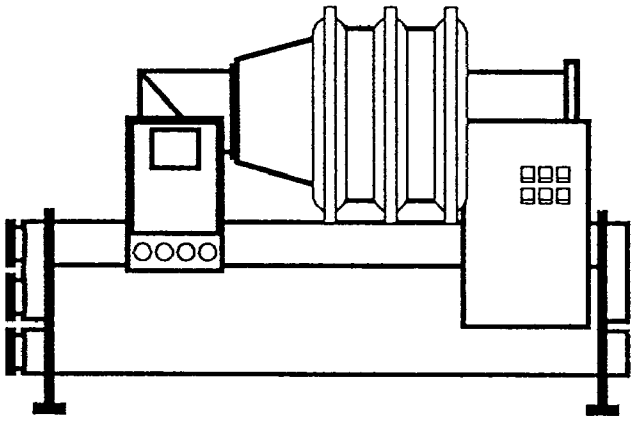
TRANE™

Installation CVHE-IN-6

Library	Service Literature
Product Section	Refrigeration
Product	Centrifugal Liq. Chiller, Water-Cooled
Model	60 HZ CVHE (Cooling-Only & Heat-Recovery)
Literature Type	Installation
Sequence	6
Date	January 1990
File No.	SV-RF-CTV-CVHE-IN-6-190
Supersedes	

Model CVHE 60 HZ Water-Cooled Hermetic CenTraVac

Cooling-Only and Heat-Recovery, Direct-Drive, 60 HZ CVHE w/UCP-695 Control Panel



Models

CVHE 130	CVHE 250	CVHE 500	CVHE 1000
CVHE 140	CVHE 280	CVHE 560	CVHE 1120
CVHE 160	CVHE 320	CVHE 630	CVHE 1250
CVHE 180	CVHE 360	CVHE 710	
CVHE 200	CVHE 400	CVHE 800	
CVHE 230	CVHE 450	CVHE 890	

Part No. X39640108-01

Table of Contents

Notice

The Trane Company urges that all HVAC servicers working on Trane equipment, or any manufacturer's products, make every effort to eliminate, if possible, or vigorously reduce the emission of CFC, HCFC and HFC refrigerants to the atmosphere resulting from installation, operation, routine maintenance, or major service on this equipment. Always act in a responsible manner to conserve refrigerants for continued use even when acceptable alternatives are available.

Conservation and emission-reduction can be accomplished by following recommended Trane service and safety procedures published in Trane General Service Bulletin CTV-SB-81. The information and procedures provided in CTV-SB-81 supersedes those published in this manual. Copies of this bulletin may be obtained by contacting your local Trane commercial product representative.

Literature Change History

CVHE-IN-6 (January 1990)

Original issue of manual describes proper installation of CVHE units of "W" and subsequent design sequences with UCP-695 microcomputer-based control systems.

About this Manual

This booklet describes proper installation of Model CVHE CenTraVac chillers equipped with microcomputer-based control systems, whether standard (cooling only) or heat-recovery. A careful review of this information—along with the submittal package provided for the unit—will assure that the chiller is installed correctly.

Product Description Block

Trane 60 Hz. Model CVHE hermetic CenTraVac units are defined by the product definition and selection system (PDS). Each unit is defined by the product description block which appears on the unit nameplate. An explanation of the PDS product code is provided in the unit operation and maintenance literature.

Commonly Used Acronyms

For convenience, a number of acronyms are used throughout this manual. These acronyms are listed alphabetically below, along with the "translation" of each:

ASME = American Society of Mechanical Engineers

BAS = Building Automation System

CASBU = CenTraVac and Absorption Systems Business Unit
CABS = Auxiliary Condenser Tube-Bundle Size
CDBS = Condenser Tube-Bundle Size
CDSZ = Condenser Shell Size
CWR = Chilled Water Reset

DTFL = Delta-T at Full Load (i.e., the difference between entering and leaving chilled water temperatures at design load)

