Installation, Operation, and Maintenance

Commercial Self-Contained Units SWUD

R-454B – 20 to 110 Tons

SWUD – 20 to 110 Tons

⚠ 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.

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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.

Copyright

Trademarks

Agency Listing

Unit is listed with ETL as a modular/cassette product and ships as such. Individual assemblies are tested and meet the requirements as such, but is not tested as a completed unit.

Important: *Installer is responsible for proper installation and for properly following assembly instructions found in this IOM.*

Table of Contents

Overview

Note: *One copy of this document ships inside the control panel of each unit and is customer property. It must be retained by the unit maintenance personnel.*

This manual describes proper installation, operation, and maintenance procedures for water cooled systems. By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized. It is important that periodic maintenance be performed to help support trouble free operation. A maintenance schedule is provided at the end of this manual. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

R-454B Compressors

- Use crankcase heaters which must be energized 24 hours prior to compressor start.

  Note: *This unit is equipped with stator heating capabilities that eliminates the need for a crankcase heater on the variable speed compressor only. All fixed speeds must utilize a crankcase heater.*

- Contains POE oil which readily absorbs potentially damaging moisture from air.
- Control box includes a phase monitor to detect phase loss, line voltage imbalance, and reversal.

SWUD Components

SWUDs are complete HVAC systems used in floor-by-floor applications.

- A single piece cabinet design to target new constructions.
- Left hand power connections.
- Left or right hand water connections.
- Factory installed options.

The hermetically sealed scroll compressor motors utilize internal motor protection and time delays to prevent excessive cycling.

Units utilize two refrigerant circuits and ship with a R-454B charge and full oil charge. Each circuit includes filter drier, pressure relief valve, moisture indicating sight glass, thermostatic expansion valve with sensing bulb and externally equalized, and high pressure cutout. The water cooled condensers are shell and tube. It is recommended to clean the condenser mechanically, but the condenser can be cleaned chemically.

Fan array consists of 1-7 direct drive plenum fans with each fan equipped with ECM motors.

Figure 1. SWUD components

Standard Controls

Standard controls supplied with the unit include Symbio™ 500 unit controls and the TD-7 touch screen display. All basic setup parameters are preset from the factory.

TD-7 Touch Screen Display

- TD-7 is unit mounted and accessible without opening the unit front panel.
- Use the TD-7 touch screen for easy setpoint adjustment.
- The TD-7 displays all unit operating parameters and conditions in a backlit color screen.

Symbio 500 Unit Controller

The Symbio™ 500 provides smart unit control with safety features and control relays for external devices. The Symbio 500 utilizes BACnet® MSTP to communicate to a front end Building Automation System (BAS).

The SWUD self-contained unit is controlled by a microelectronic programmable control system programmed from the factory specifically for the application. If additional input or output points are needed, expansion modules can be used.

For more detailed information on the control points provided, see the Owners section of this manual.

Optional Controls

Optional controls include a disconnect switch, dirty filter switch, water flow switch, supply air temperature reset, or external setpoint inputs. Morning warm-up operation is available on all units with heat or with downstream VAV boxes with heat.

Note: *A water flow switch is required for the installation, either supplied from the factory or field-provided.*

The static pressure probe, supply air temperature reset sensor options ship separate, but with the unit for field

installation. For more detailed unit control options, see the Owners section of this manual.

Unit Nameplate

The unit nameplate identifies the unit model number. It is located on the door of the starter panel.

Model Number Description

Digit 1, 2, 3, 4 — Unit Model

SWUD = Self-Contained Water-Cooled Unitary Device

Digit 5 — Refrigerant

5 = R-454B

Digit 6, 7, 8 — Capacity

020 = 20 Tons
025 = 25 Tons
030 = 30 Tons
035 = 35 Tons
040 = 40 Tons
045 = 45 Tons
050 = 50 Tons
055 = 55 Tons
060 = 60 Tons
065 = 65 Tons
070 = 70 Tons
075 = 75 Tons
085 = 85 Tons
090 = 90 Tons
100 = 100 Tons
110 = 110 Tons

Digit 9 — Unit Voltage

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

Digit 10, 11 — Design Sequence

**

Digit 12 — Fan Type

1 = 1 Fan
2 = 2 Fans
3 = 3 Fans
4 = 4 Fans
5 = 5 Fans
6 = 6 Fans
7 = 7 Fans

Digit 13 — Compressor Technology

F = Fixed Speed

Digit 14 — Control Valves

0 = None
H = Head Pressure Control Valves

Digit 15 — Future Use

0 = None

Digit 16 — Economizer

0 = No Economizer
W = With Water Side Economizer
H = 2-position Damper Ventilation Interface
J = Airside Economizer Interface
K = Airside Economizer Interface W/Comparative Enthalpy

Digit 17 — Water Connections

L = Left Hand Connections with Flow Switch
R = Right Hand Connections with Flow Switch

Digit 18 — Unit Water Connections

1 = Victaulic

Digit 19 — Air Discharge

H = Horizontal Discharge
V = Vertical Discharge

Digit 20 — Electrical Connections

L = Left Hand Connections

Digit 21 — Unit Electrical Connections

1 = Disconnect Switch
2 = Terminal Block

Digit 22 — Drain Pan

G = Galvanized Drain Pan
S = Stainless Steel Drain Pan

Digit 23 — Future Use

0 = None

Digit 24 – Filter Type

A = 2 inch - MERV 8
B = 4 inch - MERV 8
C = 2 inch - Pre-MERV 8, 4 inch, Post-MERV 13
D = 2 inch - MERV 13
E = 4 inch - MERV 13
F = 6 inch - MERV 15

Digit 25 — Heater

0 = None
4 = Hydronic Remote
5 = Electric Remote (3 stages max, on/off)

Digit 26 — Shipping Method

S = Single Piece

Digit 27— Unit Isolators

0 = None
A = Isopads

Digit 28 — Air Volume/Temp Control

A = VAV Control Scheme (Fixed DA Temp)
B = VAV Control Scheme (Return Air Reset)
C = VAV Control Scheme (Space Temp Reset)
D = CV Control Scheme (Fixed DA Temp)

Digit 29 — Agency Listing

0 = None
E = ETL listing

Digit 30 — Options

0 = None
2 = Compressor Service Valves

Digit 31 — Space Sensor Options

0 = None
1 = Space Sensor Only

Digit 32 — Future Use

0 = None

Digit 33 — Industrial Options

0 = None
A = Protective Coating Evaporator Coil
B = Protective Coating Evaporator Coil + WSE

Digit 34 — Discharge Plenum

0 = None
S = Standard Plenum with Field-Cut Holes

Digit 35 — Future Use

0 = None

Digit 36 — Future Use

0 = None

Digit 37 — Controller

3 = Symbio™ 500

Digit 38 — Future Use

0 = None

Digit 39 — Major Design Version

A = 1.0

Digit 40 — Design Special

0 = None
S = Design Special

General Data

Table 1. SWUD water-cooled self-contained

Tonnage	20	25	30	35	40	45	50	55	60	65	70	75	85	90	100	110
Compressor Data																
Quantity	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Nominal Ton/Comp	5	6.25	7.5	8.75	10	11.25	12.5	13.75	15	16.25	17.5	18.75	21.25	22.5	25	27.5
Circuits	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Evaporator Coil Data																
Rows	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sq. Ft.	28.65	28.65	28.65	28.65	35.42	37.5	39.58	40.63	40.63	50	51.11	52.78	52.78	68.33	68.33	68.33
Fins/in	12.0	12.0	12.0	12.0	12	12	12	12	12	12	12	12	12	12	12	12
Number of Coils	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Condenser Data																
Minimumum GPM w/o Econ [a]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Minimum GPM w/ Econ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maximum GPM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Evaporator Fan Data																
Quantity	1	1	2	2	2	2	3	3	4	4	4	4	5	5	6	7
Diameter	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Power consumption kW	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Minimum Design cfm[b]	4000	5000	6000	7000	7400	8600	10000	10800	12000	13000	13600	15200	16600	18000	20400	22600
Maximum Design cfm	7600	9500	11400	13300	14060	16340	19000	20520	22800	24700	25840	28880	31540	34200	38760	42940
Refrigerant Charge, lbs. R-454B[c]																
Circuit A	10.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	42.5	45.0	50.0	55.0
Circuit B	10.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	42.5	45.0	50.0	55.0
Total	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	85.0	90.0	100.0	110.0
Filter Data, Water-Cooled Units																
Number - Size (in.)	9-20"x24"				12-20"x24"					15-20"x24"				21-20"x24"		
Number of Compressor Tandems																
8T Fixed Speed Tandem	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10T Fixed Speed Tandem	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13T Fixed Speed Tandem	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
15T Fized Speed Tandem	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0
20T Fixed Speed Tandem	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0
23T Fixed Speed Tandem	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
26T Fixed Speed Tandem	0	0	0	0	0	0	0	0	1	2	1	1	0	0	0	0
30T Fixed Speed Tandem	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
37T Fixed Speed Tandem	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	0
45T Fixed Speed Tandem	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Number of Fans/Unit																
No. of fans	1		2				3		4				5		6	7

Note: All performance data is provided in the Performance Selection Program. Contact Trane Sales at 770-988-8338 for more information.

[a] All performance data is provided in the Performance Selection Program. Contact MJC Sales at 770-988-8338 for more information.

[b] Minimum air flow at part load is 35% of full load design CFM.

[c] Refrigerant charge shown is a general guideline, charge to sub-cooling as described in IOM. Note that occasionally a TXV adjustment may need to be made but only after adequate sub-cooling has been reached.

Table 2. EER/IEER ratings

Tonnage	Model Number	EER	IEER	AHRI Net Cooling Capacity (MBH)
20	SWUD5020	18.7	21.3	252
25	SWUD5025	16.7	19.9	292
30	SWUD5030	17.9	22.6	387
35	SWUD5035	18.2	22.0	411
40	SWUD5040	18.2	21.9	458
45	SWUD5045	17.9	22.1	536
50	SWUD5050	18.8	22.8	625
55	SWUD5055	18.3	22.1	665
60	SWUD5060	18.2	21.7	743
65	SWUD5065	17.7	21.2	775
70	SWUD5070	17.3	21.7	839
75	SWUD5075	16.5	20.4	920
85	SWUD5085	16.6	20.6	987
90	SWUD590F	16.4	20.1	1096
100	SWUD5100	16.5	20.3	1234
110	SWUD5110	16.2	19.6	1371

Notes:

1. Cooling only.
2. Cooling performance is rated at 80F EDB/67F EWB with 85 EWT for water-cooled performance and 95F Ambient for air-cooled performance.
3. EER, IEER, and AHRI Net Cooling Capacity are tested in accordance with the AHRI 340/360 (I-P) and certified to 10 CFR Part 431 from the US Department of Energy.

Pre-Installation

Receiving

Receiving Checklist

Complete the following checklist immediately after receiving unit shipment to detect possible shipping damage:

- Inspect individual cartons before accepting. Check for rattles, bent carton corners, or other visible indications of shipping damage.
- If a unit appears damaged, inspect it immediately before accepting the shipment. Make specific notations concerning the damage on the freight bill. Do not refuse delivery.
- Inspect the unit for concealed damage before it is stored and as soon as possible after delivery. Report concealed damage to the freight line within the allotted time after delivery. Check with the carrier for their allotted time to submit a claim.
- Do not move damaged material from the receiving location. It is the receivers responsibility to provide reasonable evidence that concealed damage did not occur after delivery.
- Do not continue unpacking the shipment if it appears damaged. Retain all internal packing, cartons, and crate. Take photos of damaged material if possible.
- Notify the carrier of the damage immediately by phone and mail. Request an immediate joint inspection of the damage by the carrier and consignee.

  Note: *Notify your Trane representative of the damage and arrange for repair. Have the carrier inspect the damage before making any repairs to the unit.*

Ship-Separate Accessories

Field installed components ship separately inside cassette labeled **Ship-With Components** or on individual pallet.

Contractor Installation Responsibilities

Complete the following checklist before beginning final unit installation:

- Verify the unit size and tagging with the unit nameplate.
- Make certain the floor or foundation is level, solid, and sufficient to support the unit and accessory weights. Level or repair the floor before positioning the unit if necessary.
- Allow minimum recommended clearances for routine maintenance and service. Allow space at end of the unit for servicing. Refer to the unit submittals for dimensions. See also the “Service Clearances,” p. 17 section in the “Dimensional Data,” p. 14.
- Electrical connection knockouts are on the top, of the starter panel.
- Allow adequate space for piping access and panel removal. Locate and properly identify condenser water piping, refrigerant piping, and condensate drain connections depending upon your application.

  Note: *Unit height and connection locations will change if using vibration isolators.*
- Electrical supply power must meet specific balance and voltage requirements as described in “Installation – Mechanical,” p. 19.
- The installer is responsible for providing a condenser main, standby water pump, cooling tower, pressure gauges, and all components for waterside piping.

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 approval.*

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

Inspection for Concealed Damage

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

If concealed damage is discovered:

- Notify the carriers 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.*

Unpacking

SWUD units ship fully assembled in a single piece. Some accessories are shipped inside an additional box.

Dimensional Data

Figure 2. Unit dimensions (in inches)

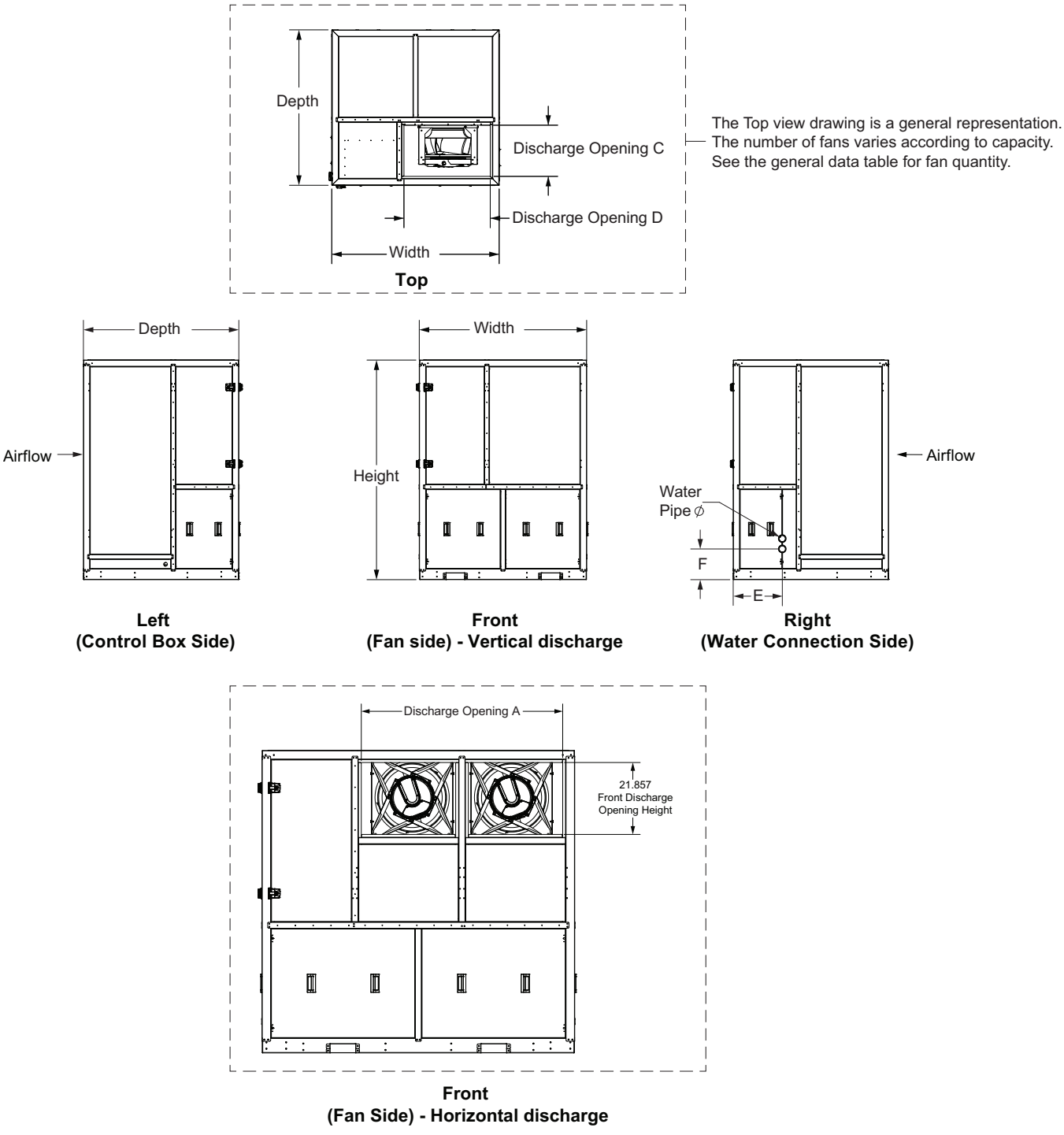
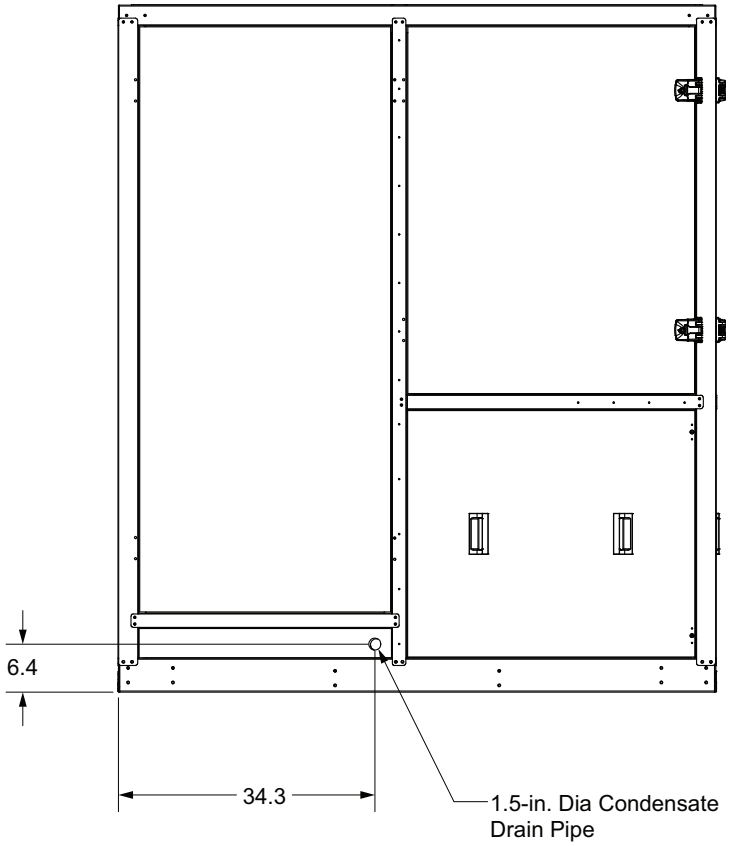


