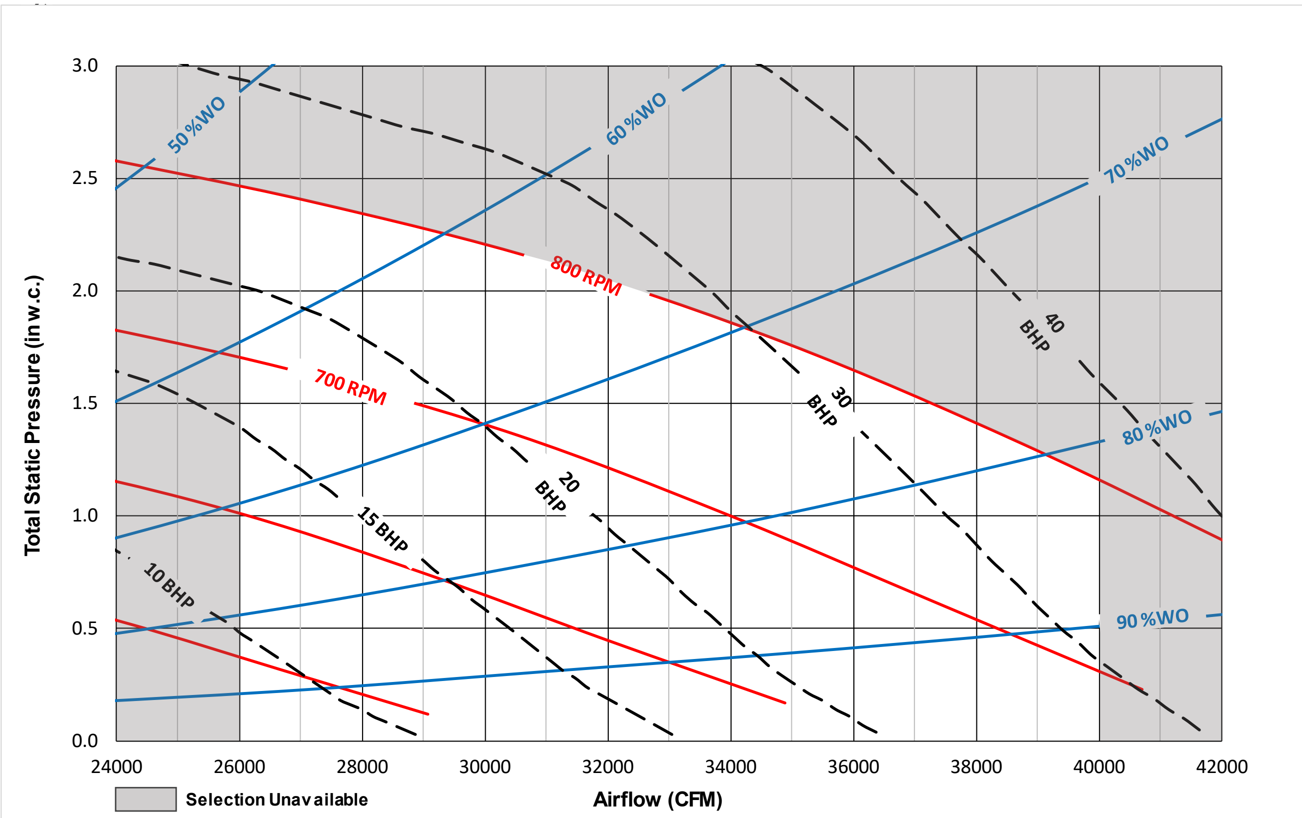
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

Figure 71. Relief fan performance - 90, 105, 115, and 130 tons



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
- *Curve can show combined operating min/max for multiple tonnages. Refer to general data for appropriate operating parameters such as motor horsepower and airflow ranges.*
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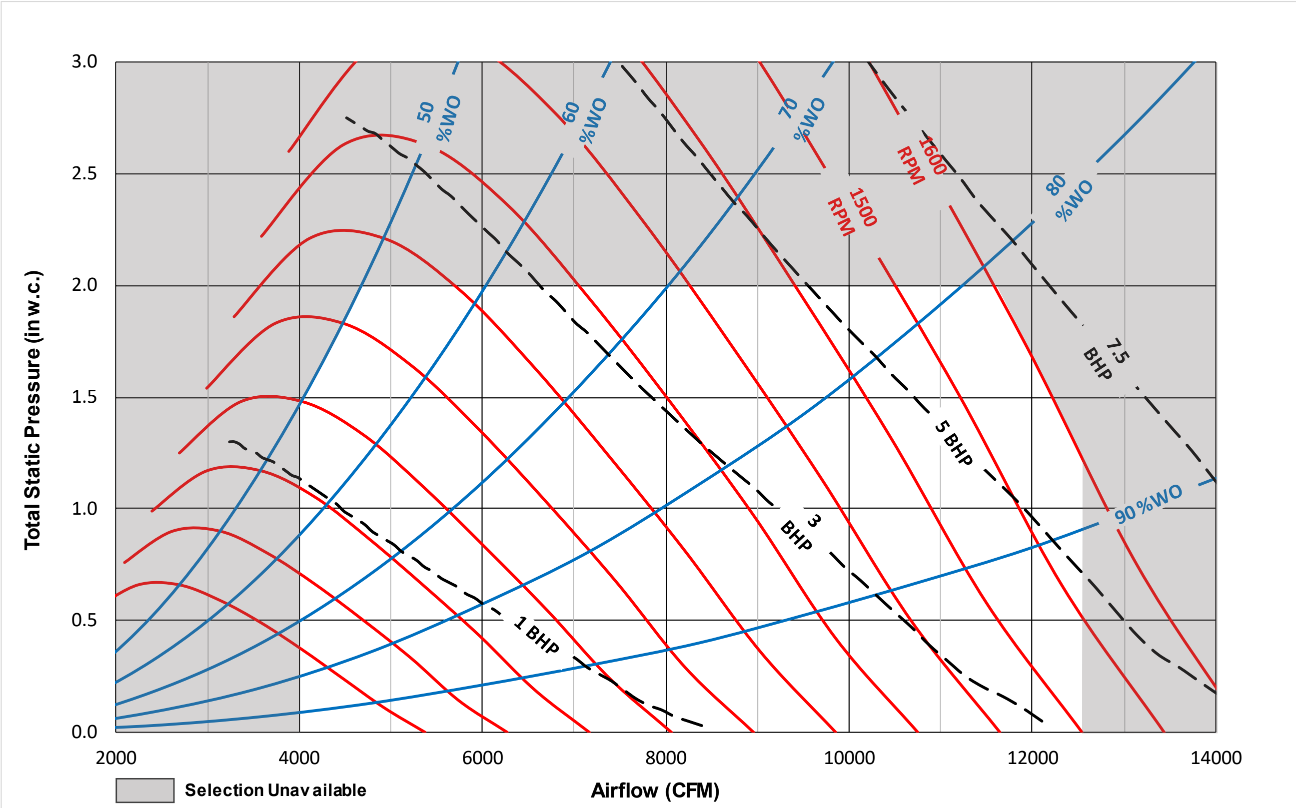
- *Catalog curves represent fan data corrected to the following standard conditions: 70°F dry bulb temperature, barometric pressure of 14.696 psia, and an air density of 0.075 lb/ft3. Use Trane Select Assist to generate fan curves for unit-specific operating temperatures and elevations.*

Figure 72. Return fan performance - 20, 25, and 30 tons



Notes:

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- *Static pressure drops from the supply fan to the space (optional heat + curb + supply ESP) cannot exceed 4.0 in w.c.*
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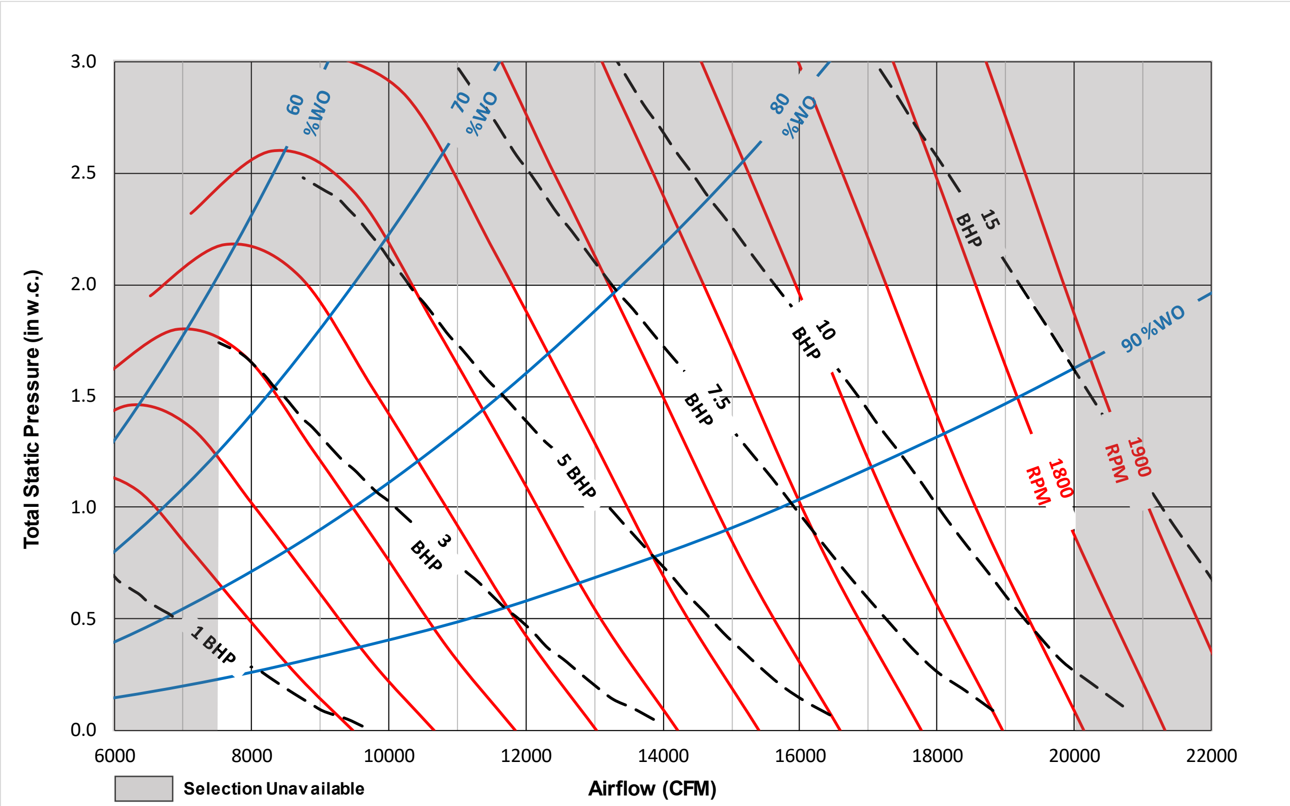
Figure 73. Return fan performance - 40, 50, and 55 tons



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
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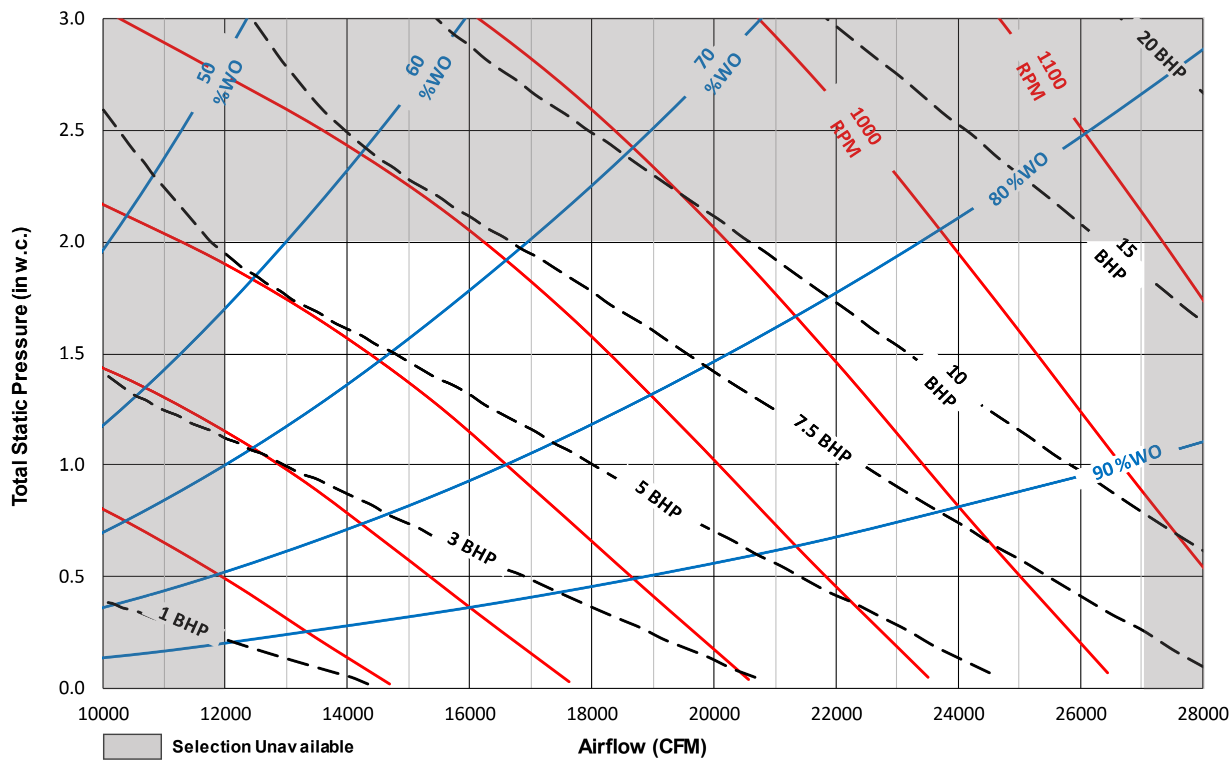
Figure 74. Return fan performance - 60, 70, and 75 tons



Notes:

- *Supply fan performance curve includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component (evaporator coil, filters, etc.) static pressure drops.*
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Pressure Drop Tables

Figure 75. Wet airside pressure drop at 0.075 lb/cu.ft. 20 to 75 ton evaporator coil

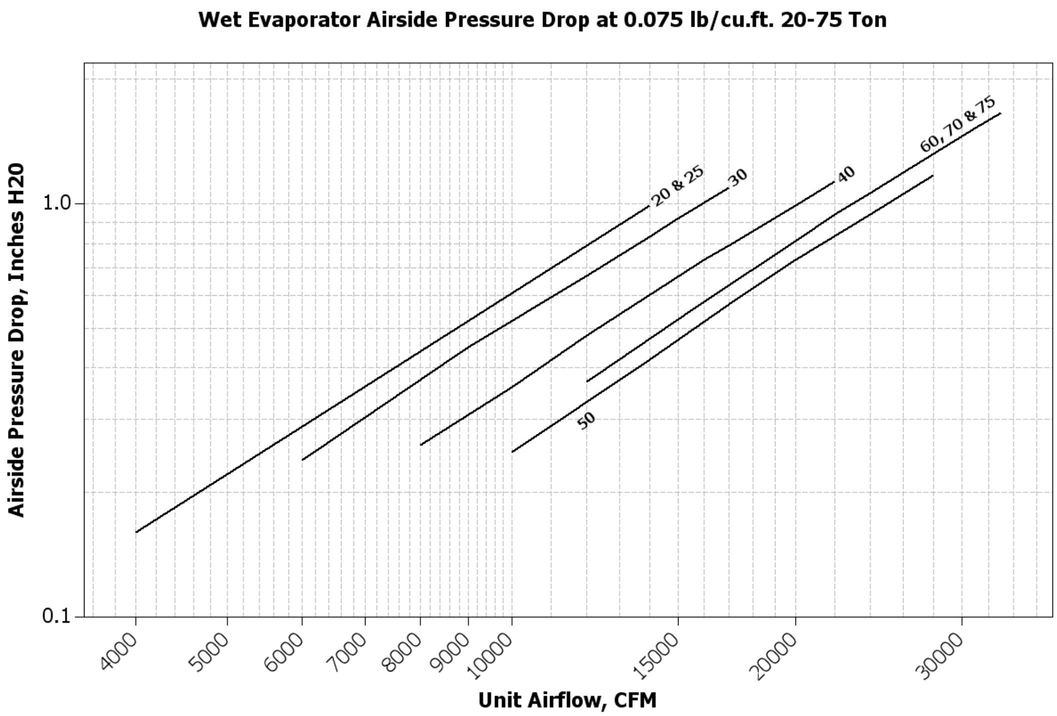


Figure 76. Dry airside pressure drop at 0.075 lb/cu.ft. 20 to 75 ton evaporator coil

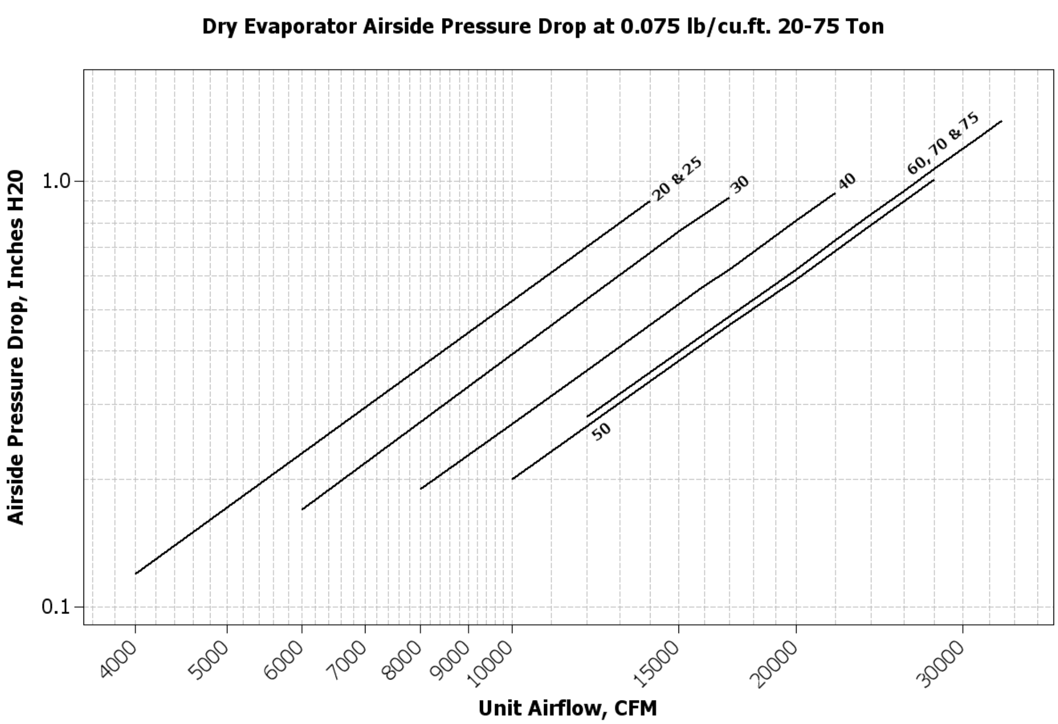


Figure 77. Wet airside pressure drop at 0.075 lb/cu.ft. 90 to 130 ton evaporator coil

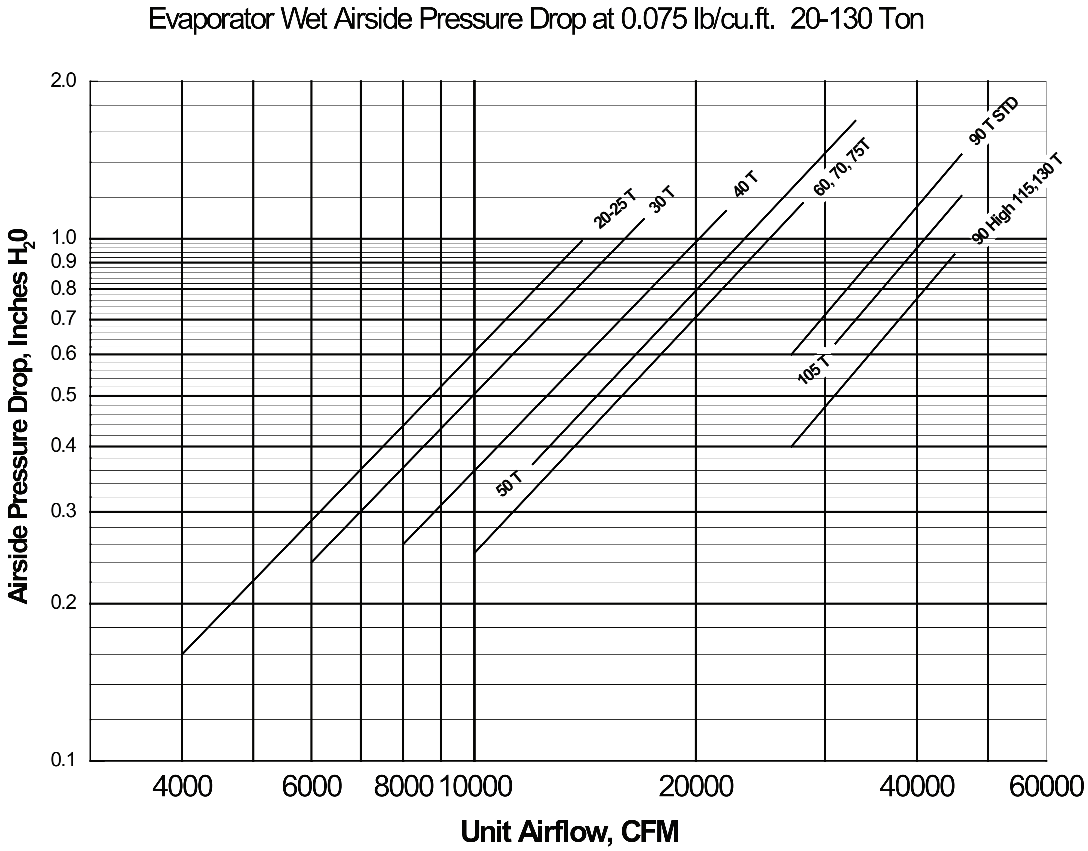
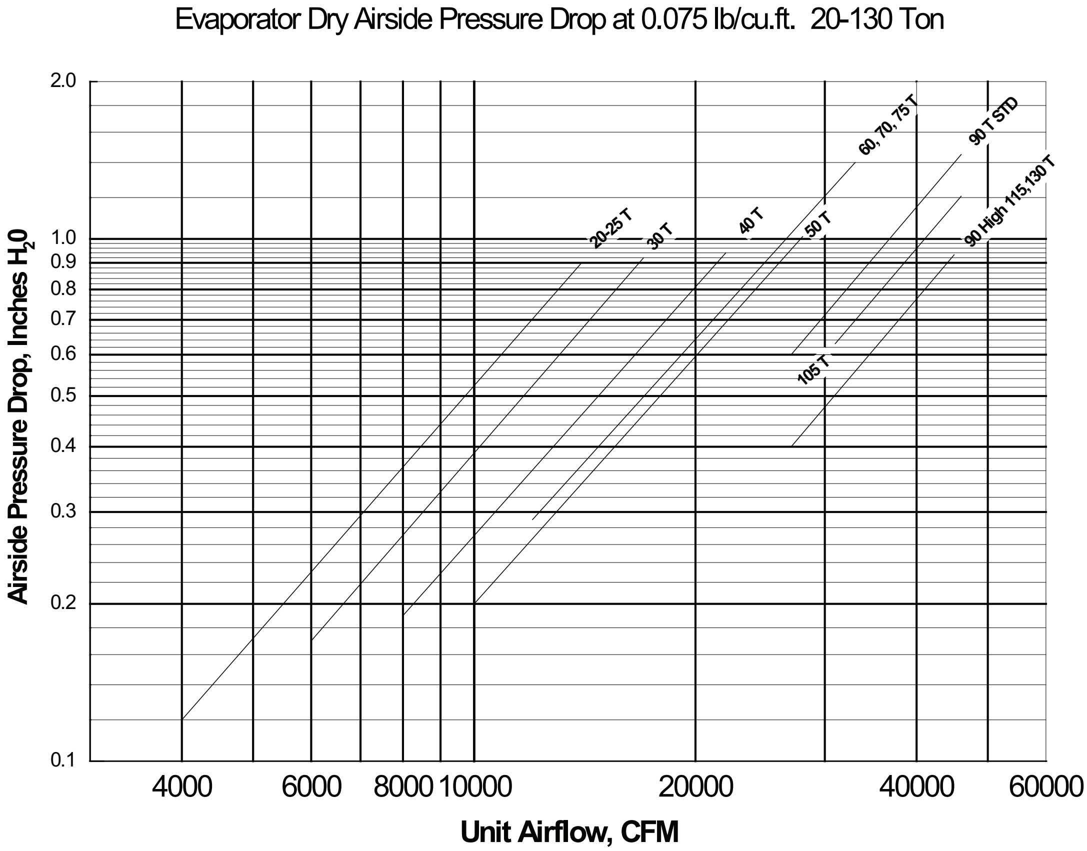


Figure 78. Dry airside pressure drop at 0.075 lb/cu.ft. 90 to 130 ton evaporator coil



