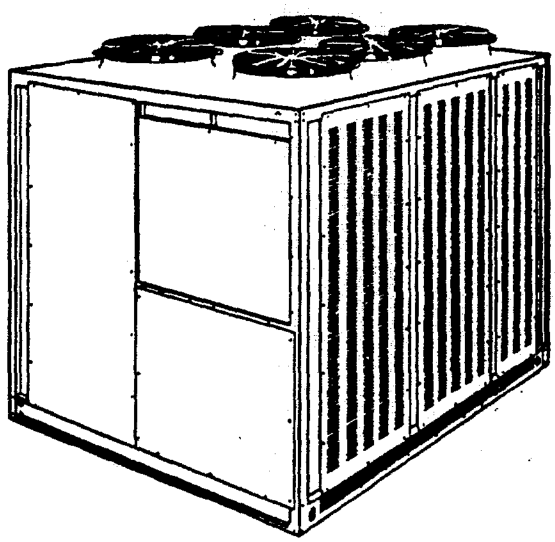
TRANE™

Installation Operation Maintenance

RAUC-IOM-3A

Library	Service Literature
Product Section	Unitary
Product	Split System Air Cond. (20 Tons and Larger)
Model	RAUC
Literature Type	Installation/Operation/Maintenance
Sequence	3A
Date	April 1993
File No.	SV-UN-S/S-RAUC-IOM-3A 4/93
Supersedes	RAUC-IOM-3A 3/92

Split System Remote Condensing Units and EVP Chillers



Models...

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

With 3-D™ Scroll Compressors

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

Table Of Contents

The Trane Company
La Crosse, WI 54601
Printed in U.S.A.

Model Number Description

<u>RA</u> <u>U</u> <u>C</u> - <u>C60</u> <u>G</u> - <u>B</u> <u>G</u> <u>1</u> <u>3</u> <u>AFG1</u>
1,2 3 4 5,6,7 8 9 10 11 12 13, etc

All standard Trane products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification codes used for RAUC units is provided on this page. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, components and options for any specific unit.

Digit 1
Unit Type
R = Remote Condensing Unit

Digit 2
Condenser
A = Air Cooled

Digit 3
Unit Airflow
U = Upflow

Digit 4
Development Sequence
C = Third

Digit 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
G = 200/230/60/3 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
E = Supply Air VAV
P = EVP Control

Digit 10
Design Sequence
D = Scroll Compressors w/o Crankcase Heaters
E = Added Pressure Switch (Compressor Protection)
F = Added 50 Hz Units, Added Disconnect Exterior Handle
G = Fan Guard Change

Digit 11
Ambient Control
0 = Standard
1 = Low Ambient 0° F

Digit 12
Agency Listing
0 = No Agency Listing
3 = UL / CSA

Digit 13
Miscellaneous Options
A = Unit Disconnect Switch (non-fused)
B = Hot Gas Bypass *
D = Suction Service Valve
F = Pressure Gauges *
G = Return Air Sensor *
H = Copper Fin Cond. Coil
T = Flow Switch *
1 = Unit Isolator - Spring *
2 = Unit Isolator - Neoprene *
9 = Packed Stock Unit

* Field Installed

General Information

Literature Change History

RAUC-IOM-3 (Nov. 1990)

First issue of manual providing installation instructions for Model RAUC condensing units ("D" design sequence) and the Model EVP chillers used with these units.

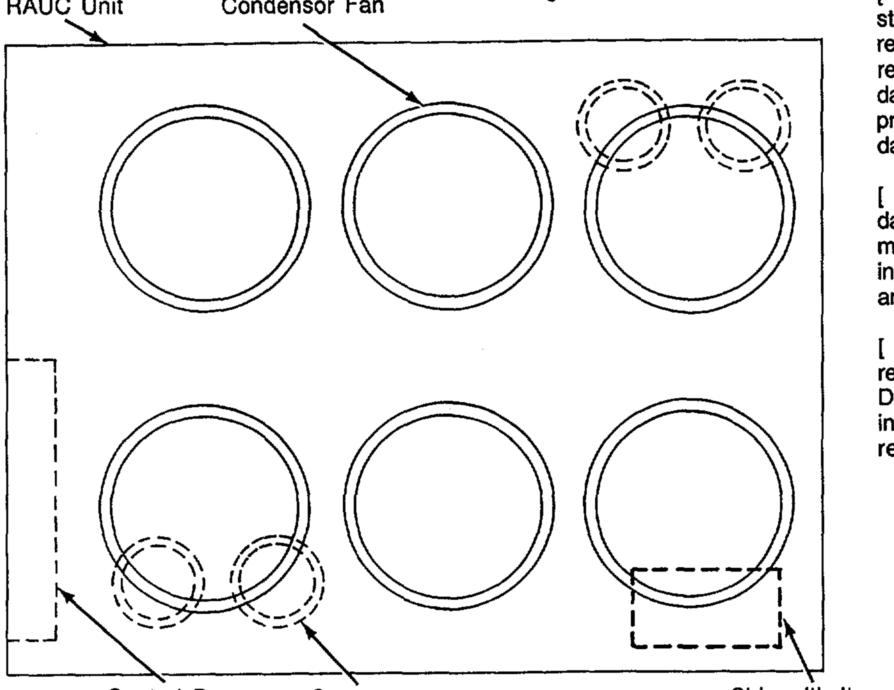
RAUC-IOM-3A (MARCH 1992)

Revised manual to include "E" and "F" design sequence units. Added 50 Hz units and ship with information. Added disconnect handle information.

Warnings and Cautions

"Warnings" and "cautions" appear at appropriate points in this manual. Cautions indicate areas where special attention is required to prevent equipment or property damage. Warnings focus attention on the personal safety of installing and operating personnel. The instructions given in each warning appearing in this manual must be followed carefully.

Figure 1a
Ship With Items



Unit Description

Model RAUC condensing units are designed for outdoor mounting with vertical air discharge. These units are most often installed on a flat roof, but may also be placed on a concrete slab at ground level.

These units may be ordered with four different unit control options:
- Constant Volume
- No System Controls (customer-provided control);
- Supply Air VAV control; or,
- EVP control.

These units are factory-dehydrated, leak-tested, charged (holding charge) and tested for proper control operation before shipment.

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. Head pressure control dampers are available, field- or factory-installed, if low ambient operation is required.

Field wiring, electrical schematics and panel connection diagrams are glued to the inside of the control panel access door.

The location of ship with items is shown in Figure 1a.

Unit Inspection

When the unit is delivered, verify that the correct one has been shipped and that it is properly equipped by comparing the information that appears on the unit nameplate with ordering and submittal information. Refer to "Nameplates".

Inspect all exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a "unit damage" notation on the carrier's delivery receipt. Specify the extent and type of damage found, and notify the appropriate Trane sales office. **Do not proceed with installation of a damaged unit without the local Trane sales office approval.**

Inspection Checklist

To protect against loss due to damage incurred in transit, complete the following checklist upon receipt of the unit:

[ ] Inspect individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.

[ ] Check the unit for concealed damage before it is stored and as soon as possible after delivery. Concealed damage must be reported within 15 days.

[ ] If concealed damage is discovered, stop unpacking the shipment. 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 carrier's terminal of damage immediately by phone and by mail. Request an immediate joint inspection of the damage by the carrier and the consignee.

[ ] Notify the local Trane sales representative and arrange for repair. Do not repair the unit until damage is inspected by the carrier's representative.

Nameplates

The nameplates on these machines provide valuable information pertaining to the identification of the unit and its components. Provide all pertinent nameplate data when ordering parts or literature, and when making other inquiries.

Unit Nameplate

The unit nameplate for 20 thru 60 ton RAUC units is mounted in the upper right corner of the control panel access door exterior. See Figure 1b. This nameplate (Figure 1b) specifies control circuit power requirements and power requirements for the chiller heat tapes (if applicable). It also identifies the order number of the unit Installation/Operation/Maintenance manual. The owner should refer to this manual for information regarding the installation, operation and maintenance of this equipment.

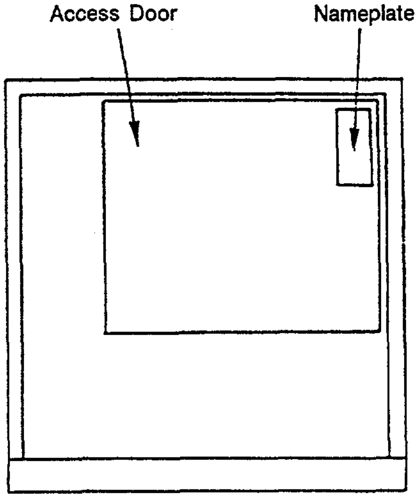
Compressor Nameplate

The nameplate for the 3-D Scroll compressor is mounted on the compressor housing.

Evaporator Nameplate

The evaporator nameplate is mounted on the top of the evaporator supply-end tube sheet. The word "Nameplate" is applied to the insulation just above the nameplate. To view the evaporator nameplate, remove the tape over the area and spread the insulation.

Figure 1b
Typical RAUC Unit Nameplate Location



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Typical Unit Nameplate

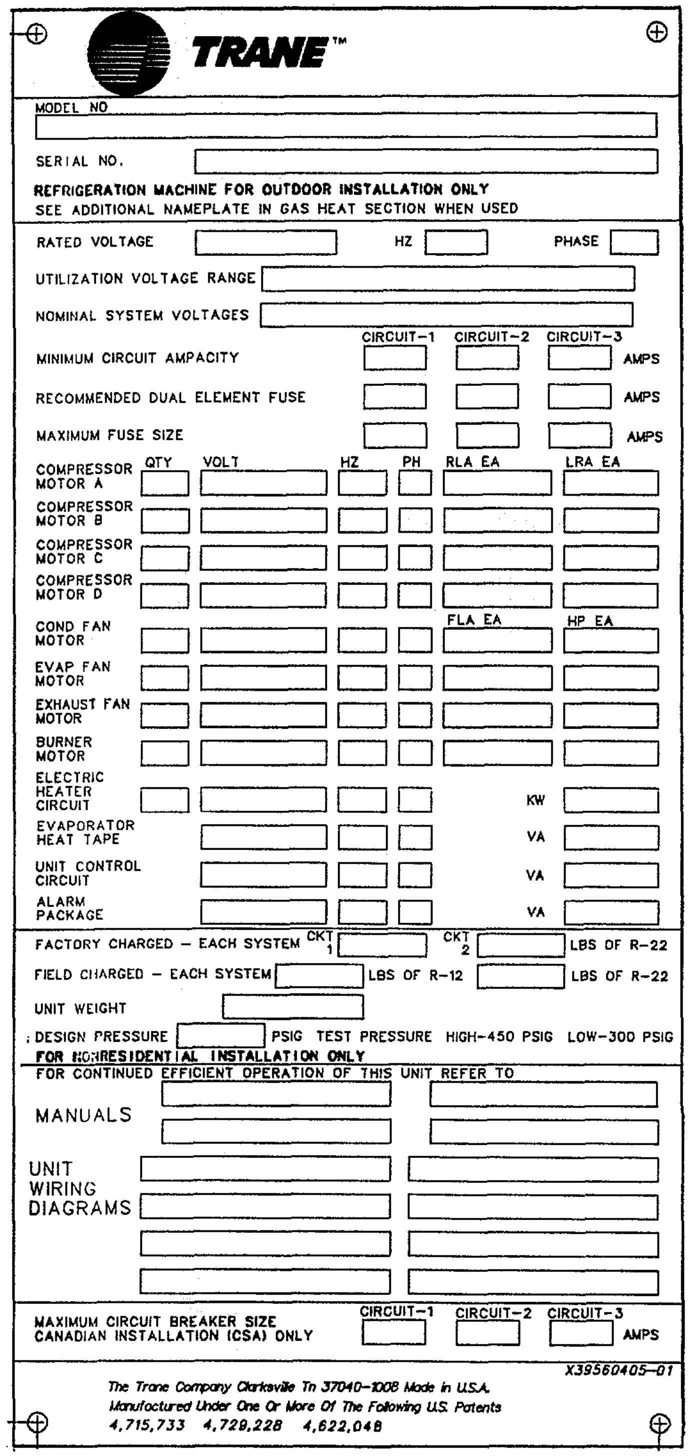

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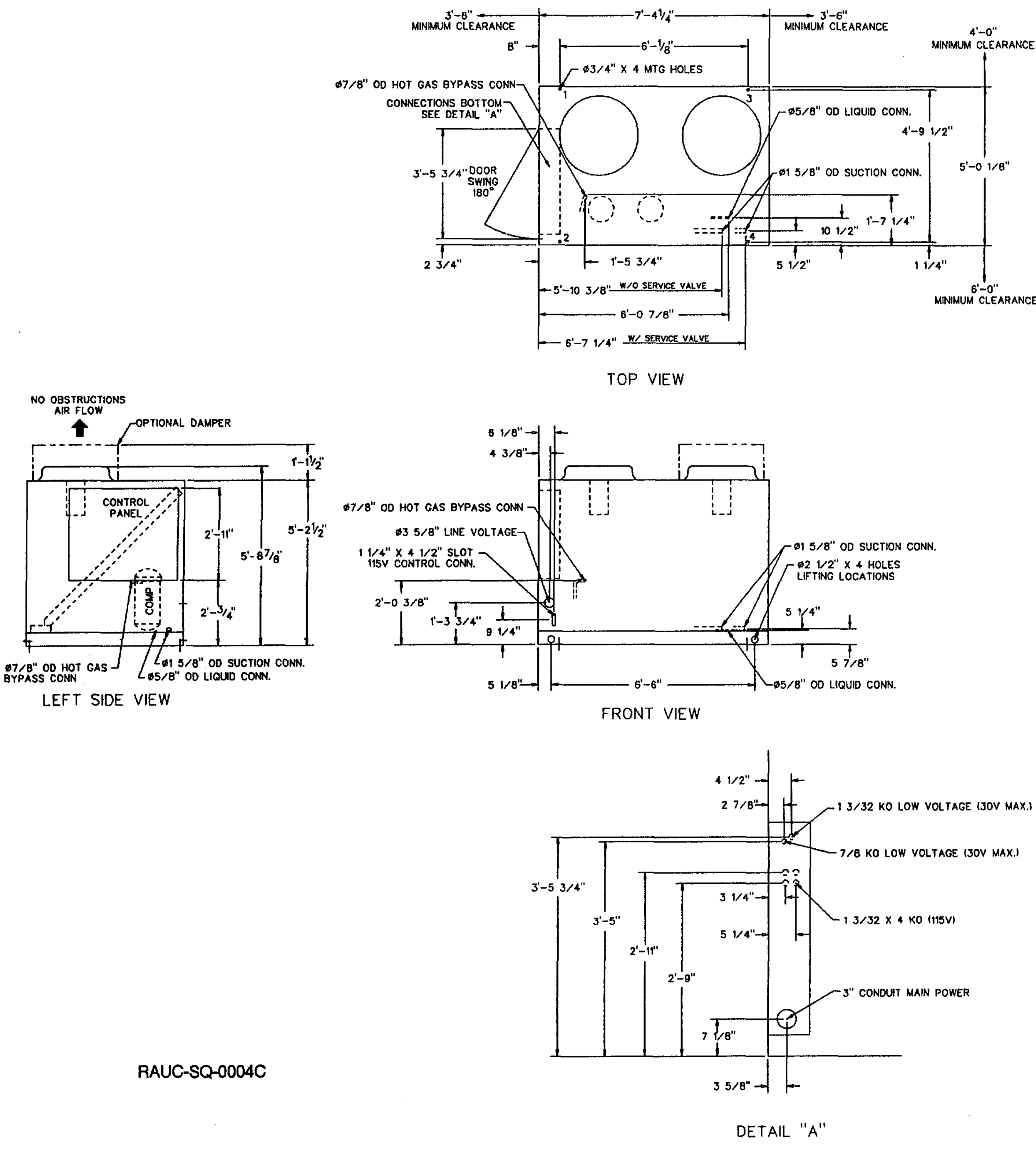
Figure 2
RAUC-C20 Unit Dimensions, Recommended Clearances, Mounting Locations, Electrical and Refrigerant Connection Sizes and Locations



RAUC-SQ-0004C

Figure 3
RAUC-C25 Unit Dimensions, Recommended Clearances, Mounting Locations, Electrical and Refrigerant Connection Sizes and Locations

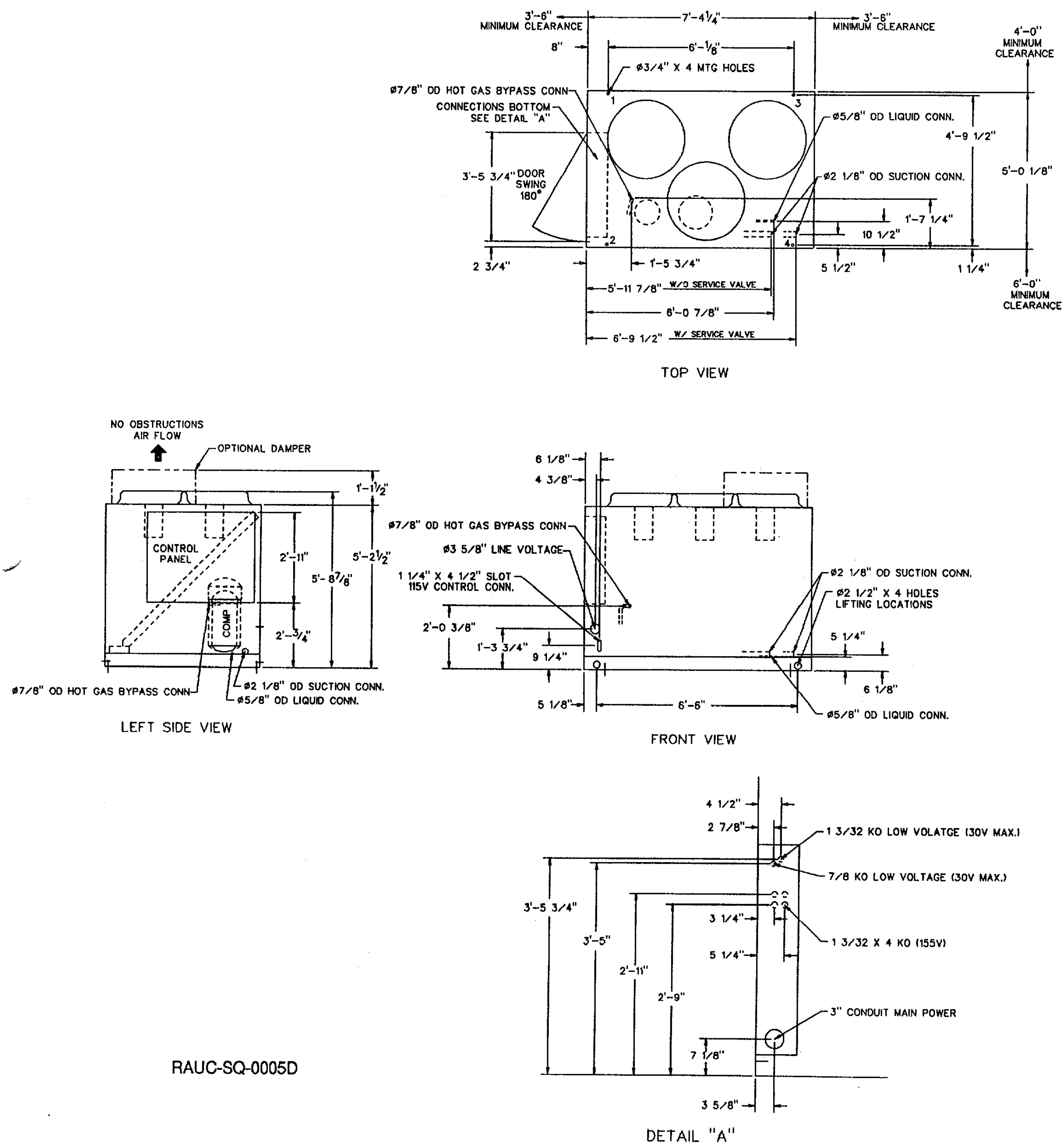
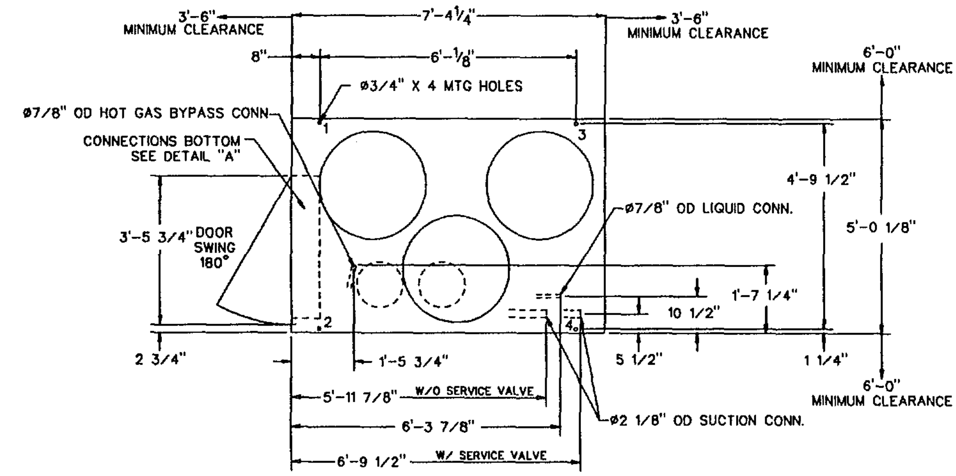
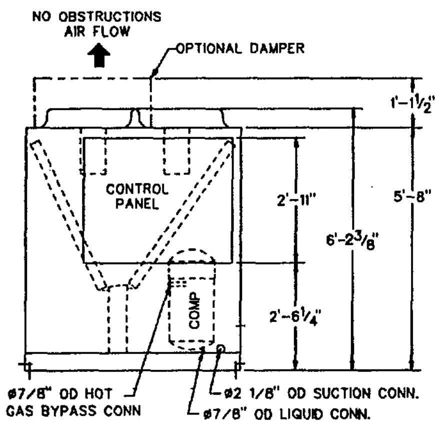


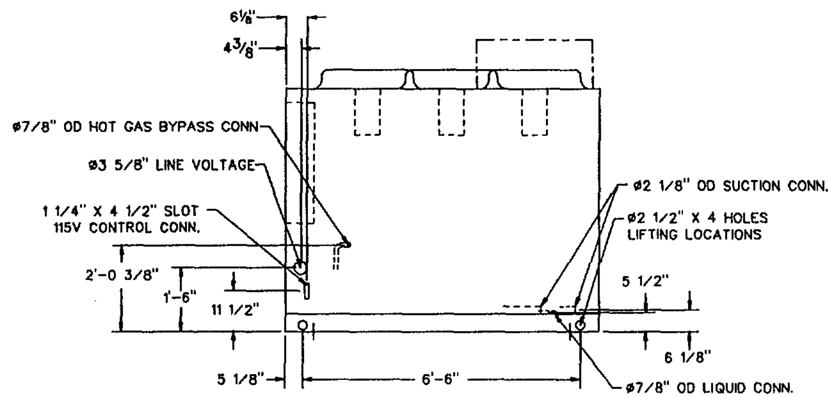
Figure 4
RAUC-C30 Unit Dimensions, Recommended Clearances, Mounting Locations, Electrical and Refrigerant Connection Sizes and Locations



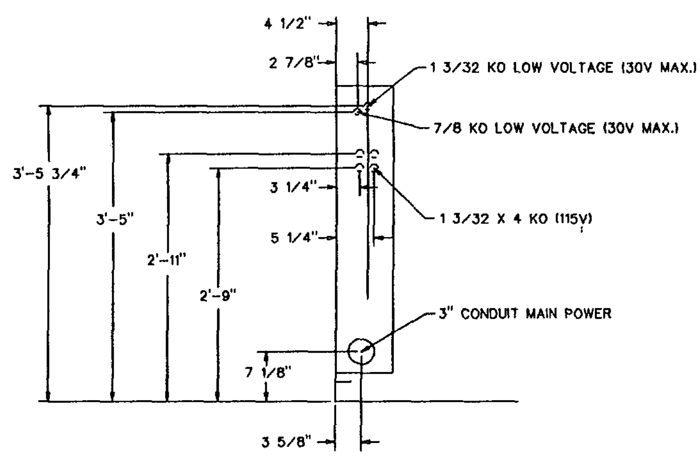
TOP VIEW



LEFT SIDE VIEW



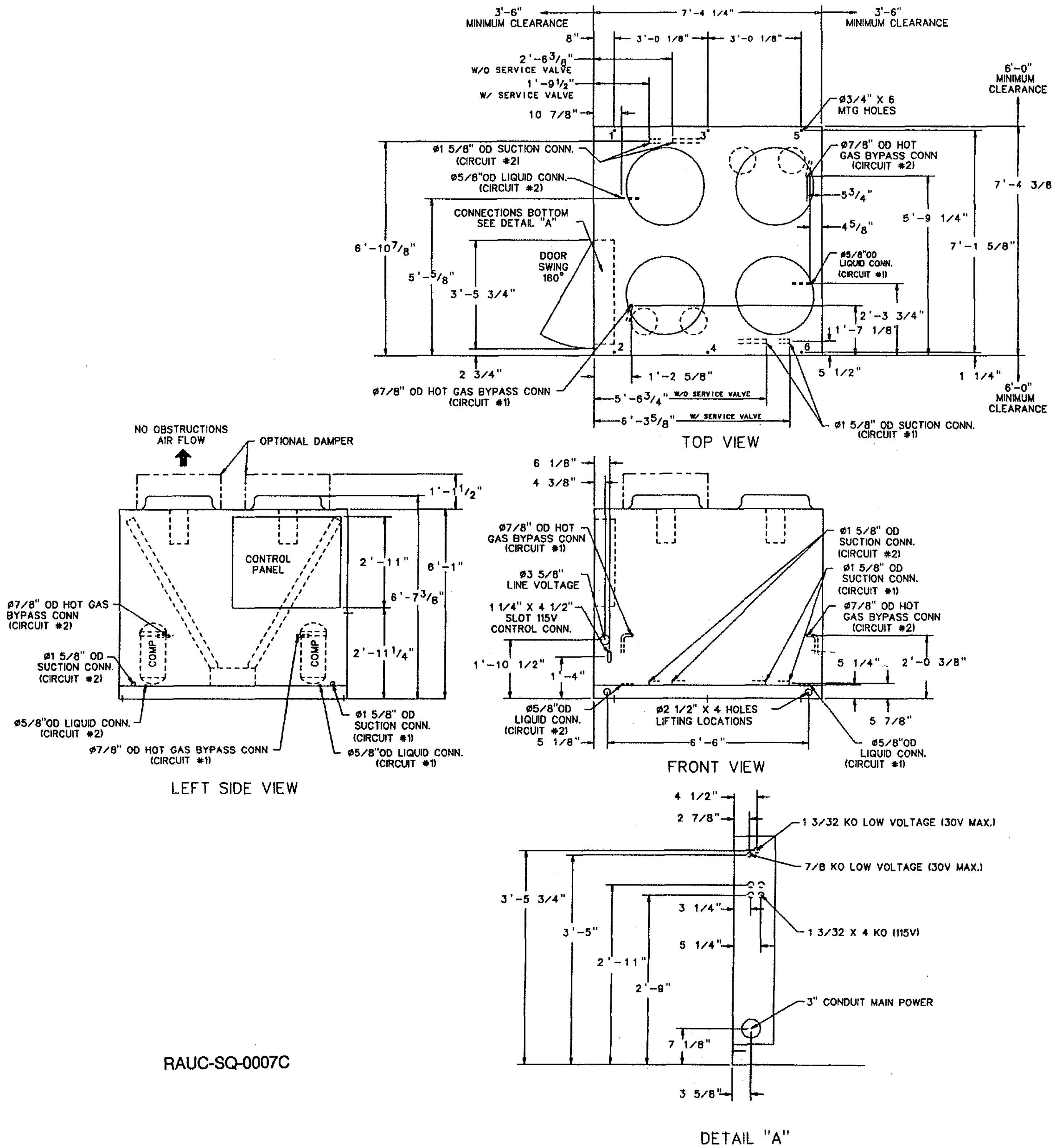
FRONT VIEW



DETAIL "A"

RAUC-SQ-0006C

Figure 5
RAUC-C40 Unit Dimensions, Recommended Clearances, Mounting Locations, Electrical and Refrigerant Connection Sizes and Locations



RAUC-SQ-0007C

Figure 6
RAUC-C50 Unit Dimensions, Recommended Clearances, Mounting Locations, Electrical and Refrigerant Connection Sizes and Locations

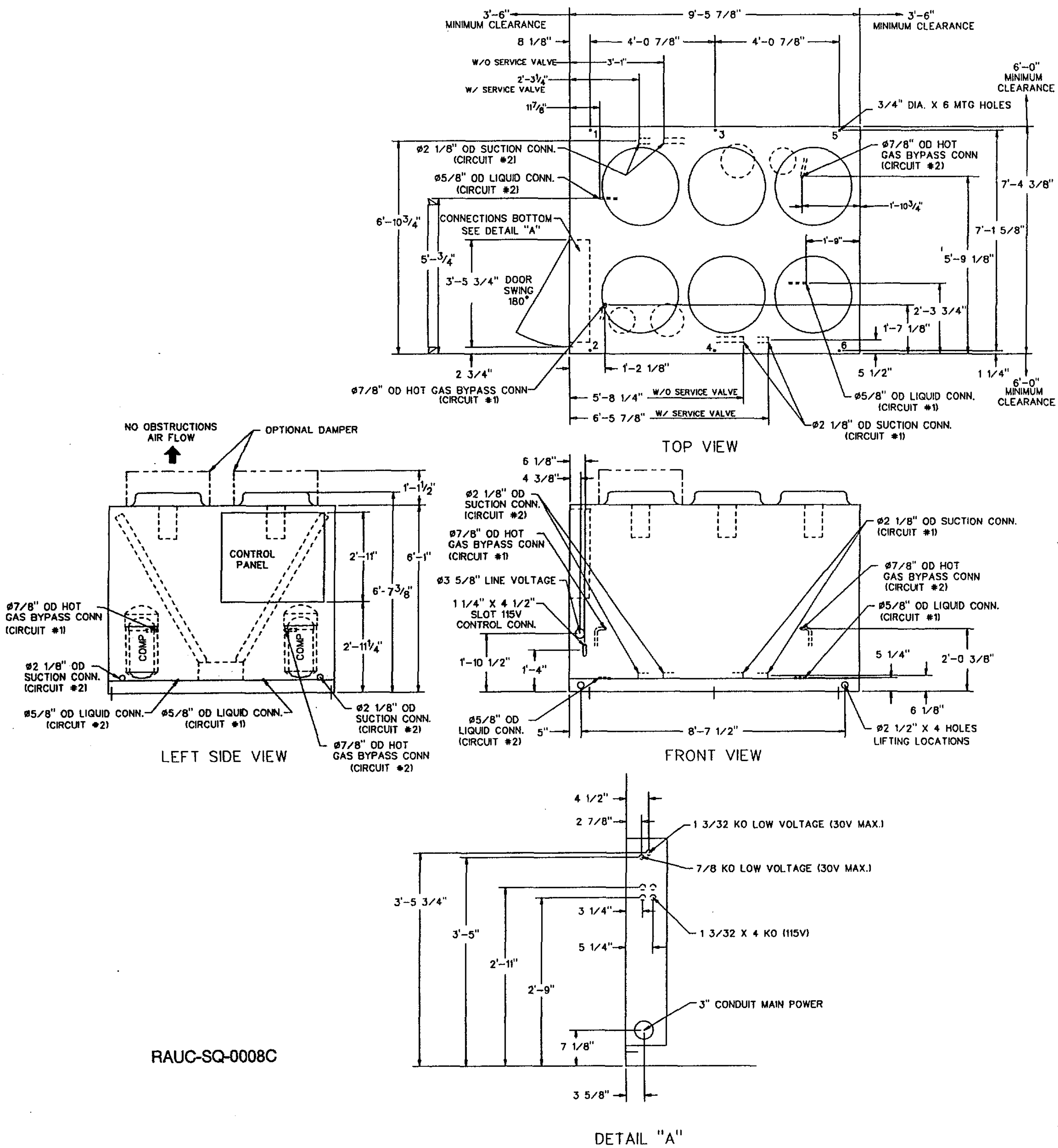
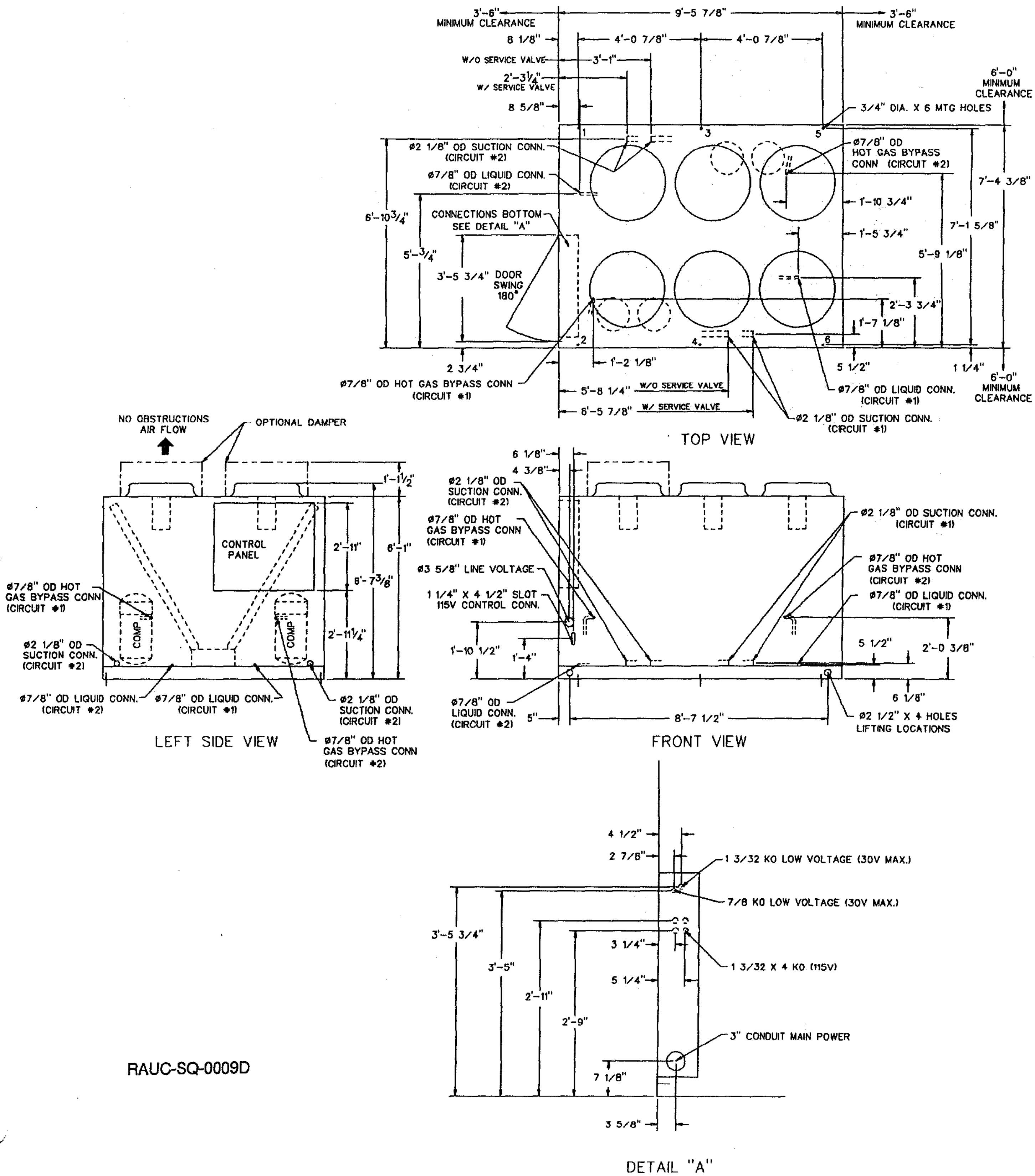


Figure 7
RAUC-C60 Unit Dimensions, Recommended Clearances, Mounting Locations, Electrical and Refrigerant Connection Sizes and Locations



Location and Clearances

RAUC Condensing Unit

Select a location for the condensing unit where air will flow, without obstruction, upward through the coil and away from the fan discharge. **Limit the length of refrigerant piping** by locating the condensing unit as close to the evaporator as possible.