Table 3. Unit dimensions (in inches)

	Unit Size			
Dimension	**20, 25, 30, and 35T**	**40, 45, 50, 55, and 60T**	**65, 70, 75, and 85T**	**90, 100, and 110T**
Width (in.)	70.00	95.00	111.00	140.00
Depth (in.)	65.00	80.00	80.00	80.00
Height (in.)	92.00	92.00	92.00	92.00
Discharge Opening - Vertical discharge				
Discharge Opening C (in.)	21.42	36.50	36.50	36.50
Discharge Opening D (in.)	36.17	61.22	77.16	106.00
Discharge Opening - Horizontal discharge				
Discharge Opening A (in.)	36.24	61.24	79.09	107.96

	Unit Size				
Dimension	**20, 25, 30, and 35T**	**40T**	**45, 50, 55, 60, and 65T**	**70T**	**75, 85, 90, 100, and 110T**
Water Pipe Ø	2.50 NPT	2.50 NPT	3.00 NPT	3.00 NPT	4.00 NPT
E	20.60	30.00	30.00	30.00	30.00
F	12.83	12.87	11.76	13.73	14.82

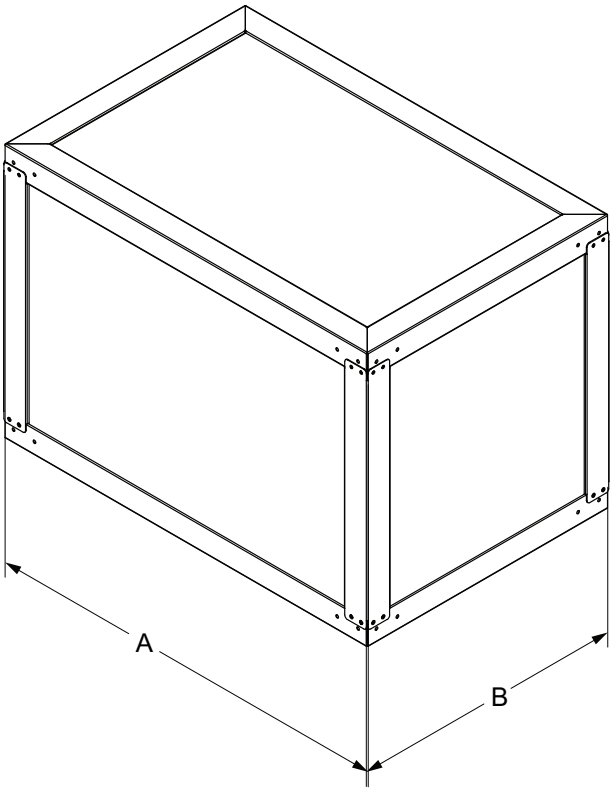
Figure 3. Condensate drain pipe location



Left
(Control Box Side)

Note: *Condensate drain connection always on the LEFT (Control Box) side.*

Figure 4. Standard plenum (option)



Note: *Custom height plenums available upon request.*

Table 4. Standard plenum (option)

Unit Size	Dim A (in.)	Dim B (in.)	Height (in.)
20, 25, 30, and 35T	42.92	28.55	30.00
40, 45, 50, 55, and 60T	67.77	43.40	30.00
65, 70, 75, and 85T	83.77	43.40	30.00
90, 100, and 110T	112.63	43.40	30.00

Service Clearances

Figure 5. Service clearance

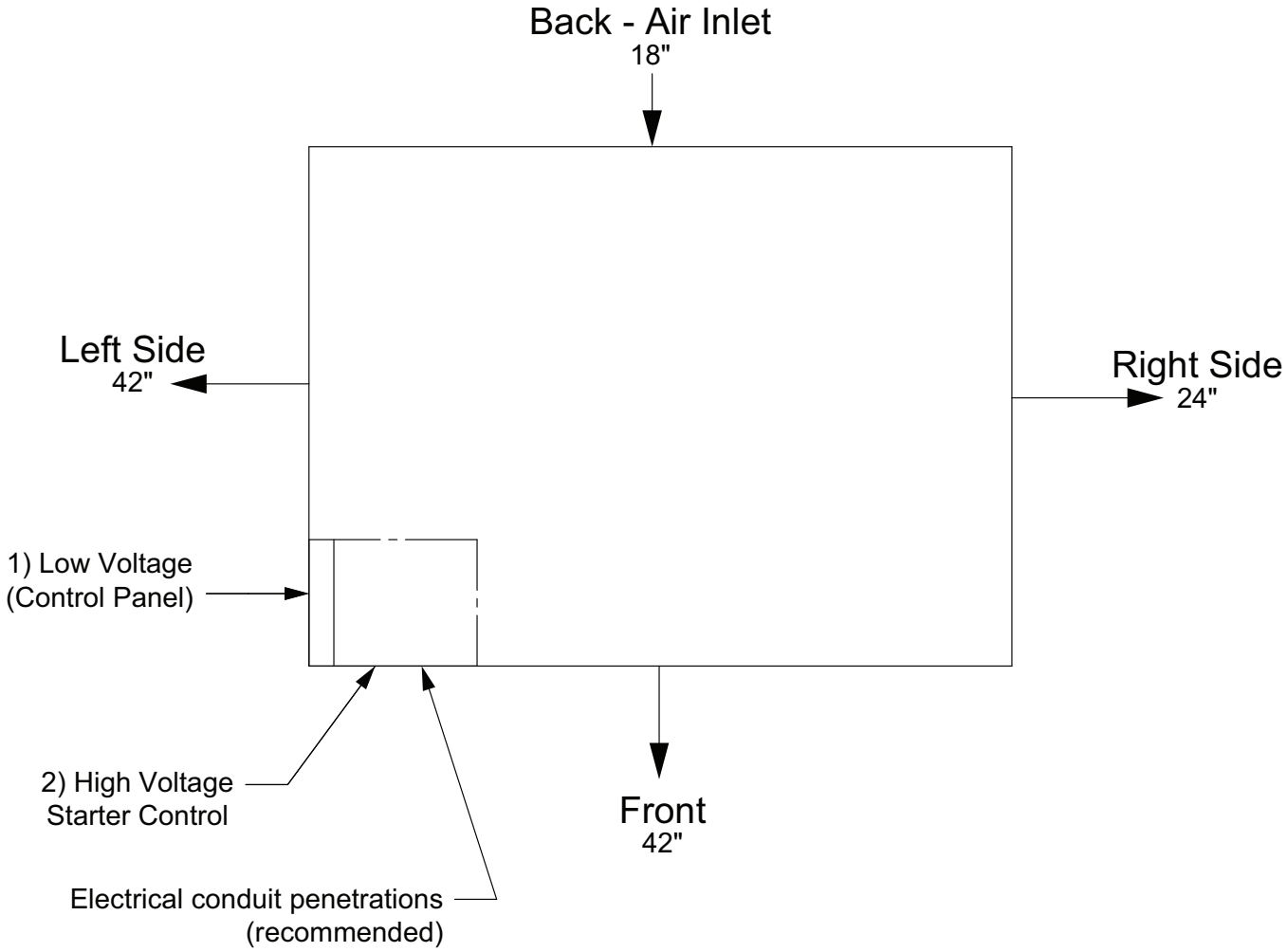


Table 5. Service/code clearance requirements

Side	Distance - in. (mm)	Purpose
Front	42	NEC Code Requirements; Fan, Compressor, Condenser, Service/Removal
Left	42	NEC Code Requirements
Right	24	Door Clearance
Back	18	Provides Uniform Airflow

Weights

Table 6. Unit weights

Unit Size	Base Weight	Waterside Economizer
	(lbs)	(lbs)
20	2763	459
25	2813	459
30	2915	459
35	2965	468
40	3423	578
45	3489	602
50	3654	626
55	3734	638
60	3904	649
65	4231	679
70	4240	777
75	4367	796
85	4466	796
90	5137	1055
100	5237	1055
110	5336	1055

Installation – Mechanical

Unit Handling

⚠ WARNING

Improper Unit Lift!

Failure to properly lift unit in a LEVEL position could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage.

Test lift unit approximately 24 inches (61 cm) to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.

- Use spreader bars to avoid unit damage.
- Spreader bar must be a minimum of 11 feet for 20 to 85 ton units and 12 feet for 90 to 110 tons. Chains must not bear on top of unit.
- Run straps through fork pockets to connect to the spreader bar. See detail in Figure 6, p. 19 and Figure 8, p. 20.
- Lift using overhead crane only. Adjust rigging for unit center of gravity.
- Unit center of gravity will fall within center of gravity block at various locations depending on unit options.
- See unit nameplate for unit weights.
- Unit has built-in fork pockets for easy forklift maneuverability.
- Do not stack units.

Figure 6. Detail of how to run straps through fork pockets to connect spreader bar on self-contained

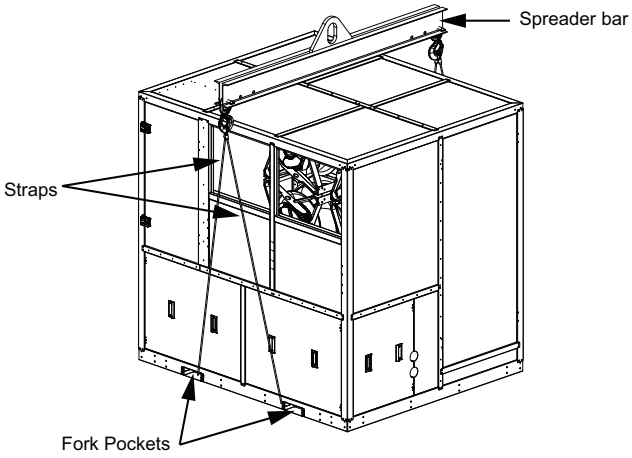


Table 7. Gravity block dimensions 20 to 80 tons, in.

Unit Size (Tons)	Dim A	Dim B	Dim C	Dim D	Dim E
20 to 35	26.8	36.2	34.8	65.0	70.0
40 to 60	34.8	35.9	47.5	80.0	95.0
65 to 85	35.4	35.7	53.9	80.0	111.0
90 to 110	35.3	36.7	70.6	80.0	140.0

Figure 7. Gravity Block Dimensions 20 to 80 tons, in.

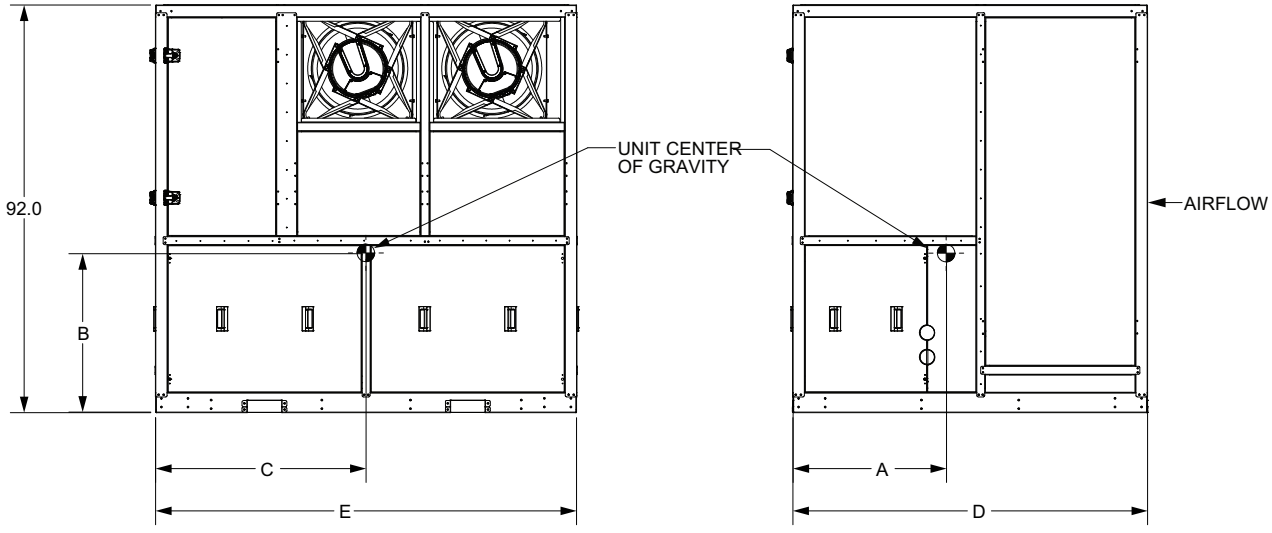
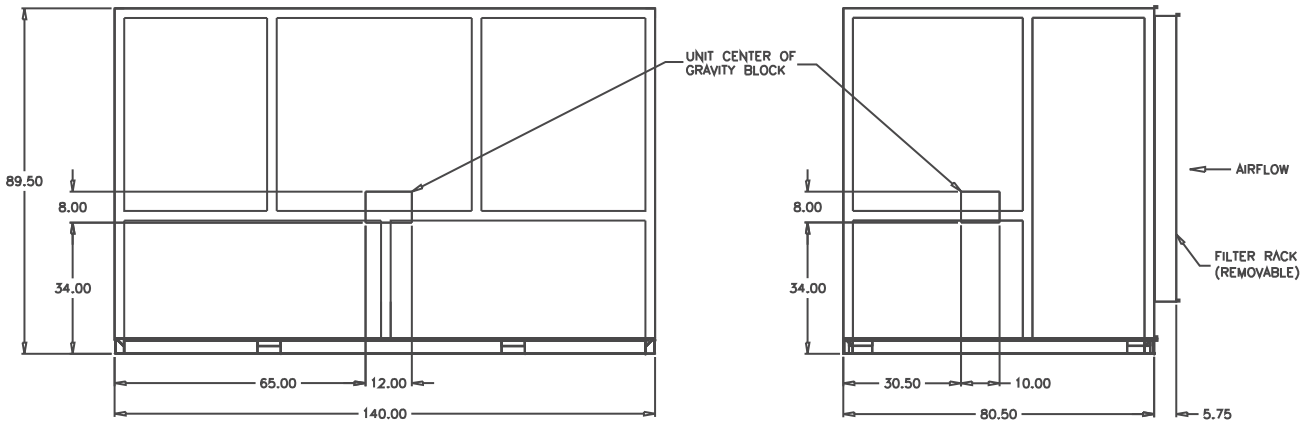


Figure 8. Gravity block location and dimensions for 90 to 110 ton units



Installation Preparation

Before installing the unit, perform the following procedures to confirm proper unit operation.

