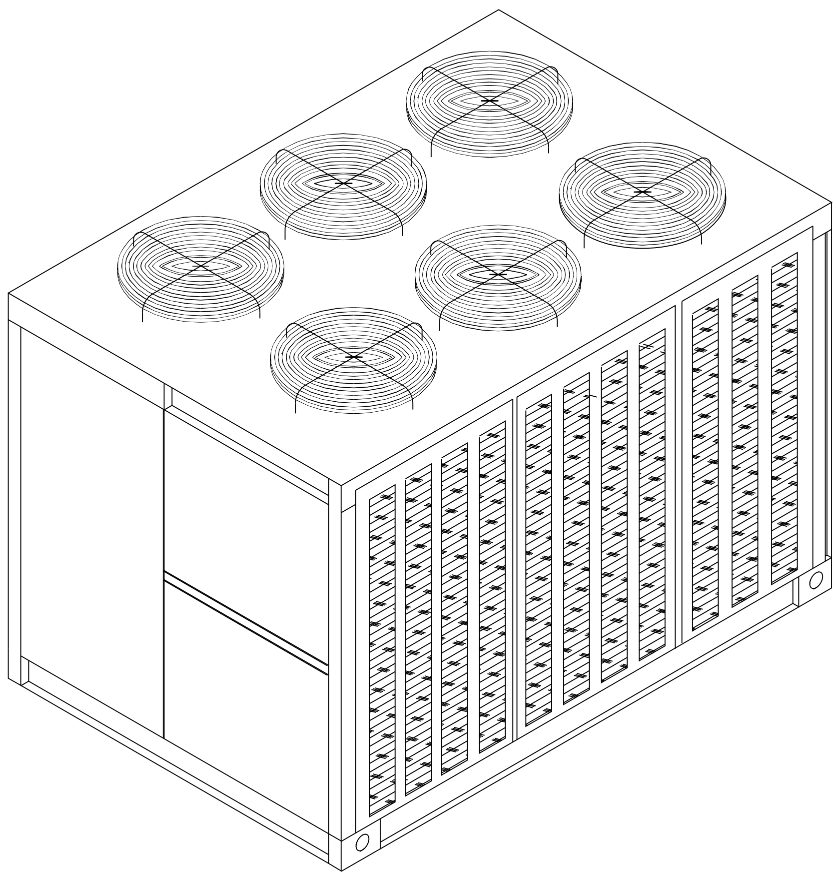
TRANE®

Installation
Operation
Maintenance

Remote Split System Units

Air Cooled Condensing Units and EVP Chillers



Models
"V" and Later Design Sequence

RAUC-C20	RAUC-C40
RAUC-C25	RAUC-C50
RAUC-C30	RAUC-C60

June 2008

SS-SVX09A-EN

Warnings, Cautions and Notices

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

Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

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

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

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

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

Important Environmental Concerns!

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

Responsible Refrigerant Practices!

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

⚠ WARNING
Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

Overview of Manual

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's maintenance personnel.*

This booklet describes proper installation, operation, and maintenance procedures for air 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 assure trouble free operation. A maintenance schedule is provided at the end of this manual. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

Table of Contents

General Information

Model Number Description

All Trane products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification code is provided below. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, specific components, and other options for any specific unit. When ordering replacement parts or requesting service, be sure to refer to the specific model number, serial number, and DL number (if applicable) stamped on the unit nameplate.

Sample Model No.: RAUC - C60 E B L 1 3 A, F, G, 1, etc
Digit No.: 1 2 3 4 5,6,7 8 9 10 11 12 13+

Digit 1 - Unit Type
R = Remote Condensing Unit

Digit 2 - Condenser
A = Air Cooled

Digit 3 - Air Flow
U = Up Flow

Digit 4 - Development Sequence
C = Third

Digits 5, 6, 7 - Nominal Capacity
C20 = 20 Tons

C25 = 25 Tons

C30 = 30 Tons

C40 = 40 Tons

C50 = 50 Tons

C60 = 60 Tons

Digit 8 - Power Supply
E = 200/60/3 XL

F = 230/60/3 XL

4 = 460/60/3 XL

5 = 575/60/3 XL

9 = 380/50/3 XL

D = 415/50/3 XL

Digit 9 - System Control
B = No System Control

C = Constant Volume Control

E = Supply Air VAV Control

P = EVP Control

Digit 10 - Design Sequence
V = Disconnect Redesign

Digit 11 - Ambient Control
0 = Standard

1 = Low Ambient 0º F

Digit 12 - Agency Approval
0 = None

3 = UL / CSA

Digit 13 - Miscellaneous Options
A = Unit Mounted Disconnect Switch
B = Hot Gas Bypass Valves *
D = Suction Service Valves
F = Pressures Gauges & Gauge Piping *
G = Return Air Sensor *
H = Condenser Coils with Copper Fins
T = Flow Switch (EVP Only) *
1 = Spring Isolators *
2 = Neoprene Isolators *
9 = Packed Stock

* Field Installed Options

Unit Nameplate

One Mylar unit nameplate is located on the outside upper right corner of the control panel door. It includes the unit model number, serial number, electrical characteristics, weight, refrigerant charge, as well as other pertinent unit data. A small metal nameplate with the Model Number, Serial Number, and Unit Weight is located just above the Mylar nameplate, and a third nameplate is located on the inside of the control panel door.

When ordering replacement parts or requesting service, be sure to refer to the specific model number, serial number, and DL number (if applicable) stamped on the unit nameplate.

Compressor Nameplate

The nameplate for the "Scroll" compressors are located on the compressor lower housing.

Evaporator Nameplate
(EVP Chiller Applications Only)

The nameplate is located on the same side of the refrigerant connections near the top. To view the nameplate, remove the tape over the area and spread the insulation. Retape the insulation after viewing.

Unit Description

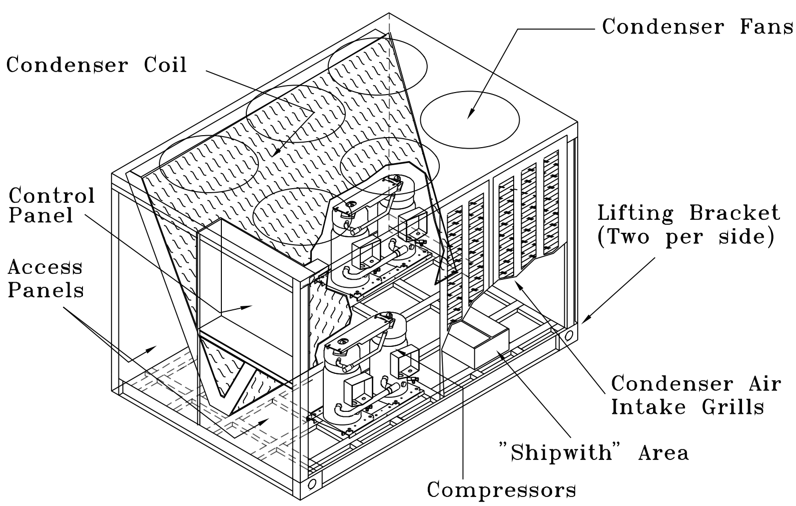
All air cooled condensing units are designed for outdoor installations with vertical air discharge. These units may be installed on a flat roof or placed on a concrete slab at ground level.

Before shipment, each unit is leak-tested, evacuated, a **Nitrogen** holding charge is added, and the controls are tested for proper operation.

The condenser coils are aluminum fin, bonded to copper tubing. Copper-fin coils are optional. Louvered condenser grilles for coil protection are standard. Direct-drive, vertical discharge condenser fans are provided with built-in current and overload protection.

For "Ship with" items, refer to the Unit Component "Layout" and "Ship with" Locations illustration.

Figure 1. Unit Component Layout and 'shipwith' Locations (60 Ton Unit Illustrated)



If low ambient operation is required, low ambient dampers are available as a field or factory installed option.

These units may be order with one of the following options:

No System Controls (Field provided controls required)

Constant Volume Controls

Supply Air Temperature Control (VAV applications)

EVP Chiller Controls

Basic unit components include:

Manifolded Scroll Compressors

Intertwined condenser coils

Condenser fans (number based on unit size)

Discharge service valve (one per circuit)

Liquid line service valve (one per circuit)

Installation

Unit Inspection

As soon as the unit arrives at the job site

[ ] Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).

[ ] Verify that the power supply complies with the unit nameplate specifications.

[ ] Visually inspect the exterior of the unit, including the roof, for signs of shipping damage.

[ ] Check for material shortages. Refer to the Component Layout and Ship with Location illustration.

If the job site inspection of the unit reveals damage or material shortages, **file a claim with the carrier immediately. Specify the type and extent of the damage on the 'bill of lading" before signing.**

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

⚠ WARNING
No Step Surface!

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

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

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

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

[ ] Notify the appropriate Trane office before installing or repairing a damaged unit.

Unit Clearances

Figure 2 illustrates the minimum operating and service clearances for either a single, multiple, or pit application. These clearances are the minimum distances necessary to assure adequate serviceability, cataloged unit capacity, and peak operating efficiency.

NOTICE

Providing less than the recommended clearances may result in condenser coil starvation or recirculation of hot condenser air.

Locate the unit as close to the applicable system support equipment as possible to minimize refrigerant piping lengths.

EVP Chiller Considerations

The EVP chiller must be installed indoors unless:

- Outdoor temperatures are always above 32° F.
- System circulating liquid is a non-freezing glycol-type solution selected for prevailing ambient temperatures.
- Chiller is protected from freeze-up by properly installed and applied insulation and heat tape.

NOTICE

To prevent internal chiller damage due to freezing, do not install the BPHE chiller outdoors without adequate freeze protection.

Allow adequate clearance for water and refrigerant piping connections, space to perform service procedures, i.e. read gauges, thermometers, and operate water system valves.

Unit Dimensions & Weight Information

Overall unit dimensional data for each unit is illustrated in Figure 3 to Figure 8.

A Center-of-Gravity illustration and the dimensional data for the unit is shown in Figure 15.

Table 1 lists the typical operating and point loading weights for the unit.

EVP chiller mounting footprints and overall dimensional data is illustrated in Figure 9 to Figure 14.

Table 2 lists the typical EVP operating weights and general data.

Foundation

If the unit is installed at ground level, elevate it above the snow line. Provide concrete footings at each support location or a slab foundation for support. Refer to Table 1 for the unit operating and point loading weights when constructing the footing foundation.

Anchor the unit to the footings or slab using hold down bolts or isolators. Isolators should be installed to minimize the transmission of vibrations into the building. Refer to the "Unit Isolation" section for spring or rubber isolator installation instructions.

For rooftop applications, ensure the roof is strong enough to support the unit. Refer to Table 1 for the unit operating weights.

Anchor the unit to the roof with hold-down bolts or isolators. Follow the instructions under "Unit Isolation" for proper isolator placement and installation.

Check with a roofing contractor for proper waterproofing procedures.

The EVP chiller must be installed level and should be mounted on a base that will adequately support the operating weight. Refer to Table 2 for operating weights.

Figure 2. Typical Installation Clearances for Single, Multiple or Pit Applications