EVBS = Evaporator Tube-Bundle Size
EVSZ = Evaporator Shell Size

FC = Free Cooling

GPM = Gallons-per-Minute

HGBP = Hot Gas Bypass
HVAC = Heating, Ventilating, and Air Conditioning

IE = Internally-Enhanced Evaporator or Condenser Tubes

PFCC = Power Factor Correction Capacitor(s)
PSID = Pounds-per-Square-Inch (differential pressure)
PSIG = Pounds-per-Square-Inch (gauge pressure)

SCI = Serial Communication Interface
SCP = Model CVMA System Control Panel (i.e., used to control up to 3 CenTraVacs with UCPs)

UCP = Microcomputer-based, UCP695 Chiller Control Panel for CenTraVacs

Warnings and Cautions

Notice that **warnings** and **cautions** appear at appropriate intervals throughout this manual. **Warnings** are provided to alert installing contractors to potential hazards that could result in personal injury or death, while **cautions** are designed to alert personnel to conditions that could result in equipment damage.

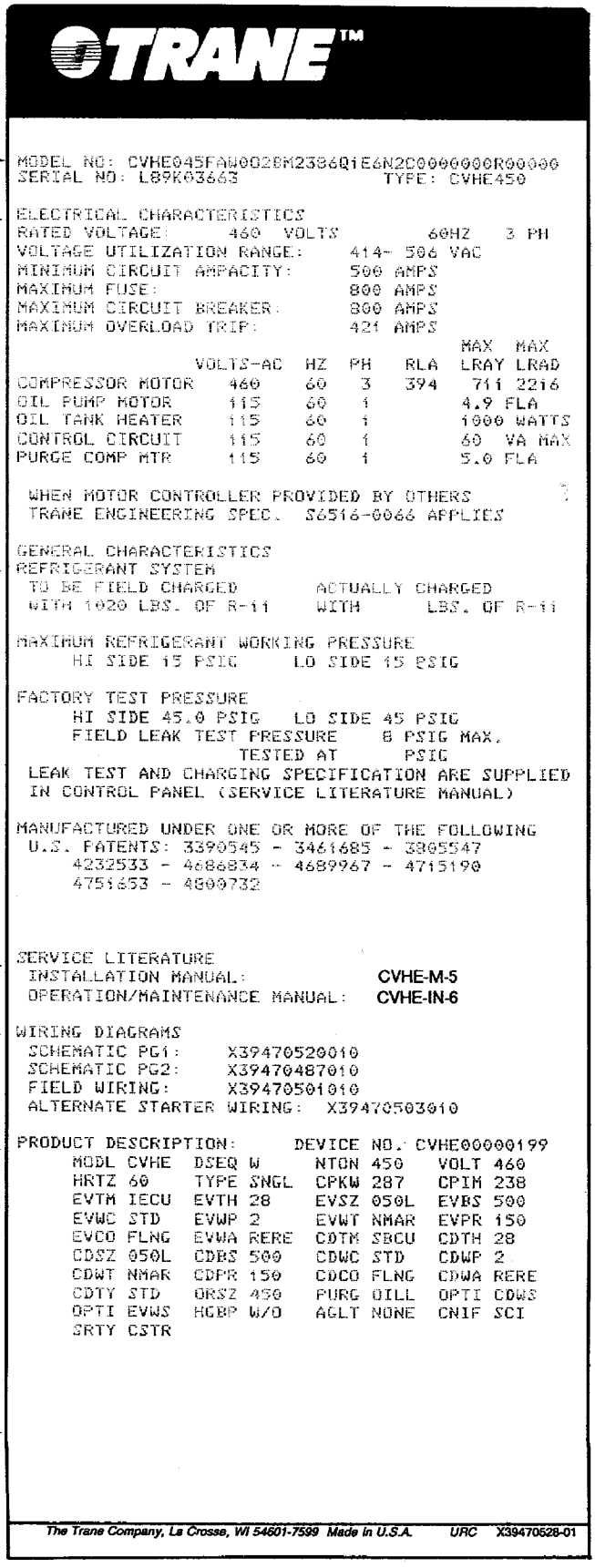
Your personal safety and the proper installation of this machine depend upon the strict observance of these precautions.

Unit Nameplate

The CVHE unit nameplate is located on the left side of the unit control panel (UCP). A typical unit nameplate is illustrated in Figure 1. The following information is provided on the CVHE unit nameplate.