1. Position the unit and pallet in its final location.
2. Test lift the unit to determine exact unit balance and stability before hoisting it to the installation location. See "Unit Handling," p. 19 for proper rigging procedures and cautions.
3. Remove the protective shipping covers from the unit.

Unit Vibration Isolator Option

Important: *Vibration isolation is not necessary for the unit since the factory internally isolates the fan and compressor, thus creating double isolation. Trane strongly recommends consulting a vibration specialist when considering double isolation. Trane does not recommend double-isolation.*

Unit Isolator Installation Procedure

Use the following procedure to install isolators:

1. Position the isolators under the unit base referring to the isolator placement sheet that ships with the unit isolators. Lift one end of the unit at a time to position the isolators.
2. Shim as required to level the unit. It must be less than 1/8-inch per foot difference.

Note: *The unit is equipped with a positively sloped drain pan to help indoor air quality (IAQ) and does not require one corner of the unit to be pitched.*

Duct Connections

Return air enters the rear of the unit and conditioned supply air discharges through the top.

Notes:

- *Attach supply air ductwork directly to the unit top panel, around the fan discharge opening. A duct collar is not provided.*
- *Units equipped with flexible horizontal discharge plenum option may include a duct collar when holes are factory cut.*

Install all air ducts according to the National Fire Protection Association standards for the Installation of Air Conditioning and Ventilation Systems other than Residence Type (NFPA 90A) and Residence Type Warm Air Heating and Air Conditioning Systems (NFPA 90B).

Make duct connections to the unit with a flexible material such as heavy canvas. If a fire hazard exists, Trane recommends using Flexweave 1000, type FW30 or equivalent canvas. Use 3 inches for return duct and 3 inches for discharge duct. Keep material loose to absorb fan vibration.

- If using return ductwork to the unit, secure it with 3 inches of flexible duct connector.
- Extend discharge duct upward without change in size or direction for at least three fan diameters.
- Use 3-inch flexible duct connection on discharge ductwork.

Note: *Compressors and fan assembly are internally isolated. External isolation devices (spring mounting isolators) are at discretion of a vibration specialist consulted by building or HVAC system designer.*

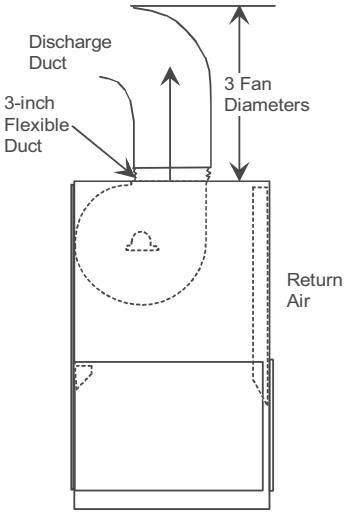
Run the ductwork straight from the opening for a minimum of three fan diameters. See Figure 9, p. 21. Extend remaining ductwork as far as possible without changing size or direction. Do not make abrupt turns or transitions near the unit due to increased noise and excessive static losses. Use elbows with splitters or turning vanes to minimize static losses.

Poorly constructed turning vanes may cause airflow generated noise. Align the fan outlet properly with the ductwork to decrease noise levels in the duct and to increase fan performance. To complete trunk ductwork to the VAV terminal units, refer to the VAV box manuals for

specific requirements. Check total external static pressures against fan characteristics to be sure the required airflow is available throughout the ductwork.

To achieve maximum acoustical performance, minimize the duct static pressure setpoint.

Figure 9. Duct connection recommendations



Water Piping

Condenser Connections

⚠ WARNING

High Pressure Water!

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

Provide relief valve on system water piping to prevent instantaneous release of high pressure water.

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

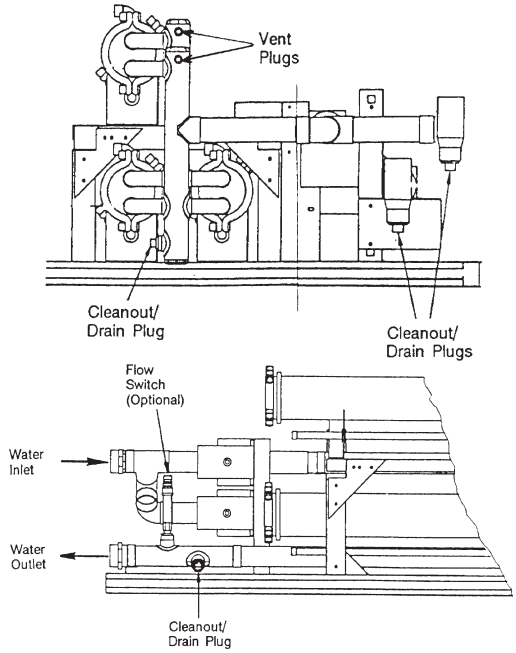
All field-installed piping must conform to applicable local, state, and federal codes. To complete condenser water connections follow the procedure below.

Note: *Four (4) condenser waterline drain plugs ship in a bag in the left end of the unit. The installer must field install these four plugs using pipe thread sealer. An additional plug is provided for units with a waterside economizer.*

1. Install the vent plugs in the economizer coil headers and condenser manifolds. See Figure 10, p. 21. These plugs ship in a bag with the condenser drain plugs.
2. Attach the water supply line to the inlet connection, and the return line to the outlet connection. Entering and leaving water connections for all condensers are factory manifolded and require only single connections for entering and leaving water. If the unit has a waterside economizer and/or control valves, the factory pipes between these components.
3. If using a cooling tower, refer to Figure 11, p. 22 for a typical piping circuit from the unit.
4. Confirm the water pressure to the unit does not exceed 150 psig.

Note: *To prevent water pump damage, design system piping to provide relief when using energy saving waterside economizer valves.*

Figure 10. Economizer coil vent and condenser cleanout/drain plugs



Condensate Drain Connections

Note: *Unit is not internally trapped. Installer will need to provide an external trap for unit to operate properly.*

Locate condensate drain on the unit. Connect condensate drain piping to the 1-1/4-inch NPT internal fitting, using at least 7/8-inch OD copper or 3/4-inch OD iron pipe. Pitch the condensate line downward a minimum of 1/2-inch for each 10–feet of horizontal run, away from the unit. Be sure to install the condensate drain p–trap drain plug. Before starting the unit, fill the trap with water to prevent negative pressure in the fan section from impeding condensate flow.

To facilitate drain pipe cleaning, install plugged tees in place of 90° elbows.

General Waterside Recommendations for Cooling Towers

Cooling tower control affects the unit cycle rates. Condenser water temperature swings from 10°F to15°F may cause excessive compressor, water valve, and unit cycling. Set the tower controls to minimize compressor/unit cycling.

Waterside Piping Arrangements

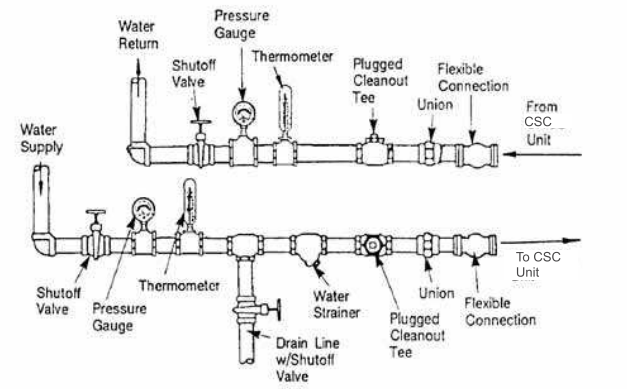
Install a condenser water pump between the cooling tower (either open or closed) and the self-contained unit. Lay out the remainder of the system condenser piping in reverse returns. This helps balance the system by equalizing the length of supply and return pipes. Multi-story buildings may use a direct return system with balancing valves at each floor.

Install the supply riser and its return in close proximity. Furnish both with permanent thermometers to check the waterside balance during start-up and routine maintenance checks.

Include strainers at each pump inlet and unit. Install drain valves at the riser base to allow drainage points for system flushing during start-up and routine maintenance. For condenser draining and header removal, include a shutoff/ balancing valve on the entering and leaving waterside pipes, drain tees, and unions of each unit.

Note: *Unit does not have floor drains.*

Figure 11. Condenser water piping components for cooling tower system



Water Temperature Requirements

Do not allow the entering water temperature to go below 54°F (12.2°C) on units with constant water flow (basic piping).This will cause the compressors to shutdown and the mechanical cooling function will lockout. The economizer (if enabled) will continue to function. The compressors will reset when the entering water temperature reaches 58°F (15°C).

Units with variable water flow (intermediate piping) have a modulating condensing pressure control valve that allows compressor operation down to entering water temperatures of 37°F (3°C).

Note: *Units with a waterside economizer can be set from the human interface panel for variable or constant water flow.*

Water Piping Verification

- Make return and supply water connections to the unit and/or waterside economizer piping package with recommended valves and piping components.
- Install unions to allow waterside maintenance.
- Install cooling tower and standby pumps.
- Treat water to prevent algae, slime, and corrosion.
- Prevent refrigerant piping from rubbing against other objects.

Installating the Hydronic Coil

Refrigerant System

Trane Water Cooled Commercial Self-Contained units ship factory charged with R-454B refrigerant.

Installation - Electrical

Unit Wiring Diagrams

Specific unit wiring diagrams are provided on the inside of the control panel door. Use these diagrams for connections or trouble analysis.

Supply Power Wiring

It is the responsibility of the installer to provide power supply wiring to the unit terminal block or the non-fused disconnect switch option. Wiring should conform to NEC and all applicable code requirements.

Bring the supply wiring through the top of the starter panel. The hole will be field cut at the electrician's discretion. Connect the three phase wires to the power terminal block or the non-fused disconnect switch in the control box terminals. Refer to specific wiring diagrams and fuse information in the control panel.

⚠ WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels 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 following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

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.

NOTICE

Motor Damage!

Correct phase sequence is critical. If phase sequence of the incoming line voltage is not correct, it could result in motor damage.

Voltage Range

Voltages must be within ±10% the nameplate voltage. Confirm the unit voltage is balanced by measuring at the compressor terminals. Voltage imbalance on three phase systems can cause motor overheating and premature failure. Maximum allowable imbalance is 2.0 percent.

Voltage Imbalance

Read the voltage at the compressor terminals to determine if it is balanced. Voltage imbalance on three phase systems can cause motor overheating and premature failure. The maximum allowable imbalance is 2.0 percent. Voltage imbalance is defined as 100 times the sum of the deviation of the three voltages from the average (without regard to sign) divided by the average voltage. For example, if the three measured voltages are 221, 230, and 227, the average voltage would be:

(221 + 230 + 227) / 3 = 226 volts

The percentage of voltage imbalance is then:
100 x (226 – 221) / 226 = 2.2%

Phase Monitor

Unit is equipped with a phase monitor in the control box. The phase monitor will protect against phase loss, imbalance and reversal of line voltage. If a fault occurs, the unit will be locked out until the phase is corrected.

Control Power

NOTICE

Component Damage!

Failure to follow instructions below could result in immediate or premature component failures.

Unit transformers are sized to provide power to the unit only. Do not use these transformers to supply power to field equipment.

In this example, 2.2 percent imbalance is not acceptable. When a voltage imbalance of more than 2.0 percent exists, check the voltage at the unit disconnect switch. If the imbalance at the unit disconnect switch does not exceed 2.0 percent, faulty unit wiring is causing the imbalance. Conduct a thorough inspection of the unit electrical wiring connections to locate the fault, and make any repairs necessary.

Access the connection terminal block through the control panel on the upper left side of the unit. All wiring should conform to NEC and applicable local code requirements.

Confirm all wiring connections are secure. Reference the unit specific diagrams inside the control panel.

Note: *Unit transformers IT1, IT3, IT4 and IT5 are sized to provide power to the unit only.*

Selection Procedures

- RLA = Rated Load Amps
- Compressor LRA = Locked Rotor Amps
- Fan Motor LRA = Locked Rotor Amps, N.E.C. Table 430 -150
- FLA = Full Load Amps, N.E.C. Table 430 -150
- Voltage utilization range is ±10%

Determine Minimum Circuit Ampacity (MCA)

MCA = 1.25 x largest motor amps/VFD amps (FLA or RLA) + the sum of the remaining motor amps.

Determine Max Fuse (MFS) and Max Circuit Breaker (MCB) Sizes

MFS and MCB = 2.25 x largest motor amps (FLA or RLA) + the sum of the remaining motor amps.

For units with the dual power option, there are two electrical circuits that need calculations using the previous formulas:

- Circuit #1 – fans
- Circuit #2 – compressors

If the rating value determined does not equal a standard current rating of over current protective device, use the next lower standard rating for the marked maximum rating.

Table 8. Electrical service sizing data — motors

Digit 9 - Unit Voltage	Digit 9	Tonnage	Comp 1	Comp 2	Comp 3	Comp 4	Fan FLA	Qty Fans	Misc	MCA	MOP
460/60/3	4	20	7.1	7.1	7.1	7.1	7.1	1.00	1.00	38	45
460/60/3	4	25	9.1	9.1	9.1	9.1	7.1	1.00	1.00	47	56
460/60/3	4	30	11.9	11.9	11.9	11.9	7.1	2.00	1.00	66	77
460/60/3	4	35	12.4	12.4	11.9	11.9	7.1	2.00	1.00	67	79
460/60/3	4	40	12.4	12.4	12.4	12.4	7.1	2.00	1.00	68	80
460/60/3	4	45	15.4	15.4	12.4	12.4	7.1	2.00	1.00	75	90
460/60/3	4	50	15.4	15.4	15.4	15.4	7.1	3.00	1.00	88	103
460/60/3	4	55	19.4	19.4	15.4	15.4	7.1	3.00	1.00	97	116
460/60/3	4	60	20.6	20.6	19.4	19.4	7.1	4.00	1.00	115	135
460/60/3	4	65	20.6	20.6	20.6	20.6	7.1	4.00	1.00	117	137
460/60/3	4	70	24.0	24.0	20.6	20.6	7.1	4.00	1.00	124	148
460/60/3	4	75	32.8	32.8	20.6	20.6	7.1	4.00	1.00	144	177
460/60/3	4	85	32.8	32.8	24.0	24.0	7.1	5.00	1.00	158	191
460/60/3	4	90	32.8	32.8	32.8	32.8	7.1	5.00	1.00	176	208
460/60/3	4	100	38.5	38.5	32.8	32.8	7.1	6.00	1.00	196	234
460/60/3	4	110	38.5	38.5	38.5	38.5	7.1	7.00	1.00	214	253
208-230/60/3	F	20	16.0	16.0	16.0	16.0	13.5	1.00	2.00	84	100
208-230/60/3	F	25	21.2	21.2	21.2	21.2	13.5	1.00	2.00	105	127
208-230/60/3	F	30	24.4	24.4	24.4	24.4	13.5	2.00	2.00	133	157
208-230/60/3	F	35	28.7	28.7	24.4	24.4	13.5	2.00	2.00	142	171
208-230/60/3	F	40	28.7	28.7	28.7	28.7	13.5	2.00	2.00	151	179
208-230/60/3	F	45	33.3	33.3	28.7	28.7	13.5	2.00	2.00	161	195
208-230/60/3	F	50	33.3	33.3	33.3	33.3	13.5	3.00	2.00	184	218
208-230/60/3	F	55	40.8	40.8	33.3	33.3	13.5	3.00	2.00	201	242
208-230/60/3	F	60	45.9	45.9	40.8	40.8	13.5	4.00	2.00	241	287
208-230/60/3	F	65	45.9	45.9	45.9	45.9	13.5	4.00	2.00	251	297
208-230/60/3	F	70	49.0	49.0	45.9	45.9	13.5	4.00	2.00	258	307
208-230/60/3	F	75	62.1	62.1	45.9	45.9	13.5	4.00	2.00	287	349
208-230/60/3	F	85	62.1	62.1	49.0	49.0	13.5	5.00	2.00	307	369
208-230/60/3	F	90	62.1	62.1	62.1	62.1	13.5	5.00	2.00	333	395