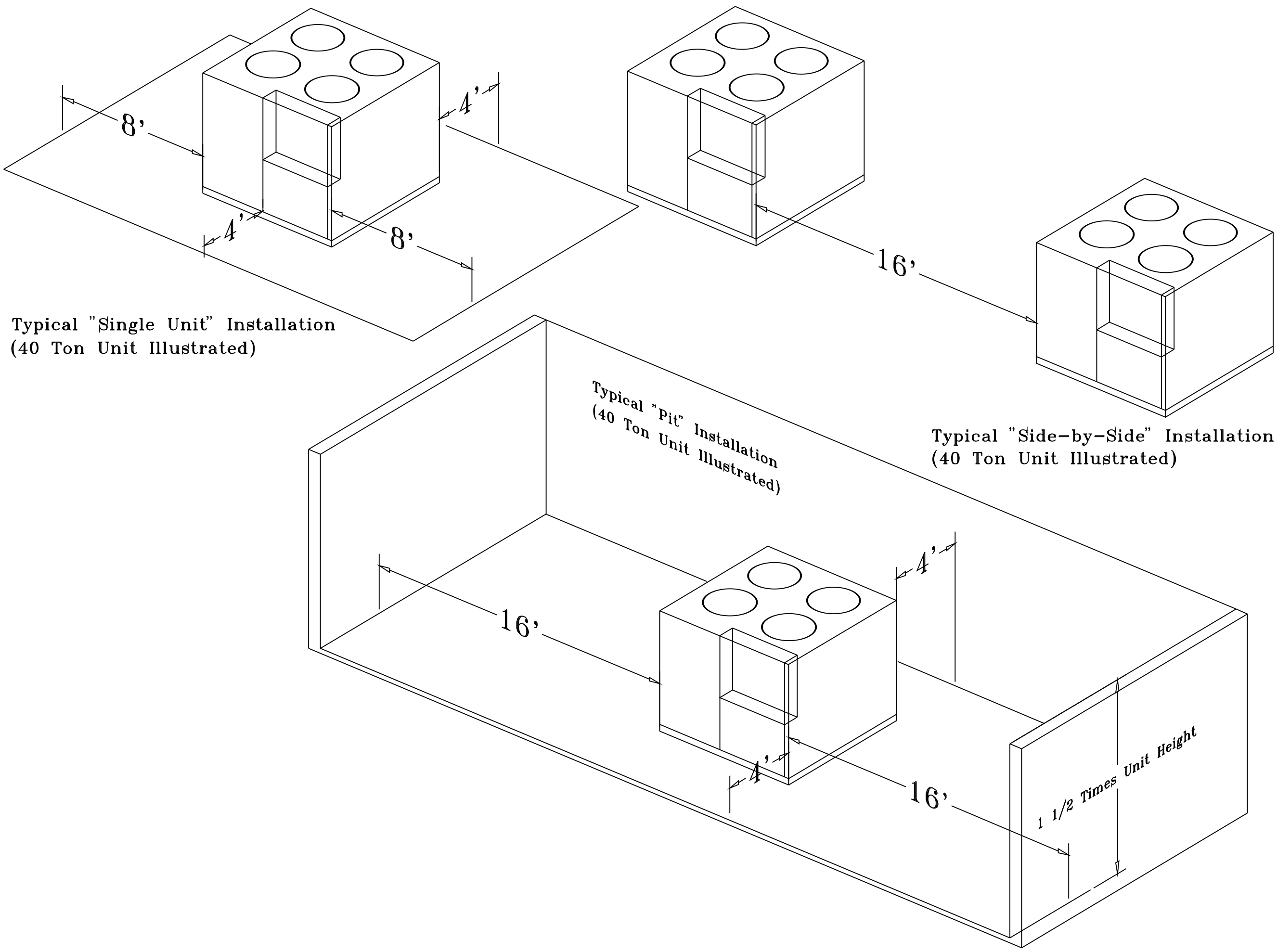


Figure 3. RAUC-C20 Unit Dimensional Data & Recommended Clearances

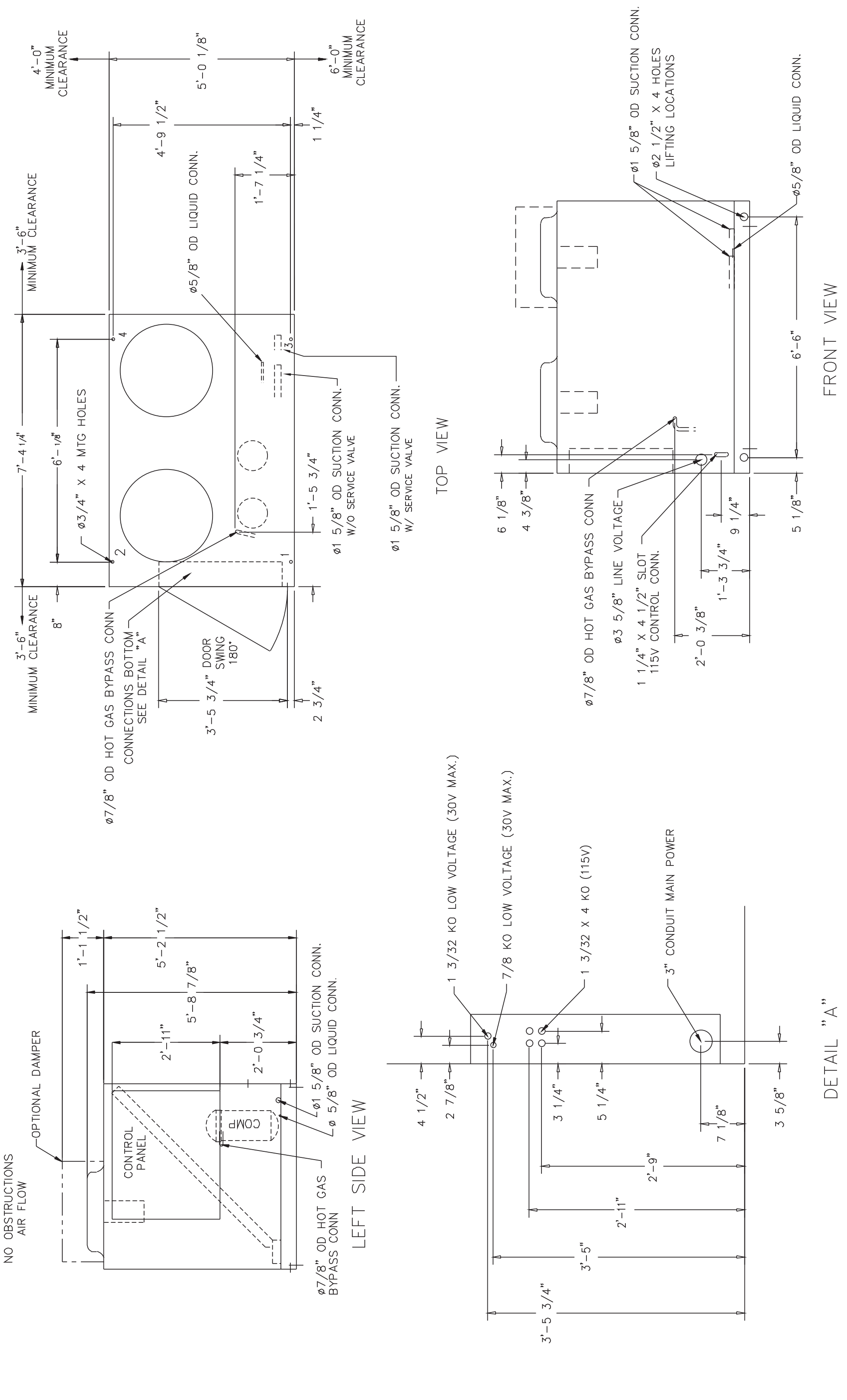


Figure 4. RAUC-C25 Unit Dimensional Data & Recommended Clearances

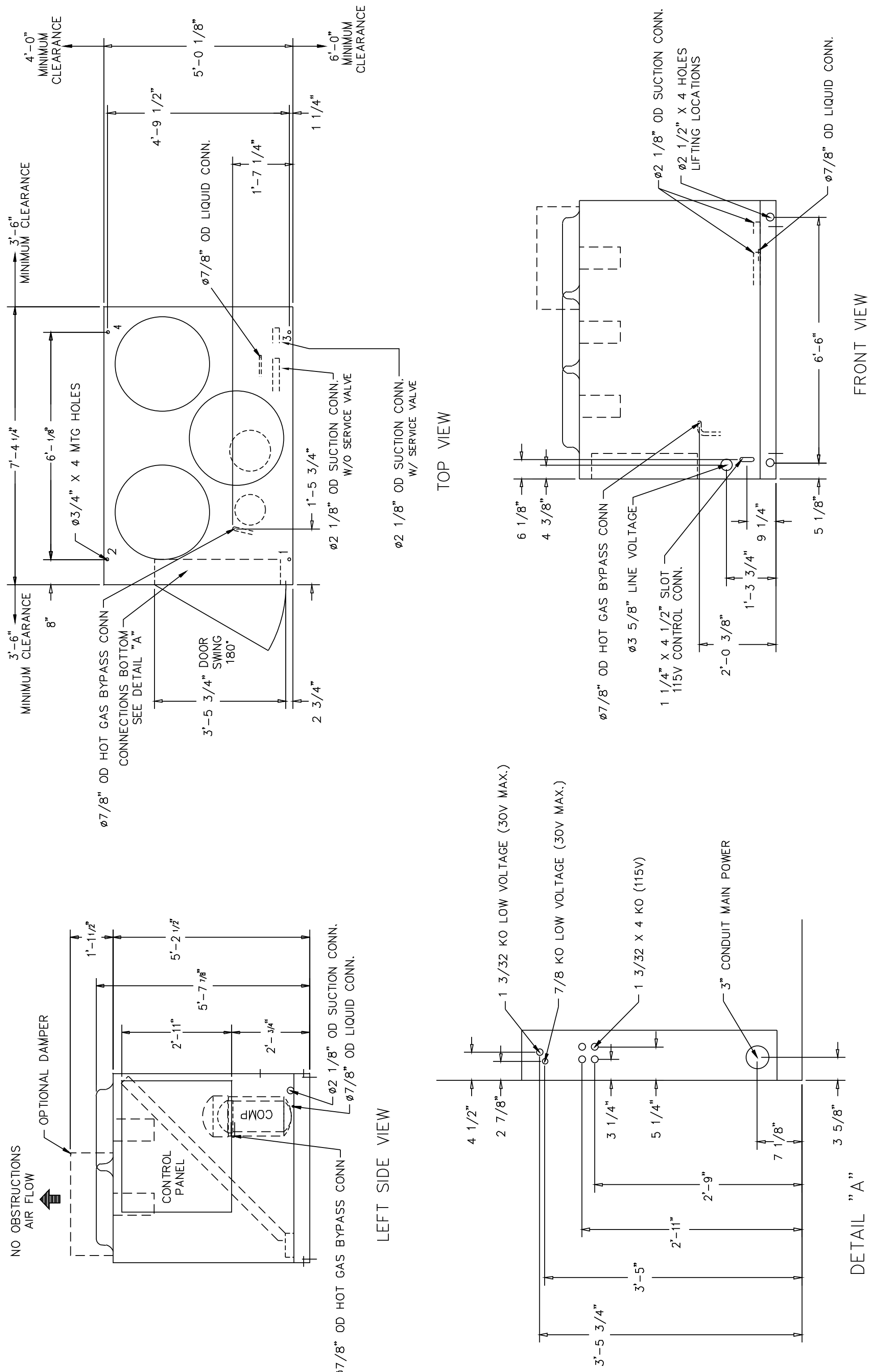


Figure 5. RAUC-C30 Unit Dimensional Data & Recommended Clearances

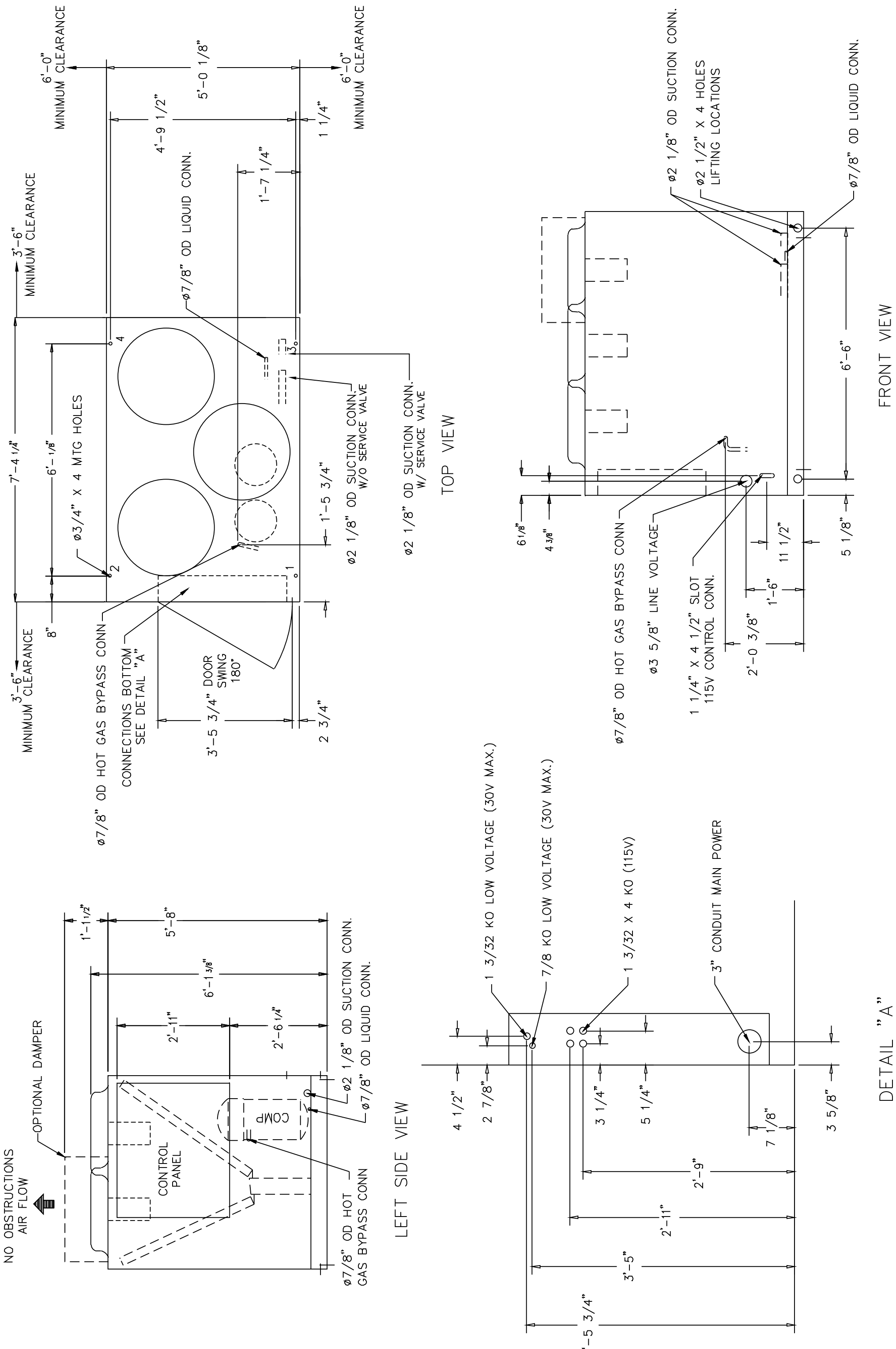


Figure 6. RAUC-C40 Unit Dimensional Data & Recommended Clearances

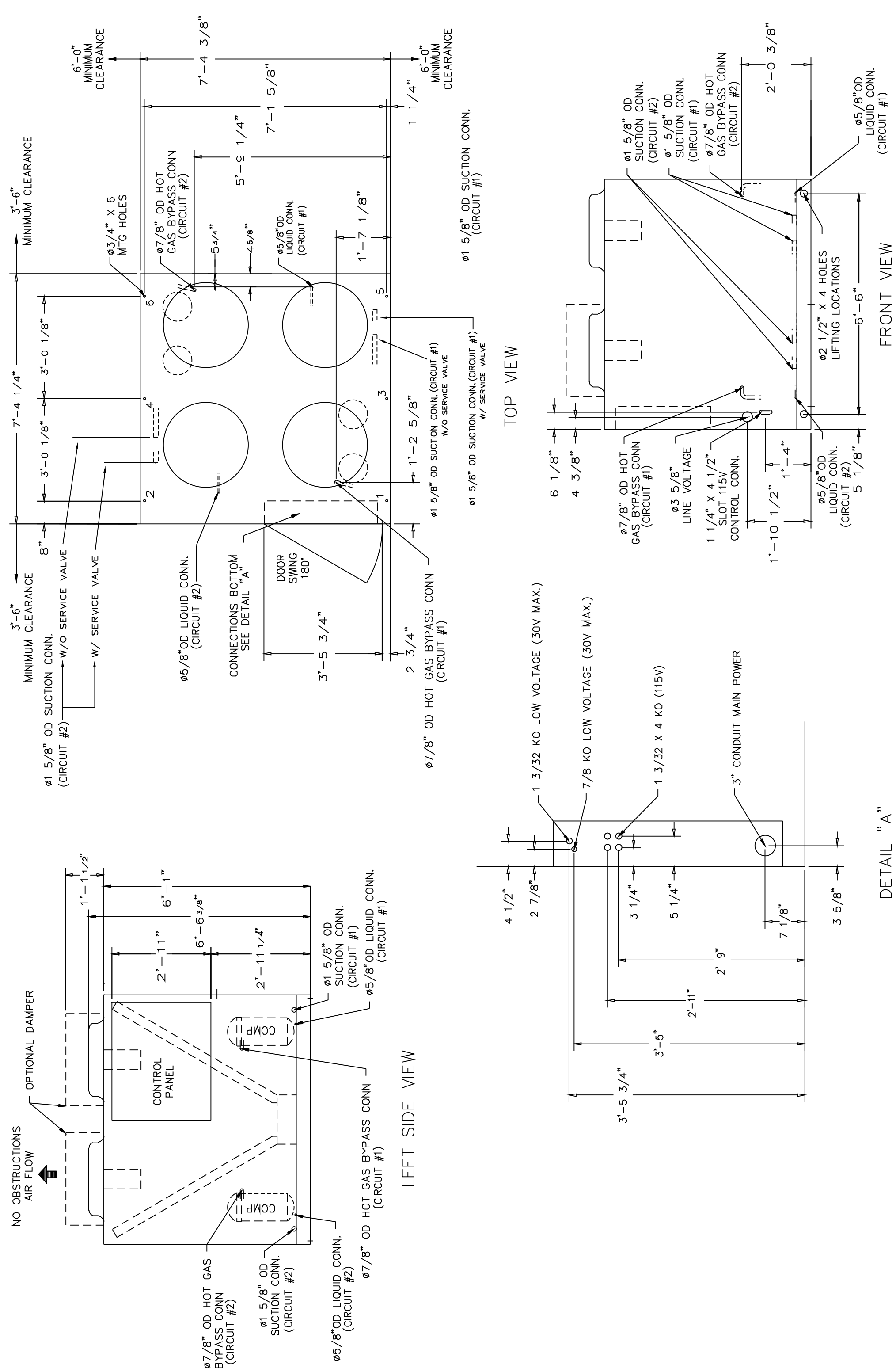


Figure 7. RAUC-C50 Unit Dimensional Data & Recommended Clearances

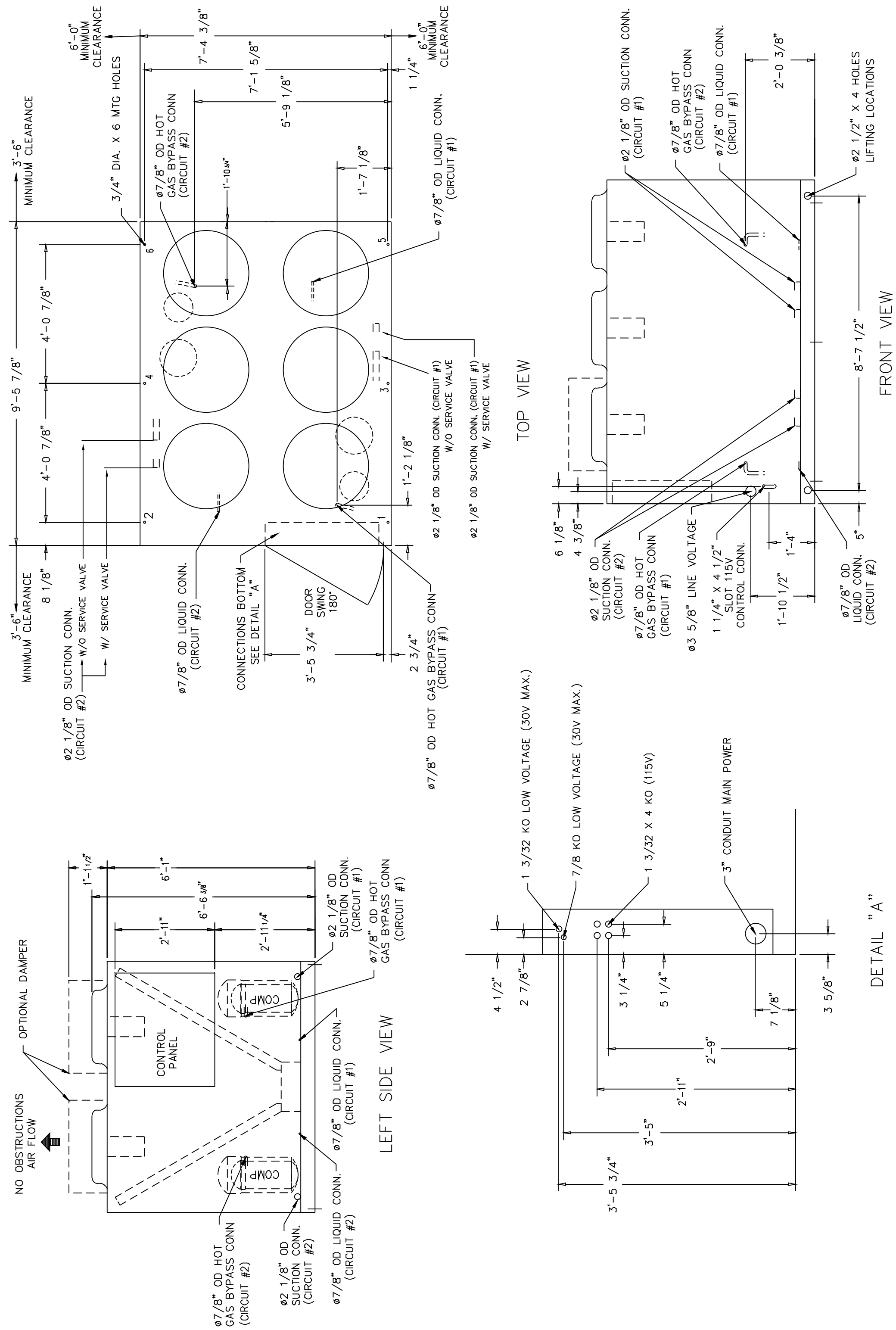


Figure 8. RAUC-C60 Unit Dimensional Data & Recommended Clearances

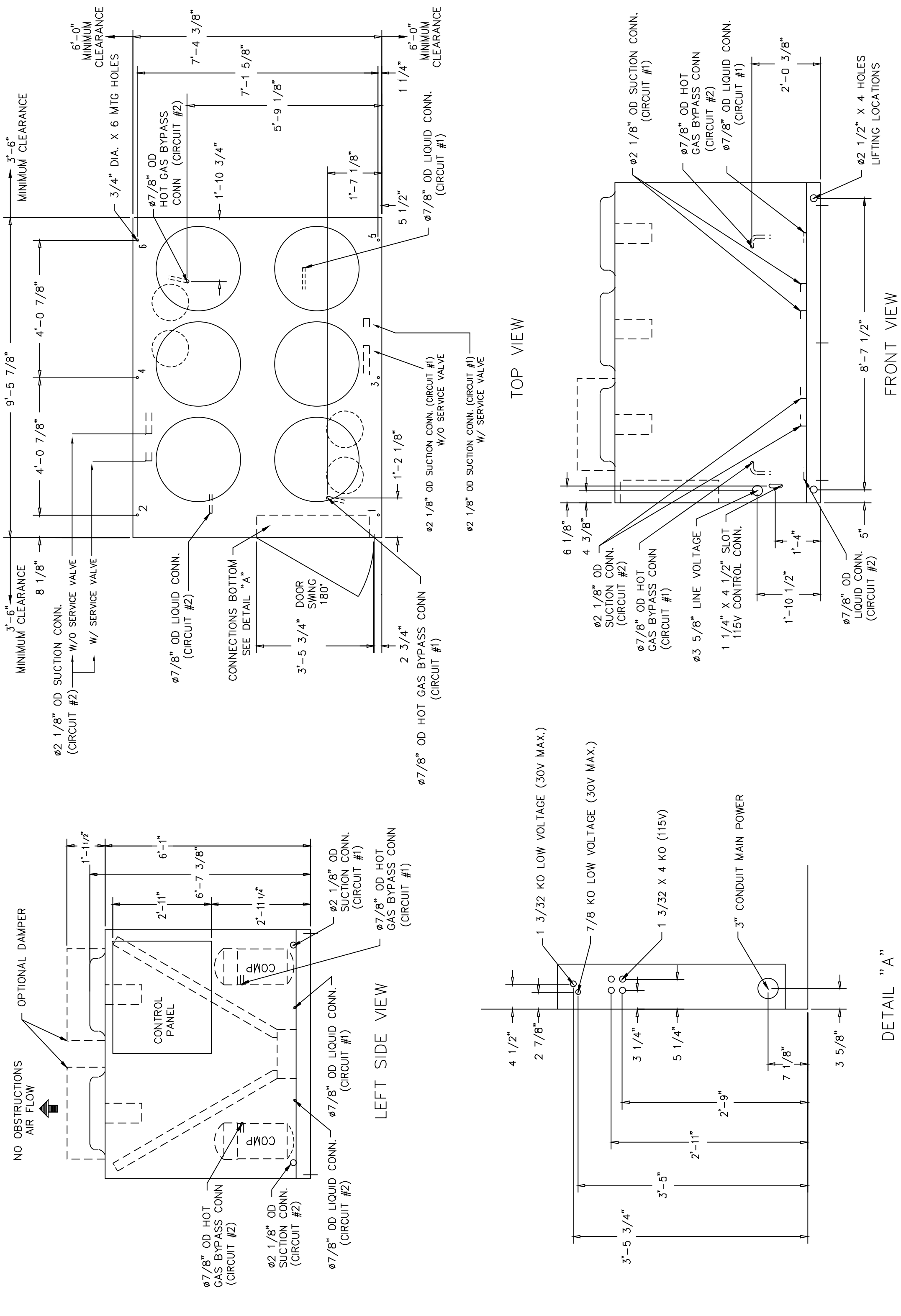
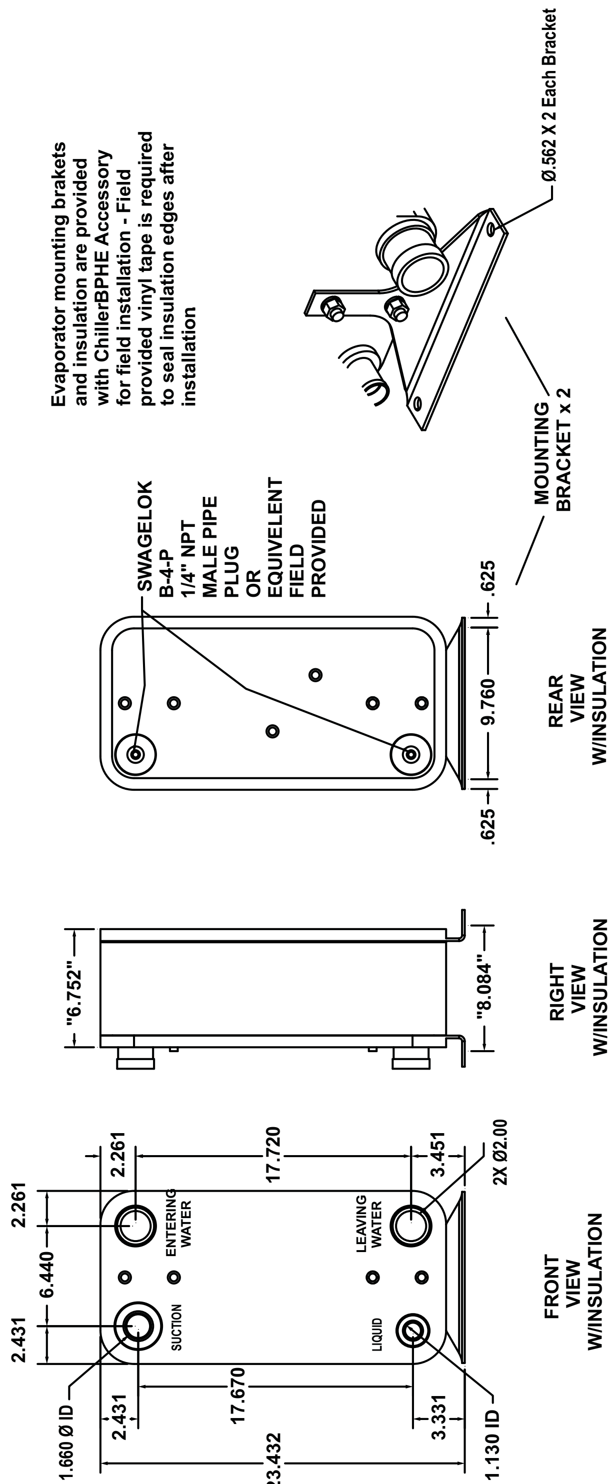
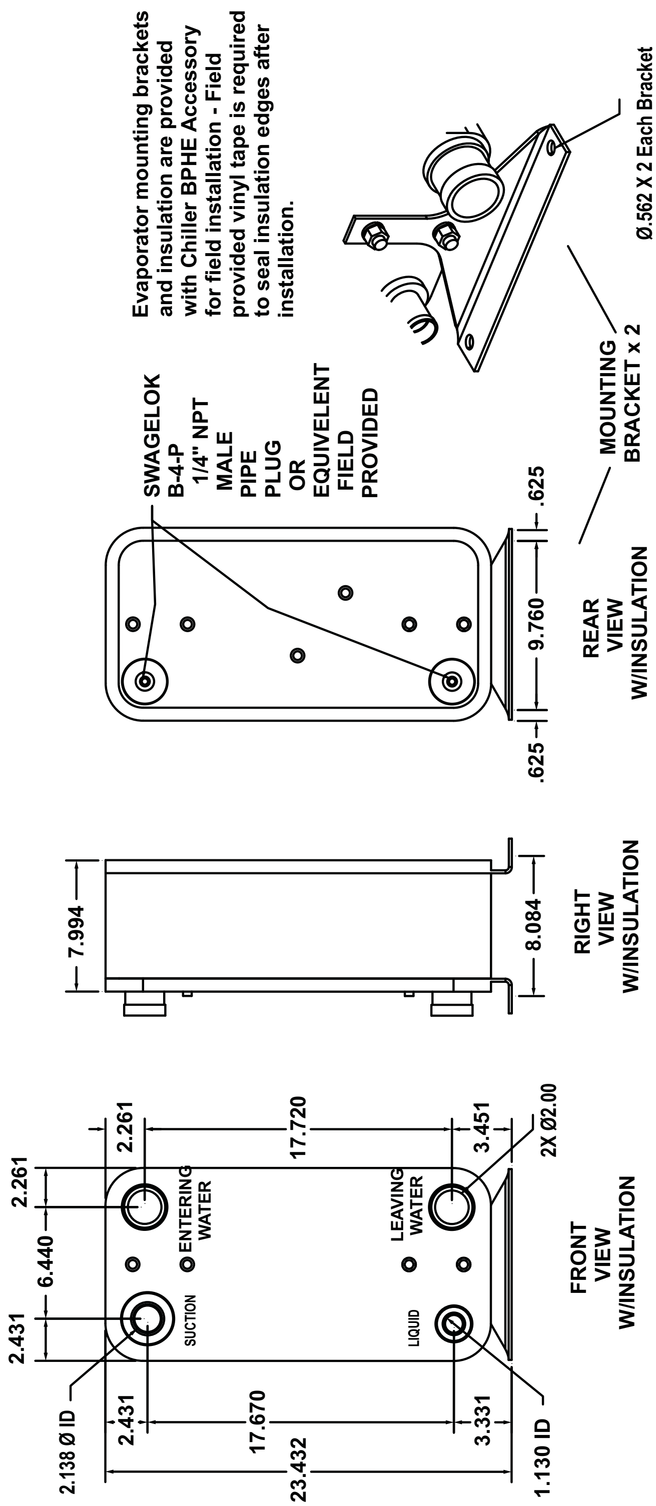


Figure 9. BPHE 20 Evaporator Chiller Dimensions



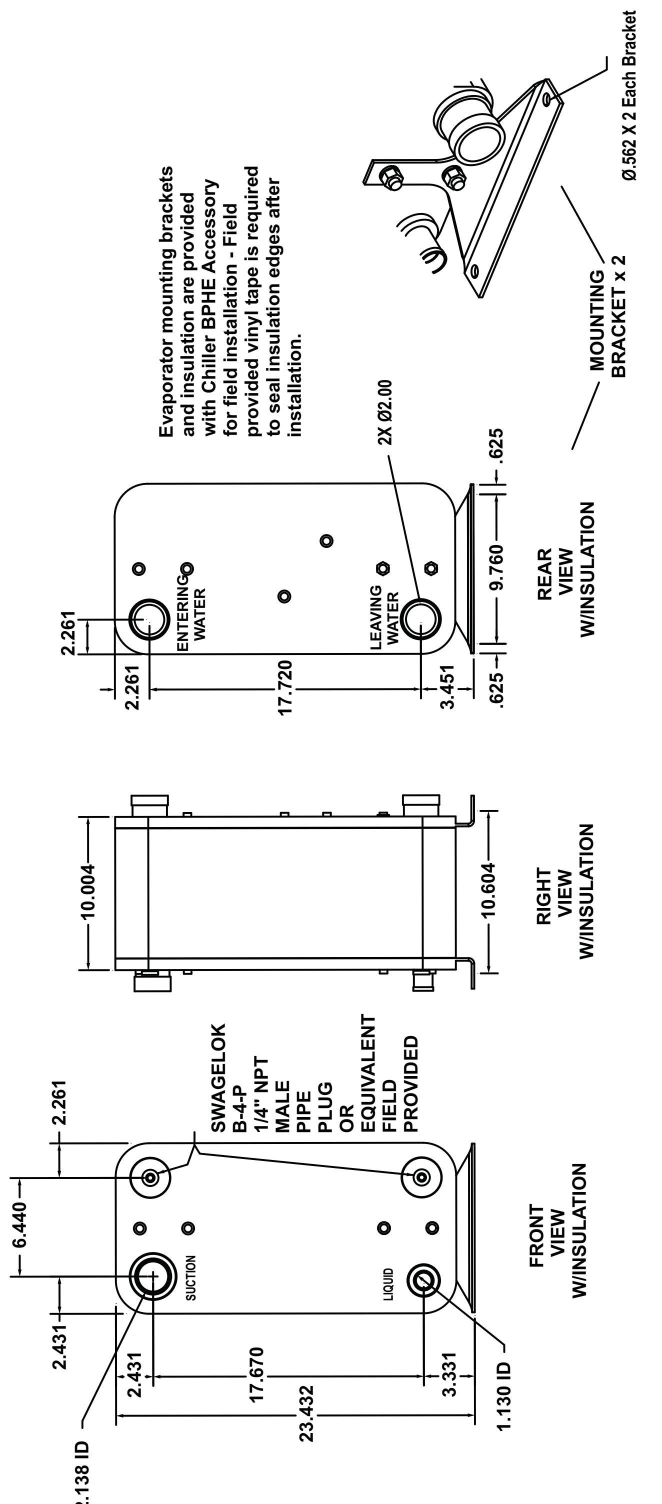
Note: *All water connections are Victaulic.*

Figure 10. BPHE 25 Evaporator Chiller Dimensions



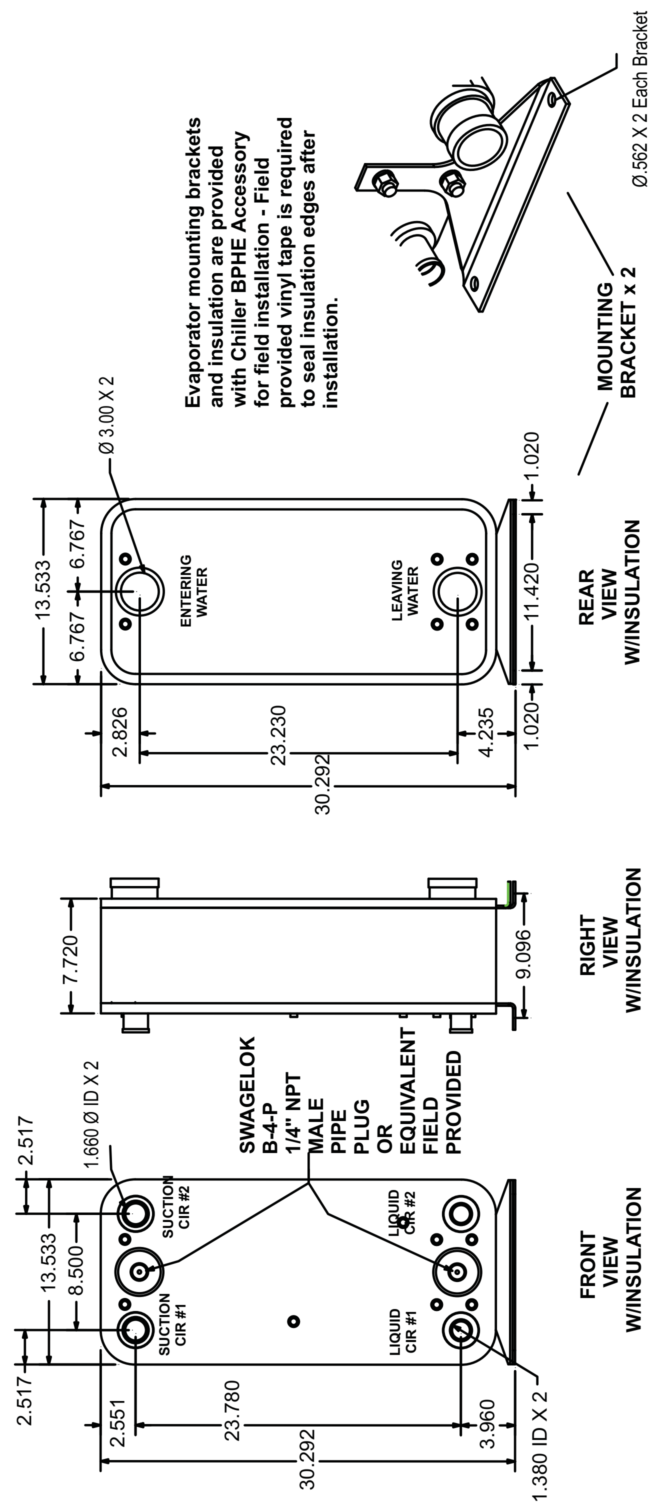
Note: *All water connections are Victaulic.*

Figure 11. BPHE 30 Evaporator Chiller Dimensions



Note: *All water connections are Victaulic.*

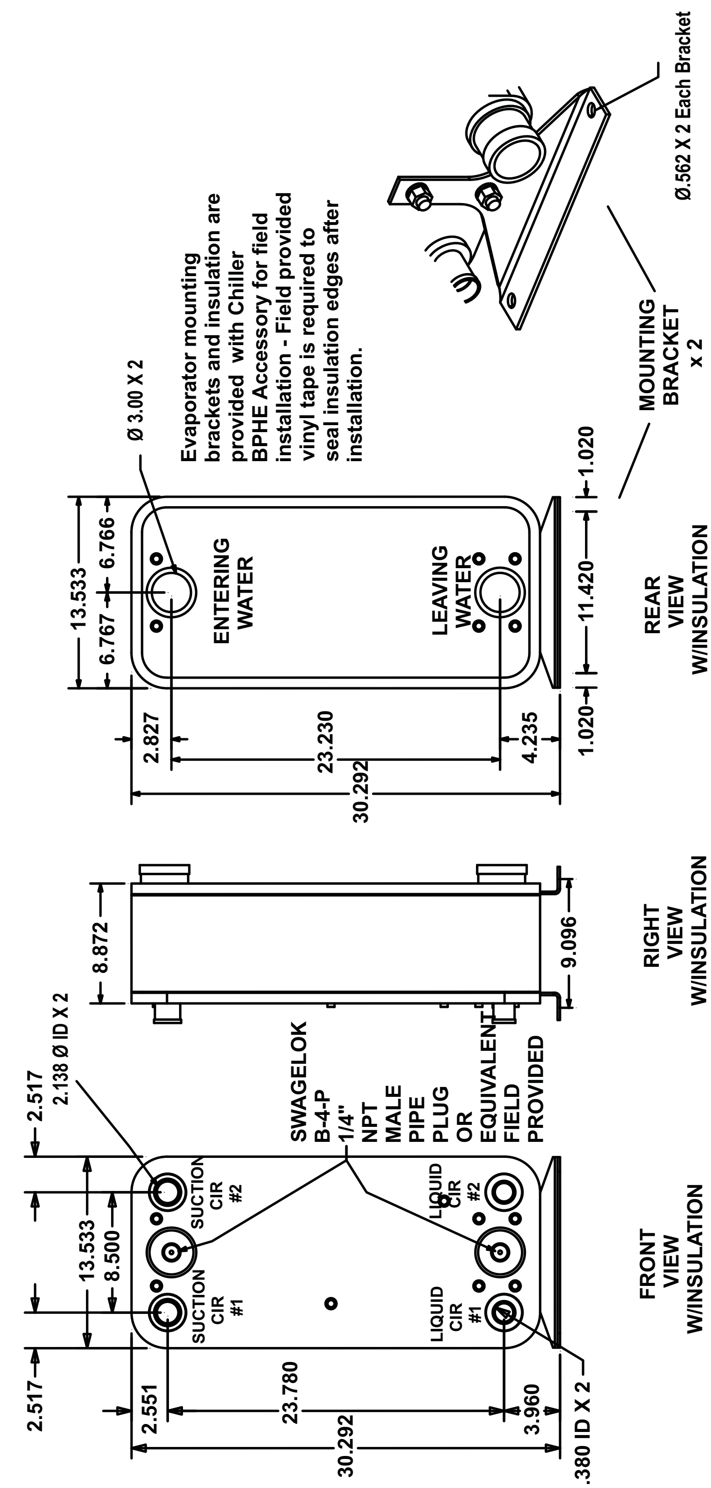
Figure 12. BPHE 40 Evaporator Chiller Dimensions



Note: *All water connections are Victaulic.*

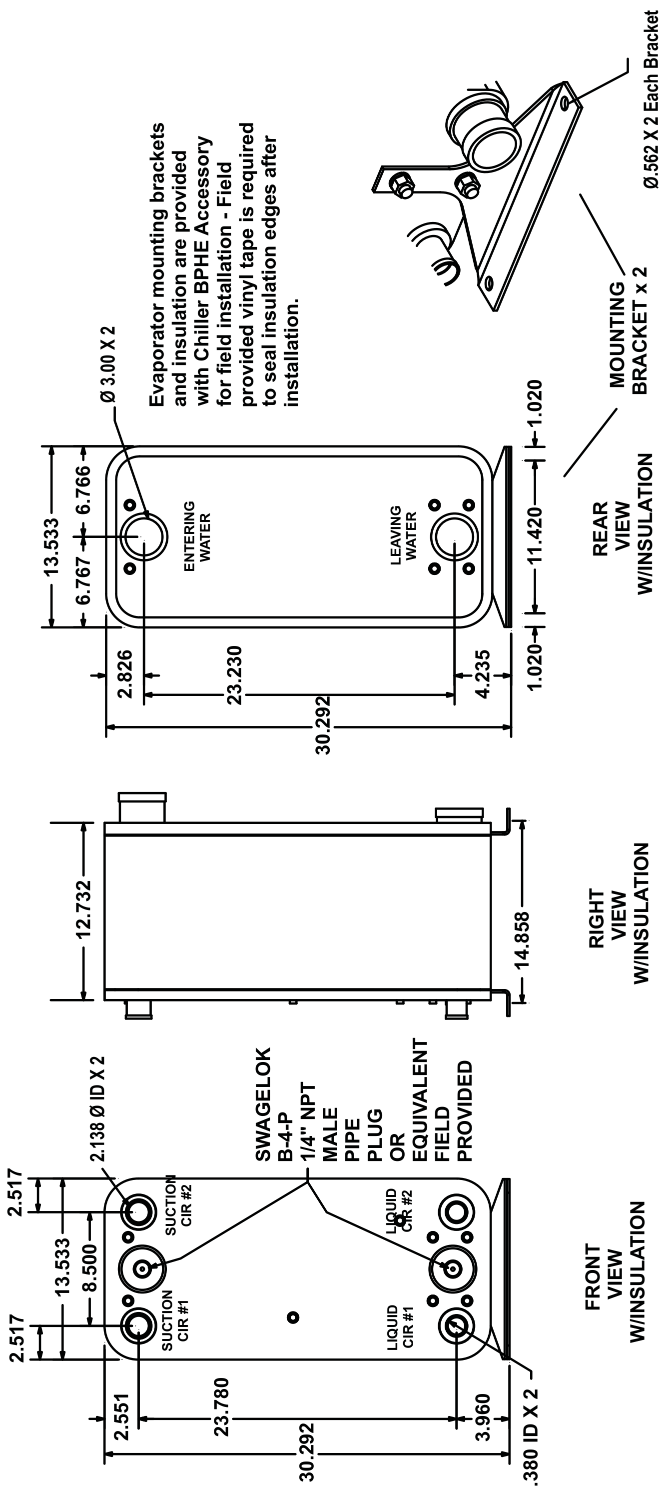
Installation

Figure 13. BPHE 50 Evaporator Chiller Dimensions



Note: *All water connections are Victaulic.*

Figure 14. BPHE 60 Evaporator Chiller Dimensions



Note: *All water connections are Victaulic.*

Table 1. Typical Unit Weights & Point Loading Data

Unit Size	Operating Weight		Unit Weight on Isolator @ Mounting Location											
			Location 1		2		3		4		5		6	
	AL	CU	AL	CU	AL	CU	AL	CU	AL	CU	AL	CU	AL	CU
C20	1522	1720	509	559	398	439	345	404	270	317				
C25	1640	1842	555	602	421	467	378	436	286	338				
C30	1824	2115	580	640	635	708	291	364	318	403				
C40	2769	3102	480	523	457	501	473	528	450	506	466	533	443	511
C50	3148	3540	586	643	562	620	536	601	514	579	485	559	465	538
C60	3480	4050	640	722	618	703	590	684	570	666	540	646	522	629

Note: Mounting locations correlate with those shown in point loading illustration

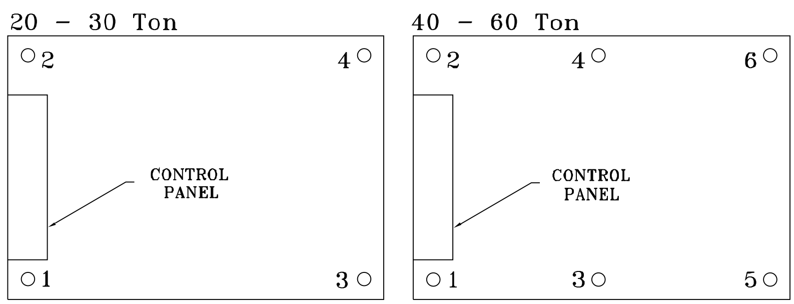


Table 2. Typical EVP Chiller Weights & General Data

Chiller Size	Shipping Weight[2]	Operating Weight	Number of Ref. Ckts.	Water Volume in Gallons[3]	Refrigerant Charge in Lbs.[4]
20 Ton	80	100	1	2.0	2.5
25 Ton	92	116	1	2.4	3.0
30 Ton	105	133	1	2.9	3.7
40 Ton	152	186	2	3.7	4.7
50 Ton	170	211	2	4.3	5.5
60 Ton	242	309	2	7.0	8.9

Notes:
2 - Shipping and Operating weights are approximate
3 - Includes volume of Water Piping Kit.
4 - Refrigerant charge is approximate for chiller evaporator only

Unit Size	Shipping weight (Max. Lbs)	Location of Center of Gravity			
		X		Z	
		In	mm	In	mm
C20	1724	38-1/16	968	26-3/8	671
C25	1843	38-1/16	968	26-3/16	666
C30	2107	34-1/16	865	31-1/2	800
C40	3088	44-3/16	1122	43-1/16	1095
C50	3532	54-11/16	1389	43-3/16	1097
C60	4024	55-3/16	1402	43-3/8	1102

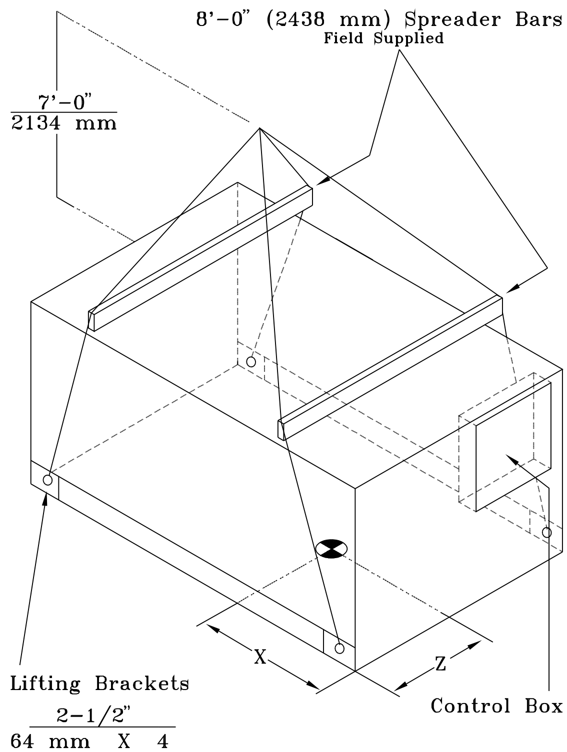
Rigging

⚠ WARNING
Heavy Objects!

Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements may cause equipment or property-only damage. Failure to properly lift unit may result in death or serious injury.

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

Figure 15. Rigging and Center-of-Gravity Data



A Rigging illustration and Center-of-Gravity dimensional data table is shown in Figure 15. Refer to the typical unit operating weights table before proceeding.

1. Rig the condensing unit as shown in Figure 15. Attach adequate strength lifting slings to all four lifting brackets in the unit base rail. Do not use cables, chains, or slings except as shown.
2. Install spreader bars, as shown in Figure 15, to protect the unit and to facilitate a uniform lift. The minimum distance between the lifting hook and the top of the unit should be 7 feet.
3. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
4. Lift the unit and position it into place.

Unit Isolation

To minimize unit sound and vibration transmission, one of the following installation methods should be used:

1. Install the unit directly on an isolated (detached) concrete pad or on isolated concrete footings located at each unit load point.
2. Install the optional neoprene or spring isolators at each mounting location. Refer to the “Neoprene isolators” or “Spring isolator” section below.

Neoprene Isolators

Install the neoprene isolators at each unit mounting (load) point, using the following procedure:

1. Elevate the unit (one side at a time) to allow access to the base rail mounting holes.

⚠ **WARNING**

Heavy Objects!

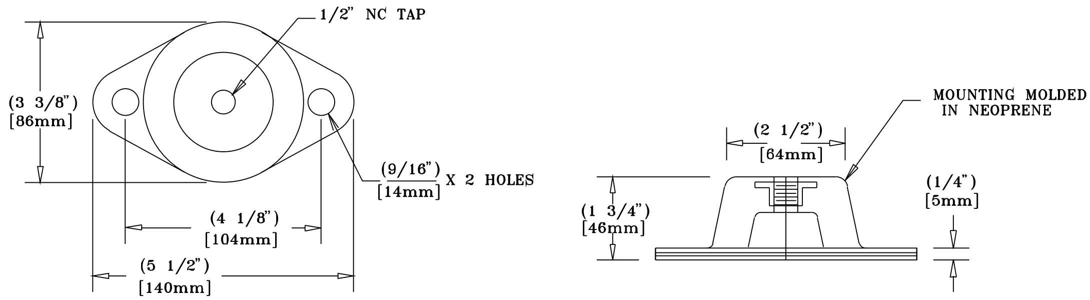
Use solid type blocks, i.e. 4" X 4" wood blocks or similar material to prevent collapsing. Keep hands and other body limbs clear of elevated base rail while installing isolators. Failure to do so could result in death or serious injury.

2. Align the mounting holes in the base rail of the unit with the holes in the top of the appropriate isolator. Refer to Table 3 for the appropriate isolator for each load point.
3. Install a 1/2" NC bolt (field supplied) through the base rail of the unit into the threaded bolt hole of the isolator. Position the isolator to allow access to the mounting holes in the base of the isolator, then tighten securely.
4. Lower the unit and isolator onto the mounting surface. The maximum isolator deflection should be approximately 1/4 inch.
5. Secure the isolator to the mounting surface using the base holes in the isolator.
6. Level the unit carefully. Refer to the “Leveling the Unit” section.
7. After the unit is level, tighten the isolator base mounting bolts to secure them to the mounting surface.

Table 3. Typical Neoprene Isolator Selection & Location

Unit Size	Fin Material	Neoprene Isolator Part Number @ Mounting Location					
		Location 1	Location 2	Location 3	Location 4	Location 5	Location 6
C20	Al	RDP-3-GRN	RDP-3-GRN	RDP-3-RED	RDP-3-RED		
	Cu	RDP-3-GRY	RDP-3-GRN	RDP-3-GRN	RDP-3-RED		
C25	Al	RDP-3-GRY	RDP-3-GRN	RDP-3-GRN	RDP-3-RED		
	Cu	RDP-3-GRY	RDP-3-GRN	RDP-3-GRN	RDP-3-RED		
C30	Al	RDP-3-GRY	RDP-3-GRY	RDP-3-RED	RDP-3-RED		
	Cu	RDP-3-GRY	RDP-3-GRY	RDP-3-RED	RDP-3-GRN		
C40	Al	RDP-3-GRN	RDP-3-GRN	RDP-3-GRN	RDP-3-GRN	RDP-3-GRN	RDP-3-GRN
	Cu	RDP-3-GRN	RDP-3-GRN	RDP-3-GRY	RDP-3-GRN	RDP-3-GRY	RDP-3-GRN
C50	Al	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRN	RDP-3-GRN	RDP-3-GRN
	Cu	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY
C60	Al	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRN
	Cu	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY	RDP-3-GRY

Note: Mounting locations correlate with those shown in point loading illustration



Spring Isolators

Install the spring isolators at each unit mounting (load) point using the following procedure:

1. Elevate the unit (one side at a time) to allow access to the base rail mounting holes.

⚠ WARNING
Heavy Objects!

Use solid type blocks, i.e. 4" X 4" wood blocks or similar material to prevent collapsing. Keep hands and other body limbs clear of elevated base rail while installing isolators. Failure to do so could result in death or serious injury.

2. Align the mounting holes in the base rail of the unit with the positioning pin in the top of the appropriate isolator. Refer to Table 4 for the appropriate isolator for each load point.
3. Position the isolator to allow access to the mounting holes in the base of the isolator.
4. Lower the unit onto the isolator. The positioning pin on the isolator must engage into the hole of the base rail. The clearance between the upper and lower isolator housings should be approximately 1/4 to 1/2 inch. A clearance greater than 1/2 inch indicates that shims are required to level the unit. Refer to the "Leveling the Unit" section.
5. Make minor clearance adjustments by turning the isolator leveling bolt (Table 4) clockwise to increase the clearance and counterclockwise to decrease the clearance. If proper isolator clearance cannot be obtained by turning the leveling bolt, level the isolators themselves. A 1/4 inch variance in elevation is acceptable.
6. Secure the isolator to the mounting surface using the base holes in the isolator.
7. After the unit is level, tighten the isolator base mounting bolts to secure them to the mounting surface.

Leveling the Unit

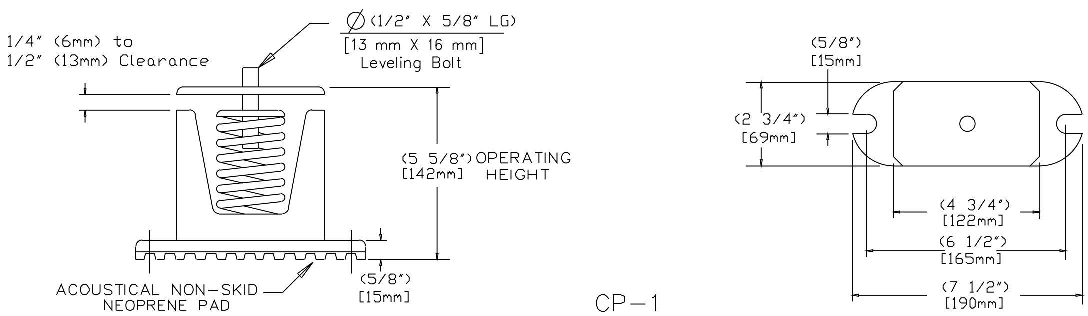
Before tightening the mounting bolts, level the unit carefully. Use the unit base rail as a reference. Level the unit to within 1/4 inch over its entire length. Use shims if non-adjustable isolators (neoprene) are used.

If adjustable isolators (spring) are used, ensure that the proper isolator housing clearance is maintained while leveling the unit. Isolators are identified by color and/or an isolator part number. Shims under the isolators may be required if the unit can not be leveled using the isolator leveling bolt.

Table 4. Typical Spring Isolator Selection & Location

Unit Tons	Spring Isolator Part Number @ Mounting Location											
	Location 1		Location 2		Location 3		Location 4		Location 5		Location 6	
	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
20	CP-1-27	CP-1-28	CP-1-26	CP-1-27	CP-1-26	CP-1-26	CP-1-25	CP-1-26				
25	CP-1-28	CP-1-28	CP-1-27	CP-1-27	CP-1-26	CP-1-27	CP-1-25	CP-1-26				
30	CP-1-28	CP-1-31	CP-1-31	CP-1-31	CP-1-25	CP-1-26	CP-1-26	CP-1-26				
40	CP-1-27	CP-1-27	CP-1-27	CP-1-27	CP-1-27	CP-1-28	CP-1-27	CP-1-27	CP-1-27	CP-1-28	CP-1-27	CP-1-27
50	CP-1-28	CP-1-31	CP-1-28	CP-1-28	CP-1-28	CP-1-28	CP-1-27	CP-1-28	CP-1-27	CP-1-28	CP-1-27	CP-1-28
60	CP-1-31	CP-1-31	CP-1-28	CP-1-31	CP-1-28	CP-1-31	CP-1-28	CP-1-31	CP-1-28	CP-1-31	CP-1-27	CP-1-28

1. Mounting locations correlate with those shown in point loading illustration.
2. The spring number is marked on the outside of the spring housing, i.e. CP-1-25 is marked 25.
   The isolator spring is color coded as follows;
   CP-1-25=Red, CP-1-26=Purple, CP-1-27=Orange, CP-1-28=Green, Cp-1-31=Gray
3. Refer to the "Spring Isolator" section, step 4, for proper clearance.