- Unit model and size descriptor.
- Unit serial number.
- Identifies unit electrical requirements.
- List correct operating charges of R-11.
- Lists unit test pressures and maximum operating pressures.
- Identifies unit Installation and Operation and Maintenance manual.
- Product description block (identifies all unit components and unit "design sequence" (used to order literature and make other inquiries about the unit).
- Lists drawing numbers for unit wiring diagrams.

Figure 1
Typical CVHE 60 Hz. Unit Nameplate



Unit Model and Size Descriptor

Unit and Motor Electrical Data

Unit Refrigerant Charge Information

Unit Service Literature

Wiring Diagram Number

Product Description Block

Responsibilities of Installing Contractor(s)

For your convenience, a summary of the contractor responsibilities typically associated with the CVHE chiller installation process is provided below. Table 1 further categorizes these responsibilities by differentiating between Trane-supplied and field-supplied materials, and factory-supplied and field-installed components.

Refer to the Installation section of this manual for more detailed instructions.

[ ] Install unit on a foundation with flat support surfaces level within 1/16", and of sufficient strength to support concentrated loading.

Place manufacturer-supplied isolation pad assemblies under unit. (Use spring isolators for upper floor installations.)

[ ] Install unit per applicable Trane installation manual.

[ ] Complete all water piping and electrical connections (including sensor installation).

Note: Field piping must be arranged and supported to avoid stress on the equipment. It is strongly recommended that the piping contractor refrain from piping closer than 3'-0" minimum to the equipment. This will allow for proper fit-up upon arrival of the unit at the job-site. Any adjustment that is necessary can be made to the piping at that time.

[ ] Where specified, provide and install valves in water piping upstream and downstream of evaporator and condenser water boxes to isolate shells for maintenance, and to balance/trim system.

[ ] Supply and install flow switches (or equivalent devices) in both chilled water and condenser water piping. Interlock each switch with proper pump starter to ensure unit can only operate when water flow is established.

[ ] Furnish and install taps for thermometers and pressure gauges in water piping adjacent to inlet and outlet connections of both evaporator and condenser.

[ ] Furnish and install drain valves to each water box.

[ ] Supply and install vent cocks on each water box.

[ ] Where specified, furnish and install strainers ahead of all pumps and automatic modulating valves.

[ ] Furnish and install all necessary auxiliary water piping.

[ ] Furnish and install pressure -relief piping from pressure-relief rupture disc to atmosphere.

[ ] Provide and install wire terminal lugs to starter.

[ ] Unit-Mounted Starters Only. Remove top of starter panel and cut access area for line-side wiring; front left quadrant of top provides recommended access to starter lugs.

[ ] Unit-Mounted Starters Only. Provide and install field wiring to line-side lugs of starter.

[ ] If necessary, furnish sufficient Refrigerant-22 (25 lbs. per machine) and dry nitrogen (15 lbs. per machine) for pressure testing under manufacturer's supervision.

[ ] Start unit under supervision of a qualified service technician.

[ ] Where specified, insulate evaporator and any other portions of machine as required to prevent sweating under normal operating conditions.

Table 1
CVHE Installation Requirements

Type of Requirement	Trane-Supplied, Trane-Installed	Trane-Supplied, Field-Installed	Field-Supplied, Field-Installed
Rigging			a. safety chains b. clevis connectors c. lifting beam
Isolation		a. isolation pads or spring isolators	a. isolation pads or spring isolators
Electrical	a. circuit breakers or fusible disconnects (optional) b. unit-mounted starter (optional) c. PFCCs (optional)	a. jumper bars b. temperature sensors (see Table 16) c. flow switches	a. circuit breakers or fusible disconnects (optional) b. remote-mounted starter (optional) c. PFCCs (remote-mounted starter option) d. terminal lugs e. ground connection(s) f. jumper bars g. SCI wiring (optional) h. external interlock wiring (optional) i. running external interlock wiring (optional) j. alarm relay circuit wiring and components (optional) k. head-relief-request relay circuit wiring and components (optional) l. auxiliary FC relay circuit wiring and components (optional)
Water Piping		a. flow switches b. temperature sensors (see Table 16)	a. thermometers b. water flow pressure gauges c. strainers and shutoff valves for purge tank water piping d. isolation and balancing valves e. vents and drain valves (1 each per pass) f. pressure-relief valves (for water boxes as required) g. 1/2" NPT pipe couplings (to install water temp. sensors)
Rupture Disc	a. rupture disc assembly		a. vent line
Insulation	a. insulation (optional)		a. insulation

Unit Shipment

Each CVHE chiller ships from the factory as a hermetically-assembled package; it is factory-piped, wired and tested. All openings are covered or plugged to prevent contamination during shipment and handling.