Table 8. Electrical service sizing data — motors (continued)

Digit 9 - Unit Voltage	Digit 9	Tonnage	Comp 1	Comp 2	Comp 3	Comp 4	Fan FLA	Qty Fans	Misc	MCA	MOP
208-230/60/3	F	100	83.1	83.1	62.1	62.1	13.5	6.00	2.00	394	477
208-230/60/3	F	110	83.1	83.1	83.1	83.1	13.5	7.00	2.00	450	533
575/60/3	5	20	6.4	6.4	6.4	6.4	5.7	1.00	0.75	34	40
575/60/3	5	25	7.7	7.7	7.7	7.7	5.7	1.00	0.75	39	47
575/60/3	5	30	9.4	9.4	9.4	9.4	5.7	2.00	0.75	52	61
575/60/3	5	35	9.0	9.0	9.4	9.4	5.7	2.00	0.75	51	60
575/60/3	5	40	9.0	9.0	9.0	9.0	5.7	2.00	0.75	50	59
575/60/3	5	45	12.9	12.9	9.0	9.0	5.7	2.00	0.75	59	72
575/60/3	5	50	12.9	12.9	12.9	12.9	5.7	3.00	0.75	73	86
575/60/3	5	55	13.7	13.7	12.9	12.9	5.7	3.00	0.75	75	88
575/60/3	5	60	14.5	14.5	13.7	13.7	5.7	4.00	0.75	84	98
575/60/3	5	65	14.5	14.5	14.5	14.5	5.7	4.00	0.75	85	100
575/60/3	5	70	19.2	19.2	14.5	14.5	5.7	4.00	0.75	96	115
575/60/3	5	75	24.0	24.0	14.5	14.5	5.7	4.00	0.75	107	131
575/60/3	5	85	24.0	24.0	19.2	19.2	5.7	5.00	0.75	122	146
575/60/3	5	90	24.0	24.0	24.0	24.0	5.7	5.00	0.75	131	155
575/60/3	5	100	27.1	27.1	24.0	24.0	5.7	6.00	0.75	144	171
575/60/3	5	110	27.1	27.1	27.1	27.1	5.7	7.00	0.75	156	183

Notes:

1. MCA: Minimum Circuit Ampacity is 125 percent of the largest compressor RLA or Drive input current, plus 100 percent of the other compressor (s) RLA, plus the sum of the condenser fan RLA, plus any other load rated at 1 AMP or more.
2. Maximum Breaker Overcurrent Protection (MOP): 225 percent of the largest compressor RLA or VSD drive Input, plus 100% of the other compressor(s) RLA, plus the sum of the condenser fan Motor/Drive FLA, plus any other load rated at 1 AMP or more.
3. Recommended disconnect switch: 110 percent to 115 percent of the sum of the RLA of the compressors, VSD drive input, fan motor/drive, and controls FLA.
4. RLA: Rated in accordance with UL standard 1995.
5. Local codes may take precedence.
6. Fix speed compressor are across the line starting, the VSD compressors are controlled by VSD drive. Compressors will never start simultaneously.
7. Voltage utilization range is ±10 percent.

Static Pressure Transducer Installation (VAV Units Only)

Supply air static pressure controls the ECM fans. A static pressure bulkhead connector ships separate in control panel for field installation in the supply air duct work. Installer is responsible for providing pneumatic tubing.

Transducer Inlet Location

Place bulkhead connector in an area of ductwork that will provide an average and evenly distributed airflow pattern. Use the following guidelines to determine an appropriate installation location.

1. Locate static bulkhead connector approximately 2/3 to 3/4 the way down longest duct run, in an area approximately 10 duct diameters downstream and 2 duct diameters upstream of major interferences, turns, or changes in duct diameter.
2. When installing pneumatic tubing between head assembly and transducer in control panel, do not exceed 250 feet for 1/4-inch OD tubing or 500 feet for 3/8-inch OD tubing.

Installing the Transducer

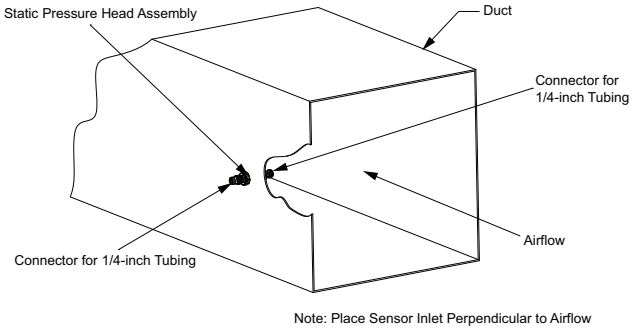
Use the following procedure to properly install the static pressure transducer:

1. Connect the pneumatic tubing from the sensing head to the push-on tubing connection in the control panel. Use a plastic static pickup tubing. Do not exceed 250 feet for 1/4-inch OD tubing or 500 feet for 3/8-inch OD tubing.

Transducer inside control panel picks up low side or reference pressure.

Note: *If plastic tubing pulls away from a connection, trim it back before replacing it on the fitting. Stretched tubing may leak and cause faulty control.*

Figure 12. Static pressure sensor installation



Zone Sensor Option used for Discharge Air Reset by Space Temperature

Zone Temperature Sensor, BAYSENS077 (Optional Item)

Figure 13. Zone temperature sensor

This zone sensor includes an internal thermistor and should be mounted in the zone, Model Number Digit 31=1. This sensor is available for use with all zone sensor options to provide remote sensing capabilities.

Zone Sensor Installation

⚠ 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.

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.

Note: *For additional information regarding the safe discharge of capacitors, see Discharging Capacitors in HVAC Systems Service Bulletin (PROD-SVB06*-EN).*

All sensor options ship in the main control panel and are field installed. Programmable option installation procedures.

Mounting Location

Mount the sensor on the wall in an area with good air circulation at an average temperature. Avoid mounting space temperature sensor is areas subject to the following conditions:

- Drafts or dead spots behind doors or in corners
- Hot or cold air from ducts
- Radiant heat from the sun or appliances
- Concealed pipes and chimneys
- Unheated or non-cooled surfaces behind the sensor, such as outside walls
- Airflows from adjacent zones or other units

To mount the sensors, remove the dust cover and mount the base on a flat surface or 2-inch x 4-inch junction box. Sensors ship with mounting screws.

Mounting the Subbase

Remove the zone sensor cover from subbase, and mount subbase on the wall or on a 2-inch x 4-inch junction box. Route wires through the wire access hole in the subbase. See Figure 14, p. 27. Seal the hole in the wall behind the subbase.

Notes:

- *Guidelines for wire sizes and lengths are shown in Table 9, p. 27. The total resistance of these low voltage wires must not exceed 2.5 ohms per conductor. Any resistance greater than 2.5 ohms may cause the control to malfunction due to excessive voltage drop.*
- *Do not run low-voltage control wiring in same conduit with high-voltage power wiring.*

Wiring

1. Run wires between the unit control panel and the zone sensor subbase. To determine the number of wires required, refer to the unit wiring diagrams.
2. Connect the wiring to the appropriate terminals at the unit control panel and at the zone sensor subbase. In general, zone sensor connections to the unit use the

convention of connecting zone sensor terminals to like numbered unit terminals (1 to 1, 2 to 2).The connection detail is shown on the unit wiring diagrams located in the unit control panel.

3. Replace the zone sensor cover back on the subbase and snap securely into place.

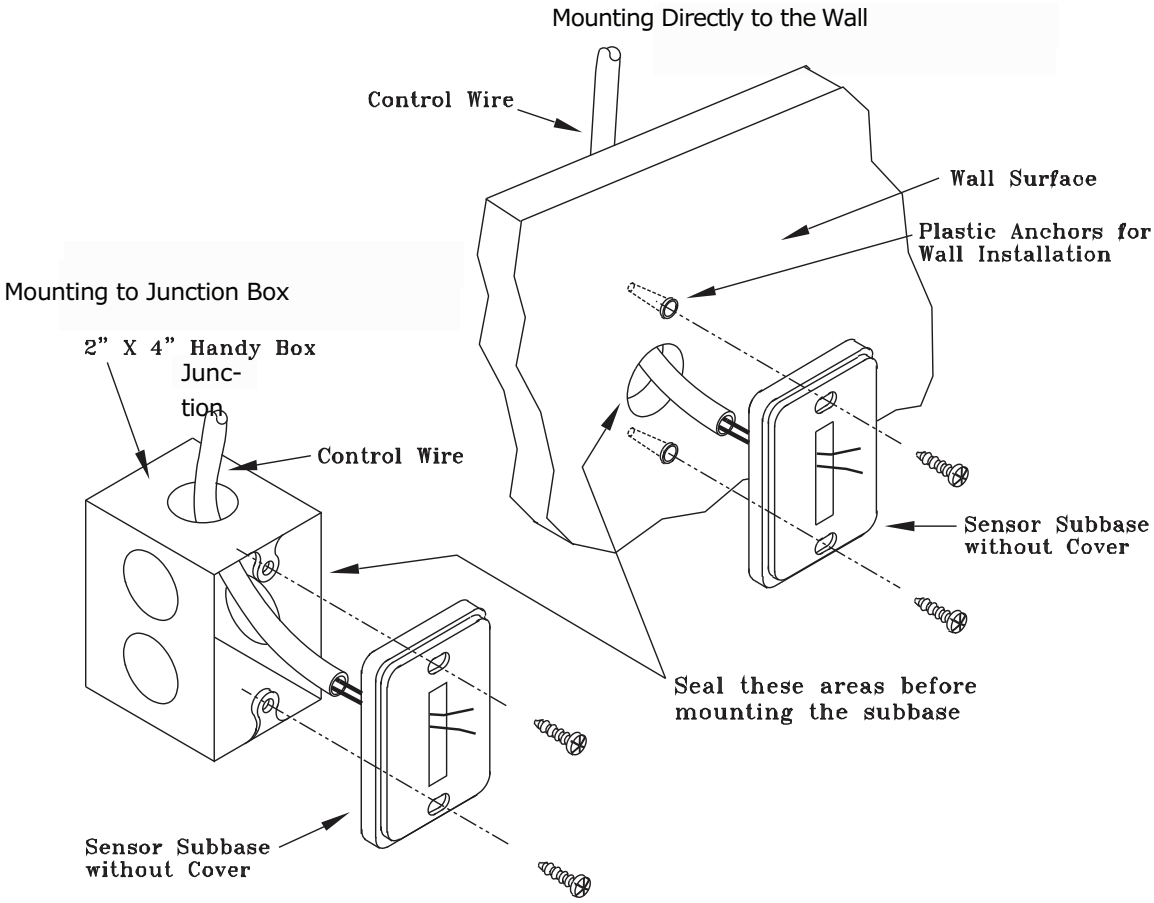
Standard Remote Sensor (BAYSENS077)

When using the remote sensor, BAYSENS077, mount it in the space that is to be controlled. Wire according to the interconnecting wiring diagrams on the unit.

Table 9. Zone sensor maximum lengths and wire size

Distance from Unit to Controller	Recommended Wiring Size
0-150 feet	22 gauge
151-240 feet	20 gauge
241-385 feet	18 gauge
386-610 feet	16 gauge
611-970 feet	14 gauge

Figure 14. Typical zone sensor installation



Operating Principles

Control Sequences of Operation

Occupied/Unoccupied Switching

There are three ways to switch occupied/unoccupied:

1. Field-supplied contact closure [hardwired binary input to field wiring terminal block (2TB3)] - This input accepts a field supplied switch or contacts closure such as a time clock. Open Contacts = Unoccupied and Closed Contacts = Occupied.
2. BACnet® MSTP control system can control the occupied/unoccupied request of the unit.
3. Through the TD-7 display via the on-board schedule.

Compressor Lead/Lag

Compressor lead/lag is present in the controls for all units. This is used to balance the run hours between all the compressors by putting the highest run hours to run last.

Emergency Stop Input

A binary input is provided on the units field wiring terminal block (2TB3) for installation of a field-provided switch or contacts to immediately shutdown all unit functions. An open contact will indicated an emergency shutdown condition exist and shut down the unit and generate a manual reset alarm. A closed set of contacts will indicate a normal condition. After the contacts are closed, the manual reset alarm must be cleared to resume unit operations.

External Auto/Stop Input

A binary input is provided on the unit's field wiring terminal block (2TB3) for installation of a field-provided switch or contacts to safely shutdown all unit functions. An Open contact will indicate a Stop condition exist and the unit will shutdown and generate an automatic reset alarm. A Closed contact will indicate an Auto condition and allow the unit to operate.

Local Auto Stop

A binary value is located on the TD-7 which allows the user to start and stop the unit in a safe manner for maintenance. On the TD-7 home screen in the upper right hand corner the unit can be put into Auto to perform normally or Stop to perform a controlled shutdown and keep the unit off.

Head Pressure Control

Water-cooled condensers: Units are ordered with the optional flow control valves and configured for variable water flow will modulate a water valve to maintain a user-defined condensing pressure setpoint and compressor refrigerant pressure differential. Condensing pressure and pressure differential will be referenced utilizing factory installed suction and discharge pressure sensors located on each circuit.

Water Purge

This user-definable feature allows the user to select a purge schedule to automatically circulate water through the economizer and condensers periodically during non-operational times. This allows fresh chemicals to circulate in waterside heat exchangers.

Note: *Only available on units with condenser valves.*

Supply Air Temperature Control Unit Sequence of Operation

Discharge Air High Temp Limit Software Alarm (Software)

When the discharge air temperature is above the discharge air high temperature cutout setpoint of 100 degrees for 5 minutes, the unit will perform a controlled shutdown. A Manual Reset alarm will generate and must be cleared before the unit can resume operating.

Condenser Water Low Temperature Alarm (Software)

When either the entering or leaving condenser water temperature is below the condenser water low temperature cutout setpoint of 35 degrees for 5 minutes, the unit will perform a controlled shutdown. All condenser water valves will be commanded open if installed, and a manual reset diagnostic will be generated and need to be cleared before the unit can resume operation.

Leaving Air Low Temperature Alarm

When the discharge air temperature is below the discharge air temperature cutout for 5 minutes, the unit will perform a controlled shutdown. A Manual Reset alarm will be generated and need to be cleared before the unit can resume operation.

Occupied Fan Operation

When all alarms are cleared, the unit is occupied, and the local auto stop is in auto, all fans that are available will start up and operate at 30 percent speed for 45 seconds. For CV, fans will then release to control to the fan fixed speed setpoint.

VAV

The fans will then release to control to the duct static pressure setpoint. The fans will modulate to maintain the duct static pressure at the duct static pressure setpoint. The fans are commanded off during the unoccupied mode.

Heat/Cool Mode

The unit is in Cooling mode by default. The front end Building Automation System will switch the Heat/Cool

Mode request multistate value between the Heating and Cooling modes to get the desired control.

Cooling/Waterside Economizer

During occupied cooling mode, the waterside economizer option and mechanical cooling are used to control the supply air temperature. The supply air temperature setpoint is user defined at the human interface panel.

After the fans run for 5 minutes, and a call for cooling is calculated, the Cooling Tower/Pump Command is turned **ON**. After the Condenser Water flow switch closes proving flow, the Compressors and/or Economizer will be allowed to start.

Waterside economizing enables when the unit entering water temperature is less than the entering mixed air temperature. This is set at Waterside Economizer Enable Offset setpoint. The factory default is 7°F, but can be adjusted by the user at the TD-7 or via BACnet.

The economizer acts as the first stage of cooling. If the economizer is unable to maintain the supply air setpoint, the compressor module will bring on the compressors as required to meet the setpoint. If the unit does not include an economizer, only mechanical cooling will satisfy cooling requirements.