Shipping Fasteners

Compressor Shipping Hardware

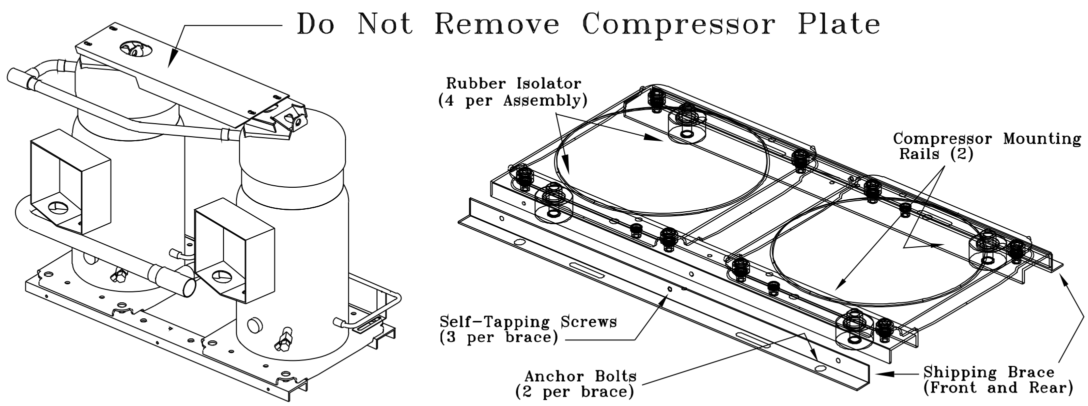
Figure 16 illustrates the location of each tiedown bolt and rubber isolator bolt for the compressor assembly in each circuit. Refer to the illustration and the following discussion to locate and remove the fasteners.

Two Manifolded Compressors

Each manifolded compressor assembly is rigidly bolted to a mounting rail assembly. The rail assembly sets on four (4) rubber isolators. The assembly is held in place by two shipping braces that secure each compressor assembly rail to the unit's base rail. To remove the shipping hardware, follow the procedures below:

1. Remove the four anchor bolts (2 front and 2 rear), used to secure the shipping brace to the unit's base rail.
2. Remove the three self-tapping screws that secure each shipping brace to the compressor mounting rails.
3. Remove and discard the two 30-1/2" long shipping braces for each assembly.
4. Do not remove the shipping plate located on top of the compressors.
5. Ensure that the compressor rail assembly is free to move on the rubber isolators.

Figure 16. Removing Scroll Compressor Shipping Hardware for 20 through 60 Ton Units



General Unit Requirements

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

[ ] Verify that the power supply complies with the unit nameplate specifications.

[ ] Check the unit for shipping damage and material shortage; file a freight claim and notify Trane office.

[ ] Verify that the installation location of the unit will provide the required clearance for proper operation.

[ ] Install appropriate isolators, if required.

Refrigerant Piping Requirements

[ ] Install properly sized liquid line(s) between the liquid line connections on the unit and the evaporator, (i.e., DX evaporator or an EVP Chiller). Refer to the “Refrigerant Piping” section for recommended line components and guidelines.

[ ] Install a properly sized liquid line isolation solenoid valve in each liquid line.

[ ] Install refrigerant rated shutoff valves in the liquid line(s) to isolate the filter drier(s) for service.

[ ] Install a properly sized filter drier in each liquid line.

[ ] Install a properly sized filter in each suction line.

[ ] Install properly sized suction line(s) between the suction line connections on the unit and the evaporator, (i.e., DX evaporator or an EVP Chiller). Refer to the “Refrigerant Piping” section for recommended line components and guidelines.

[ ] Install properly sized hot gas bypass line(s) between the hot gas bypass connections on the unit and the evaporator, (i.e., EVP Chiller, if applicable).

[ ] Insulate the suction line.

⚠ **WARNING**
Hazard of Explosion!

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

[ ] Leak test the system. Refer to the "Refrigerant Piping" section for recommended procedures.

EVP Chilled Water Piping Requirements

[ ] Install properly sized chilled water pipe between the EVP chiller and the supporting equipment. Refer to the "Chilled Water Piping" section for recommended system components and guidelines. Ensure that the recommended components have been installed:

Water pressure gauges (with isolation valves)

Thermometers

Chiller isolation (shutoff) valves in the solution inlet and outlet piping

Strainer in the solution inlet piping

Balancing valve

Flow switch in the solution outlet piping

Chilled solution sensor well and sensor in the solution outlet piping

Freezestat well and freezestat bulb in the chilled solution outlet piping

Chiller drain plug, or drain piping with a shutoff valve

[ ] Flushing the chilled solution piping system, if applicable.

Note: *If using an acidic, commercial flushing solution, to prevent damage to the internal evaporator components, flush all chilled solution piping before making the final connection to the EVP chiller.*

[ ] Connecting the chilled solution piping to the chiller.

[ ] Install heat tape and insulation, if necessary, to protect any exposed solution piping from external freezing conditions.

Main Electrical Power Requirements

⚠ **WARNING**
Hazardous Voltage!

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

[ ] Verify the power supply meets the required power requirements of the system.

[ ] Install power wiring in accordance with all applicable codes.

[ ] Install and connect properly sized power supply wiring, with over current protection, to the main power terminal block (1TB1) or to an optional factory mounted nonfused disconnect switch (1S1) in the control panel.

[ ] Install and connect properly sized power supply wiring, with over current protection, to the proper termination point in the air handling unit (If applicable).

[ ] Install and connect properly sized power supply wiring, with over current protection, to the proper termination point for the chilled solution pump (EVP units only).

⚠ **WARNING**
Ground Wire!

All field-installed wiring must be completed by qualified personnel. All field-installed wiring must comply with NEC and applicable local codes. Failure to follow this instruction could result in death or serious injuries.

⚠ **WARNING**
Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

[ ] Install proper grounding wires to an earth ground.

Field Installed Control Wiring Requirements

115 Volt Control Wiring (All Units)

⚠ **WARNING**
Hazardous Voltage!

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

[ ] Verify that the Control transformer (1T1) is wired for the proper operating voltage.

[ ] Connect properly sized wiring to the liquid line solenoid valve(s).

[ ] Connect properly sized wiring to the hot gas bypass solenoid valve(s), if applicable, to operate with the unit. Refer to the unit wiring diagram that shipped with the unit.

[ ] Install the interlock circuitry wiring for the air handling unit or the chilled solution pump to permit compressor operation after the fan or chilled solution pump has started, i.e., proof of fan operation device, fan starter auxiliary contacts or pump starter station, pump starter auxiliary contacts, proof of flow device, etc). Refer to the field connection diagram that shipped with the unit for interlocking information.

[ ] Install properly sized power supply wiring, with over current protection, to the proper termination point for the field provided economizer actuator(s), if applicable. Refer to the “Economizer Actuator Circuit” illustrated in the “Field Installed Control Wiring” section.

”No Controls” Units

[ ] A field provided “step” controller must be installed and properly wired. Refer to the field connection diagram for connection information.

“EVP” Chiller Units

⚠ **WARNING**
Hazardous Voltage!

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

[ ] Install the EVP chiller remote panel.

[ ] Install and connect properly sized control wiring to the proper termination points between the remote panel and the unit control panel.

⚠ WARNING
Ground Wire!

All field-installed wiring must be completed by qualified personnel. All field-installed wiring must comply with NEC and applicable local codes. Failure to follow this instruction could result in death or serious injuries.

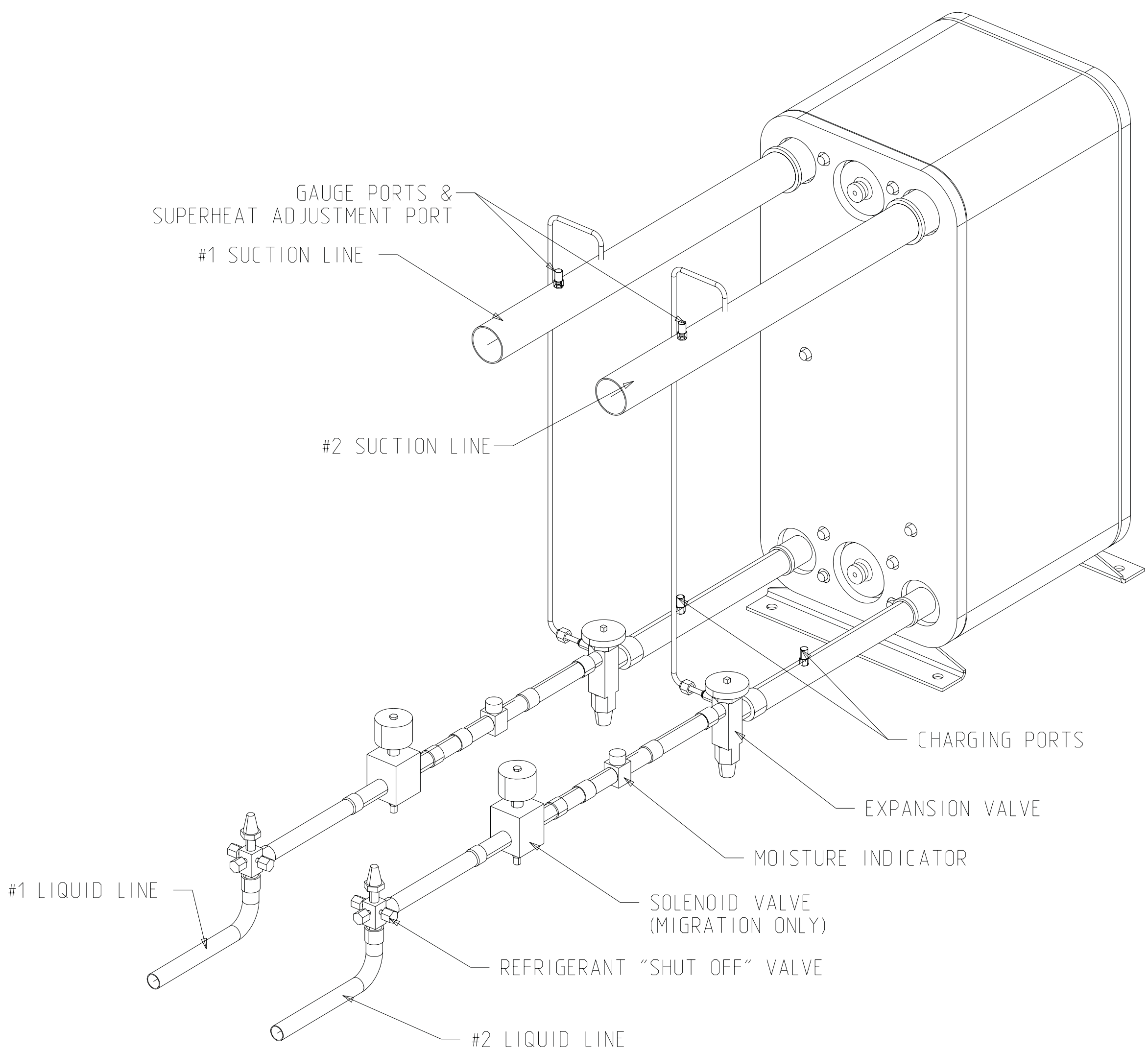
⚠ WARNING
Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

[ ] Install proper grounding wires to an earth ground.

[ ] Install an outside air thermostat in series with the flow switch to stop or prevent the unit from operating below the recommended ambient temperatures.

Figure 17. EVP Chiller Piping



Low Voltage Wiring (AC & DC)

⚠ **WARNING**

Hazardous Voltage!

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

Variable Air Volume (VAV) Units

[ ] Install a field provided remote system control switch to activate the system.

[ ] Connect properly sized wiring from the field provided economizer, if applicable, to the discharge air controller in the unit control panel.

[ ] Install and connect properly sized wiring from the night setback relay contacts to the proper termination points inside the unit control panel. Verify the appropriate jumpers have been removed.

[ ] Install the suction line thermostat onto the suction line. Connect properly sized wiring between the thermostat and terminal strip 7TB7 in the unit control panel.

[ ] Install the discharge air sensor and wire it to the discharge air controller with shielded cable.

EVP Chiller Units

[ ] Install the appropriate jumpers on the chilled solution temperature controller for hot gas bypass operation (If applicable). Refer to the control wiring diagram that shipped with the unit for jumper details.

[ ] Install and connect the chilled solution temperature sensor to the chilled solution temperature controller with shielded cable.

[ ] Install the proper staging resistor onto the chilled solution temperature controller.

Constant Volume Units

[ ] Install the zone thermostat, with or without switching subbase.

[ ] Connect properly sized control wiring to the proper termination points between the zone thermostat and the unit control panel.

[ ] Install the discharge air sensor and connect it to the master energy controller (MEC) with shielded cable.

[ ] Connect properly sized wiring from the field provided economizer, if applicable, to the master energy controller (MEC) in the unit control panel.

Refrigerant Line Components

Suction line refrigerant components necessary for field installation in the suction line are a filter (Core Type), access valves (ports), Frostat™ control for coil frost protection, and ball shutoff valves. They are placed in the suction line as illustrated in Figure 18.

The required liquid line refrigerant components include a filter drier (Core Type), access valve(s) or (ports), solenoid valve(s), moisture indicating sight glass, expansion valve(s), and ball shutoff valve(s). They are placed in the liquid line as shown in Figure 18.

Suction And Liquid Line Filter/Filter Drier (Field Supplied)

Install the filter in the suction line upstream of the compressors. It should be installed so the canister is at either a 45 or 90 degree angle to prevent oil accumulation.

Install the filter drier in the liquid line as close as possible to the expansion valves. Locate them upstream of the moisture indicator and solenoid valve.

Refer to Table 5 for filter/filter drier recommendations.

Liquid Line Moisture Indicator Sight Glass

To aid in troubleshooting, install a moisture indicator sight glass in the liquid line near the evaporator, down stream of the solenoid valve prior to any branch takeoffs to the expansion valve. The sight glass should not be used to determine adequate refrigerant charge or sub-cooling. Actual temperature measurements are required to determine proper charge and sub-cooling.

Refer to Table 6 for solenoid valve/moisture indicator sight glass recommendations.

Liquid Line Solenoid Valves

Liquid line isolation solenoid valves are required for refrigerant migration control into the evaporator during the “Off” cycle and should be connected as illustrated in the applicable field connection diagram.

Under certain conditions, liquid line solenoid valves may be used to trim the amount of active evaporator as compressors unload. Generally, the trim solenoid valve is unnecessary on comfort cooling VAV systems, and is only required on CV systems when dehumidification is a concern.

Refer to Table 6 for solenoid valve/moisture indicator sight glass recommendations.

Thermostatic Expansion Valve (TEV)

Trane recommends a balance-ported externally equalized valve in order to maintain satisfactory superheat control down to lower valve loading conditions and to compensate for pressure drops between the expansion valve and superheat control point (evaporator refrigerant outlet).

In order to get proper refrigerant distribution into the coil, an expansion valve is required for each coil distributor.

Access Valves (Ports)

The access ports in the liquid line allows the unit to be charged with liquid refrigerant and is used to determine sub-cooling.

The access ports in the suction line allows the operating suction pressure to be checked across the suction line filter. These ports are usually a Schraeder valve with core.

Ball Shutoff Valves

The ball shutoff valve allows for isolation of the Filter/Filter Drier for easier core replacement.

Two ball shutoff valves equal to the OD Tubing size for both the liquid line and suction line are required.

Frostat™ Coil Frost Protection

The Froststat control is the preferred method of coil frost protection. The Frostat control bulb is mechanically attached to the suction line near the evaporator and wired to the unit control panel. Refer to the proper field connection diagram for details.

Table 5. Filter/Filter Drier Recommendations

Capacity	Suction Line (Sporlan)	Filter Core (Sporlan)	Liquid Line (Sporlan)	Filter Drier Core (Sporlan)
20 Ton	RSF-4817-T	RPE-48-BD	C-485-G	RCW-48
25 Ton	RSF-4817-T	RPE-48-BD	C-487-G	RCW-48
30 Ton	RSF-4817-T	RPE-48-BD	C-487-G	RCW-48
40 Ton	RSF-4817-T	RPE-48-BD	C-485-G	RCW-48
50 Ton	RSF-4817-T	RPE-48-BD	C-487-G	RCW-48
60 Ton	RSF-4817-T	RPE-48-BD	C-487-G	RCW-48

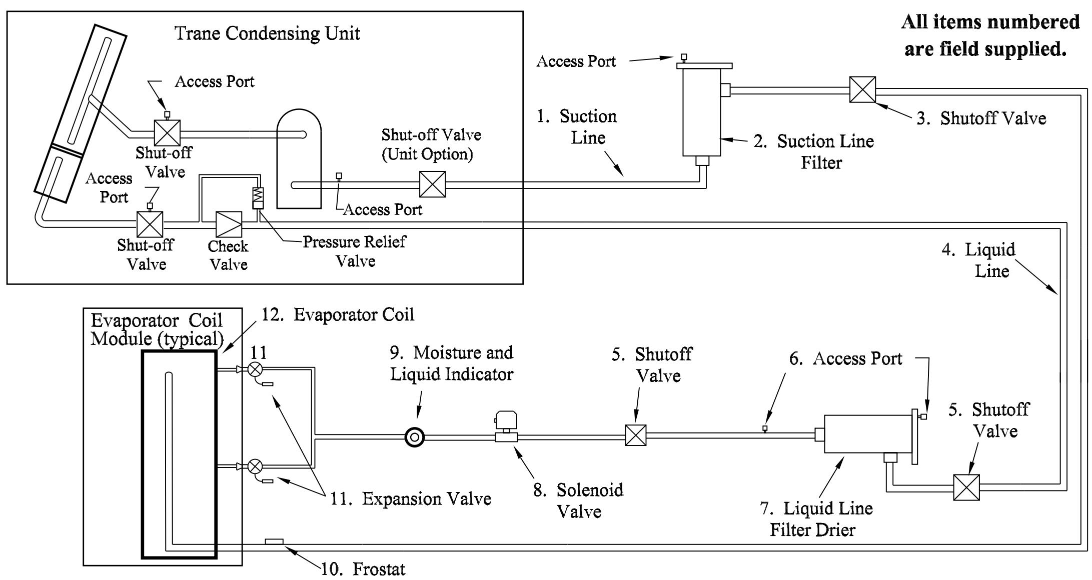
Note: Use specific parts listed or equivalent. (Per Circuit)

Table 6. Solenoid Valve & Sight Glass w/Moisture Indicator

Capacity	Solenoid Valve (Sporlan)	Solenoid Valve Coil (Sporlan)	Sight Glass with Moisture Indicator (Sporlan)
20 Ton	E19S250	MKC-2 @ 120V	SA-15S
25 Ton	E19S270	MKC-2 @ 120V	SA-17S
30 Ton	E19S270	MKC-2 @ 120V	SA-17S
40 Ton	E19S250	MKC-2 @ 120V	SA-15S
50 Ton	E19S270	MKC-2 @ 120V	SA-17S
60 Ton	E19S270	MKC-2 @ 120V	SA-17S

Note: Use specific parts listed or equivalent. (Per Circuit)

Figure 18. Typical Placement of Split System piping Components



Split System Component Number Definitions

(1)Interconnecting Suction Line Tubing

(2)Suction Line Filter

(3)Shutoff Valves - Manual ball valves

(4)Interconnecting Liquid Line Tubing. If risers exceed 10 feet, Trane must review the application

(5)Shutoff valves - Manual ball valves

(6)Access Ports

(7)Liquid Line Filter Drier

(8)Liquid Line Solenoid Valve

(9)Moisture and Liquid Indicator

(10)FrostatTM (Required for coil freeze protection)

(11)Expansion Valve (One Expansion Valve for each Coil Distributor)

(12)Evaporator Coil

Refrigerant Piping

Refrigerant piping must be properly sized and applied. These two factors have a very significant effect on both system performance and reliability.

NOTICE

Use Type "L" refrigerant grade copper tubing only.

Refrigerant Piping should be sized and laid out according to the job plans and specifications. This should be done when the system components are selected.

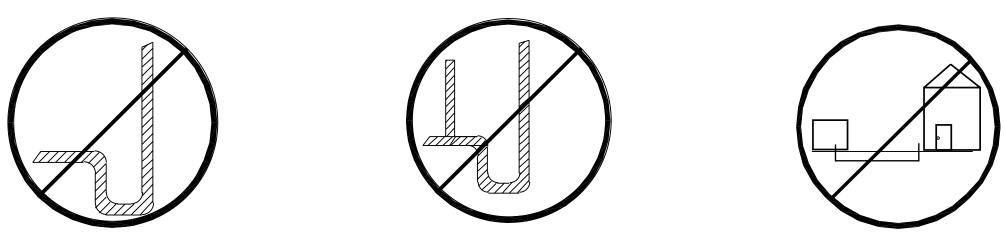
Suction Line Piping

Proper suction line sizing is required to guarantee that oil is returned to the compressor throughout the operating system. Furthermore, the line must be sized so that the pressure drop does not excessively affect capacity or efficiency. To accomplish both, it may be necessary to have two sizes, one for horizontal run and vertical drops, and another for the vertical lifts. The suction line size pre-selected in the Table below are independent of the line length for a properly charged RAUC unit operating in a normal air conditioning application.

For more information, refer to the latest edition of Application Guide SS-APG001-EN.

1. Do not use suction line traps.
2. Do not use double risers.
3. Avoid putting liquid lines underground.
4. Route suction lines as short and direct as possible.
5. Slope suction lines toward the evaporator ¼-inch to 1-inch for every 10 feet.
6. Insulate the suction lines.
7. The suction line filter should be as close to the compressor as possible.

Note: *If Suction Riser Exceeds 50 Feet, Trane Must Review The Application.*



Suction Line Interconnecting Tubing

Capacity	OD Horizontal (Per Circuit)	OD Vertical (Per Circuit)
20 Ton	2-1/8"	1- 5/8"
25 Ton	2-1/8"	1-5/8"
30 Ton	2-1/8"	2-1/8"
40 Ton	2-1/8"	1-5/8"
50 Ton	2-1/8"	2-1/8"
60 Ton	2-1/8"	2-1/8"

Note: If risers exceed 50 feet, the application must be reviewed by Trane.

Liquid Line Piping

Liquid line sizes are based on their ability to provide a minimum of 5 degrees F (2.7ºC) of sub-cooling at the expansion valve throughout the unit's operating system. Increasing the liquid line size does not increase the available sub-cooling. The uniform liquid line size, pre-selected in the Table below, are independent of the line length or rise within the permissible guidelines to maintain this minimum required 5 degree F (2.7ºC) sub-cooling at the expansion valve for a properly charged RAUC unit operating in a normal air conditioning application.

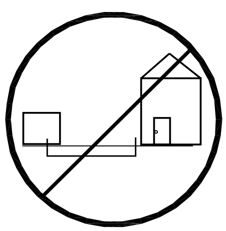
The liquid line should have a slight slope in the direction of flow so that it can be routed with the suction line.

The unit has a liquid line check valve that prevents liquid refrigerant from flowing backward through the liquid line, filling the condenser, and overflowing to the compressor during the "Off" cycle. A relief valve is also installed to prevent the build up of high pressure in the liquid line when the unit is off. For proper operation of the relief valve, the liquid line service valve should not be in the back seated position but cracked open so the relief valve (and the fan pressure switch) is open to the condenser. The line that connects the outlet of the 235 psig relief valve to the liquid line service valve must not be removed.

For more information, refer to the latest edition of Application Guide SS-APG001-EN.

1. Avoid putting liquid lines underground.
2. Route liquid lines as short and direct as possible.
3. Slope liquid lines away form the condensing unit 1-inch for every 10 feet.
4. Only insulate liquid lines that pass through heated areas.
5. Wire solenoid valves according to the field connection diagram for proper pump down operation.
6. The liquid line filter drier should be as close to the solenoid valve as possible.

Note: *If the liquid line riser exceeds 10 feet, refer to Tube Size and Component Selection, publication number SS-APG001-EN*



Liquid Line Interconnecting Tubing

Capacity	OD Horizontal (Per Circuit)	OD Vertical (Per Circuit)
20 Ton	5/8"	5/8"
25 Ton	7/8"	7/8"
30 Ton	7/8"	7/8"
40 Ton	5/8"	5/8"
50 Ton	7/8"	7/8"
60 Ton	7/8"	7/8"

Note: If risers exceed 10 feet, refer to Tube Size and Component Selection, publication number SS-APG001-EN

Evaporator Piping

1. Install the TXV directly to the unit liquid connection.
2. Locate the TXV bulb midway between the 90 degrees bends on top of the suction line as illustrated in Figure 19 and Figure 20.
3. Secure the bulb to the suction line with two clamps provided by the manufacturer and insulate the bulb.
4. Install the Frostat™ according to the instructions enclosed in the kit as close to the evaporator as possible.

Figure 19. Typical Coil Piping For Dual Circuit Units

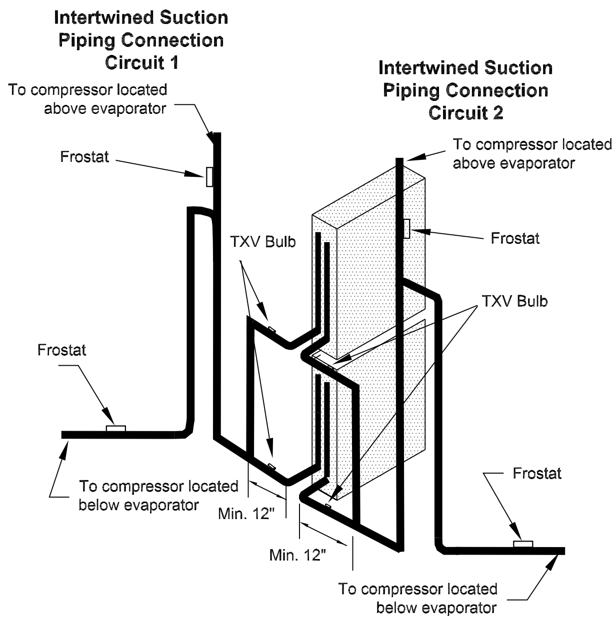
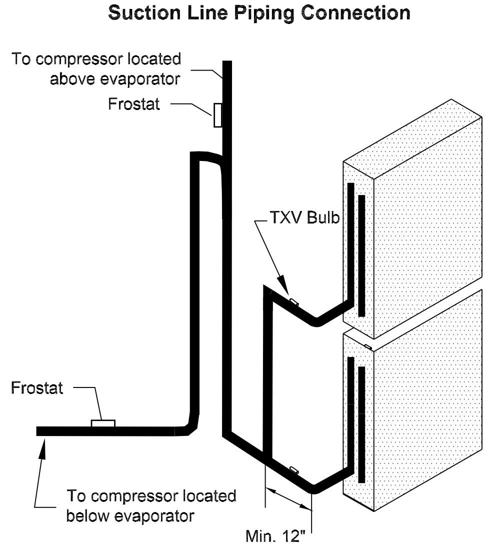


Figure 20. Typical Coil Piping For Dual Circuit Units



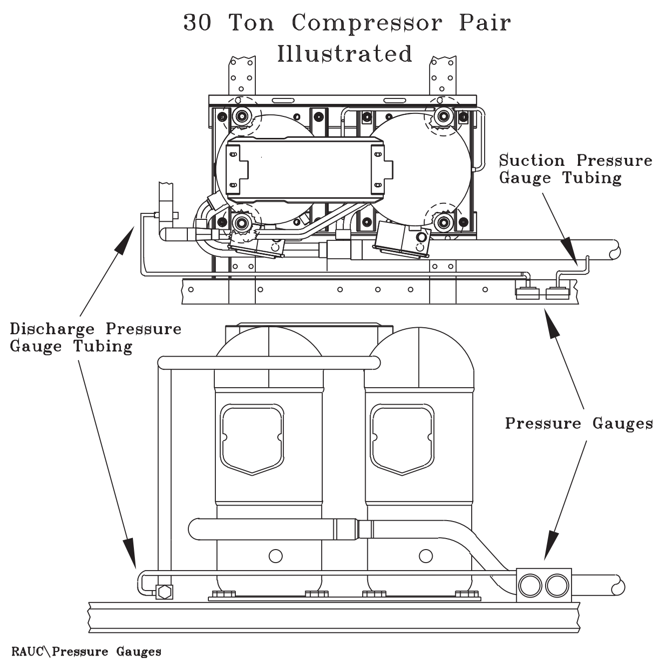
Hot Gas Bypass for Commercial Comfort-Cooling Applications

Hot gas bypass is not recommended for use on RAUC units. Frostat™ is the preferred method of protecting the evaporator from freeze-up. It turns off compressors when the coil frosting is sensed. The compressor is allowed to operate when the coil temperature rises a few degrees above the frosting condition. This action reduces the overall energy consumption of the system while reliably maintaining system control.

For more information, refer to the latest edition of Application Guide SS-APG001-EN.

Optional Pressure Gauges

When a unit is ordered with optional pressure gauges, (“F” is included in the miscellaneous digit of the model number), a set of gauges and the necessary mounting hardware ship in the location illustrated in the Unit Component “Layout” and “Shipwith” Location. The mounting location and tubing configuration for the optional pressure gauges after field installation is shown below.



Final Refrigerant Pipe Connections

To access the refrigerant pipe connections, remove the louvered side grills.

These condensing units are shipped with a Nitrogen holding charge. Install pressure gauges to the appropriate access valve(s) and take a reading. If no pressure is present, refer to the “Leak Testing Procedure” section. If pressure is present, relieve the pressure before attempting to unsweat the “seal” caps. If refrigerant connections are not capped, but are “spun-end” tubes, use a tubing cutter to remove the end from the pipe.

Note: *To prevent damage to the system, do not drill a hole in the seal caps or saw the ends off pipe stubs. This may introduce copper chips into the system piping.*

Brazing Procedures

⚠ WARNING

Hazard of Explosion and Deadly Gases!

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. Failure to follow all proper safe refrigerant handling practices could result in death or serious injury.

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

⚠ WARNING

Hazard of Explosion!

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 mixtures of a hydrogen 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. Failure to follow these recommendations could result in death or serious injury or equipment or property-only damage.

1. When copper is heated 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. Nitrogen displaces air in the tubing and prevents oxidation of the interior surfaces. A nitrogen flow of one to three cubic feet per minute is sufficient to displace the air. Use a pressure regulating valve or flow meter to control the flow.
2. Ensure that the tubing surfaces to be brazed are clean, and that the ends of the tubes have been carefully reamed to remove any burrs.
3. Make sure 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 tensile strength of the connection will be significantly reduced. The overlap distance should be equal to the diameter of the inner tube.
4. Wrap the body of each refrigerant line component with a wet cloth to keep it cool during brazing. Move any tube entrance grommets away for the brazing area.

Note: *Use 40 to 45% silver brazing alloy (BAg-7 or BAg-28) on dissimilar metals. Use BCup-6 brazing alloy on copper to copper joints.*

5. If flux is used, apply it sparingly to the joint. Excessive flux can enter the system which will contaminate the refrigerant system.
6. Apply heat evenly over the length and circumference of the joint to draw the brazing material into the joint by capillary action. Remove the brazing rod and flame from the joint as soon as a complete fillet is formed to avoid possible restriction in the line.
7. Visually inspect the connection after brazing to locate any pin holes or crevices in the joint. The use of a mirror may be required, depending on the joint location.

Leak Testing Procedure

⚠ WARNING

Hazard of Explosion!

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 mixtures of a hydrogen 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. Failure to follow these recommendations could result in death or serious injury or equipment or property-only damage.

⚠ WARNING

Hazard of Explosion!

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

When Leak-testing a refrigerant system, observe all safety precautions.

⚠ WARNING

Never use oxygen, acetylene or compressed air for leak testing. Always install a pressure regulator, shutoff valves and gauges to control pressure during leak testing. Failure to do so could result in death or serious injury.

Trane condensing units are shipped with a Nitrogen holding charge. If there is no pressure, the unit must be leak tested to determine the location of leak as follows:

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

Use refrigerant gas as a tracer for leak detection and use oil-pumped dry nitrogen to develop the required test pressure. Test the high and low side of the system at pressures dictated by local codes.

1. Close the field supplied liquid line service valve(s) installed near the evaporator and the compressor discharge service valve to isolate the system's high side from the low side. Pressure test the liquid line, discharge line, and condenser coils at pressures dictated by local codes. Do not exceed 10# above the pressure control settings.
2. Connect a refrigerant cylinder to the charging port of the liquid line service valve. Use the refrigerant to raise the high side pressure to 12 to 15 psig.
3. Disconnect the refrigerant cylinder. Connect a dry nitrogen cylinder to the charging port and increase the high side pressure. Do not exceed the condenser maximum working pressure listed on the unit nameplate.
4. Use a halide torch, halogen leak detector or soap bubbles to check for leaks. Check all piping joints, valves, etc...
5. If a leak is located, use proper procedures to remove the refrigerant/nitrogen mixture, break the connection and remake as a new joint. Retest for leaks after making repairs.
6. Repeat the test procedure for the low side of the system, charging through the suction pressure gauge port or through an access provided on the suction line by the installer. Increase the system pressure to 100 psig.

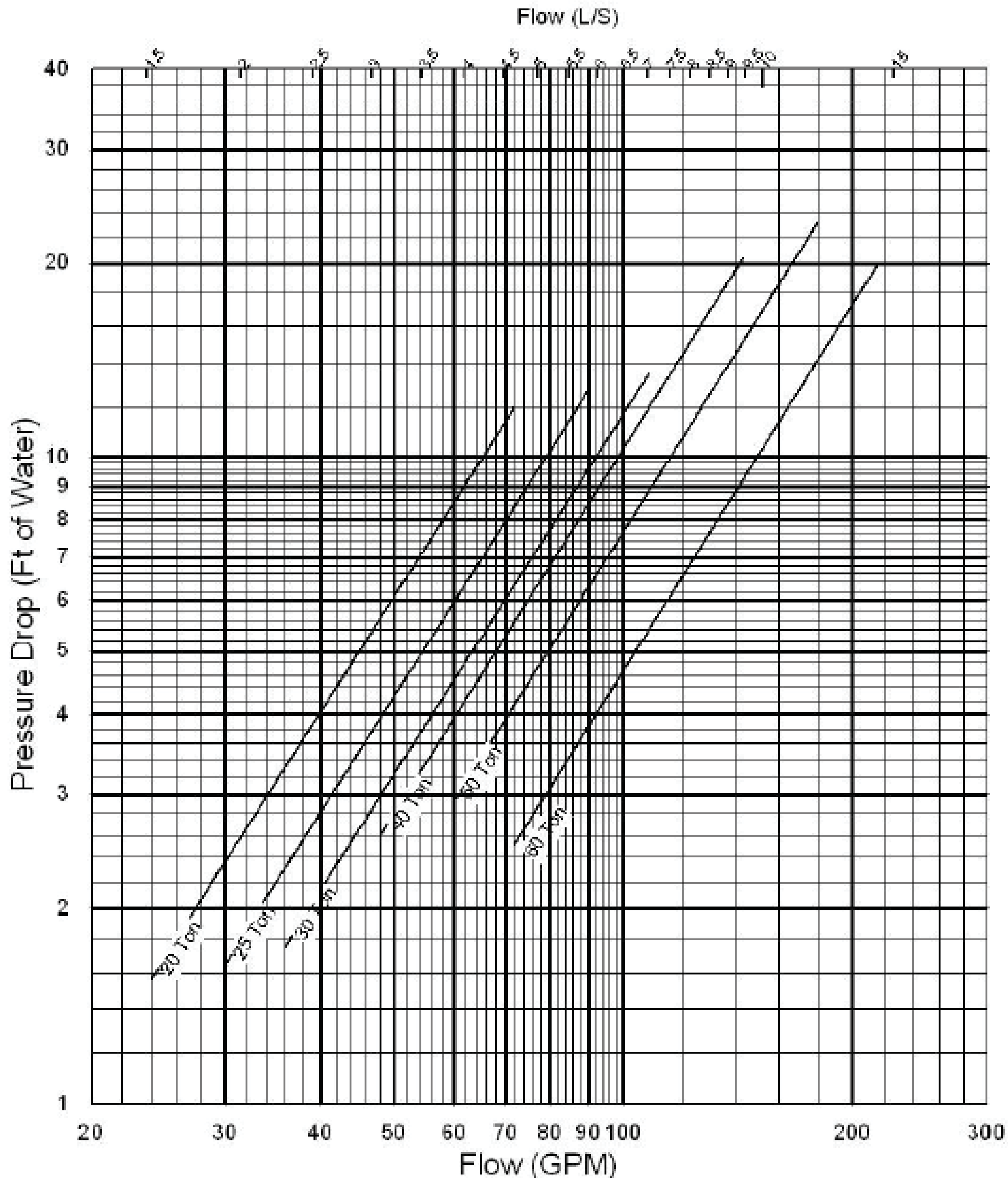
7. If a leak is located, use proper procedures to remove the refrigerant/nitrogen mixture, break the connection and remake as a new joint. Retest for leaks after making repairs.
8. Open the liquid line service valve and the compressor discharge service valve.