Caution: To prevent coil starvation, do not locate the unit under any type of overhanging obstruction.

Do not place the unit near any obstruction which may hinder airflow. Minimum required condenser air clearances are shown in Table 1. These clearances must be maintained.

Table 1 also shows recommended clearances for multiple unit installations and clearances applying to units placed in a pit or well.

Foundation

If the condensing unit is installed at ground level, place it above the snow line. Provide concrete footings or foundation for support. Construct the footings in accordance with the operating weight distribution given in Figure 9. Install isolators, if desired, or hold down bolts in the footings to anchor the unit. Refer to "Condensing unit Isolation" for spring isolator selection and location.

For rooftop applications, make certain the roof is strong enough to support the unit and to avoid transmitting vibrations. Figure 9 lists unit operating weights. Check with a roofing contractor for proper waterproofing procedures to ensure that the roof does not develop leaks as a result of the unit weight, vibration, and hot weather. Use isolators to minimize transmission of vibrations into the building. Anchor the unit to the roof with hold-down bolts or isolators. Follow the instructions under "Condensing Unit Isolation" for proper isolator placement and installation.

Rigging

WARNING! Any on-site lifting equipment must be capable of handling the weight of the unit with an adequate safety factor. Use of under-capacity lifting equipment can result in personal injury or death and serious damage to the unit.

Rig the condensing unit as shown in Figure 8. Connect the lifting cables to lifting holes on the unit base rail. Use spreaders to protect the top of the unit when it is lifted. The point where the slings meet at the lifting hook must be at least 7 feet above the unit. Unit weights are given in Figure 8.

Warning! Do not use chains (cables) or slings except as shown in Figure 8. Other lifting arrangements may cause equipment damage or serious personal injury.

Figure 8
RAUC-C20 Thru C60
Rigging and Center of Gravity Data

Unit Size	Shipping Weight (Max. Lbs)	Location of Center of Gravity = ⊕			
		X		Z	
		In	mm	In	mm
RAUC-C20	1730	37	940	34	864
RAUC-C25	1906	37	940	35	889
RAUC-C30	2225	31	787	29	737
RAUC-C40	3100	44	1118	45	1143
RAUC-C50	3658	54	1372	45	1143
RAUC-C60	4260	54	1372	45	1143

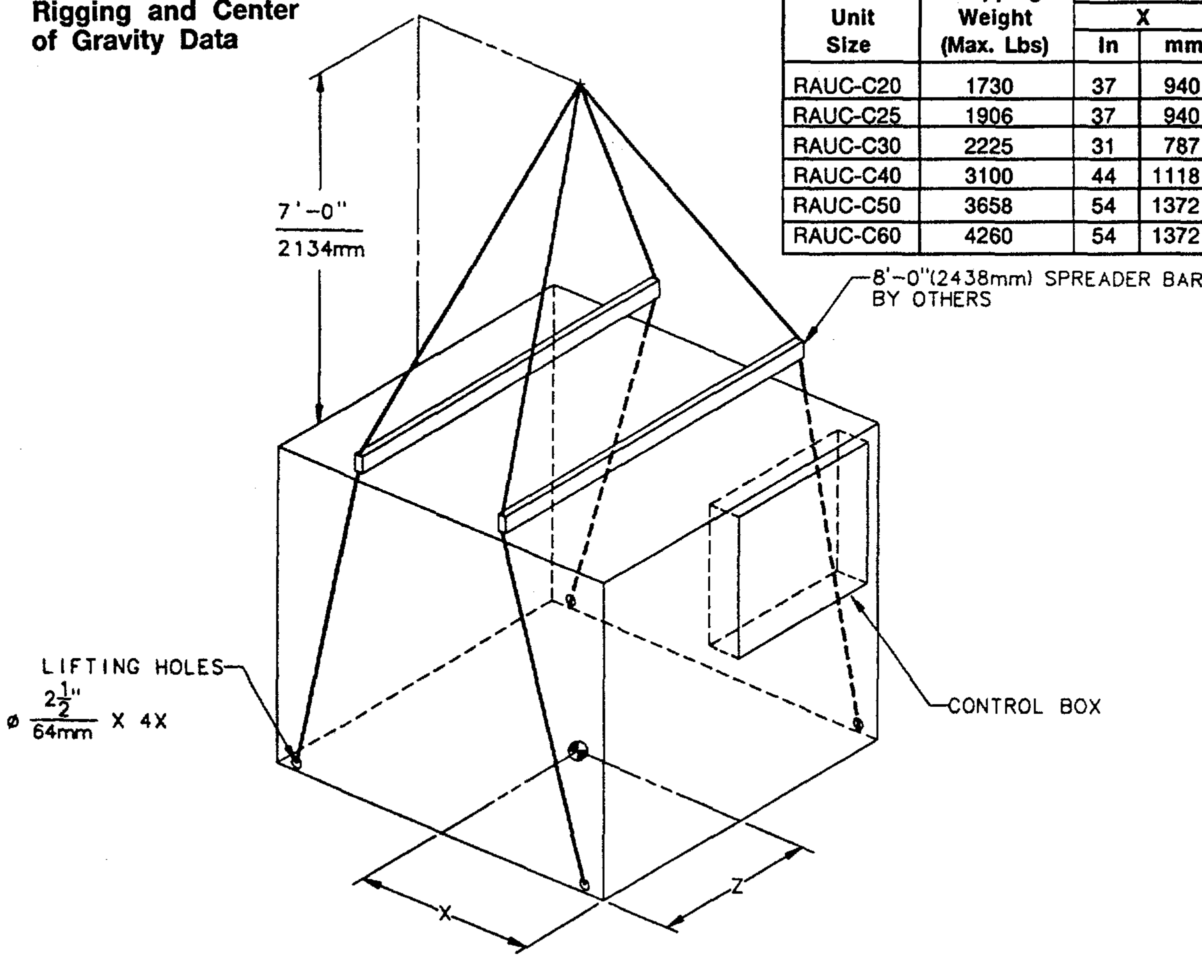


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Table 1
Rauc Unit Clearance Data

Unit Size	Service Clearance	Airflow Clearances: Single Unit Installation	Side by Side Installation	Pit Installation: Max. Depth	Coil Clearance
20 ton	4' 0"	8' 0"	16' 0"	5' 2½"	16' 0"
25 ton	4' 0"	8' 0"	16' 0"	5' 2½"	16' 0"
30 ton	4' 0"	8' 0"	16' 0"	5' 8"	16' 0"
40 ton	4' 0"	8' 0"	16' 0"	6' 1"	16' 0"
50 ton	4' 0"	8' 0"	16' 0"	6' 1"	16' 0"
60 ton	4' 0"	8' 0"	16' 0"	6' 1"	16' 0"

Condensing Unit Isolation

Mounting methods that will minimize sound and vibration problems are:

1. Mount the unit directly on an isolated concrete pad or on isolated concrete footings at each unit mounting point.
2. Install the optional neoprene or spring mounting isolators at each mounting location. Refer to "Neoprene isolators" or "Spring isolators".

Leveling the Unit

Before snugging down 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 adjustable isolators are not used. Unit mounting locations are shown in Figures 2-7 and Figure 9. Operating weights and weight loading at each mounting location are provided in Figure 9. See Figure 9 for isolator selection and placement data. Isolators are identified by color and by the isolator part number.

Neoprene Isolators

Install neoprene isolators at each unit mounting point using the following procedure (isolator locating dimensions are shown in figures 2-7):

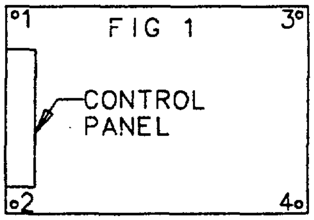
1. Secure the isolator to the mounting surface using the mounting holes in the base of the isolator (Figure 9). **Do not fully tighten the isolator mounting bolts at this time.**
2. Align the mounting holes in the base rail of the unit with the holes in the top of the isolators and lower the unit.
3. Install mounting bolts through the unit base rail into the threaded tap in the isolator and tighten securely. Maximum isolator deflection should be approximately 1/4 inch.
4. Level the unit carefully. Refer to "Leveling the Unit".
5. After the unit is level, tighten the isolator mounting botls to secure them to the mounting surface.

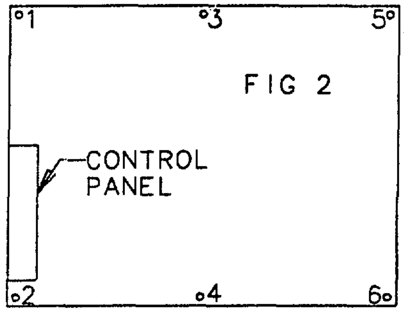
Spring Isolators

Install spring isolators at each unit mounting point using the following procedure (isolator locating dimensions are shown in figures 2-7):

1. Bolt the isolators to the mounting surface using the mounting slots in the isolator base plate. **Do not fully tighten the isolator mounting bolts at this time.**
2. Set the unit to the isolators; the isolator positioning pins (Figure 9) must register in the unit mounting holes.
3. Clearance between upper and lower isolator housings should be 1/4 to 1/2 inch (Figure 9). A clearance of over 1/2 inch dictates that shims are required to level the unit (See "Leveling the Unit").
4. Make minor clearance adjustments by turning the isolator leveling bolt (Figure 9) clockwise to increase clearance and counterclockwise to decrease clearance.
5. 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. After the unit is level, tighten the isolator mounting bolts to secure them to the mounting surface.

Figure 9
Typical RAUC Isolators and Isolator Selection and Positioning Information

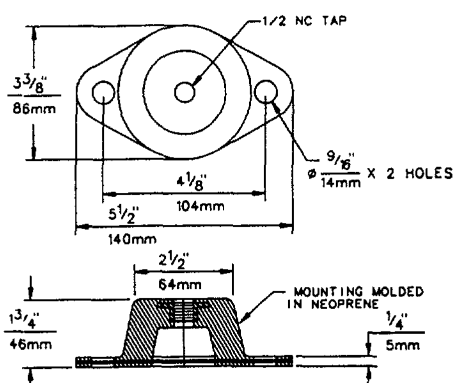




CUSTOMER NOTE:
1. ADJUST ISOLATOR SO THAT TOP PLATE CLEARS LOWER HOUSING BY AT LEAST 1/4" [6 mm] & NOT MORE THAN 1/2" [13 mm]

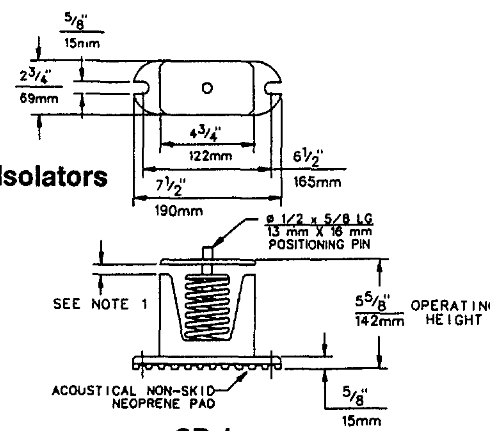
UNIT	OPERATING WEIGHT		WEIGHT ON ISOLATOR AT MOUNTING LOCATION											
			LOC. 1		LOC. 2		LOC. 3		LOC. 4		LOC. 5		LOC. 6	
	AL	CU	AL	CU	AL	CU	AL	CU	AL	CU	AL	CU	AL	CU
RAUC-C20	1528	1726	399	440	512	562	270	318	347	406	—	—	—	—
RAUC-C25	1703	1905	430	476	587	633	290	342	396	454	—	—	—	—
RAUC-C30	1942	2233	694	768	630	690	324	408	294	367	—	—	—	—
RAUC-C40	2782	3114	458	503	482	525	452	508	475	530	446	513	469	535
RAUC-C50	3274	3666	586	643	610	667	535	600	557	622	483	557	504	577
RAUC-C60	3716	4256	662	747	684	766	609	705	629	723	556	664	575	680

Neoprene Isolators



R-3

Spring Isolators



CP-1

KIT NO.	UNIT	FIG	MOUNTING LOCATION & ISOLATOR PART NO.					
			LOC. 1	LOC. 2	LOC. 3	LOC. 4	LOC. 5	LOC. 6
5707-0377-2900	RAUC-C20	1	R-3-GRN	R-3-GRN	R-3-RED	R-3-RED	—	—
5707-0377-3000	RAUC-C25	1	R-3-GRN	R-3-GRAY	R-3-RED	R-3-GRN	—	—
5707-0377-3100	RAUC-C30	1	R-3-GRAY	R-3-GRAY	R-3-RED	R-3-RED	—	—
5707-0377-3200	RAUC-C40	2	R-3-GRN	R-3-GRN	R-3-GRN	R-3-GRN	R-3-GRN	R-3-GRN
5707-0377-3300	RAUC-C50	2	R-3-GRAY	R-3-GRAY	R-3-GRAY	R-3-GRAY	R-3-GRN	R-3-GRN
5707-0377-3400	RAUC-C60	2	R-3-GRAY	R-3-GRAY	R-3-GRAY	R-3-GRAY	R-3-GRAY	R-3-GRAY

KIT NO.	UNIT	FIG	MOUNTING LOCATION & ISOLATOR PART NO.					
			LOC. 1	LOC. 2	LOC. 3	LOC. 4	LOC. 5	LOC. 6
5707-0377-3700	RAUC-C20	1	CP-1-26	CP-1-27	CP-1-25	CP-1-26	—	—
5707-0377-3800	RAUC-C25	1	CP-1-27	CP-1-28	CP-1-25	CP-1-26	—	—
5707-0377-3900	RAUC-C30	1	CP-1-31	CP-1-31	CP-1-26	CP-1-25	—	—
5707-0377-4000	RAUC-C40	2	CP-1-27	CP-1-27	CP-1-27	CP-1-27	CP-1-27	CP-1-27
5707-0377-4100	RAUC-C50	2	CP-1-28	CP-1-28	CP-1-28	CP-1-28	CP-1-27	CP-1-27
5707-0377-4200	RAUC-C60	2	CP-1-31	CP-1-31	CP-1-28	CP-1-28	CP-1-28	CP-1-28

Compressor Isolation

To prepare the compressors for operation, the shipping braces must be removed.

Removing Compressor Shipping Braces

Before the unit ships, two shipping braces are factory installed, securing each compressor mounting rail to the base rails of the unit (Figure 10). This prevents excessive compressor movement during shipment (both compressors are rigidly bolted to their mounting rails.). **These braces must be removed before the unit is operated.** Use the procedure that follows:

1. Remove the two hold-down bolts that secure each shipping brace to the base rail of the unit.

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.

Compressor Rail Isolator Sleeve Removal

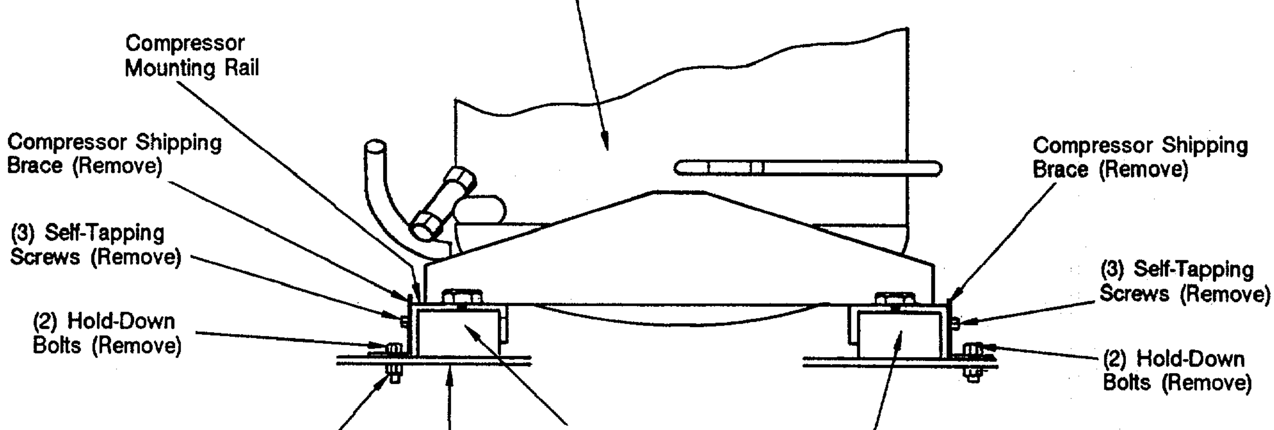
1. Remove the cap screw, washer and upper isolator from the top of one of the compressor mounting feet.

2. Extract the sleeve from the lower isolator.

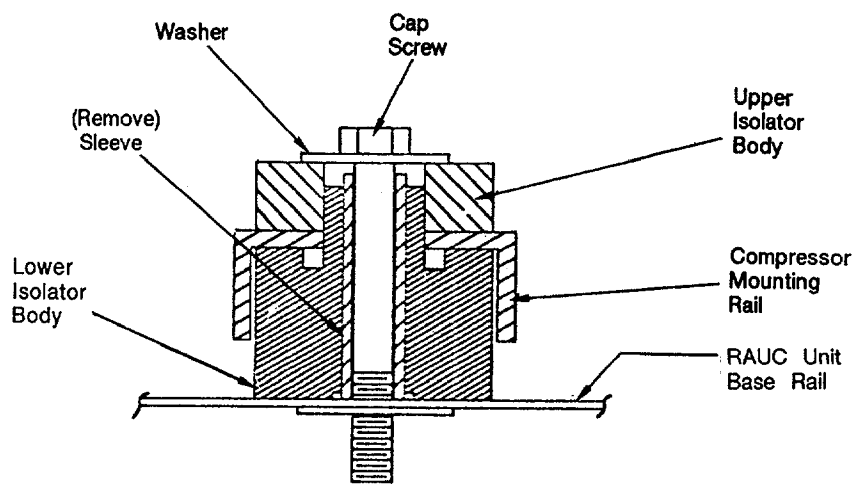
3. Reinstall the upper isolator and washer, then insert the cap screw and tighten it down approximately 2 to 3 turns.

4. Repeat steps 1 through 3 for each compressor mounting foot.

Figure 10
RAUC Compressor Isolation



End View



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Detail - Cross Section of Compressor Rail Isolator

Model EVP Chiller Unit Installation Considerations

The model 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.

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

The EVP chiller should be mounted on a base of suitable strength to support operating weight. EVP chiller weights and mounting foot dimensions are given in Figures 11-16 and Table 2.

The EVP chiller unit must be installed level. Be sure to allow adequate clearance for water and refrigerant piping connections, space to conduct service procedures and to read gauges, thermometers and operate water system valves. Provide sufficient space at one end of the chiller to pull tubes (Figures 11-16 and Table 3). EVP general information is given in Table 3.

Table 2
EVP Chiller Weights (lbs)

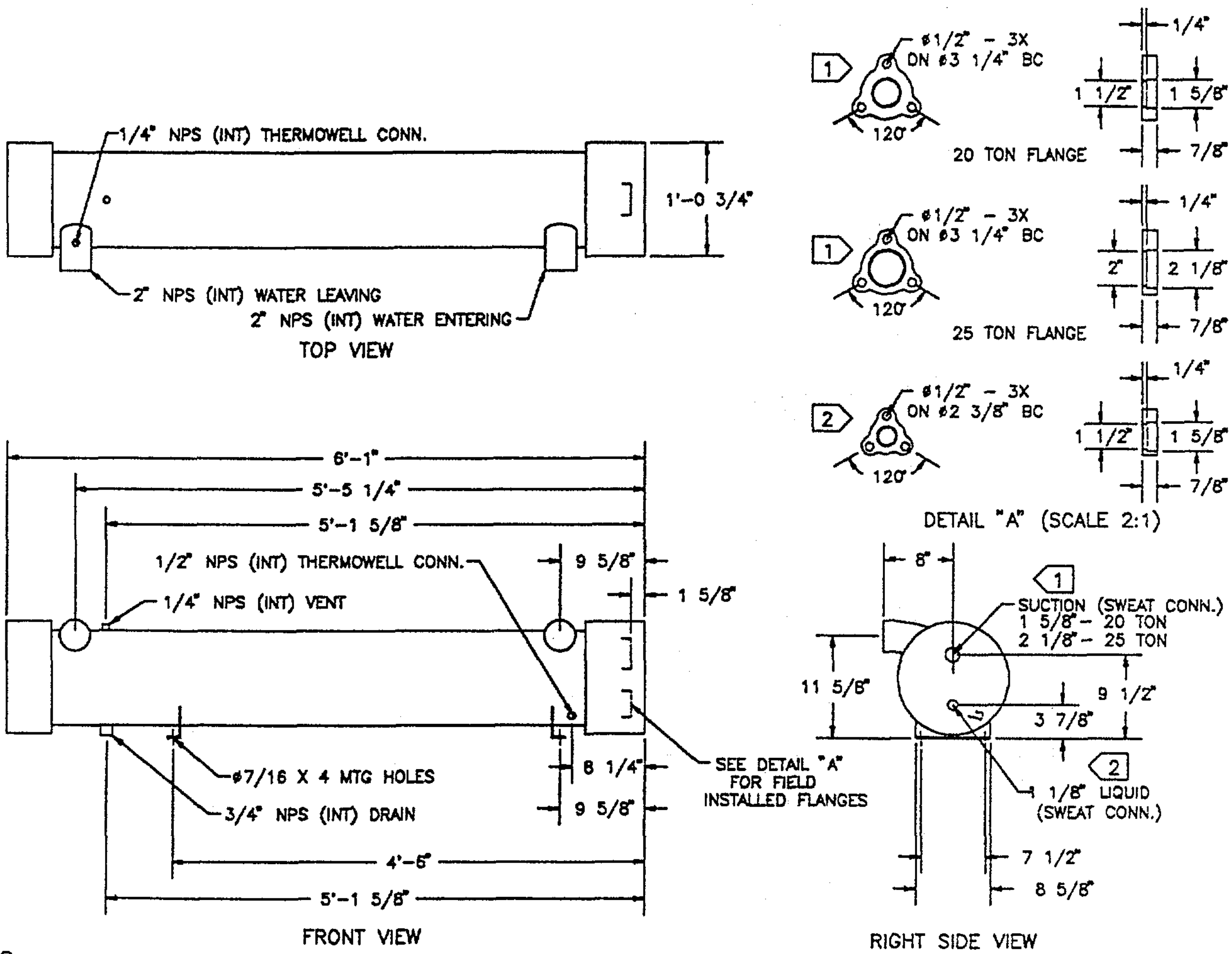
Chiller Size	Shipping Weight	Operating Weight
20 ton	280	360
25 ton	280	360
30 ton	360	470
40 ton	380	480
50 ton	430	580
60 ton	470	600

Table 3
EVP Chiller General Information

Chiller Size	No. of Ref. Circuits	Capacity (Gallons)	Refrigerant Charge (lbs)*	Tube Pull (Inches)**
20 ton	1	11.7	8	73
25 ton	1	10.7	10	73
30 ton	1	16.3	12	74
40 ton	2	13.8	16	74
50 ton	2	21.0	20	96
60 ton	2	18.5	24	96

* Refrigerant charge is approximate and for the evaporator chiller only
** Tube pull given is the length of the evaporator

Figure 11
EVPB-C20 Evaporator Chiller Dimensions, Refrigerant and Water Connection Sizes and Locations, and Pressure Drop Chart



NOTES:

1. DIMENSIONAL TOLERANCE IS ±1/8".
2. ALLOW 6'-1" TUBE REMOVAL CLEARANCE EITHER END OF EVAPORATOR.

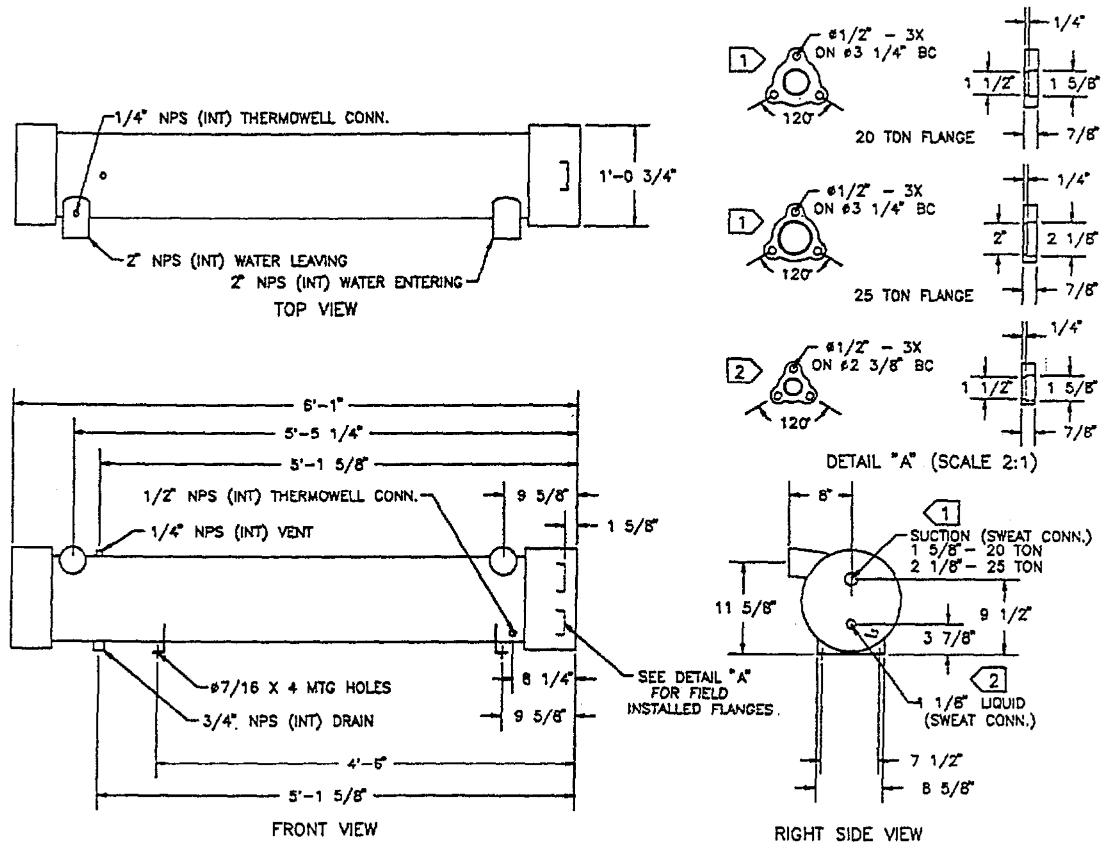
Evaporator Flange Connection.
Flange adapter and O-ring supplied by Trane.

Evaporator Chiller Pressure Drop

	GPM	Pressure Drop
MIN	25	3.8
	30	5.4
	35	7.2
	40	9.2
	45	11.5
	50	14.0
	60	19.6
MAX	70	26.1

Feet of Water

Figure 12
EVPB-C25 Evaporator Chiller Dimensions, Refrigerant and Water Connection Sizes and Locations, and Pressure Drop Chart



NOTES:

1. DIMENSIONAL TOLERANCE IS ±1/8".
2. ALLOW 6'-1" TUBE REMOVAL CLEARANCE EITHER END OF EVAPORATOR.

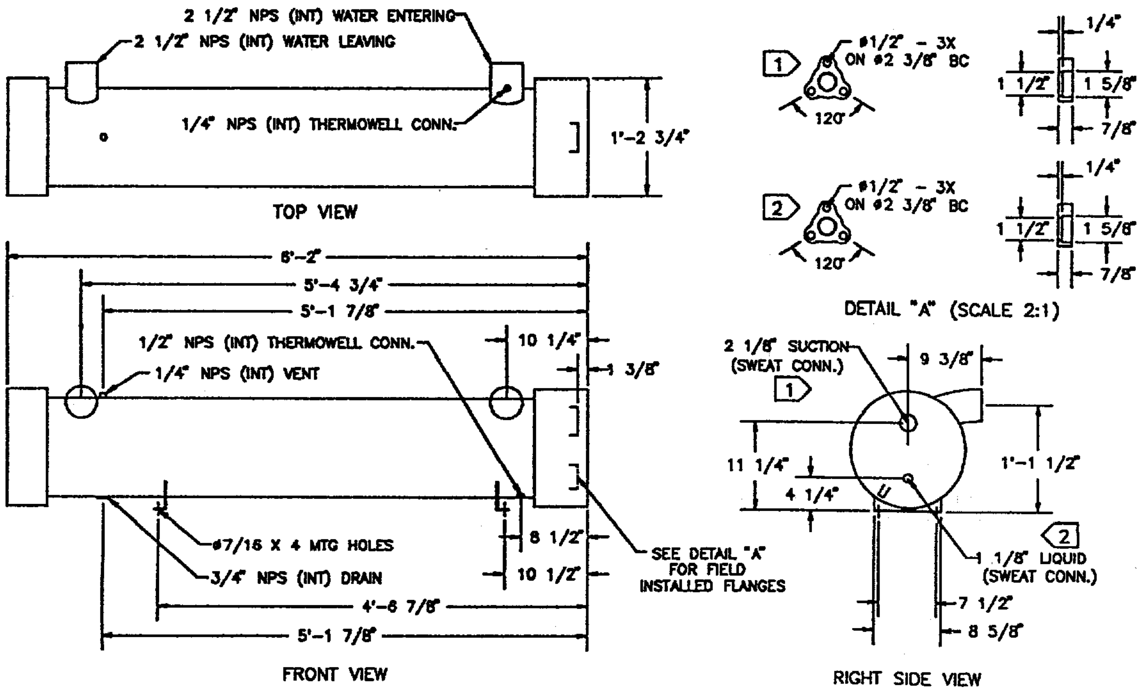
Evaporator Flange Connections.
Flange adapter and O-ring supplied by Trane.

Evaporator Chiller Pressure Drop

	GPM	Pressure Drop
MIN	30	3.7
	35	5.0
	40	6.4
	45	7.9
	50	9.6
	60	13.5
	70	18.1
MAX	80	23.2

Feet of Water

Figure 13
EVPB-C30 Evaporator Chiller Dimensions, Refrigerant and Water Connection Sizes and Locations, and Pressure Drop Chart



NOTES:

1. DIMENSIONAL TOLERANCE IS ± 1/8".
2. ALLOW 6'-2" TUBE REMOVAL CLEARANCE EITHER END OF EVAPORATOR.

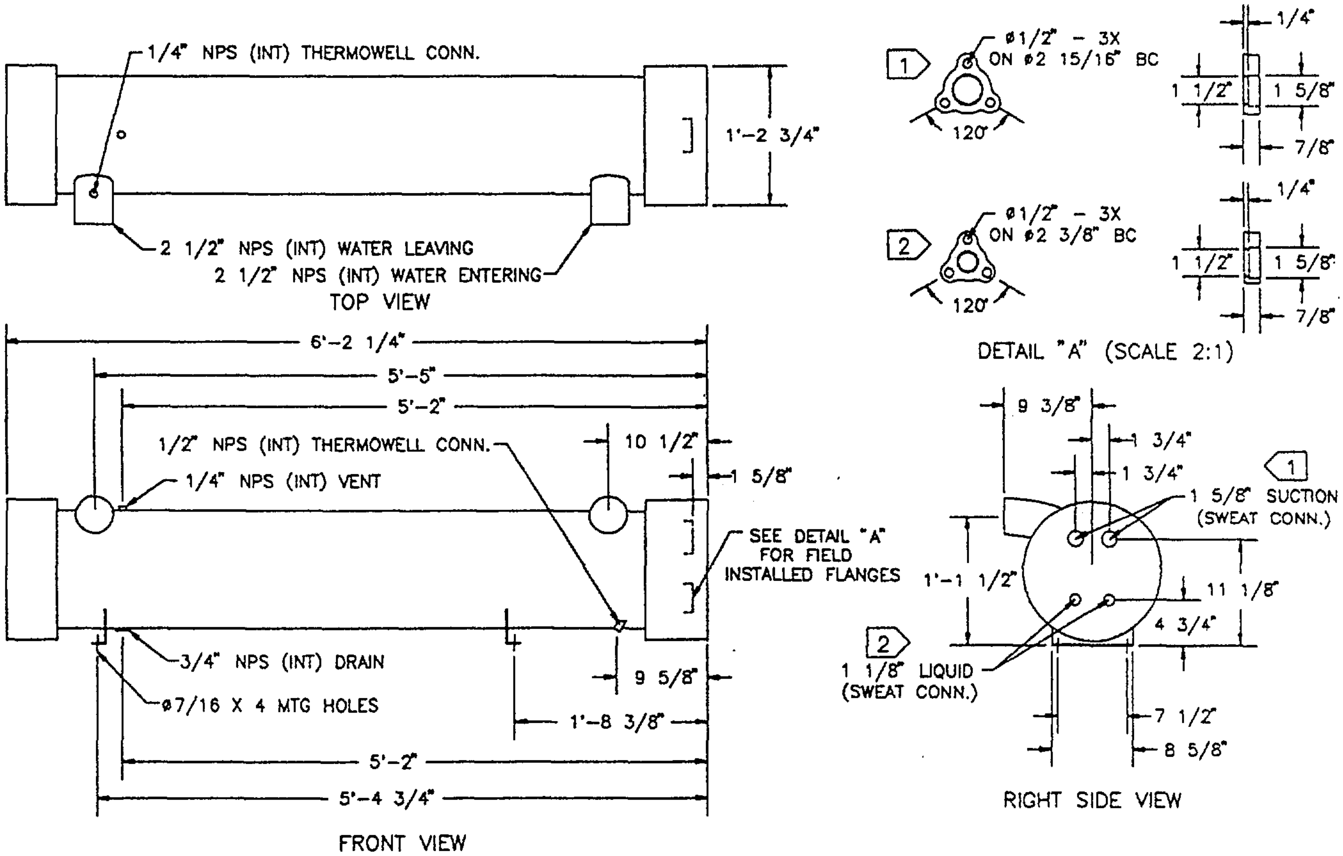
Evaporator Flange Connections.
Flange adapter and O-ring supplied by Trane.