Component Static Pressure Drops

Table 51. Component static pressure drops (in. W.G.), 20 to 75 tons air-cooled

Nom	CFM Std	Evap Coil Dry	Evap Coil Wet	SFH_ - FC Low	SFH_ - FC High	SFH_ - DDP Low	SFH_ - DDP High	SHE_ All kW	SLH_ Low	SLH_ High	SSH_ Low	SSH_ High	Throwaway Std	Throwaway High	Perm Wire	Bag & Pre	Cart & Pre	Final Cart	Std Roof	Econ w/ or w/out Relief	HGRH
20	4000	0.12	0.16	0.02	N/A	0.09	N/A	0.02	0.05	0.06	0.02	0.06	0.03	0.03	0.01	0.30	0.24	0.22	0.01	0.03	0.01
	6000	0.24	0.29	0.05	0.05	0.21	0.22	0.04	0.09	0.12	0.05	0.12	0.06	0.06	0.02	0.50	0.44	0.30	0.02	0.06	0.02
	8000	0.37	0.44	0.09	0.09	0.37	0.39	0.07	0.15	0.19	0.10	0.20	0.09	0.09	0.03	0.71	0.68	0.45	0.05	0.12	0.04
	9000	0.45	0.52	0.12	0.12	0.48	0.50	0.09	0.19	0.24	0.12	0.22	0.11	0.11	0.04	0.83	0.81	0.55	0.07	0.15	0.05
25	5000	0.18	0.22	0.03	N/A	0.04	N/A	0.03	0.07	0.09	0.04	0.09	0.05	0.05	0.02	0.40	0.34	0.25	0.01	0.03	0.01
	6000	0.24	0.29	0.05	0.05	0.21	0.22	0.04	0.10	0.12	0.06	0.13	0.07	0.07	0.02	0.50	0.44	0.30	0.02	0.05	0.02
	7500	0.34	0.41	0.08	0.08	0.31	0.35	0.06	0.14	0.17	0.09	0.18	0.09	0.09	0.03	0.66	0.62	0.41	0.04	0.10	0.03
	10000	0.53	0.62	0.14	0.15	0.58	0.61	0.11	0.23	0.28	0.15	0.29	0.13	0.13	0.05	0.95	0.95	0.66	0.10	0.19	0.06
	11000	0.62	0.71	0.17	0.18	0.71	0.74	0.13	0.29	0.33	0.19	0.35	0.15	0.15	0.06	1.06	1.11	0.79	0.12	0.23	0.07
30	6000	0.17	0.24	0.05	0.05	0.08	0.13	0.04	0.09	0.12	0.05	0.12	0.04	0.04	0.01	0.34	0.26	0.24	0.02	0.06	0.02
	9000	0.33	0.45	0.11	0.12	0.17	0.29	0.09	0.19	0.24	0.12	0.22	0.07	0.07	0.02	0.54	0.48	0.36	0.07	0.15	0.04
	12000	0.53	0.67	0.20	0.21	0.30	0.51	0.16	0.31	0.39	0.22	0.41	0.11	0.11	0.04	0.75	0.75	0.58	0.16	0.27	0.07
	14000	0.68	0.83	0.26	0.29	0.39	0.69	0.22	0.40	0.51	0.30	0.50	0.14	0.14	0.06	0.95	0.95	0.76	0.25	0.39	0.09
40	8000	0.19	0.26	0.09	N/A	0.13	n/a	0.07	0.09	0.11	0.05	0.11	0.04	0.04	0.02	0.37	0.31	0.25	0.01	0.03	0.02
	10000	0.27	0.36	0.14	0.11	0.20	0.37	0.11	0.13	0.16	0.08	0.16	0.06	0.06	0.02	0.49	0.43	0.32	0.02	0.03	0.03
	12000	0.36	0.48	0.20	0.15	0.28	0.47	0.16	0.17	0.22	0.11	0.21	0.08	0.08	0.03	0.61	0.56	0.41	0.04	0.07	0.05
	16000	0.57	0.73	0.34	0.26	0.49	0.70	0.29	0.28	0.36	0.20	0.36	0.12	0.12	0.05	0.88	0.87	0.66	0.10	0.09	0.08
	17000	0.62	0.79	N/A	0.29	0.55	0.77	0.32	0.31	0.39	0.22	0.41	0.13	0.13	0.06	0.95	0.95	0.74	0.12	0.11	0.10
	18000	0.68	0.86	N/A	0.33	N/A	0.83	0.36	0.35	0.43	0.25	0.44	0.14	0.14	0.07	1.02	1.04	0.83	0.14	0.13	0.11
50-55	10000	0.20	0.25	0.12	0.10	0.20	N/A	0.11	0.13	0.16	0.07	0.15	0.04	0.04	0.01	0.37	0.30	0.25	0.03	0.05	0.03
	14000	0.34	0.42	0.26	0.20	0.38	0.17	0.22	0.22	0.28	0.15	0.28	0.07	0.07	0.03	0.56	0.50	0.37	0.07	0.08	0.05
	17000	0.46	0.57	0.39	0.29	0.55	0.26	0.32	0.31	0.40	0.22	0.41	0.10	0.10	0.04	0.72	0.68	0.50	0.12	0.11	0.08
	20000	0.59	0.73	0.58	0.41	0.75	0.38	0.44	0.42	0.52	0.30	0.51	0.12	0.12	0.05	0.88	0.88	0.66	0.19	0.17	0.11
	23000	0.74	0.89	0.69	0.54	0.99	0.53	0.58	0.47	0.67	0.41	0.69	0.15	0.15	0.07	1.05	N/A	0.87	0.27	0.22	0.14
60	12000	0.27	0.37	0.10	0.08	0.28	0.14	0.06	0.10	0.13	0.06	0.11	0.05	0.05	0.01	0.44	0.37	0.27	0.02	0.07	0.03
	16000	0.43	0.58	0.18	0.14	0.44	0.28	0.11	0.17	0.21	0.11	0.19	0.07	0.07	0.02	0.63	0.58	0.39	0.05	0.10	0.06
	20000	0.62	0.80	0.27	0.21	0.63	0.46	0.17	0.24	0.31	0.16	0.27	0.10	0.10	0.03	0.84	0.82	0.56	0.10	0.16	0.09
	24000	0.83	1.03	0.40	0.30	0.86	0.68	0.24	0.33	0.42	0.22	0.39	0.11	0.11	0.04	1.06	1.08	0.78	0.16	0.23	0.13
	27000	1.00	1.22	0.46	0.32	1.05	0.88	0.30	0.41	0.52	0.30	0.47	0.16	0.16	0.06	1.18	1.24	0.98	0.27	0.28	0.16
70-75	16000	0.44	0.58	0.18	0.14	0.44	0.28	0.11	0.17	0.21	0.11	0.19	0.07	0.07	0.02	0.63	0.58	0.39	0.05	0.10	0.06
	20000	0.62	0.82	0.27	0.21	0.63	0.46	0.17	0.24	0.31	0.16	0.27	0.10	0.10	0.03	0.84	0.82	0.56	0.10	0.16	0.09
	22000	0.73	0.94	0.33	0.25	0.74	0.56	0.20	0.29	0.37	0.19	0.33	0.12	0.12	0.04	0.95	0.95	0.66	0.13	0.20	0.11
	24000	0.84	1.07	0.40	0.30	0.86	0.68	0.24	0.33	0.42	0.22	0.39	0.14	0.14	0.04	1.06	1.08	0.78	0.16	0.23	0.13
	26000	0.95	1.20	0.47	0.32	0.98	0.81	0.28	0.39	0.49	0.27	0.45	0.16	0.16	0.05	1.17	1.23	0.91	0.23	0.26	0.15
	27000	1.01	1.26	0.51	0.33	1.05	0.88	0.30	0.42	0.52	0.30	0.48	0.17	0.17	0.06	1.12	1.26	0.98	0.27	0.28	0.16

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 SXH_.
7. For final filters w/ prefilters (digit 13 = M, N, P, Q) also add pressure drop for throwaway filter.

Table 52. Component static pressure drops (in. W.G.), 90 to 130 tons air-cooled

		Evap Coil		High Cap Evap		Heating System							Filters						Std Roof	Econ w/ or w/ out Relief
						SFHL		SEHL	SLHL		SSHL		Throwaway		Perm Wire	Bag & Pre	Cart & Pre	Final Cart		
Nom	CFM Std	Dry	Wet	Dry	Wet	Low	High	All kW	Low	High	Low	High	Std	High						
90	27000	0.40	0.53	0.60	0.80	N/A	0.25	0.13	0.26	0.31	0.22	0.32	0.11	0.13	N/A	0.68	0.65	0.77	N/A	0.20
	32000	0.53	0.70	0.80	1.03	N/A	0.31	0.16	0.35	0.41	0.30	0.43	0.14	0.16	N/A	0.84	0.84	1.07	N/A	0.31
	37000	0.67	0.88	1.01	1.32	N/A	0.39	0.23	0.45	0.52	0.40	0.55	0.17	0.19	N/A	1.02	1.04	1.43	N/A	0.41
	42000	0.83	1.08	1.25	1.62	N/A	0.46	0.29	0.56	0.65	0.50	0.68	0.21	0.22	N/A	1.19	1.06	1.86	N/A	0.52
	45000	0.93	1.20	1.40	1.80	N/A	0.52	0.32	0.63	0.73	0.58	0.76	0.24	0.24	N/A	N/A	N/A	2.14	N/A	0.63
105	31000	N/A	N/A	0.63	0.83	N/A	0.28	0.17	0.33	0.39	0.29	0.40	N/A	0.13	N/A	0.82	0.80	1.00	N/A	0.22
	35000	N/A	N/A	0.77	1.01	N/A	0.36	0.21	0.41	0.48	0.36	0.50	N/A	0.16	N/A	0.96	0.96	1.28	N/A	0.32
	39000	N/A	N/A	0.92	1.20	N/A	0.42	0.26	0.49	0.57	0.44	0.60	N/A	0.19	N/A	1.09	1.12	1.59	N/A	0.44
	43000	N/A	N/A	1.08	1.40	N/A	0.45	0.30	0.57	0.66	0.53	0.71	N/A	0.22	N/A	1.22	1.30	1.95	N/A	0.54
	46000	N/A	N/A	1.21	1.56	N/A	0.55	0.34	0.65	0.75	0.61	0.79	N/A	0.24	N/A	N/A	N/A	2.24	N/A	0.64
115/130	31000	0.76	1.00	N/A	N/A	N/A	0.28	0.17	0.33	0.39	0.29	0.40	N/A	0.13	N/A	0.82	0.80	1.00	N/A	0.22
	35000	0.92	1.21	N/A	N/A	N/A	0.36	0.21	0.41	0.48	0.36	0.50	N/A	0.16	N/A	0.96	0.96	1.28	N/A	0.32
	39000	1.10	1.44	N/A	N/A	N/A	0.42	0.26	0.49	0.57	0.44	0.60	N/A	0.19	N/A	1.09	1.12	1.59	N/A	0.44
	43000	1.30	1.68	N/A	N/A	N/A	0.45	0.30	0.57	0.66	0.53	0.71	N/A	0.22	N/A	1.22	1.30	1.95	N/A	0.54
	46000	1.45	1.86	N/A	N/A	N/A	0.55	0.34	0.65	0.75	0.61	0.79	N/A	0.24	N/A	N/A	N/A	2.24	N/A	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 SXHL.
7. For final filters w/ prefilters (digit 13 = M, N, P, Q) also add pressure drop for throwaway filter.

Table 53. Component static pressure drops (in. W.G.)—relief damper for return fan

Nom Tons	Cfm	Relief Damper for Return Fan	Nom Tons	Cfm	Relief Damper for Return Fan
20	4000	0.08	50-55,	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	5000	0.13	60,	12000	0.31
	6000	0.19		16000	0.56
	7500	0.30		20000	0.88
	10000	0.55		24000	1.27
	11000	0.67		28000	1.73
	12500	0.85		30000	1.99
	14000	1.08	70-75,	12000	0.31
30	6000	0.19		16000	0.56
	9000	0.44		20000	0.88
	12000	0.79		22000	1.05
	14000	1.08		24000	1.27
	15000	1.20		26000	1.47
	17000	1.60		28000	1.73
40	8000	0.18		31000	N/A
	10000	0.28		33000	N/A
	12000	0.41			
	16000	0.73			
	17000	0.82			
	20000	1.15			
	22000	1.39			

Fan Drive Selections

Relief Fan Performance

Table 54. Modulating 100% relief fan performance — 20 to 75 tons

Nom Tons	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
20	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64				
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66						
	8000	487	1.10	583	1.56	674	2.11	757	2.72								
	10000	567	1.88	643	2.37	719	2.96										
25	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64	927	3.22	988	3.84
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66	882	3.28	948	3.94	1010	4.64
	8000	487	1.10	583	1.56	674	2.11	757	2.72	834	3.38	904	4.09	970	4.82		
	10000	567	1.88	643	2.37	719	2.96	794	3.63	864	4.35						
	12000	651	2.98	716	3.56	779	4.18	843	4.88								
30	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64	927	3.22	988	3.84
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66	882	3.28	948	3.94	1010	4.64
	8000	487	1.10	583	1.56	674	2.11	757	2.72	834	3.38	904	4.09	970	4.82	1030	5.59
	10000	567	1.88	643	2.37	719	2.96	794	3.63	864	4.35	931	5.11	993	5.91	1053	6.77
	12000	651	2.98	716	3.56	779	4.18	843	4.88	905	5.64	967	6.47	1026	7.34		
	14000	736	4.47	796	5.17	850	5.83	904	6.57	960	7.38						
40	7500	318	0.67	444	1.21	545	1.85	629	2.54	702	3.27	767	4.02	828	4.83	884	5.66
	9000	331	0.97	444	1.47	543	2.17	628	2.94	702	3.75	770	4.60	831	5.48	887	6.37
	12000	381	2.13	460	2.40	546	3.04	627	3.89	701	4.83	769	5.82	831	6.87	889	7.93
	14000	422	3.40	486	3.49	557	3.98	631	4.76	701	5.72	768	6.78	830	7.90	888	9.07
	16000	468	5.12	520	5.07	579	5.37	643	6.01	707	6.88	769	7.92	829	9.08	887	10.32
50-55	9000	331	0.97	444	1.47	543	2.17	628	2.94	702	3.75	770	4.60	831	5.48	887	6.37
	12000	381	2.13	460	2.40	546	3.04	627	3.89	701	4.83	769	5.82	831	6.87	889	7.93
	15000	445	4.20	502	4.21	567	4.61	636	5.32	704	6.26	769	7.32	830	8.47	888	9.67
	18000	516	7.41	559	7.19	609	7.32	662	7.76	719	8.49	776	9.44	833	10.56	887	11.79
	20000	566	10.31	602	9.91	644	9.88	690	10.15	739	10.69	789	11.48	841	12.48	893	13.68

Table 54. Modulating 100% relief fan performance — 20 to 75 tons (continued)

Nom Tons	CFM Std Air	Negative Static Pressure 0.25 RPM	0.25 BHP	0.50 RPM	0.50 BHP	0.75 RPM	0.75 BHP	1.00 RPM	1.00 BHP	1.25 RPM	1.25 BHP	1.50 RPM	1.50 BHP	1.75 RPM	1.75 BHP	2.00 RPM	2.00 BHP
60, 70, 75	12000	351	1.49	423	2.09	502	3.00	572	4.02	634	5.07	690	6.09	740	7.04	784	7.91
	15000	412	2.68	460	3.15	521	3.96	585	5.02	646	6.24	702	7.53	749	8.83	801	10.14
	18000	478	4.41	516	4.88	557	5.54	607	6.49	662	7.66	715	9.01	766	10.48	814	12.01
	21000	549	6.75	578	7.36	612	7.92	647	8.71	688	9.77	735	11.03	781	12.46	827	14.03
	24000	617	9.83	644	10.59	672	11.22	702	11.88	732	12.77	766	13.89	805	15.22	846	16.72
	27000	688	15.11	711	15.09	736	15.45	761	16.18	788	17.02	815	17.92	844	18.99	876	20.31

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.

Table 55. Air-cooled modulating 100% relief fan performance — 90 to 130 tons

Nom Tons	CFM Std Air	Negative Static Pressure 0.25 RPM	0.25 BHP	0.50 RPM	0.50 BHP	0.75 RPM	0.75 BHP	1.00 RPM	1.00 BHP	1.25 RPM	1.25 BHP
90-130	28000	495	12.81	519	13.30	547	13.93	582	15.27	619	17.14
	30000	527	15.67	550	16.22	573	16.71	604	17.84	637	19.53
	32000	559	18.92	581	19.53	602	20.03	628	20.90	658	22.39
	34000	591	22.60	612	23.28	632	23.84	653	24.48	681	25.74
	36000	623	26.73	643	27.47	662	28.09	680	28.62	705	29.66
	38000	656	31.34	675	32.14	693	32.83	710	33.42	730	34.17
	40000	688	36.46	707	37.31	724	38.07	741	38.73	757	39.29

Nom Tons	CFM Std Air	Negative Static Pressure 1.50 RPM	1.50 BHP	1.75 RPM	1.75 BHP	2.00 RPM	2.00 BHP	2.25 RPM	2.25 BHP	2.50 RPM	2.50 BHP
90-130	28000	655	18.85	689	20.51	721	22.51	750	24.43	777	26.28
	30000	672	21.63	705	23.38	737	25.16	768	27.31	795	29.37
	32000	690	24.39	723	26.63	753	28.44	784	30.37	811	32.54
	34000	710	27.55	739	29.75	771	32.16	799	34.04	828	36.04
	36000	732	31.25	759	33.29	788	35.76	817	38.26	844	40.23
	38000	755	35.51	780	37.38	806	39.60	834	42.26	861	44.90
	40000	779	40.45	804	42.09	827	44.14	853	46.63	879	49.41

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.

Table 56. 100% Relief fan drive selections — 20 to 75 tons

	3 Hp RPM	3 Hp Drive No.	5 Hp RPM	5 Hp Drive No.	7.5 Hp RPM	7.5 Hp Drive No.	10 Hp RPM	10 Hp Drive No.	15 Hp RPM	15 Hp Drive No.	20 Hp RPM	20 Hp Drive No.
20	500 600 700 800 900	5 6 7 8 9										
25	500 600 700 800 900	5 6 7 8 9	700 800 900 1000	7 8 9 A								
30	500 600 700 800 900	5 6 7 8 9	700 800 900 1000	7 8 9 A	800 900 1000 1100	8 9 A B						
40			400 500 600 700 800	4 5 6 7 8	600 700 800	6 7 8	700 800	7 8				
50–55			400 500 600 700 800	4 5 6 7 8	600 700 800	6 7 8	700 800	7 8	700 800 900	7 8 9		
60			400	4	600	6	600	6	700	7	800	8

Table 56. 100% Relief fan drive selections — 20 to 75 tons (continued)

	3 Hp		5 Hp		7.5 Hp		10 Hp		15 Hp		20 Hp	
	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.
70			500	5	700	7	700	7	800	8		
75			600	6								

Table 57. 100% Relief fan drive selections — 90 to 130 tons

Nom Tons	15 HP		20 HP		25 HP		30 HP		40 HP	
	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.
90-130	500 600	5 6	500.00 600.00 700	5 6 7	600.00 700.00 800	6 7 8	600.00 700.00 800	6 7 8	700.00 800.00	7 8

Table 58. 50% Relief fan performance — 90 to 130 tons

Nom Tons	CFM Std Air	Negative Static Pressure									
		0.25		0.50		0.75		1.00		1.25	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
90-130	12000	432	4.09	461	4.31	502	4.86	545	5.67	585	6.35
	14000	495	6.40	519	6.65	547	6.96	582	7.64	619	8.57
	16000	559	9.46	581	9.77	602	10.02	628	10.45	658	11.20
	18000	623	13.36	643	13.73	662	14.05	680	14.31	705	14.83
	20000	688	18.23	707	18.66	724	19.03	741	19.36	757	19.65
Nom Tons	CFM Std Air	Negative Static Pressure									
		1.50		1.75		2.00		2.25		2.50	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
90-130	12000	622	7.19	655	7.99	686	8.78	717	9.57	748	10.48
	14000	655	9.42	689	10.26	721	11.26	750	12.21	777	13.14
	16000	690	12.19	723	13.32	753	14.22	784	15.18	811	16.27
	18000	732	15.63	759	16.65	788	17.88	817	19.13	844	20.12
	20000	779	20.22	804	21.04	827	22.07	853	23.31	879	24.70

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.

Table 59. 50% Relief fan drive selections, 90 to 130 tons

Nom Tons	15 Hp	
	RPM	Drive No.
90-130	500 600 700 800 900	5 6 7 8 9

Return Fan Performance

Table 60. Return fan performance—20, 25, 30 ton air-cooled and (24.5" Fan)

CFM Std Air	Return Fan Static Pressure Including Relief Damper P.D.															
	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, 25; 5HP, 30T: 7.5 HP
3. Max CFM available is as follows; 20T: 9000, 25T: 11000, and 30T: 13500
4. Min CFM is 4000 for 20T, 25T, and 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. See table Component static pressure drops - relief damper for return fan in Performance Data.
7. Shaded area indicates nonstandard BHP or RPM selections. Contact a local Trane® representative for more information.

Table 61. Return fan performance—40, 50 and 55 ton air-cooled and (27" Fan)

CFM Std Air	Return Fan Static Pressure Including Relief Damper P.D.															
	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

Table 61. Return fan performance—40, 50 and 55 ton air-cooled and (27" Fan) (continued)

CFM Std Air	Return Fan Static Pressure Including Relief Damper P.D.															
	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
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 must be added to the return duct static. See table Component static pressure drops - relief damper for return fan in Performance Data.
8. Shaded area indicates nonstandard BHP or RPM selections. Contact a local Trane® representative for more information.

Table 62. Return fan performance—60 to 75 tons air-cooled and (36.5" fan)

CFM Std Air	Return Fan Static Pressure Including Relief Damper P.D.															
	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, and 75T
4. Max CFM is 27000 for 60, 70, and 75T
5. Min CFM is 12000 for 60, 70, and 75T
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 must be added to the return duct static. See table Component static pressure drops - relief damper for return fan in Performance Data.

Table 63. 100% Return fan drive selections — 20 to 75 tons air-cooled and

	3 Hp		5 Hp		7.5 Hp		10 Hp		15 Hp		20 Hp	
	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.
20	500	5										
	600	6										
	700	7										
	800	8										
	900	9										
	1000	A										
	1100	B										
	1200	C										
	1300	D										
25	500	5	1100	B								
	600	6	1200	C								
	700	7	1300	D								
	800	8	1400	E								
	900	9	1500	F								
	1000	A	1600	G								
	1100	B										
	1200	C										
	1300	D										
30	500	5	1100	B	1400	E						
	600	6	1200	C	1500	F						
	700	7	1300	D	1600	G						
	800	8	1400	E								
	900	9	1500	F								
	1000	A	1600	G								
	1100	B										
	1200	C										
	1300	D										
40			700	7	1200	C	1400	E				
			800	8	1300	D	1500	F				
			900	9	1400	E	1600	G				
			1000	A	1500	F	1700	H				
			1100	B								
			1200	C								
			1300	D								
50–55			700	7	1200	C	1400	E	1600	G		
			800	8	1300	D	1500	F	1700	H		
			900	9	1400	E	1600	G	1800	J		
			1000	A	1500	F	1700	H	1900	K		
			1100	B								
			1200	C								
			1300	D								
60			500	5	700	7	800	8	900	9	1100	B
			600	6	800	8	900	9	1000	A		
			700	7	900	9	1000	A	1100	B		
			800	8								
70, 75			500	5	700	7	800	8	900	9	1100	B
			600	6	800	8	900	9	1000	A		
			700	7	900	9	1000	A	1100	B		
			800	8								

Pressure Curves

Note: *To check operating pressure, see instructions* *"Check Operating Pressures," p. 153.*

Figure 79. 20 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

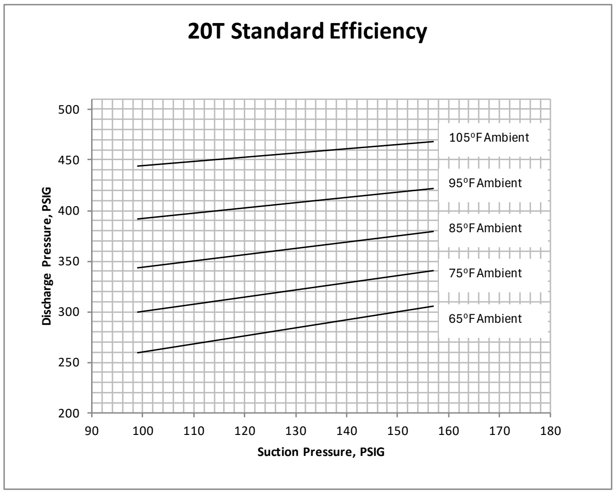


Figure 80. 20 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

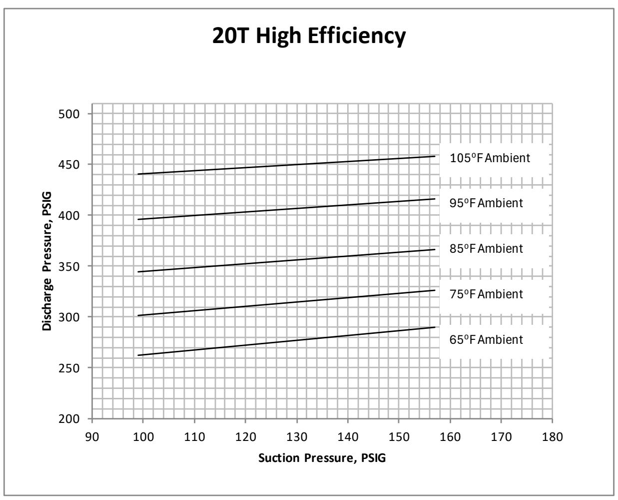


Figure 81. 20 ton eFlex variable speed operating pressure curve (compressor at 100% and condenser all fans ON)

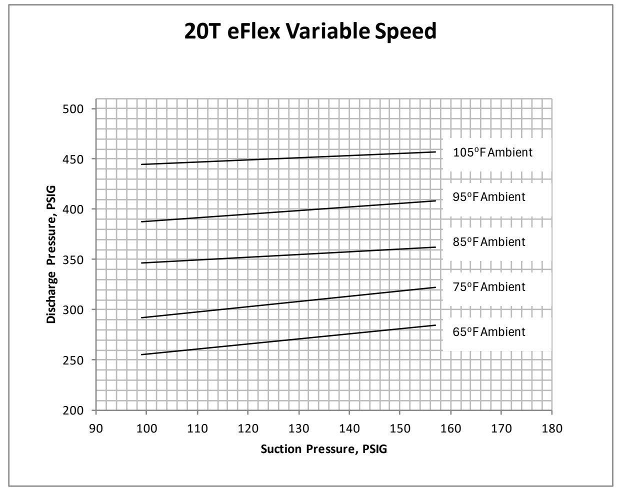


Figure 82. 25 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

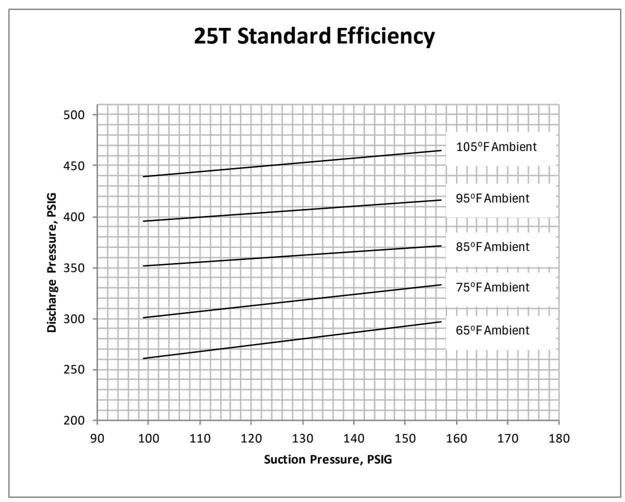


Figure 83. 25 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

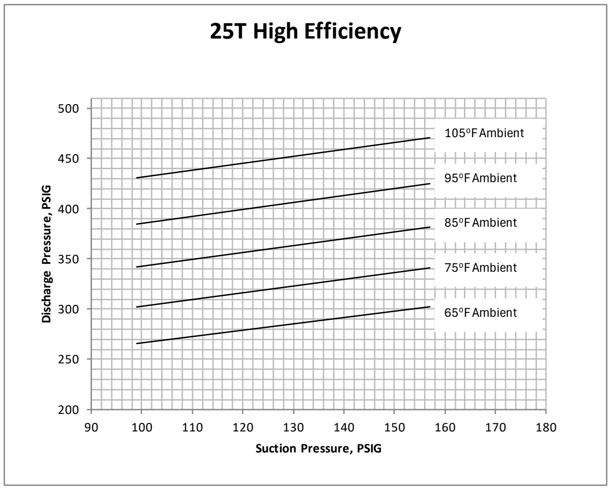


Figure 84. 25 ton eFlex variable speed operating pressure curve (compressor at 100% and condenser all fans ON)