Chilled Water Piping

Evaporator water inlet and outlet types, sizes and locations are shown in Figure 9 to Figure 14. Refer to the operating GPM parameters listed in Figure 21 when determining flow and piping requirements. Figure 22 illustrates the typical water piping components for chiller applications. Refer to this illustration while following the discussion on the various piping components.

Isolate the water pumps from the system to avoid vibration transmission. To minimize heat gain and prevent condensation, insulate all water piping. Use an appropriate pipe sealant on all threaded connections.

Figure 21. Evaporator Water-Pressure Drop



Note: *Factor to convert "Feet of Water" to "Lbs. per Sq. Inch" (PSI): 2.3 Feet of Water = 1 PSI*

Air Vents

Vents must be installed at high points in the piping system to facilitate air purging during the filling process.

Water Pressure Gauges

Install pressure gauge(s) to monitor the entering and leaving chilled water pressure.

NOTICE

To prevent evaporator damage, do not exceed 150 psig evaporator pressure.

Water Shutoff Valves

Provide shutoff valves in the “Supply” and “Return” pipe near the chiller so the gauge(s), thermostats, sensors, strainer, etc., can be isolated during service.

Pipe Unions

Use pipe unions to simplify disassembly for system service. Use vibration eliminators to prevent transmitting vibrations through the water lines.

Thermometers

Install thermometers in the lines to monitor the evaporator entering and leaving water temperatures.

Balancing Valves

Install a balancing cock (valve) in the leaving water line. It will be used to establish a balanced flow.

Note: *Both the entering and leaving water lines should have shutoff valves installed to isolate the evaporator for service.*

Strainer

Install a pipe strainer in the water return line to protect the components from entrapped debris.

Chiller Drain

The chiller drain should be piped to a suitable drain facility to facilitate evaporator draining during service or shutdown procedures. Provide a shutoff valve in the drain line.

Note: *The BPHE chiller does not include a drain plug. Drain piping and shutoff valve must be installed at the lowest point in the water piping to insure proper draining of the chiller. Insure that the drain is closed before filling system with water.*

Chiller Flow Switch

Install a flow switch or other flow sensing device, illustrated in Figure 23, to prevent or stop the compressor operation if the water flow drops off drastically. A flow switch ships with a each unit when a “T” is included in the miscellaneous digit of the model number. Locate the device in the chilled water supply line (water outlet) as shown in Figure 22. Refer to the field wiring and unit schematics for the flow switch electrical interlock connections.

Water Temperature Sensor

The Temperature Sensor and Sensor-well must be installed in the leaving water piping as close to the chiller as possible. Both devices are located inside the remote panel. Thermal paste is also provided inside the remote panel and must be used when installing the sensor into the sensor-well. Refer to Figure 22 for the recommended location. Figure 24 illustrates the Sensor-well dimensions.

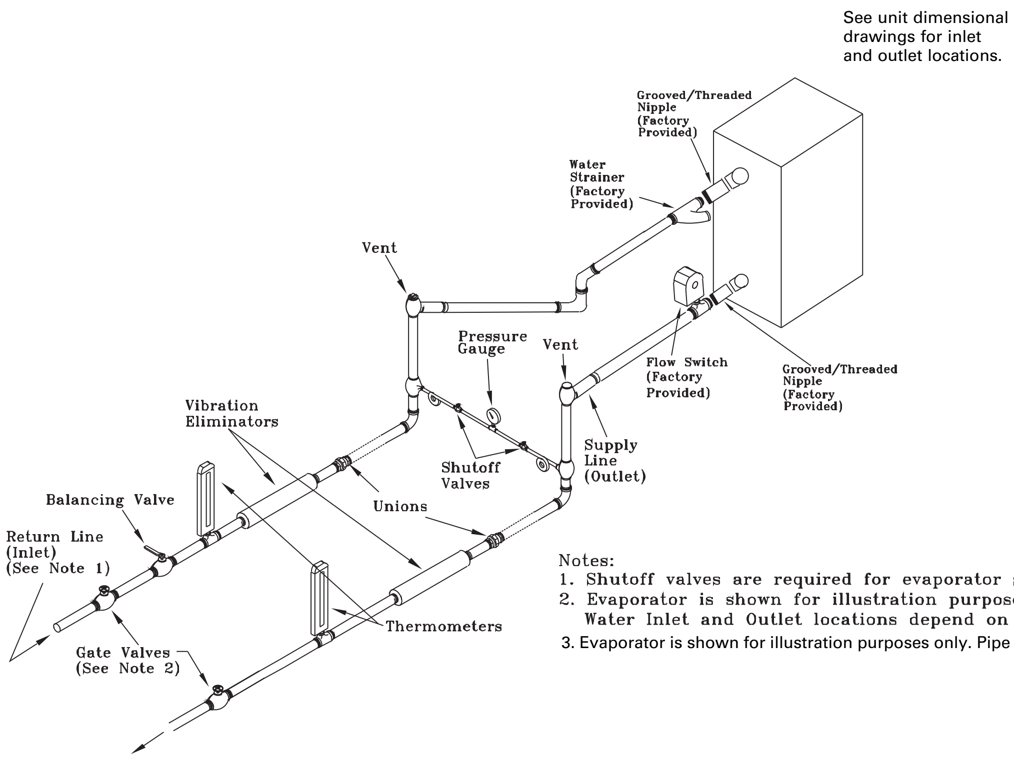
NOTICE

Failure to use thermal paste could result in erratic temperature sensing resulting in equipment damage.

Freezestat

A Bulb-well (located inside the remote panel) must be installed in the leaving water piping as close to the chiller barrel as possible. It should be located upstream of the Temperature Sensor location. The Freezestat, located within the remote panel, is equipped with a remote Sensing Bulb and 20 feet of capillary tube. The Remote Sensing Bulb must be installed by the installing personnel. Thermal paste is also provided inside the remote panel and must be used when installing the bulb into the bulb-well. Refer to Figure 22 for the recommended location. Figure 24 illustrates the Bulb-well dimensions.

Figure 22. Typical Piping Recommendations



Notes:
1. Shutoff valves are required for evaporator servicing.
2. Evaporator is shown for illustration purposes only. Water Inlet and Outlet locations depend on unit size.
3. Evaporator is shown for illustration purposes only. Pipe connections are grooved.

Figure 23. Optional Flow Switch Illustration

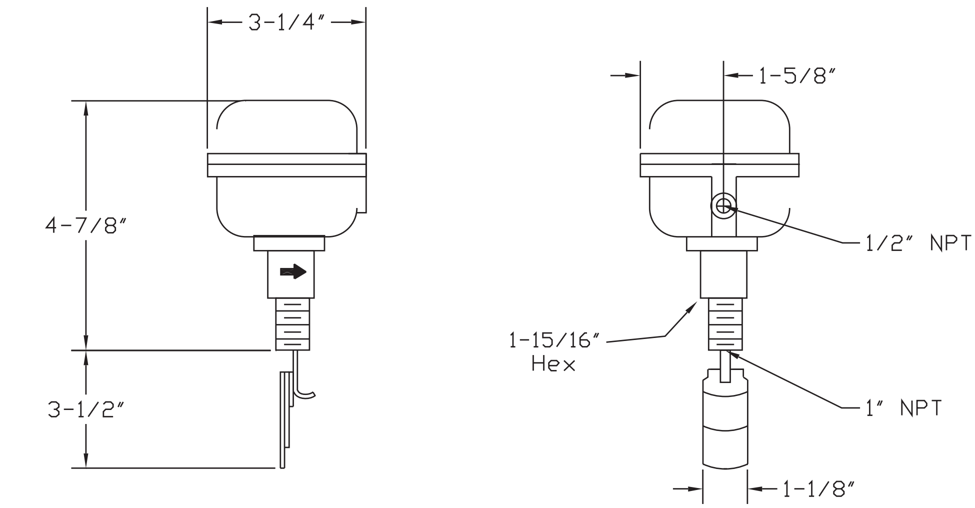
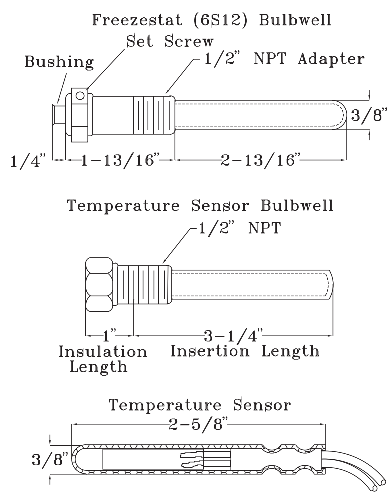


Figure 24. Freezestat Bulb-well, Temperature Sensor & Well



NOTICE

Failure to use thermal paste could result in erratic temperature sensing resulting in equipment damage.

Final Water Piping Connections

1. All water piping to the system should be flushed thoroughly before making the final connections.

NOTICE

If an acidic commercial flushing solution is used, construct a temporary bypass around the EVP chiller to prevent damage to the internal components of the evaporator.

2. Connect the water pipe to the EVP chiller.

3. Install the drain plug, (if no drain is used) or ensure the drain shutoff valve is closed.
4. While filling the chiller system with solution, vent the air from the system at the highest points.

NOTICE

To prevent possible damage to the equipment, do not use untreated or improperly treated water in the system.

Field Installed Power Wiring

An overall dimensional layout for the field installed wiring entrance into the unit is illustrated in Figure 3 to Figure 8. To insure that the unit's supply power wiring is properly sized and installed, follow the guidelines outlined below.

Note: *Ensure the water drain shutoff valve is closed.*

Verify that the power supply available is compatible with the unit's nameplate ratings. The available supply power must be within 10% of the rated voltage stamped on the nameplate.

NOTICE

Use only copper conductors to connect the 3-phase power supply to the unit.

Disconnect Switch External Handle (Factory Mounted Option)

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

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

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

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

Once the door has been opened, it can be closed with the handle in any one of the three positions outlined above, provided it matches the disconnect switch position.

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

Main Unit Power Wiring

⚠ WARNING
Hazardous Voltage!

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

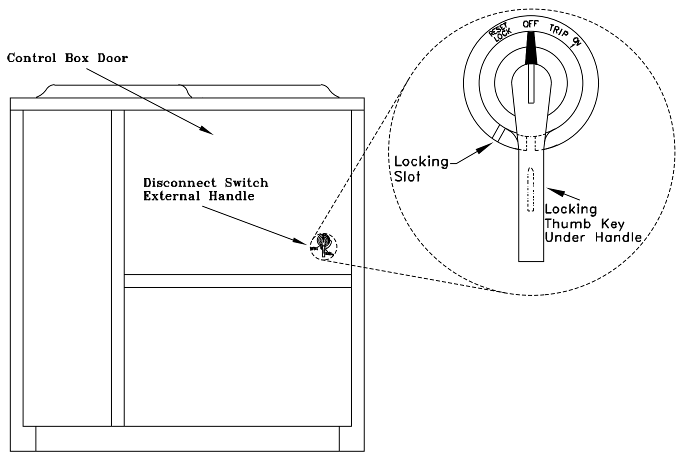


Table 7 lists the field connection wire ranges for both the main power terminal block 1TB1 and the optional main power disconnect switch 1S1. The unit electrical data is listed in Table 8. The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements. Protection devices must be sized according to the electrical data on the nameplate. Refer to the "Power Wire Sizing & Protection Device Equations", for determining;

a. the appropriate electrical service wire size based on "Minimum Circuit Ampacity" (MCA),

b. the "Maximum Over current Protection" (MOP) device.

c. the "Recommended Dual Element fuse size" (RDE).

1. If the unit is not equipped with an optional factory installed nonfused disconnect switch, a field supplied disconnect switch must be installed at or near the unit in accordance with the National Electrical Code (NEC latest edition). Refer to the "Power Wire Sizing & Protection Device Equations" (DSS calculation), for determining the correct size.
2. Complete the unit's power wiring connections onto either the main terminal block 1TB1, or the factory mounted nonfused disconnect switch 1S1, inside the unit control panel. Refer to the customer connection diagram that shipped with the unit for specific termination points.
3. Provide proper grounding for the unit in accordance with local and national codes.

Power Wire Sizing and Protection Device

Equations

Table 7. Customer Connection Wire Range

CUSTOMER WIRE SELECTION			
POWER WIRE SELECTION TO DISCONNECT SWITCH (1S1)			
UNIT SIZE	UNIT VOLTAGE	DISCONNECT SWITCH SIZE	CONNECTOR WIRE RANGE
20 - 40 TON	380/415/460/575 VOLT	100 AMP	(1) #14 - 1/0
50 TON	575 VOLT	100 AMP	(1) #14 - 1/0
20 - 40 TON	200/230 VOLT	250 AMP	(1) #4 - 350 kcmil
50 - 60 TON	380/415/460 VOLT	250 AMP	(1) #4 - 350 kcmil
60 TON	575 VOLT	250 AMP	(1) #4 - 350 kcmil
50 - 60 TON	200/230 VOLT	400 AMP	(1) #1 - 600 kcmil OR (2) #1 - 250 kcmil
POWER WIRE SELECTION TO MAIN TERMINAL BLOCK (1TB1)			
UNIT SIZE	UNIT VOLTAGE	TERMINAL BLOCK SIZE	CONNECTOR WIRE RANGE
20 - 60 TON	ALL VOLTAGES	335 AMP	(1) #6 - 350 MCM
CONTROL WIRE SELECTION TO CONTROL TERMINAL BLOCKS (7TB5 THRU 7TB8 6TB9)			
WIRE GAUGE	OHMS PER 1000 FEET	MAX WIRE LENGTH	
18 AWG	8	500 FT	
16 AWG	5	1000 FT	
14 AWG	3	2000 FT	

To correctly size the main power wiring for the unit, use the appropriate calculation(s) listed below. Read the load definitions that follow and use Calculation #1 for determining the MCA (Minimum Circuit Ampacity), MOP (Maximum Over current Protection), and RDE (Recommended Dual Element fuse size) for each unit. Use Calculation #2 to determine the DSS (Disconnect Switch Size) for each unit.

Load Definitions:

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

LOAD 2 = SUM OF THE CURRENTS OF ALL REMAINING MOTORS

LOAD 4 = CONTROL POWER TRANSFORMER

= AND ANY OTHER LOAD RATED AT 1 AMP OR MORE

Calculation #1 (MCA, MOP, and RDE)

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

MOP = (2.25 x LOAD 1) + LOAD 2 + LOAD 4

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

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

RDE = (1.5 x LOAD 1) + LOAD 2 + LOAD 4

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

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

Calculation #2
Disconnect Switch Sizing (DSS)

DSS = 1.15 X (LOAD 1 + LOAD 2 + LOAD 4)

Table 8. Electrical Service Sizing Data

		Unit Characteristics				Condenser Fan Motor					Compressor Motor						
Model	Electrical Charac.	Allow-able Voltage Range	Min. Circuit Amp	Max. Over-current Protect -ion	Rec. Dual Element Fuse Size	KW (Ea)	No	HP	FLA (Ea)	LRA (Ea)	No	RLA (Ea) 10 Ton	RLA (Ea) 15 Ton	LRA (Ea) 10 Ton	LRA (Ea) 15 Ton	Kw (Ea) 10 Ton	Kw (Ea) 15 Ton
RAUC-C20E	200/60/3XL	180-220	101	125	125	0.90	2	1.0	4.1	20.7	2	41.4	_	269.0	_	10.7	_
RAUC-C20F	230/60/3XL	208-254	101	125	125	0.90	2	1.0	4.1	20.7	2	41.4	_	251.0	_	10.7	_
RAUC-C204	460/60/3XL	416-508	44	60	50	0.90	2	1.0	1.8	9.0	2	18.1	_	117.0	_	10.4	_
RAUC-C205	575/60/3XL	520-635	35	45	40	0.90	2	1.0	1.4	7.2	2	14.4	_	94.0	_	10.4	_
RAUC-C209	380/415/50/ 3XL	342-418/ 373-456	42	50	50	0.75	2	1.0	1.7	9.2	2	17.2	_	110.0	_	10.6	_
RAUC-C25E	200/60/3XL	180-220	129	175	150	0.90	3	1.0	4.1	20.7	2	41.4	60.5	269.0	409.0	10.9	16.3
RAUC-C25F	230/60/3XL	208-254	129	175	150	0.90	3	1.0	4.1	20.7	2	41.4	60.5	251.0	376.0	10.9	16.3
RAUC-C254	460/60/3XL	416-508	56	80	70	0.90	3	1.0	1.8	9.0	2	18.1	26.3	117.0	178.0	10.6	15.8
RAUC-C255	575/60/3XL	520-635	45	60	60	0.90	3	1.0	1.4	7.2	2	14.4	21.0	94.0	143.0	10.6	15.8
RAUC-C259	380/415/50/ 3XL	342-418/ 373-456	55	80	70	0.75	3	1.0	1.7	9.2	2	17.2	26.2	110.0	174.0	10.8	16.3
RAUC-C30E	200/60/3XL	180-220	148	200	175	0.90	3	1.0	4.1	20.7	2	_	60.5	_	409.0	_	15.9
RAUC-C30F	230/60/3XL	208-254	148	200	175	0.90	3	1.0	4.1	20.7	2	_	60.5	_	376.0	_	15.9
RAUC-C304	460/60/3XL	416-508	65	90	80	0.90	3	1.0	1.8	9.0	2	_	26.3	_	178.0	_	15.5
RAUC-C305	575/60/3XL	520-635	52	70	60	0.90	3	1.0	1.4	7.2	2	_	21.0	_	143.0	_	15.5
RAUC-C309	380/415/50/ 3XL	342-418/ 373-456	65	90	80	0.75	3	1.0	1.7	9.2	2	_	26.2	_	174.0	_	16.2
RAUC-C40E	200/60/3XL	180-220	192	225	225	0.90	6	1.0	4.1	20.7	4	41.4	_	269.0	_	10.7	_
RAUC-C40F	230/60/3XL	208-254	192	225	225	0.90	6	1.0	4.1	20.7	4	41.4	_	251.0	_	10.7	_
RAUC-C404	460/60/3XL	416-508	84	100	90	0.90	6	1.0	1.8	9.0	4	18.1	_	117.0	_	10.4	_
RAUC-C405	575/60/3XL	520-635	67	80	80	0.90	6	1.0	1.4	7.2	4	14.4	_	94.0	_	10.4	_
RAUC-C409	380/415/50/ 3XL	342-418/ 373-456	80	90	90	0.75	6	1.0	1.7	9.2	4	17.2	_	110.0	_	10.6	_
RAUC-C50E	200/60/3XL	180-220	244	300	175	0.90	6	1.0	4.1	20.7	4	41.4	60.5	269.0	409.0	11.0	16.4
RAUC-C50F	230/60/3XL	208-254	244	300	175	0.90	6	1.0	4.1	20.7	4	41.4	60.5	251.0	376.0	11.0	16.4
RAUC-C504	460/60/3XL	416-508	106	125	125	0.90	6	1.0	1.8	9.0	4	18.1	26.3	117.0	178.0	10.7	15.9
RAUC-C505	575/60/3XL	520-635	85	100	100	0.90	6	1.0	1.4	7.2	4	14.4	21.0	94.0	143.0	10.7	15.9
RAUC-C509	380/415/50/ 3XL	342-418/ 373-456	104	125	125	0.75	6	1.0	1.7	9.2	4	17.2	26.2	110.0	174.0	10.9	16.4
RAUC-C60E	200/60/3XL	180-220	282	300	300	0.90	6	1.0	4.1	20.7	4	_	60.5	_	409.0	_	16.1
RAUC-C60F	230/60/3XL	208-254	282	300	300	0.90	6	1.0	4.1	20.7	4	_	60.5	_	376.0	_	16.1
RAUC-C604	460/60/3XL	416-508	123	125	125	0.90	6	1.0	1.8	9.0	4	_	26.3	_	178.0	_	15.6
RAUC-C605	575/60/3XL	520-635	98	11	110	0.90	6	1.0	1.4	7.2	4	_	21.0	_	143.0	_	15.6

Table 8. Electrical Service Sizing Data (continued)

Model	Electrical Charac.	Unit Characteristics: Allow-able Voltage Range	Min. Circuit Amp	Max. Over-current Protect -ion	Rec. Dual Element Fuse Size	Condenser Fan Motor: KW (Ea)	No	HP	FLA (Ea)	LRA (Ea)	Compressor Motor: No	RLA (Ea) 10 Ton	RLA (Ea) 15 Ton	LRA (Ea) 10 Ton	LRA (Ea) 15 Ton	Kw (Ea) 10 Ton	Kw (Ea) 15 Ton
RAUC-C609	380/415/50/ 3XL	342-418/ 373-456	122	125	125	0.75	6	1.0	1.7	9.2	4	_	26.2	_	174.0	_	16.4

1. Electrical data is for each individual motor.
2. Max Overcurrent Protection device permitted by N.E.C. 440-22 (1993) is 225% of the largest compressor motor RLA plus the remaining motor RLA and FLA values.
3. Minimum circuit ampacity is 125% of the largest compressor motor RLA plus the remaining motor RLA and FLA values.
4. Recommended dual element fuse size is 150% of the largest compressor motor RLA plus the remaining motor RLA and FLA values.
5. Kw values are taken at conditions of 45ºF saturated suction temperature at the compressor and 95ºF ambient.
6. Local codes may take precedence.

Field Installed Control Wiring

⚠ WARNING
Hazardous Voltage!

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

Before installing any connecting wiring, refer to Figure 3 to Figure 8 for the electrical access locations provided on the unit. Install appropriately sized control wiring for the 115 volt electrical components as required by the application.

Since the unit-mounted 115V control power transformer (1T1) is provided on all units, it is not necessary to run a separate 115 volt control power source to the unit.

Note: *200/230 Volt units are shipped with transformer 1T1 wired for 200 volt operation. If the unit is to be operated on a 230 volt power supply, rewire the transformer as shown on the unit schematic.*

Controls Using 115 VAC

⚠ WARNING
Hazardous Voltage!

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

Install appropriately sized 115 volt control wiring for the electrical components as required by the application.

These components may include:

hot gas bypass solenoid wiring;

supply fan interlock and control circuit;

system control switch wiring (“No Control” units);

step controller wiring (“No Control” units);

chilled water pump interlock wiring (EVP units);

chilled water flow switch wiring (EVP units);

outside air thermostat wiring (EVP units):

liquid line solenoid valve(s).

Supply Fan Interlock (Control options utilizing an Air Handler)

The normally open evaporator fan interlock auxiliary contacts and the evaporator fan controls; system On/Off switch, fan starter/contactor, and overloads, must be wired as illustrated in the appropriate interlock connection wiring diagram for the specified application.

EVP Interlocks (EVP Flow control 6S58)

The flow switch is a binary output device and must be wired within the interlock circuit. Before installing the control wiring, refer to the remote panel illustration for the electrical access into the panel. Refer to the field connection diagram for the specific connection points inside the remote panel.

⚠ **WARNING**

Ground Wire!

All field-installed wiring must be completed by qualified personnel. All field-installed wiring must comply with NEC and applicable local codes. Failure to follow this instruction could result in death or serious injuries.

⚠ **WARNING**

Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

Provide a proper ground for all control circuitry at the ground connection screws provided within both the remote panel and the unit's control panel.

(EVP Circulating Pump Interlock)

Pump operation and sequence is the responsibility of the installer. During compressor operation, the fluid flow through the chiller must be maintained. The field provided; ON/OFF switch, pump starter/contactor, auxiliary contacts and overloads (OL's) must be installed as part of the system's interlock circuit to disable the compressors in the event the circulating pump shuts down or is turned off.

Note: *Due to the location of the 5S1 switch within the circulating pump control circuit, it can be used as a system ON/OFF switch.*

(Outside Air Thermostat 5S57)

A field provided outside air thermostat must be installed within the interlock circuit to prevent the system from operating below it's workable temperature range. Before installing the control wiring, refer to the remote panel illustration for the electrical access into the panel. Refer to the field connection diagram for the specific connection points inside the remote panel. Refer to the "EVP Chiller Controls" section for temperature requirements.

Hot Gas Bypass (All control options)

If hot gas bypass is required, refer to the "Refrigerant Piping" illustration for supporting equipment tubing connections. Refer to the specific control option field connection diagram terminal connections for the hot gas bypass solenoid coils.

Controls using 24 VAC

⚠ WARNING
Hazardous Voltage!

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

Before installing any connecting wiring, refer to Figure 3 to Figure 8 for the electrical access locations provided on the unit and Table 9 for AC conductor sizing guidelines, and;

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

NOTICE

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

3. Be sure to check all loads and conductors for grounds, shorts, and miswiring.
4. Do not run the AC low voltage wiring in the same conduit with the high voltage power wiring.

Typical Low voltage components may include:

zone thermostat wiring (AC & DC wiring);
system control switch wiring (VAV units);
night setback relay wiring (VAV units);
economizer actuator circuit wiring (VAV units);
discharge air sensor wiring (VAV units);
chilled water temperature sensor (EVP units);
jumpers for hot gas bypass operation.

Table 9. AC Conductors

Distance from Unit to Control	Recommended Wire Size
000 - 460 feet	18 gauge
461 - 732 feet	16 gauge
733 - 1000 feet	14 gauge

Controls using DC Analog Input/Outputs

⚠ WARNING
Hazardous Voltage!

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

Before installing any connecting wiring between the unit and components utilizing a DC analog input\output signal, refer to Figure 3 to Figure 8 for the electrical access locations provided on the unit.

These components may include:

Field installed Discharge Duct Sensor (6RT1 CV units);

Field installed Return Duct Sensor (6RT6 CV units);

Field installed Discharge Air Sensor (6RT3 VAV units);

Field installed Chilled Water Sensor (6RT2 EVP units);

1. Wiring for the components utilizing a DC analog input\output signal must be shielded cable (Belden 8760 or equivalent). Ground the shield at one end only.
2. Table 10 lists the conductor sizing guidelines that must be followed when interconnecting a DC binary output device to the unit.

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

3. Ensure that the wiring between the binary controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.
4. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

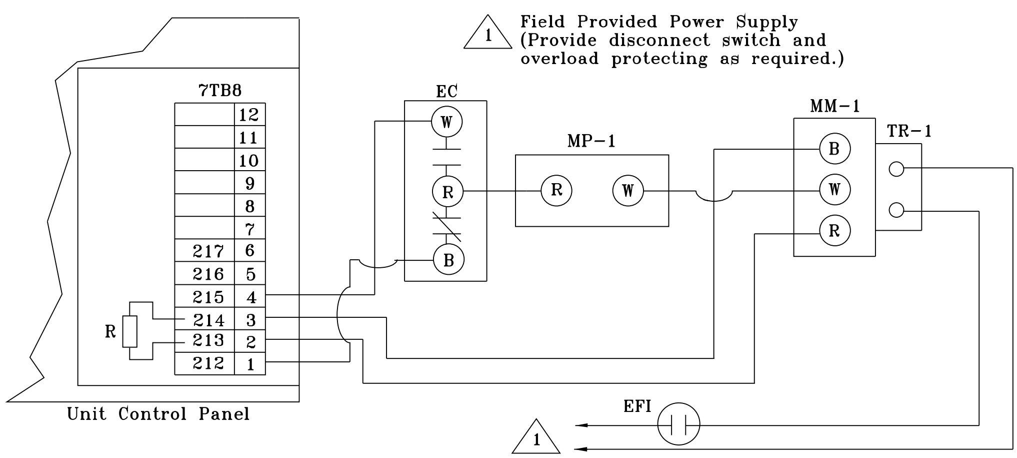
Table 10. DC Conductors

Distance from Unit to Control	Recommended Wire Size
000 - 499 feet	16 gauge
500 - 1000feet	14 gauge

Economizer Actuator Circuit

Each unit ordered with the Constant Volume or Variable Air Volume control option has the capability of controlling a field installed economizer. The diagram below illustrates a typical economizer actuator circuit.

When connecting the economizer actuator control circuit to the terminal board inside the unit control panel, refer to the actual unit wiring diagram for terminal designation, i.e. W, B, R, & Y. A separate power supply for the actuator(s) must be field provided.



Economizer Actuator Circuit Legend

Device Designation	Device Designation	Parts And Notes
MM	Modutral Motor	M.H. M955, (Up to 3 motors may be controlled as shown. Additional motors must be slaved.)
TR	Transformer	M.H. 13081B; cover mounted
EC	Enthalpy Control	M.H. H2051046
MP	Minimum Position Potentiometer	M.H. S96A1012
EFI	Evaporator Fan Interlock	Field Provided
7TB88	Low Voltage Terminal Strip	Located in Temperature Controller Panel
R	1/4 Watt - 5% Carbon	1 Motor/Circuit = None Req. 2 Motors/ circuit = 1300 Ohms 3 Motors/Circuit = 910 Ohms

No System Control

Temperature Control Parameters

Each unit ordered with the “No Controls” option, requires a field provided and field wired temperature controller. Single refrigerant circuit units require a 2-step control device, and dual refrigerant circuit units require a 4-step control device.

Each unit is shipped form the factory with internal “Fixed-On” & “Fixed-Off” time delays wired into each step of cooling. The “Fixed-Off” timers are 5 minutes each and they begin timing when the circuit for that step of cooling is deactivated. The “Fixed-On” timers are 3 minutes each and they begin timing when the circuit for that step is activated.

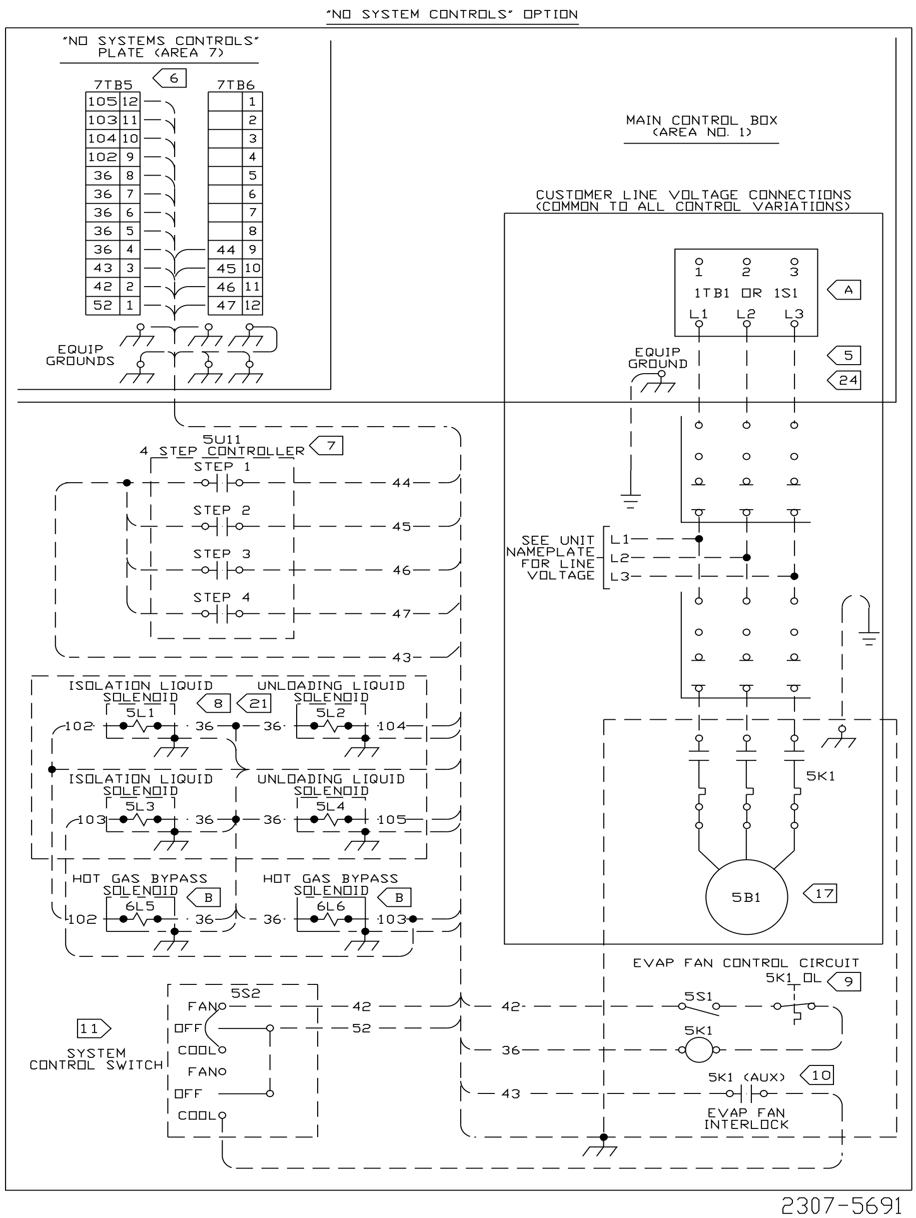
Note: *Units ordered with the “No Controls” option can not be used with EVP Chiller applications.*

⚠ WARNING
Hazardous Voltage!

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

Wire the controller in accordance with the field connection diagram illustrated in Figure 25.