Evaporator Chiller Pressure Drop

	GPM	Pressure Drop
MIN	35	2.1
	40	2.7
	45	3.4
	50	4.1
	60	5.8
	70	7.7
	80	9.9
	90	12.3
MAX	100	16.0

Feet of Water

Figure 14
EVPB-C40 Evaporator Chiller Dimensions, Refrigerant and Water Connection Sizes and Locations, and Pressure Drop Chart



NOTES:

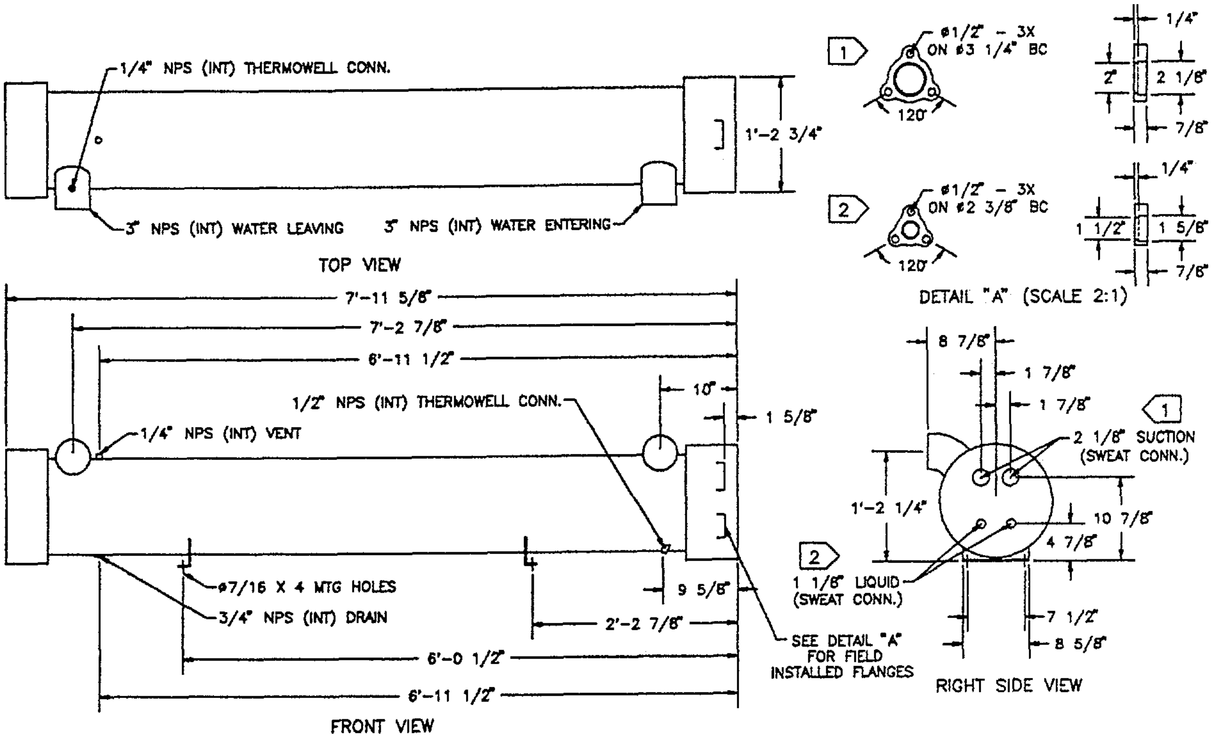
1. DIMENSIONAL TOLERANCE IS ± 1/8".
2. ALLOW 6'-2" TUBE REMOVAL CLEARANCE EITHER END OF EVAPORATOR.

Evaporator Chiller Pressure Drop

	GPM	Pressure Drop
MIN	50	4.1
	60	5.8
	70	7.7
	80	9.9
	90	12.3
	100	15.0
	120	21.1
MAX	140	28.1

Feet of Water

Figure 15
EVPB-C50 Evaporator Chiller Dimensions, Refrigerant and Water Connection Sizes and Locations, and Pressure Drop Chart



NOTES:

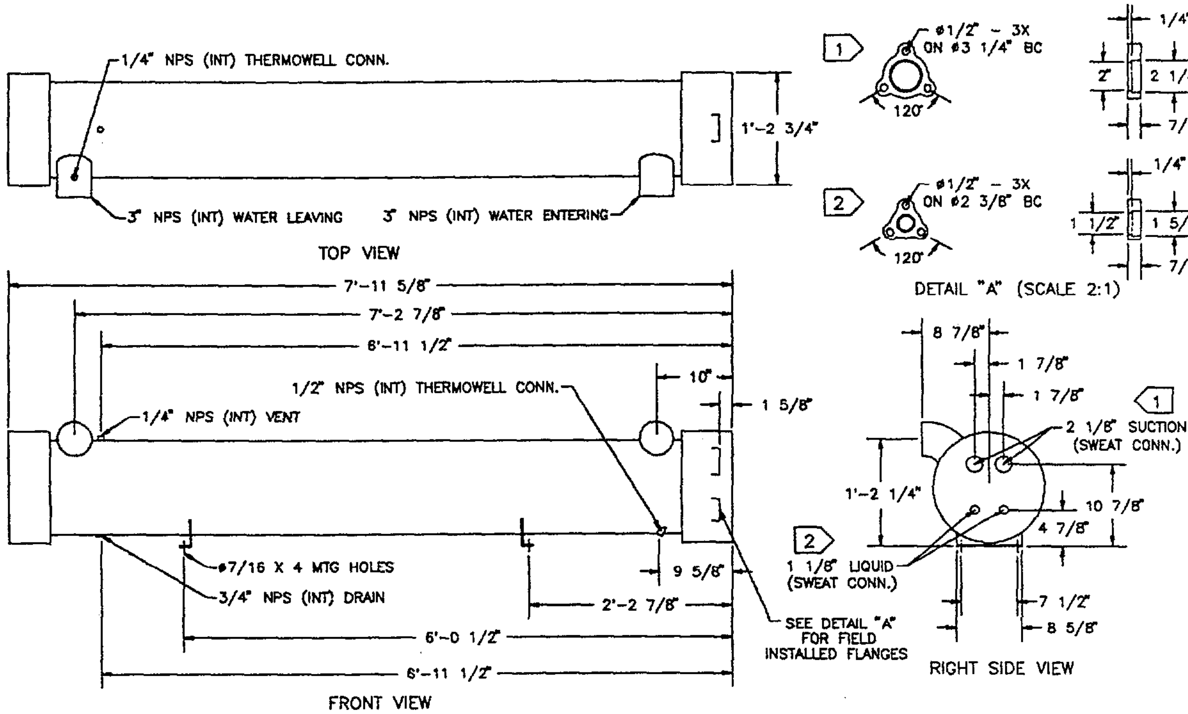
1. DIMENSIONAL TOLERANCE IS ±1/8".
2. ALLOW 8'-0" TUBE REMOVAL CLEARANCE EITHER END OF EVAPORATOR.

Evaporator Chiller Pressure Drop

	GPM	Pressure Drop
MIN	60	4.0
	70	5.4
	80	6.9
	90	8.6
	100	10.4
	120	14.7
	140	19.6
MAX	160	25.1

Feet of Water

Figure 16
EVPB-C60 Evaporator Chiller Dimensions, Refrigerant and Water Connection Sizes and Locations, and Pressure Drop Chart



NOTES:

1. DIMENSIONAL TOLERANCE IS ±1/8".
2. ALLOW 8'-0" TUBE REMOVAL CLEARANCE EITHER END OF EVAPORATOR.

Evaporator Chiller Pressure Drop

	GPM	Pressure Drop
MIN	80	5.6
	90	7.0
	100	8.5
	120	12.0
	140	15.9
	160	20.5
	180	25.5
MAX	200	31.0

Feet of Water

RAUC/EVPB Interconnecting Piping

Initial Leak Test

Trane condensing units and some evaporators are shipped with a holding charge of Refrigerant-22. Before installing these units, verify that the holding charge has not been lost. Install appropriate pressure gauges to the service valves and take the reading. If there is no pressure, the unit must be leak tested to determine the source of refrigerant loss. Before making any piping connections, check for leaks.

Important Note:
Do **not** release refrigerant to the atmosphere! Refer to general service bulletin MSCU-SB-1 (latest edition).

Refrigerant Piping Recommendations

Access unit refrigerant connections by removing the louvered grills. This will expose compressors and refrigerant connections (Figures 2-7).

Refrigerant piping must be properly sized and applied, since these factors have a significant effect on system performance and reliability.

Note: Piping should be sized and laid out according to the job plans and specifications. This should be done when the system components are selected. The primary objective when sizing piping for this unit is to make refrigerant line sizes as small as possible while avoiding excessive refrigerant pressure drops.

Caution: To prevent operating problems, use Type L refrigerant grade copper tubing only.

Isolate refrigerant lines from the building. This prevents transferring line vibration to the structure. Do not secure the lines rigidly to the building at any point since this will defeat the isolation system of the unit.

Liquid Line Piping

Liquid Line Connections

Liquid Line connection types, sizes and locations are given in Figures 2-7 and Table 4. Run liquid lines to the unit and connect to the stubs provided at the liquid line shutoff valves. See "Making Refrigerant Connections".

Note: The installer must cut appropriately-sized openings in the unit sheet metal for refrigerant piping entrance into the unit.

Liquid Line Components

Filter driers and valves (expansion valves, solenoid valves, charging valves, etc.) should be provided on the indoor portion of liquid lines (Figures 17 and 18). Minimize the use of valves, reducers and tube bends as much as possible to avoid excessive pressure drop before the expansion valve.

Liquid Line Filter Drier

Install filter driers (provided by the installer) in the liquid lines at the evaporator unit. Locate the drier upstream of the sight glass, solenoid and expansion valves (Figures 17 and 18).

Liquid Line Sight Glass

To aid in troubleshooting, charging and servicing the system, install sight glasses in the liquid lines at the evaporator unit (Figures 17 and 18). Locate the sight glass between the solenoid and expansion valves.

Liquid Line Solenoid Valves

Liquid line solenoid valves are not recommended on RAUC 20-60 ton units.

Thermostatic Expansion Valve (TEV)

The thermostatic expansion valve is a modulating valve designed to regulate the rate of refrigerant flow into the evaporator in exact proportion to the rate of the refrigerant evaporation. By regulating the rate of refrigerant flow, the level of superheat leaving the evaporator is held relatively constant. For maximum compressor reliability, Trane recommends that expansion valves be adjusted to achieve approximately 12° F superheat leaving the evaporator.

Trane recommends that externally equalized valves be utilized in order to compensate for pressure drop between the expansion valve and superheat control point (evaporator refrigerant outlet).

Thermostatic expansion valves are more likely to hunt at low system pressure conditions versus valve capacity conditions (valve pin is close to valve seat). This is most pronounced on larger tonnage valves and on systems with unloading compressors. Major expansion valve manufactures have a balance-ported valve which tends to overcome this problem: The Trane Company recommends this type of valve (when sizing permits) in order to maintain satisfactory superheat control down to lower valve loading conditions.

Various sensor charges are available and are described in valve supplier catalogs. Trane recommends the use of VGA charge (Sporlan) or straight W charge (Alco). These charges provide smooth control at air conditioning conditions and are less prone to charge migration than the conventional gas charged sensors.

Liquid Line Sizing

The Trane Company recommends sizing the liquid line diameter as small as possible while maintaining acceptable pressure drop. This will minimize required refrigerant charge, which in turn, maximizes compressor life.

Liquid risers in a system require an additional 0.5 psig pressure drop per each foot of vertical rise. If riser length exceeds 15 feet, a larger diameter and/or shorter liquid line may be required to provide required subcooling at the expansion valve. The line does not have to be pitched.

Basic liquid line sizing parameters with the system operating at full load are:
- Liquid velocity (max.)...600 fpm.
- Maximum allowable pressure drop ...7 psig (1F).

Liquid lines are not usually insulated. If, however, the line runs through an area of high ambient temperature (i.e., boiler room, etc.), subcooling may drop below required levels. Liquid lines passing through these warm spaces should be insulated.

Under typical operating conditions (40° F suction temperature and 95° F entering condensing air or 125° F condensing temperature) the liquid leaving the condenser is subcooled by approximately 17° F. Use this figure in calculating friction and static pressure losses in the line.

Suction Line Piping

Connections

Suction line connection types, sizes and locations are shown in Figures 2-7 and Table 4. Make connections at the pipe stubs provided. See "Making Refrigerant Connections".

Note: The installer must cut appropriately sized openings in the unit sheet metal for refrigerant piping entrance into the unit.

Components

Figure 17 illustrates typical EVP chiller refrigerant piping. Figure 18 shows typical evaporator piping for DX coils. Where suction lines must rise more than four feet, use a "P" trap at the base of the riser to ensure proper oil return to the compressor. Repeat the "P" trap for each 25 feet of riser. Traps must not be long enough horizontally to trap any significant amount of oil (two "street L's" may be connected together to form this type of trap).

Suction Line sizing

Design the suction line to provide sufficient gas velocity in both horizontal and vertical runs to entrain the compressor oil and insure a uniform rate of return to the compressor..

Size the **suction line** on the basis of:

- Producing gas velocity in horizontal runs at least 500 fpm at **minimum** operating conditions.
- Producing gas velocity in vertical risers at least 1000 fpm at **minimum** operating conditions.
- Maximum pressure drop of 3 psig.
- Gas velocity not to exceed 4000 fpm under **maximum** load conditions.

Pitch the horizontal runs of suction line toward the condensing unit at least 1/2" for each 10 feet of run.

Insulate the full length of the suction line and waterproof the insulation at all points that are exposed to the weather.

Note: Do not run uninsulated liquid and suction lines in contact with each other.

Hot Gas Bypass

If hot gas bypass is required, connect refrigerant tubing at the connection stubs provided on the unit, and run properly sized lines to the evaporator location. Hot gas bypass connection types, sizes and locations are shown in Figures 2-7. Insulate any portion of bypass line exposed to outdoor temperatures. An example of a DX coil utilizing hot gas bypass is shown in Figure 18.

Install hot gas bypass solenoid valves and regulating valves in the hot gas bypass lines. Connect solenoid valve coil leads as described in "Electrical Wiring."

Hot Gas Bypass Regulating Valves

The HGBP valve (Figure 19) regulates evaporator pressure by opening when suction pressure decreases, to maintain a desired minimum evaporating pressure regardless of a decrease in evaporator external loading.

When 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.

Valve Setpoint...

Hot gas bypass valves are adjustable and should be set to begin opening at 66 psig suction pressure and reach the full open position at 58 psig.

Making Refrigerant Connections

Refer to "Brazing Procedures" on page 68 of this manual when making refrigerant connections.

Note: Do not disperse refrigerant into the atmosphere!

If refrigerant piping connection stubs at the unit are capped, use refrigerant recovery devices attached to the service valves to recover as much refrigerant from the system as possible. Once the holding charge is recovered, punch a small hole in each of the seal cap connection stubs and unsweat the seal caps.

Caution: To prevent damage to the system, do not drill a hole in the seal caps. This may introduce copper chips into the system piping.

If refrigerant connections are not capped, but are "spun-end" tubes, use a tubing cutter to remove the end from the pipe.

Caution: To prevent damage to the system, do not saw ends off pipe stubs. This may introduce copper chips into the system piping.

Note: When making copper-to-steel flange connections at the chiller, use a BAg-7 or BAg-28 silver solder (or equivalent.)

Note: The installer must cut properly sized openings in the unit sheet metal for refrigerant piping entrance into the unit.

Flow dry nitrogen through the system piping when sweating the copper joints. This prevents scale formation and the possible formation of an explosive mixture of R-22 and air. Refrigerants near an open flame may also form highly-toxic phosgene gas.

WARNING! To prevent injury or death due to explosion and/or inhalation of phosgene gas, purge the system thoroughly while sweating connections.

Use a pressure regulator in the line between the unit and the high pressure nitrogen cylinder to avoid over pressurization and possible explosion.

WARNING! To prevent injury or death and possible equipment damage, always provide a pressure regulator to prevent excessively high system pressures.

Leak Testing Procedure

When Leak-testing a refrigerant system, observe the safety precautions:

WARNING! To prevent injury, do not work in a confined area where refrigerant or nitrogen may be leaking. Provide proper ventilation.

Table 4 Interconnecting Line Sizes

CONDENSING UNIT	LENGTH OF INTERCONNECTING LINES (FT)**																			
	0-20		21-40		41-60		61-80		81-100		101-120		121-140		141-160		161-180		181-200	
	LINE SIZE — O.D. (IN.)																			
	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT
RAUC20,40	5/8	1 5/8	7/8	1 5/8	7/8	1 5/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8
RAUC25,50	7/8	1 5/8	7/8	1 5/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	—	—
RAUC30,60	7/8	1 5/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	—	—	—	—	—	—

** In shaded region, use 2 1/8 for all horizontal runs, and 1 5/8 for all vertical risers.

WARNING! To prevent injury or death due to an explosion, never use oxygen, acetylene or compressed air for leak testing.

WARNING! To prevent injury or death and equipment damage due to line rupture or explosion, always install pressure regulator, shutoff valves and gauges to control pressure during leak testing.

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

1. Close the liquid line service valve(s) and the compressor discharge valve(s) to isolate the system high side from the low side.
2. Connect a refrigerant cylinder to the charging port of the liquid line service valve. Charge enough refrigerant into the circuit to raise high side pressure to 12 to 15 psig.
3. Disconnect the refrigerant cylinder and bring high side pressure up to code test pressure with oil-pumped dry nitrogen. Do not exceed condenser maximum working pressure. Refer to unit nameplate.

Caution: To prevent damage to system high side components, do not exceed condenser maximum working pressure during leak testing.

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, recover and reclaim the refrigerant, break the connection and remake as a new joint. Re-test for leaks after making repairs.
6. Repeat the test procedure for the system low side, charging through the suction pressure gauge port (with gauge removed) or through other access provided on the suction line by the installer. Build the system pressure to 100 psig.
7. Once the entire system is tested and repaired, recover and reclaim the refrigerant. Reopen the liquid line service valve and the compressor discharge service valve.

WARNING! To prevent injury or death, never exceed unit working pressure.

Pressure Testing

Pressure test the liquid line, evaporator and suction line at pressures dictated by local codes. Do not exceed the pressure control settings plus 10 + psig.

Low Ambient Option

When an RAUC unit is ordered with the low ambient option (i.e., model no. Digit 11 is "1"), a set of damper(s) is factory-installed over condenser fan(s) 2B2 (and 2B5 on 40, 50 and 60 ton units). See Figures 2-7 for damper locations.

Low Ambient Dampers

Low ambient dampers extend the minimum ambient temperature for RAUC operation from 40° F (45° F with HGBP) to 0° F (10° F with HGBP), by restricting airflow across the condenser coils. This allows the unit to maintain sufficient condenser head pressure during cold weather operation

Modulation of the low ambient dampers is controlled by a refrigerant-operated actuator that responds to circuit head pressure. When head pressure is 250 psig, the dampers are fully open, but they modulate closed as head pressure falls, reaching the fully closed position at 170 psig.

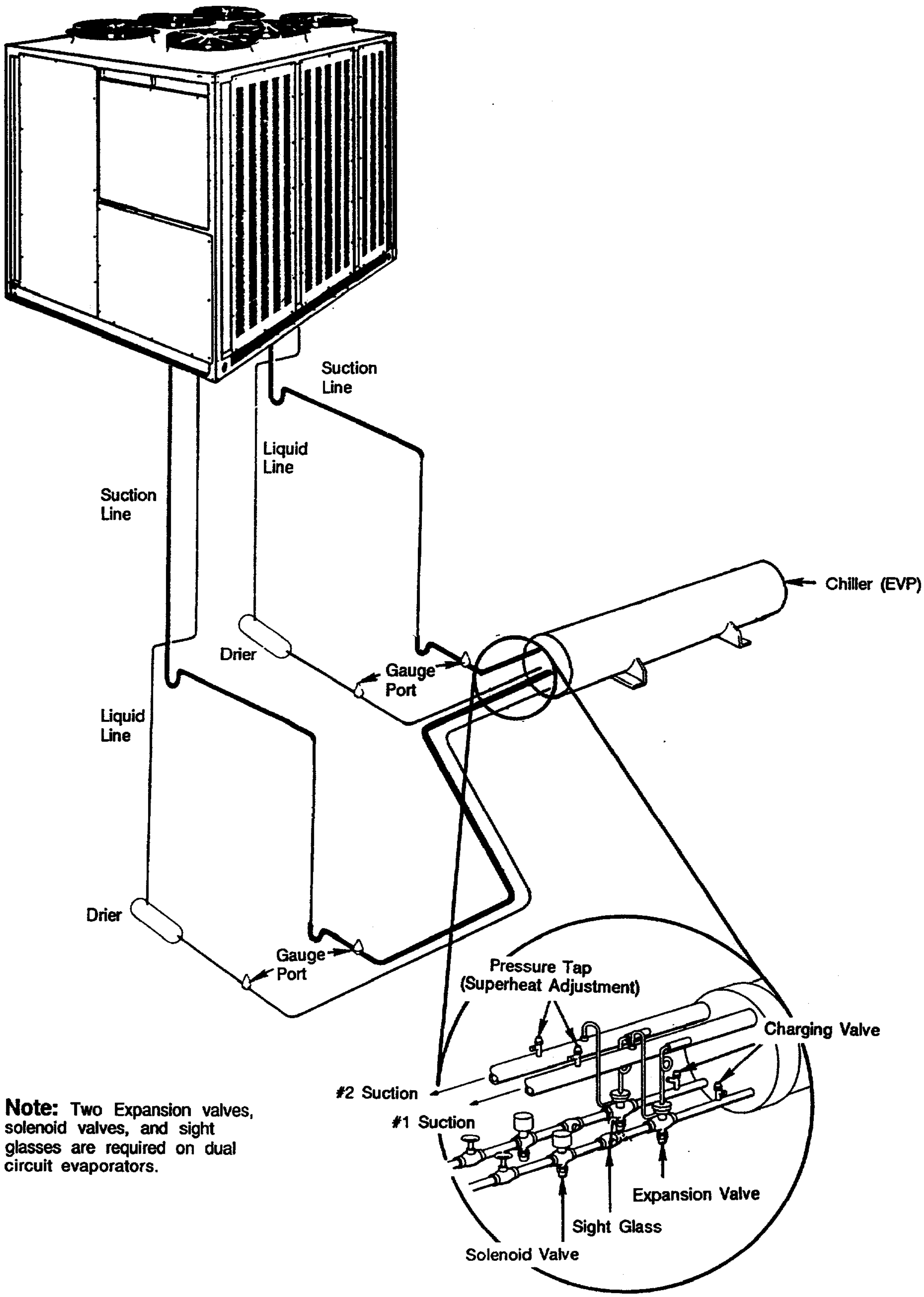
If low ambient dampers are to be field installed, mount them over the condenser fans at the locations shown in Figures 2 through 7 and connect the actuator capillary tube to the backseat port of the liquid line service valve for each circuit. (See installation instructions provided with the damper kit.) Check the damper blades for proper alignment and operation. If adjustment is required, hold the damper blades firmly in the closed position, and slide the operator to remove any slack in the actuating linkage.

Low Ambient Thermostats

(RAUC 25, 30, 50 and 60 ton units only)

In addition to the dampers, low ambient units are also equipped with low ambient thermostats which, upon opening at 30° F, further restrict airflow across the condenser by removing power from condenser fan(s) 2B3 (and 2B6 on 50 and 60 ton units). These condenser fans will re-energize when the temperature rises to 33° F.

Figure 17
Typical System Refrigerant Piping Layout for RAUC Unit (Located Above) with EVP Chiller (Located Below)



Note: Two Expansion valves, solenoid valves, and sight glasses are required on dual circuit evaporators.

Figure 18
Typical Refrigerant Piping Components for DX coil (including Hot Gas Bypass) Used with RAUC Condensing Unit

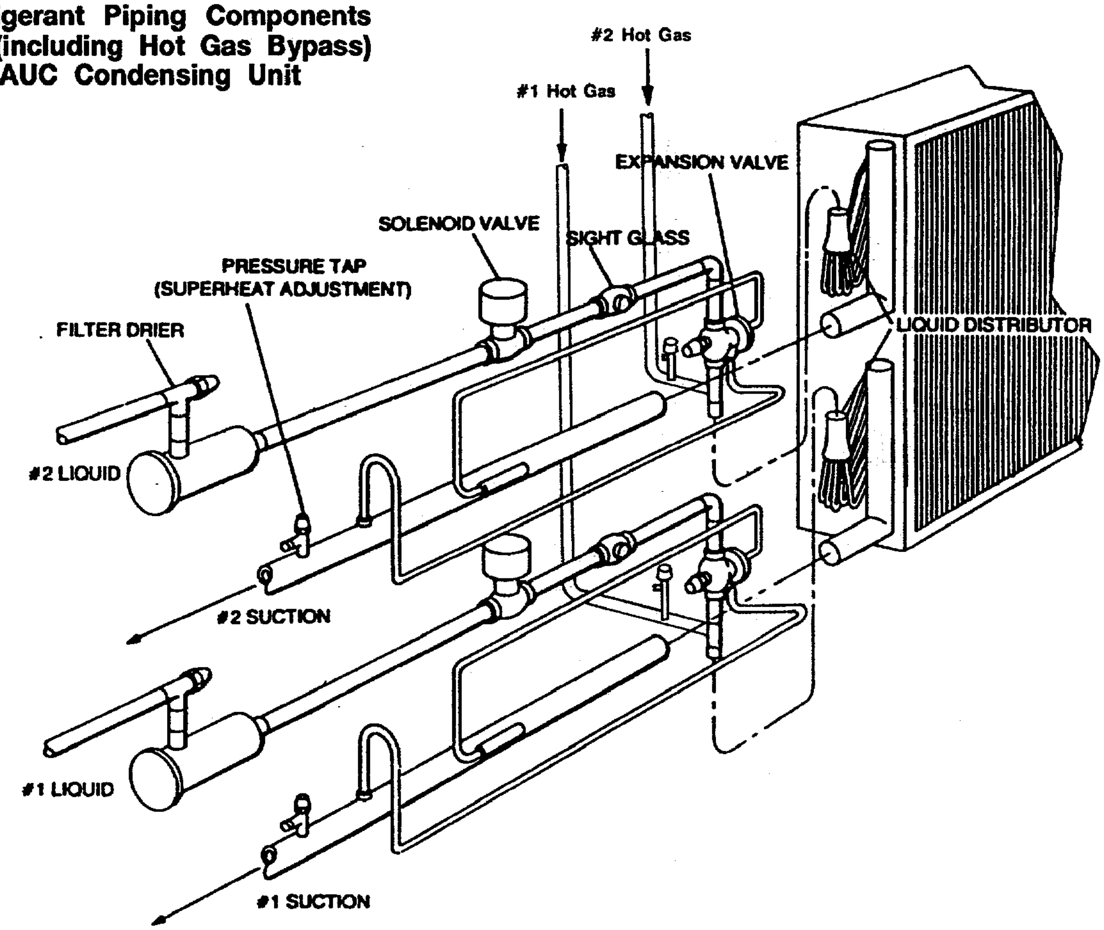
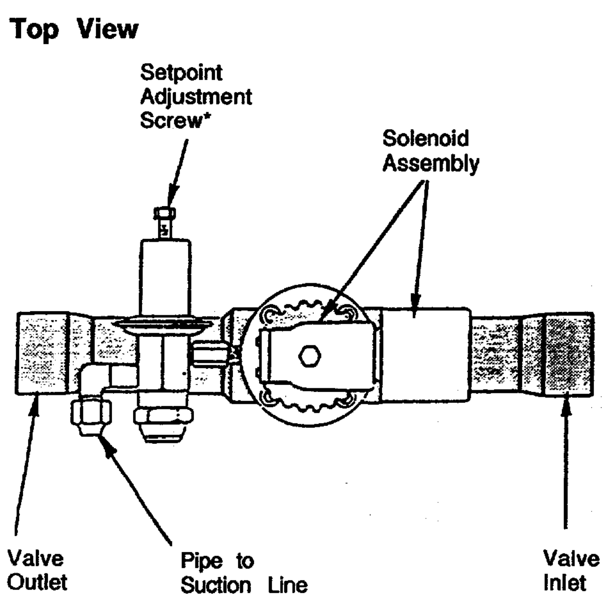
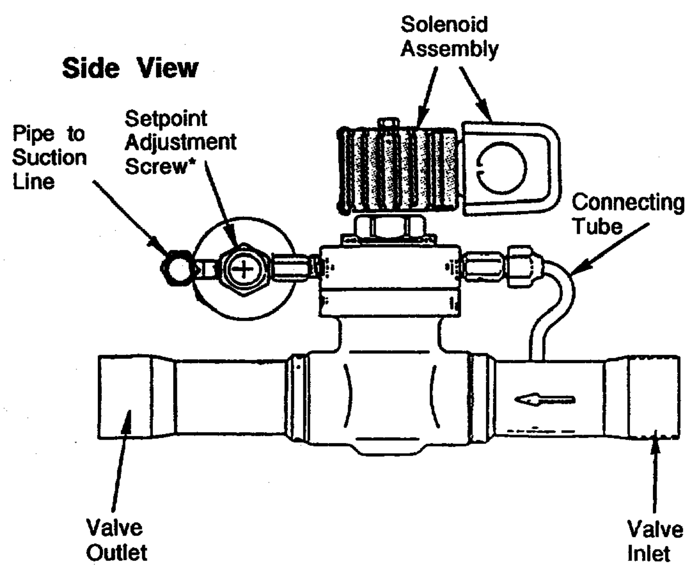


Figure 19
Typical Hot Gas Bypass Regulating Valve





*Turn Screw Clockwise (in) to increase valve setpoint and counterclockwise (out) to decrease setpoint.

EVP Chiller Piping and Components

Chilled Water Piping General Recommendations

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

Caution: If using an acidic commercial flushing solution, construct a temporary bypass around the EVP chiller barrel to prevent damage to internal components of evaporator.

Isolate water pumps from the system to avoid vibration transmission. Minimize heat gain and prevent condensation by insulating all water piping. Use a pipe sealant or teflon tape on all water connections.

Caution: To prevent damage to water piping, do not over tighten connections.

Chiller Water Connections

Evaporator water inlet and outlet types, sizes and locations are shown in Figures 11-16.

Chiller Water Piping Components

Figure 20a illustrates typically recommended evaporator piping components. A vent is located on top of the chiller at the return end. Provide additional vents at high points in the piping to bleed air from the chilled water system. Install pressure gauge(s) to monitor entering and leaving chilled water pressure.

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

Provide shutoff valves in the line(s) to the gauge(s) to isolate the gauges when not in use. Use pipe unions to simplify disassembly for system service. Use vibration eliminators to prevent transmitting vibrations through the water lines.

Install thermometers in the lines to monitor evaporator entering and leaving water temperatures. Install a balancing cock in the leaving water line. It will be used to establish a balanced water flow.

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

Install a pipe strainer in the evaporator water return line to protect components from water-borne debris.

Chiller Drain

The chiller drain connection (Figure 20a) should be piped to a suitable drain facility for evaporator drain-down during service or shutdown. Provide a shutoff valve in the drain line.

If the drain connection is not piped, remove the drain plug from its shipping location in the control panel and install it in the drain connection.

Chiller Flow Switch

Install a flow switch or other flow sensing device to prevent or stop compressor operation if evaporator water flow drops off drastically. Locate the device in the evaporator chilled water outlet line as shown in Figure 20a. See field wiring and unit schematics for the flow switch electrical interlock diagram. The flow switch shown in Figure 20b ships with only those RAUC units whose model numbers include a "T" in digit 13 or later.

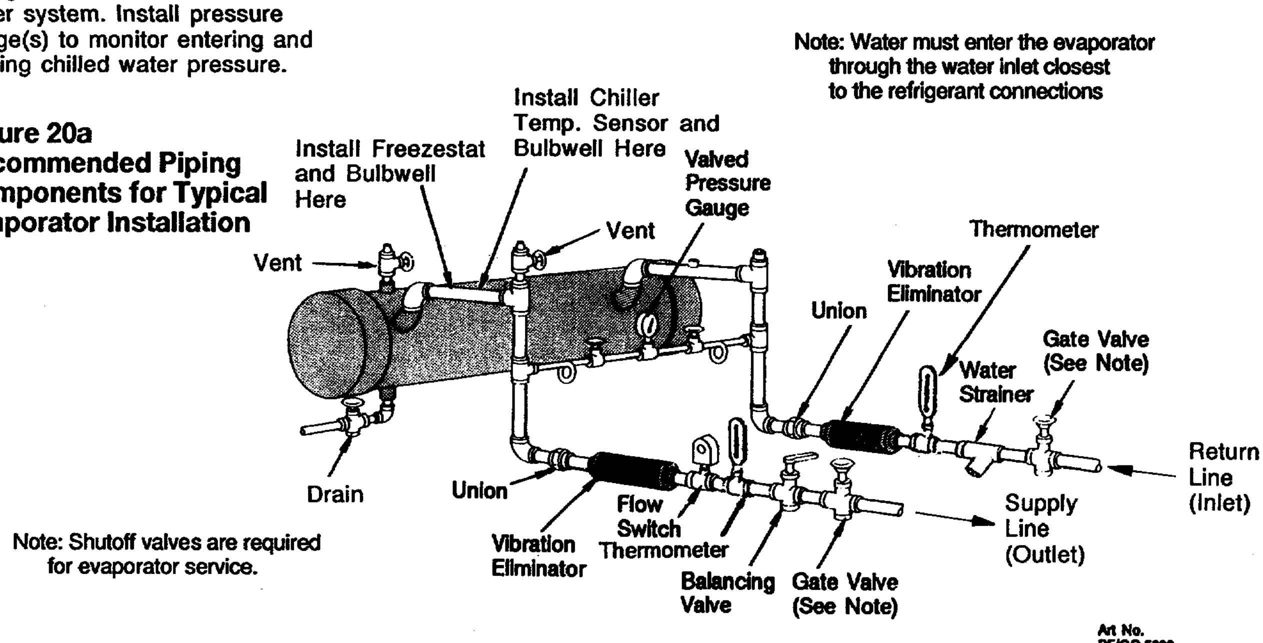
Chilled Water Temperature Sensor

On EVP chiller units, the chiller control (located in the temperature controller panel) controls system operation in response to evaporator leaving water temperature as sensed by the chilled water temperature sensor. This sensor must be installed by the unit installer.

Water Shut-off Valves

Water shut-off valves must be installed for evaporator, sensor and other component service.