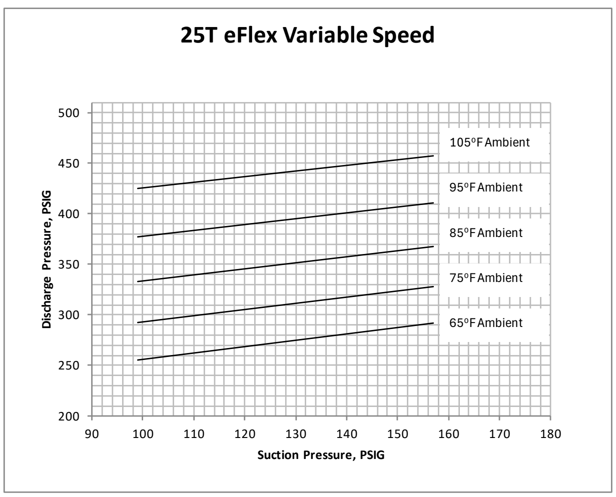


Figure 85. 30 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

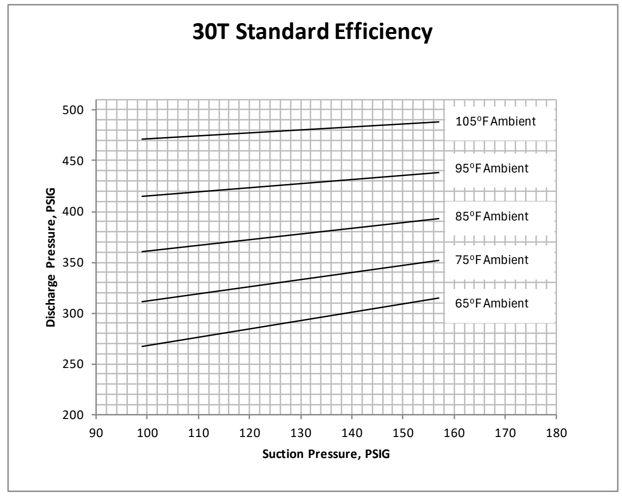


Figure 86. 30 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

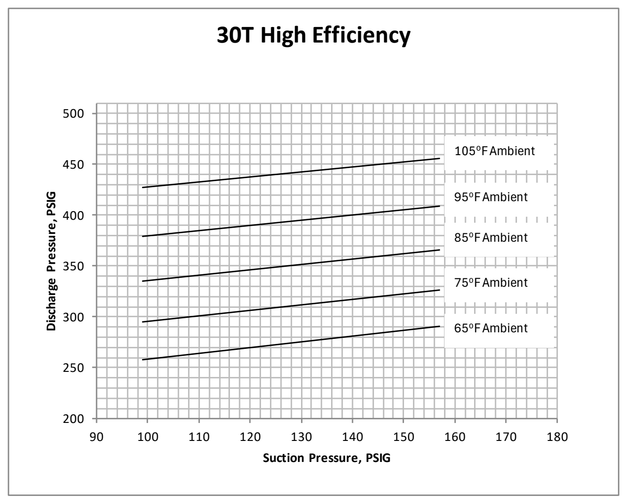


Figure 87. 30 ton eFlex variable speed operating pressure curve (compressor at 100% and condenser all fans ON)

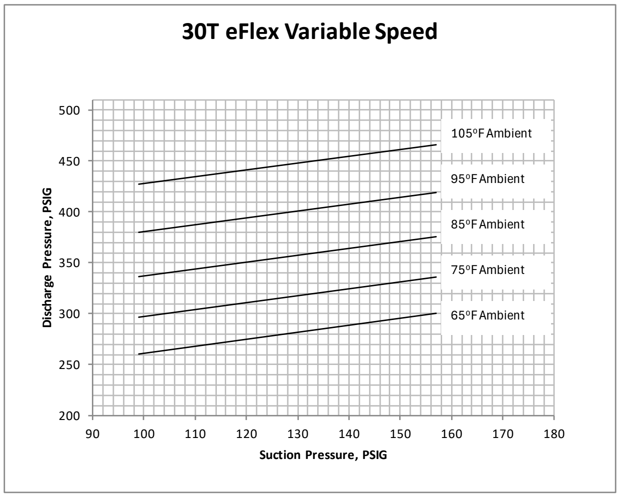


Figure 88. 40 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

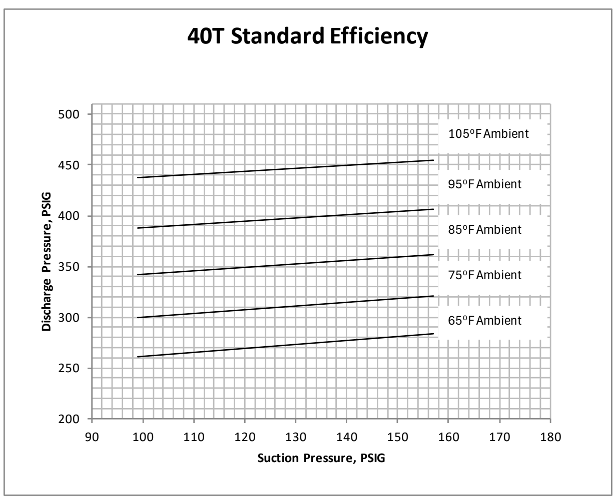


Figure 89. 40 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

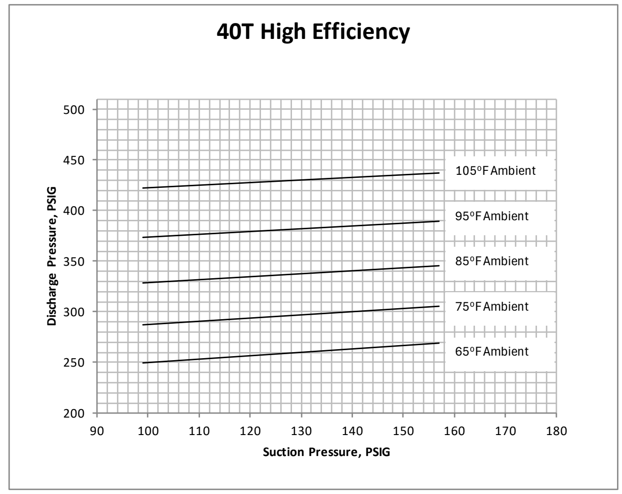


Figure 90. 40 ton eFlex variable speed—circuit 1 only operating pressure curve (compressor at 100% and all condenser fans ON).

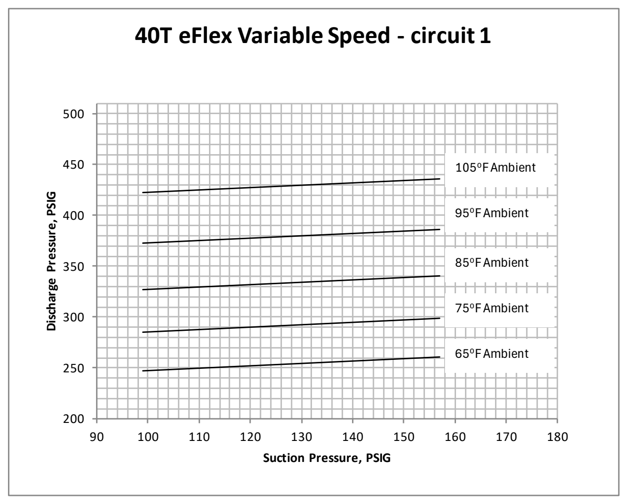


Figure 91. 40 ton eFlex variable speed—circuit 2 only operating pressure curve (compressor at 100% and all condenser fans ON).

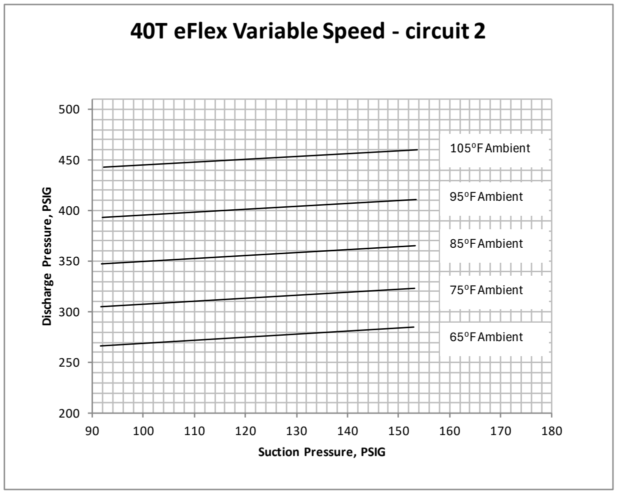


Figure 92. 50 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

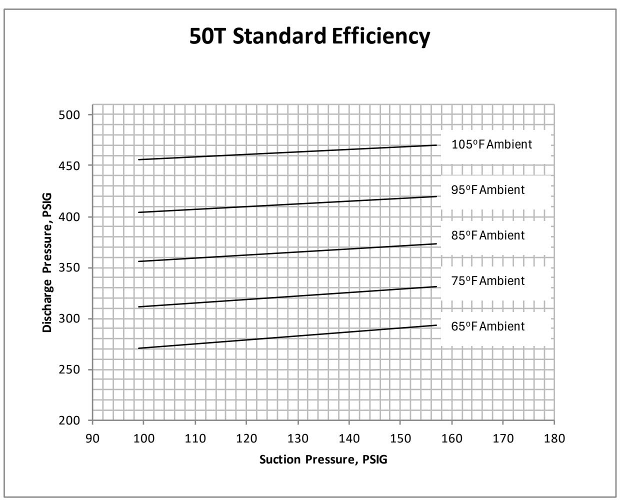


Figure 93. 50 ton high efficiency—circuit 1 operating pressure curve (all compressors and condenser fans ON)

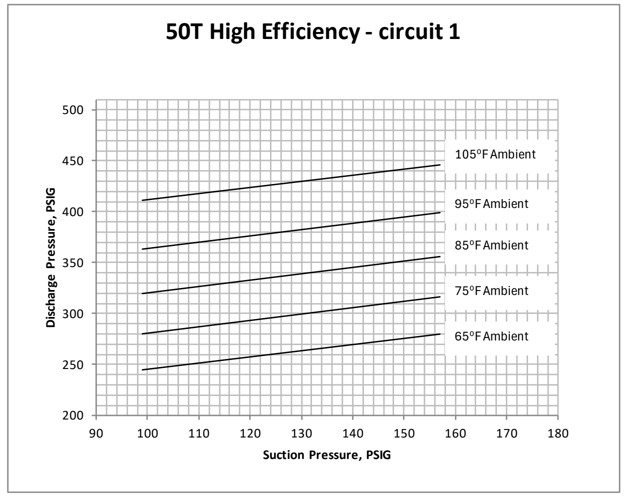


Figure 94. 50 ton high efficiency—circuit 2 operating pressure curve (all compressors and condenser fans ON)

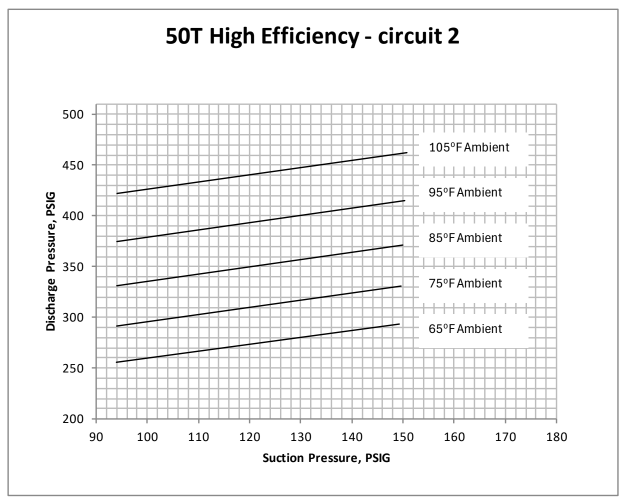


Figure 95. 50 ton eFlex variable speed—circuit 1 operating pressure curve (all compressors and condenser fans ON)

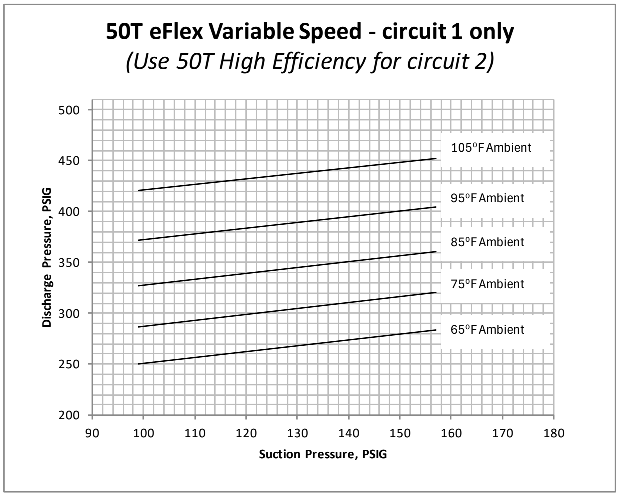


Figure 96. 55 ton standard efficiency—circuit 1 operating pressure curve (all compressors and condenser fans ON)

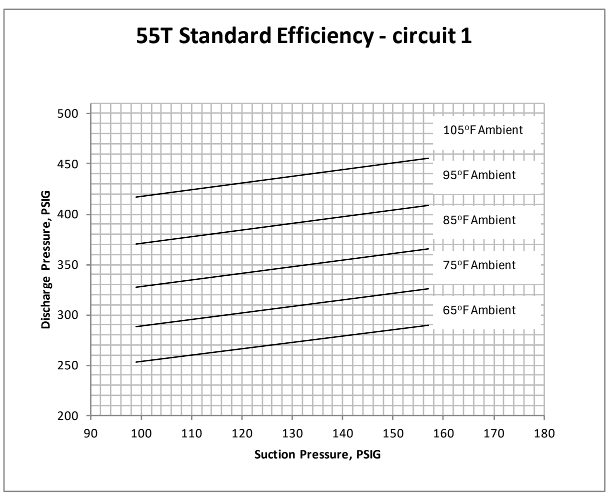


Figure 97. 55 ton standard efficiency—circuit 2 operating pressure curve (all compressors and condenser fans ON)

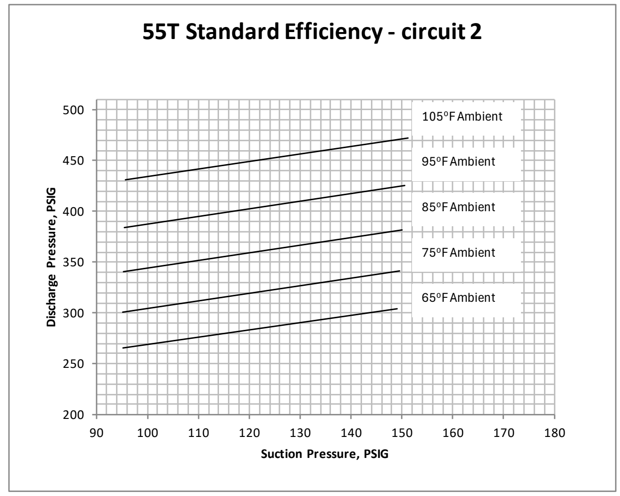


Figure 98. 55 ton high efficiency—circuit 1 operating pressure curve (all compressors and condenser fans ON)

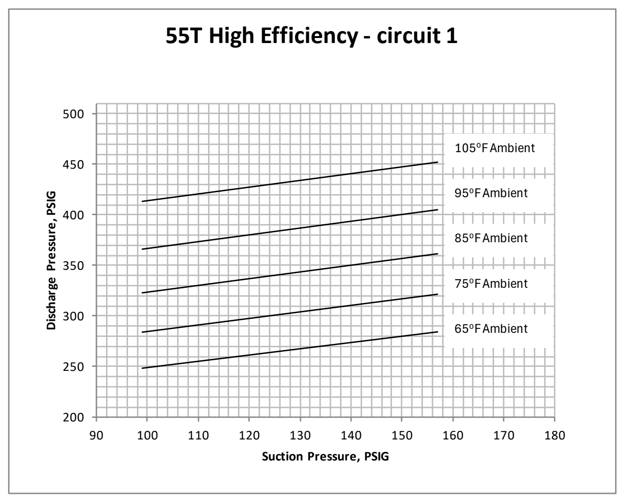


Figure 99. 55 ton high efficiency—circuit 2 operating pressure curve (all compressors and condenser fans ON)

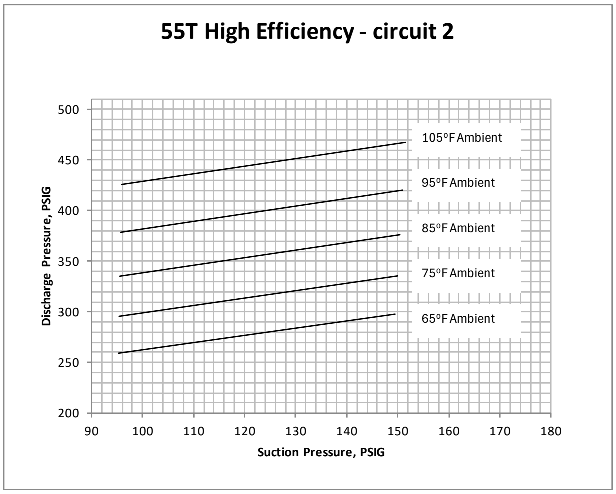


Figure 100. 55 ton eFlex variable speed—circuit 1 operating pressure curve (all compressors and condenser fans ON)

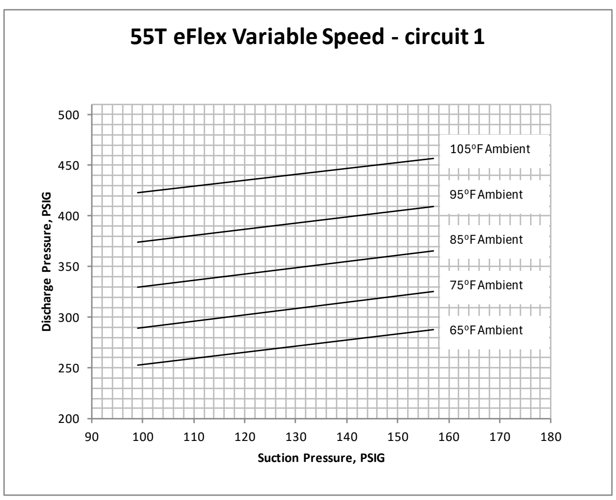


Figure 101. 55 ton eFlex variable speed—circuit 2 operating pressure curve (all compressors and condenser fans ON)

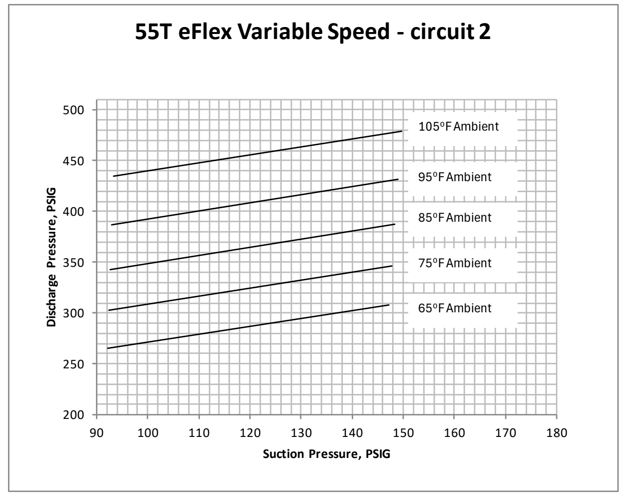


Figure 102. 60 ton standard efficiency—circuit 1 operating pressure curve (all compressors and condenser fans ON)

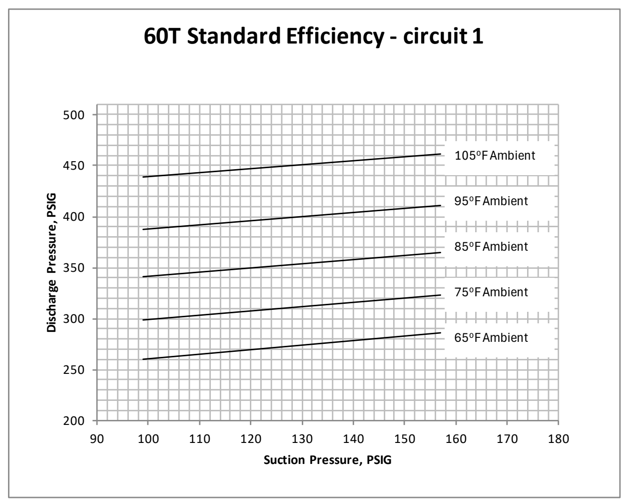


Figure 103. 60 ton standard efficiency—circuit 2 operating pressure curve (all compressors and condenser fans ON)

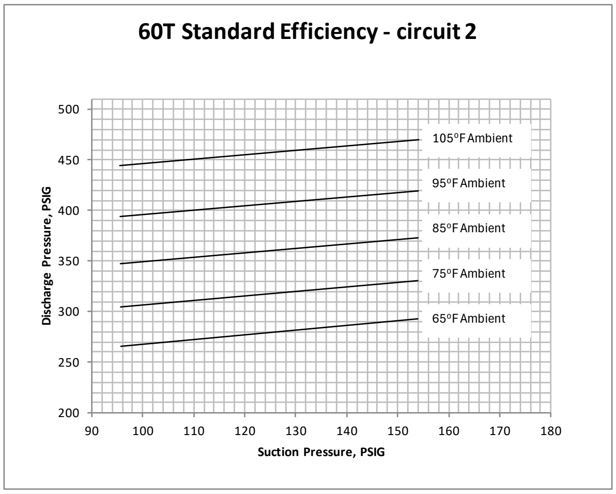


Figure 104. 60 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

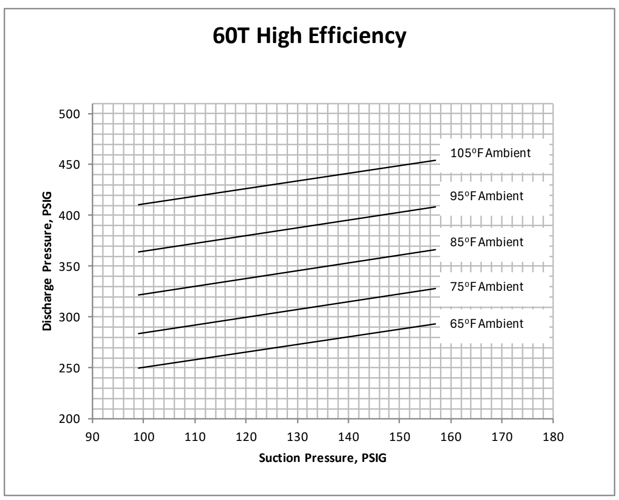


Figure 105. 60 ton eFlex variable speed—circuit 1 only operating pressure curve (compressor at 100% and all condenser fans ON).

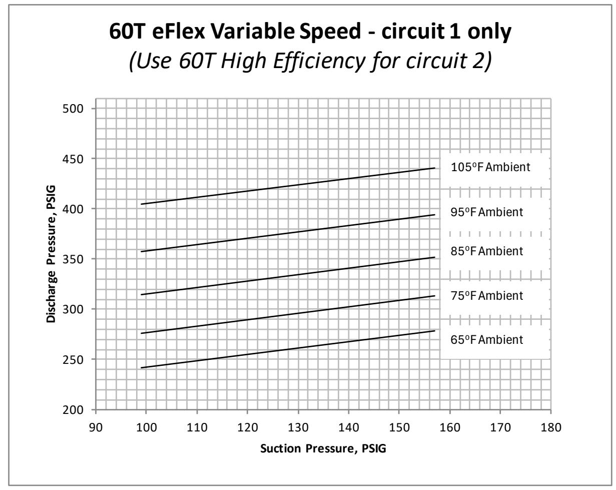


Figure 106. 70 ton standard efficiency—circuit 1 operating pressure curve (all compressors and condenser fans ON)

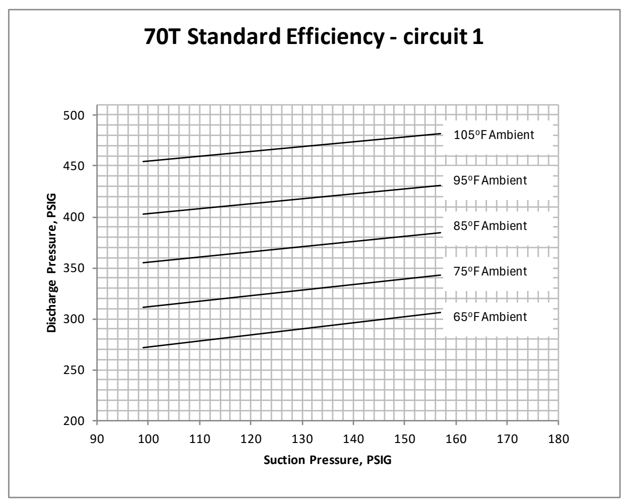


Figure 107. 70 ton standard efficiency—circuit 2 operating pressure curve (all compressors and condenser fans ON)

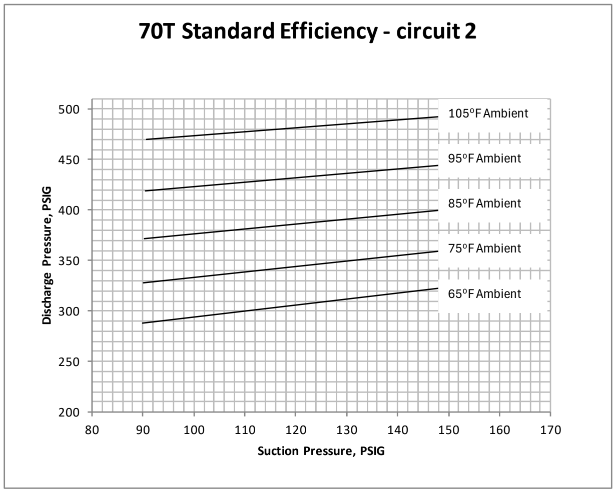


Figure 108. 70 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

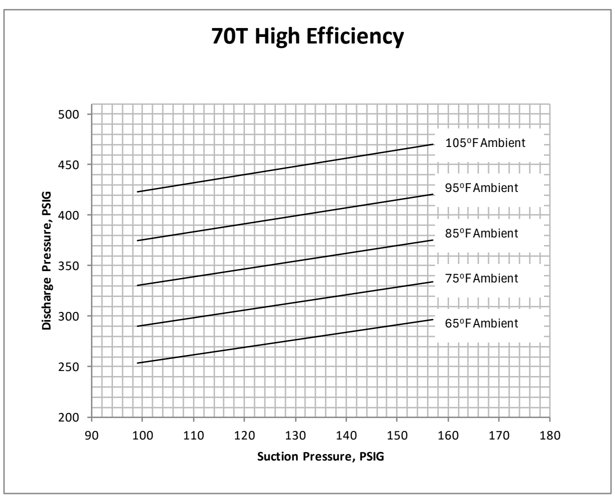


Figure 109. 70 ton eFlex variable speed—circuit 1 only operating pressure curve (compressor at 100% and all condenser fans ON).

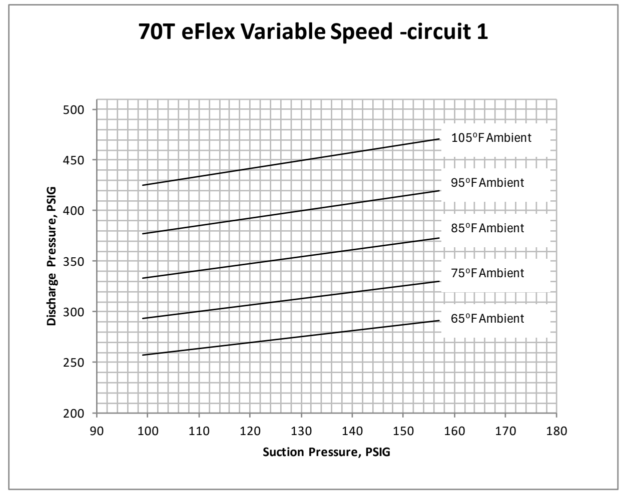


Figure 110. 70 ton eFlex variable speed—circuit 2 only operating pressure curve (compressor at 100% and all condenser fans ON).