Thermostatic Expansion Valve

NOTICE

Compressor Damage!

Do not operate with water loops with less than five minutes circulation time as it could result in poor superheat control and compressor damage.

Refrigerant system reliability and performance is heavily dependent upon proper superheat. The importance of maintaining the proper superheat cannot be overemphasized. Accurate measurements of superheat will provide the following information:

- How well the expansion valve is controlling the refrigerant flow.
- The efficiency of the evaporator coil.
- The amount of protection the compressor is receiving against flooding.

The expected range for superheat is 11-15°F at full load conditions. At part load, expect a properly adjusted expansion valve to control to 8-12°F superheat.

Systems operating with lower superheat could cause serious compressor damage due to refrigerant floodback.

Fan Operation

Multiple, identical fans are arranged in the fan cabinet to meet the customer airflow and static requirements. Each fan speed, start/stop command, and fault status are controlled and monitored individually by the unit controller. However, all fans receive the same fan speed signal to meet airflow and static demand, and all fans are commanded On upon Unit Controller status transition to Occupied Mode.

Each fan assembly has its own motor with integrated electronically commutated motor (ECM). Each fan ECM varies the speed of the fan proportional to a 0-10 Vdc signal supplied by the XM90.1 module (and XM30.2 on 85 to 100 units / XM30.3 on 110 ton units). The ECM starts and stops the fan according to the Enable/ Disable Binary Output from the XM90.1 module. If the ECM is faulted it annunciates this via a dry contact that is sensed by the unit controller on the XM90.1 module (and XM30.2 on 85 to 100 units / XM30.3 on 110 ton units).

Supply Air Static Pressure High Limit

During normal operation, the supply air static is monitored. If at any time the static pressure exceeds the software high static limit (defaulted at 2.0 inches from the factory) the unit will immediately shut down and generate a diagnostic.

In order for the unit to resume operation, the Alarm Reset must be toggled from the TD-7. The software high static limit can be user adjusted at the TD-7.

Compressors

SWUD uses fixed speed (FS) compressors and a balanced starts routine.

Compressor Oil

All compressors have an Oil Sight Glass. Confirm oil is visible in the sight glass when the compressor is off or running.

High Pressure Cutout Switch (HPC)

Each FS compressor has an HPC installed in its discharge line. The switch is set to open at 553 psi +/-15 and re-close at 424 +/-30.

Table 10. Pressure cutouts (open/close)

Unit Model	High Pressure Cutout	Low Pressure Cutout
SWUD	553/424	49/74

Note: *Update with MSC high pressure cutout. No low pressure cutout for .*

On the fixed speed compressors, if an HPC opens, the 24 Vac power that energizes the compressor start contactor is interrupted and the compressor will turn off. The unit controller will detect this and lock the circuit out on a high pressure cutout.

Compressor Pressure Sensors

Each circuit has its own set of suction and discharge pressure sensors. The sensors are powered by the 5 Vdc power supply 2U1. Their range is 0-600 psig and their

voltage output is linearly proportional to the sensed pressure.

The discharge pressure sensor is used by the unit controller to do the following:

- Compute circuit differential pressure.
- Warn the user if a high discharge pressure condition occurs.

The suction pressure sensor is used by the unit controller to do the following:

- Detect low suction pressures.
- Compute circuit suction superheat.
- Compute circuit differential pressure.

Compressor Suction Temperature

Each circuit has its own suction temperature thermistor. It is used to compute circuit suction superheat. If superheat is less than 4 degrees for 5 minutes, or more than 25 degrees for 1 O minutes, the circuit is locked out on a fault and a diagnostic is annunciated.

Fixed Speed Compressor (FS)

Each FS compressor has two 24 Vac, 30W crankcase heaters. The power for these heaters is routed through a NC auxiliary contact on it's respective start contactor. This way the heater is energized whenever the compressor is Off.

In each FS compressor motor junction box is a 24 Vac powered CoreSense™ compressor protection module (MCSP). This module displays compressor status and diagnostics and provides the following protections:

- Motor temperature protection.
- Missing phase protection.
- Reverse phase protection.
- Low control circuit voltage protection.
- Short cycling detection and alert.

If the CoreSense module detects a fault condition it opens a dry contact on the module interrupting power to that compressors run contactor coil. The power interruption is detected by the Unit Controller, which disables the compressor and annunciates a Compressor Safety Circuit diagnostic. After the cause of the fault is remedied, a latching fault can be cleared by cycling 24 Vac module power.

Compressor Safety Circuit

Each fixed speed compressor has a Compressor Safety Circuit intended to protect the circuit from a variety of fault conditions and to distinguish those failures from HPC trips.

For each FS compressor, 24 Vac power is routed in order from the control power transformer (CPT) through its respective:

1. HPC
2. MCSP dry contact
3. Circuit breaker auxiliary - 1CB1, 1CB2, 1CB3 or 1CB4
4. Start/Stop NO contact on the Symbio™ 500 binary output module
5. Compressor start contactor coil - 1K1, 1K2, 1K3 or 1K4
6. From the compressor start contactor coil, the same 24 Vac signal is routed through the contactor NO auxiliary to an isolating relay - 2K2, 2K4, or 2K8

If any of these devices contacts should open, 24 Vac is interrupted from the compressor start contactor and the compressor will shut-off.

The unit controller can distinguish between an HPC switch opening and any of the other devices in the circuit opening. It will annunciate either High Pressure Cutout Compressor X or Compressor Safety Circuit X.

Compressor Limit Conditions

Because the SWUD uses suction and discharge pressure sensors rather than limit switches, the Unit Controller can sense when a refrigerant circuit is approaching a high or low pressure limit condition.

Low Pressure Limit conditions can be caused by the following:

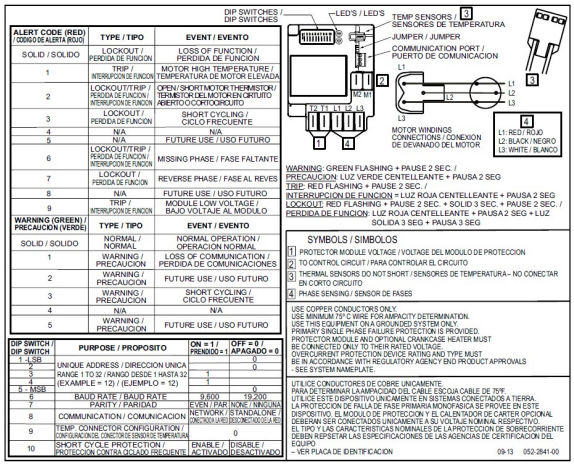
- Low discharge air temperature
- Low airflow
- Dirty air filters
- TXV malfunction
- Low refrigerant charge
- Faulty suction pressure sensor

High Pressure Limit conditions can be caused by the following:

- Low condenser water flow
- High entering condenser water temperature
- Fouled entering condenser water strainer
- TXV malfunction
- Refrigerant over charge
- Faulty discharge pressure sensor

The Unit Controller TD-7 will annunciate a Limit Condition if an FS compressor circuit enters one.

Figure 15. Fixed speed compressor protection module (MCSP)



ALERT CODE (RED) / CODIGO DE ALERTA (ROJO)	TYPE / TIPO	EVENT / EVENTO
SOLID / SOLIDO	LOCKOUT / PERDIDA DE FUNCION	LOSS OF FUNCTION / PERDIDA DE FUNCION
1	TRIP / INTERRUPCION DE FUNCION	MOTOR HIGH TEMPERATURE / TEMPERATURA DE MOTOR ELEVADA
2	LOCKOUT/TRIP / PERDIDA DE FUNCION / INTERRUPCION DE FUNCION	OPEN/ SHORT MOTOR THERMISTOR / TERMISTOR DEL MOTOR EN CIRTUITO ABIERTO O CORTOCIRCUITO
3	LOCKOUT / PERDIDA DE FUNCION	SHORT CYCLING / CICLO FRECUENTE
4	N/A	N/A
5	N/A	FUTURE USE / USO FUTURO
6	LOCKOUT/TRIP / PERDIDA DE FUNCION / INTERRUPCION DE FUNCION	MISSING PHASE / FASE FALTANTE
7	LOCKOUT / PERDIDA DE FUNCION	REVERSE PHASE / FASE AL REVES
8	N/A	FUTURE USE / USO FUTURO
9	TRIP / INTERRUPCION DE FUNCION	MODULE LOW VOLTAGE / BAJO VOLTAJE AL MODULO
WARNING (GREEN) / PRECAUCION (VERDE)	**TYPE / TIPO**	**EVENT / EVENTO**
SOLID / SOLIDO	NORMAL / NORMAL	NORMAL OPERATION / OPERACION NORMAL
1	WARNING / PRECAUCION	LOSS OF COMMUNICATION / PERDIDA DE COMUNICACIONES
2	WARNING / PRECAUCION	FUTURE USE / USO FUTURO
3	WARNING / PRECAUCION	SHORT CYCLING / CICLO FRECUENTE
4	N/A	N/A
5	WARNING / PRECAUCION	FUTURE USE / USO FUTURO

DIP SWITCH / DIP SWITCH	PURPOSE / PROPOSITO	ON = 1 / PRENDIDO = 1	OFF = 0 / APAGADO = 0
1 - LSB	UNIQUE ADDRESS / DIRECCION UNICA		0
2	RANGE 1 TO 32 / RANGO DESDE 1 HASTA 32		0
3	(EXAMPLE = 12) / (EJEMPLO = 12)	1	0
4		1	0
5 - MSB			0
6	BAUD RATE / BAUD RATE	9,600	19,200
7	PARITY / PARIDAD	EVEN / PAR	NONE / NINGUNA
8	COMMUNICATION / COMUNICACION	NETWORK / ISTANDALONE / CNCTADO A LA RED	ESTANDALONE / DESCONECTADO DE LA RED
9	TEMP. CONNECTOR CONFIGURATION / CONFIGURACION DEL CONECTOR DE SENSOR DE TEMPERATURA	0	
10	SHORT CYCLE PROTECTION / PROTECCION CONTRA CICLADO FRECUENTE	ENABLE / ACTIVADO	DISABLE / DESACTIVADO

Compressor Staging

Fixed speed compressors cycle to maintain the operating state required by the temperature controls. In the event of a compressor failure, the next available compressor turns on. During normal conditions, compressors will not turn on until they have been off for at least three minutes. Normal operating conditions are established on an individual compressor basis. When a compressor starts, its timer also starts.

Compressor Control

Steps of mechanical cooling are control based on supply air or zone temperature. Compressor staging is based upon a proportional, integrating (PI) control algorithm.

Waterside Components

Waterside components consist of water piping, water valves, water flow switch option, water cooled condenser, and the economizer option.

Water Purge

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

This user-definable feature allows the user to select a purge schedule to automatically circulate water through the economizer and condensers periodically during non-operational times. This allows fresh chemicals to circulate in waterside heat exchangers. This feature is on all units and is defined at the TD-7.

Water Piping Options

Water piping is factory-installed with left-hand (standard) and right hand (optional) connections on units.

If equipped, the unit water cooled condenser uses 24 VAC powered water regulating ball valve to control flow through the condenser. the unit controller modulates the condenser flow to limit discharge pressure, help prevent high pressure cutout trips, and maintain a circuit minimum differential pressure.

The valve can also be used for condenser system chemical purge and condenser cooling loop system balance.

This option provides condensing temperature control when the unit is configured (user defined at the HI) for variable water flow with or without a waterside economizer. A two-way modulating control valve is wired and installed in the unit to maintains a specific range of water temperature rise through the condenser when entering fluid temperature is less than 58°F (15°C).This option allows the compressor to operate with entering fluid temperature down to 35°F (2°C). The minimum valve position to maintain minimum condenser flow rates is user-defined at the HI. This valve drives closed if the unit shuts down or if a power failure occurs.

With Compatible piping configurations, the unit can be set to the following control schemes at the TD-7.

- Constant water flow
  or
- Variable water flow

Constant water flow is for condenser pumping systems that are not capable of unloading the water-pumping system. Variable water flow maximizes energy saving by unloading the water pumping system.

Water Flow Switch Option

A water flow switch is factory installed in the condenser water pipe within the unit. Whenever the flow switch detects a water flow loss prior to or during mechanical cooling, compressor operation locks out and a diagnostic code displays. If water flow is restored, the compressor operation automatically restores.

Water-Cooled Condensers

Units that are set up for variable water flow will modulate a water valve to maintain a user-defined condensing temperature setpoint. Condensing temperature will be referenced utilizing factory installed sensors located at each condenser.

Table 11. Condenser water piping connection sizes

	20 to 40 tons	45 to 70 tons	75 to 110 tons
Water Pipe (inlet and outlet)	2.50 NPT	3.00 NPT	4.00 NPT

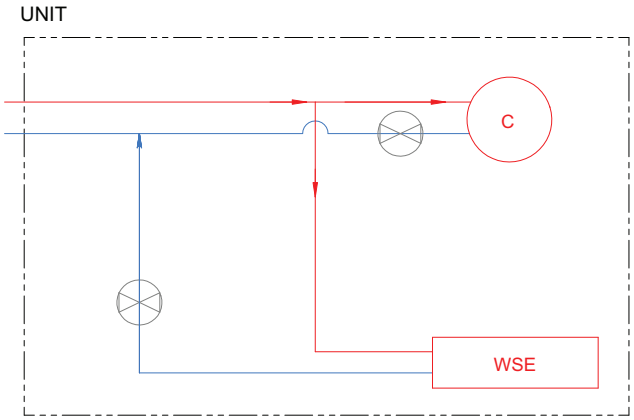
Waterside Economizer Option

The waterside economizer option takes advantage of cooling tower water to either precool the entering air to aid the mechanical cooling process or, if the water temperature is low enough, provide total system cooling. Waterside economizing enables when the unit's entering water temperature is below the unit's entering mixed air temperature by a minimum of 4°F plus the economizer's approach temperature. The approach temperature default is 4°F. Waterside economizing disables when the unit's entering water temperature is not below the unit's entering mixed air temperature by at least the water economizer approach temperature. The approach temperature defaults to 4°F. The economizer acts as the first stage of cooling. If the economizer is unable to maintain the supply air setpoint, the unit control module brings on compressors as required to meet the setpoint.

The waterside economizer includes a coil, modulating valves, controls, and piping with cleanouts. The coil construction is ½-inch (13 mm) OD seamless copper tubes expanded into aluminum fins. The evaporator and economizer coils share a common sloped (IAQ) drain pan. Drain pan options are either galvanized or stainless steel, and are insulated and internally trapped.

The tubes are arranged in a staggered pattern to maximize heat transfer. The coil has round copper supply and return headers with removable clean-out and vent plugs.

Figure 16. Waterside economizer flow control



Heat Mode

The BAS HEAT option supports remote heat (hot water coil or electric heat).

When the SWUD Operating Mode is set to BAS HEAT, the unit controller ends any Cooling Mode operation (Mechanical and/or Water Side Economizer) and transitions to control Discharge Air Temperature to the BAS HEAT setpoint temperature. The unit controller does this by opening and closing the heating ball valve or staging the electric. The Fan Array is controlled normally to maintain static pressure to the Static Pressure Setpoint.

If the Discharge Air Temperature exceeds 104°F a Manually Resettable High Discharge Air Temperature Diagnostic is annunciated.

Dirty Air Filter Sensor Option

A factory installed differential pressure sensor senses the pressure differential across the filters. When the differential pressure exceeds a user selectable setting will display a diagnostic. The unit will continue to run until you replace the air filters.

Supply Air Static Pressure High Limit

During normal operation, the Supply Air Static is monitored. If at any time the static pressure exceeds the software high static limit (defaulted at 2.0 inches from the factory) the unit will immediately shut down and generate a diagnostic.

In order for the unit to resume operation, the Alarm Reset must be toggled from the TD-7. The software high static limit can be user adjusted at the TD-7.

Airside Components

Two-Position Damper Interface

Units with two-position damper ventilation interface are equipped with the necessary control sequences to allow opening of a two-position outdoor air damper to deliver ventilation air to the return air stream of the unit.

When the unit is in the occupied mode and the supply fans are running, a binary output will turn on sending 24 Vac to the two-position damper to allow ventilation air into the unit.