Figure 20a
Recommended Piping Components for Typical Evaporator Installation



Fiqure 20b
Optional Flow Switch

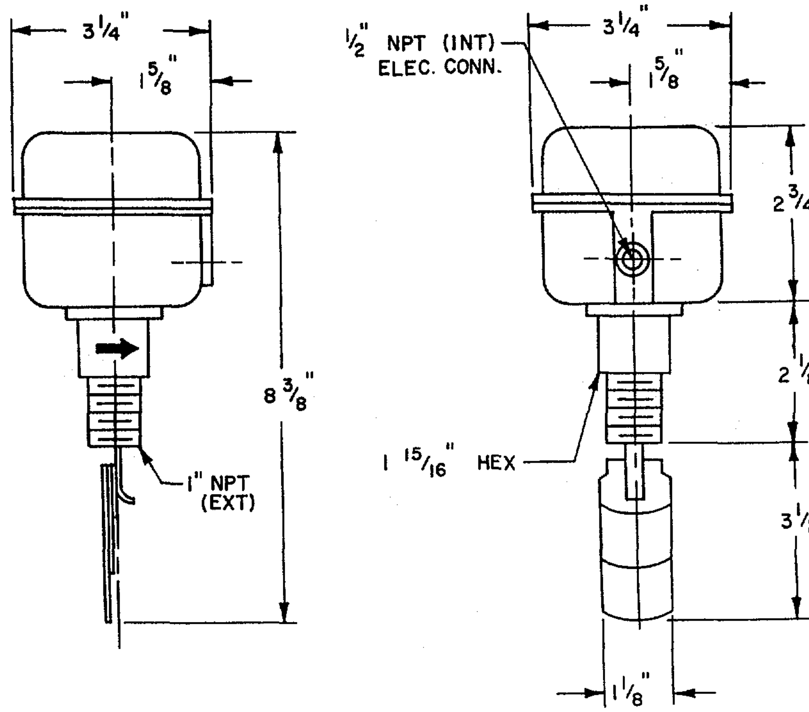
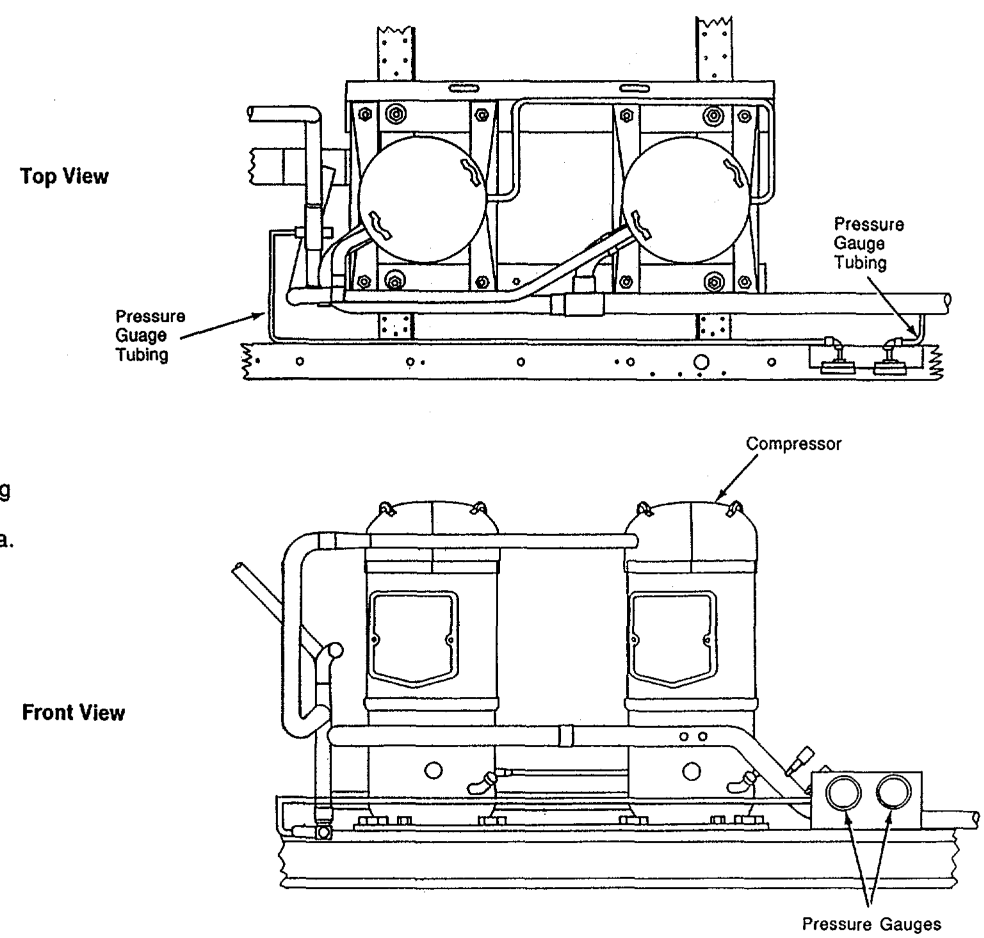


Figure 20c
Optional Field Installed Pressure Gauge Locations



Optional Pressure Gauges

Figure 20c shows the location of optional pressure gauges after field installation.

When an RAUC unit is ordered with optional pressure gauges, (model number digit 13 or later is a "F"), a set of gauges, the necessary mounting hardware, and installation instructions ship in the location shown in figure 1a.

Electrical Information

Electrical Wiring

General Recommendations

WARNING! To prevent injury or death from electrical shock, disconnect power source before completing wiring connections to unit.

All wiring must comply with local and national electrical codes. The installer must provide properly sized system interconnecting and power supply wiring with appropriate fused disconnect switches. Type and locations of disconnects must comply with all applicable codes.

Caution: Use only copper conductors for terminal connections to avoid corrosion or overheating.

Refer to Table 5 on pages 32 and 33 for unit and motor electrical data (minimum circuit ampacities, maximum fuse size, etc.). This information is also provided on the unit nameplate. Typical field wiring diagrams are shown on pages 41, 47, 50 and 52.

Power Supply Wiring - All Units

Run appropriately sized power wiring through the line voltage access opening(s) provided on the right side of the unit. Then, run it up through the conduit connection(s) provided in the bottom of the control panel and connect it to the power terminal block (1TB1) or unit disconnect switch (1S1) in the control panel (Figure 2-7).

Refer to page 34 for wire sizing recommendations at the line power terminal block (1TB1) or unit disconnect switch (1S1) in the control panel.

Note: When connecting wires at the terminal block or disconnect switch, make sure that all lugs are tight. Also check the terminal blocks and compressor contactor lugs that were wired at the factory.

Unit electrical diagrams (schematic, connection and field wiring) are glued to the inside of the control panel access door.

Install fused disconnects as required by local codes. Provide a proper equipment ground to the ground connections in the control panel.

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

Caution: 200/230-Volt Units:

As shipped, transformer 1T1 is wired for 200-volt operation. If unit is to be operated on 230-volt power supply, rewire the transformer as shown on the unit schematic.

Note: It is also necessary to provide proper line power (with fused disconnects) to the evaporator unit ("No Control", VAV and Constant Volume units) or chilled water pump motor (EVP control units). Be certain that these components are properly grounded.

Unit Voltage

Electrical power to the unit must meet stringent requirements for the unit to operate properly. Total voltage supply and voltage imbalance between phases should be within the following tolerances.

Voltage Supply

Measure each leg of supply voltage at all line voltage disconnect switches. Readings must fall within the voltage utilization range shown on the unit nameplate. If voltage on any leg does not fall within tolerance, notify the power company to correct this situation before operating the unit. Inadequate voltage to the unit will cause control components to malfunction and shorten the life of electrical components and compressor motors.

Voltage Imbalance

Excessive voltage imbalance between phases in a three-phase system will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2 percent. Voltage imbalance is defined as follows:

$$\%\ \text{Voltage Imbalance} = \frac{100 \times |V_A - V_D|}{V_A}$$

$$\text{Where } V_A = \frac{V_1 + V_2 + V_3}{3} \text{ (Avg. Voltage)}$$

$V_1, V_2, V_3,$ = Line Voltage

V_D = Line Voltage that deviates farthest from V_A.

Example:

If the three voltages measured at the line voltage fused disconnect are 221 volts, 230 volts and 227 volts, the average (V_A) would be:

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

V_D = 221

The percentage of imbalance is then:

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

The 2.2 percent imbalance that exists in the example above exceeds maximum allowable imbalance by 0.2 percent. This much imbalance between phases can equal as much as 20 percent current imbalance with a resulting increase in winding temperature that will decrease compressor motor life.

115 V Control Wiring

Run appropriately sized 115V control wiring for system electrical components through the access openings provided on the right side of the unit (Figures 2-7). Then, run the leads to the (5) 115V conduit connections provided in the temperature controller panel. Connect the 115V leads to the appropriate terminals in the temperature controller panel.

These components may include:
- hot gas bypass solenoid wiring;
- evaporator fan control and interlock wiring;
- system control switch wiring ("No Control" units only);
- step controller wiring ("No Control" units only);
- chilled water pump interlock wiring (EVP units only);
- chilled water flow switch wiring (EVP units only); and,
- outside air thermostat wiring (EVP units only).

Note: Provide proper ground for control circuitry at the ground connections provided in the temperature controller panel.

Low Voltage Wiring

Run appropriately sized 24V control wiring (NEC Class 2) for low-voltage control components through the access openings provided on the right side of the unit (Figures 2-7). Then, run the leads to the (2) 24V conduit connections provided in the side of the temperature controller panel. Connect the 24V leads to the appropriate terminals in the temperature controller panel.

Low-voltage components include:
- constant-volume thermostat (including DC wiring);
- system control switch wiring (VAV units only);
- night setback relay wiring (VAV units only);
- economizer actuator circuit wiring VAV units only);
- discharge air sensor wiring (VAV units only);
- chilled water temperature sensor (EVP units only); and,
- jumpers for hot gas bypass operation.

Table 5
Condensing Unit
Electrical Data
(Unit Characteristics)

Electrical Data – Condensing Units

		Unit Characteristics			
Model	Electrical Characteristics	Allowable Voltage Range	Minimum Circuit Ampacity	Maximum Fuse Size	Recommended Dual Element Fuse Size
RAUC-C20G	200-230/60/3XL	180-220/208-254	101	125	125
RAUC-C204	460/60/3XL	416-508	44	60	50
RAUC-C205	575/60/3XL	520-635	35	45	40
RAUC-C209	380/415/50/3XL	342-418/373-456	42	50	50
RAUC-C25G	200-230/60/3XL	180-220/208-254	129	175	150
RAUC-C254	460/60/3XL	416-508	56	80	70
RAUC-C255	575/60/3XL	520-635	45	60	60
RAUC-C259	380/415/50/3XL	342-418/373-456	55	80	70
RAUC-C30G	200-230/60/3XL	180-220/208-254	148	200	175
RAUC-C304	460/60/3XL	416-508	65	90	80
RAUC-C305	575/60/3XL	520-635	52	70	60
RAUC-C309	380/415/50/3XL	342-418/373-456	65	90	80
RAUC-C40G	200-230/60/3XL	180-220/208-254	192	225	225
RAUC-C404	460/60/3XL	416-508	84	100	90
RAUC-C405	575/60/3XL	520-635	67	80	80
RAUC-C409	380/415/50/3XL	342-418/373-456	80	90	90
RAUC-C50G	200-230/60/3XL	180-220/208-254	244	300	175
RAUC-C504	460/60/3XL	416-508	106	125	125
RAUC-C505	575/60/3XL	520-635	85	100	100
RAUC-C509	380/415/50/3XL	342-418/373-456	104	125	125
RAUC-C60G	200-230/60/3XL	180-220/208-254	282	300	300
RAUC-C604	460/60/3XL	416-508	123	125	125
RAUC-C605	575/60/3XL	520-635	98	110	110
RAUC-C609	380/415/50/3XL	342-418/373-456	122	125	125

NOTES:
1. Electrical data is for each individual motor.
2. Maximum fuse size permitted by N.E.C. 440-22 is 225 percent of the largest compressor motor RLA plus the remaining motor RLA and FLA values.
3. Minimum circuit ampacity is 125 percent of the largest compressor motor RLA plus the remaining motor RLA and FLA values.
4. Recommended dual element fuse size is 150 percent of the largest compressor motor RLA plus the remaining motor RLA and FLA values.
5. Kw values are taken at conditions of 45° F saturated suction temperature at the compressor and 95° F ambient.
6. Local codes may take precedence.

(Continued on the next page)

Table 5 (continued)

Model	Electrical Characteristics	Condenser Fan Motor Kw (Ea)	Condenser Fan Motor No.	Condenser Fan Motor Hp	Condenser Fan Motor FLA (Ea)	Condenser Fan Motor LRA (Ea)	Compressor Motor No.	Compressor Motor RLA (Ea) 10 Ton	Compressor Motor RLA (Ea) 15 Ton	Compressor Motor LRA (Ea) 10 Ton	Compressor Motor LRA (Ea) 15 Ton	Compressor Motor Kw (Ea) 10 Ton	Compressor Motor Kw (Ea) 15Ton
RAUC-C20G	200-230/60/3XL	0.9	2	1.0	4.1	20.7	2	41.4	—	247.0	—	10.7	—
RAUC-C204	460/60/3XL	0.9	2	1.0	1.8	9.0	2	18.1	—	95.0	—	10.4	—
RAUC-C205	575/60/3XL	0.9	2	1.0	1.4	7.2	2	14.4	—	76.0	—	10.4	—
RAUC-C209	380/415/50/3XL	0.75	2	1.0	1.7	9.2	2	17.2	—	104.0	—	10.6	—
RAUC-C25G	200-230/60/3XL	0.9	3	1.0	4.1	20.7	2	41.4	60.5	247.0	376.0	10.9	16.3
RAUC-C254	460/60/3XL	0.9	3	1.0	1.8	9.0	2	18.1	26.3	95.0	142.0	10.6	15.8
RAUC-C255	575/60/3XL	0.9	3	1.0	1.4	7.2	2	14.4	21.0	76.0	114.0	10.6	15.8
RAUC-C259	380/415/50/3XL	0.75	3	1.0	1.7	9.2	2	17.2	26.2	104.0	153.0	10.8	16.3
RAUC-C30G	200-230/60/3XL	0.9	3	1.0	4.1	20.7	2	—	60.5	—	376.0	—	15.9
RAUC-C304	460/60/3XL	0.9	3	1.0	1.8	9.0	2	—	26.3	—	142.0	—	15.5
RAUC-C305	575/60/3XL	0.9	3	1.0	1.4	7.2	2	—	21.0	—	114.0	—	15.5
RAUC-C309	380/415/50/3XL	0.75	3	1.0	1.7	9.2	2	—	26.2	—	153.0	—	16.2
RAUC-C40G	200-230/60/3XL	0.9	6	1.0	4.1	20.7	4	41.4	—	247.0	—	10.7	—
RAUC-C404	460/60/3XL	0.9	6	1.0	1.8	9.0	4	18.1	—	95.0	—	10.4	—
RAUC-C405	575/60/3XL	0.9	6	1.0	1.4	7.2	4	14.4	—	76.0	—	10.4	—
RAUC-C409	380/415/50/3XL	0.75	6	1.0	1.7	9.2	4	17.2	—	104.0	—	10.6	—
RAUC-C50G	200-230/60/3XL	0.9	6	1.0	4.1	20.7	4	41.4	60.5	247.0	376.0	11.0	16.4
RAUC-C504	460/60/3XL	0.9	6	1.0	1.8	9.0	4	18.1	26.3	95.0	142.0	10.7	15.9
RAUC-C505	575/60/3XL	0.9	6	1.0	1.4	7.2	4	14.4	21.0	76.0	114.0	10.7	15.9
RAUC-C509	380/415/50/3XL	0.75	6	1.0	1.7	9.2	4	17.2	26.2	104.0	153.0	10.9	16.4
RAUC-C60G	200-230/60/3XL	0.9	6	1.0	4.1	20.7	4	—	60.5	—	376.0	—	16.1
RAUC-C604	460/60/3XL	0.9	6	1.0	1.8	9.0	4	—	26.3	—	142.0	—	15.6
RAUC-C605	575/60/3XL	0.9	6	1.0	1.4	7.2	4	—	21.0	—	114.0	—	15.6
RAUC-C609	380/415/50/3XL	0.75	6	1.0	1.7	9.2	4	—	26.2	—	153.0	—	16.4

NOTES:

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

Table 6
Customer Wire Selection
And Fuse Replacement

⚠ WARNING	⚠ CAUTION
DISCONNECT ELECTRIC POWER SUPPLY BEFORE SERVICING TO PREVENT INJURY OR DEATH DUE TO ELECTRICAL SHOCK.	USE COPPER CONDUCTORS ONLY TO PREVENT EQUIPMENT DAMAGE. UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT ANY OTHER WIRING.
AVERTISSEMENT	**ATTENTION**
DEBRANCHER DU CIRCUIT D'ALIMENTATION ELECTRIQUE AVANT L'ENTRETIEN POUR EVITER BLESSURE OU MORT PAR ELECTROCUTION.	UTILISER SEULEMENT DES CONDUCTEURS EN CUIVRE POUR EVITER D'ENDOMMAGER L'EQUIPMENT. LES BORNES NE SONT PAS PREVUES POUR AUTRES TYPES DE FILS CONDUCTEURS.

CUSTOMER WIRE SELECTION AND FUSE REPLACEMENT TABLE

POWER WIRE SELECTION TO DISCONNECT SWITCH (1S1)			
UNIT SIZE	UNIT VOLTAGE	DISCONNECT SWITCH SIZE	CONNECTOR WIRE RANGE
20 - 40 TON	200/230 VOLT	225 AMP	(1) #1 — 300 MCM
50 & 60 TON	200/230 VOLT	400 AMP	(1) 250 — 500 MCM
20 - 50 TON	380/415/460/575 VOLT	100 AMP	(1) #14 — 1/0
50 & 60 TON	380/415/460/575 VOLT	250 AMP	(1) #4 — 350 MCM

POWER WIRE SELECTION TO MAIN TERMINAL BLOCK (1TB1)			
UNIT SIZE	UNIT VOLTAGE	TERMINAL BLOCK SIZE	CONNECTOR WIRE RANGE
20 - 60 TON	ALL VOLTAGES	310 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

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 40 - 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

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See wiring notes on Page 35

Notes from Field Wiring Diagram 2306-1833 K

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 LIQUID LINE VALVES (5L1 THRU 5L4) AND HOT GAS BYPASS 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.

21 200/230 VOLT UNITS ARE SHIPPED WITH TRANSFORMER (1T1) WIRED FOR 200 VOLT OPERATION. 230 VOLT OPERATION, REQUIRES THAT WIRE "18D" BE MOVED TO "H3" TERMINAL ON TRANSFORMER, AS SHOWN IN INSET "A".

22 CAUTION - DO NOT RUN LOW VOLTAGE WIRE (30 VOLTS MAXIMUM) IN CONDUIT OR RACEWAY WITH HIGHER VOLTAGE WIRE.

⚠ WARNING

HAZARDOUS VOLTAGE!

DISCONNECT POWER BEFORE SERVICING.

FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

⚠ AVERTISSEMENT

VOLTAGE HASARDEUX!

DECONNECTEZ LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRETIEN.

FAUTE DE DECONNECTER LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRAINER DES BLESSURES CORPORELLES SEVERES OU LA MORT.

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.

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

USE COPPER CONDUCTORS ONLY
UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT ANY OTHER WIRING

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Disconnect Switch External Handle

All RAUC units ordered with the unit mounted disconnect switch, (model number digit 13 or later is an "A") get the disconnect switch mounted in the control box and a factory installed switch handle mounted on the control box door's exterior. This handle allows the operator to disconnect power from the unit without having to open the door. The handle, shown in figure 21a, has three positions;

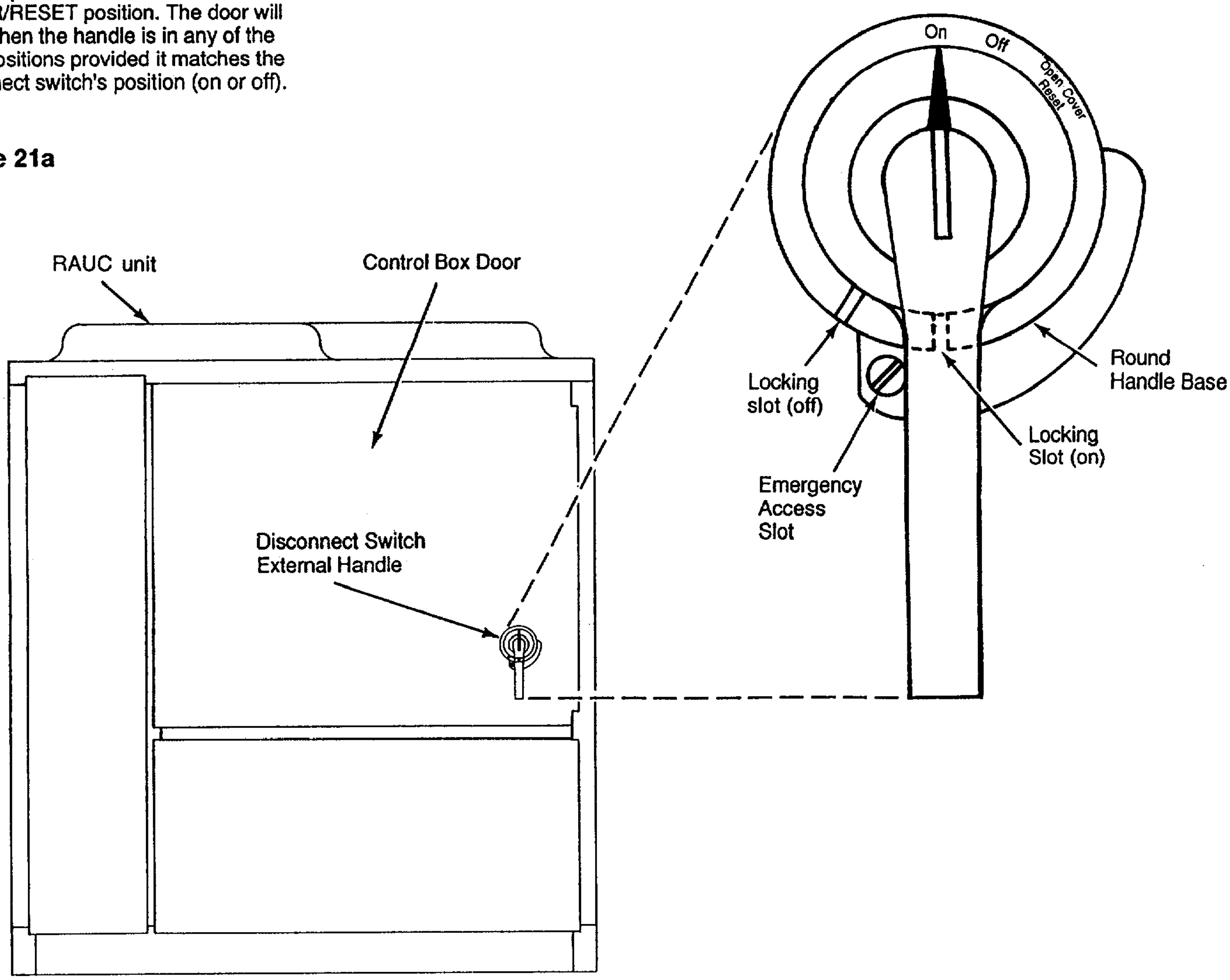
ON - the position used when power is applied to the unit.
OFF - the position used when unit power is disconnect.
OPEN COVER/RESET - the position used when the door must be opened for service.

The control box door will not open when the handle is in the ON or OFF position, but will open when it's in the OPEN COVER/RESET position. The door will close when the handle is in any of the three positions provided it matches the disconnect switch's position (on or off).

With the use of a standard padlock (not provided), the handle may be locked in either the ON or the OFF position. Push the spring loaded handle key into one of the slots in the round handle base and insert the lock's shackle to prevent the key from springing back into place.

There is an emergency access feature which allows the service technician to open the door with the power on or off without having to turn the handle, even if the handle is locked in this position. Simply insert a flat head screwdriver into the slot located in the handle base and turn it clockwise. This will disengage the handle's locking mechanism and allow the door to open.

Figure 21a



Constant Volume Control Option

Evaporator Fan Interlock

Evaporator fan interlock 5K1-auxilliary and evaporator fan controls 5S1, 5K1 and 5K1-OL must be installed as shown on the interconnecting wiring diagram.

Hot Gas Bypass Solenoid(s)

If hot gas bypass is required, install hot gas bypass solenoid(s) and wire per the interconnecting wiring diagrams.

Electronic Zone Thermostat (6U37)

Each constant-volume unit is provided with a Honeywell T7067 electronic zone thermostat for control of space temperature. A switching subbase (Honeywell Q667) is also included to enable operator selection of manual or automatic fan or system operation.

Location: When selecting a site for thermostat installation, be sure to choose a location in a frequently occupied area with good air circulation at an average temperature. Position the thermostat about 54" above the floor.

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

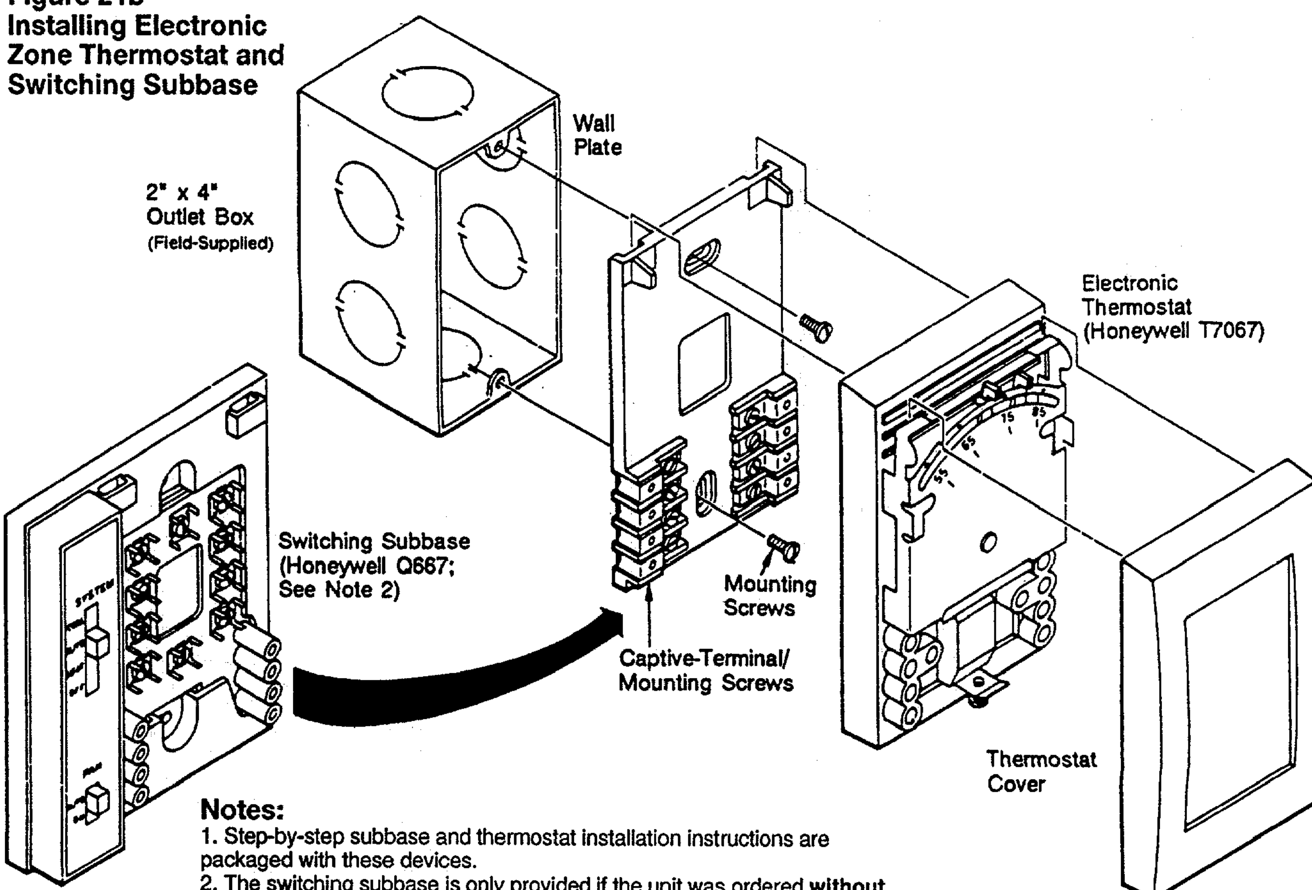
- **a.** drafts or "dead" spots behind doors or in corners;
- **b.** hot or cold air from ducts;
- **c.** radiant heat from the sun, or from appliances;
- **d.** concealed pipes and chimneys;
- **e.** vibrating surfaces; or
- **f.** unheated or uncooled areas behind the thermostat (e.g., outside walls).

Installation: Mount the thermostat (with subbase) vertically or horizontally on either a standard 2" X 4" outlet box, a comparable European outlet box, or on any nonconductive flat surface. See Figure 21b.

Specific installation instructions are packaged with the thermostat and subbase. For subbase and thermostat terminal identification, see Figure 22.

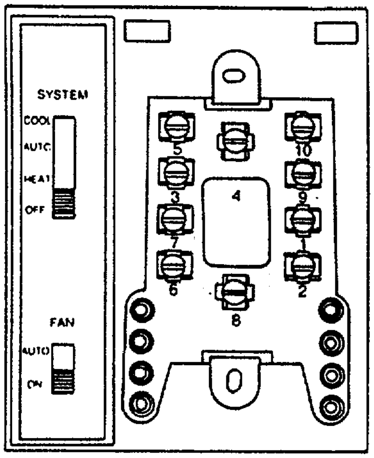
Checkout: After mounting the subbase and thermostat — but before wiring them to the unit — use an ohmmeter to complete the continuity checks listed in Table 7.

Figure 21b
Installing Electronic Zone Thermostat and Switching Subbase

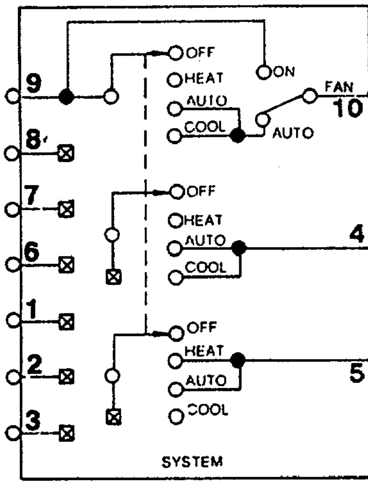


Notes:
1. Step-by-step subbase and thermostat installation instructions are packaged with these devices.
2. The switching subbase is only provided if the unit was ordered **without** a remote panel.

Figure 22
Subbase and Thermostat Terminal Identification



Terminal Layout



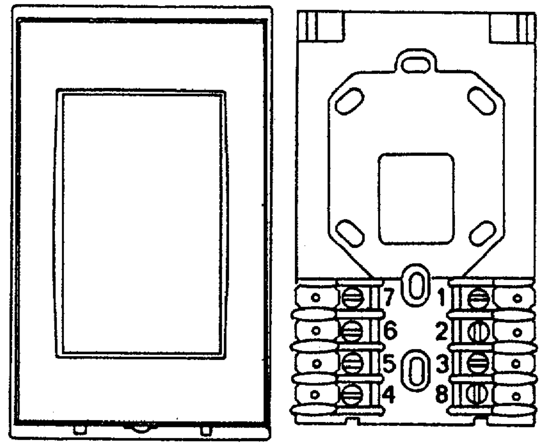
Internal Wiring Schematic

Switching Subbase (Honeywell Q667)

Wiring Terminal Identification:

- **1** = Common (-DC) and Night Setback/Setup Input
- **2** = +20 VDC Input
- **3** = Duct Sensor Input
- **4** = COOL Signal Output
- **5** = HEAT Signal Output
- **6** = Heating Setback
- **7** = Not Used
- **8** = Night Setup of Cooling Setpoint
- **9** = Fan Switching
- **10** = Fan Switching

⊠ Internal Thermostat Connections



Electronic Thermostat (Honeywell T7067)

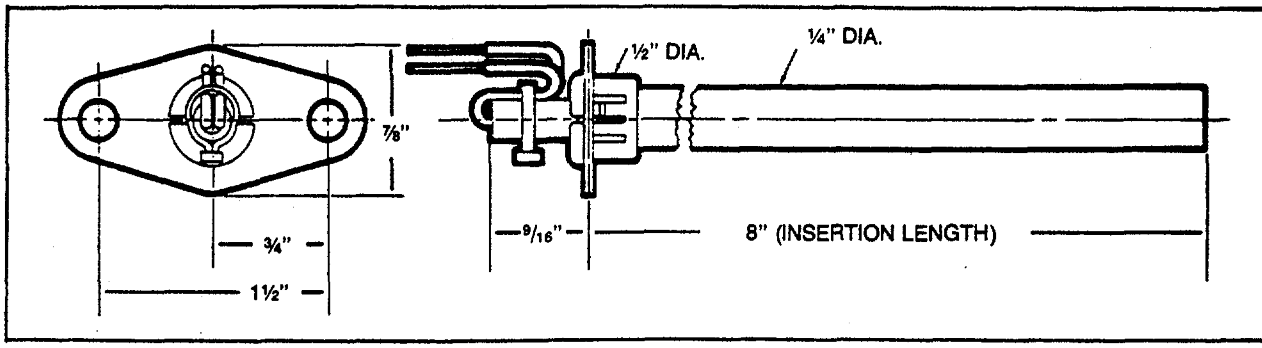
Wiring Terminal Identification:

- **1** = Common (-DC) and Night Setback/Setup Input
- **2** = +20 VDC Input
- **3** = Duct Sensor Input
- **4** = COOL Signal Output
- **5** = HEAT Signal Output
- **6** = Heating Setback
- **7** = Not Used
- **8** = Night Setup of Cooling Setpoint

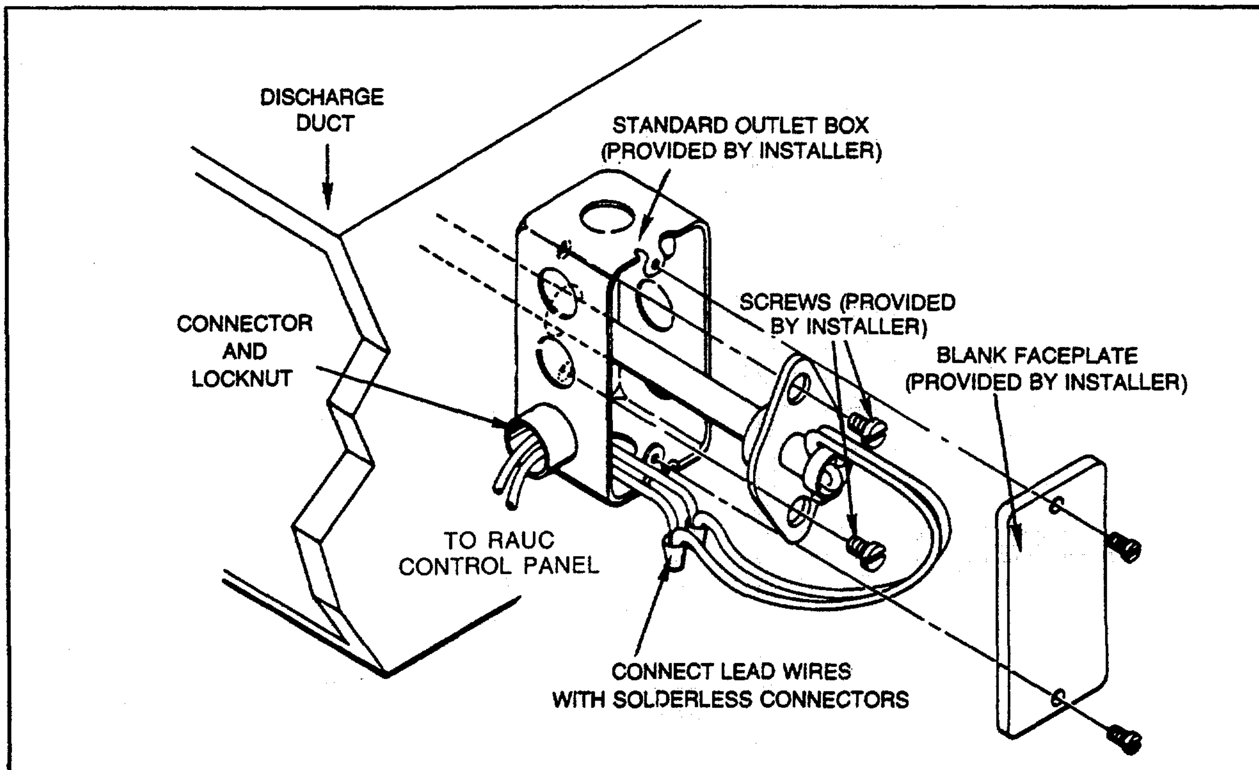
Table 7
Electronic Zone Thermostat/Subbase Continuity Checks

Subbase Switch Positions		Check Continuity between These Terminal Pairs ...	Circuit Should be ...
Fan	System		
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

Figure 23a
Duct Sensor Assembly



Duct Sensor Dimensions



Constant Volume Discharge Air Sensor (Duct Sensor)

Install the constant volume discharge air sensor in the discharge air so that it senses supply air temperature. Wire the sensor per the field wiring diagram.