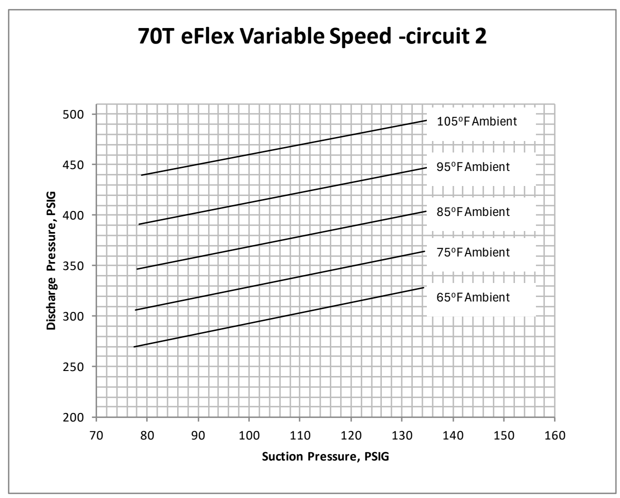


Figure 111. 75 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

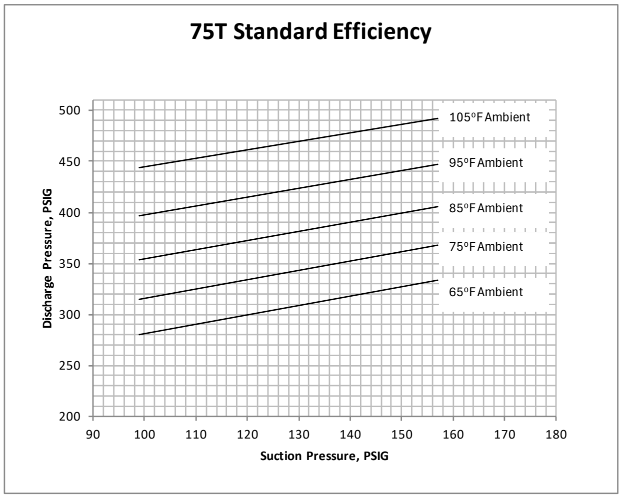


Figure 112. 75 ton high efficiency—circuit 1 operating pressure curve (all compressors and condenser fans ON)

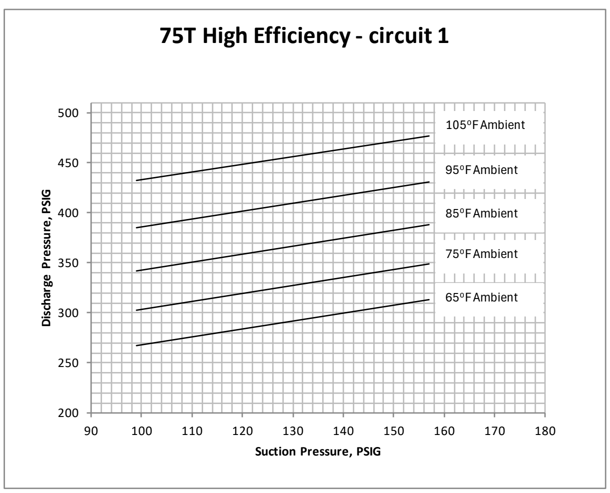


Figure 113. 75 ton high efficiency—circuit 2 operating pressure curve (all compressors and condenser fans ON)

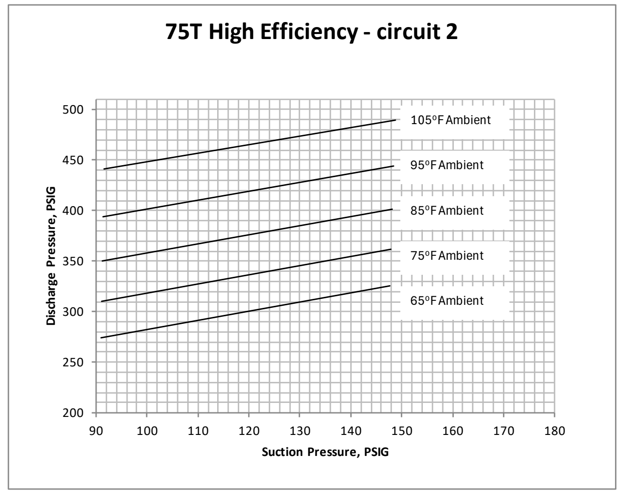


Figure 114. 75 ton eFlex variable speed—circuit 1 only operating pressure curve (compressor at 100% and all condenser fans ON).

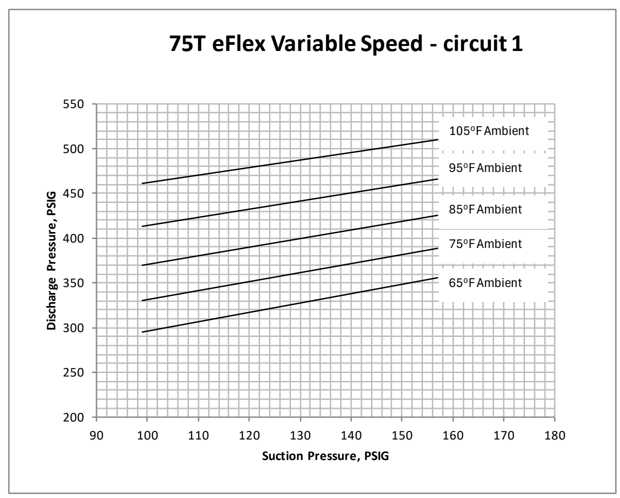


Figure 115. 75 ton eFlex variable speed—circuit 2 only operating pressure curve (compressor at 100% and all condenser fans ON).

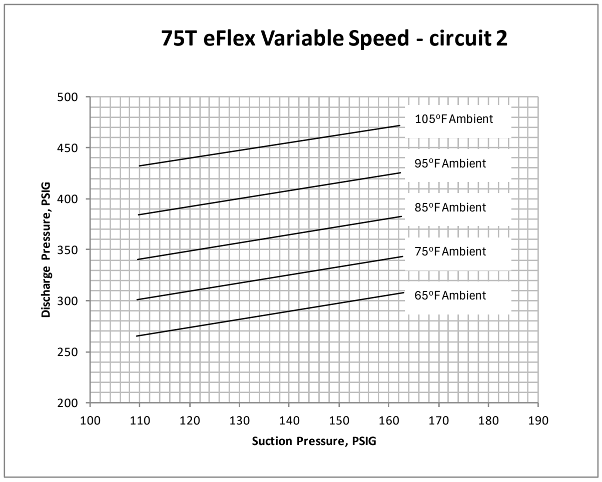


Figure 116. 90 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

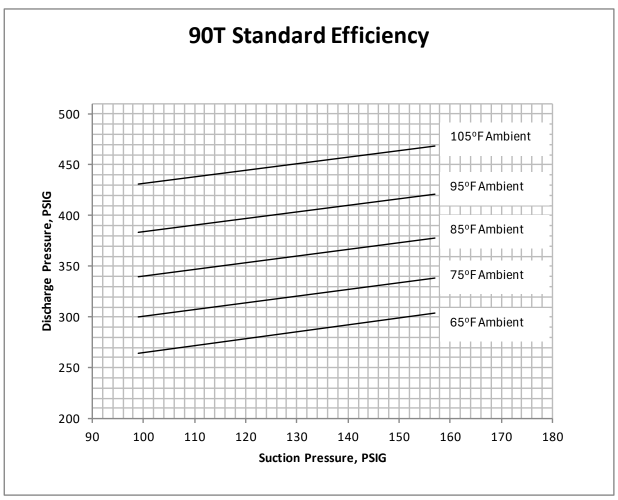


Figure 117. 90 ton high efficiency operating pressure curve (all compressors and condenser fans ON)

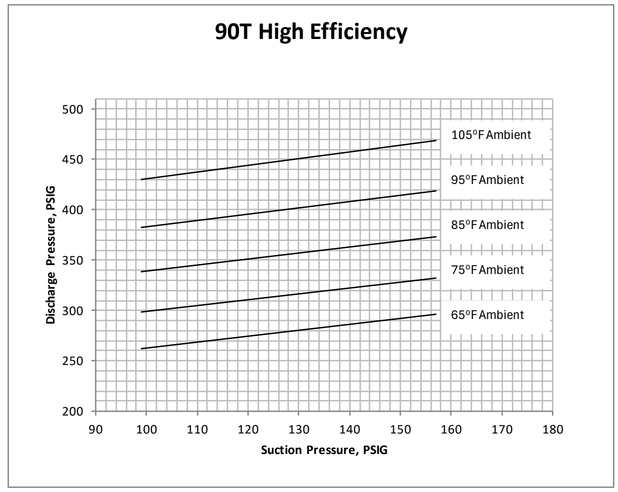


Figure 118. 105 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)

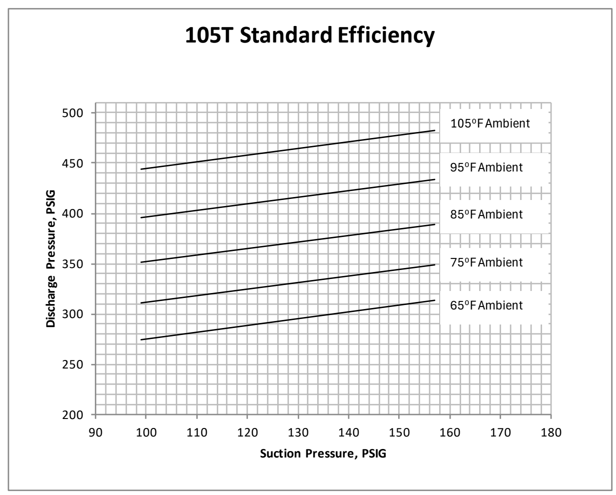
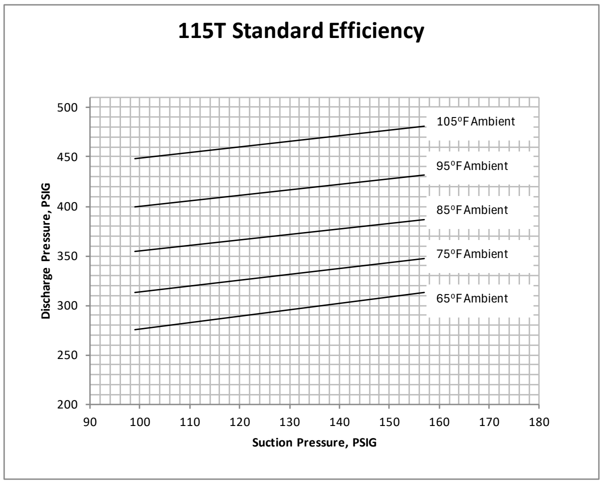


Figure 119. 115 ton standard efficiency operating pressure curve (all compressors and condenser fans ON)



Check Operating Pressures

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

   Note: *If unit includes 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 ± 7 psig of the graph.

Economizer and Relief Air 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.

Outside Air and Return Air Damper Operation

The outside air and return air damper linkage is accessible from the filter section of the unit. The damper linkage connecting the outside air dampers to the return air dampers is preset from the factory in the number 1 position. Refer to Table 64, p. 155 for the appropriate linkage position for the unit and operating airflow (CFM).

⚠ WARNING

No Step Surface!

Failure to follow instruction below could result in death or serious injury.
Do not walk on the sheet metal drain pan. Walking on the drain pan could cause the supporting metal to collapse and result in the operator/technician falling.

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

Arbitrarily adjusting the outside air dampers to open fully when the return air dampers are closed or; failing to maintain the return air pressure drop with the outside 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 outside 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 outside air damper travel in order to match the return static pressure.

Refer to Table 64, p. 155 for the equivalent return air duct losses that correspond to each of the holes illustrated in Figure 120, p. 155.

To Adjust the Outside 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, then average the reading.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Important: *HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK OR UNIT DISCONNECT SWITCH.*

2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit terminal block (2XD1 on 20-75T units / 1XD1 on 90-130T units) or the unit mounted disconnect switch (2QB1 on 20-75T units / 1QB1 on 90-130T units).
3. Turn the 115 volt control circuit switch (1S1) to the "On" position.

   Turn the 115 volt control circuit switch (1S20) to the "On" position. (90-130T units only)

4. Open the access door located in the unit control panel, and press the Manual Override key to display the first

service screen. Refer to the latest edition of the applicable programming manual for applications for the SERVICE TEST screens and programming instructions.

5. Use tables in “,” 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)
   - Outside 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 outside 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 in the unit control panel to stop the fan operation.

⚠ WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.
When it is 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.

⚠ WARNING

Rotating Components!

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

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.

    Note: *Gravity will cause the damper to close. Support or secure the damper blades while removing the actuator to prevent unexpected damper rotation.*

11. Compare the static pressure reading to the static pressure ranges and linkage positions in Table 64, p. 155 for the unit size and operating CFM.

    Relocate the outside air/return air connecting rod to balance the outside air damper pressure drop against the return static pressure, using 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 outside 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.

Figure 120. Outside air and return air linkage adjustment (standard and low leak dampers only)

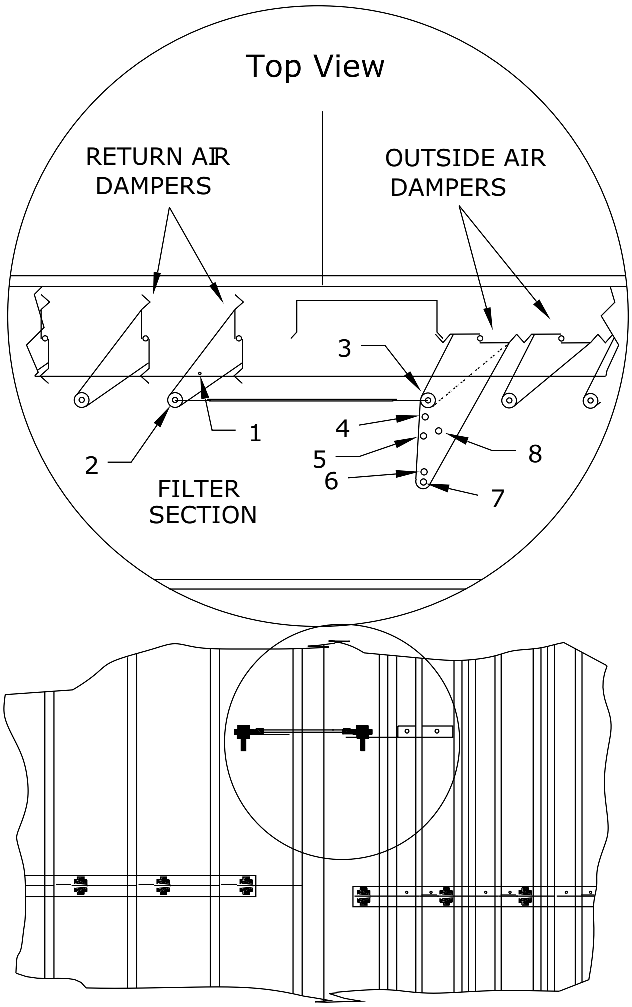


Figure 121. Outside air linkage adjustment (ultra low leak dampers only)

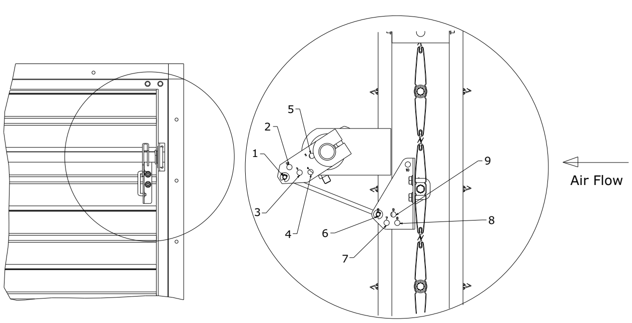


Table 64. O/A Damper travel adjustment

Position of Connecting Rod	Damper Crank Arm Hole Configuration	
	Standard and Low Leak F/A Dampers (Figure 120, p. 155)	Ultra Low Leak F/A Dampers(Figure 121, p. 155)
Position #1	2–3	1–6
Position #2	2–4	2–6
Position #3	2–5	3–7
Position #4	2–6	4–8
Position #5	1–8	5–9
Position #6	1–7	5–7

Use Table 65, p. 155 to select the appropriate crank arm hole configuration based on the following:

- specific unit
- operating CFM
- and return static pressure

Table 65. Outside air damper pressure drop (inches w.c.) — air-cooled

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
20, 25 Ton						
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	-
30						
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	-
40, 48 Ton						
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	-
50, 55 Ton						

Table 65. Outside air damper pressure drop (inches w.c.) — air-cooled (continued)

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
10000	0.03	0.04	0.09	0.18	0.23	0.55
14000	0.09	0.12	0.20	0.35	0.50	1.36
18000	0.31	0.36	0.50	0.79	1.10	-
20000	0.45	0.51	0.70	1.05	1.57	-
22000	0.58	0.66	0.75	1.30	1.95	-
24000	0.75	0.88	1.10	1.75	2.50	-
(60, 70, 75 Ton) Units						
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	-	-
(90 to 130 Ton) Units						
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	-	-	-

Compressor Startup (All Systems)

NOTICE

Compressor Failure!

Failure to follow instruction below could result in compressor failure.
Unit must be powered and crankcase heaters energized at least 8 hours BEFORE compressors are started.

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 for each circuit is back seated.

NOTICE

Compressor Damage!

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

Important: *COMPRESSOR SERVICE VALVES MUST BE FULLY OPENED BEFORE STARTUP (SUCTION, DISCHARGE, AND OIL LINE).*

3. Close the disconnect switch or circuit protector switch that provides the supply power to the unit terminal block (2XD1 on 20-75T units / 1XD1 on 90-130T units) or the unit mounted disconnect switch (2QB1 on 20-75T units / 1QB1 on 90-130T units).
4. Turn the 115 volt control circuit switch (1S1) to the "On" position.

   Turn the 115 volt control circuit switch (1S20) to the "On" position. (90-130T units only)
5. Allow compressor crankcase heaters to operate for a minimum of 8 hours before continuing.

   Important: *Compressor Damage could occur if the crankcase heater is not allowed to operate the minimum of 8 hours before starting the compressor(s).*
6. Open the access door located in the unit control panel, and press Manual Overrides to display the first service screen. Refer to the latest edition of the applications programming guide (RT-SVP07*-EN) for applications for the Manual Overrides screens and programming instructions.
7. Use tables in “,” to program the following system components for operation by scrolling through the displays:

   20–30 Ton
   - Compressor 1A (On)
   - Compressor 1B (Off)
   - Condenser Fans

   40-75 ton (VSC units only)
   - Compressor 1A (On)
   - Compressor 2A (Off)
   - Compressor 2B (Off)
   - Condenser Fans

   40-130 ton
   - Compressor 1A (On)
   - Compressor 1B (Off)
   - Compressor 2A (Off)
   - Compressor 2B (Off)
   - Condenser Fans
8. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. See for the various compressor locations.
9. Once the configuration for the components is complete, press the NEXT key until the LCD displays the “Start test in __Sec.” screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the

ENTER key to confirm this choice.

⚠ WARNING

Rotating Components!

Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.
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.

10. Press the Auto key to start the test. Remember that the delay designated in step 8 must elapse before the system will begin to operate.
11. 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.
12. Press the STOP key and clear all Manual Overrides in the unit control panel to stop the compressor operation.
13. Repeat steps 5–11 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. See for the various compressor locations.
2. Open the access door, located in the unit control panel, and press the Manual Overrides key to display the first service screen. Refer to the latest edition of the applications programming guide for VAV applications for the Manual Overrides screens and programming instructions.
3. Use tables in “,” to program the following system components for the number 1 refrigeration circuit by scrolling through the displays;

   OCC/UNOCC Relay (Unoccupied for VAV units)

   All Compressors for each circuit (On)

   Condenser Fans for each circuit (On)

⚠ WARNING

Rotating Components!

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

4. Press the Auto Button key to start the test. Remember that the delay designated in step 4 must elapse before the system will begin to operate.
5. 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 found in “,” to determine the proper operating pressures. For superheat and subcooling guidelines, refer to “Electronic Expansion Valves,” p. 161.

   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.*
6. Verify that the oil level in each compressor is correct. The oil level may be down to the bottom of the sightglass but should never be above the sightglass.
7. Press the STOP key and clear all Manual Overrides in the unit control panel to stop the system operation.
8. Repeat steps 1 through 8 for the number 2 refrigeration circuit.

Compressor Crankcase Heaters

Please see the table below for the crankcase heater sizes used for each compressor type.

Table 66. Crankcase heater sizes

Compressor Name	Crankcase Heater Watts
ZPS*	70
ZP*	90
CSHE*	
VZH088*, VZH117*	
VZH170*	160
CSHP*	

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. This causes a low differential across the expansion valve that limits its capacity. Under these conditions, it is not unusual to hear the compressor rattle until the suction pressure climbs and the flow rate increases.

Variable Speed Compressors

At all operating speeds, eFlex™ permanent magnet variable speed compressors sound different than fixed speed scrolls. At low speed, variable speed compressors can sputter. At high speed, variable speed compressor buzz. These are normal operating sounds. To ensure a quiet installation, eFlex variable speed compressors are installed in a sound enclosure. Make sure and keep the sound enclosure installed at all times other than servicing.

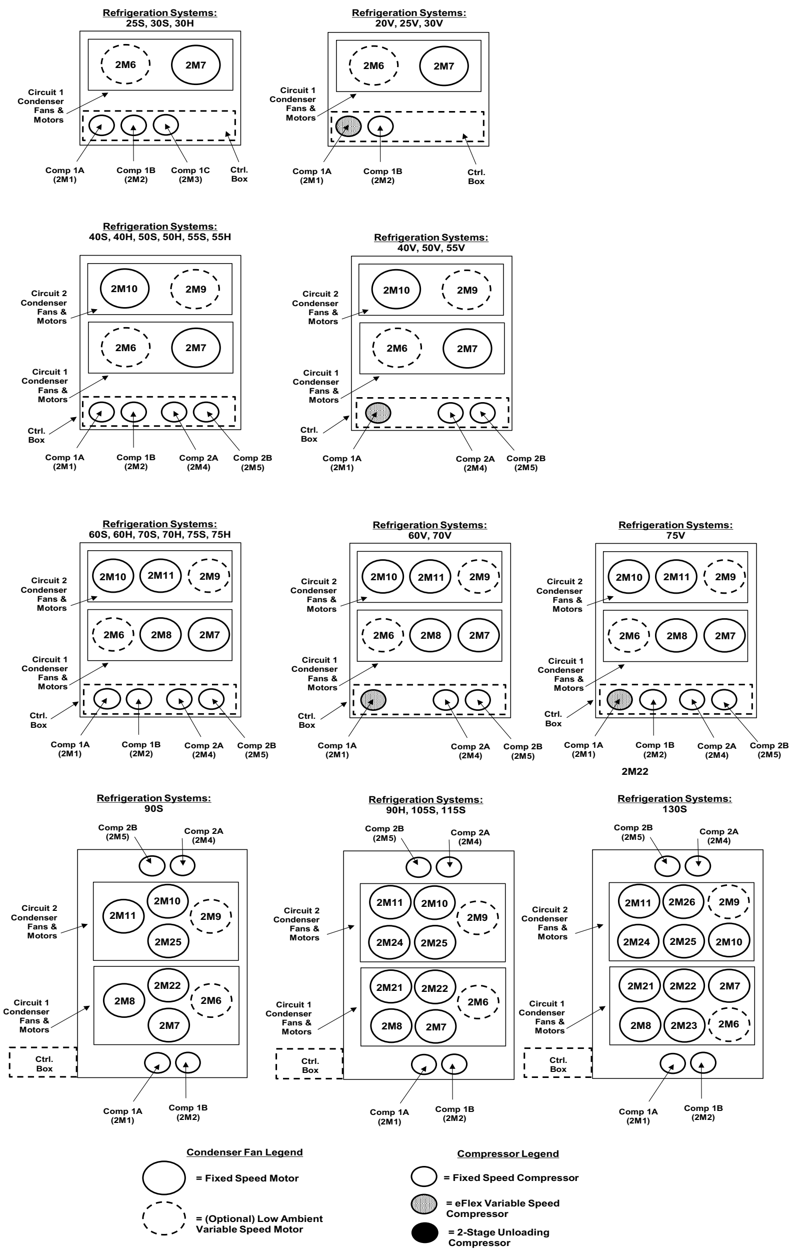
Important: *Variable speed scroll compressors sound different than single speed scroll compressors. Sound changes with speed and condition.*

Electronic Compressor Protection Module (CPM)

The CSHP*** compressors come equipped with a compressor protection device (CPM) capable of detecting phase reversal, phase loss, and motor overheating. When a fault is identified, the output relay will open. Depending on the fault, the CPM may either auto-reset or it may lock-out. The CPM can be manually reset by cycling control power.

Note: *If the compressor has tripped due to an overheated windings condition, the motor winding temperature sensor resistance (PTC) will be 4500 ohms or greater; the resistance must be less than 2750 ohms before the 5 minute reset timer becomes enabled.*

Figure 122. Compressor locations



Note: *For refrigeration system names listed here, please refer to Model Number Digit 26 to differentiate between the 'S', 'H', and 'V' designations.*

Table 67. Fixed speed staging sequence and compressor data

25T (Std), 30T (Std), 30T (High)				
Stage	**Comp 1A**	**Comp 1B**	**Comp 1C**	
1	X			
2		X		
3	X	X		
4		X	X	
5	X	X	X	
40T - 130T (All Std. and High Efficiency Systems)				
Stage	**Comp 1A**	**Comp 1B**	**Comp 2A**	**Comp 2B**
1	X			
2	X		X	
3	X	X	X	
4	X	X	X	X

Table 68. eFlex™ staging sequence and compressor data

20 Ton eFlex™ Variable Speed Compressor				
Stage	Comp 1A VZH088	Comp 1B	VZH	
			Min Spd	Max Spd
1	X		1602	6000
2	X	X	1500	5202
25 Ton eFlex™ Variable Speed Compressor				
Stage	Comp 1A VZH088	Comp 1B	VZH	
			Min Spd	Max Spd
1	X		1818	6000
2	X	X	1500	6000
30 Ton eFlex™ Variable Speed Compressor				
Stage	Comp 1A VZH117	Comp 1B	VZH	
			Min Spd	Max Spd
1	X		1620	5970
2	X	X	1500	5400

40 Ton eFlex™ Variable Speed Compressor					
Stage	Comp 1A VZH117	Comp 2A	Comp 2B	VZH	
				Min Spd	Max Spd
1	X			1938	4860
2	X	X		1500	5460
3	X	X	X	2490	5550
50 Ton eFlex™ Variable Speed Compressor					
Stage	Comp 1A VZH170	Comp 2A	Comp 2B	VZH	
				Min Spd	Max Spd
1	X			1662	4320

Table 68. eFlex™ staging sequence and compressor data (continued)

2	X	X		1500	5040	
3	X	X	X	2520	5352	
55 Ton eFlex™ Variable Speed Compressor						
Stage	Comp 1A VZH170	Comp 2A	Comp 2B	VZH		
				Min Spd	Max Spd	
1	X			1800	4662	
2	X	X		1500	5280	
3	X	X	X	2550	5598	
60 Ton eFlex™ Variable Speed Compressor						
Stage	Comp 1A VZH170	Comp 2A	Comp 2B	VZH		
				Min Spd	Max Spd	
1	X			1932	4650	
2	X	X		1500	5730	
3	X	X	X	2502	6000	
70 Ton eFlex™ Variable Speed Compressor						
Stage	Comp 1A VZH170	Comp 2A	Comp 2B	VZH		
				Min Spd	Max Spd	
1	X			2340	6000	
2	X	X		1500	6000	
3	X	X	X	2610	6000	
75 Ton eFlex™ Variable Speed Compressor						
Stage	Comp 1A VZH170	Comp 1B	Comp 2A	Comp 2B	VZH	
					Min Spd	Max Spd
1	X				2550	5118
2	X		X		1500	5220
3	X	X	X		1500	5868
4	X	X	X	X	1500	6000

Electronic Expansion Valves

All Intellipak1 with Symbio systems use electronic expansion valves (EXV's) to control superheat. These valves are factory set to 12°F of superheat to balance efficiency and compressor reliability at all operating conditions.

This setting can be adjusted through the Symbio controller display, but this only recommended to be done at the discretion of Trane Product Support

Pressure curves included in this document 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 option, adjust superheat only in the cooling mode of operation.*

***Note:** Due to the placement of the sensors that control the refrigeration system's electronic expansion valves, it is possible that there will be differences between what is measured by the method described above, and what is shown on the Symbio controller display for its current superheat measurement. This by itself is not a cause for concern or reason to adjust operating parameters in the Symbio controller.*

When communicating with Trane Product Support, please report the superheat value(s) described above (obtained with refrigerant gauges), and follow their guidance for any controller adjustments which should be attempted.