See Figure 2 for an illustration of a typical CVHE unit and its components. As soon as the unit arrives at the job site, inspect it thoroughly for damage and material shortages. In addition:

- Verify that the chiller is dehydrated by checking the condenser and evaporator pressure gauges for an indication of holding charge pressure.

- To prevent damaging air or moisture from entering the unit and causing corrosion, each chiller is pressurized with dry nitrogen before shipment.

Note: The holding charge should register approximately 5 psig on the gauges. If the charge has escaped, contact your local Trane sales office for instructions.

- Check the oil sump sight glasses to verify that the sump was factory-charged with 7 gallons of oil.

If no oil level is visible, contact your local Trane sales office.

- Compare the unit nameplate data (including electrical characteristics) with the corresponding ordering and shipping information to verify that the correct unit was shipped to the job site.

If a thorough inspection of the chiller reveals damage or material shortages, be sure to file these claims with the carrier immediately. Specify the extent and type of damage found, and notify the appropriate Trane sales representative. Do not install a damaged unit without the sales representative's approval!

Storage

If the chiller will be stored at the job site for an extended period of time before it is installed, exercise these precautionary measures to protect the unit from damage:

1. Do not remove the protective coverings factory-installed on the control panel and compressor inlet vane actuator for shipment.

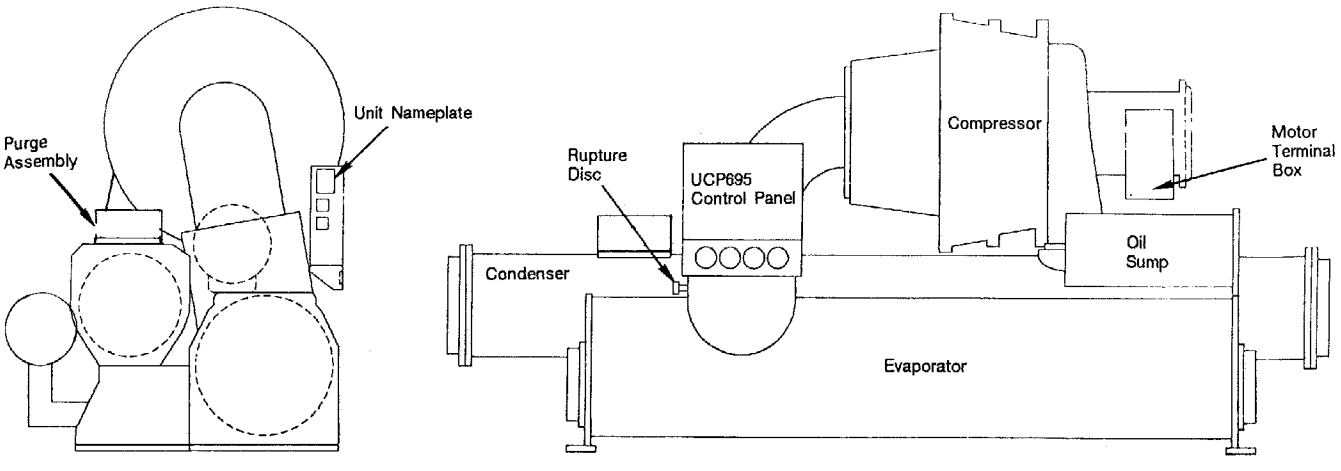
2. Store the chiller in a dry, vibration free and secure area. If factory insulated, protect chiller from prolonged exposure to sunlight.

Caution: To prevent damage to the factory-installed insulation do not allow excessive exposure to sunlight.