Wiring - Max. Ohms

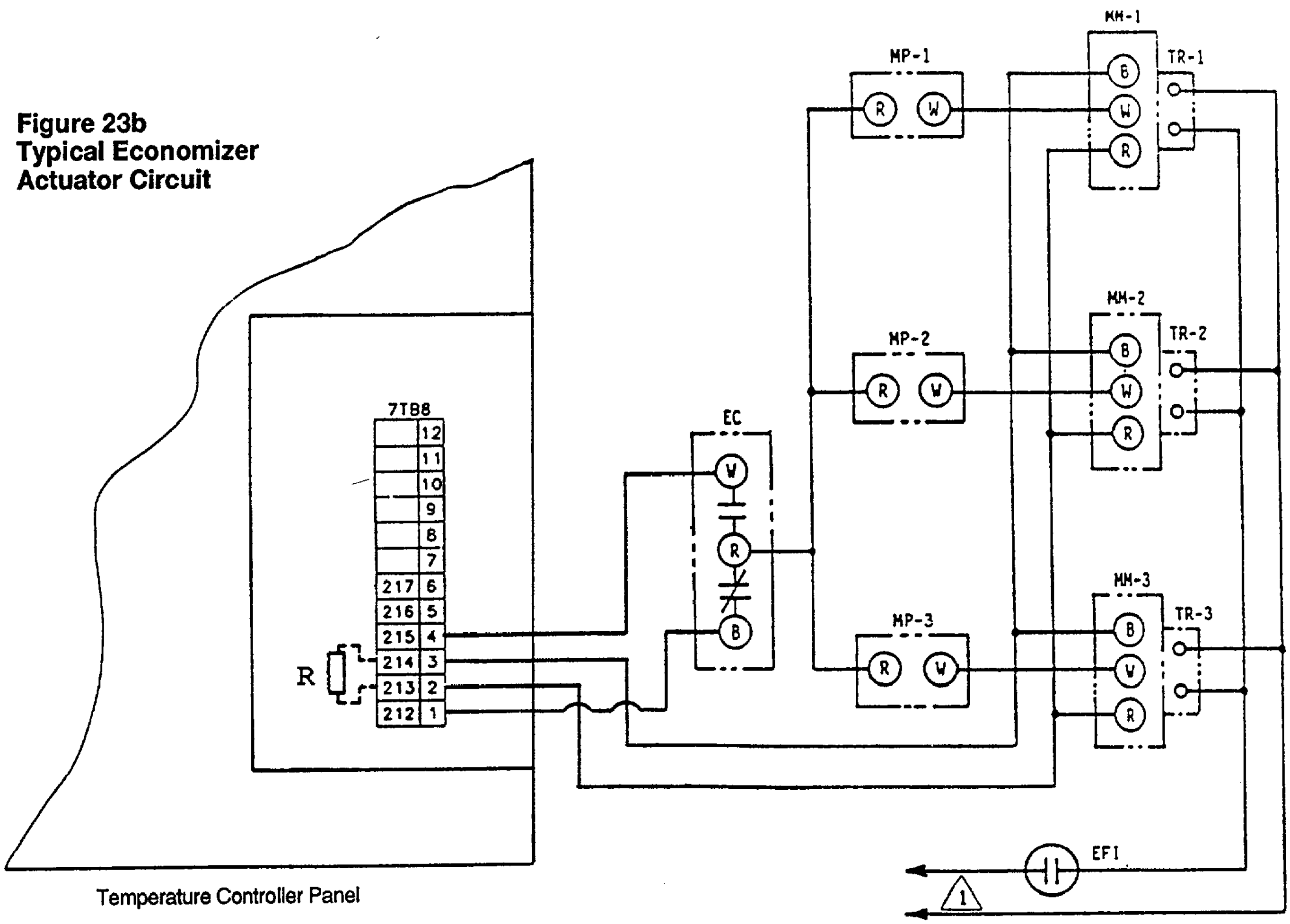
Electronic zone thermostat, discharge air sensor and economizer control circuit wiring should be sized not to exceed 6 ohms for the total wire run.

Table 8
Suggested Wire Sizes (Constant Volume)

Distance from RAUC to Remote Component	Minimum Recommended Wire Size
180 Feet	22 AWG
289 Feet	20 AWG
460 Feet	18 AWG
732 Feet	16 AWG
1165 Feet	14 AWG

Note: All wiring and wire sizing must meet national and local codes.

Figure 23b
Typical Economizer Actuator Circuit

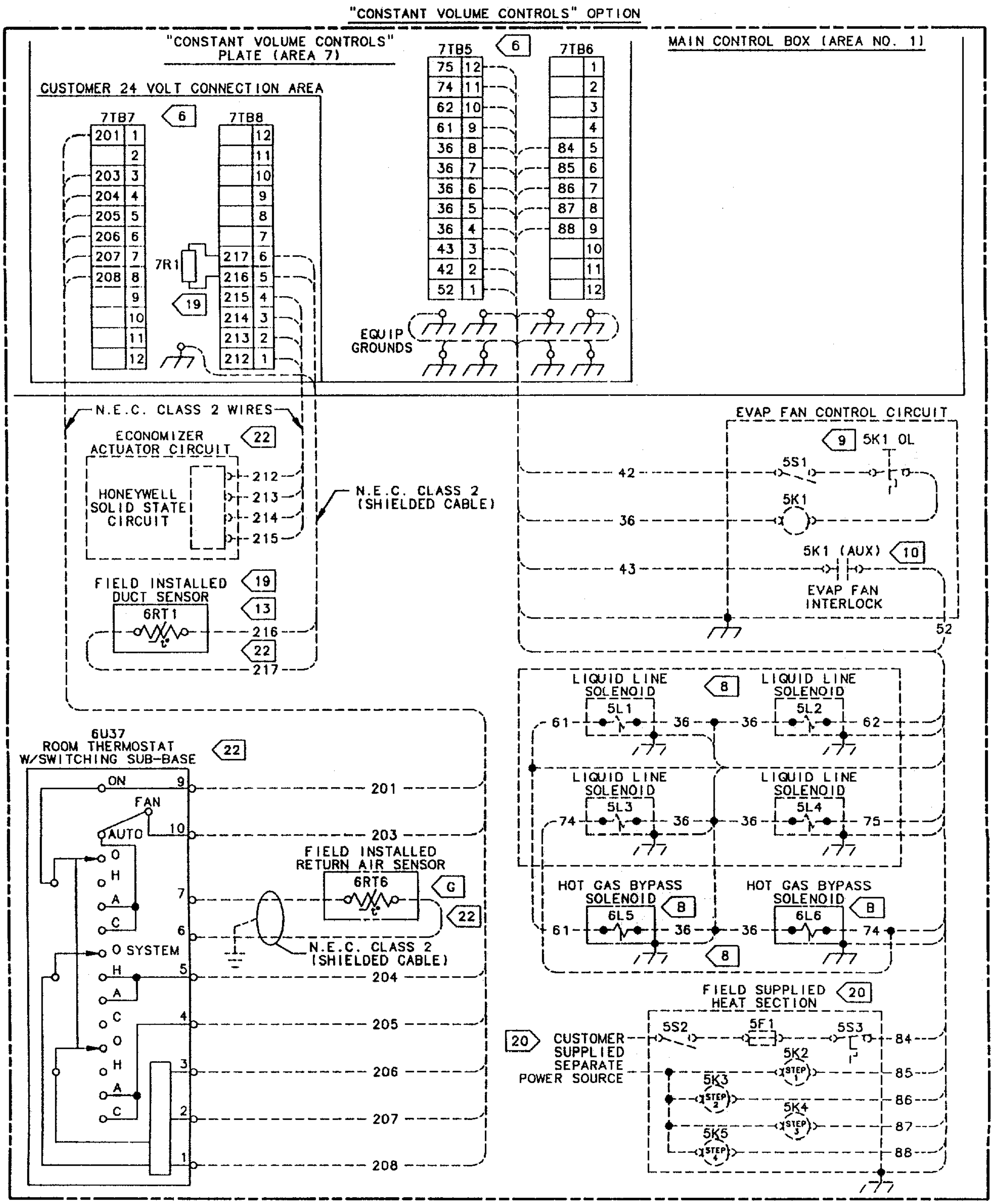


△1 Power Supply: (Provide disconnect means and overload protection as required.)

Table 9
Economizer Actuator Circuit Legend

Device Designation	Device Description	Parts and Notes
MM	Modutrol Motor	M.H. M955. (Up to 3 motors may be controlled as shown. Additional motors must be slaved.)
TR	Transformer	M.H. 130810B; cover-mounted.
EC	Enthalpy Control	M.H. H205A1046
MP	Minimum Position Potentiometer	M.H. S96A1012
EFI	Evaporator Fan Interlock	Field Provided
7TB8	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

Figure 24
RAUC-C20 thru C60
Field Wiring Diagram
"Constant Volume Controls"



See wiring notes on Page 35

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Electronic Zone Thermostat Operation and Checkout

Use the procedure outlined below to check the operation of electronic zone thermostat 6U37:

1. Open the system control switches 5S1 and 5S2 to disable the evap. fan, cooling and heating.

2. Close the unit disconnect switch and set control circuit switch 1S2 at ON.

WARNING! To Prevent injury or death from electrical shock, use extreme caution when working with energized components.

3. Using a digital volt-ohmmeter, verify that there is 20-volt DC power between thermostat Terminals 2-to-1.

4. Check the voltage signal between thermostat Terminals 4-to-1 as you:

a. move the **cooling** (blue) setpoint lever from **right to left**. See Figure 25. The voltage signal registered by the volt-ohmmeter should **increase** (and the cooling LED brighten) as the cooling setpoint drops.

b. move the blue **cooling** setpoint lever from **left to right**. The voltage signal should **decrease** (and the cooling LED dim) as the cooling setpoint rises.

5. Check the voltage signal between thermostat Terminals 5-to-1 as you:

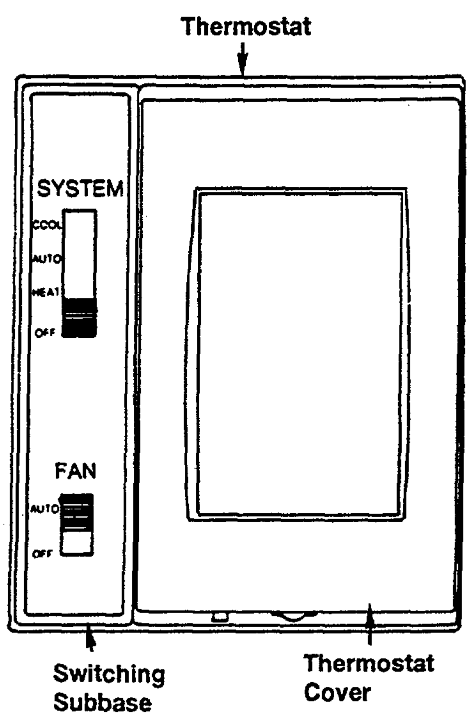
a. slide the **heating** (red) setpoint lever from **left to right**. See Figure 25. The voltage signal registered by the volt-ohmmeter should **increase** (and the heating LED brighten) as the heating setpoint rises.

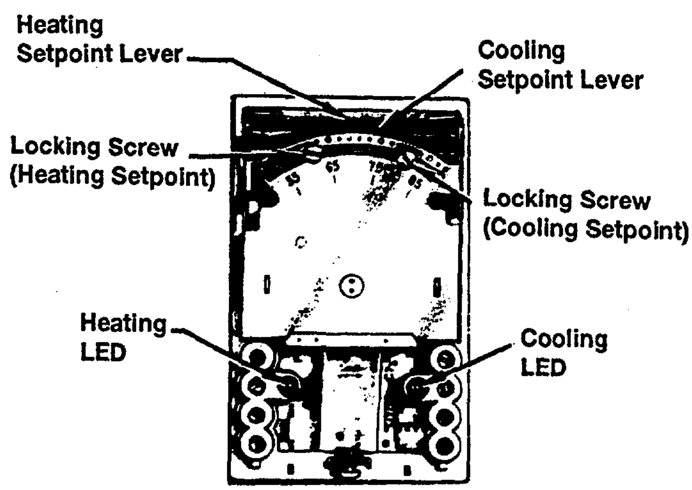
b. slide the red **heating** setpoint lever form **right to left**. The voltage signal should **decrease** (and the heating LED dim) as the heating setpoint drops.

For thermostat voltage output ramps, see Figure 28.

6. Enable the system by closing switches 5S1 and 5S2.

Figure 25
Electronic Zone Thermostat





MEC (7U11) Operation and Checkout

1. Open the system control switches 5S1 and 5S2 to disable the Evap. Fan, Cooling and Heating.

2. Close the unit disconnect switch and set control circuit switch 1S2 at "ON."

WARNING! To prevent injury or death from electrical shock, use extreme caution when working with energized components.

3. Using a digital volt-ohmmeter, verify that there is 20-volt DC power between MEC terminals 2-to-1.

4. Verify that the MEC's **heating output relays** are operative:

- **a.** Install a jumper between MEC Terminals 2 and 5.
- **b.** Use a voltmeter to verify that all of the MEC's **heating output relays** have "pulled in". (The meter should read "0" VAC on C1 and "No Resistance" on C2, C3 and C4.)

5. To verify that the MEC's **cooling output relays** are operative:

- **a.** Remove the jumper from Terminals 2 and 5 and reinstall it between MEC Terminals 2 and 4.
- **b.** Use a voltmeter to verify that all of the MEC's **cooling output relays** have "pulled in". (The meter should read "No Resistance").

6. With all of the MEC's cooling output relays pulled in (step 5), check the DC voltage between MEC Terminals R (-) and W (+).

The measured voltage should be approximately 1.7 to 2.1 VDC.

7. Remove the jumper installed between MEC Terminals 2 and 4.

8. Check the voltage between MEC Terminals R (-) and W (+).

The measured voltage should now be approximately 0.2 VDC.

9. Set control circuit switch 1S2 to the "OFF" position.

10. Remove the wires from MEC Terminals R, B, W, and Y.

11. Check the resistance across the following pairs of MEC 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

12. To verify that duct sensor 6RT1 is operative:

- **a.** Disconnect the wire connected to MEC Terminal T1, then use a digital volt-ohmmeter to measure the resistance between MEC Terminal T and the wire removed from Terminal T1.
- **b.** Use the conversion chart in Figure 27 to convert the measured resistance to an equivalent temperature.

If the measured resistance is **not** within ± 10.0 ohms of the actual temperature, 6RT1 is out of range; **replace it**.

13. Reconnect economizer leads W, R, B and Y to the appropriate terminals on the MEC.

14. Reconnect the loose duct sensor lead to MEC terminal T1.

15. Close switches 1S2, 5S1, and 5S2 to restore power to the system.

Figure 26
MEC (Master Energy Controller)

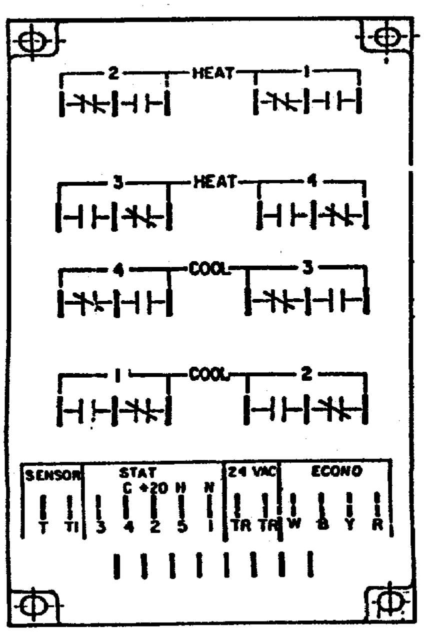
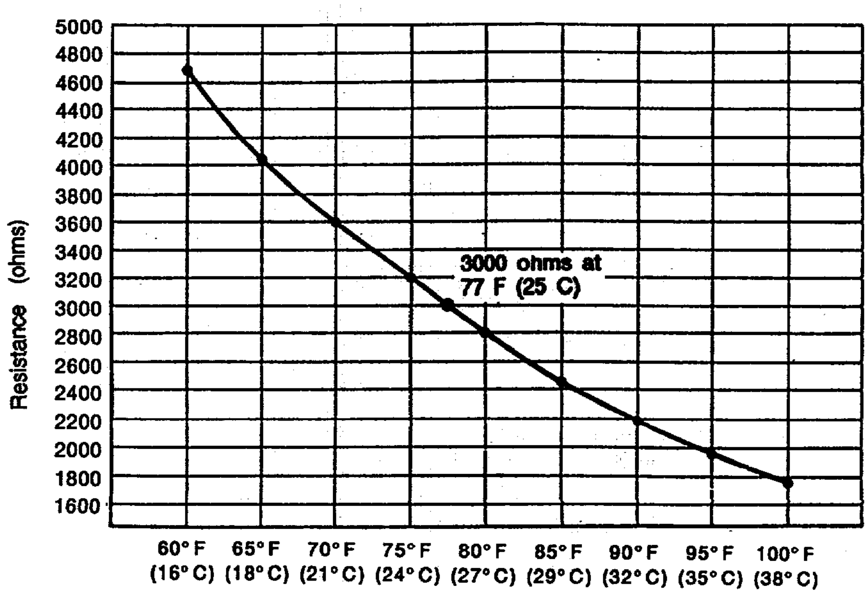
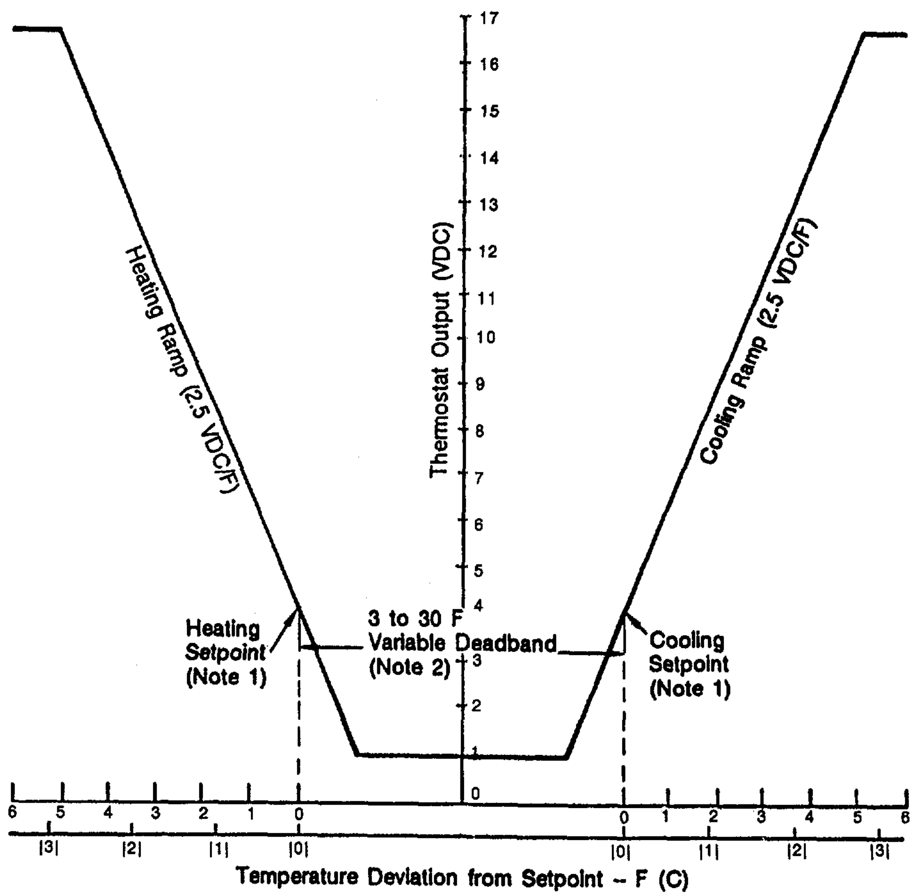


Figure 27
Duct Sensor Resistance-vs-Temperature Conversion Chart



Drg. No. X13540688 H

Figure 28
Nominal Operating Points and Economizer Throttling Range



Notes:
1. Thermostat output voltage is 4 VDC when space temperature equals setpoint temperature.
2. "Deadband" is the temperature range between the cooling and heating setpoints.

Economizer Actuator Check-out

To check a typical Honeywell economizer actuator for proper operation:

1. Set 1S2 at "OFF" and remove power from the economizer actuator; then disconnect the wires connected to the actuator's W, R, B, and Y terminals.

2. Jumper actuator terminals R-to-W **and** R-to-B and reapply power to the actuator. If the economizer actuator is working properly, it should drive to midposition.

3. Remove power from the actuator, then remove the jumpers installed in step 2.

4. Reconnect the economizer actuator wires to the actuator's W, R, B, and Y terminals.

5. Restore power to the actuator and set 1S2 to "ON."

Table 10
Voltage Ramp

	Nominal Operating Points and Throttling Ranges			Measured between these 1U11 Terminals ...
1U11 Function	Pull-In Voltage*	Drop-Out Voltage*	Throttling Range	
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	6.5 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" values are ± 0.25 VDC.
** If applicable

VAV Control Option

VAV Control System

In a VAV control system, the desired space temperature is maintained by varying the **amount** of relatively constant-temperature air delivered to the space. As the cooling requirement of the space **decreases, less air** is delivered to the zone; conversely, a greater volume of air is provided to the space as the cooling load increases.

Discharge Air Sensor Installation (6RT3)

Run 18 AWG shielded, twisted-pair wire (Belden 8760 or equivalent) for the discharge air sensor (located in the evaporator fan discharge ductwork) to the proper terminals in the temperature controller panel. Use stranded, tinned copper conductors only.

Connect the wires and run **in separate conduit** through the access openings provided in the right side of the unit, and to the conduit connection provided in the side of the temperature controller panel for this purpose.

Then connect the leads to the appropriate terminals on terminal strip 7TB7 and ground the shield at the ground screw in the temperature controller panel as shown in the field wiring diagram and unit schematics.

Suction Line Thermostat Installation (6S63)

Install suction line thermostat 6S63 close to the expansion valve bulb on a slightly flattened portion of the suction line. The thermostat must be securely and tightly fastened to the suction line, and field-provided thermoconductive grease must be used to guarantee good heat transfer. Insulate the suction-line-thermostat-to-suction-line joint to assure a good connection.

Wire the suction line thermostat to the terminal strip 7TB7 in the unit control panel using properly sized wire. (Refer to field wiring diagram and unit schematics.)

Evaporator Fan Interlock

Evaporator fan interlock 5K1-auxiliary and evaporator fan controls 5S1, 5K1 and 5K1-OL must be installed as shown on the interconnecting field wiring diagram.

Hot Gas Bypass

If hot gas bypass is required, it is recommended that solenoids be installed in the hot gas bypass lines, and wired per the interconnecting wiring diagrams.

Night Setback

If night setback is required, a set of field-provided contacts must be installed as shown on the interconnecting wiring diagram. Be sure to remove the jumper which parallels these contact termination points if night setback is required.

Figure 29
VAV Discharge Air Sensor

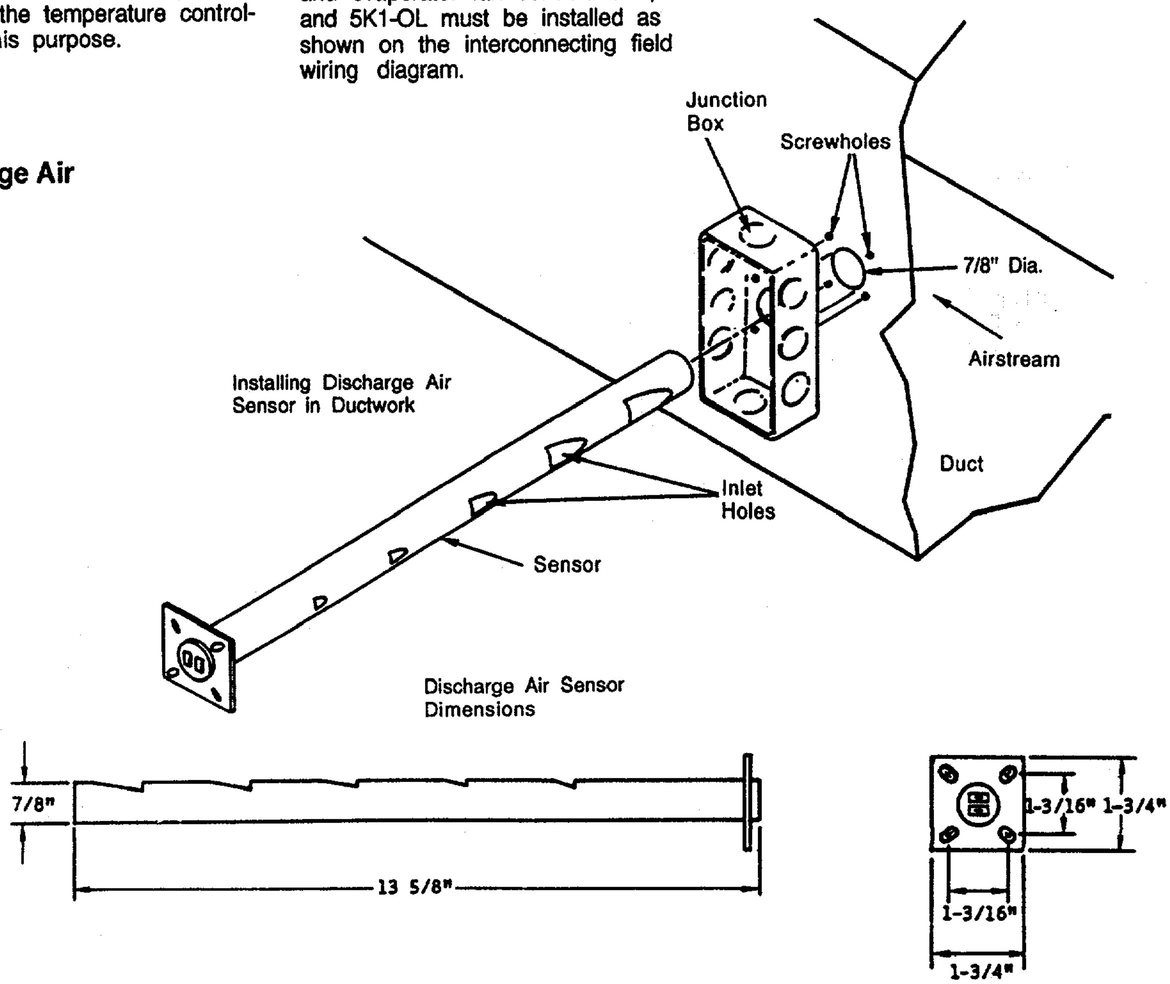
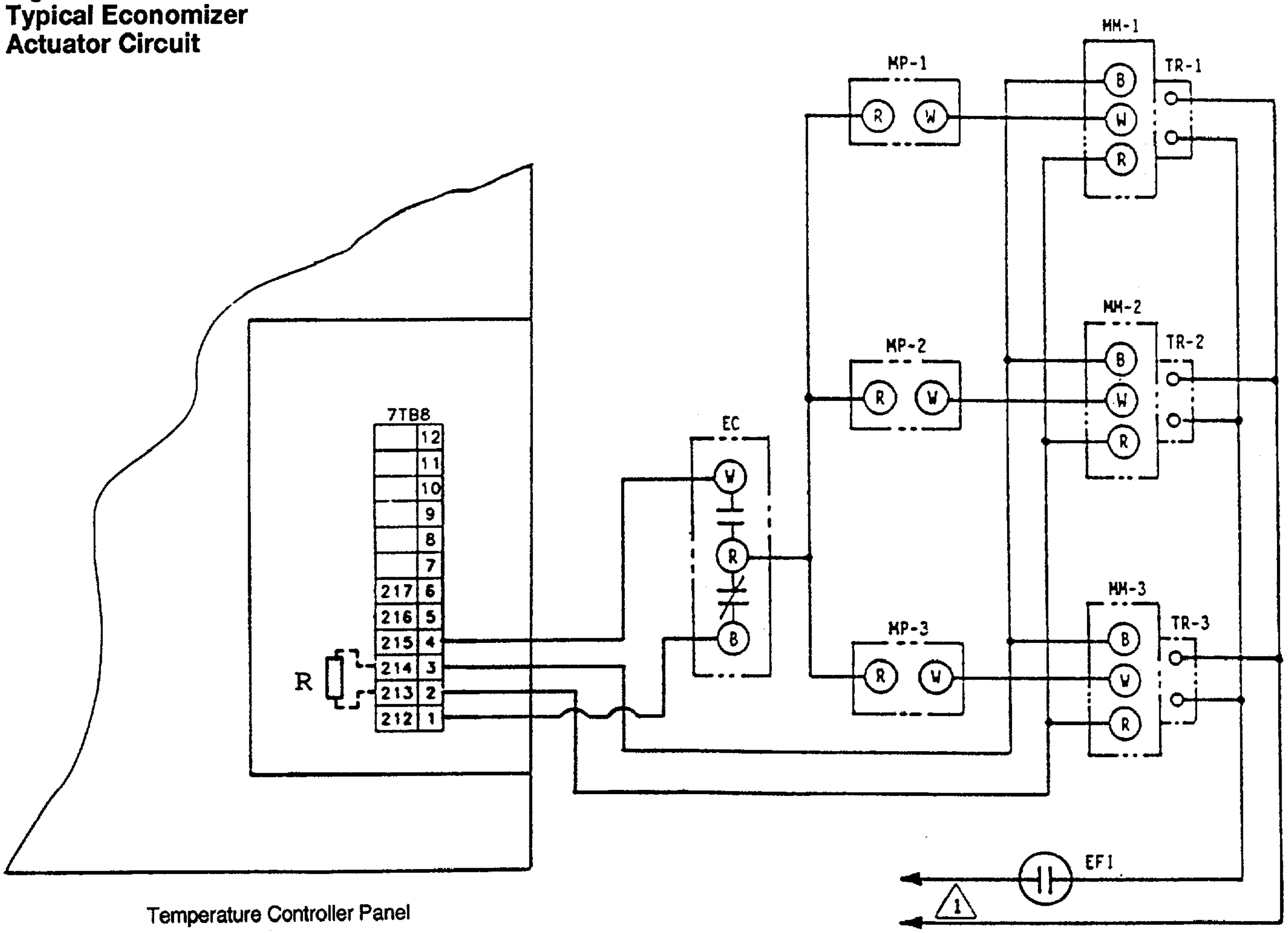


Figure 30
Typical Economizer Actuator Circuit

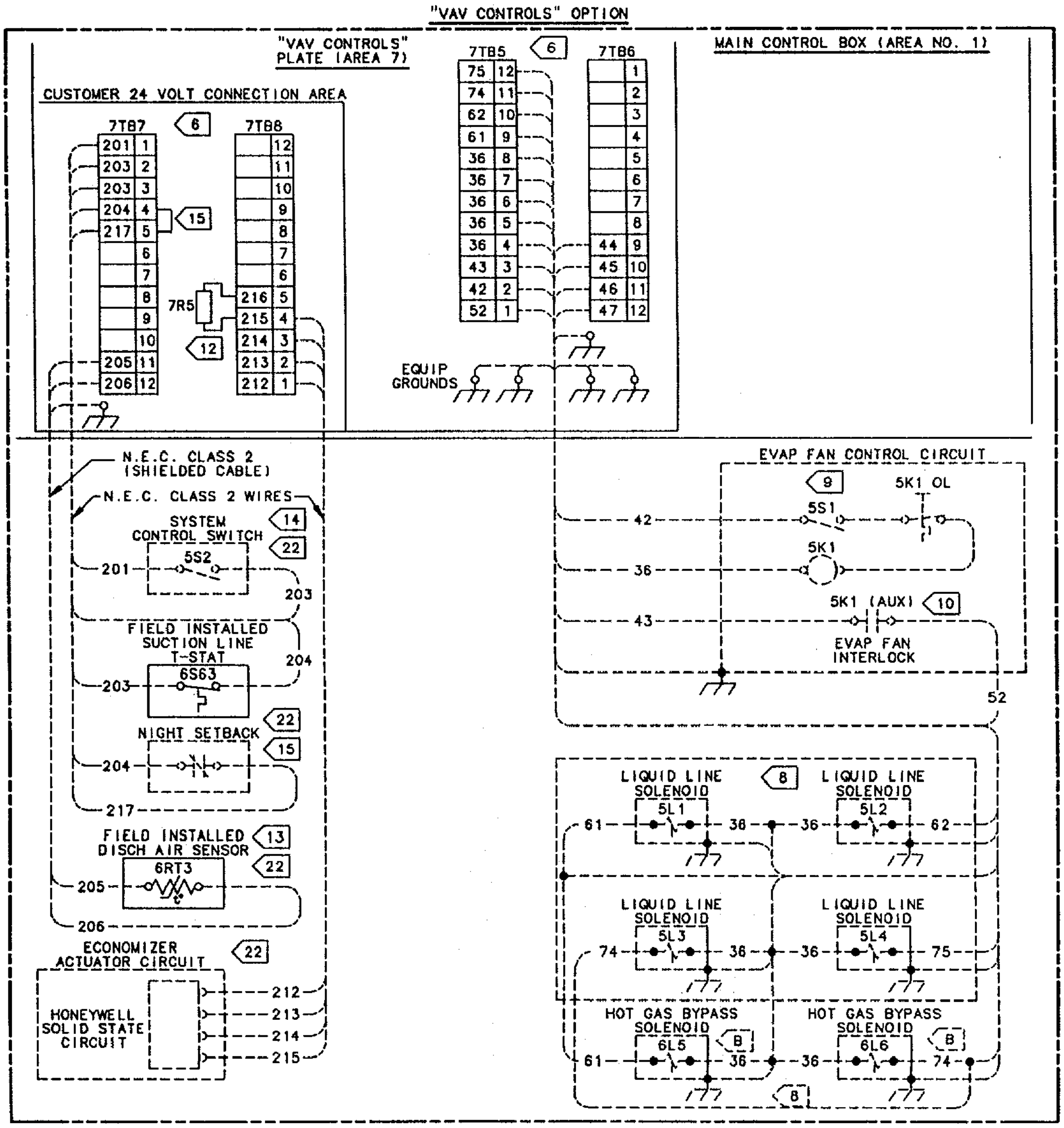


⚠1 Power Supply: (Provide disconnect means and overload protection as required.

Table 11
Economizer Actuator Circuit Legend

Device Designation	Device Description	Parts and Notes
MM	Modutrol Motor	M.H. M955. (Up to 3 motors may be controlled as shown. Additional motors must be slaved.)
TR	Transformer	M.H. 130810B; cover-mounted.
EC	Enthalpy Control	M.H. H205A1046
MP	Minimum Position	M.H. S96A1012 Potentiometer
EFI	Evaporator Fan Interlock	Field Provided
7TB8	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

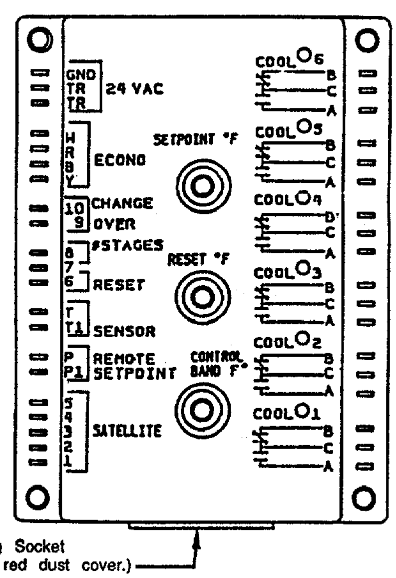
Figure 31
RAUC-C20 thru C60
Field Wiring Diagram
"VAV Controls"



See wiring notes on Page 35

Drg. No. 2306-1833K

Figure 32
Discharge Air Controller (7U11)



Drg. No. X13650150 B

D/A Controller (7U11) Operation

The discharge air controller used in RAUC/VAV units is a Honeywell W7100. This microprocessor-based controller, shown in Figure 32, is designed to maintain an average discharge air (D/A) temperature by:

... monitoring inputs from a standard D/A temperature sensor.

and

... modulating economizer dampers and sequencing stages of mechanical cooling on or off, as necessary.

In operation, the W7100 samples D/A temperature every 2 to 3 seconds by pulsing DC current across the D/A sensor—then "reading" the voltage potential across this thermistor.

If the comparison between setpoint and actual D/A temperature indicates that cooling is required, the W7100 first attempts to satisfy the load by modulating the economizer open; it then stages on mechanical cooling as needed.