Charging by Subcooling

Before beginning the charging procedure, locate the "," figure which corresponds to your refrigeration system. This plot will indicate the approximate discharge pressure which should be observed when the unit has the correct amount of 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 hot gas bypass operating (if applicable). Disable the low ambient dampers in the "Open" position (refer to the "Low Ambient Options" section) and de-energize the hot gas bypass valves before taking performance measurements. With the unit operating at "Full Circuit Capacity", acceptable subcooling ranges for air-cooled units is between 10°F to 23°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 port, 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 port 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.

   ***Note:** Glass thermometers do not have sufficient contact area to give an accurate reading.*
3. Determine the system subcooling by subtracting the actual liquid line temperature (measured in step 2) from the saturated liquid temperature (converted in step 1).

Low Ambient Options

Operation

When the Low Ambient option is selected for IntelliPak 1 with Symbio systems, its function will be accomplished by the usage of at least one variable speed condenser fan motor on each circuit to actively keep the refrigerant discharge pressure within a defined range, in order to maintain acceptable refrigerant pressure differences throughout the system.

The low ambient modulating output(s) on the compressor module controls the condenser fan airflow 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 will be at 100%. 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 69. Minimum starting temperatures for air-cooled units

Unit Size	Minimum Starting Ambient	
	Standard	Low Ambient
20 & 40	50°	0°
25 & 30	50°	0°
50, 55	50°	0°
60	50°	0°
70-130	50°	0°

Note: Min. starting ambients in °F and is based on unit operating at min. step of unloading and 5 mph wind across condenser.

Standard Ambient Condenser Fans

Standard ambient units stage condenser fans down to a minimum of one fan per circuit. All standard ambient units ship with the Symbio™ controller set to allow mechanical cooling down to 50°F outdoor temperature. This setting is adjustable. Below table lists the minimum recommended mechanical cooling setting for standard ambient units by application and unit type.

Table 70. Minimum outside air temperature

Standard Unit Minimum Outside Air Temperature for Mechanical Cooling	Std & High Cap units	eFlex™ units	
		20, 60, 70, 75 ton	25, 30, 40, 50, 55 ton
Economizer - A/C Applications	45°F	45°F	50°F
No Economizer - 80/67F design return air	45°F	45°F	55°F
No Economizer - 90/78F design return air	50°F	50°F	70°F

Low Ambient Condenser Fans

When a unit is ordered with the low ambient option (i.e., Digit 19 is a "1" in the model number), it can affect the selection of condenser fan motors. Please see the table below and "," to see which fan motors will be variable speed.

		Low Ambient Variable Speed Condenser Fans	
Ton-nage	Efficiency Tier	Circuit 1	Circuit 2
20	eFlex	All	-
25	Std.	2M6	-
	High & eFlex	All	-
30	Std. & High	2M6	-
	eFlex	All	-
40	Std.	2M6	2M9
	High & eFlex	All	All
50	Std.	2M6	2M9
	High & eFlex	All	All
55	Std.	2M6	2M9
	High & eFlex	All	All
60	Std. & High	2M6	2M9
	eFlex	All	All
70	Std. & High	2M6	2M9
	eFlex	All	All
75	Std. & High	2M6	2M9
	eFlex	All	All
90	Any	2M6	2M9
105	Any	2M6	2M9
115	Any	2M6	2M9
130	Any	2M6	2M9

Electric, Steam and Hot Water Start-Up

(Variable Air Volume Systems)

1. Ensure that the "System" selection switch at the remote panel is in the Off position.
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit terminal block (1TB1) or the unit-mounted disconnect switch (1S14).

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Important: *Do not open the service access doors while the unit is operating. HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 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 User Interface access door, located in the unit control panel, and press the Manual Overrides key to display the first service screen. Refer to the latest edition of the appropriate programming manual for VAV applications for the Manual Overrides screens and programming instructions.
5. Use tables in "," to program the following system components for operation by scrolling through the User Interface displays:

   Electric Heat

   Heat Stages - 1, 2, or 3 (as required)

   Steam or Hot Water Heat

   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 Auto key.

⚠ WARNING

Rotating Components!

Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.
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.

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 User Interface Module in the unit control panel to stop the system operation.

Electric, Steam and Hot Water Start-Up

1. Ensure that the “System” selection switch at the remote panel is in the Off position.
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit terminal block (2XD1 on 20-75T units / 1XD1 on 90-130T units)or the unit-mounted disconnect switch (2QB1 on 20-75T units / 1QB1 on 90-130T units).

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Important: *Do not open the service access doors while the unit is operating. HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK OR UNIT DISCONNECT SWITCH.*

3. Turn the 115 volt control circuit switch (1S1) to the "On" position.

   Turn the 115 volt control circuit switch (1S20) to the "On" position. (90-130T units only)
4. Press the Manual Override key to display the first service screen. Refer to the latest edition of the appropriate programming manual for VAV applications for the Manual Override screens and programming instructions.
5. Program the following system components for operation by scrolling through the displays:

   Electric Heat

   Heat Stages - 1, 2, or 3 (as required)

   Steam or Hot Water Heat

   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 Auto key.

⚠ WARNING

Rotating Components!

Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.
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.

7. Press the Auto 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 and clear all Manual Overrides in the unit control panel to stop the system operation.

Gas Furnace Startup

⚠ WARNING

Hazardous Gases and Flammable Vapors!

Failure to observe the following instructions could result in exposure to hazardous gases, fuel substances, or substances from incomplete combustion, which could result in death or serious injury. The state of California has determined that these substances may cause cancer, birth defects, or other reproductive harm.
Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures or lead to excessive carbon monoxide. To avoid hazardous gases and flammable vapors follow proper installation and setup of this product and all warnings as provided in this manual.

⚠ WARNING

Explosion Hazard!

Failure to properly regulate pressure could result in a violent explosion, which could result in death, serious injury, or equipment or property-only-damage.

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.

⚠ WARNING

Rotating Components!

Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

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.

Staged, Modulating, and Ultra Modulating

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 rather than manifold pressure alone.

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.

Confirming 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.

Note: *Prior to startup, ensure the gas supply line installation is adequate to maintain 7–inch w.c. as measured leaving the unit gas regulator for natural gas while the furnace is operating at full capacity.*

Two Stage Gas Furnace

Two-stage gas heaters are available for the 235, 350, 500, 850, and 1000 MBh heater sizes.

Modulating Gas Furnace

Modulating gas heaters are available for the 500, 850, and 1000 MBh heater sizes.

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 Symbio controller of the IntelliPak Unit. The control signal from the Symbio controller is 0 – 10V DC for modulating gas heat. The higher the voltage signal, the higher the call for heat. For two stage heat, a relay is energized per stage of heat requested.

The gas heat controller manages the speed of the combustion blower. The greater the combustion air speed, the greater the call for gas and the higher the firing rate of the heater. As the temperature setpoint is reached, the modulating heat controller will cause the combustion air speed to change to a lower firing rate that matches the heat load of the space.

Two-Stage and Modulating Burner Setup

Important: *It is necessary to measure gas pressure at the following points listed below. Install the necessary fittings prior to starting the burner in the Manual Override.*

- *Inlet pressure*
- *Manifold pressure*
- *Unit gas regulator outlet pressure*

Refer to Figure 24, p. 52 to Figure 26, p. 54.

Important:

- *The flue reading should be taken from center of the flue and at least 4 inches down from the outlet. See Figure 124, p. 168 .*
- *If burner fails to light or stay lit during startup procedure, return burner to the settings listed on the burner control box door. Contact Trane Large Commercial Technical Support if failures continue to occur.*

Program the following system components for operation by scrolling through the User interface displays:

1. **Prepare Unit for Startup:**
   a. Open the manual gas valves located in the gas heat section.
   b. Set toggle switch located on heater control box to ON.
   c. Press Stop button on user interface.
   d. Turn the Supply Fan ON by the navigating to the Manual Override Screen. Set the Fan speed to 100%.

2. **Verify Gas Pressure at High Fire**:
    a. Navigate to the Gas Heat Manual override screen. See Figure 123, p. 167 for two-stage and modulating.
    b. Set the modulating percentage to 100% and/or enable the 2nd stage.
    c. Press the Auto button in the top right of the screen.
3. After the initial purge sequence and once the burner has started, run the burner at high fire for 10 minutes to allow the burner to stabilize.
4. Measure the outlet pressure of the unit gas regulator at the unit gas regulator outlet pressure tap on the solenoid valve. Refer to the appropriate illustrations beginning with Figure 24, p. 52. Adjust unit gas regulator to provide an outlet pressure of 7-inch w.c. while operating at high fire.
5. **Low Fire O_2 Adjustment**:
    a. After the inlet gas pressure has been verified at high fire, adjust the user interface to operate the furnace at low firing rate (1%) and/or 1st Stage.
    b. Allow the system to operate for 10 minutes for burner to stabilize.
6. Use a flue analyzer to measure the oxygen (O_2), carbon dioxide (CO_2), and carbon monoxide (CO) levels in the flue gas. Take several readings to ensure burner operation is stable.
7. See Table 71, p. 167 for the required oxygen level during LOW fire operation. If the measured oxygen level is not within the specified range, turn the adjustment screw on the ratio regulator.

    See Figure 125, p. 169 for adjustment screw location. If the O_2 is high, turn 1/2 turn CW. If the O_2 is low, turn 1/2 turn CCW. Recheck O_2 levels and continue to adjust the ratio regulator to match the O_2 values in Table 71, p. 167.

Important: *On 235/350/500MBh heaters, the ratio regulator cap must be reinstalled after adjustment to ensure measurement accuracy.*

8. **High Fire O_2 Adjustment:** Adjust the User interface to operate the furnace at max firing rate (100%) or 2nd Stage. Allow the system to operate for 10 minutes to allow the burner to stabilize.
9. Use a flue analyzer to measure the oxygen (O_2), carbon dioxide (CO_2), and carbon monoxide (CO) levels in the flue gas. Take several readings to ensure burner operation is stable.
10. See Table 71, p. 167 for the required oxygen level during HIGH fire operation. If the measured oxygen level is within the specified range and the carbon dioxide level is between 8.5 to 10% and the CO is less than 100 PPM, no adjustment is necessary. If an adjustment is needed, check the air damper on the burner (closing will increase the CO_2 level). See Figure 127, p. 170 for air damper location. If the O_2 is high, close ½ notch. If the O_2 is low, open ½ notch.
11. If any adjustments were made during Low Fire O_2 Adjustment and/or High Fire O_2 Adjustment, repeat steps starting from Low Fire O_2 Adjustment to confirm oxygen levels for both low and high fire are within specified range on Table 71, p. 167.
12. **Low Fire Manifold Pressure Adjustment**: Adjust the User interface to operate the furnace at low firing rate (1%) and/or 1st Stage. Allow the system to operate for 10 minutes to allow the burner to stabilize. Check manifold pressure at tap closest to where the valve train attaches to the burner. See Figure 126, p. 169.
13. See Table 71, p. 167 for the expected manifold pressure during LOW fire operation. If manifold pressure is not within the specified range, adjust P0 (ignition speed of blower) and P1 (low fire speed of blower). See "Adjusting P0, P1, and P2 via the Siemens LME7 Built-in Display," p. 166 for instructions.

Important: *P0 should always be equal to or greater than P1.*

14. **High Fire Manifold Pressure Adjustment**: Adjust the User interface to operate the furnace at max firing rate (100%) or 2nd Stage. Allow the system to operate for 10 minutes to allow the burner to stabilize. Check manifold pressure at tap closest to where the valve train attaches to the burner. See Figure 125, p. 169.
15. See Table 71, p. 167 for the expected manifold pressure during HIGH fire operation. If manifold pressure is not within the specified range, adjust P2 (high fire speed of blower). See "Adjusting P0, P1, and P2 via the Siemens LME7 Built-in Display," p. 166 for instructions.
16. If any adjustments were made during Low Fire Manifold Pressure and High Fire Manifold Pressure, repeat from Low Fire Manifold Pressure Adjustment to confirm manifold pressures for both low and high fire are within specified range on Table 71, p. 167.
17. Adjust the user interface to operate the furnace at low firing rate (1%) and 1st Stage. After the burner has stabilized, recheck O_2 (or CO_2) and CO values.
18. Press the STOP key in the top right corner of the User interface screen and remove manual overrides to stop the system operation.

Adjusting P0, P1, and P2 via the Siemens LME7 Built-in Display

1. While in standby (OFF), press and hold the A button and either the + or - button for more than five seconds until "OFF" starts blinking.
2. Give the LME7 a call for heat. The LME7 will proceed to start the burner. After prepurge is complete, the LME7 will slow the blower down to the preset ignition speed (P0).

Important: *On staged heaters, Relay A must be removed in the gas heat control box to enter commissioning mode. Refer to the following support article for how to video instructions: https://support.trane.com/hc/en-us/sections/27318546270221. If using a Siemens AZL23 Handheld Display for commissioning, removing Relay A is not necessary.*

3. At this point, the LME7 will alternately display P0 and a three-digit number. The three-digit number is the setting of the ignition speed P0 divided by 10. For example, if the display alternately displays P0 and 200, this means that the ignition speed is currently set for 2000 RPM.
4. To adjust the ignition speed, press and hold the A button while simultaneously pressing the + or - button to increase or decrease the speed respectively. The speed of the blower will change in real time. Once the desired ignition speed P0 has been set, press the info button.
5. The startup of the burner will continue. The burner will light off and establish flame. Once the burner has lit off, it will drive to the preset low fire speed (P1).
6. The LME7 will then alternately display P1 and a three-digit number that is representative of the low fire speed divided by 10. To adjust the low fire speed, press and hold the A button while simultaneously pressing the + or - button to increase or decrease the speed respectively. The speed of the blower will change in real time. Once the desired low fire speed P1 has been set, press the info button.
7. The LME7 will immediately drive to the preset high fire speed P2.
8. The LME7 will then alternately display P2 and a three-digit number that is representative of the high fire speed divided by 10. To adjust the high fire speed, press and hold the A button while simultaneously pressing the + or - button to increase or decrease the speed respectively. The speed of the blower will change in real time. Once the desired high fire speed P2 has been set, press the info button.
9. Press the + and - buttons together (escape) to return to normal operation. The PWM blower will now respond to the external load control signal being supplied to the LME7.

Note: *For more information contact Large Commercial Technical Support.*

Figure 123. Gas Heat Manual Override screen — two–stage

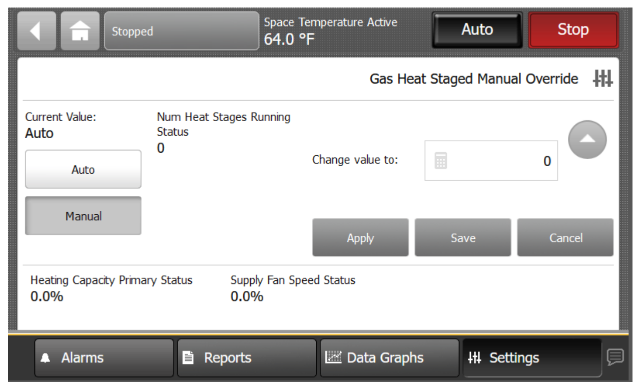


Table 71. Recommended manifold pressures and O_2 levels for furnace operation — natural gas

Burner size	Low Fire (1%)		High Fire (100%)	
	O_2 (%)	Manifold (in. w.c)	O_2 (%)	Manifold (in. w.c)
235 MBH 2-stg	6.5 – 7.2	0.37 – 0.39	3.0 – 3.4	1.4 – 1.6
350 MBH 2-stg	6.8 – 7.2	0.33 – 0.37	3.0 – 3.4	1.2 -1.3
500 MBH 2-stg	6.0 – 8.0	0.68 – 0.72	3.0 – 3.4	2.3 – 2.6
500 MBH Mod	9.0 – 11.0	0.18 – 0.22	3.0 – 3.4	2.3 – 2.6
800 MBH 2-stg[a]	5.6 – 5.8	0.45 – 0.49	3.8 – 4.0	1.84 – 1.88
800 MBH Mod [a]	11.2 – 11.6	0.04	3.8 – 4.0	1.83 – 1.87
850 MBH 2-stg[a]	5.6 – 5.9	0.43 – 0.45	3.0 – 3.3	1.8 – 2.1
850 MBH Mod[a]	10.9 – 11.4	0 – 0.05	3.0 – 3.3	1.8 – 2.1
1000 MBH 2-stg	4.5 – 5.2	0.63 – 0.68	2.8 – 3.2	2.5 – 2.7
1000 MBH Mod	10.6 – 10.9	0 – 0.05	2.8 – 3.2	2.5 – 2.7

Note: *If the manifold pressure is not within the range shown on the chart, then the combustion fan speeds (P0, P1, and/or P2) need adjustment. Typically, in increments of 20-40 RPM*

[a] For Horizontal MBH, refer to gas heat rating plate for actual capacity.

Table 72. Recommended manifold pressures and O_2 levels for furnace operation — LP

Burner size	Low Fire (1%)		High Fire (100%)	
	O_2 (%)	Manifold (in. w.c)	O_2 (%)	Manifold (in. w.c)
235 MBH 2-stg	6.4 - 6.8	0.18 - 0.21	3.2 - 3.6	0.70 - 0.73
350 MBH 2-stg	6.8 - 7.2	0.18 - 0.21	3.2 - 3.6	0.57 - 0.61
500 MBH 2-stg	5.7 - 6.1	0.29 - 0.32	2.8 - 3.2	1.08 - 1.11
500 MBH Mod	10.5 - 10.9	0.06 - 0.10	2.8 - 3.2	1.08- 1.11
800 MBH 2-stg[a]	5.8 - 5.9	0.19 - 0.2	3.3 - 3.6	0.78 - 0.82
800 MBH Mod[a]	11.8 - 12.0	0.01	3.5 - 3.6	0.78 - 0.82
850 MBH 2-stg[a]	5.9 - 6.1	0.19 - 0.23	3.4 - 3.6	0.87 - 0.92
850 MBH Mod[a]	11.6 - 11.8	0.02	3.6 - 3.8	0.93 - 0.97
1000 MBH 2-stg	5.7 - 5.8	0.30 - 0.31	3.5 - 3.7	1.19 - 1.23
1000 MBH Mod	11.4 - 11.6	0.014	3.4 - 3.6	1.20 - 1.24

Note: *If the manifold pressure is not within the range shown on the chart, then the combustion fan speeds (P0, P1, and/or P2) need adjustment. Typically, in increments of 20-40 RPM*

(a) For Horizontal MBH, refer to gas heat rating plate for actual capacity.

Figure 124. Flue gas carbon dioxide and oxygen measurements

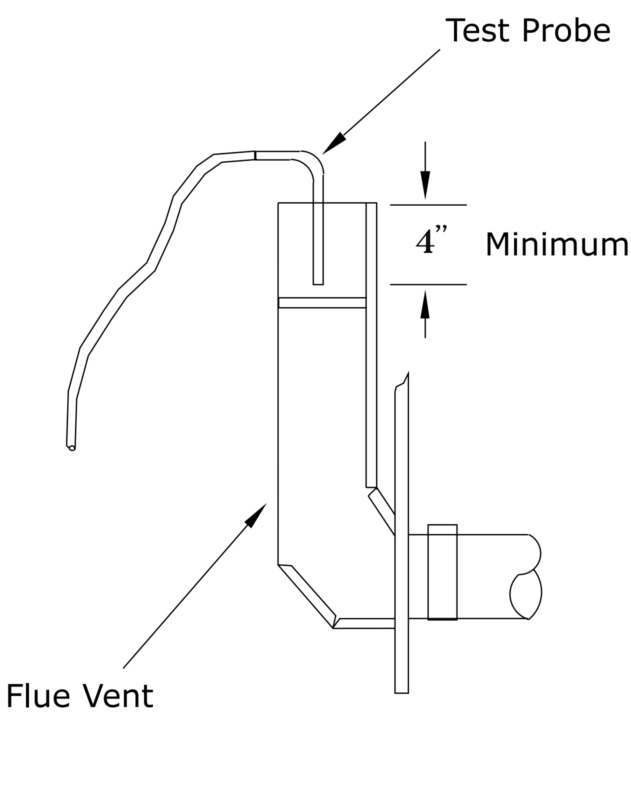


Figure 125. Ratio regulator - two-stage and modulating

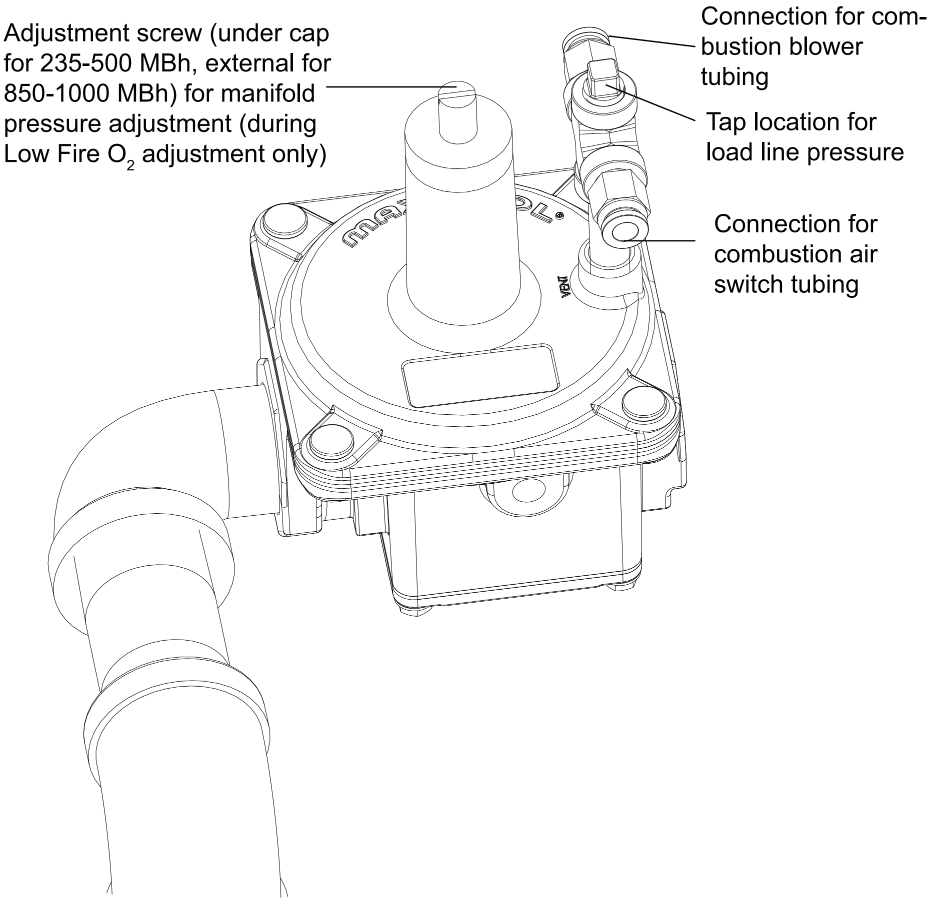


Figure 126. Manifold pressure tap location - two-stage and modulating

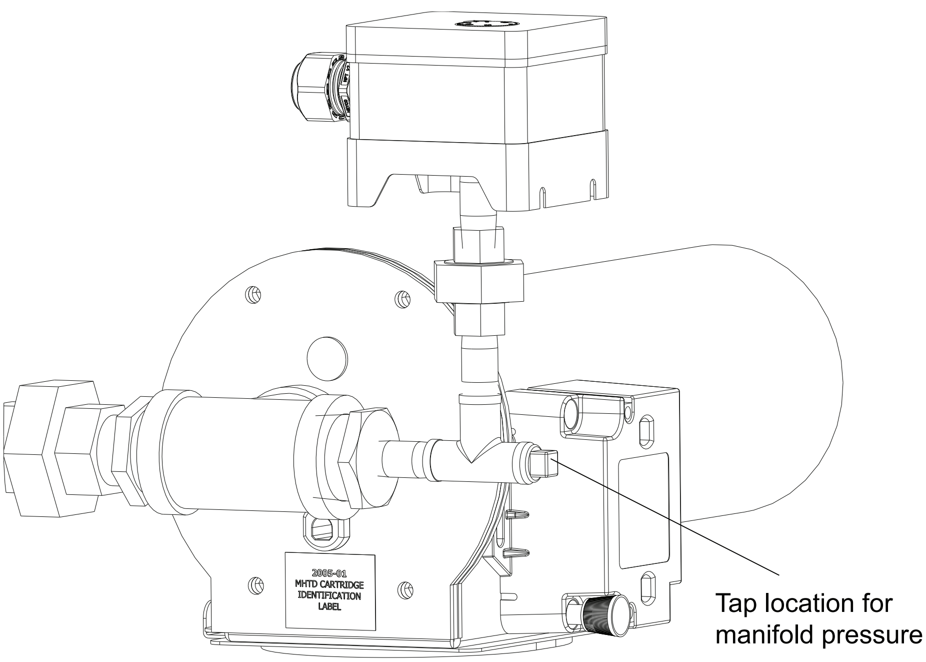
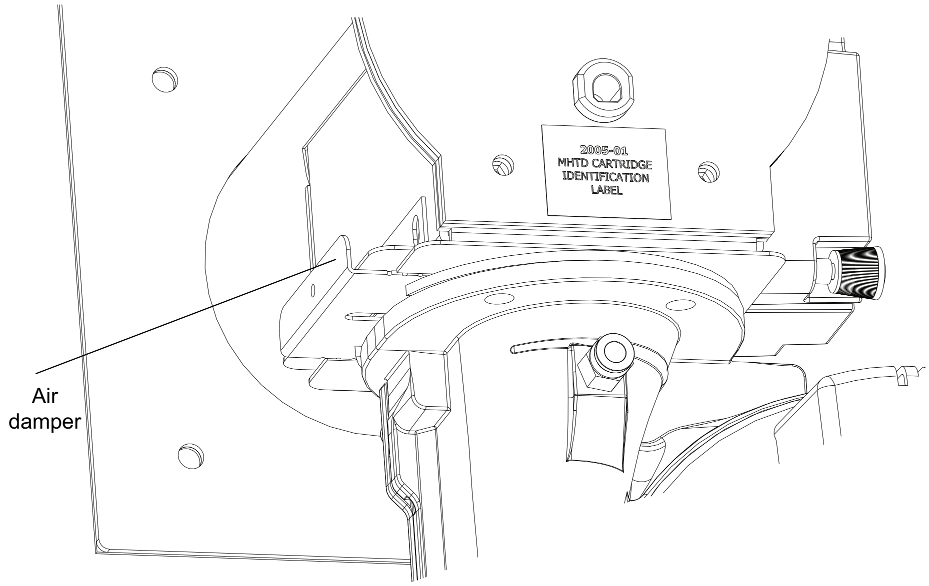


Figure 127. Air Damper location - two-stage and modulating



Ultra Modulating Gas Furnace

Ultra modulating gas heaters are available for the 500, 850 and 1000 MBh heater sizes.

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 Symbio controller of the IntelliPak unit. The control signal from the Symbio controller is 2-10V DC. The higher the voltage signal, the higher the call for heat.

The 2 -10V DC signal controls the heat output of the gas heat controller. The greater DC voltage, the greater the call for gas and the higher the firing rate of the heater. As the temperature setpoint is reached, the modulating heat controller will cause the combustion air speed to change to a lower firing rate that matches the heat load of the space.

Ultra Modulating Burner Setup

Important: *It is necessary to measure gas pressure at the following points listed below. Install the necessary fittings prior to starting the burner in the Manual Override.*

- *Inlet pressure*
- *Unit gas regulator outlet pressure*
- *Manifold pressure*
- *Pilot gas pressure*

See Figure 130, p. 173.