Figure 25. Field Connection Diagram or RAUC-C20 - C60 “No System Controls” Applications



Refer to Wiring Notes on p. 55

Field Connection Diagram Notes for all System Control Options

NOTE:

1. ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY CUSTOMER IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES.
2. ALL WIRING TO BE N.E.C. CLASS 1 UNLESS OTHERWISE SPECIFIED.
3. CAUTION -- DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.
4. ALL THREE PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
5. SEE TABLE OF ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (1TB1) OR DISCONNECT SWITCH (1S1).
6. SIZE CONTROL WIRING SUCH THAT TOTAL WIRE RESISTANCE OF THE RUN DOES NOT EXCEED 6 OHMS. SEE TABLE FOR WIRE SELECTION.
7. 4 STEP CONTROLLER (5U11) MIN. RATING - N.O. CONTACTS = 150 VA INRUSH/75 VA SEALED; N.C.CONTACTS = 80 VA INRUSH/40 VA SEALED.
8. ISOLATION LIQUID SOLENOID VALVES (5L1,5L3), UNLOADING LIQUID SOLENOID VALVES (5L2,5L4) AND HOT GAS BYPASS SOLENOID VALVES (6L5,6L6) -- MAX. SOLENOID RATINGS ARE 72 VA INRUSH/30 VA SEALED.
9. EVAPORATOR OR CIRCULATING PUMP CONTROL CIRCUIT MAX. RATINGS ARE 240 VA INRUSH/40 VA SEALED.
10. STARTER INTERLOCK (5K1 AUX), OUTSIDE AIR T-STAT (5S57), SYSTEM ON/OFF SWITCH (5S1), STARTER OVERLOAD RELAY (5K1 OL) AND FLOW SWITCH (6S58) MIN. RATINGS ARE 250 VA INRUSH/125 VA SEALED.
11. SUGGESTED SYSTEM CONTROL SWITCH (5S2) FOR "NO SYSTEM CONTROLS" OPTION IS CUTLER HAMMER 7562K5 2PDT TOGGLE SWITCH OR EQUIVALENT.
12. REMOVE RESISTOR (7R5 - 7TB8-4 & 5) WHEN FIELD SUPPLIED ECONOMIZER IS REQUIRED WITH OPTIONAL VARIABLE AIR VOLUME ("VAV") CONTROLS.
13. WIRING FOR DUCT SENSOR (6RT1), CHILLER TEMP SENSOR (6RT2), DISCHARGE AIR SENSOR (6RT3) AND RETURN AIR SENSOR (6RT6) MUST BE SHIELDED CABLE AND NOT RUN IN CONDUIT WITH OTHER WIRING. FOR RUNS UNDER 500 FEET USE 16 GA (MIN) WIRE. FOR RUNS FROM 500 TO 1000 FEET USE 14 GA (MIN) WIRE. MAXIMUM RUN IS 1000 FEET. GROUND SHIELD AT ONE END ONLY.
14. SUGGESTED SYSTEM CONTROL SWITCH (5S2) FOR "VAV" CONTROLS OPTION IS CUTLER HAMMER 7580K5 SPST TOGGLE SWITCH OR EQUIVALENT.
15. WHEN NIGHT SETBACK IS REQUIRED WITH OPTIONAL "VAV", PROVIDE A CONTACT CLOSURE SUITABLE FOR A DRY CIRCUIT WITH MIN. RATING OF 125 VA/24 VAC - PILOT DUTY. REMOVE JUMPER (7TB7-4 & 5) WHEN REQUIRED.
16. OUTSIDE AIR T-STAT (5S57) IS REQUIRED ONLY WITH "EVP" OPTION - FOR LOW AMBIENT COMPRESSOR LOCKOUT.
17. CIRCUIT AS SHOWN IS FOR A CUSTOMER SUPPLIED EVAPORATOR FAN MOTOR (5B1) AND EVAP FAN STARTER (5K1). WHEN "EVP" OPTION IS REQUIRED, THIS CIRCUIT BECOMES A CIRCULATING PUMP MOTOR (5B1) AND A CIRCULATING PUMP STARTER (5K1).
18. INSTALL JUMPER (6TB9-7 & 8) WHEN HOT GAS BYPASS OPTION IS REQUIRED WITH OPTIONAL "EVP". INSTALL HOT GAS BYPASS SOLENOID VALVE (6L5) AS SHOWN.
19. WHEN DUCT SENSOR (6RT1) IS REQUIRED, REMOVE RESISTOR (7R1 FROM 7TB8-5 & 6).
20. CUSTOMER SUPPLIED HEATER CONTACTOR CONTROL CIRCUIT - 120V/240V/1PH MAX RATING = 750VA INRUSH, 75VA SEALED; 24V/1PH MAX RATING = 240VA INRUSH, 60VA SEALED.
21. ISOLATION LIQUID SOLENOID VALVES (5L1,5L3) ARE REQUIRED FOR CHARGE ISOLATION (PROVIDED AND INSTALLED BY THE FIELD). UNLOADING LIQUID SOLENOID VALVES (5L2,5L4), IF APPLICABLE, ARE PROVIDED INSTALLED BY THE FIELD.
22. CAUTION - DO NOT RUN LOW VOLTAGE WIRE (30 VOLTS MAXIMUM) IN CONDUIT OR RACEWAY WITH HIGHER VOLTAGE WIRE.
23. THE FOLLOWING CAPABILITIES ARE OPTIONAL - THEY ARE IMPLEMENTED AND WIRED AS REQUIRED FOR A SPECIFIC APPLICATION.
    - A. UNIT DISCONNECT SWITCH - NON FUSED (AVAILABLE ON ALL CONTROL OPTIONS)
    - B. HOT GAS BYPASS (AVAILABLE ON ALL CONTROL OPTIONS)
    - G. RETURN AIR SENSOR (AVAILABLE WITH "CONSTANT VOLUME" CONTROL)
    - T. FLOW SWITCH (AVAILABLE WITH "EVP" CONTROL)
24. SUPPLY CONDUCTORS MUST BE SIZED PER AMPACITIES BASED ON 60°C WIRE.

Variable Air Volume Control (Honeywell W7100A)

In a variable air volume system, the desired space temperature is maintained by varying the amount of conditioned air being delivered to the space. As the cooling requirements of the space decreases, less air is delivered to the zone; conversely, as the cooling requirements of the space increases, a greater volume of air is delivered to the zone.

The descriptions of the following basic input devices used with the Honeywell W7100A discharge air controller are to acquaint the operator with their function as they interface with the controller. Refer to the field connection diagram in Figure 27 for the specific component connections at the unit control panel.

For discussion of evaporator fan interlock, hot gas bypass, and economizer connections, refer to the "Controls Using 115 VAC" section. Refer to Figure 26 for the specific component connections.

Discharge Air Sensor (Honeywell 6RT3)

Each unit ordered with variable air volume controls (digit 9 in the model number) is shipped with a Honeywell 6RT3 discharge air sensor.

⚠ WARNING

Hazardous Voltage!

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

The sensor should be installed in a turbulent free area of the discharge air duct at a location that will provide accurate supply air sensing. Refer to the illustration in Figure 26 for installation and sensor dimensional information.

The sensor serves two functions;

1. It sends the supply air temperature data to the Discharge Air Controller, in the form of an analog input, to control the economizer (if applicable) and the cycling of the compressors.
2. It serves as a low limit sensor for the system when the supply air temperature reaches too high a delta tee between the actual supply air temperature and the supply air temperature setpoint.

Before installing any connecting wiring, refer to Figure 3 to Figure 8 for the electrical access locations provided on the unit. Wire the sensor in accordance with the field connection diagram in Figure 27. Shielded cable (Belden 8760 or equivalent) must be used when wiring the sensor to the terminal board inside the unit's control panel.

Connect the shielded cable to the appropriate terminals on the terminal board (7TB7), in the unit's control panel.

⚠ WARNING

Ground Wire!

All field-installed wiring must be completed by qualified personnel. All field-installed wiring must comply with NEC and applicable local codes. Failure to follow this instruction could result in death or serious injuries.

⚠ WARNING

Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

Ground the shield (at the unit only) using the ground screw in the "customer 24 volt connection area as shown in the field connection diagram.

Suction Line Thermostat

Each unit ordered with variable air volume controls (digit 9 in the model number) is shipped with a suction line thermostat (6S63) that must be field installed.

Locate the thermostat close to the expansion valve bulb on a slightly flattened portion of the suction line. The thermostat must be securely fastened to the suction line and a field provided thermoconductive grease must be applied to the area to ensure good heat transfer.

⚠ WARNING
Hazardous Voltage!

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

Before installing any connecting wiring, refer to Figure 3 to Figure 8 for the electrical access locations provided on the unit. Wire the suction line thermostat in accordance with the field connection diagram in Figure 27. Refer to Table 9 (AC Conductors) for wiring specifications.

Insulate the suction line, where the thermostat is mounted, to isolate it from the surrounding air.

Night Setback

⚠ WARNING
Hazardous Voltage!

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

If night setback operation is desired, connect a set of normally open contacts (field provided) to the appropriate terminals on the terminal board (7TB7), in the unit's control panel. Remove the factory installed jumper at the terminal board when making the final wiring termination. Refer to the field connection diagram in Figure 27 for details.

Figure 26. 6RT3 Discharge Air Sensor Assembly

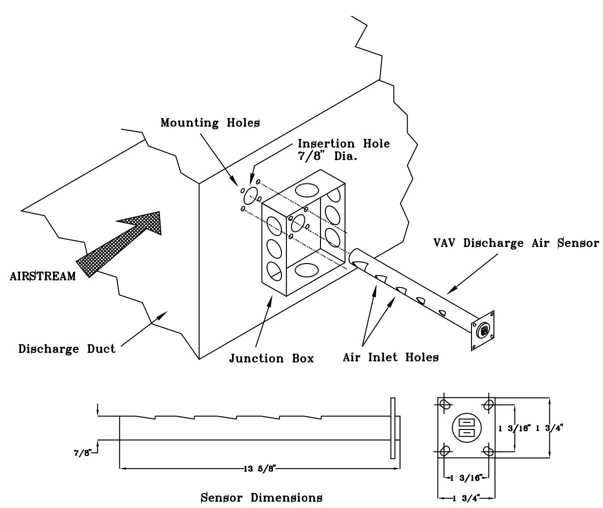
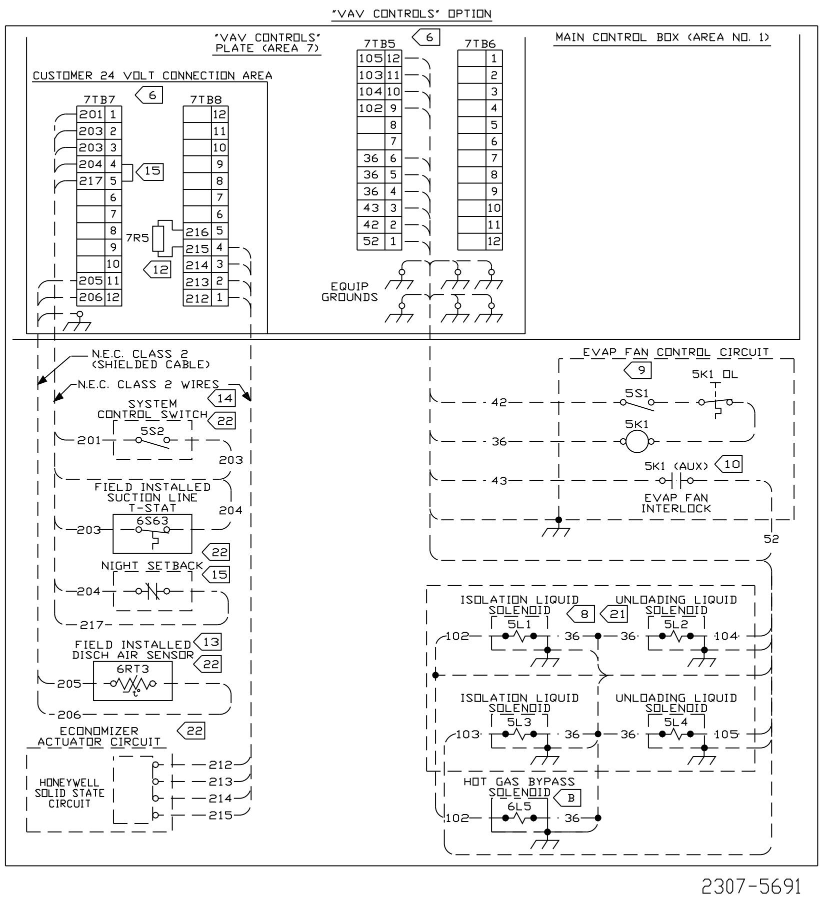


Figure 27. Field Connection Diagram for RAUC-C20 - 60 “Variable Air Volume” Application



Refer to Wiring Notes on Page p. 55

EVP Chiller Control

Each unit ordered for EVP Chiller applications (digit 9 in the model number), is shipped with the following controls:

EVP Remote Panel w/ W7100G Controller

Freezestat (6S12)

Chiller Water Temperature Sensor (6RT2)

Freezestat Bulb well

Chilled Water Temperature Sensor Well

The installation of the freezestat bulb well, freezestat bulb, and the chilled water temperature sensor was discussed in the “Chilled Water Piping” section. Refer to that section for their installation locations and dimensional data.

The chiller control (located in the remote panel) controls the system operation by responding to the leaving water temperature. The remote panel must be mounted indoors and within 20 feet of the chiller.

Figure 28 illustrates the remote panel dimensional data, the component locations, the locations for the shipwith items, grounding lugs, and the field connection terminal board 6TB9. Refer to the field connection diagram illustrated in Figure 29 for the interconnecting points between the remote panel and the unit's control panel.

⚠ **WARNING**

Ground Wire!

All field-installed wiring must be completed by qualified personnel. All field-installed wiring must comply with NEC and applicable local codes. Failure to follow this instruction could result in death or serious injuries.

⚠ **WARNING**

Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

A ground wire must be installed between the EVP remote panel and the unit control panel.

W7100G Discharge Chilled Water Controller

The discharge chilled water controller (6U11) is shipped from the factory with a combination wire/resistor type jumper installed across Terminals 6, 7, & 8. The resistive portion of the jumper is across Terminals 7 & 8, which set the number of operating stages, of the control.

As shipped, a 200 ohm resistive jumper is installed across Terminals 7 & 8 on the controller. The 200 ohm resistive jumper is required for two (2) stage operation on 20 through 30 Ton units. If the unit is a 20, 25, or 30 Ton unit, locate the bag that is secured to the controller, and discard it.

⚠ **WARNING**

Hazardous Voltage!

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

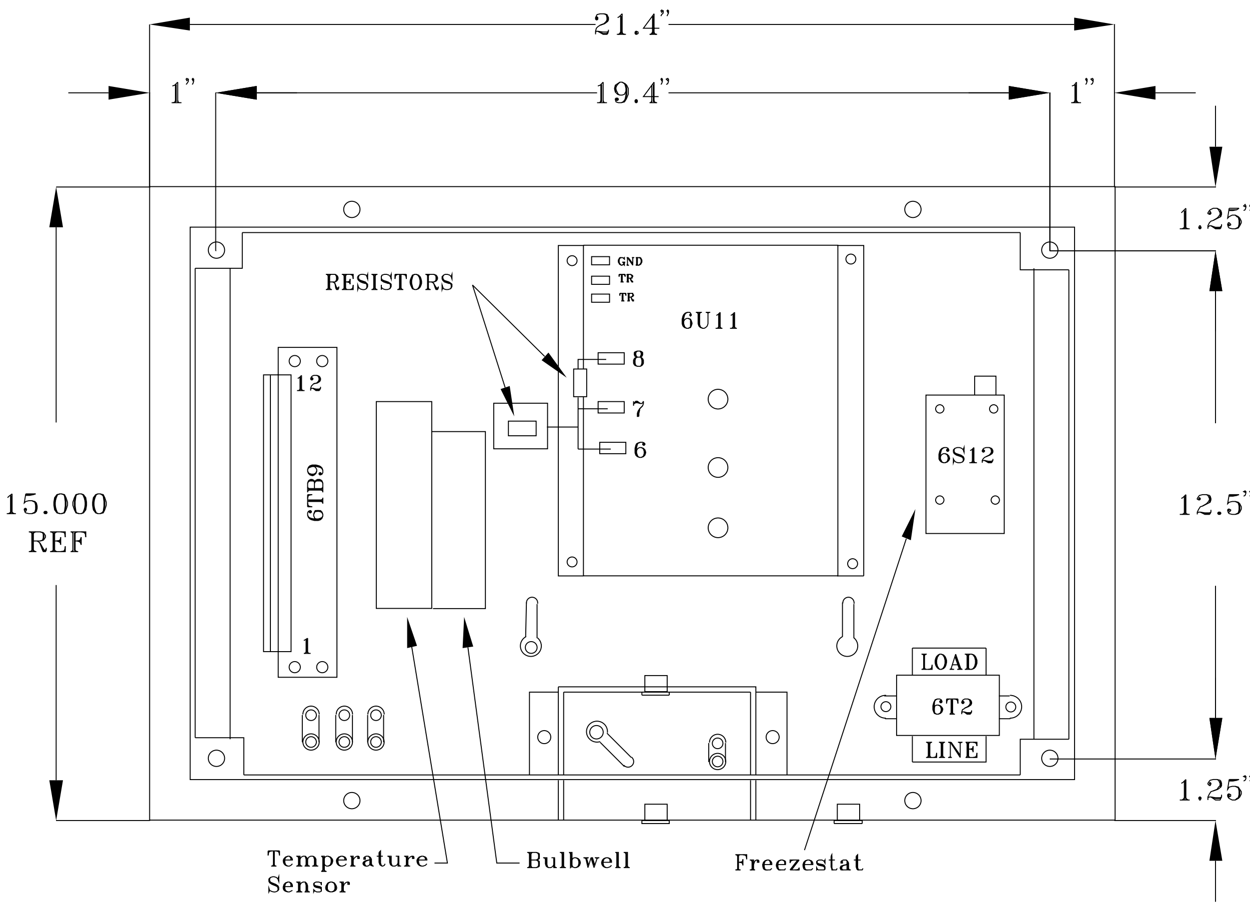
For 40 through 60 Ton units, requiring four (4) stages of operation, a 402 ohm resistive jumper must be installed across Terminals 7 & 8 on the controller. Remove the combination wire/resistor jumper containing the 200 ohm resistor from Terminals 6, 7, & 8. Locate the bag that is secured to the controller, and install the 402 ohm combination jumper across Terminals 6, 7, & 8 on the controller. Refer to the remote panel illustration for the terminal identification.

Note: *The resistor portion of the combination jumper must be installed across Terminals 7 & 8 on the controller.*

The descriptions of the following input devices are to acquaint the operator with their function as they interface with the Honeywell W7100G controller.

Note: *All wiring must comply with local and national electrical codes (NEC).*

Figure 28. EVP Chiller Remote Panel



Chilled Water Temperature Sensor (Honeywell 6RT2)

With the sensor installed in its proper location within the chilled water piping (Figure 18), connect shielded cable (Belden 8760 or equivalent) from the sensor leads to the leads inside the remote panel. Refer to Figure 28 for the electrical access into the remote panel and the field connection diagram illustrated in Figure 29 for the final cable termination points.

⚠ WARNING
Ground Wire!

All field-installed wiring must be completed by qualified personnel. All field-installed wiring must comply with NEC and applicable local codes. Failure to follow this instruction could result in death or serious injuries.

⚠ WARNING
Grounding Required!

Follow proper local and state electrical code on requirements for grounding. Failure to follow code could result in death or serious injury.

Note: *Connect the shield ground to the ground screw inside the remote panel. Do not connect both ends of the shield to ground.*

Outside Air Thermostat (5S57 Field Provided)

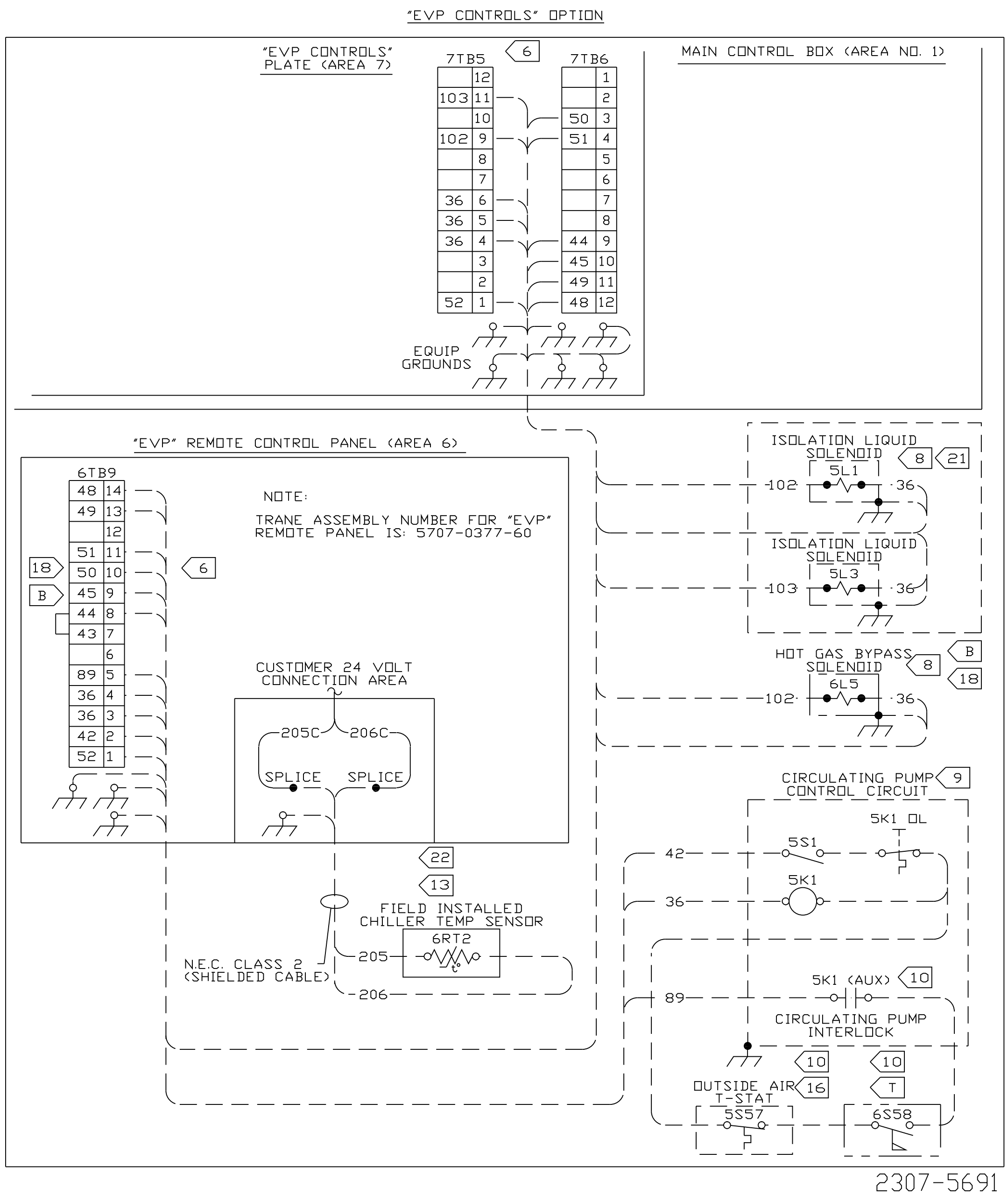
The setpoint for the outside air thermostat is based upon the working ambient selected when the unit was ordered. A Zero (“0”) in the 11th digit of the model number indicates the system is designed for standard ambient operation of 40ºF and above. A One (“1”) in the 11th digit of the model number indicates the system is designed for low ambient operation of 0ºF and above. Therefore, select a thermostat with the appropriate operating range based on the unit specifications.

⚠ WARNING
Hazardous Voltage!

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

Refer to the field connection diagram for the specific connection points inside the remote panel.

Figure 29. Field Connection Diagram for RAUC-C20 - 60 "EVP Chiller" Applications



Refer to Wiring Notes on Page p. 55

Constant Volume Control (Honeywell 973)

The descriptions of the following basic input devices used with the Honeywell 973 Master Energy Controller (MEC) are to acquaint the operator with their function as they interface with the controller. Refer to the field connection diagram in Figure 32 for the specific component connections at the unit's control panel.

Electronic Zone Thermostat (Honeywell T7067)

Each unit ordered with constant volume controls (digit 9 in the model number) is shipped with a Honeywell T7067 electronic zone thermostat. A Honeywell switching subbase (Q667) is also included. The switching subbase allows the operator to select the "System Mode" of operation, i.e., Cool, Heat, Auto, or Off and the "Fan Mode" of operation, i.e., On or Auto.

Note: *As long as the status of the system is in an occupied mode, the supply fan will operate continuously. The fan will only cycle in the "Auto" mode during unoccupied periods.*

The zone thermostat should be located in an area with good air circulation to enhance zone temperature averaging. Position the thermostat about 54" above the floor in a frequently occupied area.

Do not mount the thermostat where its sensing element may be affected by:

a. Drafts or "dead" spots behind doors or in corners;
b. Hot or cold air from ducts;
c. Radiant heat from the sun, or from appliances;
d. Concealed pipes and chimneys;
e. Vibrating surfaces; or
f. Unconditioned areas behind the thermostat (e.g., outside walls).

Mount the thermostat subbase on either a standard 2" X 4" handy box, a comparable European outlet box, or on any nonconductive flat surface. Refer to the illustration in Figure 30 for mounting details.

Note: *Specific installation instructions are packaged with each thermostat and subbase. For subbase and thermostat terminal identification, refer to Figure 31.*

Thermostat Checkout

Once the subbase is mounted, before connecting any wiring, use an ohm meter and complete the continuity checks listed in Table 11.

Thermostat Wiring

⚠ WARNING

Hazardous Voltage!

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

Before installing any connecting wiring, refer to Figure 3 to Figure 8 for the electrical access locations provided on the unit. Wire the thermostat in accordance with the field connection diagram in Figure 32.

Figure 30. T7067 Electronic Zone Thermostat & Q667 Switching Subbase

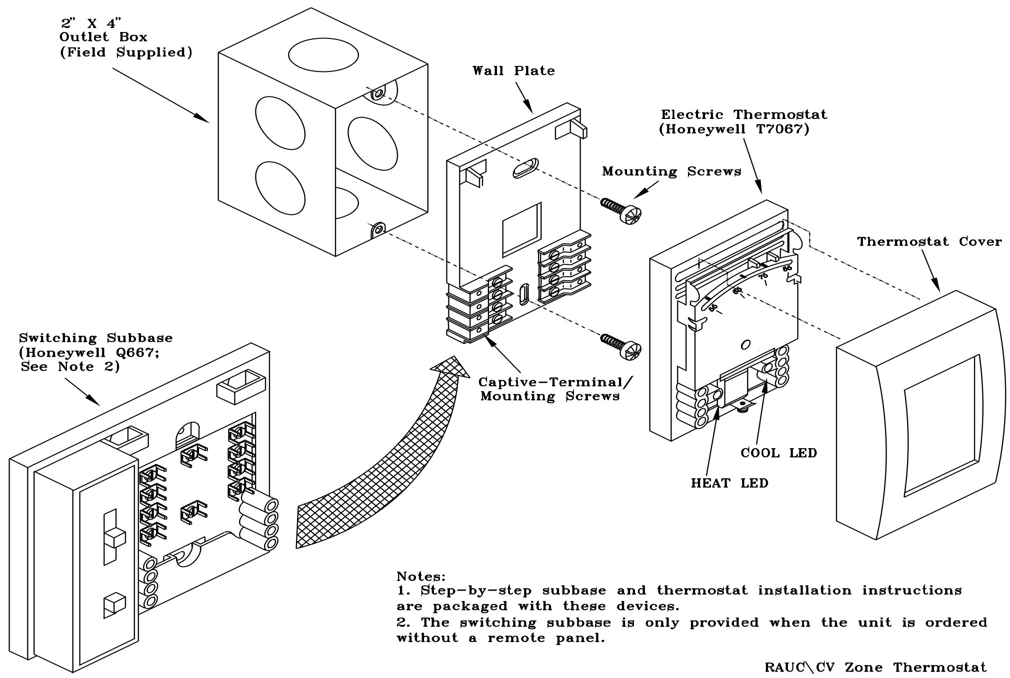


Figure 31. Q667 Switching Subbase & T7067 Thermostat Terminal Identification

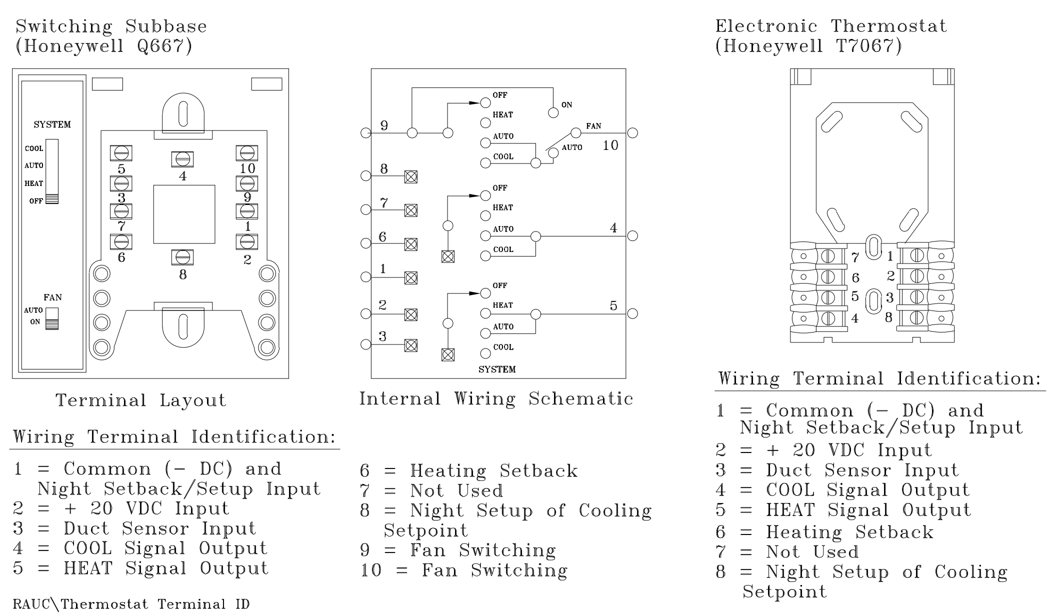


Table 11. (Q667) Switching Subbase

Subbase Switch Positions: Fan	Subbase Switch Positions: System	Check Continuity between These Terminal Pairs	Circuit should be
ON	N/A	9 (Subbase) & 10 (Subbase)	Closed
AUTO	OFF	9 (Subbase) & 10 (Subbase)	Open
		5 (Subbase) & 5 (T'stat)	Open
		4 (Subbase) & 4(T'Stat)	Open
AUTO	HEAT	9 (Subbase) & 10 (Subbase)	Open
		5 (Subbase) & 5 (T'stat)	Closed
		4 (Subbase) & 4(T'Stat)	Open
AUTO	AUTO	9 (Subbase) & 10 (Subbase)	Closed
		5 (Subbase) & 5 (T'stat)	Closed
		4 (Subbase) & 4(T'Stat)	Closed
AUTO	COOL	9 (Subbase) & 10 (Subbase)	Closed
		5 (Subbase) & 5 (T'stat)	Open
		4 (Subbase) & 4(T'Stat)	Closed

Discharge Air Sensor (Honeywell 6RT1)

A discharge air sensor ships with each unit when the constant volume control option is ordered. The sensor should be installed in a turbulent free area of the discharge air duct at a location that will provide accurate supply air sensing. Refer to the illustration in Figure 33 for installation and sensor dimensional information.

⚠ WARNING

Hazardous Voltage!

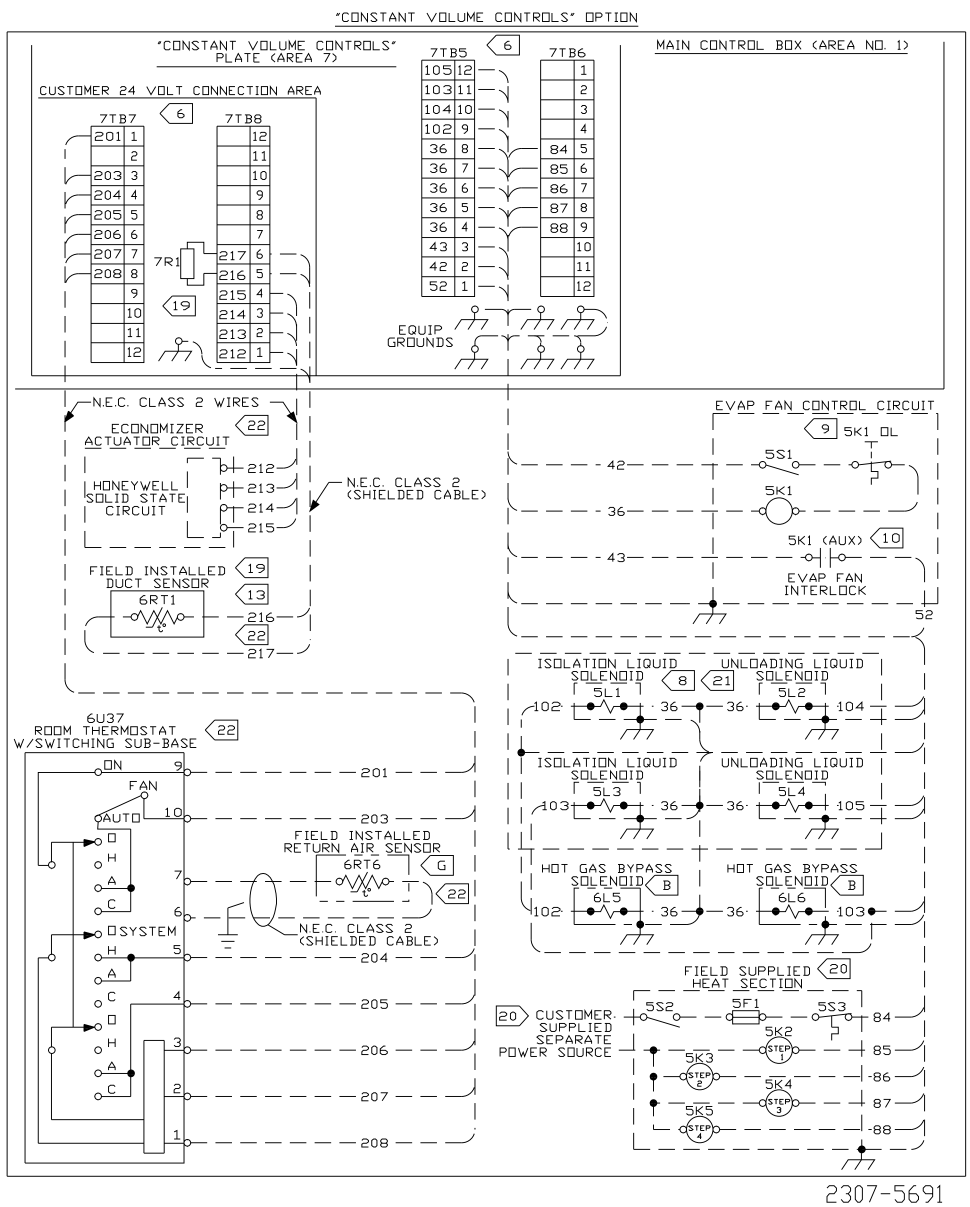
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Wire the sensor in accordance with the field connection diagram in Figure 32. As shipped form the factory, a resistor (7R1) is installed on terminal board 1TB8 terminals 5 & 6). Remove this resistor when the sensor is installed. Shielded cable (Belden 8760 or equivalent) must be used when wiring the sensor to the terminal board inside the unit's control panel.