Economizer Cycle

Note that the economizer is only allowed to function freely **if** ambient conditions are **below** the control range of the enthalpy switch.

If outside air is **not** suitable for "economizing", the F/A dampers drive to the minimum open position.

To take full advantage of the "free cooling" provided by the economizer, the W7100 is programmed to set an economizer control point that is **below** the S/A setpoint. The amount of offset between these two values is equal to 1/2 of the W7100's control band adjustment.

Example: Since a control band setting of "6" is typically recommended, the amount of economizer offset is "3". Therefore, if the S/A setpoint is 55° F, the economizer control point is 52° F (i.e., 55° F - 3).

A second economizer "program" within the W7100 alters the response time of the economizer based on deviation of the D/A temperature from the economizer control point. That is, as D/A temperature strays further from the control point, economizer operating speed **increases**; and, as the D/A temperature approaches the control point, the economizer slows down.

"Deadband" is reached when the D/A temperature is within ± 1.5° F of the economizer control point; within this range, the W7100 stops the economizer actuator.

* * * * * * * * * * * *

Mechanical Cooling

When the economizer alone can no longer handle the cooling requirement —or when outdoor air is unsuitable for "economizing", the W7100 activates the unit's mechanical cooling section.

The control strategy used by the W7100 to add stages of cooling is shown on a graph in Figure 33 and described below.

When the economizer is unable to satisfy the cooling requirement, D/A temperature gradually drifts above the S/A setpoint. (See "Region 1" in Figure 33.) Eventually, based on time and the amount of deviation from setpoint, the W7100 energizes a single stage of mechanical cooling.

If this stage is capable of satisfying the cooling requirement, the D/A temperature gradually drops back toward the S/A setpoint. (See "Region 2" in Figure 33.) If the D/A temperature remains above setpoint, the W7100 energizes additional stages of mechanical cooling.

Also, as long as ambient air conditions are acceptable, the economizer continues to allow outside air into the unit during mechanical cooling operation.

When a decrease in cooling requirements causes the D/A temperature to fall below setpoint for a sufficient period of time, the W7100 turns off the highest-numbered stage of cooling. (See "Region 3" in Figure 33.) Successive stages of cooling are cycled off in a similar manner as the D/A temperature approaches setpoint.

Note: The length of the time delay enforced when staging mechanical cooling on and off is determined by the W7100. Within the control band range, this delay is greatest at setpoint, and decreases to a minimum of 4 minutes when the D/A temperature exceeds the upper or lower limit of the control band. See Figure 33.

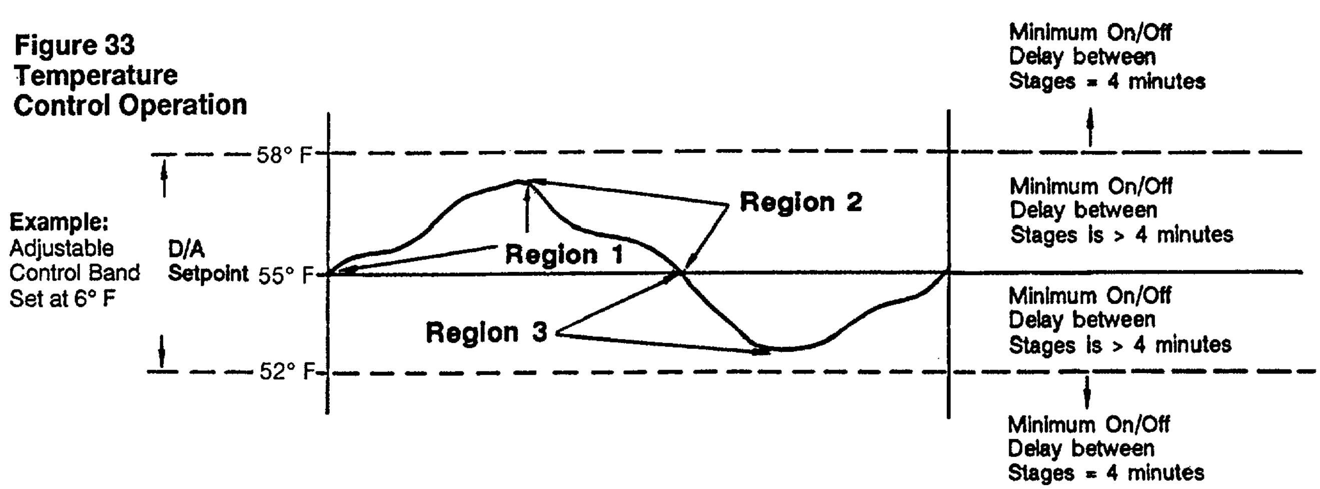
D/A Controller Checkout

Note: The checkout procedure outlined in Steps 1 through 19 **must be performed in its entirety — and in the sequence given.**

To perform the W7100 checkout procedure described below, use a highly accurate, digital volt-ohmmeter and the W7100 accessory resistor-and-test-plug kit (i.e., Trane part no. TOL-0101 or Honeywell part no. 4074EDJ).

WARNING! To prevent injury or death due to electrocution, use utmost care when working with energized components.

Figure 33
Temperature Control Operation



1. Set control circuit switch 1S2 at "OFF" and open the unit disconnect switch. Set fan switch 5S1 to "OFF" to deactivate mechanical cooling for the test.

2. Disable all mechanical cooling.

3. Remove the red dust cover from the test plug socket at the bottom of the W7100A and insert the checkout kit jumper plug.

(Use of the test plug overrides most of the W7100A's built-in time delays for staging the compressors on and off.)

4. Install 1 jumper wire between the W7100A's P and P1 terminals (remote setpoint input), and another jumper between Terminals 6 and 7 (reset input).

5. Disconnect the leads of the discharge air sensor from W7100A Terminals T and T1.

6. To simulate a discharge air temperature of 60 F, connect the 3400-ohm resistor (**blue** leads) between Terminals T and T1. (The resistor is included in the W7100 checkout kit.)

7. Set the W7100's "Setpoint (F)" dial at 56° F **or less**; then set the "Control Band (F)" dial at 2 to minimize control response time.

It is not necessary to set the "Reset (F)" dial since the jumper factory-installed between W7100A Terminals 6 and 7 disables this dial.

8. Close the unit disconnect switch; then set 1S2 at ON. Verify that there is 24 VAC power at the W7100A's TR terminals, **and** that the controller ground wire is connected to chassis ground.

WARNING! To prevent injury or death from electrocution, use extreme caution when working with energized components.

After about 2 minutes (i.e., time required to drive the economizer fully open), the LEDs on the W7100 should begin to illuminate as the cooling outputs stage on.

9. Set the "Setpoint (F)" knob at 64° F; within 10 seconds, the LEDs should go out as the cooling outputs stage off.

10. Immediately readjust the "Setpoint (F)" knob to 56° F; momentarily, the LEDs should begin to illuminate again as the cooling outputs stage on.

Note: If your unit includes the zone reset option, proceed to the next step; **if not, go to Step 14.**

11. Set the "Reset (F)" dial at 15° F **cooling** and the "Setpoint (F)" dial at 41° F; then remove the jumper installed across W7100A Terminals 6 and 7.

To simulate a call for maximum reset, install the 1780-ohm resistor (**red** leads) — from the W7100 checkout kit—across Terminals 6 and 7.

The W7100A's cooling LEDs should remain lit.

12. Turn the "Setpoint (F)" dial to 49° F; within 1 to 2 minutes, the LEDs should go out as **all** of the cooling outputs stage **off**.

13. 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 between these points.

Next, adjust the "Setpoint (F)" knob to 56° F; within 1 minute, the LEDs should illuminate as all of the cooling outputs stage **on**.

Note: Complete Steps 14 through 16 to verify proper operation of the W7100A's economizer control function.

WARNING! To prevent injury or death from electrocution, use extreme caution when working with energized components.

14. With all of the W7100A's cooling LEDs lit, check the DC voltage between W7100A Terminals R (-) and W (+).

The measured voltage should be 1.7 to 2.1 VDC.

15. Set the "Setpoint (F)" dial at 64° F to drive the economizer outputs to the minimum position. **Wait about 5 minutes**; then recheck the voltage between Terminals R and W.

Within 2 minutes, the W7100A's LEDs should go out as all the cooling outputs stage **off**. After 5 minutes, the voltage measured between Terminals R and W should drop to approximately 0.2 VDC.

16. Open control circuit switch 1S2 to remove power from the W7100A; then disconnect the wires connected to the W7100A's R, B, W, and Y terminals. Check the resistance across the following pairs of terminals, and compare the actual resistance readings with the values shown below.

W7100A Terminals	Resistance
Term. R-to-W	226 ohms
Term. R-to-B	432 ohms
Term. R-to-Y	226 ohms

17. Complete Steps 17a and 17b to verify that the discharge air sensor is functioning properly.

a. With the discharge air sensor disconnected from the W7100A, measure the resistance across the sensor leads.

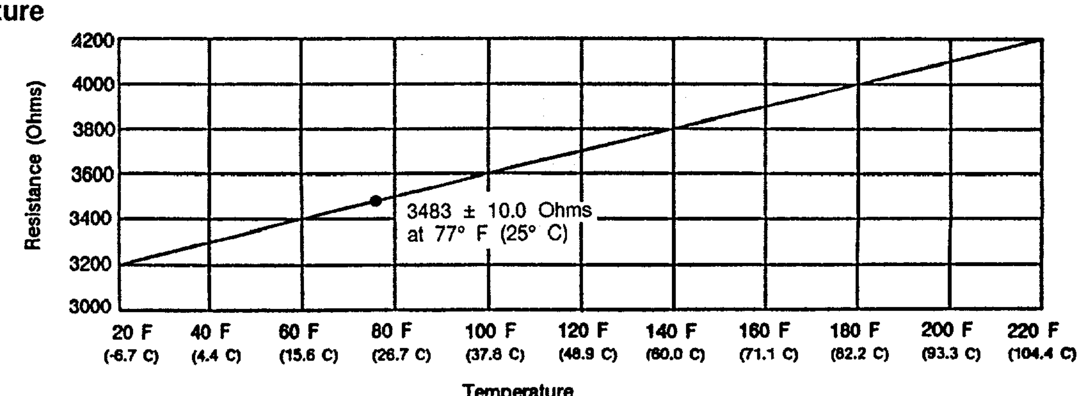
b. Use the conversion chart in Figure 34 to convert the measured resistance to an equivalent discharge air temperature.

If the measured resistance is **not** within ± 10.0 ohms of the actual discharge air temperature, the sensor must be replaced.

18. Reconnect wires to the W7100A's R, B, W, and Y terminals; also reconnect discharge air sensor leads to W7100A's T and T1 terminals.

19. Close switches 5S1 and 1S2.

Figure 34
D/A Sensor Resistance-vs-Temperature Conversion Chart

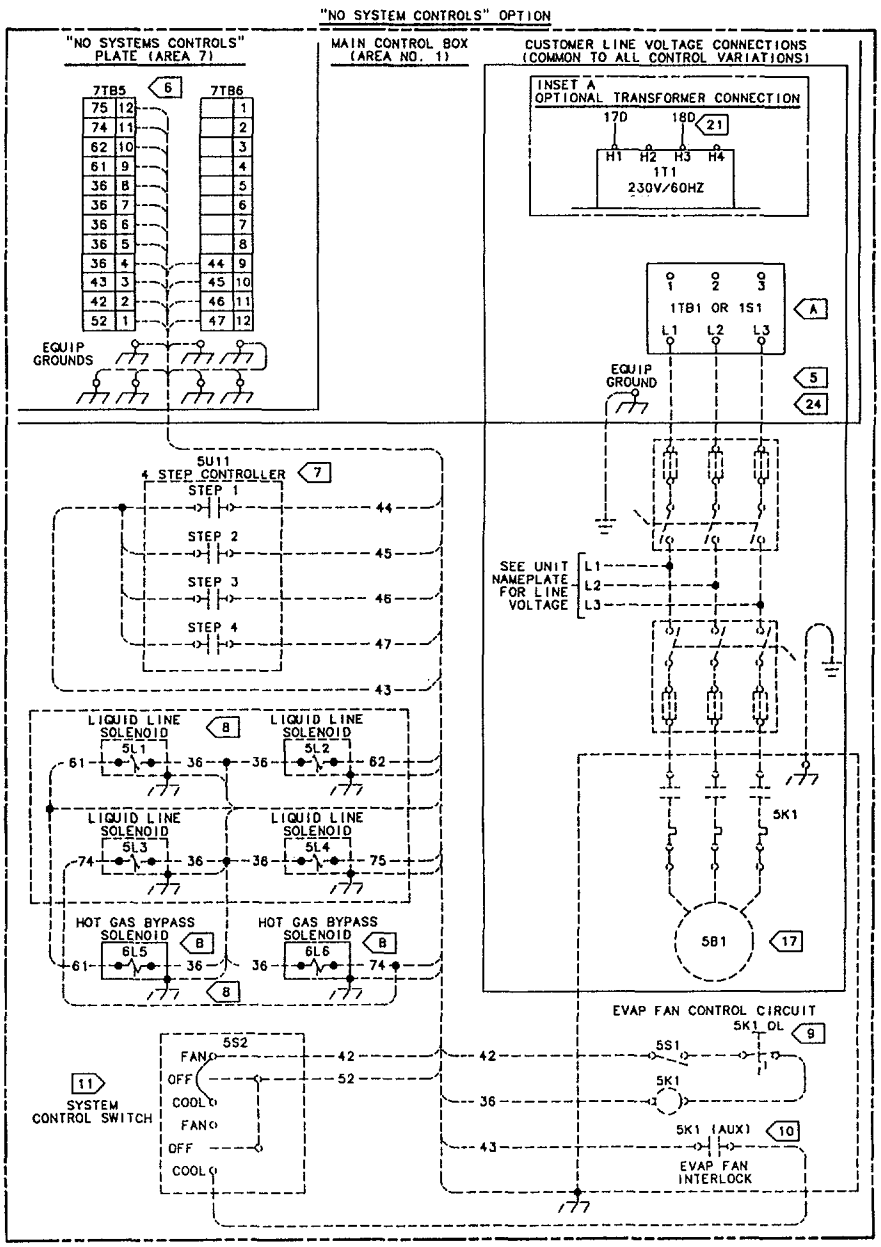


Economizer Actuator Check-out

To check a typical Honeywell economizer actuator for proper operation:

1. Set 1S2 at "OFF" and remove power from the economizer actuator; then disconnect the wires connected to the actuator's W, R, B, and Y terminals.
2. Jumper actuator terminals R-to-W and R-to-B and reapply power to the actuator. If the economizer actuator is working properly, it should drive to midposition.
3. Remove power from the actuator, then remove the jumpers installed in step 2.
4. Reconnect the economizer actuator wires to the actuator's W, R, B, and Y terminals.
5. Restore power to the actuator and set 1S2 to "ON."

Figure 35
RAUC-C20 thru C60
Field Wiring Diagram
"No System Controls"



No System Control Option

Temperature Control

A 2-step (20-30 ton units) or 4-step (40-60 ton units) temperature control must be selected and installed in the field by the controls contractor. The cooling stages are wired per the interconnecting field wiring diagram. Five-minute fixed-off and 3-minute fixed-on timers are provided in the unit on each of the steps of cooling. **This control option cannot be used for water chiller applications.**

Evaporator Fan Interlock

Evaporator fan interlock 5K1-auxiliary and evaporator fan controls 5S1, 5K1 and 5K1-OL must be installed as shown on the interconnecting wiring diagram.

Hot Gas Bypass

If hot gas bypass is required, it is recommended that solenoids be installed in the hot gas bypass lines and wired per the interconnecting wiring diagrams.

"No Controls" option Operation and Checkout

The temperature controls for the RAUC-C20 through C60 unit ordered with the "No Controls" option were provided by others. Contact the system engineer for operation, maintenance and checkout of this device.

See wiring notes on Page 35

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EVP Control Option

Pump logic is the responsibility of the installer. Fluid flow must be guaranteed at all times while the unit is running.

Mounting the EVP Control Option Remote Panel

Figure 36 shows an EVP control option remote panel. This panel must be mounted indoors as close to the chiller barrel as possible. The freezestat, which is installed in the evaporator leaving-fluid line, has a capillary tube which is 20 feet long. The panel must be mounted so that this capillary reaches the field-installed bulbwell.

A ground wire must be run between the EVP control panel and the RAUC control panel.

Circulating Pump Control Circuit and Interlock

The 5K1 pump starter, 5K1-OL overloads and 5K1-auxiliary contacts must be field-provided, -installed and -wired per the chilled water pump interconnecting wiring diagram.

Circulating Pump Starter On/Off Switch

Pump ON/OFF switch 5S1 must be field-provided, -installed and -wired per the interconnecting wiring diagram. This switch can be used as a system ON/OFF switch.

Freezestat 6S12

A factory-wired freezestat is shipped installed in the EVP optional remote panel. A bulbwell is shipped (see Figure 37), and must be installed in the leaving-evaporator chilled solution piping as close to the chiller barrel as possible. Uncoil the freezestat capillary tube and insert it into the installed bulbwell. Use of thermal paste in the bulbwell is mandatory.

Chiller Temperature Sensor Bulbwell

Temperature control is factory-installed and -wired in the evaporator control panel. The leaving-solution temperature sensor must be installed in the bulbwell that shipped with the panel. Install the bulbwell in the leaving-solution piping as close to the chiller barrel as possible. Use of thermal paste in the bulbwell is mandatory. (See Figure 37).

Chiller Temperature Sensor (6RT2)

Splice 18 AWG shielded, twisted-pair wire (Belden 8760 or equivalent) from the chilled water temperature sensor (located in the chiller water outlet) to the proper terminals in the temperature controller panel. Use only stranded, tinned copper conductors.

Then, connect the leads to the appropriate terminals on terminal strip in the evaporator control panel, and ground the shield at the ground screw as shown on the interconnecting wiring diagram.

Outside Air Thermostat (5S57)

A field-provided low ambient thermostat must be installed and wired per the field wiring diagrams. This thermostat will prevent the unit from operating below its workable temperature rating. The settings of this control are as follows:

(a) standard ambient = 40° F;
(b) low ambient = 0° F.

Chiller Flow Switch (6S58)

Install a flow switch or other flow sensing device to prevent or stop compressor operation if evaporator water flow drops off drastically. Locate the device in the evaporator chilled water outlet line as shown in Figure 20. See field wiring and unit schematics for the flow switch electrical interlock diagram.

Temperature Controller (6U11) Resistor Removal and Installation

6U11 requires a resistor/jumper device connected between terminals 6, 7, and 8 (see Figure 36). The device, as shipped from the factory, has a resistance rating of 200 ohms and is required on all 20-30 ton units. The 40-60 ton units require a 402 ohm resistor/jumper device. The bag connected to 6U11 contains this device. If yours is a 20, 25 or 30 ton unit, remove the bag and discard. If yours is a 40, 50 or 60 ton unit, remove the factory installed resistor/jumper device and replace it with the one in the bag. **Note:** The resistor portion of the device must be installed between terminals 7 and 8.

Hot Gas Bypass

If hot gas bypass is required, install hot gas bypass solenoids and wire them per the interconnecting wiring diagrams.

Figure 36
EVP Control
Remote Panel

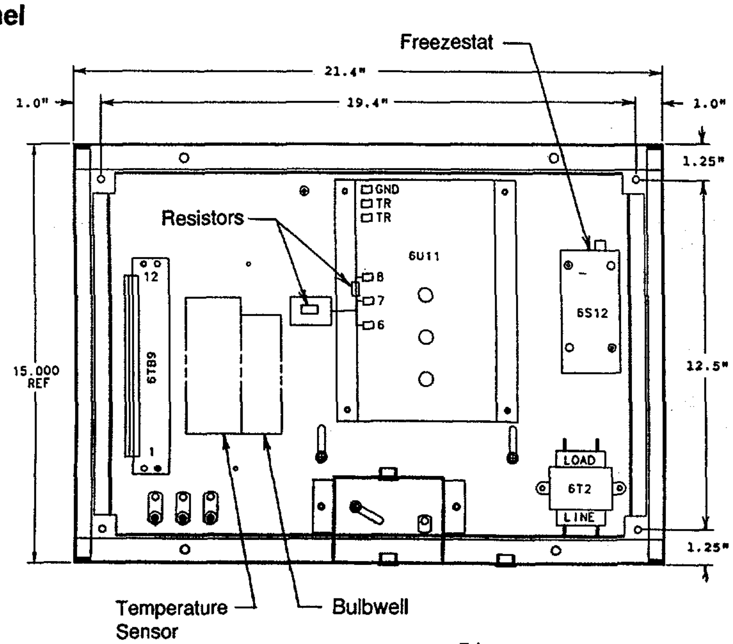

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Figure 37
Temperature Sensor/ Bulbwell and Freezestat Bulbwell

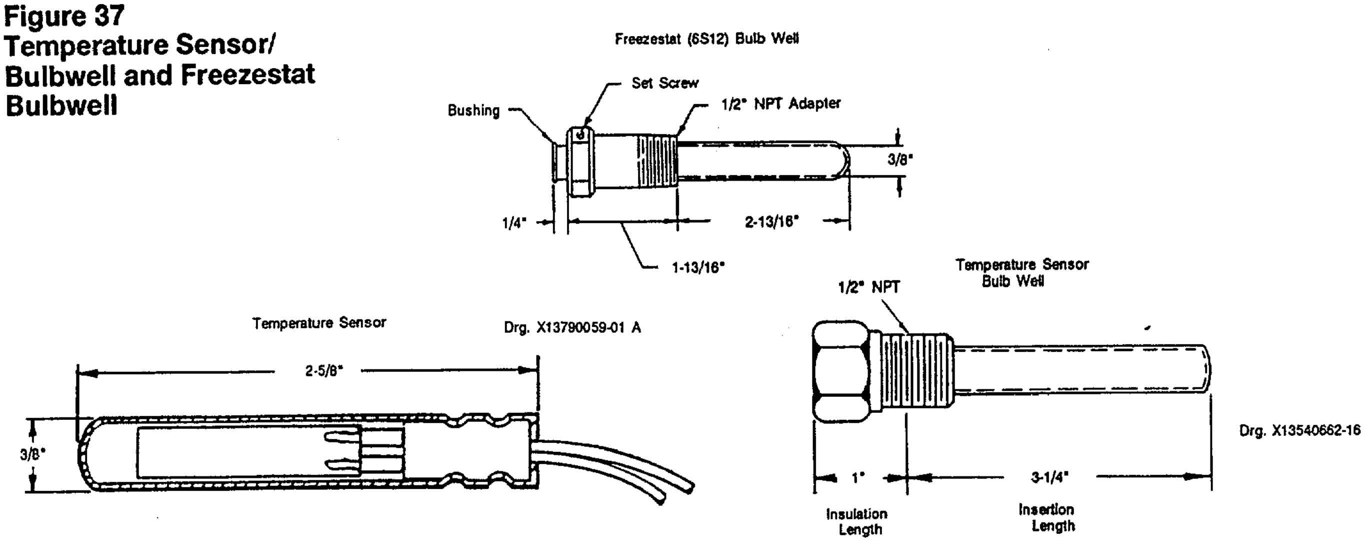
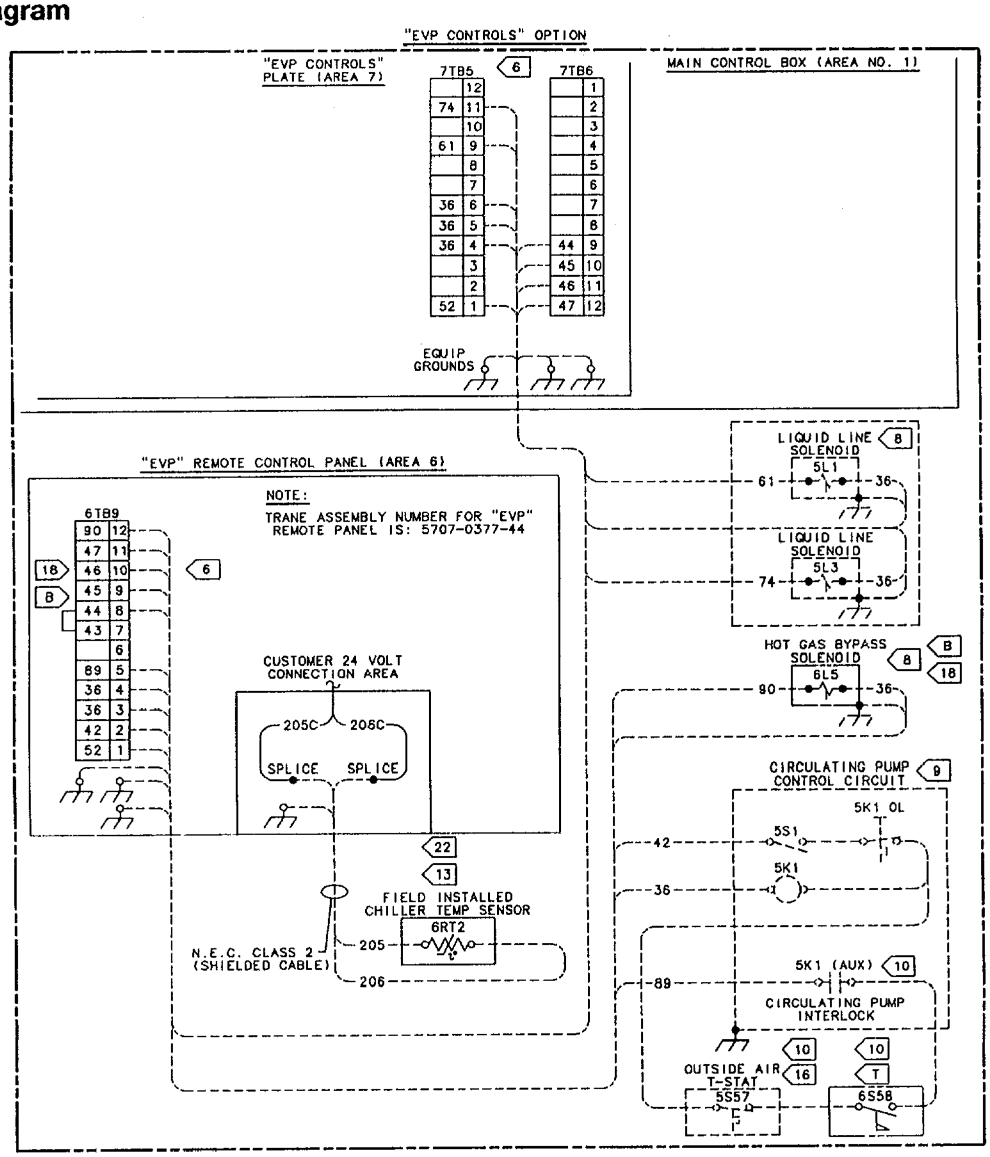


Figure 38
RAUC-C20 thru C60 Field Wiring Diagram "EVP Controls"



See wiring notes on Page 35

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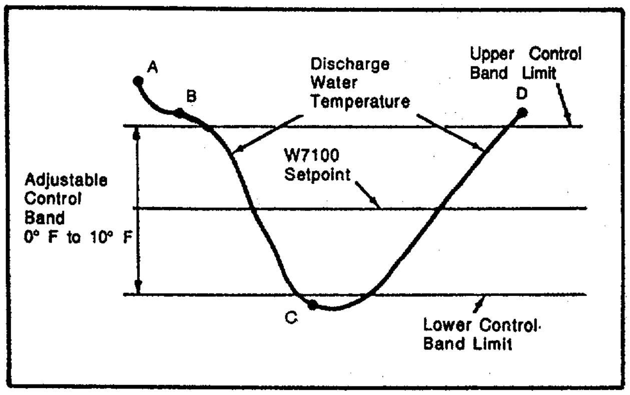
W7100G Discharge Water Temperature Control Operation (Chiller Controller 6U11)

The W7100G uses an integrating control band concept to provide temperature control of discharge water. The control band concept matches required operating capacity to chiller load, while the integral action minimizes the offset from the control setpoint which normally occurs in proportional-only type controllers.

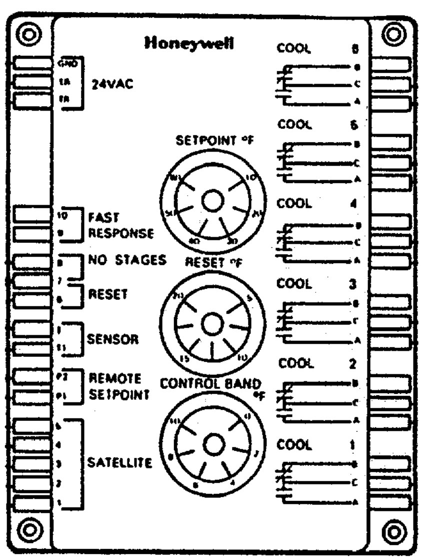
The control band setting is centered on the discharge water set point (Figure 39). The control band setting is adjustable from 0° F to 10° F [0° C to 6° C]. This adjustment is used to stabilize system operation. Following is a description of how chiller control stages operate.

Using Figure 39 and beginning at point A, the discharge water temperature is above the upper control band limit and the minimum OFF time has elapsed (selectable either 30 or 60 seconds, using fast response input). The first stage will energize on the W7100. At point B, the discharge water temperature is still above the upper control band limit. If the minimum time between stages has elapsed (selectable), the next highest stage of cooling will energize. At point C, the discharge water temperature has fallen below the lower control band. If the minimum ON time has elapsed for that stage, the highest stage on will shut off. This sequence will continue until the demand for cooling increases (point D) at which time stages will sequence ON in the same manner as before. As a rule, any time the discharge water temperature is above the upper control band limit, a stage will go ON, and anytime the discharge water temperature falls below the lower control band limit, a stage will go OFF.

Figure 39
Discharge Water Temperature Controller



Discharge Water Control Algorithm Operation



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EVPB Controller Checkout (6U11)

Note: The following equipment is needed to perform the controller checkout procedure described below:

(1) Test Plug and Resistor Bag Assembly (Honeywell Part No. 4074EDJ)
(1) Resistor Bag Assembly (Honeywell Part No. 4074EFV)
(1) Digital VOM Meter

WARNING! To prevent possible injury or death due to electrocution, always open unit disconnect switch before disconnecting or connecting wires, jumpers, etc. during system checkout.

1. Set control circuit switch 1S2 at "OFF".

2. Remove the reset relays 1K11 (20-60 ton units) and 1K12 (40-60 ton units) from the unit control box.

3. Disconnect chiller temperature sensor 6RT2 from W7100 Terminals T and T1; in its place, connect the 3400-ohm resistor (blue leads) from the 4074EDJ bag assembly.

4. Remove the factory-installed jumper (wire 209A) from the W7100's "fast response" Terminals 9 and 10.

5. Remove the factory-installed jumper from Terminals 6 and 7 on the W7100, and connect the 1780-ohm resistor (red leads) from the 4074EDJ bag assembly in its place.

6. Jumper W7100 Terminals P and P1.

7. Remove the red plastic dust plug from the bottom of the W7100, and insert the test plug from bag assembly 4074EDJ into the socket provided.

8. Adjust the W7100's reset knob to 20° F.

9. Set the W7100's setpoint knob at 10° F.

10. Close control circuit switch 1S2 and verify that 24 VAC power is present at W7100 terminals TR and TR.

WARNING! To prevent injury or death from electrocution, use extreme caution when working with energized components.

11. Wait 15 seconds.

12. Check the LEDs on the face of the W7100 to verify that all stages are energized. All of the red LEDs should be lit.

13. Readjust the W7100's setpoint knob to 60° F.

14. Wait 15 seconds.

15. Check the LEDs on the face of the W7100 to verify that all stages are now off. None of the red LEDs should be lit.

16. Remove the 1780-ohm resistor from W7100 Terminals 6 and 7; then jumper these terminals.

17. Readjust the W7100's setpoint knob to 50° F.

18. Wait 15 seconds.

19. Check the LEDs on the face of the W7100 to verify that all stages are now energized. All of the red LEDs should be lit.

20. Set control circuit switch 1S2 at "OFF".

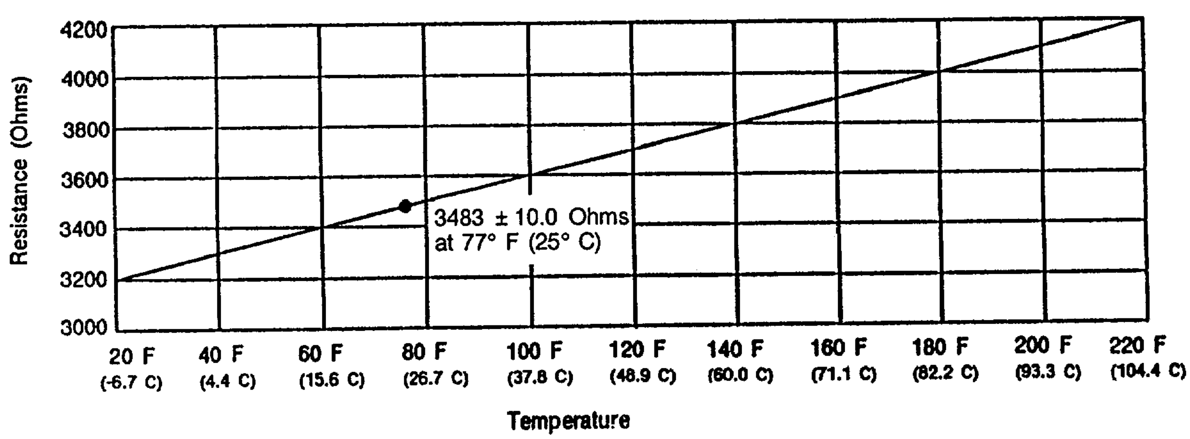
21. Re-connect all wiring as originally installed. Remove the test plug from the W7100's socket and reinstall the red plastic dust cover in its place.

22. Close the compressor disconnect(s), and adjust the W7100 setpoints as desired.

23. With switch 1S2 at "OFF", reinstall reset relays 1K11 (20-60 ton units) and 1K12 (40-60 ton units).

24. Set control circuit switch 1S2 at "ON".

Figure 40
Sensor Resistance-vs-Temperature Conversion Chart



RAUC Compressor Information

Trane 3-D Scroll Compressors

Because Trane scroll compressors are uniquely different from traditional reciprocating compressors, their operating characteristics and requirements represent a departure from reciprocating compressor technology.

Warning! Avoid contact with the top of the scroll compressor. It becomes hot during normal operation.

Compressor Electrical Phasing

Proper phasing of the electrical power wiring is critical for proper operation and reliability of the scroll compressor. Figure 41 illustrates correct supply power phasing for the scroll compressor.

Proper rotation of the scroll compressor must be established before the machine is started. This is accomplished by confirming that the electrical phase sequence of the power supply is correct. The motor is internally connected for clockwise rotation with the inlet power supply phased A, B, C.

To confirm the correct phase sequence (ABC), use a Model 45 Associated Research Phase indicator or equivalent. See Figure 42.

Voltages generated in each phase of a polyphase alternator or circuit are called phase voltages. In a three-phase circuit, three sine wave voltages are generated, differing in phase by 120 electrical degrees. The order in which the three voltages of a three-phase system succeed one another is called phase sequence or phase rotation. This is determined by the direction of rotation of the alternator. When rotation is clockwise, phase sequence is usually called "ABC", when counter-clockwise, "CBA".

This direction may be reversed outside the alternator by interchanging any two of the line wires. It is this possible interchange of wiring that makes a phase sequence indicator necessary if the operator is to quickly determine the phase rotation of the motor.

Correcting Improper Electrical Phase Sequence

Proper compressor motor electrical phasing can be quickly determined and corrected before starting the unit. Use a quality instrument such as an Associated Research Model 45 Phase Sequence Indicator and follow this procedure.