Important:

- *Flue readings should be taken from center of the flue and at least 4 inches down from the outlet. See .*
- *It is crucial to keep the manifold gas manual shutoff valve closed until the pilot flame is established to eliminate delayed ignition events.*

Program the following system components for operation by scrolling through the user interface displays:

1. **Prepare Unit for Startup:**
   a. Open the manual shutoff valve located near the unit gas regulator to feed the pilot flame and ensure that the manifold gas manual shutoff valve is closed. See Figure 131, p. 173.
   b. Set toggle switch located on heater control box to ON.
   c. Press Stop button on user interface.
   d. Navigate to the Gas Heat Manual override screen. See Figure 128, p. 172. Set the modulating percentage to 1% and enable the 1st stage. Touch the Auto button in the top right corner of the screen.
   e. Turn the Supply Fan ON by the navigating to the Manual Override Screen. Set the Fan speed to 100%.
2. **Establish Pilot Flame**:
   a. After the initial purge sequence and once the burner has lit the pilot flame, measure pilot gas pressure at pilot gas pressure tap. See Figure 130, p. 173
   b. Adjust pilot gas regulator to 3.0 to 3.5-inch w.c.
3. Once pilot flame is established, slowly open the manifold gas manual shutoff valve until fully open. See

Figure 131, p. 173 for location of the manifold gas manual shut-off valve. Burner should light at low fire.

Important: *If the proof of flame is lost and the pilot is not re-established within 10 seconds after the pre-purge, the controller will lockout. Re-establish pilot by repeating startup from Step 1. Contact Trane Large Commercial Technical Support if failures continue to occur.*

4. **Verify Gas Pressure at High Fire**:
   a. Adjust the user interface to operate the furnace at max firing rate (100%) or 2nd Stage.
   b. Allow the system to operate for 10 minutes for burner to stabilize.
5. Check the inlet pressure at the inlet pressure tap upstream of the pilot regulator. See Figure 130, p. 173. The unit inlet pressure should between 7.0 to 14.0–inch w.c. when burner is operating at high fire.
6. Check the outlet pressure of the unit gas regulator at tap on the upstream solenoid valve. See Figure 130, p. 173. The outlet pressure from the main gas regulator should be 5.8 to 6.2–inch w.c. while the burner is operating at high fire.
7. **Low Fire Adjustment**:
   a. AAfter the unit inlet and unit gas regulator outlet pressures have been verified at high fire, adjust the user interface to operate the furnace at low firing rate (1%) and/or 1st Stage.
   b. Allow the system to operate for 10 minutes for burner to stabilize.
8. Use a flue analyzer to measure the oxygen (O_2), carbon dioxide (CO_2), and carbon monoxide (CO) levels in the flue gas. Take several readings to confirm burner operation is stable.
   - If the measured O_2 level is between 17.0%-19.0% and the CO level is no more than 400ppm (corrected to 3% O_2), no adjustment is necessary.
   - If an adjustment is needed, turn the adjustment screw on the ratio regulator. CCW to increase O_2, CW to decrease O_2. See Figure 129, p. 172.

Note: *Ratio regulator turns affects amount of gas flow. The number of turns on the ratio regulator is preset at the factory. Only small adjustments should be made for fine tuning combustion.*

9. **High Fire Adjustment**:
   a. Adjust the user interface to operate the furnace at max firing rate (100%) or 2nd Stage.
   b. Allow the system to operate for 10 minutes for burner to stabilize.

   Note: *The burner capacity is controlled by the combustion fan speed. This has been preset at the factory and normally does not need field adjustment.*
10. Check manifold pressure at the manifold pressure tap closest to where the valve train attaches to the burner. Refer to the illustration in Figure 131, p. 173. Verify the manifold pressure is within range shown in Chart B (Table 74, p. 171). If manifold pressure is not within the specified range, contact Large Commercial Technical Support for information on how to adjust maximum fan speed (FHi).
11. Use a flue analyzer to measure the oxygen (O_2), carbon dioxide (CO_2), and carbon monoxide (CO) levels in the flue gas. If the measured oxygen level is between 3.0 to 5.0% and the carbon dioxide level is between 8.5 to 10% and the CO is less than 100 PPM, no adjustment is necessary. If an adjustment is needed, check the inlet gas pressure or the air damper on the burner (closing will increase the CO_2 level). See Figure 132, p. 174.
12. **Verify Low Fire Adjustment**:
   a. Adjust the user interface to operate the furnace at low firing rate (1%) and/or 1st Stage.
   b. Allow the system to operate for 10 minutes for burner to stabilize.
   c. Recheck O_2 (or CO_2) and CO values, making adjustments as necessary to dial in furnace operation.
13. Press the STOP key on the user interface screen and remove manual overrides to stop the system operation.

Table 73. Chart A - ultra modulating service mode setup parameters

Modulating Gas Heat Actuator (Service Mode)	Low Fire (1%)	High Fire (100%)
VDC Signal to actuator	2.0 VDC	10.0 VDC
Unit Inlet Pressure	7.0" to 14.0”	7.0" to 14.0"
Unit Gas Regulator Outlet Pressure - NG	5.8” to 6.2”	5.8” to 6.2”
Manifold Pressure - NG		See chart B
Unit Gas Regulator Outlet Pressure - LP	10.0”	10.0”
Manifold Pressure - LP		See chart B

Table 74. Chart B - high fire manifold pressure

Burner size	High Fire Manifold Pressure	
	NG	LP
500 MBh	2.6" to 2.9"	1.13”
850 MBh	1.6" to 1.9"	0.65”
800 MBh [(a)]	1.3” to 1.6”	0.59”
1000 MBh	2.1" to 2.4"	0.91”

Note: *If the manifold pressure is not within the range shown on the chart, then the maximum combustion fan speed (Fhi) needs adjustment. Contact Large Commercial Technical Support for assistance.*

(a) 800 MBh is horizontal discharge. MBh is listed on gas heat rating plate.

Figure 128. Gas Heat Manual Override screen - modulating

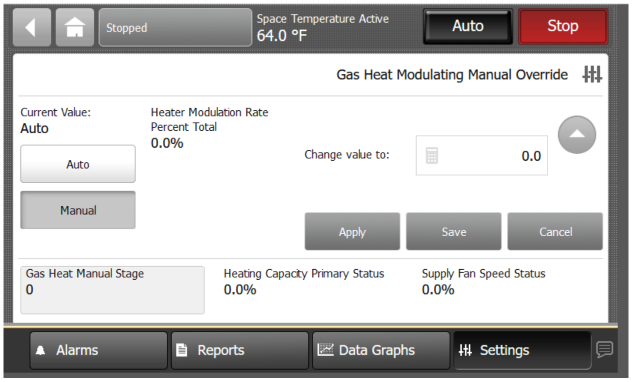


Figure 129. Ratio regulator — ultra modulating

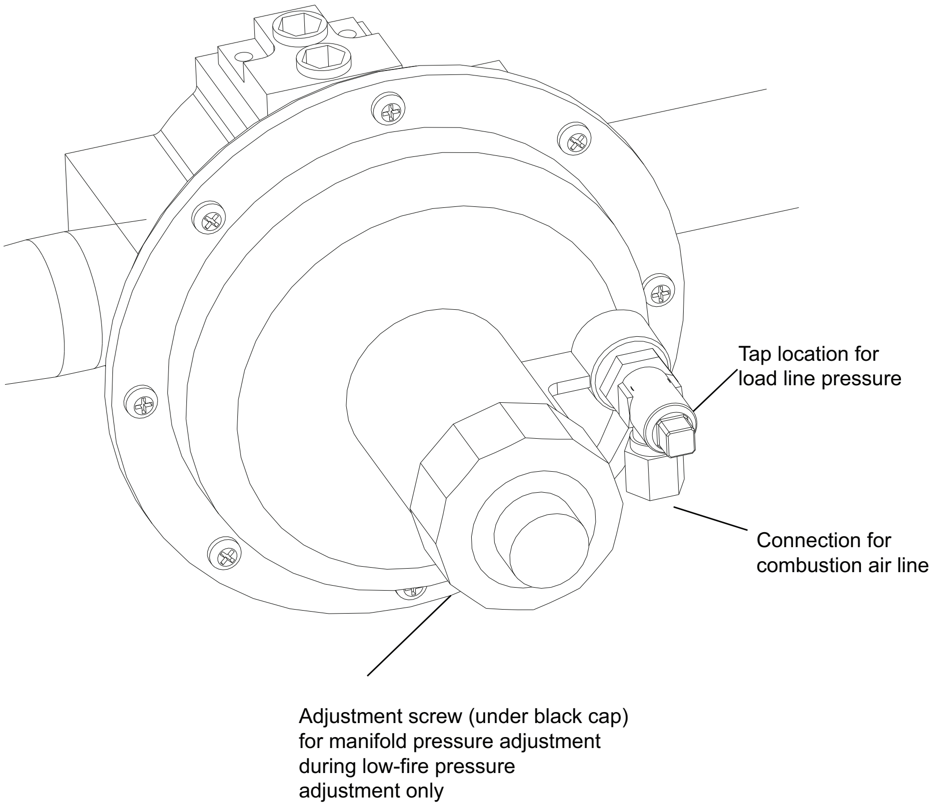


Figure 130. Main gas regulator and inlet pressure tap locations — ultra modulating

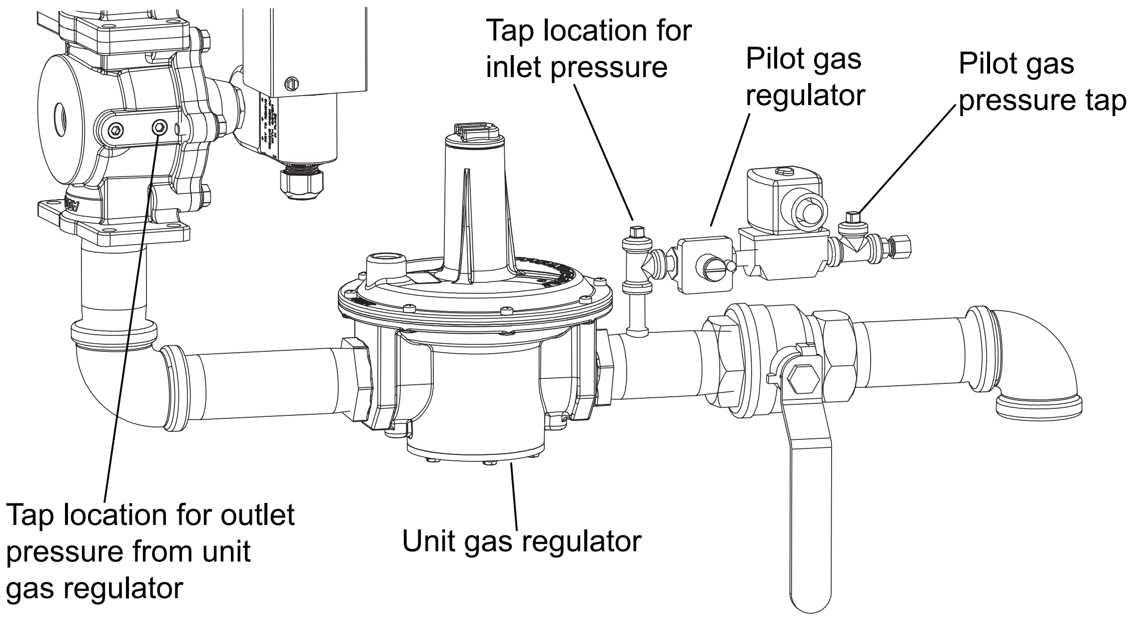


Figure 131. Manifold pressure tap location — ultra modulating

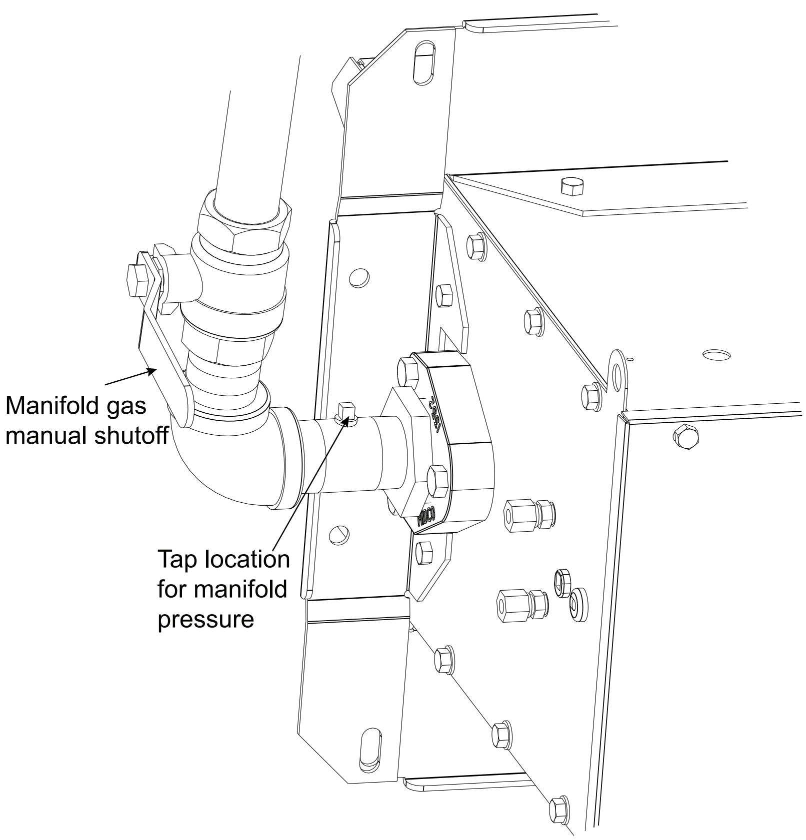
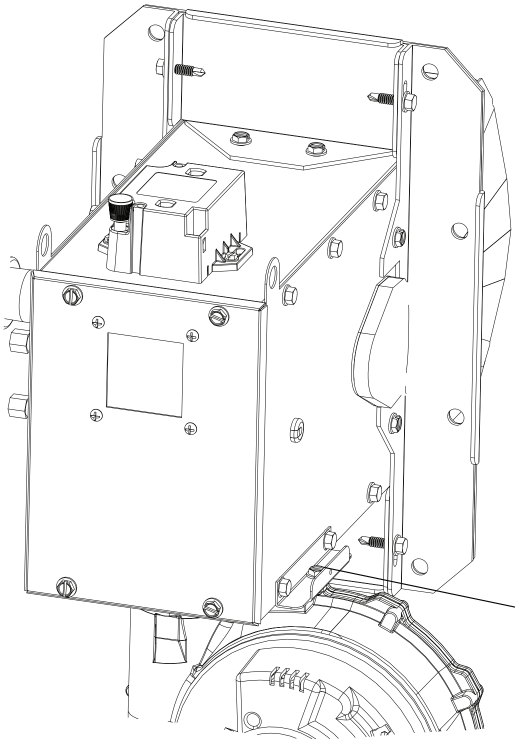


Figure 132. Air damper location— ultra modulating



Final Unit Checkout

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

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Important: *HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK OR UNIT DISCONNECT SWITCH.*

- ☐ Close the disconnect switch or circuit protector switch that provides the supply power to the unit terminal block (2XD1 on 20-75T units / 1XD1 on 90-130T units)or the unit mounted disconnect switch (2QB1 on 20-75T units / 1QB1 on 90-130T units).
- ☐ Turn the 115 volt control circuit switch (1S1) to the "On" position.
- ☐ Turn the 115 volt control circuit switch (1S20) to the "On" position. (90-130T units only)
- ☐ 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 VAV applications.
- ☐ Inspect the unit for misplaced tools, hardware, and debris.
- ☐ Press the AUTO key to begin system operation. The system will start automatically once the dampers modulate and a request for either heating or cooling has been given.
- ☐ Verify that all exterior panels including the control panel doors and condenser grilles are secured in place.

Trane Start-up Checklist

This checklist is intended to be a guide for the Trane technician just prior to unit 'startup'. Many of the recommended checks and actions could expose the technician to electrical and mechanical hazards. Refer to the appropriate sections in the this manual for appropriate procedures, component specifications and safety instructions.

Important: *This checklist is not intended as a substitution for the contractor's installation instruction.*

Important: *Except where noted, it is implied that the Trane technician is to use this checklist for inspection/verification of prior tasks completed by the general contractor at installation. Use the line item content to also record the associated values onto the Trane unitary packaged equipment log.*

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

Table 75. Startup checklist for 20–75 ton air-cooled units

		Completed?			
General Start-up					
1	Is adequate access/egress provided?		Yes		No
2	Initial site inspection performed?		Yes		No
3	Unit exterior inspected for damage (dents, bends, missing panels, doors work properly)?		Yes		No
4	Unit clearances adequate to avoid air recirculation?		Yes		No
5	Wear electrical PPE		Yes		No
6	Lockout & tagout unit		Yes		No
7	Verify unit interior is free from debris and obstructions, etc.		Yes		No
8	All unit drain lines and traps are properly installed		Yes		No
9	Remove electrical access panel fastened (9) bolt/screws or open access		Yes		No
10	Verify unit is grounded. Confirm a ground wire is coming from the power source		Yes		No
11	Verify main power feed wire gauge is properly sized for current load		Yes		No
12	Verify all wiring connections are tight		Yes		No
13	Verify all field control wiring for VAV controls are complete		Yes		No
14	Verify all automation and remote controls installed/wired		Yes		No
15	Verify all shipping hardware and plastic covers for compressors have been removed		Yes		No
16	Verify hold down bolts and channels from fan sections removed		Yes		No
17	Fan section isolators checked/adjusted (approximately ¼" gap above shipping block)		Yes		No
18	Verify damper linkages are tight/adjusted and tip seals are in good condition		Yes		No
19	Verify compressor oil levels at proper levels (½ - ¾ high in glass)		Yes		No
20	Compressor discharge service valves and oil valves open/back seated		Yes		No
21	All fan belts tensioned, bearings greased and sheaves in alignment		Yes		No
22	Verify supply and relief fan pulley bolts are tight		Yes		No
23	Verify fans rotate freely		Yes		No
24	Verify refrigerant charge on each circuit		Yes		No
25	Remove lock tag out		Yes		No
26	Wear electrical PPE		Yes		No
27	Verify correct voltage supplied to unit and electrical heaters (see IOM for assistance)		Yes		No
28	Allow compressor crankcase heaters to operate for 8 hours prior to starting the refrigeration system.		Yes		No
29	Verify incoming voltage phase balanced		Yes		No
30	Check the incoming power phase rotation.		Yes		No
31	Verify all fans rotate in proper direction		Yes		No
32	Verify fan amperages within nameplate specs (please document on log sheet)		Yes		No

Table 75. Startup checklist for 20–75 ton air-cooled units (continued)

		Completed?			
Unit Configuration and Setup					
1	Verify model number in the UCM configuration matches unit model number on nameplate		Yes		No
2	Configure unit using IOM and critical control parameters using critical control parameters table		Yes		No
Air Cooled Condenser (Digit 27)					
1	All coil fins inspected and straightened		Yes		No
2	Condenser fans are rotating freely		Yes		No
3	Verify the fan blade set-screws to the motor shaft of the condenser fan assemblies are tight		Yes		No
Electric Heat (if applicable)					
1	Electric heat circuits have continuity		Yes		No
2	Perform electric heat start up procedure		Yes		No
Gas Heat (if applicable)					
1	Gas heat piping includes drip leg previously installed by installing contractor		Yes		No
2	Gas heat flue assembly fully installed		Yes		No
3	Gas heat condensate line and heat tape installed where applicable		Yes		No
4	Verify heating system matches name plate		Yes		No
5	Perform gas heat start up procedure in IOM				
Hot Water Heat (if applicable)					
1	Verify hot water pipes are proper size, routed through the base and no leaks are present		Yes		No
2	Verify swing joints or flexible connectors are installed next to hot water coil		Yes		No
3	Verify gate valve is installed in the supply and return branch line		Yes		No
4	Verify three way modulating valve is installed with valve seating against the flow		Yes		No
5	Verify coil venting is installed if water velocity is less than 1.5 feet per second		Yes		No
Steam Water Heat (if applicable)					
1	Verify steam pipes are proper size, routed through the base and no leaks are present		Yes		No
2	Verify steam heat swing check vacuum breakers installed and vented		Yes		No
3	Verify 2-way modulating valve has been installed		Yes		No
4	Verify steam trap installed properly with discharge 12” below the outlet connection on the coil		Yes		No
System Checkout					
1	Verify system airflow		Yes		No
2	Verify dampers open and close properly		Yes		No
3	Adjust fresh air damper travel		Yes		No
4	Verify compressor operation, voltage and amperage matches name plate information (please document on log sheet)		Yes		No
5	Operating log completed		Yes		No
6	All panels & doors secured		Yes		No
7	Complete all required documentation		Yes		No

Table 76. Startup checklist for 90–130 ton air-cooled units

		Completed?			
General Start-up					
1	Is adequate access/egress provided?		Yes		No
2	Initial site inspection performed?		Yes		No
3	Unit exterior inspected for damage (dents, bends, missing panels, doors work properly)?		Yes		No
4	Unit clearances adequate to avoid air recirculation?		Yes		No
5	Wear electrical PPE		Yes		No
6	Lockout & tagout unit		Yes		No
7	Verify unit interior is free from debris and obstructions, etc.		Yes		No
8	All unit drain lines and traps are properly installed		Yes		No
9	Remove electrical access panel fastened (9) bolt/screws or open access		Yes		No
10	Verify unit is grounded. Confirm a ground wire is coming from the power source		Yes		No
11	Verify main power feed wire gauge is properly sized for current load		Yes		No
12	Verify all wiring connections are tight		Yes		No

Table 76. Startup checklist for 90–130 ton air-cooled units (continued)

		Completed?			
13	Verify all field control wiring for VAV controls are complete		Yes		No
14	Verify all automation and remote controls installed/wired		Yes		No
15	Verify all shipping hardware and plastic covers for compressors have been removed		Yes		No
16	Verify hold down bolts and channels from fan sections removed		Yes		No
17	Fan section isolators checked/adjusted (approx ¼” gap above shipping block)		Yes		No
18	Verify damper linkages are tight/adjusted and tip seals are in good condition		Yes		No
19	Verify compressor oil levels at proper levels (½ - ¾ high in glass)		Yes		No
20	Compressor discharge service valves and oil valves open/back seated		Yes		No
21	All fan belts tensioned, bearings greased and sheaves in alignment		Yes		No
22	Verify supply and relief fan pulley bolts are tight		Yes		No
23	Verify fans rotate freely		Yes		No
24	Verify refrigerant charge on each circuit		Yes		No
25	Remove lock tag out		Yes		No
26	Wear electrical PPE		Yes		No
27	Verify correct voltage supplied to unit and electrical heaters (see IOM for assistance)		Yes		No
28	Allow compressor crankcase heaters to operate for 8 hours prior to starting the refrigeration system.		Yes		No
29	Verify incoming voltage phase balanced		Yes		No
30	Check the incoming power phase rotation.		Yes		No
31	Verify all fans rotate in proper direction		Yes		No
32	Verify fan amperages within nameplate specs (please document on log sheet)		Yes		No
Unit Configuration and Setup					
1	Verify model number in the UCM configuration matches unit model number on nameplate		Yes		No
2	Configure unit using IOM and critical control parameters using critical control parameters table		Yes		No
Air Cooled Condenser (Digit 27)					
1	All coil fins inspected and straightened		Yes		No
2	Condenser fans are rotating freely		Yes		No
3	Verify the fan blade set-screws to the motor shaft of the condenser fan assemblies are tight		Yes		No
Electric Heat (if applicable)					
1	Electric heat circuits have continuity		Yes		No
2	Perform electric heat start up procedure		Yes		No
Gas Heat (if applicable)					
1	Gas heat piping includes drip leg previously installed by installing contractor		Yes		No
2	Gas heat flue assembly fully installed		Yes		No
3	Gas heat condensate line and heat tape installed where applicable		Yes		No
4	Verify heating system matches name plate		Yes		No
5	Perform gas heart start up procedure in IOM				
Hot Water Heat (if applicable)					
1	Verify hot water pipes are proper size, routed through the base and no leaks are present		Yes		No
2	Verify swing joints or flexible connectors are installed next to hot water coil		Yes		No
3	Verify gate valve is installed in the supply and return branch line		Yes		No
4	Verify three way modulating valve is installed with valve seating against the flow		Yes		No
5	Verify coil venting is installed if water velocity is less than 1.5 feet per second		Yes		No
Steam Water Heat (if applicable)					
1	Verify steam pipes are proper size, routed through the base and no leaks are present		Yes		No
2	Verify steam heat swing check vacuum breakers installed and vented		Yes		No
3	Verify 2-way modulating valve has been installed		Yes		No
4	Verify steam trap installed properly with discharge 12” below the outlet connection on the coil		Yes		No
System Checkout					
1	Verify system airflow		Yes		No
2	Verify dampers open and close properly		Yes		No
3	Adjust fresh air damper travel		Yes		No
4	Verify compressor operation, voltage and amperage matches name plate information (please document on log sheet)		Yes		No

Table 76. Startup checklist for 90–130 ton air-cooled units (continued)

		Completed?			
5	Operating log completed		Yes		No
6	All panels & doors secured		Yes		No
7	Complete all required documentation		Yes		No

Critical Control Parameters and Dry Bulb Changeover Map

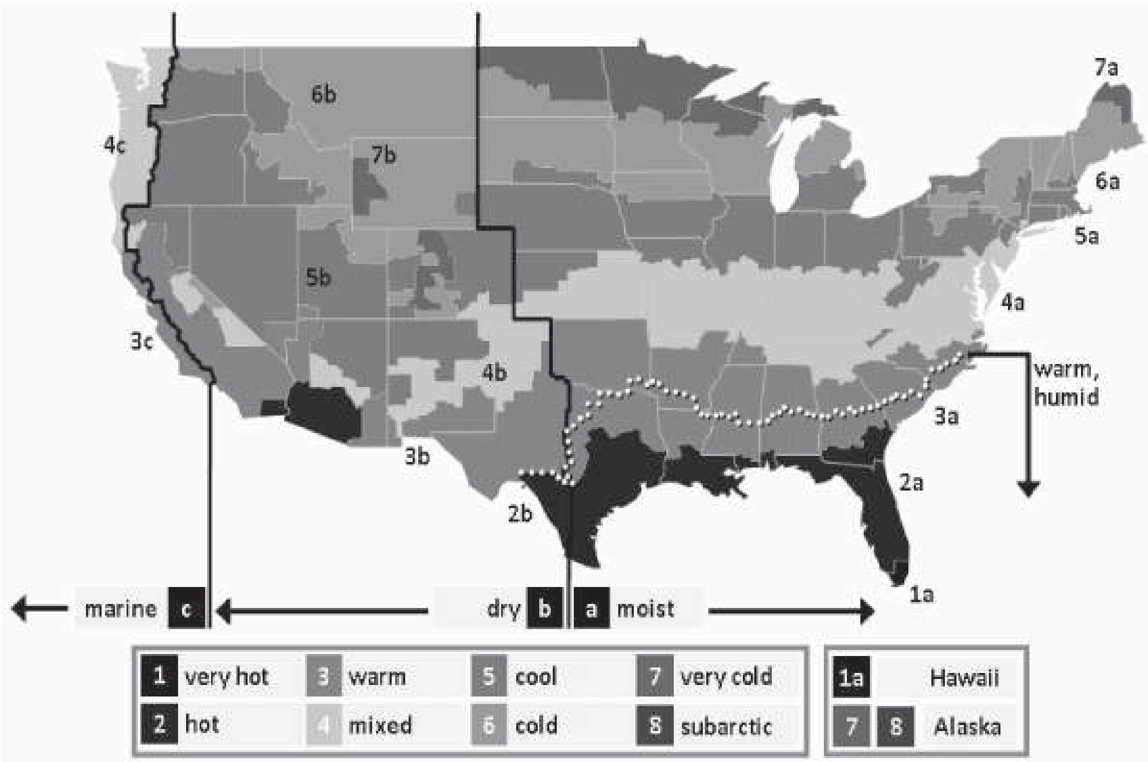
Table 77. Critical control parameters

Description	Suggested Parameter	Economizer Settings						
		Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
Supply Air Temperature Control Setpoint	55°F							
Supply Air Temperature Deadband	8°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%							
Relief 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							

Notes:

1. See map in next figure for dry bulb changeover.
   Examples:
   - Minneapolis, Minnesota is in “Region 6" and resides in “Moist” subregion, thus designation is 6b. Economizer changeover setting should be 75°F.
   - Charleston, South Carolina is in “Region 3" and resides in “Moist” subregion, thus the designation is 3c. Economizer changeover setting should be 65°F.
2. Go to SETUP menu and input setting for parameters listed in the table above.
3. Use the Dry bulb changeover map to determine region of country based on unit site location.
4. Fixed speed compressor units 8°F deadband.
5. eFlex™ compressor units 4°F deadband.