When the sensor is installed, it serves two functions;

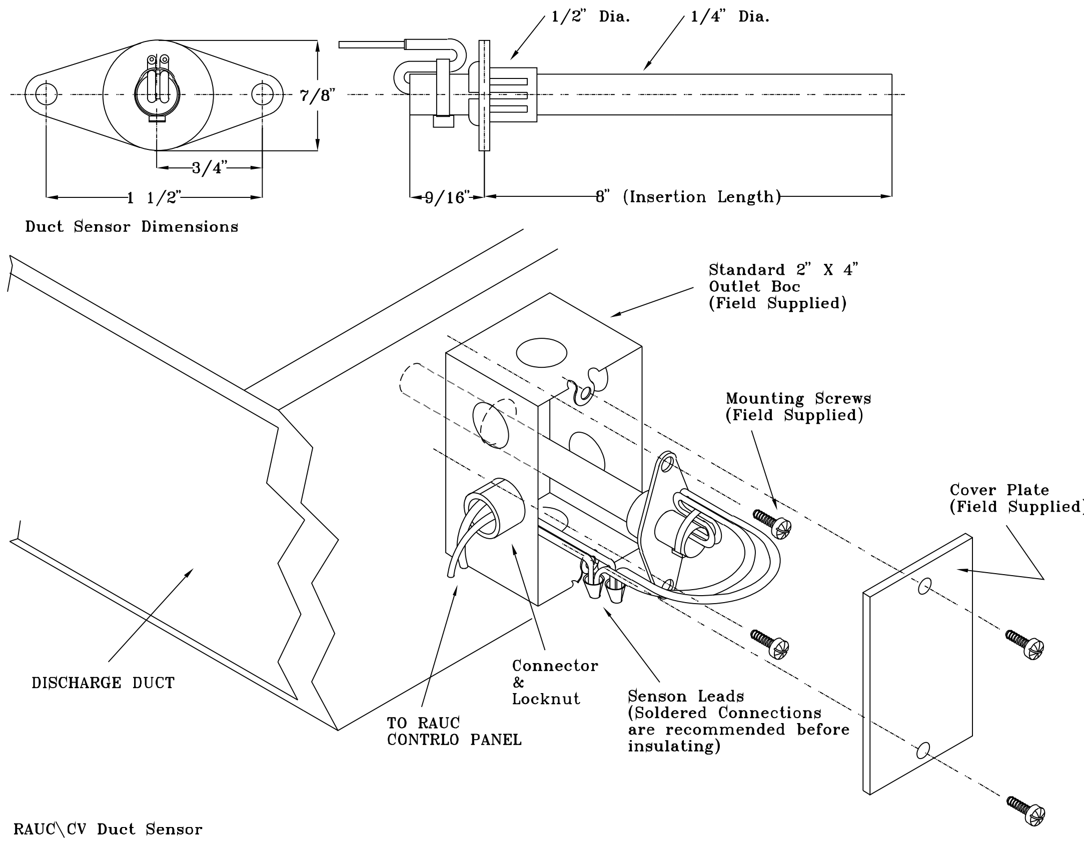
1. It sends the supply air temperature to the master energy controller (MEC), in the form of an analog input, to assist in the rate at which the system changes the space temperature. By offsetting the actual zone thermostat setpoint, up or down, the MEC can closer control the zone comfort level.
2. It serves as a low limit for the system when the supply air temperature reaches too high a delta tee between the actual supply air temperature and the zone temperature to help prevent overshooting of the zone thermostat setpoint.

Figure 32. Field Connection Diagram for RAUC- C20 through 60 “Constant volume” Applications



Refer to Wiring Notes on Page p. 55

Figure 33. 6RT1 Discharge Air Sensor Assembly



System Pre-Start Procedures

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

⚠ WARNING

Hazardous Voltage!

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

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

[ ] Turn the "System" selection switch (at the Remote Panel) to the "Off" position and the "Fan" selection switch (if applicable) to the "Auto" or "Off" position.

[ ] Check all electrical connections for tightness and "point of termination" accuracy.

[ ] Verify that the condenser airflow will be unobstructed.

[ ] Check the condenser fan blades. Ensure they rotate freely within the fan orifices and are securely fastened to the fan motor shaft.

[ ] Disable the compressor (s) by unplugging the reset relay for each circuit. Refer to the unit-wiring diagram that sipped with the unit.

NOTICE

Compressor Damage!

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

[ ] Verify that all compressor service valves, discharge service valves, and liquid line service valves is back seated on each circuit.

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

[ ] Remove the protective plastic coverings that shipped over the compressors.

[ ] Check the compressor oil levels. The oil level in each manifold set of compressor sight glasses should be equally 1/2 to 3/4 full when they are "Off".

[ ] Pack Stock Units;

Two low pressure switches are installed at the factory. However, only one is wired into the control circuit. This is to facilitate either an EVP chiller application or an air over evaporator application. Before starting the system, verify that the correct pressure switch for the application is connected to the control circuit. Refer to Table 13 for the pressure control settings and the unit wiring diagram, that shipped with the unit, for the appropriate connections.

[ ] Check the condenser coils. They should be clean and the fins should be straight. Straighten any bent coil fins with an appropriate sized fin comb.

[ ] Inspect the interior of the unit for tools and debris.

EVP Chiller Applications

[ ] Fill the chilled water system.

[ ] Vent the chilled water system at the highest points in the system. Brazed plate heat exchangers should be purged with water through the field provided vent ports to displace any air in the heat exchanger. Shell and tube heat exchanges (chiller barrels) should have the vent plug removed

before filling with water to displace any air in the barrel. Close vent ports or replace the vent plug after purging or filling.

[ ] Once the system has been filled, inspect the entire chilled water piping system for leaks. Make any necessary repairs before proceeding.

NOTICE

To avoid possible equipment damage, do not use untreated or improperly treated system water.

[ ] Inspect the interior of the unit for tools and debris in preparation for starting the unit and complete the remainder of the “Pre-start” procedures before starting the unit.

System Evacuation Procedures

Each refrigeration circuit for split system applications must be evacuated before the unit can be 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”.

The oil in the vacuum pump should be changed each time the pump is used with a 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 the vacuum pump to a refrigeration system, it is important to manifold the vacuum pump to both the high and low side of the system (liquid line access valve and suction line access valve). Follow the pump manufacturer’s directions for the proper methods of using the vacuum pump.

The 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 because they have moisture absorbing characteristics which result in excessive rates of evaporation, causing pressure rise during the standing vacuum test. This makes it impossible to determine if the system has a leak, excessive residual moisture, or a continual or high rate of pressure increase due to the hoses.

An electronic micron vacuum gauge should be installed in the common line ahead of the vacuum pump shutoff valve, as shown in Figure 34. Close Valves B and C, and open Valve A.

Start the 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

Do not, under any circumstances, use a megohm meter or apply power to the windings of a compressor while it is under a vacuum. Electrical shorting between motor windings and/or housing can occur while in a vacuum, causing motor burnout.

Open Valves B and C. Evacuate the system to a pressure of 300 microns or less. As the vacuum is being pulled on the system, there could be a time when it would appear that no further vacuum is being obtained, yet, the pressure is high. It is recommended that during the evacuation process, the vacuum be “Broken”, to facilitate the evacuation process.

To break the vacuum;

Shutoff valves A, B, & C and connect a refrigerant cylinder to the charging port on the manifold. Purge the air from the hose. Raise the standing vacuum pressure in the system to “zero” (0 psig) gauge pressure. Repeat this 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. Refer to the General Service Bulletin MSCU-SB-1 (latest edition).*

Standing Vacuum Test

Once 300 microns or less is obtained, close Valve A and leave valves B and C open. This will allow the vacuum gauge to read the actual system pressure. Let the system equalize for approximately 15 minutes. This is referred to as a "standing vacuum test" where, time versus pressure rise. The maximum allowable rise over a 15 minute period is 200 microns. If the pressure rise is greater than 200 microns but levels off to a constant value, excessive moisture is present. If the pressure steadily continues to rise, a leak is indicated. Figure 35 illustrates three possible results of the "standing vacuum test". If a leak is encounter, 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 34. Typical Vacuum Pump Hookup

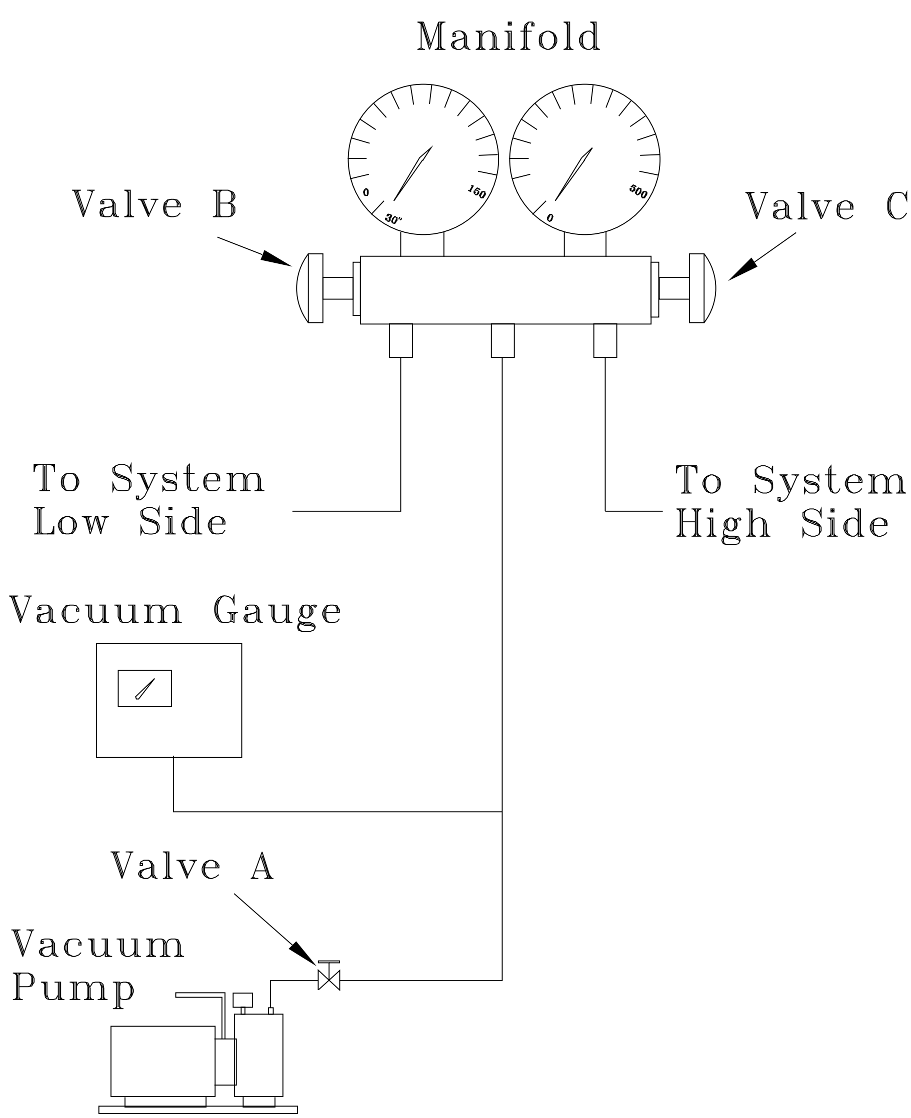
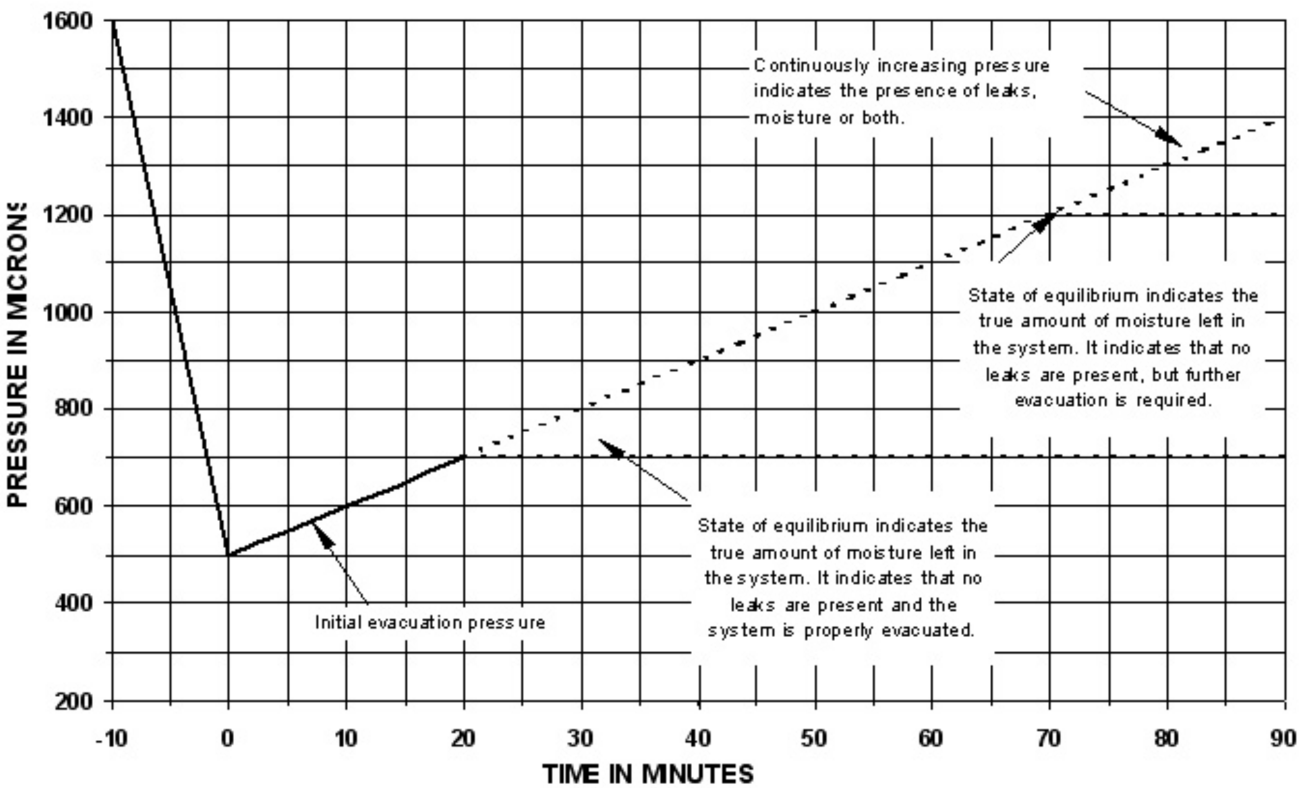


Figure 35. Evacuation Time vs. Pressure Rise



Discharge Air Controller Checkout (Honeywell W7100A)

***Note:** The following checkout procedure must be performed in its entirety and in the sequence given.*

⚠ WARNING
Hazardous Voltage!

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

The W7100A (7U11) discharge air controller can be checked out using a highly accurate digital volt-ohmmeter and the W7100A accessory tool kit (Trane part # TOL-0101 or Honeywell part # 4074EDJ).

1. Turn all control switches to the "OFF" position to deactivate the Evaporator Fan and the Mechanical Cooling.
2. Turn the main power disconnect switch for the evaporator fan and condensing unit "OFF".
3. Disable the mechanical cooling by removing the field installed evaporator fan auxiliary interlock wire from terminal board 7TB5 terminal 3 inside the unit control panel.
4. At the Discharge Air Controller, in the unit control panel, remove the red dust cover from the test plug socket at the bottom of the W7100A. Insert the "Test Plug", from the kit, into the test plug socket. The test plug overrides most of the built-in time delays for staging the compressors "On" and "Off". Refer to the illustration in Figure 36 for terminal and control dial identification.

5. Install a jumper across the P and P1 terminals (remote setpoint input), and another jumper across terminals 6 and 7 (reset input) if reset is enabled.
6. Disconnect the wires from terminals T and T1 (discharge air sensor).
7. Remove the 3,400 ohm resistor (blue leads) from the test kit and connect it across terminals T and T1 to simulate a discharge air temperature of 60ºF.
8. Set the “Setpoint F” dial at 56ºF or below; then set the “Control Band F” dial at 2 to minimize the control response time.
9. At the Discharge Air controller, verify that the controller ground wire is connected to the chassis ground. Refer to the unit wiring diagram that shipped on the unit.

Note: *It is not necessary to set the “Reset F” dial since the factory installed jumper across Terminals 6 and 7 disables this dial.*

10. Turn the control circuit switch 1S2, in the unit control panel, and the main power disconnect switch for the condensing unit to the “ON” position.

⚠ WARNING

High Voltage is Present at Terminal Block 1TB1 or Unit Disconnect Switch 1S1.

To prevent injury or death form electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.i

After approximately 2 minutes (time required to drive the economizer fully open), the LEDs on the W7100 should begin to illuminate as the cooling outputs stage “On”.

11. At the Discharge Air Controller, use a digital voltmeter to verify there is 24 volts AC across terminals TR & TR.
12. Set the “Setpoint F” dial at 64ºF; within 10 seconds, the LEDs should turn “Off” as the cooling outputs stage “Off”.
13. Immediately readjust the “Setpoint F” dial to 56oF; the LEDs should begin to illuminate again as the cooling outputs stage “On”.

If the unit includes the zone reset option, proceed to the next step; if not, proceed to step 18.

14. Set the “Reset F” dial at 15oF and the “Setpoint F” dial at 41ºF; then remove the jumper across terminals 6 & 7.

To simulate a call for maximum reset, install the 1780 ohm resistor (red leads), from the test kit, across terminals 6 and 7. The cooling LEDs should remain lit.

15. Turn the “Setpoint F” dial to 49ºF; within 1 to 2 minutes, the LEDs should turn “Off” as the cooling outputs stage “Off”.
16. As soon as all of the cooling LEDs are “Off”, remove the 1780 ohm resistor from terminals 6 and 7 and re-install the jumper across these terminals.
17. Adjust the “Setpoint F” dial to 56ºF; within 1 minute, the LEDs should illuminate as the cooling outputs stage “On”.

If the system includes an economizer, complete steps 18 through 23 to verify proper economizer control operation; if not, proceed to step 24.

18. With all of the cooling LEDs “On”, measure the DC voltage across terminals R (-) and W (+). The measured voltage should be 1.7 VDC to 2.1 VDC.
19. Set the “Setpoint F” dial at 64ºF to drive the economizer output to the minimum position.

    Within 2 minutes, the LEDs should turn “Off” as the cooling outputs stage “Off”.

In approximately 5 minutes; measure the voltage across terminals R (-) & W (+). The measured voltage should drop to approximately 0.2 VDC.

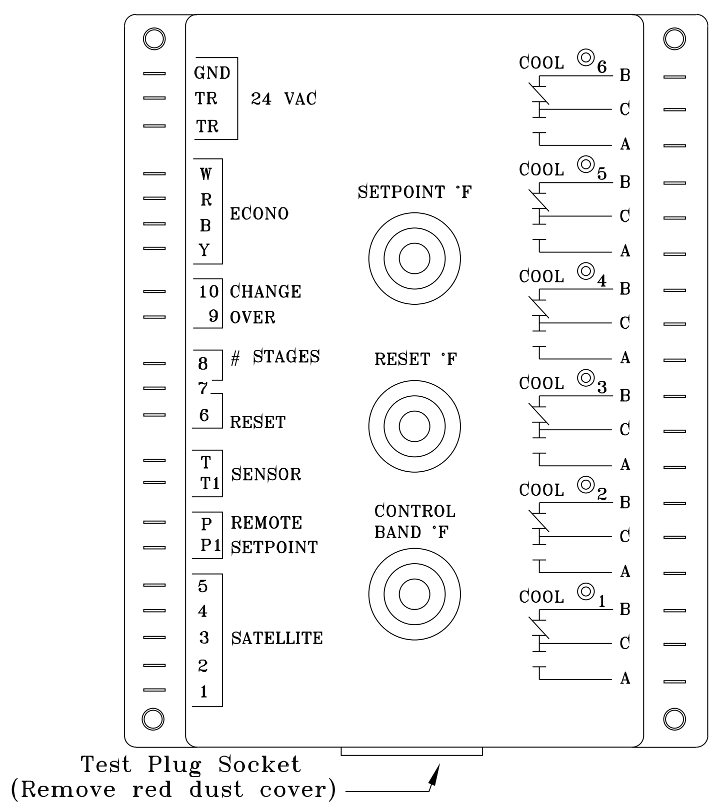
20. Turn the control circuit switch 1S2, in the unit control panel, and the main power disconnect switch to the “OFF” position.
21. Remove the wires from terminals R, B, W, & Y.
22. Measure the resistance across the following pairs of terminals, and compare the actual resistance readings with the values shown below.

    W7100 Terminals R-to-W = 226 ohms

    W7100 Terminals R-to-B = 432 ohms

    W7100 Terminals R-to-Y = 226 ohms
23. Reconnect the economizer leads R, B, W, & Y to the appropriate terminals on the controller.
24. Turn the control circuit switch 1S2, in the unit control panel, and the main power disconnect switch to the “OFF” position.
25. Remove the jumper, installed in step 5, from terminals 6 & 7.
26. Remove the 3,400 ohm resistor from terminals T & T1 and reconnect the discharge air sensor leads to terminals T & T1.
27. Remove the “Test Plug” from the W7100 test socket and reinstall the red dust cover.
28. Reconnect the field installed evaporator fan auxiliary interlock wire to terminal board 7TB5 terminal 3.
29. Turn all control switches to the “On” position and restore main power to the system.

Figure 36. W7100A Discharge Air Controller



Discharge Air Sensor Checkout (Honeywell Sensor)

⚠ **WARNING**

Hazardous Voltage!

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

1. Verify that the main power disconnect switch and the control circuit switch 1S2, in the unit control panel, is “OFF”.
2. At the Discharge Air Controller, in the unit control panel, disconnect the wire connected to Terminal T1. Use a digital ohmmeter to measure the resistance across Terminal T and the wire removed from Terminal T1.
3. Use the conversion chart in Figure 37 to convert the measured resistance to an equivalent temperature.
4. Measure the actual temperature at the sensor location. If the measured resistance in step 2 is not within ± 10.0 ohms of the actual temperature, the sensor is out of range; replace it.

Note: *Before condemning the sensor, verify that the connecting cable resistance is not excessive. Refer to the “Field Installed Control Wiring” section.*

5. Make all necessary repairs and reconnect the duct sensor lead to terminal T1 on the controller.
6. Restore power to the system and turn all control switches to the “ON” position.

Economizer Actuator Checkout

(w/ “Zone” or “Discharge Air” Temp Controller)

The following procedures should be used to verify that the field provided economizer actuator(s) function properly. These procedures are based on using a typical Honeywell actuator. If another type actuator is used, refer to the specific checkout procedures for that actuator.

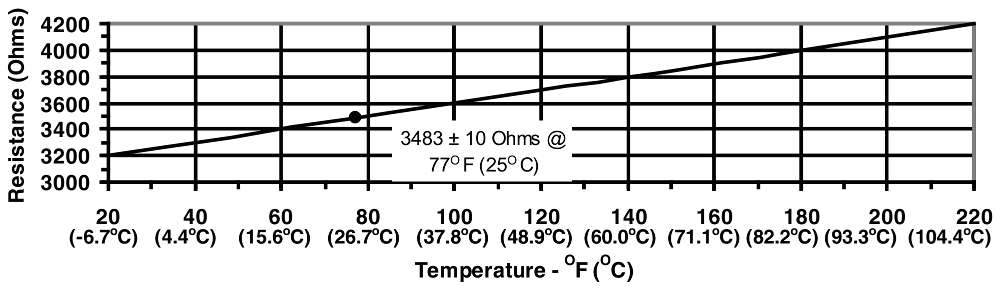
⚠ **WARNING**

Hazardous Voltage!

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

1. Turn all control switches to the “Off” position to deactivate the Evaporator Fan and the Mechanical Cooling. Verify that the main power disconnect switch for the condensing unit and the control circuit switch 1S2, in the unit control panel, is “OFF”.
2. Verify that the field provided disconnect switch and/or the control circuit switch for the economizer actuator(s) is “OFF”.
3. At the actuator, disconnect the control wires connected to Terminals W, R, B, and Y.
4. Install a jumper across the actuator terminals R-to-W-to-B.
5. Close the field provided disconnect switch and/or the control circuit switch for the economizer actuator(s). If the economizer actuator is working properly, it should drive to mid-position.
6. Open the field provided disconnect switch and/or the control circuit switch for the economizer actuator(s) and remove the jumpers installed in step 4.
7. Reconnect the control wires to the actuator terminals W, R, B, and Y.
8. Restore power to the actuator circuit and turn all control switches to the “ON” position and restore power to the system.

Figure 37. Discharge Duct Sensor 6RT2 & 6RT3 "Temperature vs Resistance" Curve



EVP Chiller Control Checkout (Honeywell W7100G)

Note: *The following checkout procedure must be performed in its entirety and in the sequence given.*

⚠ WARNING
Hazardous Voltage!

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

The W7100G (6U11) chilled water controller can be checked out using a highly accurate digital volt-ohmmeter, the W7100 accessory tool kit (Trane part # TOL-0101 or Honeywell part # 4074EDJ), and the Honeywell 4074EFV resistor bag assembly.

1. Verify that the main power disconnect switch and the control circuit switch 1S2, in the unit control panel, is "OFF".
2. At the unit control panel, unplug the reset relay 1K11 and 1K12, (1K12 used on 40 through 60 Ton units only). Refer to the connection diagram that shipped with the unit for the location of the relay(s).
3. At the Chilled Water controller (6U11) inside the remote panel, disconnect the sensor (6RT2) leads form Terminals T & T1.
4. Remove the 3,400 ohm resistor (blue leads) from the test kit and connect it across Terminals T and T1 to simulate a discharge air temperature of 60°F.
5. Remove the factory-installed jumper (wire 209A) from the "fast response" Terminals 9 & 10.
6. To simulate a call for maximum reset, remove the jumper from Terminals 6 & 7 and install the 1780 ohm resistor (red leads), from the test kit, across Terminals 6 and 7.
7. Install a jumper across the P1 and P2 Terminals (remote setpoint input).
8. Remove the red dust cover from the test plug socket at the bottom of the W7100G. Insert the "Test Plug", from the kit, into the test plug socket. The test plug overrides most of the built-in time delays for staging the compressors "On" and "Off". Refer to the illustration in Figure 38 for terminal and control dial identification.
9. Set the "Reset F" dial at 20°F and the "Setpoint F" dial at 10°F

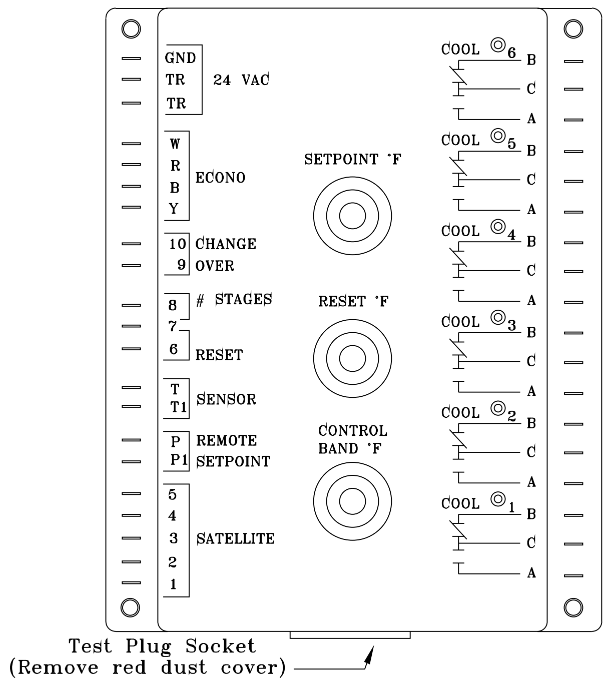
10. “Close” the main power disconnect switch and turn the control circuit switch 1S2, in the unit control panel, “ON”.

⚠ WARNING
High Voltage is Present at Terminal Block 1TB1 or Unit Disconnect Switch 1S1.

To prevent injury or death form electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

11. At the Chilled Water Controller, use a digital voltmeter to verify there is 24 volts AC across terminals TR & TR.
12. After approximately 15 seconds, the LEDs on the W7100G should begin to illuminate as the cooling outputs stage “On”.
13. Set the “Setpoint F” dial at 60°F; within 15 seconds, the LEDs should turn “Off” as the cooling outputs stage “Off”.
14. Remove the 1780 ohm resistor from Terminals 6 & 7 and reinstall the wire jumper removed in step 6.
15. Set the “Setpoint F” dial at 50°F; within 15 seconds, the LEDs should turn “On” as the cooling outputs stage “On”.
16. Turn the control circuit switch 1S2, in the unit control panel, to the “OFF” position.
17. Remove the 3,400 ohm resistor from Terminals T & T1 and reconnect the chilled water temperature sensor leads to Terminals T & T1.
18. Remove the “Test Plug” from the W7100G test socket and reinstall the red dust cover.
19. Plug the reset relay(s) 1K11 and 1k12 (if applicable) back into their receptacle.
20. Turn the control switch 1S2 to the “On” position to restore power to the control system.

Figure 38. W7100G Chilled Water Controller



Chilled Water Sensor Checkout (Honeywell Sensor)

⚠ WARNING

Hazardous Voltage!

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

1. Verify that the main power disconnect switch and the control circuit switch 1S2, in the unit control panel, is "OFF".
2. At the temperature controller, disconnect the wire connected to terminal T1. Use a digital ohmmeter to measure the resistance across terminal T and the wire removed from terminal T1.
3. Use the conversion chart in Figure 37 to convert the measured resistance to an equivalent temperature.
4. Measure the actual temperature at the sensor location. If the measured resistance in step 2 is not within ± 10.0 ohms of the actual temperature, the sensor is out of range; replace it.

Note: *Before condemning the sensor, verify that the connecting cable resistance is not excessive. Refer to the "Field Installed Control Wiring" section.*

5. Make all necessary repairs and reconnect the duct sensor lead to terminal T1 on the controller.
6. Turn all control switches to the "ON" position and restore power to the system.

Master Energy Control Checkout

⚠ **WARNING**

Hazardous Voltage!

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

1. Open the system control switches 5S1 and 5S2 to disable the Evaporator Fan and Heating system.
2. Verify that the main power disconnect switch and the control circuit switch 1S2, in the unit control panel, is "OFF".
3. At the Master Energy Controller (7U11), in the unit control panel, remove at least one wire from each of the "Heat Relay" normally open contacts and one from each of the "Cool Relay" normally open contacts. Insulate the wires with tape to prevent shorting or grounding during control checkout.
4. Close the main power disconnect switch and turn the control circuit switch 1S2, in the unit control panel, "ON".

⚠ **WARNING**

High Voltage is Present at Terminal Block 1TB1 or Unit Disconnect Switch 1S1.

To prevent injury or death form electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

5. At the Master Energy Controller, use a digital voltmeter to verify that there is 20 volts DC power between terminals 1 (N) & 2 (+20). Refer to the illustration in Figure 36 for terminal identification.

Note: *The wires that are still connected to one side of the "Cool Relay" contacts, are active with 115 volts applied. Ohming the contacts when only one wire is connected will not cause any damage to the ohmmeter. However, do not try to ohm any set of contacts with wires connected to both terminals of that contact.*

6. To verify the "Heating" output relays are operating;
   a. place a jumper between Terminals 2 (+20) & 5 (H).
   b. place the ohmmeter leads across each set of normally open "Heat Relay" contacts. The ohmmeter should read "Resistance" which indicates that the heating output relays have "pulled in".
7. To verify the "Cooling" output relays are operating;
   a. Remove the jumper from Terminals 2 (+20) & 5 (H) and reinstall it between Terminals 2 (+20) & 4 (C).
   b. place the ohmmeter leads across each set of normally open "Cool Relay" contacts. The ohmmeter should read "Resistance" which indicates that the cooling output relays have "pulled in".
8. With all of the "Cooling Output" relays pulled in (step 7), measure the DC voltage across Terminals R (-) and W (+). The measured voltage should be approximately 1.7 to 2.1 VDC.
9. Remove the jumper installed between Terminals 2 (+20) & 4 (C).

10. Measure the voltage again across Terminals R (-) and W (+). The measured voltage should now be approximately 0.2 VDC.
11. Turn the control circuit switch 1S2, in the unit control panel, to the “OFF” position.
12. Remove the wires from Terminals R, B, W, & Y.
13. Measure the resistance across the following pairs of terminals and compare the actual resistance readings with the values shown below:

    (1) MEC Terminals R-to-W = 226 ohms

    (2) MEC Terminals R-to-B = 432 ohms

    (3) MEC Terminals R-to-Y = 226 ohms
14. Reconnect the economizer leads W, R, B and Y to the appropriate terminals on the controller.
15. Turn switches 1S2, 5S1, & 5S2 to the “ON” position to restore power to the control system.

Zone Thermostat Checkout (Honeywell T7067)

1. Open the system control switches 5S1 and 5S2 to disable the Evaporator Fan and Heating system.
2. Close the main power disconnect switch and turn the control circuit switch 1S2, in the unit control panel, “ON”.

⚠ WARNING

High Voltage is Present at Terminal Block 1TB1 or Unit Disconnect Switch 1S1.

To prevent injury or death form electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

3. At the Zone Thermostat (6U37), use a digital voltmeter to verify that there is 20 volts DC power between thermostat Terminals 1 & 2. Refer to the illustration in Figure 31 for terminal identification. Refer to Table 12 for the thermostat “voltage output” ramps.
4. To check the “Cooling” output signal, place the voltmeter leads between thermostat Terminals 1 & 4. Refer to Figure 30 and;
    a. move the cooling (blue) setpoint lever from right to left. As the cooling setpoint is lowered, the voltage signal should increase and the “Cooling” LED brighten.
    b. move the cooling (blue) setpoint lever from left to right. As the cooling setpoint rises, the voltage signal should decrease and the “Cooling” LED dim.
5. To check the “Heating” output signal, place the voltmeter leads between thermostat Terminals 1 & 5. Refer to Figure 30 and;
    a. move the heating (red) setpoint lever from left to right. As the heating setpoint rises, the voltage signal should increase and the “Heating” LED brighten.
    b. move the heating (red) setpoint lever form right to left. As the heating setpoint lowers, the voltage signal should decrease and the “Heating” LED dim.

Table 12. Zone Thermostat (6U37) “Voltage Output” ramps

1U11 Function	Nominal Operating Points and Throtting Ranges: Pull-In Voltage*	Drop-Out Voltage	Throtting Range	Measured between these 1U11 Terminals
HEAT 1	4.63 VDC	4.0 VDC		Terminal 5 (heating) & Terminal 1 (common)
HEAT 2	5.88 VDC	5.25 VDC		
HEAT 3	7.13 VDC	6.50 VDC		
HEAT 4	8.38 VDC	7.75 VDC		
COOL 1	4.58 - 5.42 VDC	3.44 - 4.56 VDC		Terminal 4 (cooling) & Terminal 1 (common)
COOL 2	5.43 - 6.34 VDC	4.69 - 5.81 VDC		
COOL 3	6.63 - 7.63 VDC	5.90 - 7.10 VDC		
COOL 4	7.84 - 8.92 VDC	7.11 - 8.39 VDC		
Economizer			2.75 - 4.00 VDC	

* "Pull-In" and "Drop-Out" valves are ± 0.25 VDC
** If Applicable

Discharge Air Sensor Checkout (Honeywell 6RT1)

⚠ WARNING
Hazardous Voltage!

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

1. Turn the control circuit switch 1S2, in the unit control panel, to the “OFF” position.
2. At the Master Energy Controller, disconnect the wire connected to Terminal T1. Use a digital ohmmeter to measure the resistance between Terminal T and the wire removed from Terminal T1.
3. Use the conversion chart in Figure 37 to convert the measured resistance to an equivalent temperature.
4. Measure the actual temperature at the sensor location. If the measured resistance in step 2 is not within ± 10.0 ohms of the actual temperature, the 6RT1 is out of range; replace it.

Note: *Before condemning the sensor, verify that the connecting cable resistance is not excessive. Refer to the “Field Installed Control Wiring” section.*

5. Make all necessary repairs and reconnect the duct sensor lead to terminal T1 on the controller.
6. Turn switches 1S2, 5S1, & 5S2 to the “ON” position to restore power to the control system.