1. Open the electrical disconnect or circuit protection switch that provides line power to the line power terminal block (1TB1) in the control panel (or to the unit-mounted disconnect 1S1).

2. Connect the phase sequence indicator leads to the 1TB1 (1S1) as follows:

Phase Seq. Lead	1TB1 Terminal
Black (Phase A)	L1
Red (Phase B)	L2
Yellow (Phase C)	L3

Refer to Figure 43.

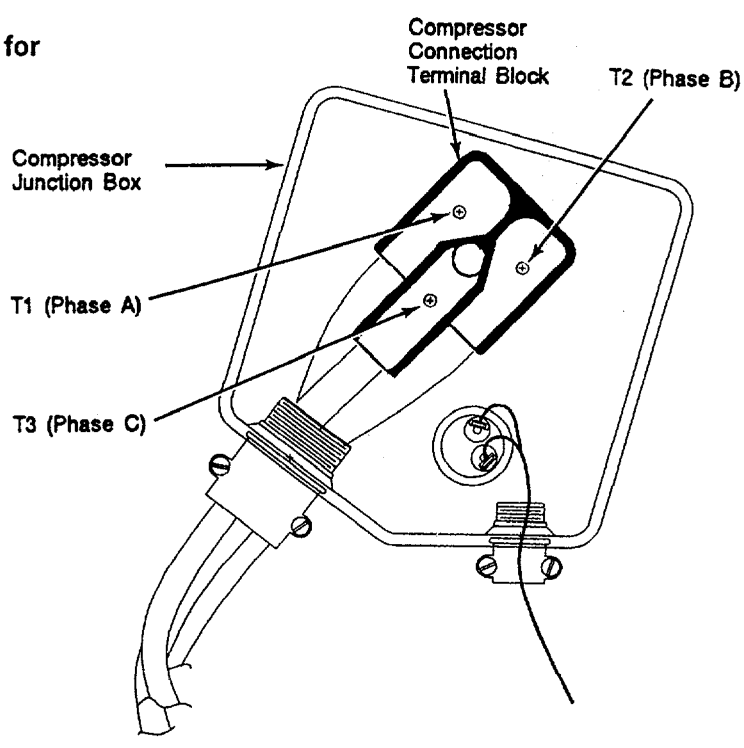
3. Read the phase sequence on the indicator after turning power on by closing the unit supply power fused disconnect. The "ABC" indicator on the face of the phase indicator will glow if phase is ABC.

WARNING! To prevent injury or death due to electrocution, take extreme care when performing service procedures with electrical power energized.

4. If the "CBA" indicator glows instead, open the unit main power disconnect and **switch two line leads** on 1TB1 (1S1). Reclose the main power disconnect and recheck phasing.

5. Disconnect the phase indicator.

Figure 41
Supply Power Phasing for RAUC 20 thru 60 Scroll Compressor



Drg. 5707-0311 P

Figure 42
Associated Research Model 45
Phase Sequence Indicator

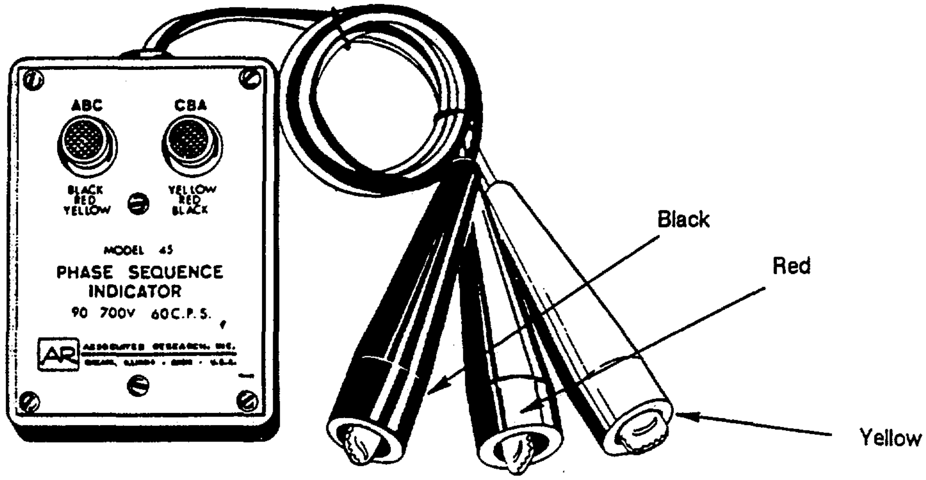
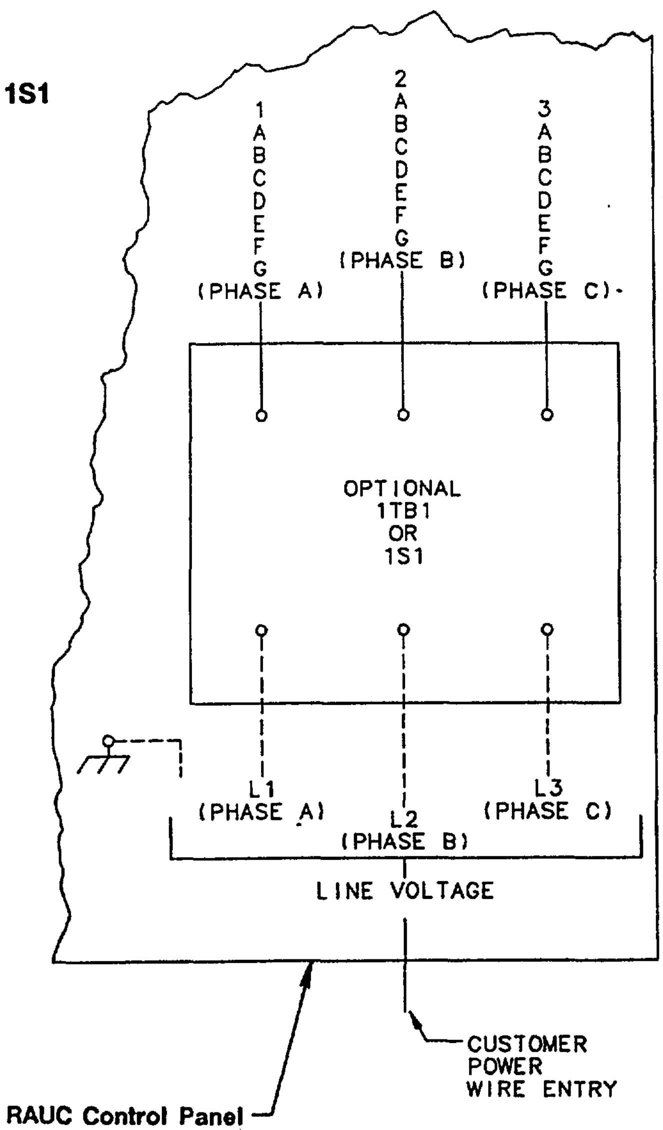


Figure 43
Terminal Block 1TB1 or 1S1
Phase Sequencing



Scroll Compressor Operational Noises

Because the scroll compressor is designed to accommodate liquids (both oil and refrigerant) and solid particles without causing compressor damage, there are some characteristic sounds that differentiate it from those typically associated with a reciprocating compressor. These sounds (which are described below) are characteristic, and do **not** indicate that the compressor is defective.

... at Shutdown. When a scroll compressor shuts down, the gas within the scroll compressor expands and causes momentary reverse rotation until the discharge check valve closes. This results in a "flutter" type of noise that is **normal**, and does **not** affect the operation or reliability of the compressor.

... 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. These sounds are **normal**, and do **not** affect the reliability or operation of the compressor.

... during Normal Operation. Under normal operating conditions, there are no unusual noises generated by the compressor.

Scroll Compressor Functional Test and Checkout Procedure

Since the scroll compressor does not use discharge or suction valves (which can be damaged), it is not necessary to perform a "pumpdown capability" test — i.e., a test where the liquid-line valve is closed and the compressor is pumped into a deep vacuum to see if it will pump down and hold. In fact, this kind of test may actually damage the scroll compressor!

Caution: Do not pump the scroll compressor into a vacuum. Scroll compressors can pull internally low vacuums when the suction side is closed or restricted. This, in turn, may cause the internal Fusite terminal to arc — resulting in compressor damage or failure. It may also trip the circuit breakers or blow fuses.

The proper procedure for checking scroll compressor operation is outlined below:

1. Verify that the compressor is receiving supply power of the proper voltage.

2. With the compressor running, measure the suction and discharge pressures to determine whether or not they fall within the normal operating ranges for the unit.

Scroll Compressor oil

The scroll compressor uses Trane OIL-15 **without substitution.** For a 10-ton scroll compressor, the appropriate oil charge is 8 pints; use 14 pints for a 15 ton scroll compressor.

3. Verify that the compressor oil level is correct. While the compressor is running, the oil level may be below the sightglass **but still visible through the sightglass.** The oil level should never be **above** the sightglass!

Note: It is not uncommon for the two sightglasses of a manifolded pair of compressors to show different oil levels. (While the unit is running, the oil level can be high in one compressor's sightglass and at the same time be low in the other compressor's sightglass.)

4. Check the oil's appearance. Discoloration of the oil indicates that an abnormal condition has occurred. **If the oil is dark and smells burnt,** it overheated because of: compressor operation at extremely high condensing temperatures; a compressor mechanical failure; or, occurrence of a motor burnout. **If the oil is black and contains metal flakes,** a mechanical failure occurred. This symptom is often accompanied by a high amperage draw at the compressor motor.

Note: 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 0.05mg KOH/G if a burnout occurred.

5. Excess Amp Draw. Normally, this condition occurs either because the compressor is operating at an abnormally high condensing temperature, or because of low voltage at the compressor motor. Motor amp draw may also be excessive if the compressor has internal mechanical damage. In this situation, vibration and discolored oil could also accompany this symptom.

6. Low Suctions. Low suctions can be caused by a plugged screen on the compressor suction inlet. If the screen is plugged, the pressure in the oil sump (as measured at the oil charging valve) will be lower than the suction pressure measured at the evaporator. Other symptoms that may accompany low suctions include ...

... a rattling sound emitted from the compressor.

... an open motor winding thermostat.

Low suction pressures may also be caused by low evaporator load.

7. Excessive Vibration. If the compressor vibrates and does not pump (i.e., there is no increase in discharge pressure or lowering of suction pressure), a mechanical failure has occurred and the compressor must be replaced.

Note: Incorrect electrical phasing could also result in similar symptoms.

8. Incorrect Compressor Electrical Phasing. If compressor electrical phasing is incorrect, (compressor operating in reverse), several symptoms will be apparent.

- Compressor will draw low current.
- Suction and discharge pressures will change very little.
- A rattling or rumbling sound may be apparent.

If allowed to run backward for an extended period (15 to 30 minutes), the motor windings will overheat and cause the motor winding thermostats to open. This, in turn, will trip the reset relay and stop the compressor.

Note: If the reset relay has tripped, power removal from the control circuit is required for a restart.

If the compressor electrical phasing is incorrect, follow the procedure under "Compressor Electrical Phasing" to correct the problem.

Compressor Motor Winding Thermostat

Each motor winding thermostat is a pilot duty control designed to stop compressor operation if the motor windings become hot due to rapid cycling, loss of charge, abnormally low suction temperatures, or the compressor running backwards.

Compressor Manifold Piping

The compressor refrigerant piping manifold system was purposely designed to provide proper oil return to both compressors; therefore, **the original refrigerant manifolding system should not be modified in any way!**

If a compressor replacement is required, do not alter the compressor manifold piping; improper oil return and compressor failure could result. If a suction filter is required, install it a minimum of 18" upstream of the compressor manifold piping. See Figure 44.

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

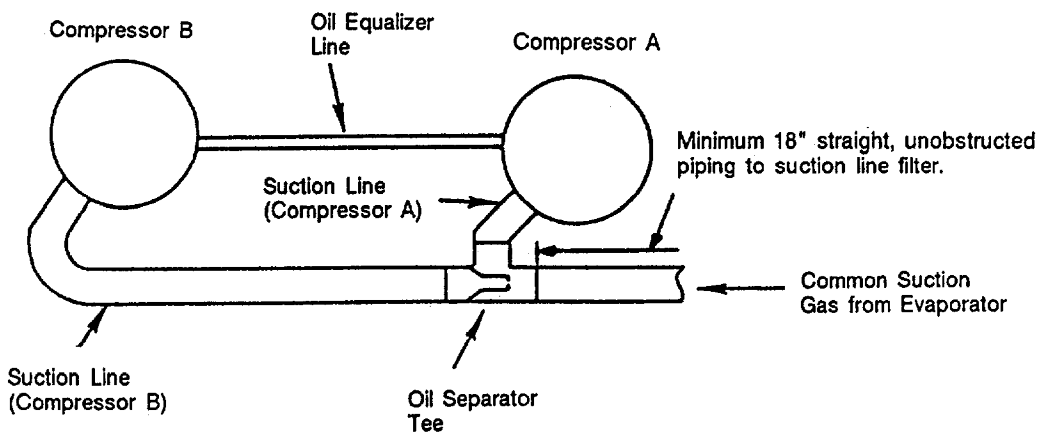
The scroll compressors in the RAUC units do not unload. Instead, they are staged on and off for various steps of loading. **This sequence is critical and must not be changed!** Altering this sequence in any way could cause compressor failure.

Table 12
Compressor Sequencing

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%)

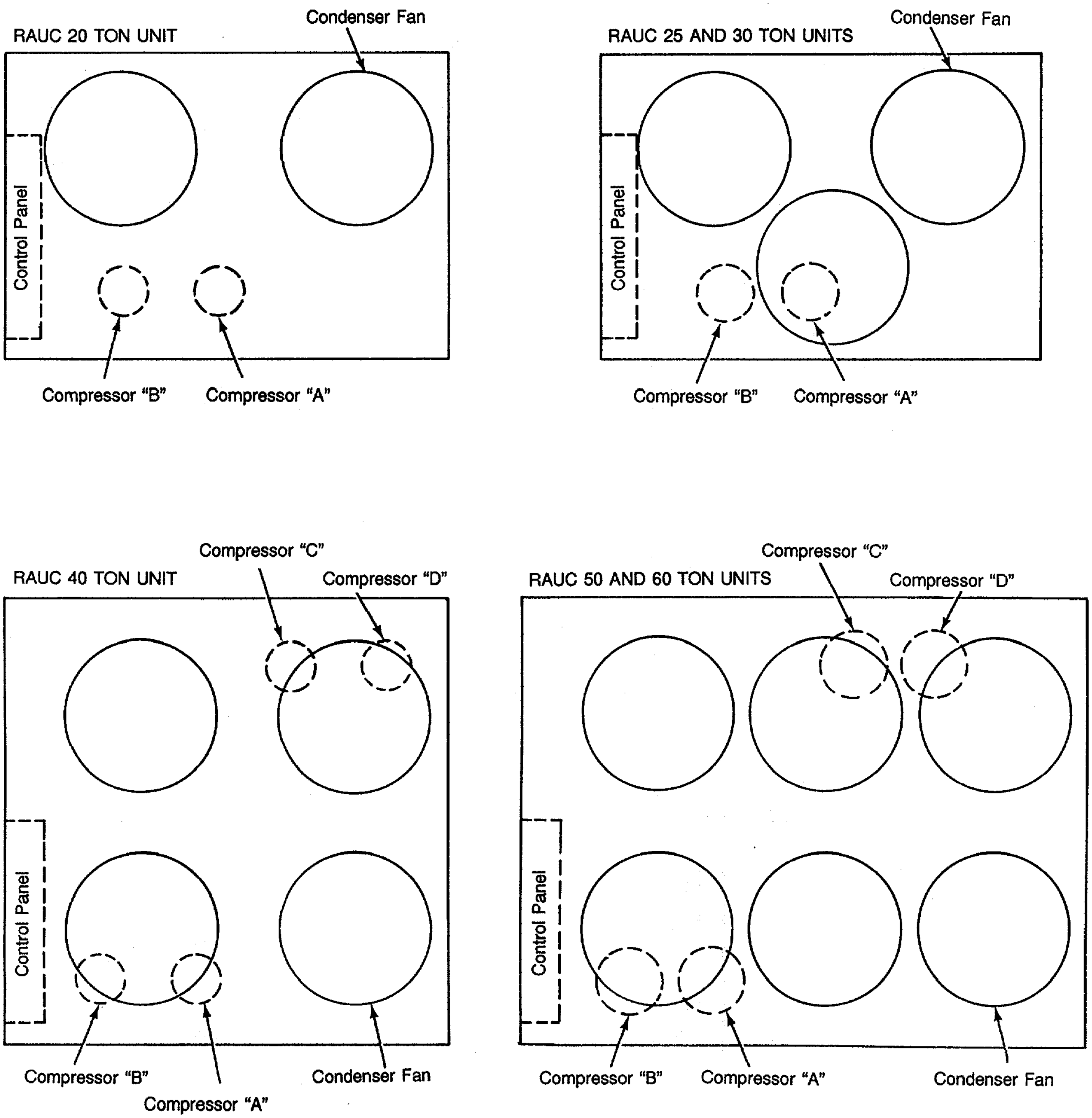
Note: A, B, C and D indicate which compressor in the unit is operating. (%) indicates the amount of the circuit in operation during a given step. Refer to Figure 45 for the location of compressors A, B, C and D in the RAUC unit.

Figure 44
Location Requirements for Suction Line Filter Installation after Motor Burnout



Note: Anytime one compressor is replaced, the oil charge for the remaining compressor must be replaced.

Figure 45
Compressor Locations
for RAUC 20 thru 60 Units



Installation Checklist

Installation Checklist

Complete this checklist as the unit is installed to verify that all recommended installation procedures are accomplished before the unit is started. This checklist does not replace the detailed instructions provided in the previous sections of this manual. Read the entire manual carefully to become familiar with the required installation procedures **before** installing the unit.

Receiving

[ ] Verify that unit nameplate data corresponds with ordering information.

[ ] Inspect unit for shipping damage and material shortage; report any damage or shortages found to the carrier.

Unit Locations and Mounting

[ ] Provide recommended service access clearances around unit.

[ ] Secure unit to mounting surface.

[ ] Level the unit.

[ ] **RAUC Unit Only:**

(a) Provide recommended condenser air clearances over and around unit.

(b) Install optional spring or neoprene isolators, if required.

(c) Remove Compressor shipping braces **and** compressor isolator sleeves.

EVP Water Piping

[ ] Flush all water piping to unit **before** making final piping connections to unit.

Caution: If using an acidic, commercial flushing solution, construct a temporary bypass around the unit to prevent damage to internal evaporator components.

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

[ ] Make evaporator water connections.

[ ] Vent chilled water system at high points in system piping.

[ ] Install pressure gauges (with shutoff valves), thermometers, and shutoff valves on water inlet and outlet piping.

[ ] Install water strainer in evaporator water supply line.

[ ] Install balancing valve and flow switch on water outlet piping.

[ ] Install evaporator drain plug, **or** install drain piping with shutoff valves.

[ ] Apply heat tape and insulation as necessary to protect any exposed water piping from freeze-up.

[ ] Install chilled water sensor and sensor well in pipe fitting provided on evaporator water outlet.

[ ] Install freezestat well and bulb in evaporator water outlet.

Refrigerant Piping

[ ] Perform initial leak test.

Important Note:
Do **not** release refrigerant to the atmosphere! Refer to general service bulletin MSCU-SB-1 (latest edition).

[ ] Braze properly sized and constructed liquid lines to liquid line connections on unit.

[ ] Braze properly sized and constructed suction lines to suction line connections on unit.

[ ] Insulate suction lines.

[ ] Braze properly sized and constructed hot gas bypass lines to bypass connections on unit **if** unit is equipped with hot gas bypass.

[ ] Install properly sized hot gas bypass regulating and solenoid valves in hot gas bypass lines **if** unit is equipped with hot gas bypass.

[ ] Install properly sized TEV(s) close to evaporator.

[ ] Install liquid line filter drier(s) upstream of TEV(s).

[ ] Install sight glasses in liquid lines between TEV and filter drier.

[ ] Leak-test unit and all refrigerant piping connections.

Electrical Wiring: Power Supply

[ ] Ensure field-installed wiring complies with all applicable codes.

[ ] Check compressor contactor and terminal block lugs for tightness.

[ ] Connect properly sized line power conductors with fused disconnect to line power terminal block (1TB1) or unit disconnect switch (1S1) in RAUC main control panel.

[ ] Connect properly sized line power conductors with fused disconnect to line power connection point in evaporator unit.

[ ] Connect properly sized line power conductors with fused disconnect to chilled water pump motor (EVP units only).

[ ] Ensure that all grounding wires are securely bonded to earth ground.

Electrical Wiring: 115V Control Wiring—All Units

[ ] Ensure Control transformer (1T1) is wired for proper Voltage.

[ ] Connect proper wiring to interlock hot gas bypass solenoid valve operation with unit shutdown (i.e., systems with hot gas bypass only).

Electrical Wiring: 115V Control Wiring— "No Controls" Units Only

[ ] Connect step controller to unit and interlock with evaporator fan operation.

[ ] Connect proper wiring to evaporator fan control circuit to interlock fan operation with compressor start-up (i.e., proof of fan operation before compressor start).

[ ] Connect system control switch to enable selection of system operating mode and start/stop from remote location.

Electrical Wiring: 115V Control Wiring— VAV Units Only

[ ] Connect proper wiring to evaporator fan control circuit to interlock fan operation with compressor start-up (i.e., proof of fan operation before compressor start).

Electrical Wiring: 115V Control Wiring— EVP Units Only

[ ] Mount the EVP control panel.

[ ] Install wiring to connect remote push button station to chilled water (evaporator) pump motor starter.

[ ] Connect chilled water (evaporator) pump starter auxiliary contacts to flow switch and to unit control panel. This interlock will require proof-of-chilled-water-flow through the evaporator before compressor start-up.

Start-Up and Operation

(Installation Checklist Continued)

[ ] Install wiring to connect flow switch to unit control panel.

[ ] Connect outside air thermostat in series with flow switch to stop or prevent unit operation below recommended ambient temperatures.

Electrical Wiring: Low-Voltage Wiring — VAV Units

[ ] Connect low-voltage system control switch to energize VAV system from desired remote location.

[ ] If VAV system utilizes an economizer, disconnect economizer resistor from terminal strip in temperature controller panel; then connect proper wiring for economizer actuator circuit.

[ ] If VAV system utilizes night setback, install and connect night setback relay contacts.

[ ] Wire the suction line thermostat to terminal strip 7TB7 in unit control panel.

[ ] Provide and connect shielded, twisted-pair wire from discharge air sensor to appropriate terminal strip in temperature controller panel.

Electrical Wiring: Low-Voltage Wiring — EVP Units Only

[ ] If hot gas bypass is required for system, install HGBP jumper on appropriate terminal strip in auxiliary control panel.

[ ] Provide and connect shielded, twisted-pair wire from chilled water temperature sensor to appropriate terminals in temperature controller panel. (Chilled water temperature sensor bulbwell must be field-installed in leaving chilled water piping.)

[ ] Ensure that proper staging resistor has been installed on temperature controller (6U11).

* * * * *

Start-Up

Pre-Start Procedures

Pre-Start Checklist

After the unit is installed, complete each step in the checklist that follows and check off each step as completed. When all are accomplished, the unit is ready to run.

[ ] Evacuate each refrigerant circuit to a pressure of 500 microns or less. Refer to "System Evacuation".

[ ] Charge each refrigerant circuit with the required amount of R-22. Refer to "System Refrigerant Charging".

[ ] Inspect all wiring connections. Connections should be clean and tight.

WARNING! To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

Caution: To prevent overheating at connections and undervoltage conditions at the compressor motor, check tightness of all connections in the compressor power circuit.

[ ] Check compressor crankcase oil levels. Oil level with the compressor not running should be at the 1/2 to 3/4 point on the oil level sight glass.

[ ] Check to ensure that any refrigerant valves in the system are set properly. Liquid line service valves must be 1/4-turn off backseat to allow operation of fan pressure controls. The compressor suction service valves (when used) must be open before operating the compressors.

Caution: To prevent compressor damage, be certain that all refrigerant valves are open before starting the unit.

[ ] Check voltage to the unit at the line power fused disconnect. Voltage must be within the voltage utilization range given in the Electrical Data Tables (also stamped on the unit nameplate). Voltage imbalance must not exceed 2 percent.

For example, see "Unit Voltage"

WARNING! To prevent injury or death due to contact with rotating parts, open and lock all electrical disconnects.

[ ] Check condenser fans. Fan blades should rotate freely in fan orifices and should be mounted securely on the motor shafts.

[ ] Check condenser coils. Coil fins should be clean and straight. There should be no restrictions to proper airflow through the condenser.

WARNING! To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

EVP Units Only

[ ] For units with EVP control, check the chilled water sensor located in the sensor well on the evaporator leaving water outlet. It must be installed securely in the well with heat transfer compound.

[ ] Fill the chilled water system. Vent the system while filling it and remove the pipe plug from the vent located on the top of the evaporator. Replace the vent plug when the evaporator is filled.

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

[ ] Close the fused disconnect for the chilled water pump starter.

[ ] Start the chilled water pump by turning the chilled water pump ON/OFF switch at the pump remote station to ON. With water circulating through the chilled water system, inspect all piping connections for leakage. Make any necessary repairs.

[ ] With water circulating through the system, adjust water flow and check evaporator water pressure drop.

[ ] Adjust the flow switch on the evaporator outlet piping for proper operation.

[ ] Stop the chilled water pump.

(Pre-start Checklist continued on next page)

All Units

[ ] Prepare remainder of system for operation and coordinate RAUC unit start-up with evaporator unit (or water pump) start.

Pack Stock Units

[ ] Ensure that the proper low pressure control has been installed.

Start-Up Checklist

To start the unit, complete each step of this checklist, in sequence. Check off each step as completed. Do not start the unit until all "Pre-Start Procedures" are complete.

[ ] Turn the control circuit switch (1S2) in the temperature controller panel to OFF.

[ ] Adjust for normal system operation. Refer to "Control Setup" (Table 14) in this section.

[ ] Close the evaporator unit disconnect switch ("No Control," Constant Volume and VAV units) or the chilled water pump fused disconnect (EVP units). Energize the pump by turning the pump On/Off switch at the remote station to ON. The chilled water circulating pump will run.

[ ] Check the liquid line service valves. They must be 1/4 turn off backseat to provide proper fan pressure control operation.

[ ] Check compressor discharge service valves and compressor suction service valves (if used). These valves must be open (backseated) before starting the compressors.

Caution: To prevent compressor damage, be sure that all refrigerant valves are in proper position before starting the unit.

[ ] Close the line voltage disconnect switch and the unit-mounted disconnect switch, if used.

[ ] Reset any control with a manual reset function, such as the compressor motor protectors.

[ ] Set any customer-provided remote thermostats and system switch for proper system operation.

[ ] Turn the control circuit switch (1S2) to ON.

If the system temperature controller calls for cooling and all safety interlocks are closed, the unit will start. The compressors stage on and off in response to changes in zone temperature, discharge air temperature or chilled water temperature as sensed by the remote thermostat ("No Control" or constant-volume units), discharge air sensor (VAV units), or chilled water sensor (EVP units) on the evaporator water outlet.

Note: Ambient temperature should be above the recommended minimum start-up temperatures given in Table 13.

[ ] Measure voltage at the compressor contactor load-side terminals.

WARNING! To prevent injury or death from electrical shock, use extreme caution when servicing the unit with any electrical components energized.

Voltage readings must fall within the utilization range shown on the compressor nameplate. Calculate voltage imbalance between phases. If a voltage drop or imbalance exists at the compressor contactors but not at the unit main disconnect, the problem is caused by faulty wiring within the unit. Open all disconnect switches and conduct a thorough inspection of the unit to locate the fault and make any necessary repairs.

Operation

Checking Operating Conditions

Once the unit has been operating for about 30 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

[ ] Check suction and discharge pressures. Normal operating pressures are shown in Figures 46-51.

Caution: To minimize gauge wear, close shutoff valves to isolate the gauges after pressure readings have been taken.

Discharge Pressures

Measure at compressor discharge service valve backseat ports.

Suction Pressures

If the unit is equipped with compressor suction service valves, take pressure readings at valve backseat ports. If the unit does not have suction valves, Schraeder valves are provided on the suction pipe stups on the unit.

Table 13
RAUC-C20 thru C60
Minimum Starting
Ambient Temperatures

	Minimum Starting Ambient (1)			
	Standard Units		Low Ambient Units	
Unit Size	With HGBP	No HGBP	With HGBP	No HGBP
RAUC 20-60	45°	40°	10°	0°

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

[ ] If the operating pressures just measured do not appear correct, shut off the unit and check compressor phasing. See the "Scroll Compressor" section for instructions.

[ ] Check compressor oil levels. At full load, the oil level should be visible about 1/2 of the way up on the oil level sight glass on the compressor. If it is not, see "Scroll Compressor Oil" on page 57 of this manual.

[ ] Check the liquid line sight glasses. Refrigerant flow past the sight glasses should be clear.

Bubbles in the liquid line indicate either low refrigerant charge or an excessive pressure drop in the liquid line. Such a restriction can often be identified by a noticeable temperature differential on either side of the restricted area; frost often forms on the outside of the liquid line at this point, also.

Caution: The system may not be properly charged although the sight glass is clear. Also consider superheat, subcooling and operating pressures.

[ ] Measure system superheat. Refer to "System Superheat".

[ ] Measure system subcooling. Refer to "System Subcooling".

[ ] If operating pressure, sight glass, superheat and subcooling readings indicate refrigerant shortage, gas-charge refrigerant into each circuit. Refrigerant shortage is indicated if operating pressures are low, and subcooling is also low.

Caution: If suction and discharge pressures are low but subcooling is normal, no refrigerant shortage exists. Adding refrigerant will result in overcharging.

Caution: To prevent compressor damage, do not allow liquid refrigerant to enter the suction line. Liquid-charge at the liquid line service valve only.

Caution: To prevent compressor damage and ensure full cooling capacity, use only refrigerants specified on the unit nameplate.

[ ] If operating conditions indicate an overcharge, **slowly** (to minimize oil loss) remove refrigerant at the liquid line service valve. **Do not** discharge refrigerant into the atmosphere.

Important Note:
Do **not** release refrigerant to the atmosphere! Refer to general service bulletin MSCU-SB-1 (latest edition).

Control Setup
Table 14
Operating Setpoints for Unit Temperature Controllers

CONTROL	CONTROL SETTING	Recommended Settings
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)	Leaving Fluid Setpoint	Set at design leaving chilled water temperature; a typical setting = 44° F.
	Reset Setpoint	Set at maximum amount of allowable reset for leaving fluid setpoint.
	Control Band	Set at 6° F. Minimum Setpoint
Zone Thermostat (CV units only)	Zone Setpoint	Set at desired space temperature.
"No Controls" Units	——See System Engineer——	

Table 15
Overload Settings (Amps): 10-Ton Scroll Compressors

VOLTAGE	MUST HOLD	MUST TRIP	% DIAL SETTING
200/230V	51.8	58.0	115.1
460V	22.7	25.4	113.4
575V	17.5	19.6	87.5

Overload Settings (Amps): 15-Ton Scroll Compressors

VOLTAGE	MUST HOLD	MUST TRIP	% DIAL SETTING
200/230V	71.5	80.1	110.0
460V	31.7	35.5	105.7
575V	25.3	28.3	84.2

Freezestat (EVPB Only)

Field-set a minimum of 5° F above the chilled solution freezing point.

Table 16
RAUC
Control settings

Following are the control settings for RAUC-C20 thru C60 condensing units.