Figure 133. Dry bulb changeover map



Service and Maintenance

> **⚠ WARNING**
>
> **Hazardous Voltage and Exposure to Ultraviolet Radiation!**
>
> **This product contains components that emit high-intensity ultraviolet (UV-C) radiation which can be harmful to unprotected eyes and skin, and cause serious damage to the equipment.**
>
> **Failure to disconnect power before servicing could result in burns or electrocution which could result in death or serious injury.**
>
> **Disconnect all electrical power, including remote disconnects, and make sure the UV lights are off before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized.**
>
> **Trane does not recommend field installation of ultraviolet lights in its equipment for the intended purpose of improving indoor air quality. Trane accepts no responsibility for the performance or operation of our equipment in which ultraviolet devices were installed outside of the Trane factory or its approved suppliers.**

Table 78. Gas heat high limit cutout

		FC or A/F — Open Value[a]				DDP — Open Value[b]			
		2 Stage & Mod		Ultra Mod		2 Stage & Mod		Ultra Mod	
Unit Size	MBh	DF	HZ	DF	HZ	DF	HZ	DF	HZ
20/25	235	250	250	n/a	n/a	195	n/a	n/a	n/a
	500			160	160	180	n/a	180	n/a
30	350	250	250	n/a	n/a	220	n/a	n/a	n/a
	500			160	160	180	n/a	160	n/a
40	350	250	250	n/a	n/a	280	n/a	n/a	n/a
	850[c]			250	250	220	n/a	195	n/a
50/55	500	250	250	195	195	195	n/a	195	n/a
	850[c]			250	250	220	n/a	260	n/a
60-75	500	250	340	220	340	195	260	220	220
	850[c]		250	195	250	220	195	220	220
90-130	1000	210	n/a	210	n/a	n/a	n/a	n/a	n/a

(a) FC and A/F units have automatic reset high limit cutouts.
(b) DDP units have manual reset high limit cutouts.
(c) MBH listed are for downflow. For Horizontal MBH, refer to gas heat rating plate.

Compressor Circuit Breakers

Every fixed speed compressor is protected by a circuit breaker. If replacement is necessary, please refer to the circuit breaker nameplate to identify the part number and manufacturer. Contact the circuit breaker manufacturer to locate the datasheet for the circuit breaker to find the "must hold / must trip" values.

Supply and Relief/Return Fan Overloads

When the VFD bypass option is selected, each supply and relief/return fan is protected by a motor overload when in VFD bypass mode. On 60-75T units with dual DDP supply fan motors (with or without VFD bypass option), each supply fan motor is protected by a motor overload in both standard operation and VFD bypass mode. The motor overloads are factory set to the motor FLA value and should not be adjusted. If the current to the motor exceeds the overload dial setting value, the overload relay auxiliary contacts will trip and interrupt the control signal to the run and bypass contactor coils. This will remove power from the fan motor and stop operation.

Table 79. Filter data

Unit Model (AC/EC)	Panel-Type Filters(a)		Bag-Type Filters(b)		Cartridge Filters (Pre-Evap and Final) (box-type)(b)		Panel-Type Prefilters (Pre-Evap and Final)(c)	
	Qty	Size of each	Qty.	Size of each	Qty. (Pre-Evap/Final Filter)	Size of each	Qty. (Pre-Evap/Final Filter)	Size of each
20 & 25 ton	12	20 X 20 X 2	4	12 X 24 X 19	4/4	12 X 24 X 12	4/4	12 X 24 X 2
			3	24 X 24 X 19	3/3	24 X 24 X 12	3/3	24 X 24 X 2
30 ton	16	20 X 20 X 2	2	12 X 24 X 19	2/1	12 X 24 X 12	2/1	12 X 24 X 2
			6	24 X 24 X 19	6/6	24 X 24 X 12	6/6	24 X 24 X 2
40 ton	16	20 X 25 X 2	5	12 X 24 X 19	5/5	12 X 24 X 12	5/1	12 X 24 X 2
			6	24 X 24 X 19	6/6	24 X 24 X 12	6/6	24 X 24 X 2
50, 55 ton	20	20 X 25 X 2	3	12 X 24 X 19	3/2	12 X 24 X 12	3/2	12 X 24 X 2
			9	24 X 24 X 19	9/9	24 X 24 X 12	9/9	24 X 24 X 2
60, 70 & 75 ton	35	16 X 20 X 2	6	12 X 24 X 19	6/6	12 X 24 X 12	6/6	12 X 24 X 2
			8	24 X 24 X 19	8/8	24 X 24 X 12	8/8	24 X 24 X 2
90-130	25	24 X 24 X 2	3	12 X 24 X 19	3/5	12 X 24 X 12	3/5	20 X 24 X 2
			15	24 X 24 X 19	15/10	24 X 24 X 12	15/10	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) 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 80. “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 ton	WC Prima Flo (hot water)	2	13.75	80	110
40, 50, 55 ton	WC Prima Flo (hot water)	2	19.25	80	110
60, 70, 75 ton	WC Prima Flo (hot water)	2	26.25	80	110
40, 50 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 81. Grease recommendation

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

Tonnage	Evaporator Coil			Condenser Coil		
	Size (ft²)	Rows/Fin Series	Tube Diameter / Surface	Size (ft²)	Rows / Fin Series	Type
20 (All), 25 (Std)	20.3	4 / 168	1/2" / Enhanced	58	1 / 252	Microchannel
25 (High & eFlex)					2 / 252	Microchannel
30 (Std)	25.5	5 / 168	3/8" / Enhanced	58	1 / 252	Microchannel
30 (High & eFlex)					2 / 252	Microchannel
40 (All)	32.5	5 / 168	3/8" / Enhanced	116	1 / 252	Microchannel
50, 55 (Std)	38	4/ 168	1/2" / Enhanced	116	1 / 252	Microchannel
50, 55 (High & eFlex)					2 / 252	Microchannel
60, 70 (Std)	43	6 / 168	3/8" / Enhanced	136	1 / 252	Microchannel
60, 70 (High & eFlex), 75 (All)					2 / 252	Microchannel
90 (Std)	59.3	4 / 148	1/2" / Enhanced	152	2 / 276	Microchannel
90 (High)		6 / 148				Microchannel
105 (Std)	59.3	5 / 148	1/2" / Enhanced	152	2 / 276	Microchannel
115, 130 (Std)	59.3	6 / 148	1/2" / Enhanced	152	2 / 276	Microchannel

Fan Belt Adjustment

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

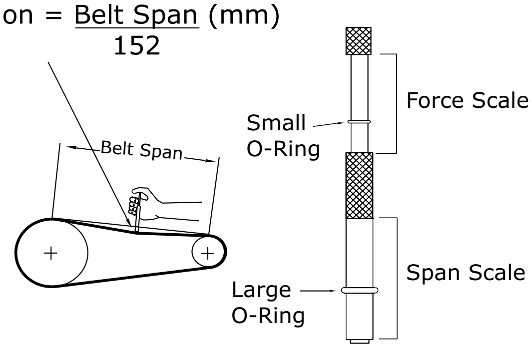
Replacement is necessary if the belts appear frayed or worn. Units with dual belts require a matched set of belts to ensure equal belt length. When installing new belts, do not stretch them over the sheaves; instead, loosen the adjustable motor-mounting base.

Once the new belts are installed, adjust the belt tension using a Browning or Gates tension gauge (or equivalent) illustrated in Figure 134, p. 182.

Figure 134. Typical belt tension gauge

$$\text{Deflection} = \frac{\text{Belt Span}}{64}\ \text{(in.)}$$

$$\text{Deflection} = \frac{\text{Belt Span}}{152}\ \text{(mm)}$$



⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

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 a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

1. To determine the appropriate belt deflection:
   a. Measure the center-to-center distance, in inches, between the fan sheave and the motor sheave.
   b. Divide the distance measured in Step 1a by 64; the resulting value represents the amount of belt deflection for the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in Step 1b.
3. Set the small O-ring at zero on the force scale of the gauge.
4. Place the large end of the gauge on the belt at the center of the belt span. Depress the gauge plunger until the large O-ring is even with the of the second belt or even with a straightedge placed across the sheaves.
5. Remove the tension gauge from the belt. Notice that

the small O-ring now indicates a value other than zero on the force scale. This value represents the force (in pounds) required to deflect the belt(s) the proper distance when properly adjusted.

6. Compare the force scale reading in step 5 with the appropriate “force” value in Table 82, p. 183. If the force reading is outside of the listed range for the type of belts used, either readjust the belt tension or contact a qualified service representative.

Note: *The actual belt deflection force must not exceed the maximum value shown in Table 82, p. 183 .*

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

Table 82. Belt tension measurements and deflection forces

Belts Cross Section	Small P.D Range	Deflection Force (Lbs.)									
		Super Gripbelts		Gripnotch		Steel Cable Gripbelts		358 Gripbelts		358 Gripnotch Belts	
		Min.	Max.	Min.	Max.	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	—	—	—	—
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

Scroll Compressor Replacement

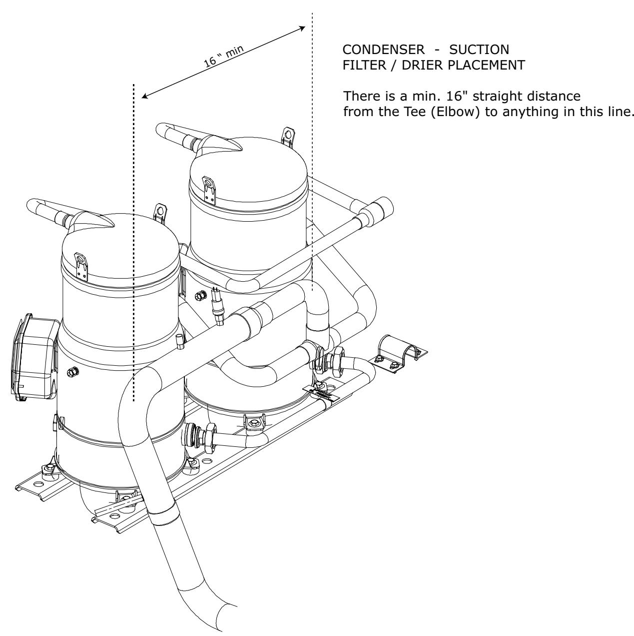
The compressor manifold system was purposely designed to provide proper oil return to each compressor. The refrigerant manifold system must not be modified in any way.

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 135, p. 183.

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).*

Figure 135. Suction line filter/drier installation



Refrigeration System

⚠ WARNING

R-454B Flammable A2L Refrigerant!

Failure to use proper equipment or components as described below could result in equipment failure, and possibly fire, which could result in death, serious injury, or equipment damage.

The equipment described in this manual uses R-454B refrigerant which is flammable (A2L). Use ONLY R-454B rated service equipment and components. For specific handling concerns with R-454B, contact your local representative.

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.

System contains 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.

Refrigerant Evacuation and Charging

NOTICE

Compressor Damage!

Failure to follow instructions below result in permanent damage to the compressor.

The unit is fully charged with R-454B 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.

The recommended method for evacuation and dehydration is to evacuate both the high side and the low side to 500 microns or less. To establish that the unit is leak-free, use a standing vacuum test. The maximum allowable rise over a 15 minute period is 200 microns. If the rise exceeds this, there is either still moisture in the system or a leak is present.

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-454B 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-454B refrigerant, it should be charged in the liquid state.*
- *The compressor should be off when the initial refrigerant recharge is performed.*
- *Charging to the liquid line is required prior to starting the compressor to minimize the potential damage to the compressor due to refrigerant in the compressor oil sump at startup.*
- *If suction line charging is needed to complete the charging process, only do so with the compressor operating. Do not charge liquid refrigerant into the suction line with the compressor off! This increases both the probability that the compressor will start with refrigerant in the compressor oil sump and the potential for compressor damage.*
- *Allow the crankcase heater to operate a minimum of 8 hours before starting the unit.*

Charge Storage

Because of 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.

Compressor Oil

Refer to “CSHE and CSHP Compressors,” p. 185 for the appropriate scroll compressor oil charge. Remove and measure oil from any compressor replaced. Adjust oil in replacement compressor to prevent excessive oil in system. Anytime a compressor is replaced, the oil for each compressor within the manifold must be replaced.

The scroll compressor uses Trane OIL00079 (one quart container) or OIL00080 (one gallon container) without substitution. Discoloration of the oil indicates that an abnormal condition has occurred. If the oil is dark and smells burnt, it has overheated because of the following:

- Compressor operating at extremely high condensing temperatures

- High superheat
- A compressor mechanical failure
- 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.

CSHE and CSHP Compressors

CSHE and CSHP compressors have an oil drain valve 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 136. PTFE gasket

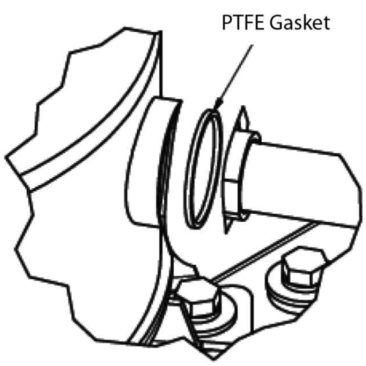


Figure 137. CSHE compressor

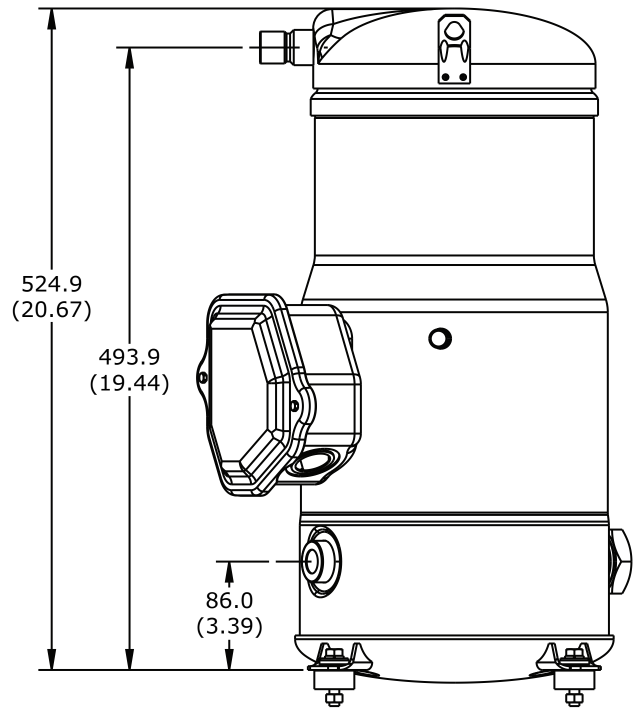
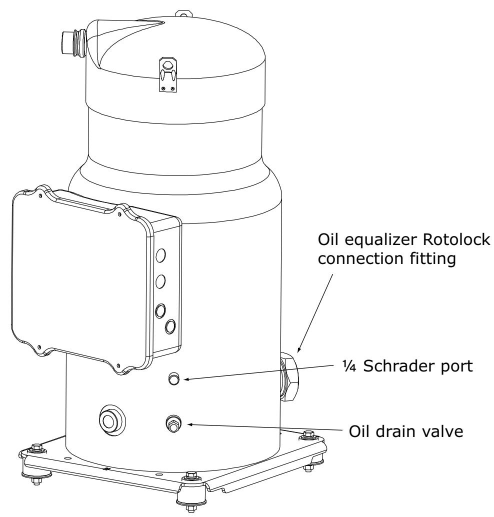


Figure 138. CSHP compressor



VZH Variable Speed Compressors

For oil removal and re-charging on VZH088* and VZH117* compressors, this will require that the oil be removed using a suction or pump device through the oil equalizer Rotolock fitting. Use a dedicated device for removing oil. It is good practice to flush the suction device with clean oil prior to use.

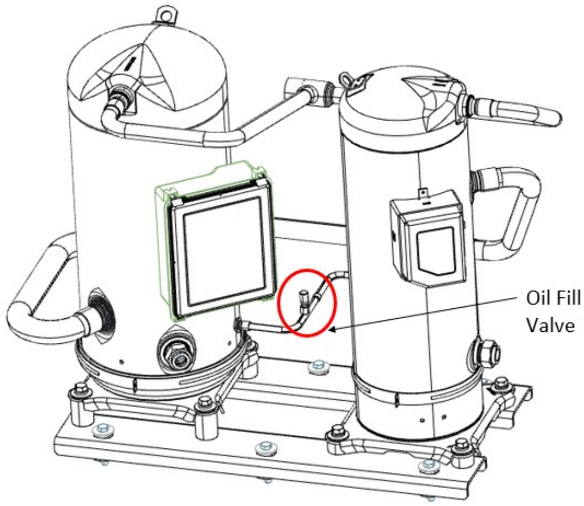
Place a catch pan under the oil equalizer Rotolock connection fitting on the compressor to catch the oil that will come out of the compressor when the oil equalizer tube is removed from the compressor.

ZPS 2-Stage Compressors

For 20 and 25 ton systems which use 2-stage unloading scrolls, please follow the same oil removal procedure for VZH088 and VZH117 compressors described in the section above.

For adding oil to these manifold sets, an oil refill port is located on the oil equalizer line, as shown in the figure below.

Figure 139. ZPS 2–stage 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 (Fig. 141). Torque Rotolock nut to the values listed in (Table 86).

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.

For oil removal and re-charging on VZH170* compressors, follow the same procedure described in “CSHE and CSHP Compressors,” p. 185

VZH variable speed compressors include the addition of an oil injection solenoid valve (2QM18) to provide supplemental oil flow from an internal gear pump to the scroll thrust bearing surface. The solenoid is de-energized at low compressor speeds to allow supplemental oil flow and ensure thrust surface lubrication. The solenoid is energized at high compressor speeds to stop supplemental lubrication. This prevents excessive oil circulation to the system. The solenoid is controlled by the inverter and switches at 3900 RPM for the VZH088, 3300 RPM for the VZH117, and 2700 RPM for the VZH170.

The 115 VAC solenoid coil operation can be checked on one of the solenoid leads with a clamp on amp meter. Above 3900 RPM (VZH088) /3300 RPM (VZH117) /2700 RPM (VZH170), the amp meter should read about 0.5 amps to indicate supplemental flow has been stopped.

Figure 140. Oil injection solenoid valve

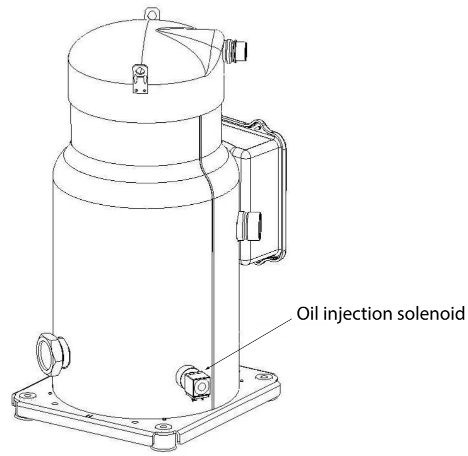


Table 83. Oil charge per compressor

Compressor	Pints
CSHE103	5.0
ZPS122, ZP104	5.3
ZP154-182	7.1
CSHE075-092	6.3
VZH170C	16.3
CSHE175-183	7..6
VZH088C	8
VZH117C	8.7
CSHP176-315	14.2
CSHE105-161	7
CSHP374	15.2

Table 84. Torque requirements for rotolock fittings

CSHE*, VZH088, and VZH117	64 +/- 12 ft-lbs
CSHP* and VZH170	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.

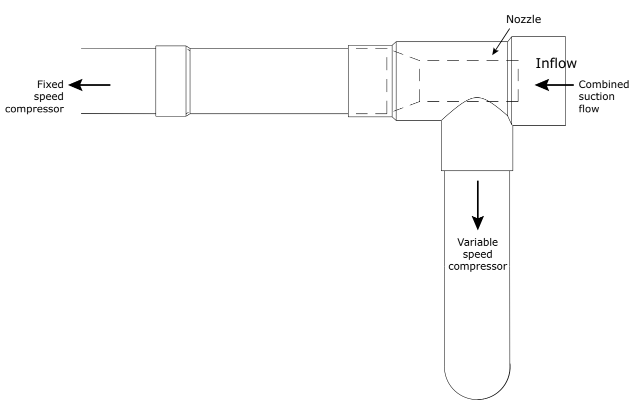
75 Ton eFlex™ Variable Speed Tandem

The 75 Ton eFlex™ variable speed compressor is manifolded with a CSHP fixed speed compressor. It uses a patented manifold design that is different from fixed speed tandems as follows:

1. The variable speed compressor is always first on and located upstream in the suction line in position 1B.
2. A nozzle in the suction tee, directly upstream of the manifold set, separates suction oil return to the upstream variable speed compressor. It also provides a sump pressure difference to move excess oil from the variable speed to the fixed speed compressor when both compressors are running. The nozzle is specifically sized for this variable speed manifold compressor combination and must not be removed.

   Suction restrictors are not used, and a smaller 3/8–inch OD oil equalizer line is used to help maintain the sump pressure differential.

Figure 141. eFlex variable speed tandem

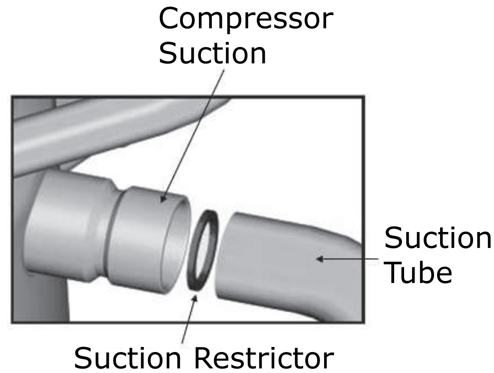


Precision Suction Restrictor

Tandem manifold compressors that have unequal capacity sizes use a precision suction restrictor to balance the oil levels in the compressors (see figure below). This restrictor is placed in the smaller capacity compressor. When replacing this compressor, it is imperative that the proper restrictor is selected from those provided with the replacement compressor.

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

Figure 142. Precision suction restrictor



VFD Programming Parameters (Supply/ Relief)

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.
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 a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

Units shipped with a variable frequency drive (VFD) are preset and run tested at the factory. If a problem with a VFD occurs, ensure that the programmed parameters have been set before replacing the drive.

Verify Parameters

Verify parameter 1-23 is set to 60 Hz (or 50 Hz where applicable) and that parameter 0-06 is set to the correct supply voltage/frequency range.

1. To check parameter 1-23 press the Main Menu button twice (if TR150 drive) (press the Back button if the main menu does not display)
2. Scroll down to Load & Motor, press OK
3. Select 1-2, press OK
4. Press down until parameter 1-23 is displayed. Parameter 1-23 can then be modified by pressing OK and pressing the Up and Down buttons.
5. When the desired selection has been made, press OK .

Should replacing the 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

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

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 a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

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

3. To modify parameters:
   a. Press Main Menu twice (if TR150 drive) (press Back if the main menu does not display)
   b. Use the Up and Down buttons to find the parameter menu group (first part of parameter number)
   c. Press OK
   d. Use the Up and Down buttons to select the correct parameter sub-group (first digit of second part of parameter number)
   e. Press OK
   f. Use the Up and Down buttons to select the specific parameter
   g. Press OK
   h. To move to a different digit within a parameter setting, use the Left and Right buttons (Highlighted area indicates digit selected for change)
   i. Use the Up and Down buttons to adjust the digit
   j. Press Cancel to disregard change, or press OK to accept change and enter the new setting
4. Repeat Step 3 for each menu selection setting in .
5. To reset all programming parameters back to the factory defaults:
   a. Go to parameter 14-22 Operation Mode
   b. Press OK
   c. Select Initialization
   d. Press OK
   e. Cut off the 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 will need to be verified or changed as described in Items 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 using parameter 0-50 LCP Copy (All to LCP to save all parameters to keypad and All from LCP to download all parameters into drive/replacement 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 "Relief Airflow Measurement" start-up procedures for the relief fan.
7. After verifying that the VFD(s) are operating properly, press the STOP key 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.

If a problem with a VFD occurs, ensure that the programmed parameters listed for supply and relief VFD have been set before replacing the drive.