Figure 39. 6RT1 Discharge Duct Sensor "Temperature vs Resistance" Curve

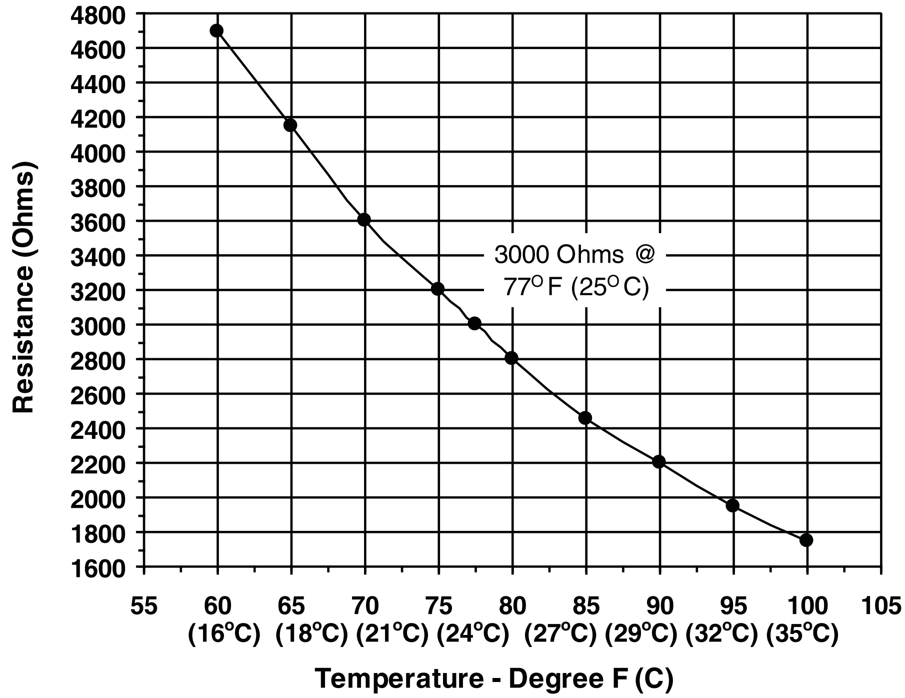
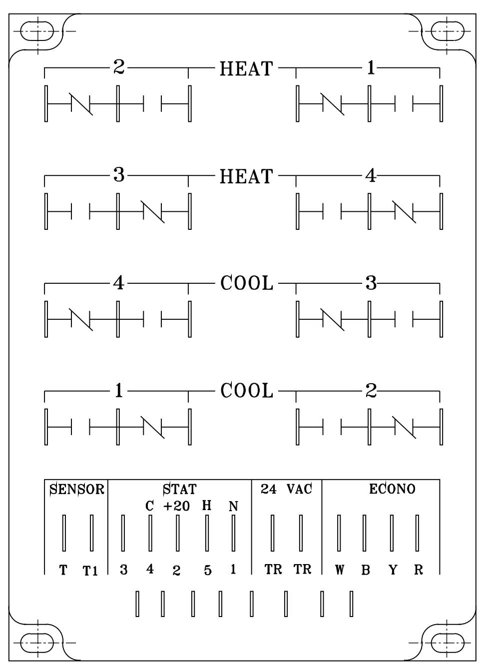


Figure 40. W973 Master Energy Controller (MEC)



Voltage Imbalance

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

% Voltage Imbalance = 100 X [(AV - VD)/(AV)] where;

AV (Average Voltage) = (Volt 1 + Volt 2 + Volt 3)/3

V1, V2, V3 = Line Voltage Readings

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

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

(221 + 230 + 227)/3 = 226 Avg.

VD (reading farthest from average) = 221

The percentage of Imbalance equals:

100 X [(226 - 221)/226)] = 2.2%

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

Electrical Phasing

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

[ ] Turn the field supplied disconnect switch that provides power to terminal block 1TB1 to the “Off” position.

[ ] Connect the phase sequence indicator leads to the terminal block or to the “Line” side of the optional factory mounted disconnect switch as follows;

Black (phase A) to L1

Red (phase B) to L2

Yellow (phase C) to L3

[ ] Close the main power disconnect switch or circuit protector switch that provides the supply power to the condensing unit.

⚠ WARNING
High Voltage is Present at Terminal Block 1TB1 or Unit Disconnect Switch 1S1.

To prevent injury or death form electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

[ ] Observe the ABC and CBA phase indicator lights on the face of the sequencer. The ABC indicator light will glow if the phase is ABC. If the CBA indicator light glows, open the disconnect switch or circuit protection switch and reverse any two power wires.

[ ] Restore the main electrical power and recheck the phasing. If the phasing is correct.

[ ] Open the main power disconnect switch or circuit protection switch and remove the phase sequence indicator.

System Start-Up

Sequence of Operation

VAV W7100A Discharge Air Controller (7U11)

The discharge air controller used in Variable Air Volume applications is a Honeywell W7100A. This microprocessor controller is designed to maintain an average discharge air (D/A) temperature by:

1. monitoring the discharge air temperature sensor; and
2. modulating economizer dampers and sequencing stages of mechanical cooling "On" or "Off", as required.

The W7100A receives analog input from the discharge air sensor mounted in the supply duct every 2 to 3 seconds by pulsing DC current across the sensor, then "reading" the voltage potential across this thermistor.

If the comparison between the setpoint and the actual discharge air temperature indicates that cooling is required, the W7100A attempts to satisfy the load by modulating the economizer open (if applicable).

Economizer Cycle

The economizer is only allowed to function if the ambient conditions are below the setpoint of the enthalpy switch.

If the ambient air conditions are above the enthalpy setpoint, the W7100A will open the Fresh Air dampers to the minimum setpoint position.

To take full advantage of the "free cooling" provided by the economizer, the W7100A "resets" the discharge air setpoint. The amount of "reset" between the actual discharge air setpoint and the economizer control point is equal to 1/2 of the W7100's control band setpoint.

Example: With a typical control band setting of 6oF, the amount of discharge air "reset" is 3°F (1/2 of the control band setpoint). Therefore, if the discharge air setpoint is 55°F, the economizer control point is 52°F (i.e., 55°F - 3°F).

A second economizer "algorithm" within the W7100A is the response time of the controller. The greater the amount of deviation between the discharge air temperature and the economizer control point, i.e., as the temperature strays further from the control point, the response time becomes faster; and, as the discharge air temperature approaches the control point, the response time becomes slower.

When the discharge air temperature is within the "Deadband" (± 1.5°F of the economizer control point); the W7100A maintains the economizer's present position.

When the economizer can not handle the cooling requirement or when the outdoor ambient conditions are unsuitable for "economizing", the W7100A activates the unit's mechanical cooling section.

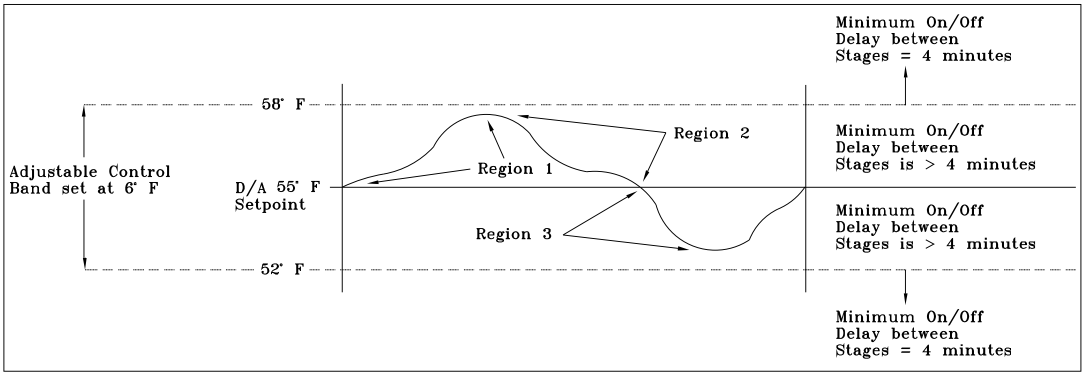
Note: *As long as ambient conditions are suitable for economizing, the economizer works in conjunction with the mechanical cooling operation.*

The control algorithm used by the W7100A to add stages of cooling is illustrated in Figure 41. When the discharge air temperature drifts above the setpoint, "Region 1", a stage of mechanical cooling is added based on time and the amount of deviation from setpoint. If the discharge air temperature remains above the setpoint, the W7100A energizes additional stages of mechanical cooling.

If the operating cooling stage is capable of satisfying the cooling requirement, as the discharge air temperature falls below the setpoint for a sufficient period of time, the W7100A turns the stages of mechanical cooling "Off", "Region 3".

The W7100A determines the length of the time before stages of mechanical cooling are turned "On" and "Off". When the system is operating within the control band, the delay is longest at setpoint, and decreases to a minimum of 4 minutes when the discharge air temperature exceeds the upper or lower limit of the control band. Refer to the illustration in Figure 41.

Figure 41. W7100A Staging Sequence



Chilled Water Temperature Controller (6U11)

The chilled water temperature controller used with EVP chiller applications is a Honeywell W7100G. This microprocessor controller is designed to maintain an average leaving water temperature using an integrating control band concept that matches the required operating capacity to the chiller load. The integral action, unlike "proportional only" type controllers, minimizes the amount of offset from the control setpoint.

The control band setting is centered on the leaving water setpoint. It is adjustable from 0ºF to 10ºF [0ºC to 6ºC] and is used to stabilize system operation.

The control algorithm used by the W7100G to add stages of cooling is illustrated in Figure 42. As the water temperature rises above the upper control band limit, a stage of mechanical cooling is added, provided the minimum "Off" time has been satisfied (Point A). The minimum "fast response" time and the time delay between staging for the W7100G is set for 60 seconds.

If the water temperature remains above the upper control band limit (Point B), the next available stage of cooling will be energized when the minimum time delay between stages has elapsed.

As the water temperature decreases below the lower control band, the last stage that was turned "On" will be cycled "Off" (Point C) when the minimum "On" time for that stage has elapsed.

As the load on the water increases due to cooling stages being cycled "Off", the controller will maintain it's current position, i.e., no staging of cooling "On" or "Off", as long as the temperature remains inside the control band.

When the temperature increases above the upper control band limit (Point D), mechanical cooling stages will be sequenced "On" in the same manner as before. As a rule, any time the water temperature is above the upper control band limit, a stage of cooling will be "added" and anytime the water temperature decreases below the lower control band limit, a stage of cooling will be "Subtracted".

Thermostatic Expansion Valve

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

1. How well the expansion valve is controlling the refrigerant flow.
2. The efficiency of the evaporator coil.
3. The amount of protection the compressor is receiving against flooding or overheating.

The recommended range for superheat is 10 to 16 degrees at the evaporator. Systems operating with less than 10 degrees of superheat:

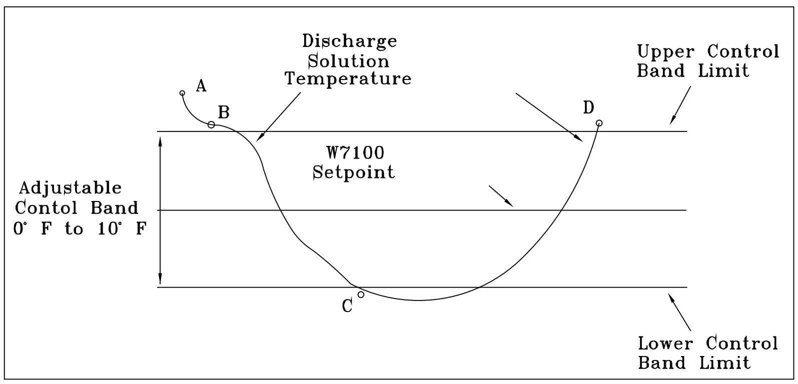
a. Could cause serious compressor damage due to refrigerant floodback.
b. Removes working surface from the evaporator normally used for heat transfer.

Systems operating with superheat in excess of 16 degrees:

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

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

Figure 42. W7100G Staging Sequence



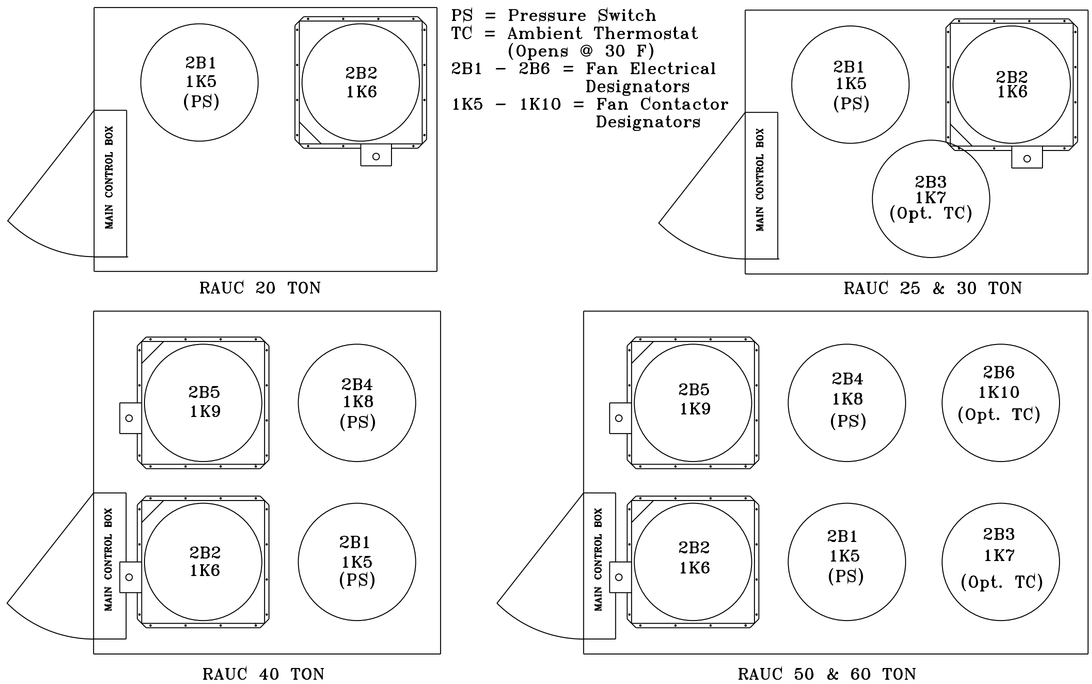
Condenser Fans

Condenser fan cycling is accomplished through interlocking the fan contactors with liquid line pressure switches (4S11 and 4S12). When the low ambient damper option is applied, ambient thermostats (1S36 & 1S37) are used to provide additional fan cycling control on "No System Control", Constant Volume, and Variable Air Volume applications. Figure 43 illustrates the condenser fan locations with their respective fan and relay designator.

When a cooling command has been initiated (circuit #1, first step), condenser fans 2B1, 2B2, and 2B3 are held "Off" by the liquid line pressure switch (4S11) and normally open interlock contacts 1K5 & 1K6. Once the pressure switch has closed (275 psig), condenser fan relay 1K5 is energized starting fan 2B1. The normally open interlock contacts 1K5 closes, energizing fan contactor 1K6, starting fan 2B2. When the normally open interlock contacts 1K6 close, they seal 1K6 contactor in the "On" position until the cooling demand has been satisfied. Condenser fan 2B3 on 25, 30, 50 & 60 Ton units is not allowed to start until compressor relay 1K13 has energized and the low ambient thermostat (1S36, if applicable) has closed.

If a second step cooling command is initiated, (circuit #2), condenser fans 2B4, 2B5, and 2B6 are held "Off" by the liquid line pressure switch (4S12) and normally open interlock contacts 1K8 & 1K9. Once the pressure switch has closed (275 psig), condenser fan relay 1K8 is energized starting fan 2B4. The normally open interlock contacts 1K8 closes, energizing fan contactor 1K9, starting fan 2B5. When the normally open interlock contacts 1K9 close, they seal 1K9 contactor in the "On" position until the cooling demand has been satisfied. Condenser fan 2B6 on 50 and 60 Ton units is not allowed to start until compressor relay 1K14 has energized and the low ambient thermostat (1S37, if applicable) has closed.

Figure 43. Condenser Fan Locations



Low Ambient Dampers

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

The low ambient damper actuator controls damper modulation for each refrigerant circuit in response to saturated condensing temperature.

Compressor Crankcase Heaters

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

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

When power has been “Off” for an extended period, allow the crankcase heater to operate a minimum of 8 hours before starting the unit.

Pump Down

Each circuit will go into a pump down cycle when the last compressor on that circuit is turned "Off". During pump down, the solenoid valves are closed, the reset circuit is bypassed and the compressor will continue to run until the 30 psig pressure switch opens.

Low Ambient Thermostats

In addition to the low ambient dampers on 25, 30, 50 & 60 Ton units, a low ambient thermostat is installed to further restrict the airflow across the condenser by cycling the 2B3 condenser fan on 25 & 30 Ton units plus 2B6 on 50 & 60 Ton units. The thermostat opens when the ambient temperature reaches 30°F and closes at approximately 33°F.

Hot Gas Bypass Operation

The HGBP valve regulates evaporator pressure by opening as suction pressure decreases, to maintain a desired minimum evaporating pressure regardless of a decrease in evaporator external loading.

When the evaporator (suction) pressure is above the valve's setpoint, it remains closed. As suction pressure falls below the valve's setpoint, the valve begins to open. The valve will continue to open at a rate proportional to the suction pressure drop, thus maintaining evaporator pressure.

Hot gas bypass valves are adjustable and should be set to begin opening at approximately 58 psig suction pressure and reach the full open position at 51 psig for DX coil applications. For EVP chiller applications, the regulator should be adjusted to begin opening at approximately 69 psig suction pressure and reach full open position at 61 psig.

Low Ambient Damper Adjustment (Factory or Field Installed)

When a unit is ordered with the low ambient option (i.e., Digit 11 is a "1" in the model number), a damper is factory installed over the lead condenser fan for each refrigeration circuit. Refer to the appropriate unit illustrated in Figure 43 for the damper locations.

For field installation, mount the dampers over the condenser fans at the locations shown in Figure 43 and connect the actuator, controller, and sensor for each circuit. (Refer to the Installation Instructions provided with each low ambient damper kit.)

The controller has a factory default setpoint of 105 F. This setpoint can be adjusted by installing a field supplied resistor on 2TB34 in the low ambient control panel located in the back of the main control panel. (See the low ambient wiring diagram, that shipped with the unit or with the field kit, for resistance values and installation location.)

⚠ **WARNING**

Live Electrical Components!

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

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

1. Remove the sensor leads from the input terminals 6 and 7 for circuit #1 and/or 11 and 12 for circuit #2. (Controller output signal will go to 0.0 VDC and the damper will drive to the closed position.)
2. Loosen the damper shaft "Locking" set screws on the actuator
3. Firmly hold the damper blades in the closed position
4. Retighten the "Locking" set screws.

To check damper operation, jumper between the sensor input terminals 6 and 7 and/or 11 and 12 (if applicable). Controller output signal will go to 10 VDC and the damper will drive to the full open position.

EVP Chiller Applications

Start the chilled water circulating pump by closing the field provided pump disconnect switch and turn the pump control circuit switch 5S1 “On”.

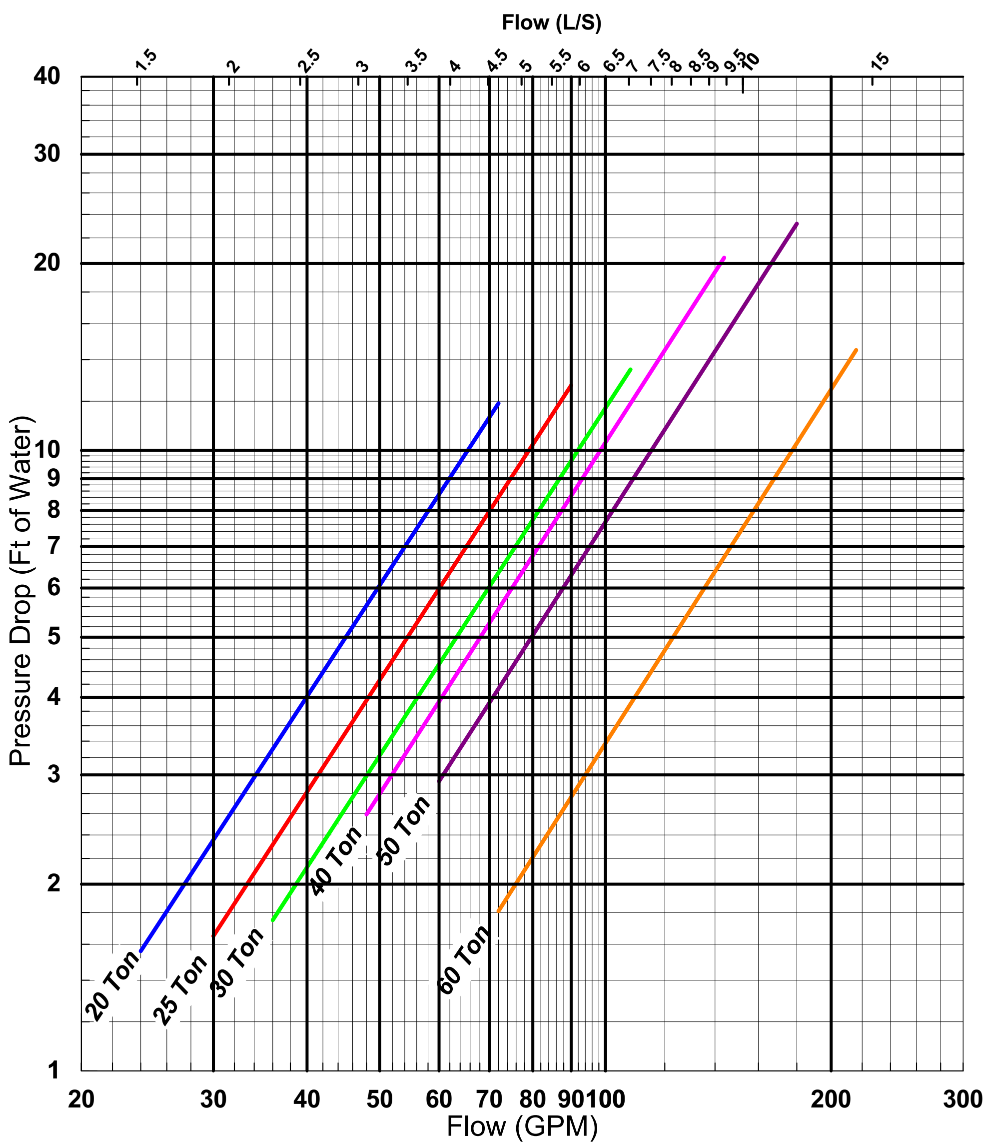
Check the flow device to ensure it opens and close properly.

With water circulating through the system, check the EVP chiller pressure drop and adjust the flow (if necessary). Refer to the appropriate EVP chiller size in Figure 44 for the operating pressure drop.

Freezestat Setting

At the remote panel, set the freezestat at a minimum of 5oF above the chilled water freezing temperature.

Figure 44. Evaporator Pressure Drops



"Air Over" Evaporator Application

Verifying Proper Supply Fan Rotation

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position and the "Fan" selection switch for the appropriate controls application is in the "Auto" position. (VAV units do not utilize a "Fan" selection input.)
2. Turn the main power disconnect switch or circuit protector switch for the unit to the "On" position.
3. Turn the 115 volt control circuit switch 1S2 to the "On" position.

⚠ WARNING
Rotating Components!

Verifying proper components rotation exposes you to rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components, perform this task. Failure to follow all safety precautions when exposed to rotating components could result in death or serious injury.

4. Turn the field provided disconnect switch for the supply fan to the "On" position and "bump" the field supplied control circuit switch "On", (i.e., "On" then immediately "Off").
5. While the fan is coasting down, check the rotation. If the fan is rotating backwards, turn the field provided disconnect switch for the air handler to the "Off" position and interchange any two of the main power wires at the fan motor starter or contactor.
6. After all adjustments have been made, restart the supply fan and proceed through the following procedures.

System Airflow Measurement

Much of the systems performance and reliability is closely associated with, and dependent upon having the proper airflow supplied both to the space that is being conditioned and across the evaporator coil.

With the supply fan rotating in the proper direction, measure the amperage at the supply fan contactor. If the amperage exceeds the motor nameplate value, the static pressure is less than design and the airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and CFM may be too low. To determine the actual CFM (± 5%);

a. Measure the actual fan RPM
b. Calculate the Theoretical BHP
   i. (Actual Motor Amps X Motor HP)/Motor Nameplate Amps
c. Plot this data onto the appropriate Fan Performance Curve or Performance Table that shipped with the Air Handling equipment. Where the two points intersect, read the CFM line.

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

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

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

NOTICE

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

2. Measure the difference between the pressures at both locations.

3. Plot this value onto the appropriate component pressure drop curve that shipped with the Air Handling equipment. Use the data to assist in calculating a new fan drive if the CFM is not at design specifications.
4. Plug the holes after the proper CFM has been established.

Turn the 115 volt control circuit switch 1S2 to the "OFF" position and open the field provided or optional factory mounted disconnect switch.

After all adjustments have been made, proceed through the following procedures.

Compressor Start-Up (All Systems)

⚠ CAUTION

Compressor Damage!

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

1. Before closing the field provided or optional factory mounted disconnect switch at the unit, ensure that the compressor discharge service valve and the liquid line service valve for each circuit is back seated.

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

2. If the system has been previously charged before starting, disable the compressor(s) by unplugging the reset relay for each circuit. Refer to the unit-wiring diagram that sipped with the unit. Turn the main power disconnect to the "On" position and allow the crankcase heater to operate a minimum of 8 hours before continuing.

NOTICE

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

3. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit.
4. Charge liquid refrigerant into the liquid line of each refrigerant circuit with the required amount of R-22. Refrigerant should be charged into the system by weight. Use an accurate scale or a charging cylinder to monitor the amount of refrigerant entering the system. Refer to Table 14 for the required amount of refrigerant for the condensing unit.

   If the pressure within the system equalizes with the pressure in the charging cylinder before charging is completed, complete the process by charging into the suction (low) side of the system after the system has been started.

   Table 15 gives the minimum starting temperatures for both "Standard" & "Low" Ambient units.

   Do not attempt to charge the system with the low ambient dampers and/or hot gas bypass operating (if applicable). Disable the low ambient dampers in the "Open" position (refer to the "Low Ambient Damper Adjustment" section) and de-energize the hot gas bypass solenoid valves before proceeding.
5. On units with dual circuits, start only one circuit at a time. To disable the compressors, unplug the appropriate lockout relay inside the unit control panel. Refer to Table 16 for the compressor sequencing and Figure 45 for their location.
6. Close the "High Side" valve on the manifold gauge set.
7. Set the "System" selection switch to the "Cool" position

⚠ WARNING

Live Electrical Components!

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

8. Turn the main power disconnect switch or circuit protector switch, to the unit, “On”.

⚠ WARNING

Rotating Components!

Verifying proper components rotation exposes you to rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components, perform this task. Failure to follow all safety precautions when exposed to rotating components could result in death or serious injury.

9. Turn the 115-volt control circuit switch 1S2 to the “On” position.
   a. Once each compressor or compressor pair has started, verify that the rotation is correct. If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed.
   b. Check the condenser fans for proper rotation. The direction of rotation is clockwise when viewed from the top of the unit.

   All Motors are Rotating Backwards;
      i. Turn the field supplied disconnect switch or circuit protector switch that provides power to the condensing unit to the “Off” position. Lock the disconnect switch in the open position while working at the unit.
      ii. Interchange any two of the field connected main power wires at the unit terminal block 1TB1 or the optional factory mounted non-fused disconnect switch (1S1) in the unit control panel.

Note: *Interchanging “Load” side power wires at the contactors will only affect the individual fan rotation. Ensure that the voltage phase sequence at the main terminal block 1TB1 is ABC as outlined in the “Electrical Phasing” section.*

Some Motors are Rotating Backwards;
   iii. Turn the field supplied disconnect switch or circuit protector switch that provides power to the condensing unit to the “Off” position. Lock the disconnect switch in the open position while working at the unit.
   iv. If the electrical phasing is correct, interchange any two of the motor leads at the contactor for each motor that is rotating backwards. Before condemning a compressor, interchange any two leads (at the compressor Terminal block) to check the internal phasing. Refer to the illustration in Figure 46 for the compressor terminal/phase identification. If the compressor runs backward for an extended period (15 to 30 minutes), the motor winding can overheat and cause the motor winding thermostat to open.

10. With the compressors operating, slowly open the “Low Side” valve on the manifold gauge set. The remainder of the refrigerant will be drawn into the system.

NOTICE

To prevent compressor damage due to no refrigerant flow, do not utilize the compressors to pump the system down below 7 PSIG under any circumstances.

11. After the compressors and condenser fans for the operating circuit have been operating for approximately 30 minutes, observe the operating pressures. Use the appropriate pressure curve in Figure 47 to determine the proper operating pressures. If the operating pressures indicate a refrigerant shortage, measure the system superheat and system subcooling.

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

Subcooling

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

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

Measuring Subcooling

a. At the liquid line service valve, measure the liquid line pressure. Using a Refrigerant 22 pressure/temperature chart, convert the pressure reading into the corresponding saturated temperature.

b. Measure the actual liquid line temperature as close to the liquid line service valve as possible. To ensure an accurate reading, clean the line thoroughly where the temperature sensor will be attached. After securing the sensor to the line, insulate the sensor and line to isolate it from the ambient air.

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

c. Determine the system subcooling by subtracting the actual liquid line temperature (measured in b) from the saturated liquid temperature (converted in a).

Measuring Superheat

d. Measure the suction pressure at the outlet of the evaporator as close to the expansion valve bulb location as possible.

e. Measured the suction line temperature as close to the expansion valve bulb, as possible.

f. Using a Refrigerant/Temperature chart, convert the pressure reading to a corresponding saturated vapor temperature.

Note: *On many Trane fan/coil units, an access valve is provided close to the expansion valve bulb location. This valve must be added on climate changers and other evaporators.*

g. Subtract the saturated vapor temperature (converted in c), from the actual suction line temperature (measured in b). The difference between the two temperatures is known as "superheat".

12. Verify that the oil level in each compressor is correct. The oil level may be down to the bottom of the sight glass but should never be above the sight glass.

13. Once the checks and adjustments for the operating circuit has been completed, check and record the:

    ambient temperature;

    compressor oil level (each circuit);

    compressor suction and discharge pressures (each circuit);

    superheat and subcooling (each circuit);

Record this data on an "operator's maintenance log" shown in Table 18. Repeat these procedures for the second refrigeration circuit, if applicable.

14. Turn the 115-volt control circuit switch 1S2 to the “OFF” position and open the field provided or optional factory mounted disconnect switch.
15. After shutting the system off, check the compressor oil appearance. Discoloration of the oil indicates that an abnormal condition has occurred. If the oil is dark and smells burnt, it has overheated because of: compressor is operating at extremely high condensing temperatures; high superheat; a compressor mechanical failure; or, occurrence of a motor burnout.

    If the oil is black and contains metal flakes, a mechanical failure has occurred. This symptom is often accompanied by a high compressor amperage draw.

    If a motor burnout is suspected, use an acid test kit to check the condition of the oil. Test results will indicate an acid level exceeding 0.05 mg KOH/g if a burnout occurred.

Compressor Oil

The scroll compressor uses **Trane OIL-42 without substitution.** The appropriate oil charge for a 9 and 10 Ton scroll compressor is 8.5 pints. For a 14 and 15 Ton scroll compressor, use 13.8 pints.

Compressor Crankcase Heaters

9 and 10 ton scroll compressors have a 100-watt heater installed. 14 and 15 ton scroll compressors have two 80-watt heaters installed per compressor.

Table 13. Pressure Control Switch Settings

Pressure Switch	Make	Break
Hi Pressure	350 psi	405 psi
Lo Pressure		
EVPB	60 psi	45 psi
All others	40 psi	30 psi
Condenser Fan Cycling switch	275 psi	155 psi
(EVP only w/HGB - wo/HGB) std.		
Lo Ambient Thermostat	33 F	30 F
Compressor Winding T-Stat	181F	221 F

Note: Pack Stock units will have both low pressure switches shipped and the user should use the above valves that apply

Table 14. Recommended Refrigerant Capacities

Capacity	Total Interconnecting Line Length 50	100	150
Approximate Total System Refrigerant Charge (Lbs. Per Circuit)			
20 Ton	49	56	64
25 Ton	58	73	87
30 Ton	71	85	99
40 Ton	46	53	61
50 Ton	56	70	85
60 Ton	68	82	97

Table 15. Minimum starting Ambient Temperature

	Minimum Starting Ambient (1)	
	Standard Units	Low Ambient Units

Table 15. Minimum starting Ambient Temperature

Unit Size	With HGBP	No HGBP	With HGBP	No HGBP
20-60	45°	40°	10°	0°

Note: Minimum starting ambients in degrees F and is based on the unit operating at minimum step of unloading and 5 mph wind across condenser.

Table 16. Compressor Sequence

Unit Size	Control Step	Circuit 1		Circuit 2
20	1	A	50%	
	2	A, B	100%	
25	1	B	40%	
	2	A, B	100%	
30	1	A	50%	
	2	A, B	100%	
40	1	A	50%	
	2	A	50%	C (50%)
	3	A	50%	C, D (100%)
	4	A, B	100%	C, D (100%)
50	1	A	61%	
	2	A	61%	C (61%)
	3	A	61%	C, D (100%)
	4	A, B	100%	C, D (100%)
60	1	A	50%	
	2	A	50%	C (50%)
	3	A	50%	C, D (100%)
	4	A, B	100%	C, D (100%)

Note: A, B, C and D indicate which compressor in the unit is operating. (%) indicates the amount of the circuit in operation during a given step. refer to the compressor location illustration for the unit.