Airside Economizer Interface with OA Reference

Units with airside economizer interface are equipped with the necessary control sequences to allow using outside air for the first stage of cooling, in occupied or unoccupied mode and when ambient conditions are favorable for economizing. Inherent in the unit controller is the ability to suppress the setpoint below the normal unit setpoint. This allows the building to improve comfort levels when possible, and at the same time, optimize building mechanical cooling operation for peak operating efficiency. An outside air temperature and relative humidity sensor are field sourced and installed.

Economizer operation enables when the outside air enthalpy is less than 25 BTU's/lb. (adjustable 19 to 28 BTU's/lb). During occupied mode, the outside air damper opens to 15 percent (adjustable 0 to 50%) for ventilation purposes. An analog 2 to 10 Vdc output is provided to modulate the field-provided and installed damper actuators.

Airside Economizer Interface with Comparative Enthalpy

Units with airside economizer interface and comparative enthalpy are equipped with the necessary control

sequences to allow using outside air for the first stage of cooling, in occupied or unoccupied mode and when ambient conditions are favorable for economizing. Inherent in the unit controller is the ability to suppress the setpoint below the normal unit setpoint. This allows the building to improve comfort levels when possible, and at the same time, optimize building mechanical cooling operation for peak operating efficiency. Outdoor and Return Air temperature and relative humidity sensors are field sourced and installed.

Economizer operation enables when the outside air enthalpy is 3 BTU's/lb. less than the return air enthalpy. During occupied mode, the outside air damper opens to 15 percent(adjustable 0 to 100%) for ventilation purposes. An analog 2 to 10 Vdc output is provided to modulate the field provided and installed damper actuators.

Controls

Unit Controller

The SWUD uses the Symbio™ 500 control platform for monitoring and control. XM expansion modules are used to expand the Symbio 500 I/O capabilities.

In the control panel, the following modules are used:

- Symbio 500
- TD-7
- XM90.1
- XM30.2
- XM30.3
- XM30.4

Note: *The number after the dot in the name (example: XM30.#) is the IMC bus address, which is set using the rotary switches on the module.*

Table 12. Points list

Hardware Connection		Point Name	Point Setup
Symbio 500 (Requires 50VA Transformer)	BO1	Cooling Tower Pump Request	Open = Off, Closed = On
	BO2	Unit Alarm Output Command	Open Normal, Closed = Alarm
	BO3	VAV Box Command Open	Open =Normal Operation, Closed = Drive Max Position
	BO4	Compressor 1 Command	Open = Off, Closed = On
	BO5	Compressor 2 Command	Open = Off, Closed = On
	BO6	Compressor 3 Command	Open = Off, Closed = On
	BO7	Compressor 4 Command	Open = Off, Closed = On
	BO8	Supply Fan Start Stop Command	Open = Off, Closed = On
	BO9	Supply Fan Start Stop Command 2	Open = Off, Closed = On
	AI1	Discharge Air Temperature	10k Ohm Resistor Trane Type 2
	AI2	Return Air Temperature Local	10k Ohm Resistor Trane Type 2
	AI3	Condenser Water Entering Temperature	10k Ohm Resistor Trane Type 2
	AI4	Condenser Water Leaving Temperature	10k Ohm Resistor Trane Type 2
	AI5	Evaporator Coil Leak Detector Signal	Open = Normal, Closed = Leak
	UI1	Occupancy Input	Open = Unoccupied, Closed = Occupied
	UI2	Space Tempertaure Sensor	10k Ohm Resistor Trane Type 2
	BI1	Emergency Stop	Open = Normal, Closed = Emergency Stop
	BI2	Circuit 1 High Pressure Cutout	Open = Alarm, Closed = Normal
	BI3	Circuit 2 High Pressure Cutout	Open = Alarm, Closed = Normal
	AO1/BI4	Ventilation Input Status	Open = Normal, Closed = Ventillation Mode
	AO2/BI5	Outdoor Air Damper Command	2 vdc = 0%, 10 vdc = 100%
	PI1	Duct Static Pressure Local	Honeywell Pressure Sensor
	PI2	Air Filter Differential Pressure	Honeywell Pressure Sensor

Table 12. Points list (continued)

Hardware Connection		Point Name	Point Setup
XM9.1 (Requires 50VA Transformer)	BO1	Heat Output 1	Open = Off, Closed = On
	BO2	Heat Output 2	Open = Off, Closed = On
	BO3	Heat Output 3	Open = Off, Closed = On
	BO4	Outdoor Air Damper (2 Position)	Open = Off, Closed = On
	BO5	Supply Fan Status Output	Open = Off, Closed = On
	BO6	—	—
	BO7	—	—
	BO8	—	—
	UI1	Compressor 1 Safety Circuit Status	Open = Circuit Open, Closed = Circuit Closed
	UI2	Compressor 2 Safety Circuit Status	Open = Circuit Open, Closed = Circuit Closed
	UI3	Compressor 3 Safety Circuit Status	Open = Circuit Open, Closed = Circuit Closed
	UI4	Compressor 4 Safety Circuit Status	Open = Circuit Open, Closed = Circuit Closed
	UI5	Circuit 1 Suction Temperature	10k Ohm Resistor Trane Type 2
	UI6	Circuit 1 Discharge Pressure Sensor	0.5 Vdc = 0 PSI, 4.5Vdc = 667 PSI
	UI7	Circuit 1 Suction Pressure Sensor	0.5 Vdc = 0 PSI, 4.5Vdc = 667 PSI
	UI8	Circuit 2 Discharge Pressure Sensor	0.5 Vdc = 0 PSI, 4.5Vdc = 667 PSI
	UI9	Circuit 2 Suction Pressure Sensor	0.5 Vdc = 0 PSI, 4.5Vdc = 667 PSI
	UI10	Circuit 2 Suction Temperature	10k Ohm Resistor Trane Type 2
	UI11	Supply Fan 1 ECM Fault	Open = Normal, Closed = Fault
	UI12	Supply Fan 2 ECM Fault	Open = Normal, Closed = Fault
	UI13	Supply Fan 3 ECM Fault	Open = Normal, Closed = Fault
	UI14	Supply Fan 4 ECM Fault	Open = Normal, Closed = Fault
	UI15	Condenser Water Flow Switch	Open = No Flow, Closed = Flow
	UI16	External Auto Stop Input Status	Open = Auto, Closed = Exterior Stop
	AO1/UI17	Compressor Coil Leak Detector Signal	Open = Normal, Closed = Leak
	AO2/UI18	Supply Fan 1 Speed Command	0 vdc = 0%, 10 vdc = 100%
	AO3/UI19	Supply Fan 2 Speed Command	0 vdc = 0%, 10 vdc = 100%
	AO4/UI20	Supply Fan 3 Speed Command	0 vdc = 0%, 10 vdc = 100%
	AO5/UI21	Supply Fan 4 Speed Command	0 vdc = 0%, 10 vdc = 100%
	AO6/UI22	Condenser Water Valve	0 vdc = 0%, 10 vdc = 100%
	AO7/UI23	Heating Output 1 Command	0 vdc = 0%, 10 vdc = 100%
	AO8/UI24	Phase Monitor Status	Open = Fault, Closed = Normal
XM30.2	AO1/UI1	Supply Fan 5 ECM Fault	Open = Normal, Closed = Fault (only on units 85 tons and above)
	AO2/UI2	Supply Fan 5 Speed Command	0 vdc = 0%, 10 vdc = 100%
	AO3/UI3	Supply Fan 6 ECM Fault	Open = Normal, Closed = Fault
	AO4/UI4	Supply Fan 6 Speed Command	0 vdc = 0%, 10 vdc = 100%
XM30.3	AO1/UI1	Supply Fan 7 ECM Fault	Open = Normal, Closed = Fault (only on 110 ton units)
	AO2/UI2	Supply Fan 7 Speed Command	0 vdc = 0%, 10 vdc = 100%
	AO3/UI3	—	—
	AO4/UI4	—	—
XM30.4	AO1/UI1	Outdoor Air Temperature Local	10k Ohm Resistor Trane Type 2 (only on units with economizer interfaces)
	AO2/UI2	Outdoor Air Relative Humidity Local	4 ma = 0, 20 ma = 100%
	AO3/UI3	Return Air Humidity Local	4 ma = 0, 20 ma = 100%
	AO4/UI4	Mixed Air Low Temperature Cutout Alarm	Open = Alarm

Navigating the TD-7

TD-7 Home Screen

To access the TD-7 home screen, press the **Home** button in the upper left of the screen.

Screen Element	Description
A	Home button
B	Displays the local Auto Stop button and displays the occupancy, Heat/Cool Mode, and Unit Information.
C	Displays information about the Air Filter.
D	Displays the Discharge Air Temperature, Setpoint, and Return Air Temperature. A red light displays if the sensor fails.
E	Displays when cooling is active and indicates the % of cooling capacity currently utilized.
F	The Water Side Econ Info tile is included on units with an economizer installed. Displays a snapshot of economizer operations and the mode of the economizer.
G	Displays fan status (on, off), duct static pressure setpoint and actual, and fan percentage.
H	Compressor 1 is always the lead compressor. This tile displays the compressor pressures, superheat, VFD signal, condenser water values (if included), and operating mode.
I	Tiles for compressors 2-4 display, depending on the number of compressors installed. The VFD compressor is always the lead compressor. The fixed speed compressors rotate to even out run time. Compressor tiles displays the compressor pressures, superheat, VFD signal, condenser water values (if included), and operating mode.
J	Displays the entering and leaving temperatures, pump command, flow status, and the condenser alarm status.

TD-7 Reports

Unit Status Report

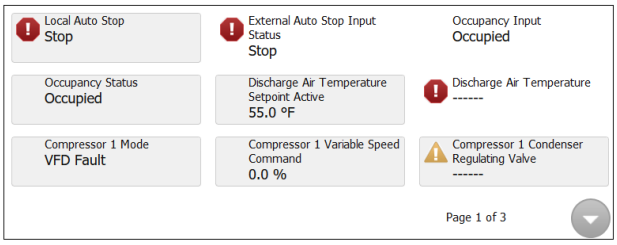
The Unit Status report provides an overview of how the unit is running and includes all available points that were pre-defined for the unit.

To access the Unit Status report:

1. Press the **Reports** button at the bottom of the screen.
2. Press **Unit Status** button.

Use the up and down arrows in the bottom right to scroll through the report.

Figure 17. Unit status report



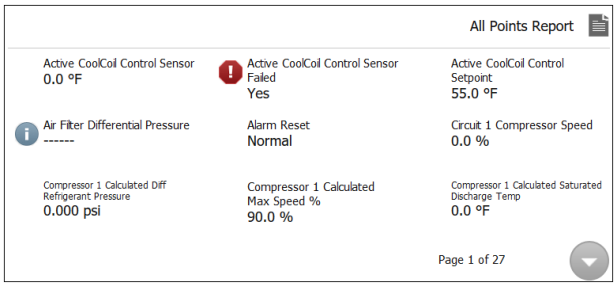
All Points Report

The All Points report provides details for all points for a unit. To access the All Points report:

1. Press the **Reports** button at the bottom of the screen.
2. Press the **All Points Report** button.

Use the up and down arrows in the bottom right to scroll through the report.

Figure 18. All points report



Starting the Unit

Before starting the unit, confirm:

- All checks are complete
- Alarms are cleared
- Compressors that you want to run are made available or locked out.

Local Auto/Stop Value

The Local Auto/Stop Value is used to stop by unit in a safe manner either locally in Tracer TU or at the TD-7 display. The factory default is set to **Auto**.

1. Navigate to the Home screen.
2. In the upper left tile, press the arrow next to either **Stop** or **Auto**.
3. To stop the unit, press the **Stop** button, or to put the unit in Auto default mode, press **Release Override**.

Figure 19. Local Auto/Stop

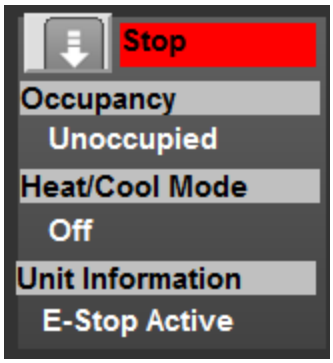
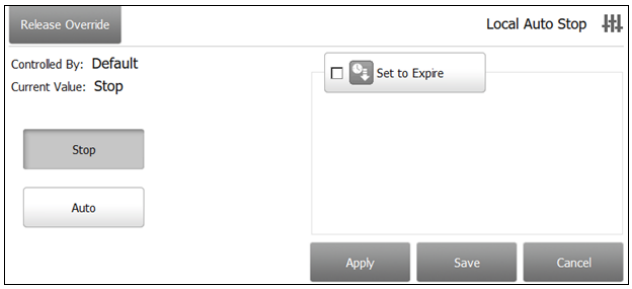


Figure 20. Stop or release override



Setpoint Adjustments

This section details control setpoints that can be modified from factory defaults and how to modify those setpoints.

Unit Setpoints

Table 13. Unit setpoints that can be modified in the TD-7

Setpoint Name	Description	Factory Default
Condenser Purge Time (on units with condenser valves only)	The amount of time (in minutes) that the compressor will open its condenser valve during purge mode when the unit is not operating.	20 minutes
Discharge Air Cooling Setpoint BAS	Used as the cooling setpoint on fixed setpoint units and on units that reset their discharge air temperature setpoint as the low value in the reset equation. This value should be set to the desired temperature needed for startup.	55°F
Discharge Air Cooling Setpoint Max BAS (reset DAT units only)	Sets the upper limit in the Reset Equation in Cooling Mode. This value can be adjusted to the desired maximum setpoint the discharge air should reach during cooling mode.	65°F
Discharge Air Heating Setpoint BAS (Units with Heat Only)	Used as the heating setpoint when the unit is in heating mode. This value should be set to the desired temperature needed for startup.	90°F
Discharge Air Low Temperature Cutout	Value that triggers a diagnostic when the discharge air temperature is below this value for 10 minutes. This value can be adjusted to the desired low air temperature, which triggers the diagnostic.	35°F
Duct Static Pressure Setpoint BAS	The duct static pressure setpoint is set by the analog value named duct static pressure setpoint BAS. This value should be set to the desired pressure needed for startup.	1 in (H_2O)
Duct Static Pressure Safety Lockout	Shuts down the unit if the duct static exceeds this setpoint. It should be set to the desired pressure needed for startup.	2 in (H_2O)
Dirty Air Filter DP	Generates a diagnostic for a dirty air filter when the differential pressure exceeds the setpoint.	10 in (H_2O)
Occupied Offset (DAT Reset Units Only)	Determines the occupied cooling and heating setpoints when the unit resets the discharge air temperature off either return or space temperature.	2°F
Occupied Standby Offset (DAT Reset Units Only)	Determines the occupied cooling and heating setpoints when the unit resets the discharge air temperature off either return or space temperature and is the occupied standby mode.	4°F
Space Temperature Setpoint BAS (DAT Reset by Space Temp Air Units Only)	Sets the space setpoint when the unit is selected to do discharge air reset based off the space temperature. This value is used to determine the occupied heating and cooling temperatures which reset the discharge air temperature setpoint.	72°F

Table 13. Unit setpoints that can be modified in the TD-7 (continued)

Setpoint Name	Description	Factory Default
Return Temperature Setpoint BAS (DAT Reset by Return Temp Air Units Only)	Sets the return setpoint when the unit is selected to do discharge air reset based off the return temperature. This value is used to determine the occupied heating and cooling temperatures which reset the discharge air temperature setpoint.	72°F
Water Side Economizer Enable Offset (Units with Water Side Economizer Only)	The temperature that the condenser entering water must be below the return air temperature before it will enable the economizer.	7°F
Water Side Economizer Sample Time (Units with Water Side Economizer Only)	Time that the controller will sample the water temperature for and compare it against the return air temperature to determine if the economizer can be enabled.	2 minutes

To modify any of the setpoints in the table above:

1. Press **Reports** at the bottom of the screen.
2. Press the **Unit Setpoints** button.
3. On the **Setpoint** report, locate the point in the menu. Use the arrows to scroll through the report if needed.
4. Use the up and down arrows to change the value, or press inside the box and type in the desired setpoint.
5. Press **Save**.