Note: *Follow listed sequence when updating VFD parameters.*

Table 85. Supply fan VFD programming parameters

Menu	ID	Description	Parameter Setting
Operation Display	0-01	Language	[0] English US
	0-03	Regional Settings	[1] North American
	0-06	Grid Type	Set to applicable unit power supply [102] 200-240V/60HZ for 208, and 230V/60HZ units [122] 440-480V/60Hz for 460V/60Hz units [132] 525-600V/60Hz for 575V/60Hz units [12] 380-440V/50Hz for 380, and 415V/50Hz supply For IT Grid (no ground connections) or Corner grounded Delta power supply systems, the applicable voltage/ Hz and IT-Grid or Delta should be selected.
	0-40	[Hand on] - Key on LCP	[0] Disabled
Load and Motor	1-20	Motor Power [HP]	Per Motor Nameplate HP
	1-22	Motor Voltage (V)	Per Motor Nameplate Voltage
	1-23	Motor Frequency (HZ)	Per Motor Nameplate Frequency
	1-24	Motor Current (A)	Per Motor Nameplate FLA
	1-25	Motor Nominal Speed (RPM)	Per Motor Nameplate Rated Speed
	1-73	Flying Start	[1] Enabled
	1-90	Motor Thermal Protection	[4] ETR Trip1
Brakes	2-00	DC Hold / Preheat Current (%)	[0] 0%
	2-01	DC Brake Current (%)	[0] 0%
	2-04	DC Brake Cut In Speed (HZ)	[10] 10Hz
Reference / Ramps	3-02	Minimum Reference (HZ)	Per Unit Nameplate - Evap Fan VFD Min Hz
	3-03	Maximun Reference (HZ)	Per Unit Nameplate - Evap Fan VFD Max Hz
	3-15	Reference 1 Source	[11] Local bus reference
	3-16	Reference 2 Source	[0] No function
	3-17	Reference 3 Source	[0] No function
	3-41	Ramp 1 Ramp Up Time (S)	[30] 30s
	3-42	Ramp 1 Ramp Down Time (S)	[30] 30s
Limits / Warnings	4-12	Motor Speed Low Limit [HZ]	[22] 22 Hz for FC fans (Digit 14=1, 2, 3, 4, 5, 6, 7, 8, 9, A) [15] 15 Hz for DDP Fan (Digit 14=B through Z)
	4-14	Motor Speed High Limit (Hz)	See Table 1 below for value
	4-18	Current Limit (%)	[100] 100%
	4-19	Max Output Frequency (HZ)	[60] 60 Hz for FC Fan (Digit 14= 1, 2, 3, 4, 5, 6, 7, 8, 9, A) [120] 120 Hz for DDP Fan (Digit=14 B through Z)

Table 85. Supply fan VFD programming parameters (continued)

Menu	ID	Description	Parameter Setting
Digital In / Out	5-10	Terminal 18 Digital Input	[0] No Operation
	5-12	Terminal 27 Digital Input	[0] No Operation for FC, single or dual DDP Units w/ Bypass (Digit 17=7, 9, B, D) [2] Coast Inverse for dual DDP Units w/o Bypass (Digit 14= H, J, K, L, M, N, T, V, W, X, Y, Z, & Digit 17= 6, 8, A, C)
	5-13	Terminal 29 Digital Input	[0] No Operation
Communica-tions and Options	8-30	Protocol	[2] Modbus RTU
	8-31	Address	Set address per unit component location diagram [7] for 6TB1 [8] for 6TB2
	8-32	Baud Rate	[7] 115200 Baud
	8-33	Parity / Stop Bits	[0] Even Parity, 1 Stop Bits
	8-35	Minimum Response Delay (s)	[0.005] 5ms Min Response Delay Time
	8-36	Maximum Response Delay (s)	[0.1] 100ms Max Response Delay Time
	8-01	Control Site	[0] Ctl. Word and digital for Dual DDP Units w/o Bypass (Digit 14= H, J, K, L, M,N, T, V, W, X, Y, Z & Digit 17= 6, 8, A, C) [2] Controlword onlly for FC, Single, or Dual DDP Units w/ Bypass
	8-03	Control Timeout Time (s)	[15] 15s
	8-04	Control Timeout Function	[2] Stop
Special Function	14-01	Switching Frequency (kHz)	[5] 5.0 KHz
	14-11	Mains Voltage Fault level	Set based on motor nameplate voltage [177] for 208V motor [196] for 230V motor [323] for 380V motor [353] for 415V motor [391] for 460V motor [489] for 575V motor
	14-12	Function at Main Imbalance	[3] Derate
	14-20	Reset Mode	[5] Automatic reset x 5
	14-50	RFI Filter	[0] Off
	14-61	Function at Inverter Overload	[1] Derate
Application Functions	22-60	Broken Belt Function	[2] Trip for FC Fans (Digit 14=1, 2, 3, 4, 5, 6, 7, 8, 9, A) [0] Disabled for DDP Fans (Digit 14=B through Z)
	22-61	Broken Belt Torque (%)	[10] 10%
	22-62	Broken Belt Delay (s)	[60] 60 Seconds

Table 86. Value for parameter 4–14 (Motor Speed High Limit)

<table>
<tr><th colspan="5">DDP Fans - (Digit # 14 = B thru H, J thru N, P, R, T thru Z)</th></tr>
<tr><td rowspan="2">Digit # 5,6,7 (Unit Tonnage)</td><td colspan="2">Digit # 2 = A, X</td><td colspan="2">Digit # 2 = F</td></tr>
<tr><td>(4 Pole)</td><td>(6 Pole)</td><td>(4 Pole)</td><td>(6 Pole)</td></tr>
<tr><td>20,25</td><td>81</td><td rowspan="6">83</td><td>75</td><td rowspan="6">83</td></tr>
<tr><td>30</td><td>75</td><td>67</td></tr>
<tr><td>40</td><td>67</td><td>61</td></tr>
<tr><td>50-55</td><td>61</td><td>61</td></tr>
<tr><td>60</td><td>75</td><td>61</td></tr>
<tr><td>70-75</td><td>67</td><td>61</td></tr>
<tr><td colspan="5">FC Fans - (Digit #14= 1 thru 9, A)</td></tr>
<tr><td>20 - 75</td><td colspan="4">60</td></tr>
<tr><td colspan="5">FC Fans - (Digit #14= C thru G)</td></tr>
<tr><td>90 - 130</td><td colspan="4">60</td></tr>
</table>

Table 87. Relief/return fan VFD parameters

Menu	ID	Description	Parameter Setting
Operation Display	0-01	Language	[0] English US
	0-03	Regional Settings	[1] North American
	0-06	Grid Type	Set to applicable unit power supply [102] 200-240V/60Hz for 208 & 230V/60Hz units [122] 440-480V/60Hz for 460V/60Hz units [132] 525-600V/60Hz for 575V/60Hz units [12] 380-440v/50Hz for 380 & 415V/50Hz supply For IT Grid (no ground connections) or Corner grounded Delta power supply systems, the applicable voltage/Hz and IT-Grid or Delta should be selected.
	0-40	[Hand on] - Key on LCP	[0] Disabled
Load and Motor	1-20	Motor Power (KW/HP)	Per Motor Nameplate HP - KW
	1-22	Motor Voltage (V)	Per Motor Nameplate Voltage
	1-23	Motor Frequency (HZ)	Per Motor Nameplate Frequency
	1-24	Motor Current (A)	Per Motor Nameplate FLA
	1-25	Motor Nominal Speed (RPM)	Per Motor Nameplate Rated Speed
	1-73	Flying Start	[1] Enabled
	1-90	Motor Thermal Protection	[4] ETR Trip1
Brakes	2-00	DC Hold / Preheat Current (%)	[0] 0%
	2-01	DC Brake Current (%)	[0] 0%
	2-04	DC Brake Cut In Speed	[10] 10 Hz

Table 87. Relief/return fan VFD parameters (continued)

Menu	ID	Description	Parameter Setting
Reference / Ramps	3-02	Minimum Reference (HZ)	[22] 22 Hz
	3-03	Maximum Reference (HZ)	[60] 60 Hz
	3-15	Reference 1 Source	[11] Local bus reference
	3-16	Reference 2 Source	[0] No function
	3-17	Reference 3 Source	[0] No function
	3-41	Ramp 1 Ramp up Time (S)	[30] 30s
	3-42	Ramp 1 Ramp down Time (S)	[30] 30s
Limits / Warnings	4-10	Motor Speed Direction	[0] Clockwise
	4-12	Motor Speed Low Limit [HZ]	[22] 22 Hz
	4-14	Motor Speed High Limit (Hz)	[60] 60 Hz
	4-18	Current Limit (%)	[100] 100%
	4-19	Max Output Frequency (Hz)	[60] 60 Hz
Digital In / Out	5-10	Terminal 18 Digital Input	[0] No Operation
	5-12	Terminal 27 Digital Input	[0] No Operation
	5-13	Terminal 29 Digital Input	[0] No Operation
Communications and Operations	8-30	Protocol	[2] Modbus RTU
	8-31	Address	[9] = 20T-75T & Unit Model Digit 11= 3, 4, 5, 6, 7, 8 [12] = 20T-75T & Unit Model Digit 11= 9, M, N, P, R, T [9] = 90T-130T
	8-32	Baud Rate	[7] 115200 Baud
	8-33	Parity / Stop Bits	[0] Even Parity,1 Stop Bits
	8-35	Minimum Response Delay (s)	[0.005] 5ms Min Response Delay Time
	8-36	Maximum Response Delay (s)	[0.1] 100ms Max Response Delay Time
	8-01	Control Site	[2] Controlword only
	8-03	Control Timeout Time (s)	[15] 15s
	8-04	Control Timeout Function	[2] Stop

Table 87. Relief/return fan VFD parameters (continued)

Menu	ID	Description	Parameter Setting
Special Function	14-01	Switching Frequency (kHz)	[5] 5.0 kHz
	14-11	Mains Voltage Fault level (V)	Set based on motor nameplate voltage [177] for 208V motor [196] for 230V motor [323] for 380V motor [353] for 415V motor [391] for 460V motor [489] for 575V motor
	14-12	Function at Main Imbalance	[3] Derate
	14-20	Reset Mode	[3] Automatic reset x 3
	14-50	RFI Filter	[0] Off
	14-61	Function at Inverter Overload	[1] Derate
Application Functions	22-60	Broken Belt Function	[2] Trip
	22-61	Broken Belt Torque (%)	[10] 10%
	22-62	Broken Belt Delay (s)	[60] 60 Seconds

Note: *Follow listed sequence when updating VFD parameters*

Table 88. Condenser fan VFD parameters

Menu	ID	Descriptions	Parameter Setting
Operation display	0-01	Language	[0] English US
	0-03	Regional Settings	[1] North American
	0-06	Grid Type	Set to applicable unit power supply [122] 440-480V/60Hz for 460V/60Hz units [132] 525-600V/60Hz for 575V/60Hz units For IT Grid (no ground connections) or Corner grounded Delta power supply systems, the applicable voltage/Hz and IT-Grid or Delta should be selected.
	0-40	[Hand on] - Key on LCP	[0] Disabled
Load and motor	1-20	Motor Power (KW/HP)	Per Motor Nameplate KW- HP
	1-22	Motor Voltage (V)	Per Motor Nameplate Voltage
	1-23	Motor Frequency (HZ)	Per Motor Nameplate Frequency
	1-24	Motor Current (A)	Per Motor Nameplate FLA
	1-25	Motor Nominal Speed (RPM)	Per Motor Nameplate RPM
	1-73	Flying Start	[1] Enabled
	1-90	Motor Thermal Protection	[4] ETR Trip1
Brakes	2-00	DC Hold / Preheat Current (%)	[0] 0%
	2-01	DC Brake Current (%)	[0] 0%
	2-04	DC Brake Cut in Speed	[10] 10 Hz

Table 88. Condenser fan VFD parameters (continued)

Menu	ID	Descriptions	Parameter Setting
Refer-ence / Ramps	3-02	Minimum Reference (HZ)	[6] 6Hz
	3-03	Maximum Reference (HZ)	[60] 60Hz
	3-15	Reference 1 Source	[11] Local bus reference
	3-16	Reference 2 Source	[0] No function
	3-17	Reference 3 Source	[0] No function
	3-41	Ramp 1 Ramp up Time (S)	[10] 10s
	3-42	Ramp 1 Ramp down Time (S)	[10] 10s
Limits / Warnings	4-12	Motor Speed Low Limit [HZ]	[6] 6Hz
	4-14	Motor Speed High Limit (Hz)	[60] 60Hz
	4-18	Current Limit (%)	[100] 100% for 1HP Motor
	4-19	Max Output Frequency (Hz)	[60] 60Hz
Digital	5-10	Terminal 18 Digital Input	[0] No Operation
	5-12	Terminal 27 Digital Input	[0] No Operation
	5-13	Terminal 29 Digital Input	[0] No Operation
Commu-nications and Opera-tions	8-30	Protocol	[2] Modbus RTU
	8-31	Address	Set address per unit component location diagram [5] for 1A (REFDES 2M6) [6] for 2A (REFDES 2M9)
	8-32	Baud Rate	[7] 115200 Baud
	8-33	Parity / Stop Bits	[0] Even Parity,1 Stop Bits
	8-35	Minimum Response Delay (s)	[0.005] 5ms Min Response Delay Time
	8-36	Maximum Response Delay (s)	[0.1] 100ms Max Response Delay Time
	8-01	Control Site	[2] Controlword only
	8-03	Control Timeout Time (s)	[15] 15s
	8-04	Control Timeout Function	[2] Stop
Special Functions	14-01	Switching Frequency (kHz)	[5] 5.0 kHz
	14-11	Mains Voltage Fault level (V)	Set based on motor nameplate voltage [391] for 460V motor [489] for 575V motor
	14-12	Function at Main Imbalance	[3] Derate
	14-20	Reset Mode	[3] Automatic reset x 3
	14-50	RFI Filter	[0] Off
	14-61	Function at Inverter Overload	[1] Derate

eFlex™ Compressor VFD Programming Parameters

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

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 a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

A factory-shipped TRV200 should not be modified in the field. It is specifically matched to the compressor.

Should replacing a VFD become necessary, refer to Table 89, p. 195. All other parameters will be appropriately set in field replacement VFDs. Do not use any other type or brand of VFD when replacing the VFD.

Note: *Failure to set parameter 4-18 Current Limit on a field replacement VFD will not allow the compressor to start and result in A18 Start Failed or A49 Speed Limit on the VFD.*

To verify and/or set parameters in the Compressor VFD:

1. Press **Quick Menu**.
2. Press **My Personal Menu**.
3. Navigate through the options using the **Up** and **Down** arrows to parameter.
4. Adjust the value as shown in .
5. Press [OK].

Note: *Parameter '4-18 Current Limit' for field installed TRV200 drives must be set according to the table for proper operation and to meet overload protection requirements. Replacement drive will not run the compressor until set properly. Factory installed drives are programmed properly for unit operation. Parameter 4-18 is available via the quick menu.*

Table 89. Compressor VFD programming parameter 4-18

Unit Tonnage	Unit Voltage			
	200V	230V	460V	575V
20	99%	90%	86%	84%
25	109%	99%	94%	92%
30	103%	96%	92%	90%
40				
50	110%	107%	96%	94%
55				
60	110%	110%	99%	97%
70				
75				

Monthly Maintenance

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

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 a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

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

Filters

Inspect the return air and final filters. Clean or replace them if necessary. Refer to the Service and Maintenance chapter for filter information.

Cooling Season

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

- ☐ Check the unit's drain pans and condensate piping to ensure that there are no blockages.
- ☐ Inspect the evaporator and condenser coils for dirt, bent fins, etc. If the coils appear dirty, clean them according to the instructions described in "Coil Cleaning" later in this section.
- ☐ Inspect the F/A-R/A damper hinges and pins to ensure that all moving parts are securely mounted. Keep the blades clean as necessary.

⚠ WARNING

Rotating Components!

Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

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.

- ☐ 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.
- ☐ 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. If the unit model number indicates that the motor has an internal shaft ground, replace with the same motor type.
- ☐ Check the fan shaft bearings for wear (FC fans only). Replace the bearings as necessary. Lubricate the supply fan shaft bearings with a lithium-based grease.

  Note: *These bearings are considered permanently lubricated for normal operation. For severe dirty applications, if relubrication becomes necessary, use a lithium based grease. See* *Table 81, p. 181* *for recommended greases.*

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

- ☐ Use a hand grease gun to lubricate these bearings (FC fans only); add grease until a light bead appears all around the seal. Do not over lubricate! After greasing the bearings (FC fans only), check the setscrews to ensure that the shaft is held securely to the bearings and fan wheels. Make sure that all bearing braces are tight.
- ☐ Check the supply fan belt(s). If the belts are frayed or worn, replace them. Refer to the "Fan Belt Adjustment," p. 182 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 following:
  - 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 91, p. 200. If the operating pressures indicate a refrigerant shortage, measure the system superheat and system subcooling. For guidelines, refer to "Charging by Subcooling ," p. 162.

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

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

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

- ☐ Inspect the unit air filters. If necessary, clean or replace them.
- ☐ Check supply fan motor bearings; repair or replace the motor as necessary. If the unit model number indicates that the motor has an internal shaft ground, replace with the same motor type.
- ☐ Check the fan shaft bearings for wear. Replace the bearings as necessary. Lubricate the supply fan shaft bearings with a lithium-based grease.

  Note: *These bearing are considered permanently lubricated for normal operation. For severe dirty applications, if relubrication becomes necessary, use a lithium based grease. See Table 81, p. 181 for recommended greases.*

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

- ☐ Use a hand grease gun to lubricate these bearings; add grease until a light bead appears all around the seal. Do not over lubricate!
- ☐ After greasing the bearings, check the setscrews to ensure that the shaft is held securely. Make sure that all bearing braces are tight.
- ☐ 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 units only - Check the heat exchanger(s) for any corrosion, cracks, or holes.
- ☐ Gas units only - Check the combustion air blower for dirt or blockage from animals or insects. 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 back of the heat exchanger to access the drum. Be sure to replace the existing gaskets with new ones before reinstalling the inspection plate.*

- ☐ Check gas piping for leaks.
- ☐ Gas units only - Open the main gas valve and apply power to the unit heating section; then initiate a "Heat" test using the startup procedure described in "Gas Furnace Startup," p. 164.

⚠ WARNING

Hazardous Gases and Flammable Vapors!

Failure to observe the following instructions could result in exposure to hazardous gases, fuel substances, or substances from incomplete combustion, which could result in death or serious injury. The state of California has determined that these substances may cause cancer, birth defects, or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures or lead to excessive carbon monoxide. To avoid hazardous gases and flammable vapors follow proper installation and setup of this product and all warnings as provided in this manual.

Coil Cleaning

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

- Compressor head pressure and amperage draw
- Water carryover
- Fan brake horsepower
- 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.

⚠ WARNING

Hazardous Chemicals!

Failure to follow this safety precaution could result in death or serious injury. Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin or eyes occurs.
Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer’s Materials Safety Data Sheet and follow all recommended safe handling practices.

Refrigerant 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.
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.

Steam or Hot Water Coils

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

1. Verify that switches 1S1 and 1S70 are turned “OFF”, and that the main unit disconnect is locked open.

⚠ WARNING

No Step Surface!

Failure to follow instruction below could result in death or serious injury.
Do not walk on the sheet metal drain pan. Walking on the drain pan could cause the supporting metal to collapse and result in the operator/technician falling.

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 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.

Microchannel Condenser Coil Repair and Replacement

If microchannel condenser coil repair or replacement is required, refer to *Unitary Light and Large Commercial Units – General Service Bulletin* (RT-SVB83*-EN) for further details.

Fall Restraint

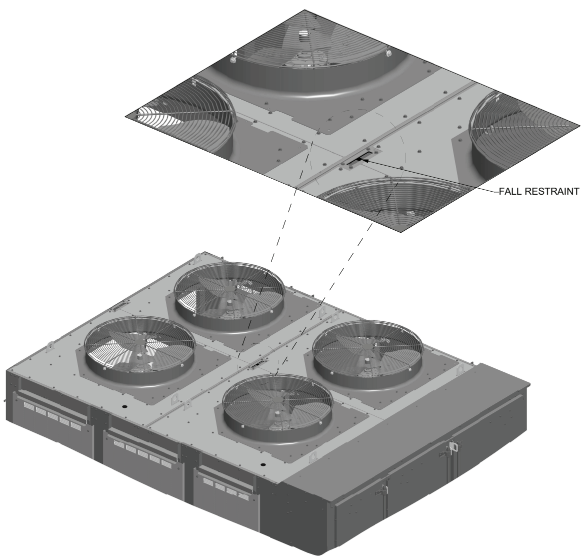
⚠ WARNING

Falling Off Equipment!

Failure to follow instructions below could result in death or serious injury.
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, as they are NOT designed to withstand the force of a falling individual.

The fall restraint is located approximately 3 feet from the unit edge.

Figure 143. Fall restraint



Final Process

Record the unit data in the blanks provided.

Table 90. Unit data log

Complete Unit Model Number:	
Unit Serial Number:	
Unit “DL” Number (“design special” units only):	
Wiring Diagram Numbers (from unit control panel):	
-schematic(s)	
-connections	
Network ID (LCI/BCI):	

Table 91. Sample maintenance log

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

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 92. Wiring diagram matrix

Diagram Number	Name
12134353	POWER SCHEMATIC; 20-75T AIRFLOW, WITH BYPASS
12134354	POWER SCHEMATIC; 20-75T AIRFLOW, WITHOUT BYPASS
12134355	POWER SCHEMATIC; 90-130T AIRFLOW, WITH BYPASS
12134356	POWER SCHEMATIC; 90-130T AIRFLOW, WITHOUT BYPASS
12134357	POWER SCHEMATIC; 20-75T REF POWER, IND MOTORS, STD AMBIENT
12134358	POWER SCHEMATIC; 20-75T REF POWER, IND MOTORS, LOW AMBIENT
12134359	POWER SCHEMATIC; 20-75T REF POWER, EC MOTORS
12134360	POWER SCHEMATIC; 90-130T REF POWER, STD AMBIENT
12134361	POWER SCHEMATIC; 90-130T REF POWER, LOW AMBIENT
12134929	CONTROLS SCHEMATIC; 20-130T UNIT CONTROLS
12134363	CONTROLS SCHEMATIC; 20-75T CUSTOMER CONNECTIONS #1
12134364	CONTROLS SCHEMATIC; 90-130T CUSTOMER CONNECTIONS #1
12134365	CONTROLS SCHEMATIC; 20-130T CUSTOMER CONNECTIONS #2
12134930	CONTROLS SCHEMATIC; 20-75T REF SYSTEM #1, IND MOTORS
12134931	CONTROLS SCHEMATIC; 20-75T REF SYSTEM #1, EC MOTORS
12134368	CONTROLS SCHEMATIC; 90-130T REF SYSTEM #1
12134369	CONTROLS SCHEMATIC; 20-75T REF SYSTEM #2
12134370	CONTROLS SCHEMATIC; 90-130T REF SYSTEM #2
12134932	CONTROLS SCHEMATIC; 20-130T AIR HANDLER CONTROLS #1
12134372	CONTROLS SCHEMATIC; 20-130T AIR HANDLER CONTROLS #2
12134373	CONTROLS SCHEMATIC; 20-130T AIR HANDLER CONTROLS #3
12134374	CONTROLS SCHEMATIC; 20-75T AIR HANDLER CONTROLS #4
12134375	CONTROLS SCHEMATIC; 90-130T AIR HANDLER CONTROLS #4
12134376	SCHEMATIC; GAS HEAT, ULTRA-MOD
12134377	SCHEMATIC; GAS HEAT, MODULATING
12134378	SCHEMATIC; GAS HEAT, 2 STAGE
12134379	SCHEMATIC; ELECTRIC HEAT, 7 CIRCUIT
12134380	SCHEMATIC; ELECTRIC HEAT, 6 CIRCUIT
12134381	SCHEMATIC; ELECTRIC HEAT, 3 CIRCUIT
12134382	SCHEMATIC; HYDRONIC HEAT

Table 92. Wiring diagram matrix (continued)

Diagram Number	Name
12134933	COMPONENT LAYOUT; 20-75T UNIT DEVICE LOCATIONS
12134934	COMPONENT LAYOUT; 90-130T UNIT DEVICE LOCATIONS
12134385	COMPONENT LAYOUT; 20-75T MAIN C-BOX / LOW VOLTAGE PANEL
12134386	COMPONENT LAYOUT; 90-130T MAIN C-BOX / AUX C-BOX
12134387	COMPONENT LAYOUT; 20-75T MAIN C-BOX FUSE REPLACEMENT TABLES
12134388	COMPONENT LAYOUT; 90-130T MAIN C-BOX FUSE REPLACEMENT TABLES
12134389	COMPONENT LAYOUT; 20-75T VFD SECTION PANELS
12134390	COMPONENT LAYOUT; 90-130T VFD SECTION PANELS
12134391	COMPONENT LAYOUT; 20-75T GAS HEAT, ULTRA-MOD
12134392	COMPONENT LAYOUT; 20-75T GAS HEAT, MODULATING AND 2 STAGE
12134393	COMPONENT LAYOUT; 20-75T ELECTRIC HEAT
12134394	COMPONENT LAYOUT; 20-75T HYDRONIC HEAT
12134395	COMPONENT LAYOUT; 90-130T GAS HEAT, ULTRA-MOD
12134396	COMPONENT LAYOUT; 90-130T GAS HEAT, MODULATING AND 2 STAGE
12134397	COMPONENT LAYOUT; 90-130T ELECTRIC HEAT

Modbus Addressing Tool and Modbus Addresses

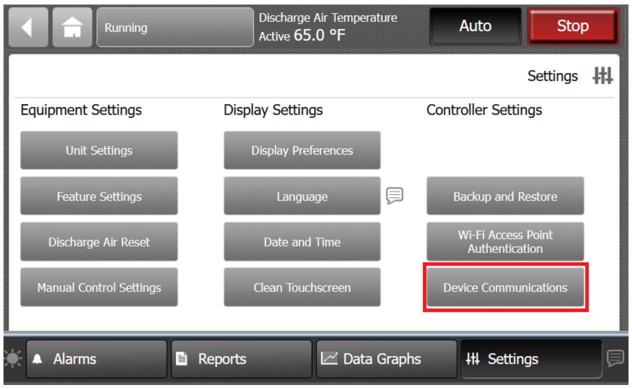
Modbus Device Addressing

Modbus Device Addressing allows the user to set and clear the address of Modbus devices via the user interface.

To set the Modbus Device Address:

1. Press the **Device Communications** button.

Figure 144. Settings — Device Communications



2. Press the **Modbus Device Addressing** button.

Figure 145. Device Communications — Modbus Device Addressing

3. Press the **Set Address** button. If the Modbus address is set, a pop-up indicates the Modbus address was set successfully. If the Modbus address was not set, a pop up alerts the user of the failure condition.

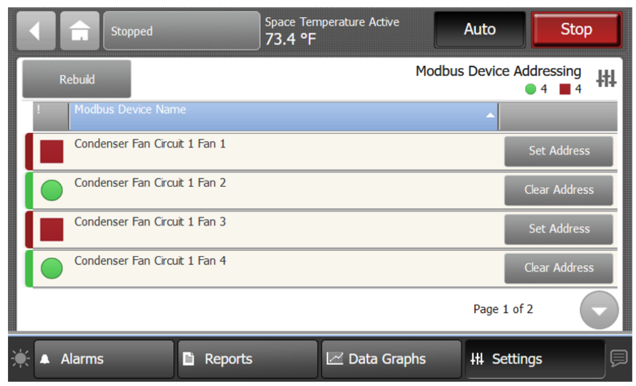
To clear the Modbus device address:

Press the **Clear Address** button. If the Modbus address is cleared, a pop-up will indicate the Modbus address was cleared successfully. If the Modbus address could not be cleared, a pop-up will alert the user of the failure condition.

To rebuild the list of Modbus devices:

Press the **Rebuild** button.

Figure 146. Modbus Device Addressing — Rebuild



Modbus Addresses

Modbus Device	Modbus Address Tool Display Name	RTU Address
Compressor 1A	Not Applicable	3
Condenser Fan 1 (90-130T only)	Not Applicable	5
Condenser Fan 2 (90-130T only)	Not Applicable	6
Supply Fan 1	Not Applicable	7
Supply Fan 2	Not Applicable	8
Relief Fan	Not Applicable	9
Return Fan	Not Applicable	12
Power Meter	Not Applicable	15

Modbus Device	Modbus Address Tool Display Name	RTU Address
Power Meter 2	Not Applicable	16
Midco Gas Heat	Not Applicable	23
EC Condenser Fan 1A Type 1	Condenser Fan 1A	31
EC Condenser Fan 1B Type 1	Condenser Fan 1B	32
EC Condenser Fan 1C Type 1	Condenser Fan 1C	33
EC Condenser Fan 1D Type 1	Condenser Fan 1D	34
EC Condenser Fan 2A Type 1	Condenser Fan 2A	40
EC Condenser Fan 2B Type 1	Condenser Fan 2B	41
EC Condenser Fan 2C Type 1	Condenser Fan 2C	42
EC Condenser Fan 2D Type 1	Condenser Fan 2D	43
Refrigerant Leak Detector A	Refrigerant Leak Sensor A	51
Refrigerant Leak Detector B	Refrigerant Leak Sensor B	52
Refrigerant Leak Detector C	Refrigerant Leak Sensor C	53
Refrigerant Leak Detector D	Refrigerant Leak Sensor D	54
EC Condenser Fan 1A Type 2	Condenser Fan 1A	60
EC Condenser Fan 1B Type 2	Condenser Fan 1B	61
EC Condenser Fan 1C Type 2	Condenser Fan 1C	62
EC Condenser Fan 1D Type 2	Condenser Fan 1D	63
EC Condenser Fan 2A Type 2	Condenser Fan 2A	70
EC Condenser Fan 2B Type 2	Condenser Fan 2B	71
EC Condenser Fan 2C Type 2	Condenser Fan 2C	72
EC Condenser Fan 2D Type 2	Condenser Fan 2D	73

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Warranty and Liability Clause

COMMERCIAL EQUIPMENT - 20 TONS AND LARGER AND RELATED ACCESSORIES

PRODUCTS COVERED - This warranty* is extended by Trane Inc. and applies only to commercial equipment rated 20 Tons and larger and related accessories.

The Company warrants for a period of 12 months from initial startup or 18 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion or deterioration. The Company's obligations and liabilities under this warranty are limited to furnishing f.o.b. factory or warehouse at Company designated shipping point, freight allowed to Buyer's city (or port of export for shipment outside the conterminous United States) replacement equipment (or at the option of the Company parts therefore) for all Company products not conforming to this warranty and which have been returned to the manufacturer. The Company shall not be obligated to pay for the cost of lost refrigerant. No liability whatever shall attach to the Company until said products have been paid for and then said liability shall be limited to the purchase price of the equipment shown to be defective.

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.

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*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.

*A 5 year limited warranty is provided for optional "AMCA 1A Ultra Low Leak" airfoil blade economizer assemblies and the "AMCA 1A Ultra Low Leak" economizer actuator.

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