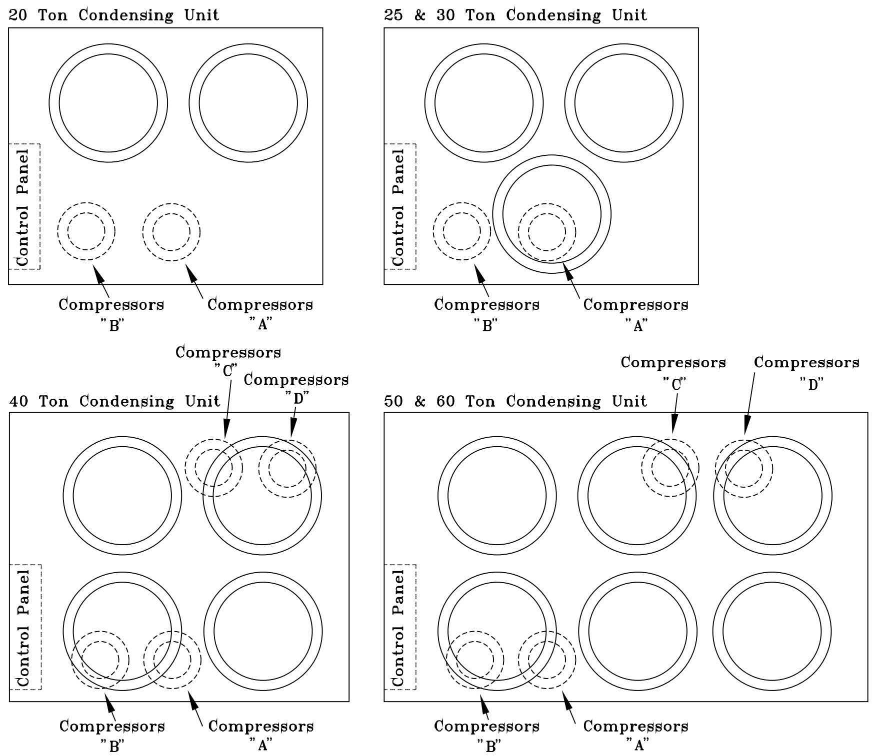


Figure 45. Typical Compressor Locations

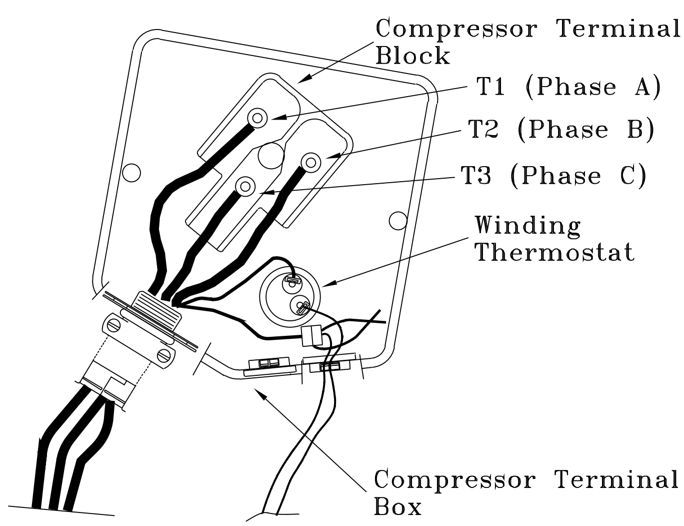
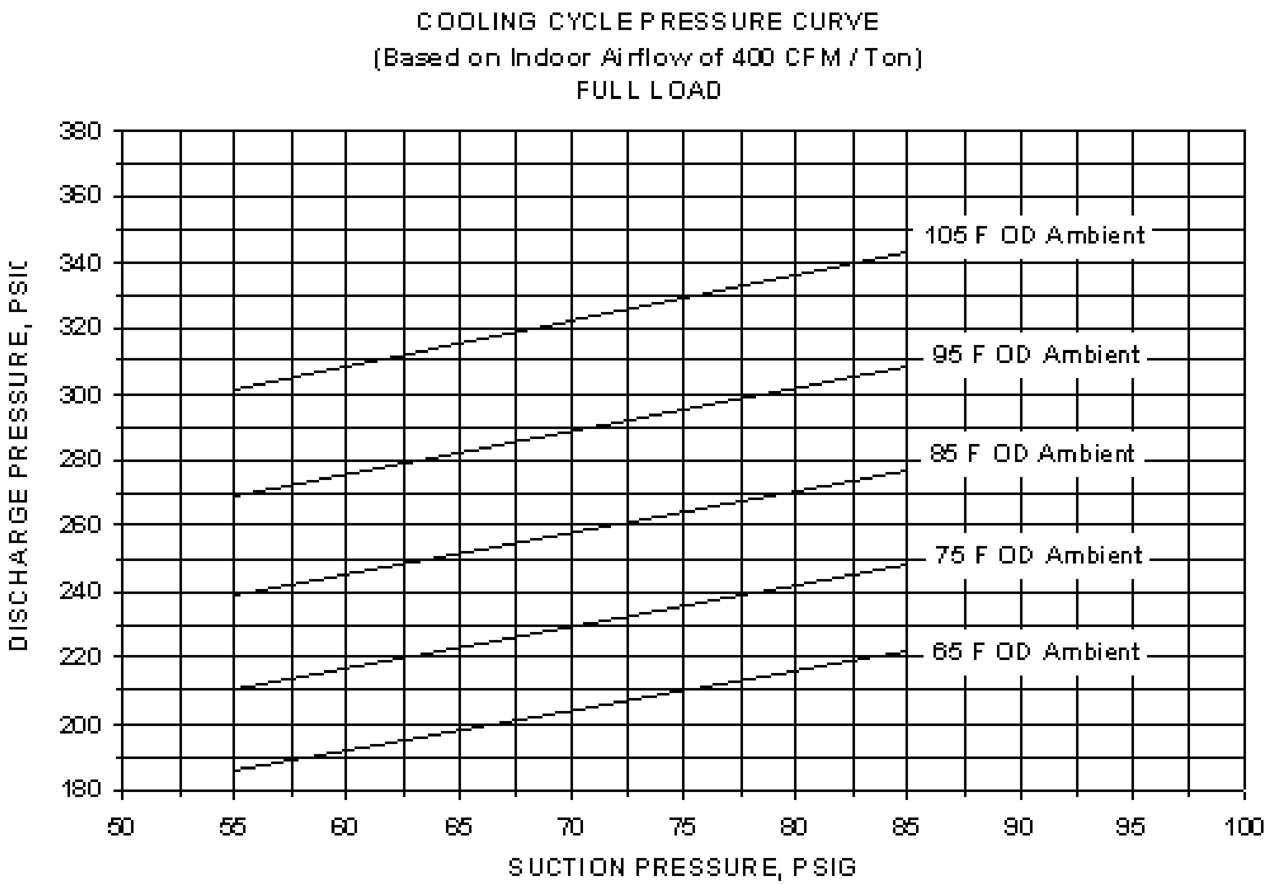


Figure 46. Typical Compressor Terminal Block

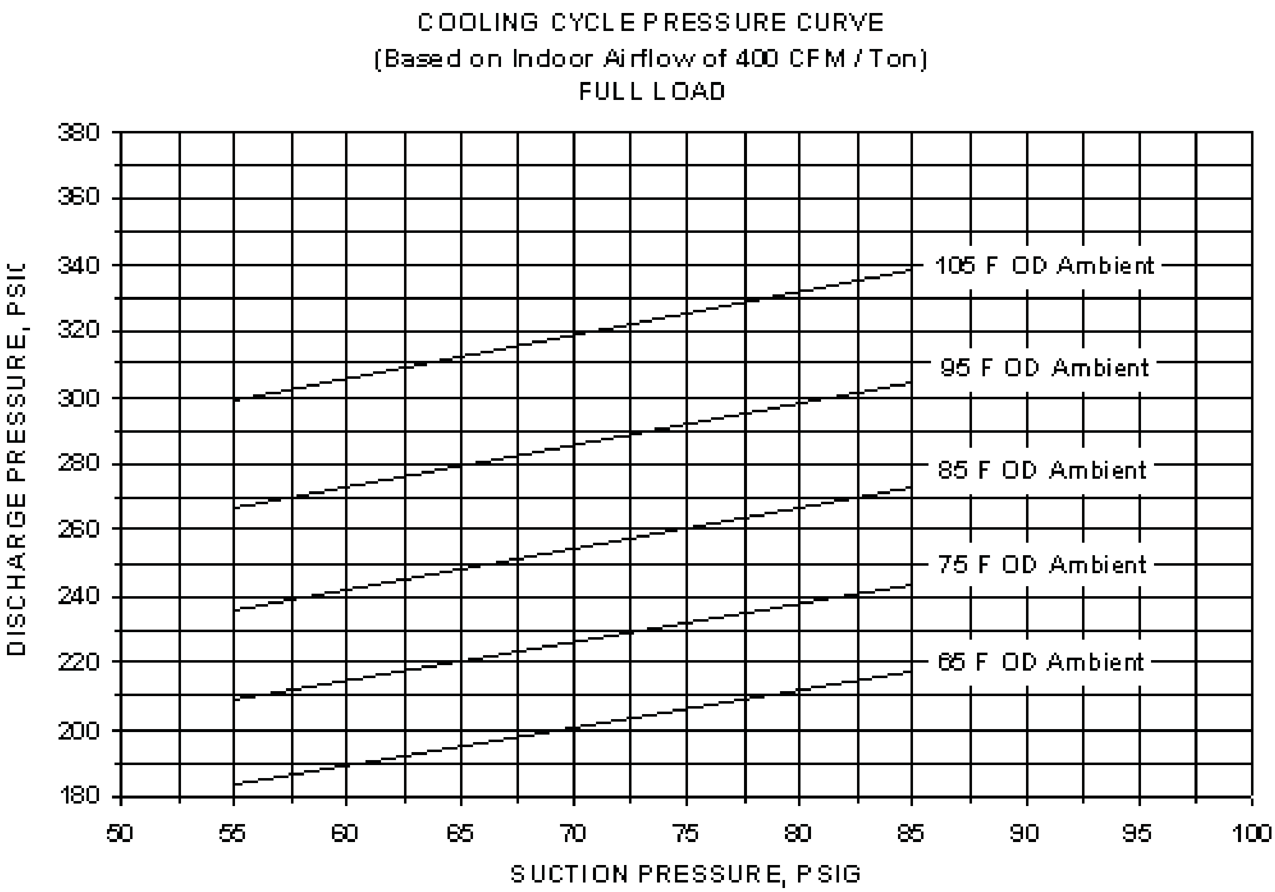
Figure 47. 20 Ton Pressure Curve



To Check Operating Pressures

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

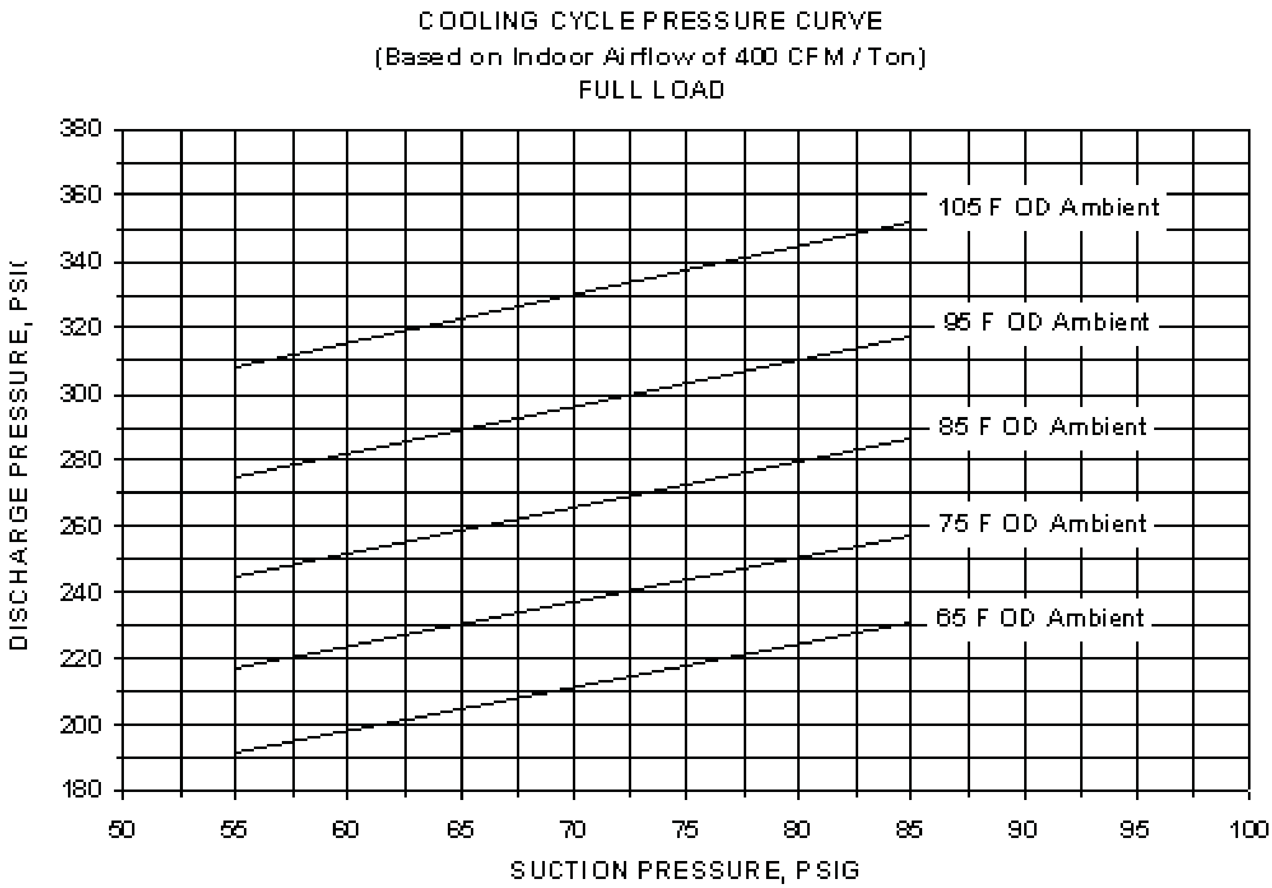
Figure 48. 25 Ton Pressure Curve



To Check Operating Pressures

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

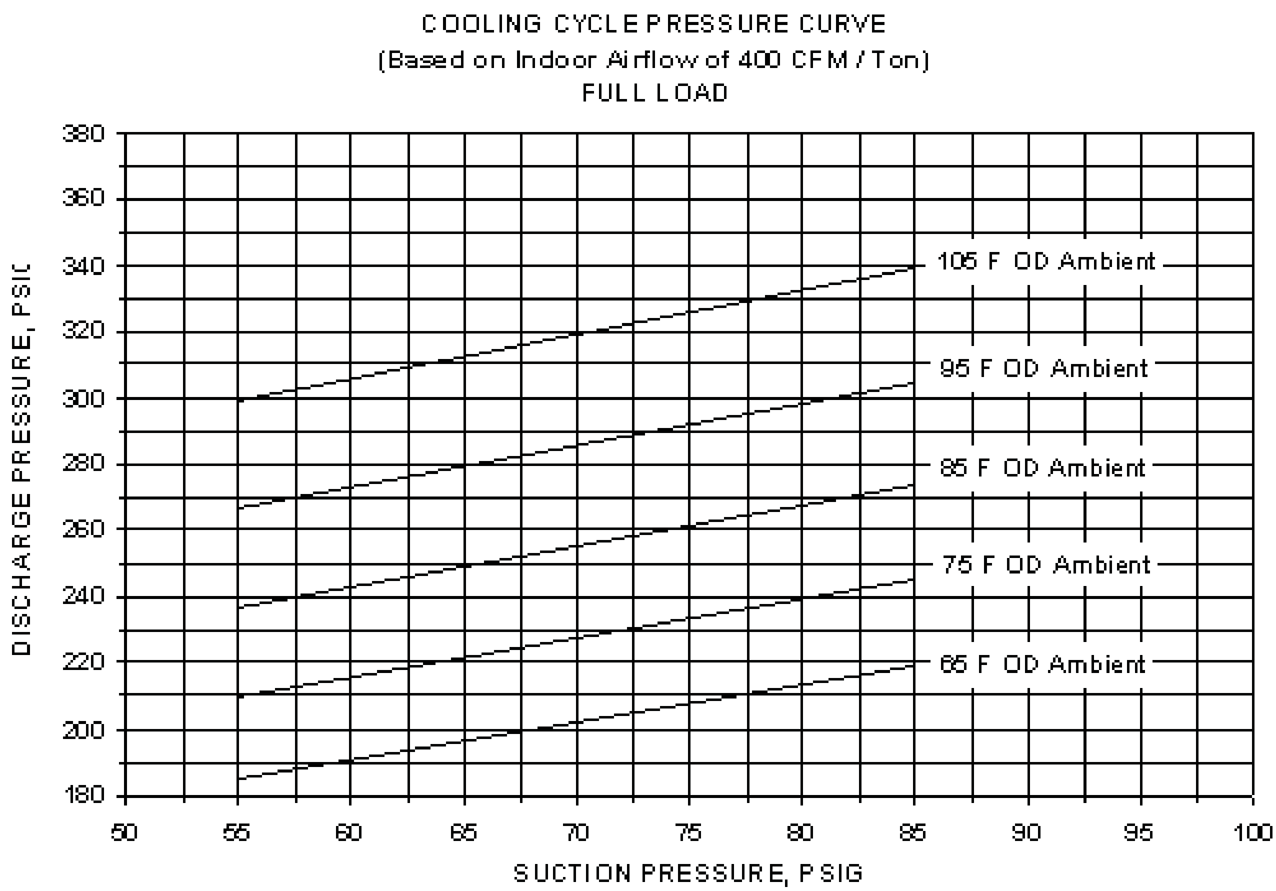
Figure 49. 30Ton Pressure Curve



To Check Operating Pressures

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

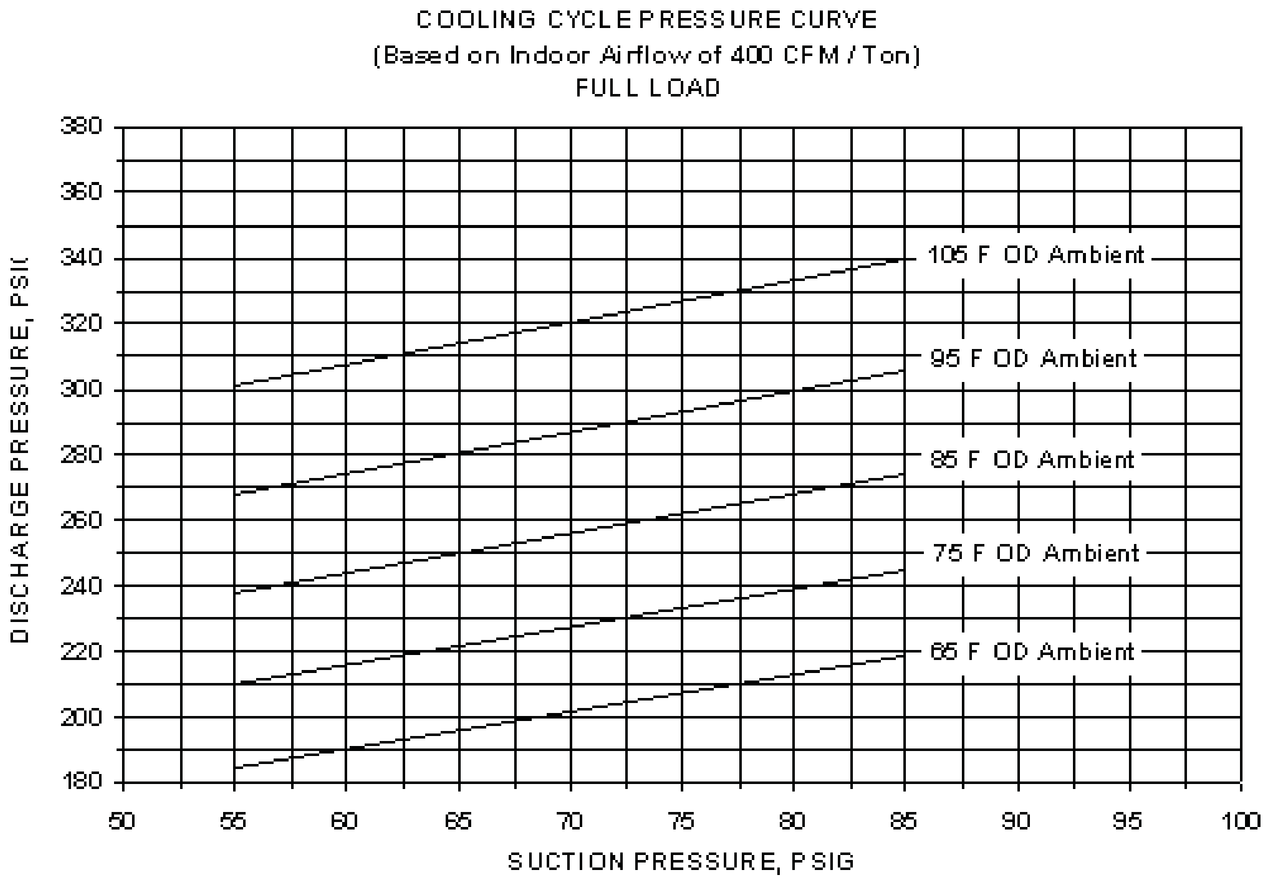
Figure 50. 40 Ton Pressure Curve per Circuit



To Check Operating Pressures

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

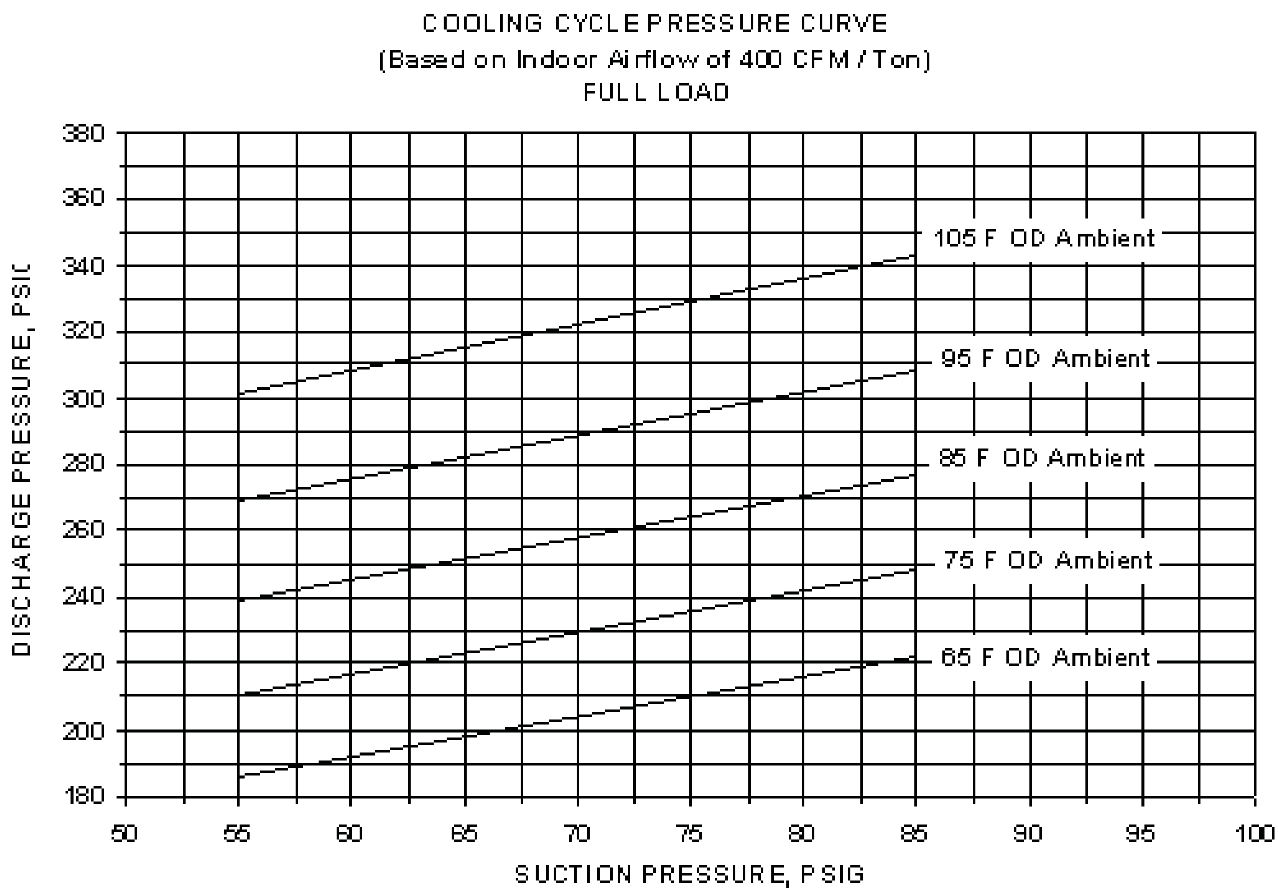
Figure 51. 50 Ton Pressure Curve per Circuit



To Check Operating Pressures

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

Figure 52. 60 Ton Pressure Curve per Circuit



To Check Operating Pressures

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

Final System Setup

After completing the Pre-start and Start-up procedures outlined in the previous sections, perform these final checks before leaving the unit:

[ ] Turn the 115 volt control circuit switch 1S2 "Off".

[ ] Program the Night Setback (NSB) panel (if applicable) for proper unoccupied operation. Refer to the programming instructions for the specific panel.

[ ] Verify that the "System" selection switch and the "Fan Mode" selection switch at the Remote panel is set correctly.

[ ] Verify that the "System" control switch for the supply fan or the chilled water pump is "On".

[ ] Set the correct "Operating Temperature" for the system at the system controller. Refer to Figure 17 for the recommended control set points for the appropriate control option.

[ ] Turn the 115 volt control circuit switch 1S2 "On". The system will start automatically once a request for cooling has been given.

[ ] Verify that all exterior panels and the control panel doors are secured in place.

Table 17. Recommended Operating Setpoints

Control	Control Setting	Recommended Setting
Discharge Air Controller (VAV units only)	Supply Air Setpoint	Set at design discharge (supply) air temperature; minimum setting = 55° F
	Reset Setpoint	Set at maximum amount of allowable reset for supply air setpoint.
	Control Band	Set at 6° F Minimum Setpoint
Chiller Control (EVP units only) Freezestat	Leaving Fluid Setpoint	Set at design leaving chilled water temperature (typically) 44° F
	Reset Setpoint	Set at maximum amount of allowable reset for leaving fluid setpoint.
	Control Band	Set at 6° F Minimum Setpoint
	Low Limit Solution Temperature	Set at 5° F Minimum above the Chilled Solution Freeze Temperature
Zone Thermostat (CV units only)	Zone Setpoint	Set at desired space temperature.

Note: "No Controls" Units See System Engineer

Table 18. Sample Maintenance Log

Date	Current Ambient Temp. (F)	Refrigerant Circuit #1						Refrigerant Circuit #2					
		Compr. Oil level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Subcool (f)	Compr. Oil level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Subcool (f)
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low						- ok - Low					
		- ok - Low											

Note: Check and record the data requested above each month during the cooling season with the unit running

Service & Maintenance

Compressor Operational Sounds

Because of the scroll compressor design, it emits a higher frequency tone (sound) than a reciprocating compressor. It is designed to accommodate liquids, both oil and refrigerant, without causing compressor damage. The following discussion describes some of the operational sounds that differentiate it from those typically associated with a reciprocating compressor. These sounds do not affect the operation or reliability of the compressor.

At Shutdown:

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

At Low Ambient Start-Up

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

Scroll Compressor Replacement

Table 19 lists the specific compressor electrical data and the circuit breaker operating ranges.

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

NOTICE

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

Should a compressor replacement become necessary and a suction line filter drier is to be installed, install it a minimum of 18 inches upstream of the oil separator tee. Refer to the illustration in Figure 53.

Anytime a compressor is replaced, the oil for each compressor within the manifolded set must be replaced.

The scroll compressor uses Trane OIL-42 without substitution. The appropriate oil charge for a 9 and 10 Ton scroll compressor is 8.5 pints. For a 14 and 15 Ton scroll compressor, use 13.8 pints.

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

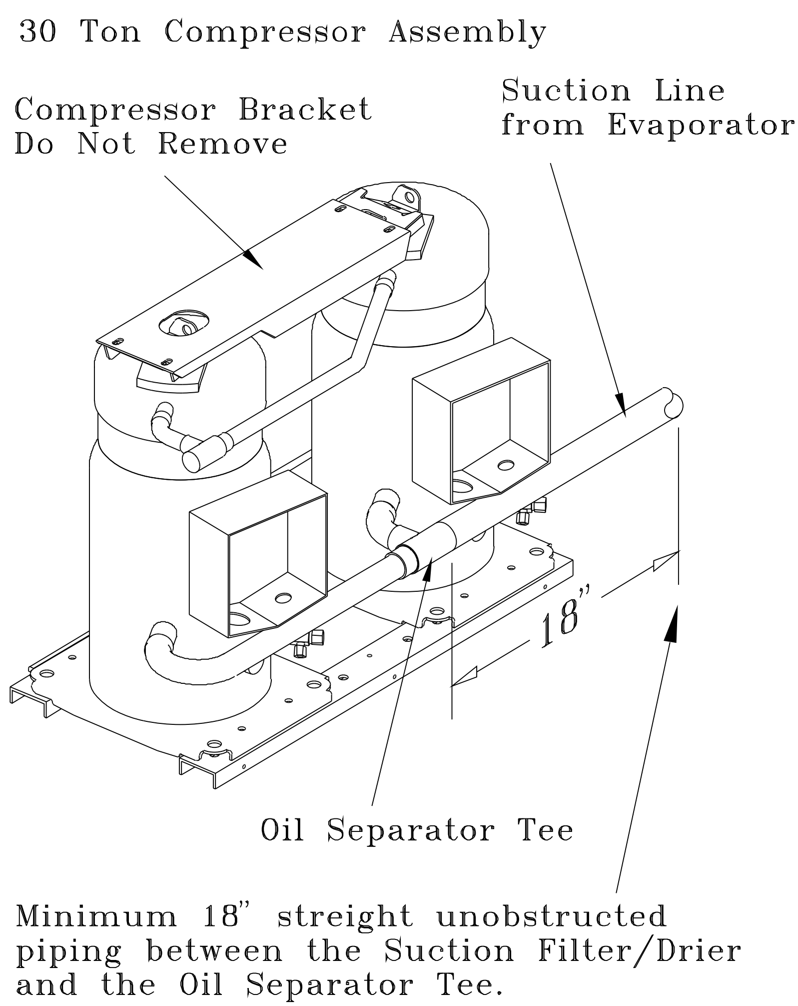
NOTICE

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

Table 19. Compressor Circuit Breaker Data

Voltage	Comp Tons	RLA	LRA	Must Hold	Must Trip
200	9	41.4	269.0	50.4	58.0
230	9	41.4	251.0	50.4	58.0
460	9	18.1	117.0	22.0	25.3
575	9	14.4	94.0	17.5	20.2
380/415	9	17.2	110.0	20.9	24.1
200	14	60.5	404.0	73.7	84.7
230	14	60.5	376.0	73.7	84.7
460	14	26.3	178.0	32.0	36.8
575	14	21.0	143.0	25.6	29.4
380/415	14	26.2	174.0	31.9	36.7

Figure 53. Suction Line Filter/Drier Installation



Fuse Replacement Data

Table 20 lists the replacement fuses for the control circuit, compressors, and condenser fans.

Table 20. Fuse Replacement Data

Fuse Replacement Selection				
Fuse Description	**Unit Size**	**Unit Voltage**	**Fuse Type**	**Fuse Size**
Condenser Fan Fuse (1F1-1F3 on 20 - 30 Ton) (1F1-1F6 on 20 - 60 Ton)	ALL	200/230 VOLT	CLASS K5	25 AMP
		460/575 VOLT 380/415 VOLT		15 AMP
Control CKT Fuse (1F7)	20 - 30 Ton	ALL	BUSSMANN S - 3.20	3.20 AMP
	40 - 60 Ton	ALL	BUSSMANN S - 6.25	6.25 AMP
Compr Protector Fuse (1F8 on 20 - 60 Ton) (1F9 on 40 - 60 Ton)	ALL	ALL	BUSSMANN MTH - 6	6 AMP

Monthly Maintenance

Air Handling Equipment

Before completing the following checks, turn the system control circuit switch 1S2 and 5S1 to the "Off" position. Open the main power disconnect switch for the Condensing Unit and Air Handling Unit and "lock it" in the "Off" position before removing any access panels.

⚠ WARNING
Hazardous Voltage!

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

[ ] Inspect the return air filters. Clean or replace them if necessary.

[ ] Check the evaporator drain pan and condensate piping to ensure that there are no blockages.

[ ] Inspect the evaporator coils for dirt. If the coils appear dirty, clean them according to the instructions described in the “Coil Cleaning” section.

[ ] Inspect the economizer damper hinges and pins (if applicable) to ensure that all moving parts are securely mounted. Clean the blades as necessary.

[ ] Verify that all damper linkages move freely; lubricate with white grease, if necessary.

[ ] Check Supply Fan motor bearings; repair or replace the motor as necessary.

[ ] Check the fan shaft bearings for wear. Replace the bearings as necessary.

[ ] Lubricate the supply fan bearings. Refer to the equipment manufacturer for their recommended greases.

NOTICE

Over lubrication can be just as harmful as not enough grease.

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

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

[ ] Check the supply fan belt(s). If the belts are frayed or worn, replace them.

[ ] Verify that all wire terminal connections are tight.

[ ] Generally inspect the unit for unusual conditions (e.g., loose access panels, leaking piping connections, etc.)

[ ] Make sure that all retaining screws are reinstalled in the unit access panels once these checks are complete.

Condensing Unit

⚠ WARNING

Rotating Components!

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

[ ] Manually rotate the condenser fans to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.

[ ] Verify that all wire terminal connections are tight.

[ ] Inspect the condenser coils for dirt and foreign debris. If the coils appear dirty, clean them according to the instructions described in the “Coil Cleaning” section.

[ ] Inspect the compressor and condenser fan motor contactors. If the contacts appear severely burned or pitted, replace the contactor. Do not clean the contacts.

[ ] Check the compressor oil level. (Compressors "Off")

Coil Cleaning

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

compressor head pressure and amperage draw;

evaporator water carryover;

fan brake horsepower, due to increase static pressure losses;

airflow reduction.

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

To clean refrigerant coils, use a soft brush and a sprayer (either a garden pump-up type or a high-pressure sprayer). A high-quality detergent is also required; suggested brands include “SPREX A.C.”, “OAKITE 161”, “OAKITE 166” and “COILOX”. If the detergent selected is strongly alkaline (ph value exceeds 8.5), add an inhibitor.

1. Remove enough panels from the unit to gain access to the coil.
2. Protect all electrical devices such as motors and controllers from any over spray.
3. Straighten any bent coil fins with a fin comb.
4. Mix the detergent with water according to the manufacturer’s instructions. If desired, heat the solution to 150oF maximum to improve its cleansing capability.

⚠ WARNING
Hazardous Pressures!

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

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

5. Pour the cleaning solution into the sprayer. If a high-pressure sprayer is used:
   a. do not allow sprayer pressure to exceed 600 psi.
   b. the minimum nozzle spray angle is 15 degrees.
   c. maintain a minimum clearance of 6" between the sprayer nozzle and the coil.
   d. spray the solution perpendicular (at 90 degrees) to the coil face.
6. Spray the leaving-airflow side of the coil first; then spray the opposite side of the coil. Allow the cleaning solution to stand on the coil for five minutes.
7. Rinse both sides of the coil with cool, clean water.
8. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 6 and 7.
9. Reinstall all of the components and panels removed in Step 1 and any protective covers installed in step 2.
10. Restore the unit to it’s operational status and check system operation.

System operation

[ ] Close the main power disconnect switch for the condensing unit and all system support equipment. Turn all system control circuit switches to the “On” position.

⚠ WARNING
Live Electrical Components!

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

[ ] With the unit running, check and record the:

ambient temperature;

compressor oil level (each circuit);

compressor suction and discharge pressures (each circuit);

superheat and Subcooling (each circuit);

Record this data on an “operator’s maintenance log” similar to the one illustrated in the “Final Setup” section of this manual. If the operating pressures indicate a refrigerant shortage, measure the system Superheat and system Subcooling. For guidelines, refer to the “System Start-Up” section.

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

WARRANTY AND LIABILITY CLAUSE

COMMERCIAL EQUIPMENT RATED 20 TONS AND LARGER AND RELATED ACCESSORIES

PRODUCTS COVERED - This warranty* is extended by Trane Inc. and applies only to commercial equipment rated 20 Tons and larger and related accessories.

The Company warrants for a period of 12 months from initial start-up or 18 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion or deterioration. The Company's obligations and liabilities under this warranty are limited to furnishing f.o.b. factory or warehouse at Company designated shipping point, freight allowed to Buyer's city (or port of export for shipment outside the conterminous United States) replacement equipment (or at the option of the Company parts therefore) for all Company products not conforming to this warranty and which have been returned to the manufacturer. The Company shall not be obligated to pay for the cost of lost refrigerant. No liability whatever shall attach to the Company until said products have been paid for and then said liability shall be limited to the purchase price of the equipment shown to be defective.

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

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

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Manager - Product Service

Trane Inc.

Clarksville, Tn 37040-1008

PW-215-2688

*Optional Extended Warranties are available for compressors and heat exchangers of Combination Gas-Electric Air Conditioning Units.

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Literature Order Number	SS-SVX09A-EN
Date	June 2008
Supersedes	RAUC-IOM-14 June 2007

Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.