Unit Setup

Table 14. Unit setup setpoints that can be modified in the TD-7

Setpoint Name	Description	Factory Default
Condenser Control % of Design	Percent of the condenser pressure design the unit will control to and is user adjustable between 50-100%.	90%
Condenser Tee Strainer Sensor Calibration	The condenser water tee high and low pressure sensor can be calibrated to match the gauge readings or recorded readings by the balancer.	0
Condenser Purge Status (On Units with Condenser Valves Only)	Each compressor has its own condenser purge status value which indicates when the condenser valve is open in the purge mode. It can also be used to manually initiate the purge mode for each compressor.	Off
Condenser Water Flow Type (On Units with Condenser Valves Only)	Indicates if the unit is a constant or variable volume flow type unit. Even with the condenser water regulating valves installed on each compressor, the flow type can be changed. When the flow is changed from variable flow to constant flow, the water regulating valve will open to its maximum position when the unit is occupied. This can be done for constant volume flow systems that do not include a VFD Pump.	Variable flow
Water Side Economizer Lockout BAS (Units with Water Side Economizer Only)	The water side economizer can be locked out by the controls system.	Available
Compressor Lockout BAS	Each compressor can be locked out individually by the controls system.	Available
Fan Lockout BAS	Each fan can be locked out individually by the controls system. Fans should be made available prior to startup.	Available

To modify any of the setpoints in the table above:

1. Press **Reports** at the bottom of the screen.
2. Press the **Unit Setup** button.
3. On the **Setup** report, locate the point in the menu. Use the arrows to scroll through the report if needed.
4. Use the up and down arrows to change the value, or press inside the box and type in the desired setpoint.
5. Press **Save**.

Reports

To access Alarms, press the Alarms button in the lower left corner of the screen. If the Alarm tab is not blinking red, there are no alarms present.

Figure 21. Alarms tab

Compressor Alarms

If there is a compressor alarm, it will need to be manually reset after it is resolved. Each compressor needs to be reset manually:

1. Press **Reports** at the bottom of the display.
2. Press **Unit Setup**.
3. In the **Setup** report, locate the appropriate point. Use the arrows to scroll through the report if needed.
4. Select the specific compressor.
5. Change the value from Normal to **Reset**.
6. Press **Save**. The point will automatically revert to its default setting (Off).

Fan Alarms

If there is a fan alarm, it will need to be manually reset after it is resolved. There is one fan reset for the entire wall fan.

1. Press **Reports** at the bottom of the display.
2. Press **Unit Setup**.
3. In the **Setup** report, press **Supply Fan Failure Reset**. Use the arrows to scroll through the report if needed.
4. Press **Reset**.
5. Press **Save**.
6. When you want the fan to be available, press the **Release Override** button in the top left.

General Alarms

General alarms are alarms that are not tied to fans or compressors. They require a manual reset, and there is one alarm reset for these alarms.

To reset a general alarm:

1. Press **Reports** at the bottom of the display.
2. Press **Unit Setup**.
3. In the **Setup** report, press **Alarm Reset**. Use the arrows to scroll through the report if needed.
4. Press **Reset**.
5. Press **Save**.

Water Purge

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

During the unoccupied mode, water-cooled units will periodically circulate water through the condensers and waterside economizer if the user has enabled the purge function at the HI. The water purge function circulates water to introduce fresh water-treatment chemicals and help prevent water stagnation. The number of hours between each periodic purge, or purge duration, is user-defined at the HI between 1-999 hours. If the periodic purge timer expires while the unit is in occupied mode, it will wait for the next available unoccupied time before initiating water purge.

Contrary, if a request for cooling occurs during a purge sequence, purge will terminate and cooling will commence.

Pre-Startup

Before starting up units, perform the following procedure to confirm proper unit operation.

Pre-Startup Checklist

Complete this checklist after installing unit to verify all recommended installation procedures are complete before start-up. This does not replace the detailed instructions in the appropriate sections of this manual. Always read the entire section carefully to become familiar with the procedures.

Supply Fan

Confirm the fan rotates freely.

Ductwork

- Confirm trunk ductwork to VAV boxes is complete and secure to prevent leaks.
- Verify that all ductwork conforms to NFPA 90A or 90B and all applicable local codes.

Water-Cooled Unit Piping

Verify condensate drain, water piping drain plugs, economizer header, strainer pressure transducers, and condenser vent plug are installed.

Units with Hydronic Heat

Verify the entering water temperature sensor is installed upstream of the hydronic coil.

Electrical

Verify electrical connections are tight.

Components

- Verify liquid line service valve, and suction and discharge service valves if present, are open at start-up.

  Note: *Each compressor suction line contains a low pressure sensor that will shut the compressor down in low pressure situations.*
- Confirm system components are properly set and installed.

Start-Up

⚠ 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

Compressor Damage!

Failure to follow instructions below will cause the compressor to operate in a vacuum and result in compressor damage.

Never manually or automatically pump down system below 7 psig.

NOTICE

Compressor Damage!

Failure to follow instructions could result in compressor damage.

Keep crankcase heaters on whenever refrigerant is in the system.

If crankcase heaters have not been on with refrigerant in the system, turn the crankcase heaters on for a minimum of 24 hours before starting compressors.

To start the unit, complete the following steps in order.

Review "Refrigerant System," p. 22, if applicable. Confirm all steps were completed.

Final Refrigerant Charge

If full charge was not used during installation, follow these steps:

1. Determine remaining charge required by subtracting charge added during "Refrigerant System," p. 22 from the total.
2. With all circuit compressors running, SLOWLY meter remaining R-454B into the suction line from the LIQUID charging connection.

NOTICE

Compressor Damage!

Overcharging system could result in compressor failure and/or reduced compressor life.

Do not overcharge system. Excessive refrigerant charging can cause compressor liquid slugging at startup, and conditions where compressors and/or condenser fans short cycle.

NOTICE

Compressor Damage!

Failure to follow instructions below could result in compressor failure and/or reduced compressor life.

To prevent compressor liquid slugging, only add liquid in the suction line when the compressor is running. Use extreme caution to meter liquid refrigerant into the suction line slowly. If liquid is added too rapidly, compressor oil dilution and oil pumpout could occur.

3. Use an accurate scale to measure and record amount of R-454B added.
4. After unit has been operating for approximately 30 minutes at full load, measure and record operating pressures.
5. Repeat for other circuits.
6. Confirm, and adjust charge, if necessary, by checking subcooling at AHRI 340/360 full load operating conditions (80°/67°F db/wb entering evaporator, ~300 cfm/ton, 85°/95°F EWT/LWT).

   Some TXV superheat adjustment may be necessary, but only, after adequate subcooling has been reached.

   Note: *Water-cooled subcooling should be 10.5°F to 12.5°F.*

Start-Up Procedure

Using the start-up log on the following pages, establish nominal conditions for consistent measurements as follows:

- Leaving air greater than 60°F
- Entering air temperature = 70 to 90°F
- Entering water temperature > 60°F

With all compressors running at full load:

1. Compute superheat from the suction line pressure and temperature at the compressor on each circuit. Adjust the thermal expansion valve settings if necessary. Superheat should be between 14°F and 20°F.
2. Inspect refrigerant flow in the liquid line sight glass. Flow should be smooth and even, with no bubbles once the system has stabilized.

   Note: *Sight glass moisture indicator may show caution or wet at start-up. May need up to 12 hours of operation for system to reach equilibrium and correctly show moisture.*

Normal startup will occur provided Tracer® Summit is not controlling the module outputs or the generic BAS is not keeping the unit off. To prevent Tracer Summit from affecting unit operation, remove Tracer wiring and make required changes to setpoint and sensor sources.

Operating and Programming Instructions

See *IntelliPak™ Commercial Self-Contained Signature Series 20 to 110 Ton, Modular Series 20 to 35 Ton Programming Guide* (PKG-SVP01*-EN) for available unit operating setpoints and instructions. A copy ships with each unit. For units with VFD option, see installer guide that ships with each VFD.

Start-Up Log

Unit:	
Unit Location:	
Unit Voltage	

Evaporator		
Evaporator fan motor horsepower:		
Evaporator fan motor amps:		
Evaporator fan rpm (actual):		
Evaporator system static (from test and balance report or actual readings)	**Supply duct static:**	**Return duct static:**
Evaporator system cfm (test and balance sheet or actual tested):		

Evaporator Air Conditioners (with all compressor operating)			
Entering		**Leaving**	
Dry-bulb °F:		**Dry-bulb °F:**	
Wet-bulb °F:		**Wet-bulb °F:**	

Water-Cooled Units				
	Circuit A	**Circuit B**	**Circuit C**	**Circuit D**
Entering water temp °F				
Leaving water temp °F				
Entering water pressure psig				
Leaving water pressure psig				

Maintenance

Service Access

All service accessible areas are provided with hinged doors that allow doors to swing open or be removed completely.

To use as a hinge, simply open hinge handle, depress Y latch and swing door open.

To remove completely, open hinge handle and depress Y latch on back side of hinge. Work door off of unit being careful to not drop door.

Note: *Evaporator door is 75 lbs and requires two-man lift to remove safely.*

Access unit controls through the front. The panel is secured with two quick release hinges. Hinged panels allow access to the fans and also the compressor and condensers. Hinges also allow for complete removal of panel. Left and right hinges allow for access to evaporator section and also allow for removable of the entire panel. Expansion valves and filter driers are easily accessible from here. Filters are accessible via a hinged panel.

Power is accessible through a hinged door on the unit (left hand is standard and right hand is optional). Hinge also allows for panel to be removed.

Air Filters

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

Filter access doors are shared with the evaporator cassette access door. To replace throwaway filters, remove the dirty elements and install new filters with the filter directional arrows pointing toward the fan. Verify no air bypasses the filters. See Table 15, p. 44 for proper filter placement.

Table 15. Unit filter sizes

Unit size	Qty	Filter size
20 to 35	9	20 x 24 inches
40 to 60	12	
65 to 85	15	
90 to 110	21	

Inspecting and Cleaning the Drain Pan

Check the condensate drain pan and drain line to confirm the condensate drains properly at least every six months or as dictated by operating experience.

If evidence of standing water or condensate overflow exists, take steps to identify and remedy the cause immediately. Refer to the "Troubleshooting," p. 52 for possible causes and solutions.

⚠ 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.

Clean drain pans using the following procedure:

1. Disconnect all electrical power to the unit.
2. Don the appropriate personal protective equipment (PPE).
3. Remove all standing water.
4. Use a scraper or other tools to remove and solid matter. Remove solid matter with a vacuum device that utilizes high efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97% at 0.3 micron particle size.
5. Thoroughly clean the contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use. Carefully follow the sanitizer manufacturer's instructions regarding product use.
6. Immediately rinse the drain pan thoroughly with fresh water to prevent potential corrosion from the cleaning solution.
7. Allow the unit to dry thoroughly before putting the system back into service.
8. Properly dispose of all contaminated materials and cleaning solution.

Compressors

Scroll Compressor Failure Diagnosis and Replacement

If compressor failure is suspected, refer to *CSHD and CSHN/CSHL Compressors Installation and Service Installation Instructions* (COM-SVN01*-EN) for detailed information regarding compressor failure diagnosis and replacement of scroll compressors.

Refrigerant System

If refrigerant system repair is required, Leak Test, Brazing and Evacuation Procedures are described.

Preliminary charging is described in the Installation – Mechanical section, "Refrigerant System," p. 22 and final charging is described in the Start-Up section, "Final Refrigerant Charge," p. 42.

Refrigerant systems that have been opened must have filter driers replaced and complete leak test and evacuation before recharging. Unit is equipped with replaceable filter core option for easy maintenance.

Refrigerant Leak Test Procedure

⚠ WARNING

Confined Space Hazards!

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

Do not work in confined spaces where refrigerant or other hazardous, toxic, or flammable gas may be leaking. Refrigerant or other gases could displace available oxygen to breathe, causing possible asphyxiation or other serious health risks. Some gases may be flammable and/or explosive. If a leak in such spaces is detected, evacuate the area immediately and contact the proper rescue or response authority.

⚠ 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.

⚠ WARNING

Explosion Hazard!

Failure to follow these instructions could result in death or serious injury or equipment or property-only damage.

Use only dry nitrogen with a pressure regulator for pressurizing unit. Do not use acetylene, oxygen or compressed air or mixtures containing them for pressure testing. Do not use hydrogen mixtures containing refrigerant and air above atmospheric pressure for pressure testing as they may become flammable and could result in an explosion. Refrigerant, when used as a trace gas should only be mixed with dry nitrogen for pressurizing units.

⚠ WARNING

Explosion Hazard!

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

Do not exceed unit nameplate design pressures when leak testing system.

⚠ 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.

Note: *These service procedures require working with refrigerant. Do not release refrigerant to the atmosphere. The service technician must comply with all federal, state, and local laws.*

When leak-testing refrigerant systems, observe all safety precautions. Leak test only one circuit at a time to minimize system exposure to potentially harmful moisture in the air.

System Repair

1. Connect R-454B refrigerant cylinder to charging port, add refrigerant to reach pressure of 12 to 15 psig.
2. Disconnect refrigerant cylinder. Connect dry nitrogen cylinder to high side charging port and increase pressure to 150 psig. DO NOT exceed unit nameplate design pressures. If testing complete system, low side design pressure is maximum.
3. Check piping and/or components as appropriate for leaks.
4. Recommend using electronic detector capable of measuring 0.1 oz/year leak rate.
5. If a leak is located, use proper procedures to remove

the refrigerant/nitrogen mixture, break connections and make repairs. Retest for leaks.

6. Confirm all service valves are open.

Brazing Procedures

⚠ WARNING

Explosion Hazard and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

Proper brazing techniques are essential when installing refrigerant piping. The following factors should be kept in mind when forming sweat connections:

1. When heating copper in the presence of air, copper oxide forms. To prevent copper oxide from forming inside the tubing during brazing, sweep an inert gas, such as dry nitrogen, through the tubing. A nitrogen flow of 1 to 3 cubic feet per minute is sufficient to displace the air in the tubing and prevent oxidation of the interior surfaces. Use a pressure regulating valve or flow meter to control the flow.
2. Confirm the tubing surfaces requiring brazing are clean, and that the tube ends are carefully reamed to remove any burrs.
3. Confirm the inner and outer tubes of the joint are symmetrical and have a close clearance, providing an easy slip fit. If the joint is too loose, the connection tensile strength is significantly reduced. Confirm the overlap distance is equal to the inner tube diameter.
4. Wrap each refrigerant line component with a wet cloth to keep it cool during brazing. Excessive heat can damage the internal components.

   Note: *Use 40-45% silver brazing alloy (BAg-7 or BAg-28) on dissimilar metals. Use BCup-6 brazing alloy on copper-to-copper joints.*
5. If using flux, apply it sparingly to the joint. Excess flux will contaminate the refrigerant system.
6. Apply heat evenly over the length and circumference of the joint.
7. Begin brazing when the joint is hot enough to melt the brazing rod. The hot copper tubing, not the flame, should melt the rod.
8. Continue to apply heat evenly around the joint circumference until the brazing material is drawn into the joint by capillary action, making a mechanically sound and gas-tight connection.
9. Visually inspect the connection after brazing to locate any pinholes or crevices in the joint. Use a mirror if joint locations are difficult to see.

System Evacuation Procedures

- Each refrigeration circuit must be evacuated before the unit can be charged and started.
- Use a rotary type vacuum pump capable of pulling a vacuum of 100 microns or less.
- Verify that the unit disconnect switch and the system control circuit switches are **OFF**.
- Oil in the vacuum pump should be changed each time the pump is used with high quality vacuum pump oil. Before using any oil, check the oil container for discoloration, which usually indicates moisture in the oil and/or water droplets. Moisture in the oil adds to what the pump has to remove from the system, making the pump inefficient.
- When connecting vacuum pump to refrigeration system, it is important to manifold vacuum pump to both high and low side of system (liquid line access valve and suction line access valve). Follow pump manufacturer's directions for proper methods of using vacuum pump.
- Lines used to connect the pump to the system should be copper and of the largest diameter that can practically be used. Using larger line sizes with minimum flow resistance can significantly reduce evacuation time.
- Rubber or synthetic hoses are not recommended for system evacuation. They have moisture absorbing characteristics that result in excessive rates of evaporation, causing pressure rise during standing vacuum test. This makes it impossible to determine if system has a leak, excessive residual moisture, or continual or high rate of pressure increase due to hoses.
- Install an electronic micron vacuum gauge in the common line ahead of the vacuum pump shutoff valve, as shown in Figure 22, p. 47. Close valves B and C, and open Valve A.
- Start vacuum pump. After several minutes the gauge reading will indicate the maximum vacuum the pump is capable of pulling. Rotary pumps should produce vacuums of 100 microns or less.