CONTROL	MAKE	BREAK
Hi Pressure Switch	350 psi	405 psi
Low Pressure Switch: EVPB	60 psi	45 psi
All Others	40 psi	25 psi

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

Fan Pressure Switch	275 psi	155 psi
Winding 'Stat	181° F	221° F
Low Ambient Thermostat	33° F	30° F

Figure 46
RAUC 20 Ton Operating Pressures
(100% Compressor Load; All Condenser Fans On)

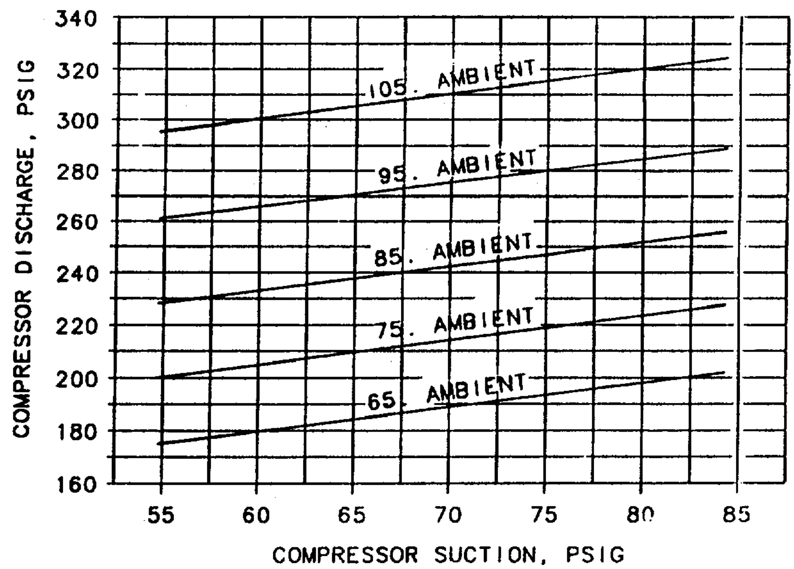


Figure 47
RAUC 25 Ton Operating Pressures
(100% Compressor Load; All Condenser Fans On)

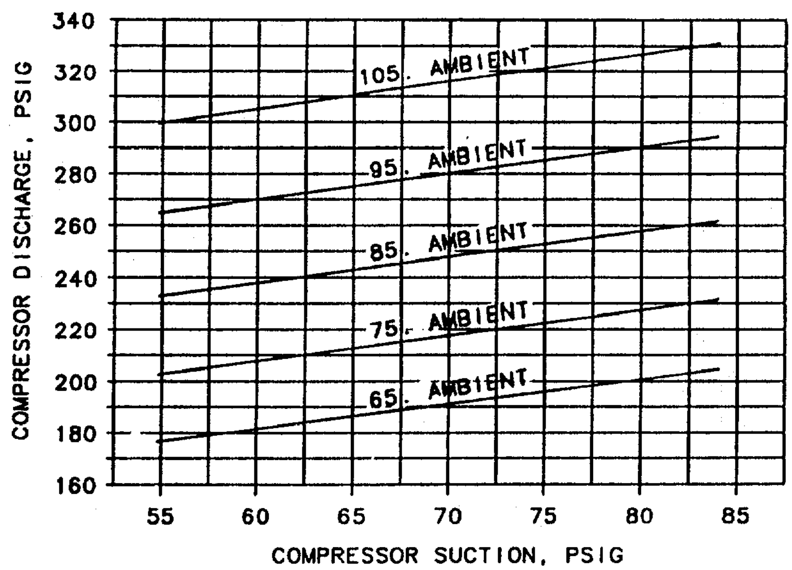


Figure 48
RAUC 30 Ton Operating Pressures
(100% Compressor Load; All Condenser Fans On)

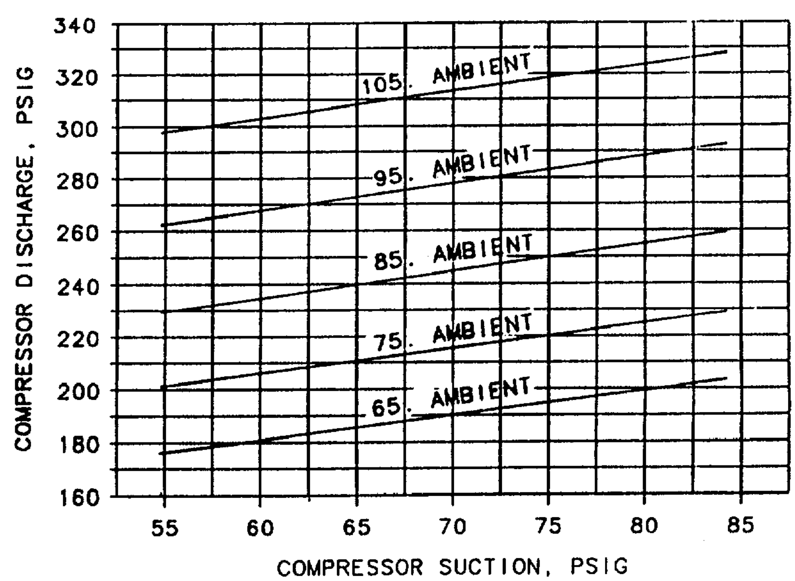


Figure 49
RAUC 40 Ton Operating Pressures
(100% Compressor Load; All Condenser Fans On)

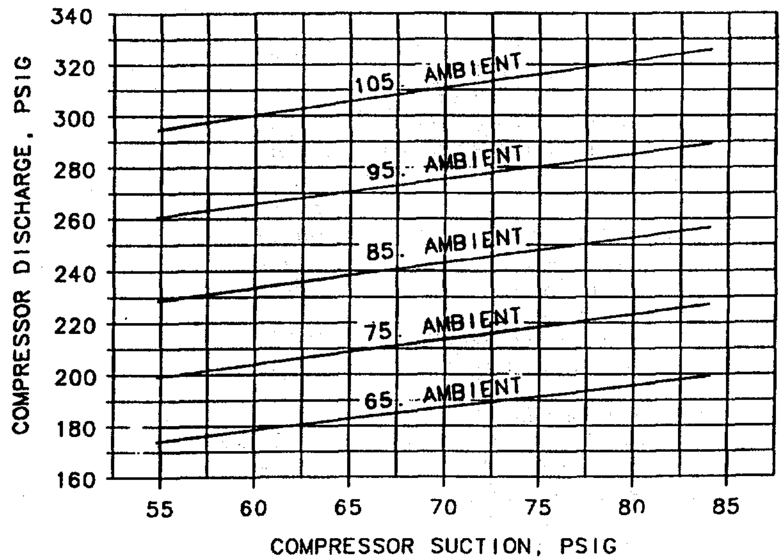


Figure 50
RAUC 50 Ton Operating Pressures
(100% Compressor Load; All Condenser Fans On)

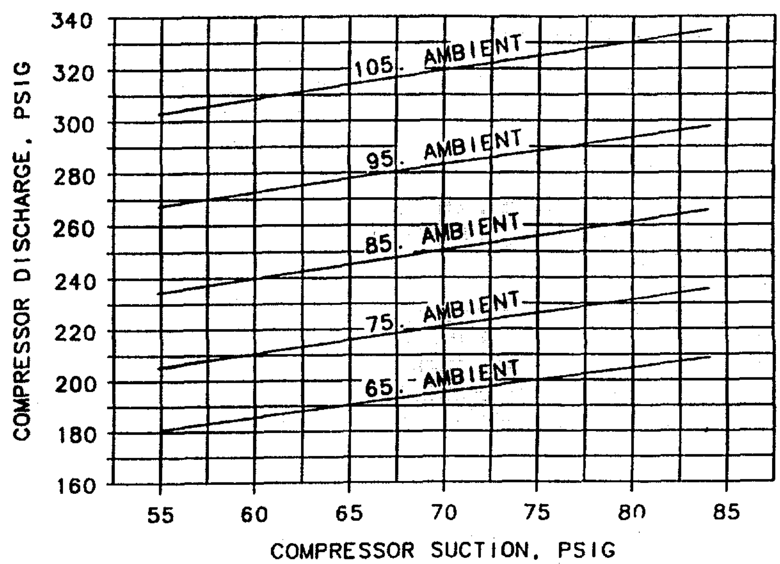
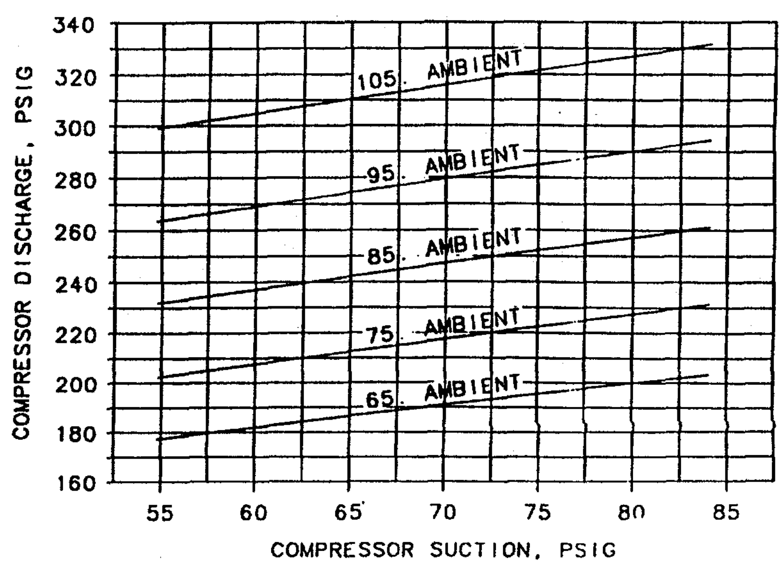


Figure 51
RAUC 60 Ton Operating Pressures
(100% Compressor Load; All Condenser Fans On)



Periodic Maintenance

Perform all of the indicated maintenance procedures at the intervals scheduled. This will prolong the life of the unit and reduce the possibility of costly equipment failure.

Once a Month

Conduct the maintenance inspections outlined below on a monthly basis during the cooling season.

[ ] Inspect the evaporator coil air filters. Clean or replace if necessary.

[ ] Inspect the evaporator and condenser coils for dirt and foreign debris. If the coils appear dirty, clean them according to the instructions provided under "Coil Cleaning" in the **Maintenance Procedures** section of this manual.

[ ] Check compressor oil level.

[ ] Check compressor phasing; see "Compressor Electrical Phasing".

Once A Year

The following maintenance practices must be performed at the beginning of each cooling season to ensure efficient unit operation.

WARNING! Open the unit disconnect switch and lock it in that position to prevent accidental start-up. Never open an access panel to inspect or service the unit without first opening the disconnect switch. Failure to do so may result in injury or death from electrical shock or contact with moving parts.

[ ] Inspect the evaporator coil air filters. Clean or replace if necessary.

[ ] Clean both the evaporator and condenser coils. Follow the procedures outlined under "Coil Cleaning" in the **Maintenance Procedures** section of this manual.

[ ] With the unit disconnect switch open, check to see that each condenser and evaporator fan is securely fastened to its motor shaft. All fans should turn freely and airflow should be unobstructed.

[ ] Replace worn or frayed evaporator fan belts. Check the belt tension of the evaporator fans. A 1/2" deflection under light hand pressure is normal. Tighten if necessary.

[ ] Remove the condensing unit control box cover and inspect the panel wiring. All electrical connections should be secure. Inspect the compressor and condenser fan motor contactors. If the contacts appear severely burned or pitted, replace the contactor (refer to Figure 52). Do not clean the contacts. Inspect the condenser fan capacitors for visible damage.

[ ] Remove any accumulation of dust and dirt from the condensing unit.

[ ] Clean and inspect the drain pan of the evaporator unit. Make sure the drain piping is clear.

[ ] Observe the compressor oil level sight glass while the unit is running. If oil is visible, the level is normal. If oil does not appear in the sight glass, refer to page 54 of this manual.

[ ] Check the superheat and subcooling.

a. The condenser and evaporator coils must be clean before making the following checks.

b. Determine the superheat of the system. Refer to "Thermostatic Expansion Valve Adjustment and Superheat Measurement" under **Maintenance Procedures.**

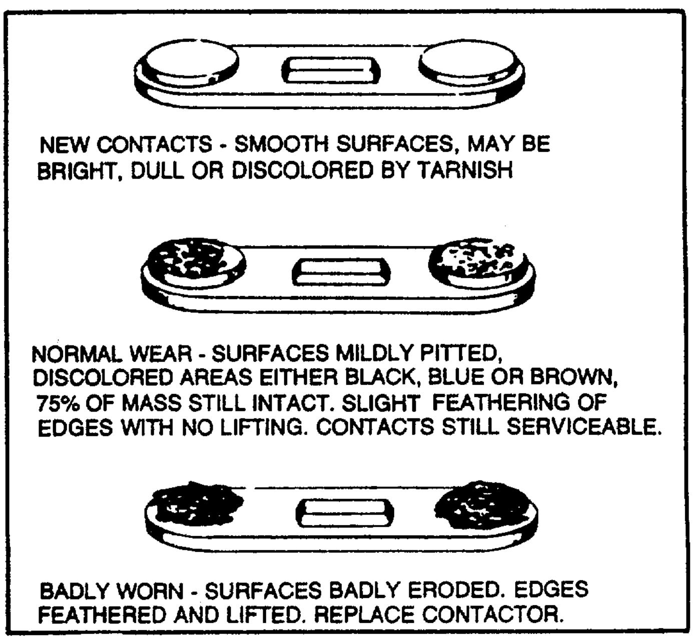
c. Adjust the superheat if necessary.

d. When the superheat setting is correct, check the subcooling. Refer to "Measuring Subcooling" under **Maintenance Procedures.**

e. If the subcooling is low, leak-test the system to determine if there is a leak. For instructions, see "Leak Testing" in **Maintenance Procedures.**

f. Charge the system with refrigerant, if necessary. Instructions are provided under "Checking Refrigerant Charge" under **Maintenance Procedures.**

Figure 52
Compressor Contactor Replacement Guide



Shutdown and Start-up

Shutdown: Short Duration

The system can be shutdown for short periods of time, such as over the weekend by placing the control circuit switch (1S2) or the system control switch in the OFF position.

Start-Up: Short Duration

The system is returned to operation after a shutdown of short duration—such as over a weekend—by adjusting the thermostat setting to the desired temperature and placing the control circuit switch (1S2) in the ON position.

Shutdown: Seasonal

For seasonal shutdown, open the unit electrical disconnect switch to prevent the unit from starting accidentally.

Start-Up: Seasonal

To start the unit after an extended shutdown period, complete the following procedures.

1. Perform all of the "Once a Year" checks listed in the **Periodic Maintenance** section of this manual.

2. Move control circuit switch 1S2 to OFF.

3. Close the condensing unit electrical disconnect switch.

4. Start the system by adjusting the thermostat setting to the desired temperature and placing the control circuit switch (1S2) in the ON position.

Maintenance Procedures

This section of the manual describes specific maintenance procedures which must be performed as a part of the unit's maintenance program. Before performing any of these operations, however, be sure that power to the unit is disconnected unless otherwise instructed.

WARNING! When maintenance checks and procedures must be completed with the electrical power on, care must be taken to avoid contact with energized components or moving parts. Failure to exercise caution when working with electrically powered equipment may result in serious injury or death.

Coil Cleaning

Refer to the evaporator service literature for evaporator coil cleaning instructions. Refrigerant coils must be cleaned at least once a year, or more frequently if the unit is located in a dirty environment. This will help maintain unit operating efficiency and reliability. The relationship between regular coil maintenance and efficient/reliable unit operation is outlined below.

1. Clean condenser coils minimize compressor head pressure and amperage draw, and promote system efficiency.

2. Clean evaporator coils minimize water carry-over and help eliminate frosting and/or compressor flood back problems.

3. Clean coils minimize required fan brake horsepower and maximize efficiency by keeping coil static pressure loss at a minimum.

4. Clean coils keep motor temperature and system pressure within safe operating limits for good reliability.

Specific instructions for cleaning condenser coils are provided in the following paragraphs. Follow these instructions as closely as possible to avoid potential damage to the coils.

To clean condenser coils, the following equipment is required: a soft brush and either a garden pump-up sprayer or a high pressure sprayer. In addition, a high quality detergent must be used: suggested brands include SPREX A.C., OAKITE 161, OAKITE 166, and COILOX. Follow the manufacturer's recommendations for mixing to make sure the detergent is alkaline with a pH value less than 8.5.

1. Disconnect power to the unit.

WARNING! Open unit disconnect switch. Failure to disconnect unit from electrical power source may result in severe electrical shock, and possible injury or death.

2. Remove enough panels from the unit to gain access to the coil.

3. Protect all electrical devices such as motors and controllers from dust and spray.

4. Straighten coil fins with a fin rake, if necessary.

5. Use a soft brush to remove loose dirt and debris from both sides of the coil.

6. Mix the detergent with water according to the manufacturer's instructions. The detergent-and-water solution may be heated to a maximum of 150° F to improve its cleansing ability.

WARNING! Do not heat the detergent and water solution to temperatures in excess of 150° F. High temperature liquids sprayed on the coil exterior will raise the pressure within the coil and may cause it to burst, resulting in possible injury to service personnel and equipment damage.

7. Place the detergent-and water solution in the sprayer. If a high pressure sprayer is used, be sure to follow these guidelines:
- Minimum nozzle spray angle is 15 degrees.
- Spray the solution perpendicular (at a 90 degree angle) to the coil face.
- Keep the sprayer nozzle at least six inches from the coil.
- Sprayer pressure must not exceed 600 psi.

Caution: Do not spray motors or other electrical components. Moisture can cause component failure.

8. Spray the leaving air side of the coil first, then spray the entering air side of the coil. Allow the detergent-and-water solution to stand on the coil for five minutes.

9. Rinse both sides of the coil with cool, clean water.

10. Inspect the coil. If it still appears to be dirty, repeat steps 8 and 9.

11. Remove protective covers installed in step 3.

12. Replace all unit panels and parts, and restore electrical power to the unit.

Brazing Procedures

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

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. Also move line insulation and tube grommets away from the joints. Excessive heat can damage these components.

5. If flux is used, apply it sparingly to the joint. Excess flux will contaminate the refrigerant system.

6. Apply heat evenly over the length and circumference of the joint. The entire joint should become hot enough to melt the brazing material.

7. Begin brazing when the joint is hot enough to melt the brazing rod. The hot copper tubing, not the flame, should melt the rod.

8. Continue to apply heat around the circumference of the joint until the brazing material is drawn into the joint by capillary action, making a mechanically sound and gas-tight connection. Remove the brazing rod as soon as a complete fillet is formed to avoid possible restriction in the line.

9. 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 joint location.

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.

Evacuation Procedures

For field evacuation, use a rotary-style vacuum pump capable of pulling a vacuum of 100 microns or less.

When hooking the vacuum pump to a refrigeration system, it is important to manifold the pump to both the high and low side of the system (liquid line access valve and compressor suction access valve). Follow the pump manufacturer's directions as to the proper methods of using the vacuum pump.

Caution: Do not, under any circumstances, use a megohm meter or apply power to the windings of a compressor while it is under a deep vacuum. In the rarified atmosphere of a vacuum, the motor windings can be damaged.

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 unit evacuation because they gave moisture absorbing characteristics which result in excessive rates of out-gassing and pressure rise during the standing vacuum test. This makes it impossible to determine if the unit 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 shut-off valve, as shown in Figure 54. Close Valves B and C, and open Valve A. After several minutes, the gauge reading will indicate the minimum blank-off pressure the pump is capable of pulling. Rotary pumps should produce vacuums of less than 100 microns.

Open Valves B and C. Evacuate the system to a pressure of 500 microns or less. Once 500 microns or less is obtained, with Valve A closed, a time versus pressure rise should be performed. 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 53 illustrates three possible results of the time versus temperature rise check.

Figure 53
Time-vs-Pressure Rise After Evacuation

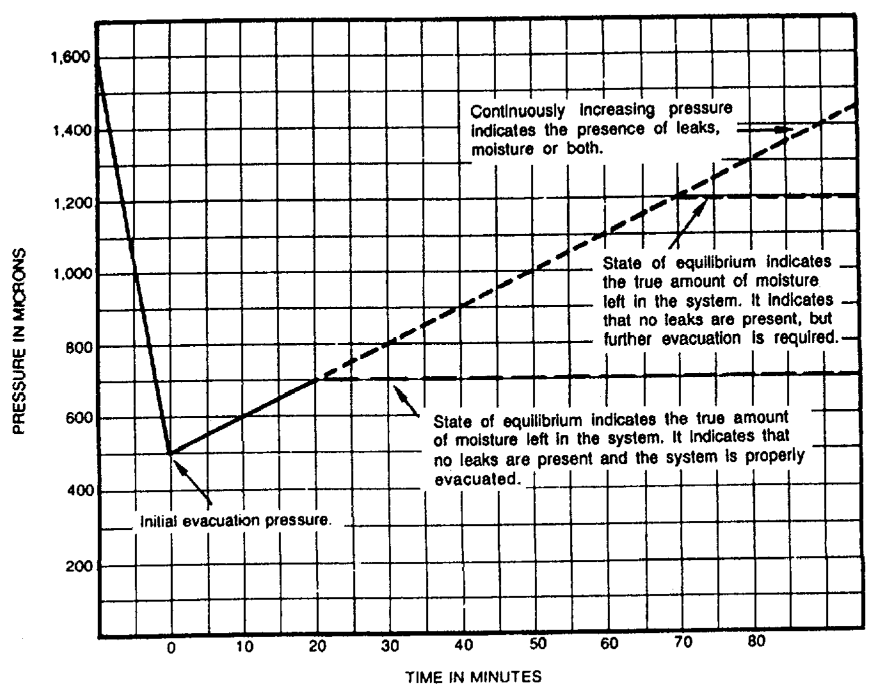
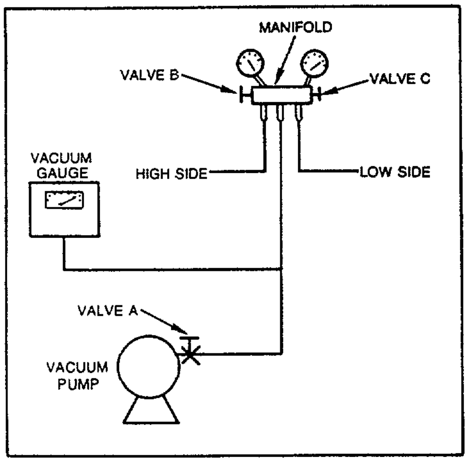


Figure 54
Typical Vacuum Pump Hook-up



Leak Testing

When leak testing the unit, the following safety precautions must be observed:

WARNING! Do not work in a closed area where refrigerant or nitrogen may be leaking. A sufficient quantity of vapors may be present to cause personal injury. Provide adequate ventilation.

WARNING! Do not use oxygen acetylene, or air in place of refrigerant and dry nitrogen for leak testing. A violent explosion will result which could cause serious injury or death.

WARNING! Always use a pressure regulator, valves, and gauges to control drum and line pressures when pressure testing the system. Excessive pressures may cause line ruptures, equipment damage, or an explosion which could result in personal injury or death.

Leak test the liquid line, evaporator, and suction line at pressures dictated by local codes.

Caution: Do not exceed 200 psig when leak testing the system.

1. Charge enough refrigerant into the system to raise the pressure to 100 psig.

2. Use a halogen leak detector or halide torch to check for leaks. Be thorough in this test, checking the interconnecting piping joints, the evaporator unit, and the condensing unit.

3. If a leak is found during the testing, recover and reclaim the refrigerant, break the connection, and remake it as a new joint. Refer to the "Brazing Procedures" in this section of the manual for proper brazing techniques.

4. If no leak is found, use nitrogen to increase the test pressure to 150 psig, and repeat the leak test. Soap bubbles should be used to check for leaks when nitrogen is added. If a leak is found after increasing the pressure to 150 psig using nitrogen, recover and reclaim the refrigerant and repair the leak.

5. Re-test the system to make sure the new connection is solid.

6. If a leak is suspected after the system has been fully charged with refrigerant, use a halogen leak detector, halide torch, or soap bubbles to check for leaks.

Refrigerant Charging

Once the system is properly installed, leak tested and evacuated, refrigerant charging should begin. Liquid refrigerant is charged into the system through the liquid line access valve.

Refrigerant should be charged into the system by weight. Use an accurate scale or a charging cylinder to determine the exact weight of the refrigerant entering the system. Failure to use either a scale or charging cylinder can lead to under-charging or over-charging, resulting in unreliable operation.

The weights of refrigerant required for the condensing unit are given in Table 17. The weight of refrigerant required for the system piping can be determined by measuring the refrigerant lines and using the data in Table 19. The total system operating charge is calculated by adding the charge weight requirements of each part of the system.

WARNING! Do not apply flame to a refrigerant drum in an attempt to increase the drum pressure. Uncontrolled heat may cause excessive drum pressures and an explosion may result causing serious personal injury or death.

WARNING! Should liquid refrigerant come in contact with the skin, the injury should be treated as if the skin has been frostbitten or frozen. Slowly warm the affected area with lukewarm water. Seek medical attention.

Proceed as follows to charge the system with refrigerant.

1. Charge liquid refrigerant into the liquid line of the No. 1 compressor circuit, using the liquid line access valve. The vacuum within the system will draw most of the required refrigerant into the system. If the pressure within the system equalizes with the pressure in the charging cylinder before the required charge has been drawn in, proceed to step 2.

2. If the system cannot be completely charged by liquid refrigerant entering the system liquid line as outlined in step 1, complete the process by charging gaseous refrigerant into the suction line. Proceed as follows:

   a. Close the liquid line valve on the manifold gauge set.

   b. Connect the manifold gauge set to the suction and discharge access valves (shown in Figure 54). The manifold valves should be closed.

   c. Start the unit by following the procedures outlined in the "Start-Up" section of this manual.

   d. With the condensing unit operating, slowly open the suction line valve on the manifold gauge set. The remainder of the refrigerant will be drawn into the system.

(Refrigerant Charging continued on next page)

Table 17
Unit Refrigerant Charge Weights

Unit Size	Refrigerant Charge*
RAUC-C20 RAUC-C40	28 lbs.
RAUC-C25 RAUC-C50	31 lbs.
RAUC-C30 RAUC-C60	40 lbs.

* Refrigerant charge given in lbs. per circuit.

Table 18
Filter Drier
Refrigerant Charge Weights

Condensing Unit	Liquid Line O.D.	Sporlan Part No.	Refrigerant Charge
RAUC-C20	5/8"	C-305-S	1 lb. - 1 oz.
RAUC-C40	3/4"	C-307-S	1 lb. - 1 oz.
	7/8"	C-307-S	1 lb. - 1 oz.
	1-1/8"	C-419-S	1 lb. - 8 oz.
RAUC-C25	5/8"	C-305-S	1 lb. - 1 oz.
RAUC-C50	3/4"	C-307-S	1 lb. - 1 oz.
	7/8"	C-307-S	1 lb. - 1 oz.
	1-1/8"	C-419-S	1 lb. - 8 oz.
RAUC-C30	3/4"	C-417-S	1 lb. - 8 oz.
RAUC-C60	7/8"	C-417-S	1 lb. - 8 oz.
	1-1/8"	C-419-S	1 lb. - 8 oz.

Table 19
Refrigerant Line
Charge Weights

Tube O.D (inches)	Refrigerant Charge Weight*	
	Liquid Line	Suction Line
5/8	1.827	—
3/4	2.728	—
7/8	3.790	—
1-1/8	6.461	—
1-3/8	—	0.203
1-5/8	—	0.288
2-1/8	—	0.500

*Refrigerant charge given in ounces per foot.

Caution: Do not allow liquid refrigerant to enter the suction line. Excessive liquid will damage the compressor.

Important: Compressor failure may result if the unit is not charged as explained. **Never** run a scroll compressor in a vacuum. The Scroll compressor should **never** be used to draw the initial liquid refrigerant into the system.

Checking Refrigerant Charge

Before taking measurements to determine if the system is correctly charged with refrigerant, verify that all other aspects of the system operation are proper. The following conditions must be checked and satisfied.

WARNING! Exercise extreme caution when checking rotation of condenser and evaporator fans to avoid entanglement in fan blades. Failure to exercise caution may result in serious personal injury or death.

1. Check the evaporator and condenser fans to ensure that they are rotating in the proper direction, that the fan blades do not have dirt buildup, and that each fan is turning at the proper RPM. Make sure that the evaporator fan RPM is correct for the airflow desired and for the external static pressure being imposed by the duct system.

2. Make sure the evaporator air filters are clean.

3. Check the evaporator and condenser coils to ensure that they are clean, that the fins are straight, and that there are not obstructions to airflow.

4. Measure the suction line superheat and adjust the expansion valve if necessary. The expansion valve superheat setting must be between 12° F and 16° F.

Visually inspect the liquid line sight glass to see if clear liquid is present. Bubbles in the liquid line sight glass indicate either low refrigerant charge, excess liquid line pressure drop, or excess liquid line heat gain.

Caution: A clear sight glass does not necessarily mean the system has sufficient refrigerant.

After verifying that the system is operating properly, determine if the refrigerant charge is correct. This is accomplished by checking subcooling leaving the condensing unit.

Caution: It is not sufficient to check only operating pressures or only subcooling. Both must be in the acceptable range in order to establish correct system charge.

Subcooling:

Determine the system subcooling. Refer to "Measuring Subcooling" in the Maintenance Procedures section of this manual.) If the system is properly charged, subcooling at the liquid line access valve should be 14° to 19° F.

The system is low on refrigerant if liquid subcooling is low (less than 14° - 19° F). The system is overcharged with refrigerant if liquid subcooling is high (greater than 14° - 19° F).

Caution: If both the suction and discharge pressures are low but subcooling is in the acceptable range, the system has a problem other than a shortage of refrigerant. Do not add refrigerant.

Adding Refrigerant

Use the suction line access valve to add refrigerant to a system with a low charge, making sure that only refrigerant vapor enters the suction line. Continue to add refrigerant until the subcooling is between 14° and 19° F.

Removing Refrigerant

If the system is overcharged, some refrigerant must be removed to lower the subcooling to the 14° - 19° F range. Refrigerant should be discharged from the system slowly to keep oil loss at a minimum. Recover and reclaim the excess refrigerant.

Important Note:
Do **not** release refrigerant to the atmosphere! Refer to general service bulletin MSCU-SB-1 (latest edition).

Warning! Do not allow refrigerant to come in contact with the skin. If this occurs, the injury should be treated as if the skin has been frostbitten or frozen. Slowly warm the affected area with lukewarm water.

Thermostatic Expansion Valve Adjustment and Superheat Measurement

Since the reliability and performance of the refrigeration system is heavily dependent on proper expansion valve adjustment, the importance of proper suction gas superheat cannot be over emphasized. The accurate measurement of suction 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 safe setting range for suction gas superheat on Trane equipment is 12 to 16 degrees at the evaporator. Settings within this range will allow for measurement error. Superheat of less than 12 degrees can cause refrigerant floodback which could cause serious compressor damage. Superheat greater than 16 degrees can reduce system efficiency by reducing the effective evaporator surface.

Caution: When checking the superheat setting, the outdoor ambient must be between 65° and 105° F. Entering evaporator air should be above 40 percent relative humidity and all condenser fans and compressors must be operating fully loaded.

To determine suction gas superheat, the pressure at the outlet of the evaporator must be measured and then converted to saturated vapor temperature by using a Refrigerant 22 pressure/temperature chart. The saturated vapor temperature can then be subtracted from the actual suction temperature which is measured on the suction line close to the expansion valve bulb. The difference between the two temperatures is known as suction gas superheat. On many Trane fan/coil units, an access valve is provided close to the expansion valve bulb. This valve must be added on climate changers and other evaporators which are not so equipped. To obtain an accurate reading, an access valve close to the expansion valve bulb must be utilized when determining suction gas superheat.

Instruments to Use

1. The gauge used to measure suction pressure should be of the best quality available. Gauges permanently installed on the equipment should not be used. A good quality gauge on a standard refrigerant manifold set is recommended.

2. To measure suction temperature, an electronic temperature tester will be sufficient. Testers manufactured by Robinnaire, Annie, and Thermal are among those available. Glass thermometers do not have sufficient contact area to give accurate readings.

Procedure

1. Cut the suction line insulation to gain access to the suction line. If armaflex is used, it is best to cut around the circumference of the tubing.

2. Clean the line carefully and attach the electronic temperature sensor. Black electrical tape works well when securing the sensor of the temperature tester to the suction line. (Make sure the sensor is making good contact with the tube.)

3. Rejoin the armaflex and seal with plastic tape to prevent sensor contact with ambient air.

Note: For measurement accuracy, the temperature sensor **must** be installed and insulated properly. Make sure the armaflex extends at least six inches on both sides of the sensor location. Seal both ends of the armaflex to keep ambient air from getting under the insulation and affecting the temperature readings.

4. Install a pressure gauge to monitor suction pressure.

5. Operate the system for approximately 10 to 15 minutes to be sure that the expansion valve has time to stabilize.

6. To measure superheat, compare the saturated vapor temperature of the refrigerant converted from the suction pressure reading (see Table 20) to the actual temperature measured at the line by the electronic tester. Proper suction superheat is 12 to 16 degrees.

Example:

Suction Pressure = 66.0 psig
Suction Temperature = 52° F
Suction Pressure converted to Saturated Vapor Temperature (from Table 17) = 38°F
Suction Superheat
= (Actual Line Temp.) - (Saturated Vapor Temp.)
= (52° F) - (38° F)
= 14° F

If initial suction superheat readings fall below 12 degrees, the adjusting stem on the expansion valve should be adjusted clockwise to close the valve, limiting the flow of refrigerant to the evaporator and thus increasing superheat. Adjustment should be made a half turn at a time. Conversely, if the initial suction superheat reading is greater than 16 degrees, the adjusting stem on the expansion valve should be adjusted counterclockwise to open the valve, increasing the flow of refrigerant to the evaporator and thus decreasing superheat. Adjustments should be made until an acceptable reading is obtained. The system should be allowed to restabilize for 10 minutes after each adjustment.

Table 20 Pressure/Temperature Conversion Chart
(For Calculating Suction Line Superheat)

Saturated Temperature*	Pressure Using Refrigerant-22
30°	54.9
31°	56.2
32°	57.5
33°	58.8
34°	60.1
35°	61.5
36°	62.8
37°	64.2
38°	65.6
39°	67.1
40°	68.5
41°	70.0
42°	71.4
43°	73.0
44°	74.5
45°	76.0
46°	77.6
47°	79.2
48°	80.8
49°	82.4
50°	84.0

*Temperature given in degrees F.

Measuring Subcooling

1. The outdoor ambient temperature must be between 65° and 105° F. At ambient temperatures outside of this range, meaningful operating pressures cannot be measured.

2. The relative humidity of the air entering the evaporator must be above 40 percent. If it is less than 40%, meaningful operating pressures cannot be measured.

3. All compressors must be operating fully loaded. Set the thermostat as necessary to accomplish this.

4. All condenser fans must be operating. If necessary, jumper the fan pressure switches. Be sure to remove the jumpers when measurements are completed.

5. Do not take measurements with the low ambient dampers and/or hot gas bypass operating. Disconnect the low ambient dampers and de-energize the hot gas bypass before taking measurements. Be sure to reconnect low ambient dampers / hotgas bypass after taking measurements.

The proper setting range for liquid subcooling is 14° to 19° F. The compressor must be fully loaded and all compressors must be operating. Use these steps to measure subcooling:

1. Measure the liquid line pressure at the liquid line access valve installed inside the condensing unit. Convert this pressure reading to saturated temperature by using a Refrigerant-22 pressure/temperature chart (refer to Table 21).

2. Measure the actual liquid line temperature on the liquid line close to the access valve. To ensure an accurate reading, clean the line thoroughly where the electronic temperature sensor will be attached. Glass thermometers do not have sufficient contact area to give accurate readings. After securing the sensor to the line, wrap the sensor and line with insulation to prevent contact with ambient air.

3. Determine the system subcooling by subtracting the actual liquid line temperature (measured in step 2) from the saturated liquid temperature (calculated in step 1).

4. If the system is properly charged, subcooling at the liquid line access valve should be 14° to 19° F.

Table 21 Pressure/Temperature Conversion Chart

(For Calculating Liquid Line Subcooling)

Saturated Temperature*	Pressure Using Refrigerant-22
70°	121.4
75°	132.2
80°	143.6
85°	155.7
90°	168.4
95°	181.8
100°	195.9
105°	210.8
110°	226.4
115°	242.7
120°	259.9
125°	277.9
130°	296.8
135°	316.6
140°	337.2
145°	358.9
150°	381.5

*Temperature given in degrees F.

Start-up Log

1. Nameplate Information

Date ____________________

Model No. ____________________ Serial No. ____________________
Voltage ____________________ RLA ____________________

2. Compressor(s)

A. Voltage at Compressor Terminals

Comp. No. 1: T1 ________ T2 ________ T3 ________
Comp. No. 2: T1 ________ T2 ________ T3 ________
Comp. No. 3: T1 ________ T2 ________ T3 ________
Comp. No. 4: T1 ________ T2 ________ T3 ________

Voltage Imbalance: Comp. "A" _____ Comp. "B" _____
Comp. "C" _____ Comp. "D" _____

B. Amp Draw

Comp. "A" T1 ________ T2 ________ T3 ________
Comp. "B" T1 ________ T2 ________ T3 ________
Comp. "C" T1 ________ T2 ________ T3 ________
Comp. "D" T1 ________ T2 ________ T3 ________

3. Operating Conditions

A. Compressor "A"

Discharge Pressure ________ Suction Pressure ________
Liquid Line Pressure ________ Suction Line Temp. ________
Liquid Line Temp. ________ SuperHeat ________
Subcooling ________ Evap. Entering Air Temp. (DB/WB) ________
Ambient Temp. ________ Evap. Discharge Air Temp. (DB/WB) ________

B. Compressor "B"
Discharge Pressure ________ Suction Pressure ________
Liquid Line Pressure ________ Suction Line Temp. ________
Liquid Line Temp. ________ SuperHeat ________
Subcooling ________ Evap. Entering Air Temp. (DB/WB) ________
Ambient Temp. ________ Evap. Discharge Air Temp. (DB/WB) ________

C. Compressor "C"
Discharge Pressure ________ Suction Pressure ________
Liquid Line Pressure ________ Suction Line Temp. ________
Liquid Line Temp. ________ SuperHeat ________
Subcooling ________ Evap. Entering Air Temp. (DB/WB) ________
Ambient Temp. ________ Evap. Discharge Air Temp. (DB/WB) ________

D. Compressor "D"
Discharge Pressure ________ Suction Pressure ________
Liquid Line Pressure ________ Suction Line Temp. ________
Liquid Line Temp. ________ SuperHeat ________
Subcooling ________ Evap. Entering Air Temp. (DB/WB) ________
Ambient Temp. ________ Evap. Discharge Air Temp. (DB/WB) ________

4. Controls

A. All Fans Operating [ ] Yes
Properly? [ ] No ______Fan Inoperative

5. Refrigerant Piping

Evacuation Level ____________________ System Charge ____________________

MAINTENANCE LOG

DATE	AMBIENT TEMP. (F)	EVAPORATOR ENTERING AIR		CIRCUIT NO. 1		CIRCUIT NO. 2		SUPERHEAT		SUBCOOLING	
		DRY BULB	WET BULB	SUCTION PRESSURE	DISCHARGE PRESSURE	SUCTION PRESSURE	DISCHARGE PRESSURE	CIRCUIT NO. 1 (F)	CIRCUIT NO. 2 (F)*	CIRCUIT NO. 1 (F)	CIRCUIT NO. 2 (F)*

For further information on this product of other Trane products, refer to the "Trane Service Literature Catalog," ordering number IDX-IOM-1. This catalog contains listings and prices for all service literature sold by Trane. The catalog may be ordered by sending a $35.00 check to: The Trane Company, Service Literature Sales, 3600 Pammel Creek Road, La Crosse WI 54601.

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P.I. (C)