NOTICE

Motor Winding Damage!

Failure to follow instructions below could result in compressor motor winding damage.
Do not use a megohm meter or apply voltage greater than 50 VDC to a compressor motor winding while it is under a deep vacuum.

- Open valves B and C. Evacuate system to a pressure of 300 microns or less. As vacuum is being pulled on system, it may appear that no further vacuum is being obtained, yet pressure is high. It is recommended during evacuation process to break vacuum to facilitate evacuation.
- To break the vacuum, shut valves A, B, and C and connect a refrigerant cylinder to charging port on manifold. Purge air from hose. Raise standing vacuum pressure in system to zero (0 psig) gauge pressure. Repeat process two or three times during evacuation.

Note: *It is unlawful to release refrigerant into the atmosphere. When service procedures require working with refrigerants, the service technician must comply with all Federal, State, and local laws.*

Standing Vacuum Test

Once 300 microns or less is obtained, close valve A and leave valves B and C open to allow the vacuum gauge to read the actual system pressure. Let system equalize for approximately 15 minutes. This is referred to as a standing vacuum test where time versus pressure rise. Maximum allowable rise over a 15 minute period is 200 microns. If pressure rise is greater than 200 microns but levels off to a constant value, excessive moisture is present. If pressure steadily continues to rise, a leak is indicated. Figure 23, p. 47 illustrates three possible results of standing vacuum test.

If a leak is encountered, repair the system and repeat the evacuation process until the recommended vacuum is obtained. Once the system has been evacuated, break the vacuum with refrigerant and complete the remaining Pre-Start procedures before starting the unit.

Figure 22. Typical vacuum pump hookup

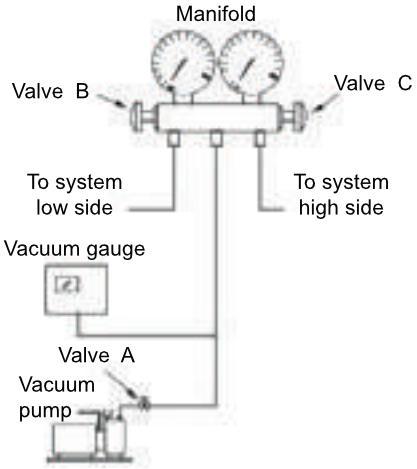
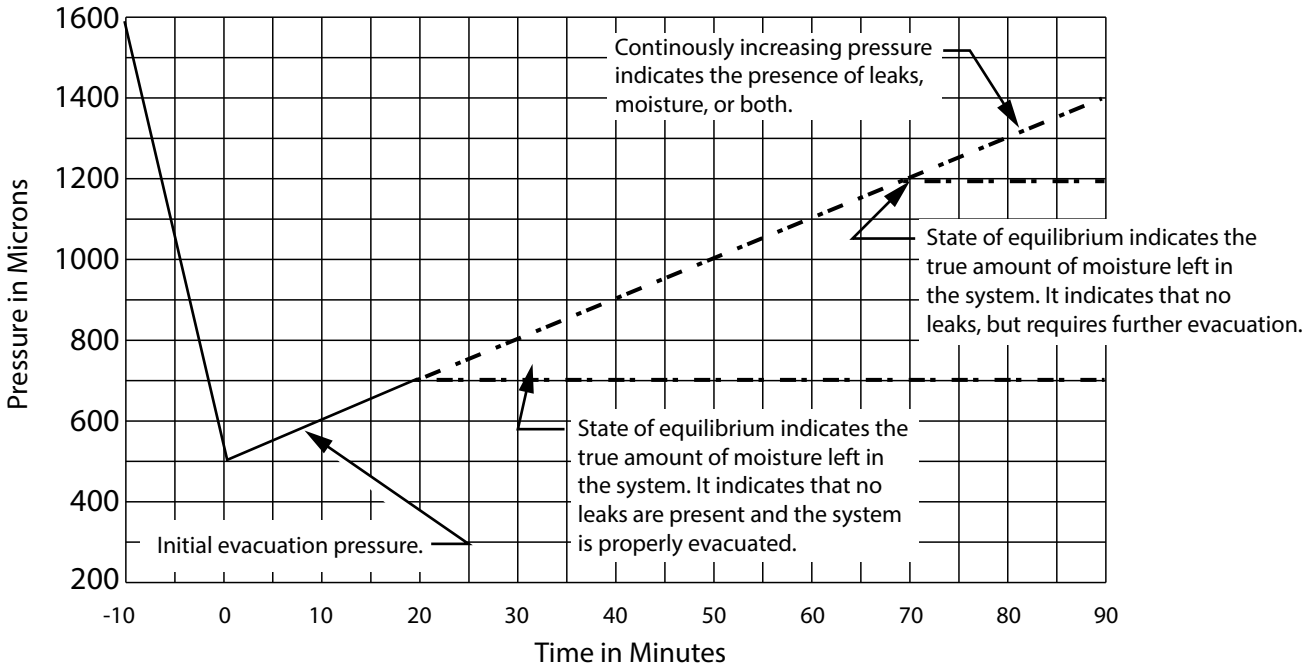


Figure 23. Evacuation time vs. pressure rise



Compressors

Scroll Compressor Failure Diagnosis and Replacement

If compressor failure is suspected, refer to *CSHD and CSHN/CSHL Compressors Installation and Service Installation Instructions* (COM-SVN01*-EN) for detailed information regarding compressor failure diagnosis and replacement of scroll compressors.

Components

Cleaning Coil Fin

⚠ 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.

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

NOTICE

Coil Damage!

Failure to follow instructions below could result in coil damage.

Do not clean the refrigerant coil with hot water or steam as it could cause high pressure inside the coil tubing.

Do not use acidic chemical coil cleaners. Also, do not use alkaline chemical coil cleaners with a pH value greater then 8.5 (after mixing) without using an aluminum corrosion inhibitor in the cleaning solution.

- Keep coils clean to maintain maximum performance. For operation at its highest efficiency, clean the refrigerant coil often during periods of high cooling demand or when dirty conditions prevail. Clean the coil a minimum of once per year to prevent dirt buildup in the coil fins, where it may not be visible.
- Remove large debris from the coils and straighten fins before cleaning. Remove filters before cleaning.
- Clean refrigerant coils with cold water and detergent, or with one of the commercially available chemical coil cleaners. Rinse coils thoroughly after cleaning.
- Economizer and evaporator coils are installed so the evaporator is directly behind the economizer. To clean between the coils, remove the sheet metal block off. Access the block off by removing the corner panels on the left or right rear side of the unit.
- If the refrigerant coil is installed back to back with the waterside economizer coil, use a cleaner that is acceptable for cleaning both types of coils.

Inspecting and Cleaning Coils

Coils become externally fouled as a result of normal operation. Coil surface dirt reduces heat transfer ability and can cause comfort problems, increased airflow resistance and thus increased operating energy costs.

Inspect coils at least every six months or more frequently as dictated by operating experience. Cleaning frequently is dependent upon system operating hours, filter maintenance, efficiency, and dirt load. Following is the suggested method for cleaning steam and hot water coils.

Hot Water Coils

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

1. Disconnect all electrical power to the unit.
2. Wear appropriate personal protective equipment (PPE).
3. Access both sides of the coil section.
4. Use a soft brush to remove loose debris from both sides of the coil.
5. Use a steam cleaning machine, starting from the top of the coil and working downward. Clean the leaving air side of the coil first, then the entering air side. Use a block-off to prevent steam from blowing through the coil and into a dry section of the unit.
6. Repeat Step 5 as necessary. Confirm that the drain line is open following completion of the cleaning process.

7. Allow the unit to dry thoroughly before putting the system back into service.
8. Straighten any coil fins that may be damaged with a fin rake.
9. Replace all panels and parts and restore electrical power to the unit.
10. Confirm contaminated material does not contact other areas of the equipment or building. Properly dispose of all contaminated materials and cleaning solutions.

Refrigerant Coils

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

1. Disconnect all electrical power to the unit.
2. Wear the appropriate personal protective equipment (PPE).
3. Access to the coil section of the unit (both sides).
4. Use a soft brush to remove loose debris from both sides of the coil.
5. Mix a high quality coil cleaning detergent with water according to the manufacturer's instructions. If the detergent is strongly alkaline after mixing (pH 8.5 or higher), it must contain an inhibitor. Carefully follow the cleaning solution manufacturer's instructions regarding product use.
6. Place the mixed solution in a garden pump-up sprayer or high pressure sprayer. If using a high pressure sprayer note the following:
   - Maintain a minimum nozzle spray angle of 15°.
   - Spray perpendicular to the coil face.
   - Protect other areas of the equipment and internal controls from contact with moisture or the cleaning solution.
   - Keep the nozzle at least 6 inches from the coil.
   - Do not exceed 600 psig.

Draining the Waterside Economizer Coil

NOTICE

Coil Freeze-Up!

Failure to follow instruction below could result in equipment damage.

Drain and vent coils when not in use. Trane recommends glycol protection in all possible freezing applications. Use a glycol approved for use with commercial cooling and heating systems and copper tube coils.

Drain plugs are in the piping below supply and return header for each coil. Use these plugs to drain the coil and piping. When draining the coil, open the vents at the top of the supply and return headers. Also, a drain plug is at the bottom of the inlet condenser manifold and in the outlet pipe near the left side of the unit. Remove these plugs to drain the condensers. Be sure to open the vent plugs at the top of the condenser inlet and outlet manifold.

When refilling the condenser/waterside economizer coil system with water, provide adequate water treatment to prevent the formation of scale or corrosion.

Chemical Cleaning of Economizer Coil

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Chemical cleaning removes scale deposits built up by minerals in the water. For a suitable chemical solution, consult a water treatment specialist. The condenser water circuit is composed of copper, steel, and cast iron. The chemical supply house should approve or provide all materials used in the external circulating system, along with the quantity of cleaning material, duration of cleaning time, and safety precautions necessary for handling the cleaning agent.

Piping Components

Water Valves

⚠ 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.

Water valves have a stern packing nut. If there is evidence of water leakage at the valve stem, proceed as follows:

1. Remove actuator motor from support plate.
2. Remove shaft coupling.
3. Torque the packing nut to 10-ft.-lbs. of torque.
4. Replace shaft coupling.
5. Replace actuator motor.

Water Flow Switch

A water flow switch is required to be installed in the condenser water pipe within the unit. It is a standard feature and supplied from the factory.

When the flow switch detects a water flow loss prior to or during mechanical cooling, the compressor operation locks out and a diagnostic code displays. If water flow is restored, the compressor operation automatically restores.

Maintenance Periodic Checklists

⚠ WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels 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 following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

Monthly Checklist

The following check list provides the recommended maintenance schedule to keep the commercial self-contained equipment running efficiently.

1. Inspect unit air filters. Clean or replace if airflow is blocked or if filters are dirty.
2. Inspect coils for excess moisture or icing. Icing on the coils may indicate low airflow supply, restricted airflow from dirty fins, evaporator frost protection sensor problems, or a shortage of refrigerant flowing through the coil.
3. Check that condensate from the evaporator and economizer coils flows freely through the condensate piping, traps, drain pan, and drainage holes. Remove algae and or any airflow obstructions.
4. Check the liquid line sight glasses during operation. Bubbles in the sight glasses indicate a possible shortage of refrigerant or an obstruction in the liquid lines, e.g. dirty liquid line filter driers.
5. Inspect filter driers for leaks, flow obstructions, or temperature drop across the filter drier. A noticeable temperature differential, e.g. 5°F, in the liquid line may indicate an obstruction. Replace the filter drier if it appears clogged.
6. Inspect the optional waterside economizer coil. Clean the coil to prevent airflow restrictions through the fins.
7. Check and record operating pressures.

Semi-Annual Maintenance

⚠ 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.

1. With power disconnected, manually rotate the fan wheel to check for obstructions in the housing or interference with fan blades. Remove obstructions and debris. Inspect for any damage to fan blades and housing. Check impeller for wear/deposits/corrosion and damage.
2. Check water valves for leakage at valve stem packing nut.

   Note: *Perform this procedure monthly if the unit is in a coastal or corrosive environment.*

Annual Maintenance

Check and tighten all set screws, bolts, locking collars and sheaves.

1. Inspect, clean, and tighten all electrical connections.
2. Visually inspect the entire unit casing for chips or corrosion. Remove rust or corrosion and repaint surfaces.
3. Visually check for leaks in refrigerant piping.
4. Inspect fan, motor, and control contacts. Replace badly worn or eroded contacts.
5. Inspect the thermal expansion valve sensing bulbs for cleanliness, good contact with the suction line, and adequate insulation from ambient air.
6. Verify the superheat setting is 12°F to 17°F at the compressor.

When checking operating pressures and conditions, establish the following nominal conditions for consistent measurements.

- Leaving air temperature greater than 60°F.
- Entering air temperature is 80°F to 90°F.
- Entering water temperature greater than 65°F.
- Compressors running at full load.
- Drain the condensing water system and inspect it thoroughly for fouling; clean if necessary.

Diagnostics

Troubleshooting

System Checks

⚠ 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.

Before proceeding with technical trouble charts or controls checkout, complete the following system analysis:

1. Measure actual supply voltage at the compressor and an motor terminals with the unit running. Voltage must be within the range listed on the motor nameplate. Phase imbalance must be less than 2.0 percent.
2. Check all wiring and connections to be sure that they are intact, secure and properly routed. The as wired system diagrams are provided in the unit control panel.
3. Check that all fuses are installed and properly sized.
4. Inspect air filters and coils to be sure that airflow to the unit is not restricted.
5. Check the zone thermostat settings.
6. Confirm the fan is rotating in the proper direction. If phasing is wrong at the main power terminal block, the fan and compressors will not run correctly.
7. Inspect ductwork and duct connections for tightness.

Operating Procedures

Install pressure gauges on the discharge and suction line access valves. When the unit has stabilized (after operating approximately 15 minutes at full load), record suction and discharge pressures. System malfunctions such as low airflow, line restrictions, incorrect refrigerant charge, malfunctioning of expansion valves, damaged compressors, etc. will result in pressure variations which are outside the normal range.

Note: *If phasing at the main incoming power terminal is incorrect, switch two of the three incoming power leads. If a compressor has been replaced and the phase is changed at the compressor, it will run backwards and discharge pressure will be very low. To resolve incorrect compressor wire phasing, change phasing at the compressor.*

It is important that pressures be measured under stable and constant conditions in order for the readings to be useful.

Voltage Imbalance

Voltage imbalance on three-phase systems can cause motor overheating and premature failure. Maximum allowable imbalance is 2.0 percent, and the readings used to determine it must be measured at the compressor terminals.

Voltage imbalance is defined as 100 times the sum of the division of the three voltages from the average voltage. If, for example, the three measured voltages are 221, 230, 227, the average is:

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

Therefore, the percentage of voltage imbalance is:

100*(226-221)/226 = 2.2%

In this example, 2.2 percent imbalance of more than 2.0 percent exists, be sure to check the voltage at the unit disconnect and terminal block switch. If an imbalance at the unit disconnect switch does not exceed 2.0 percent, the imbalance is caused by faulty wiring within the unit. Be sure to conduct a thorough inspection of the unit electrical wiring connections to locate the fault, and make any repairs necessary.

Table 16. Potential unit issues and solutions

Problem	Possible Cause	Remedy
Drain pan is overflowing	Plugged drain line Unit not level	Clean drain line Level unit
Standing water in drain pan	Unit not level Plugged drain line	Level Unit Clean drain line
Wet interior insulation	Coil face velocity too high Improper trap design Drain pan leaks/overflowing Condensation on surfaces	Reduce fan speed Design trap per unit installation instructions Repair Leaks Insulate surfaces
Excess dirt in unit	Missing filters Filter bypass	Replace filters Reduce filter bypass
Microbial growth (mold)	Standing water in drain pan	See "Standing water in drain pan" above

Notes

Trane - by Trane Technologies (NYSE: TT), a global innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

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