3. Periodically check the condenser and evaporator pressure gauges to verify that the 5 psig dry nitrogen holding charge is still in the chiller. If this charge escapes, contact a qualified service organization and the Trane sales engineer that handled the order.

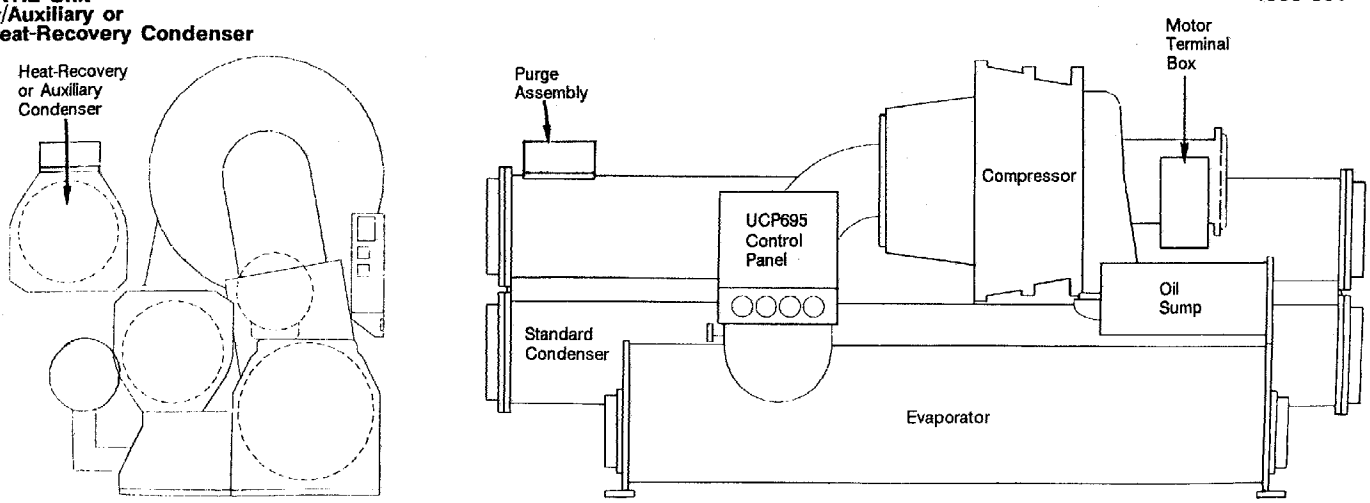
Note: The storage range for the microcomputer-based devices in the unit control panel is -40 F (-40 C) to 158 F (70 C).

Figure 2
Typical CVHE Chillers



4532-6236E
4533-8504

CVHE Unit w/Auxiliary or Heat-Recovery Condenser



4532-6238E
4533-8504

Recommended Unit Clearances

Adequate clearance around and above the chiller is required to allow sufficient access for service and maintenance operations.

Figures 3, 4 and 5 illustrate the recommended clearances for CVHEs with and without options. Notice that, in each instance, the minimum vertical clearance above the chiller is 3-feet. In addition, be sure to provide at least 3-feet of working space in front of the unit control panel to satisfy Article 110-16 of the National Electric Code.

Important! Do not install piping or conduit above the compressor motor assembly or behind the suction elbow!

(Specific unit clearance requirements are also indicated in the submittal package provided for your unit.)

Operating Environment

Besides assuring that the site selected for chiller installation provides the necessary clearances, consider the equipment's operating environment.

To assure that electrical components operate properly, do not locate the chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity. Note that the maximum ambient temperature range for chiller operation is 95 to 100 F (35 to 38 C).

Caution: CVHE operation at ambient temperatures exceeding 100 F (38 C) can fatigue the unit's rupture disc, causing it to break at a reduced refrigerant pressure (i.e., <15 psig). Starter component damage can also occur because of the panel's inability to dissipate heat adequately.

If any of these adverse operating conditions is present, take whatever action is necessary to improve the equipment room environment.

Foundation Requirements

Provide rigid, nonwarping mounting pads or a concrete foundation as a mounting surface for the chiller. Ensure that the base is of sufficient strength and mass to properly support the chiller at its full operating weight (i.e., including completed piping, and full operating charges of refrigerant, oil and water).

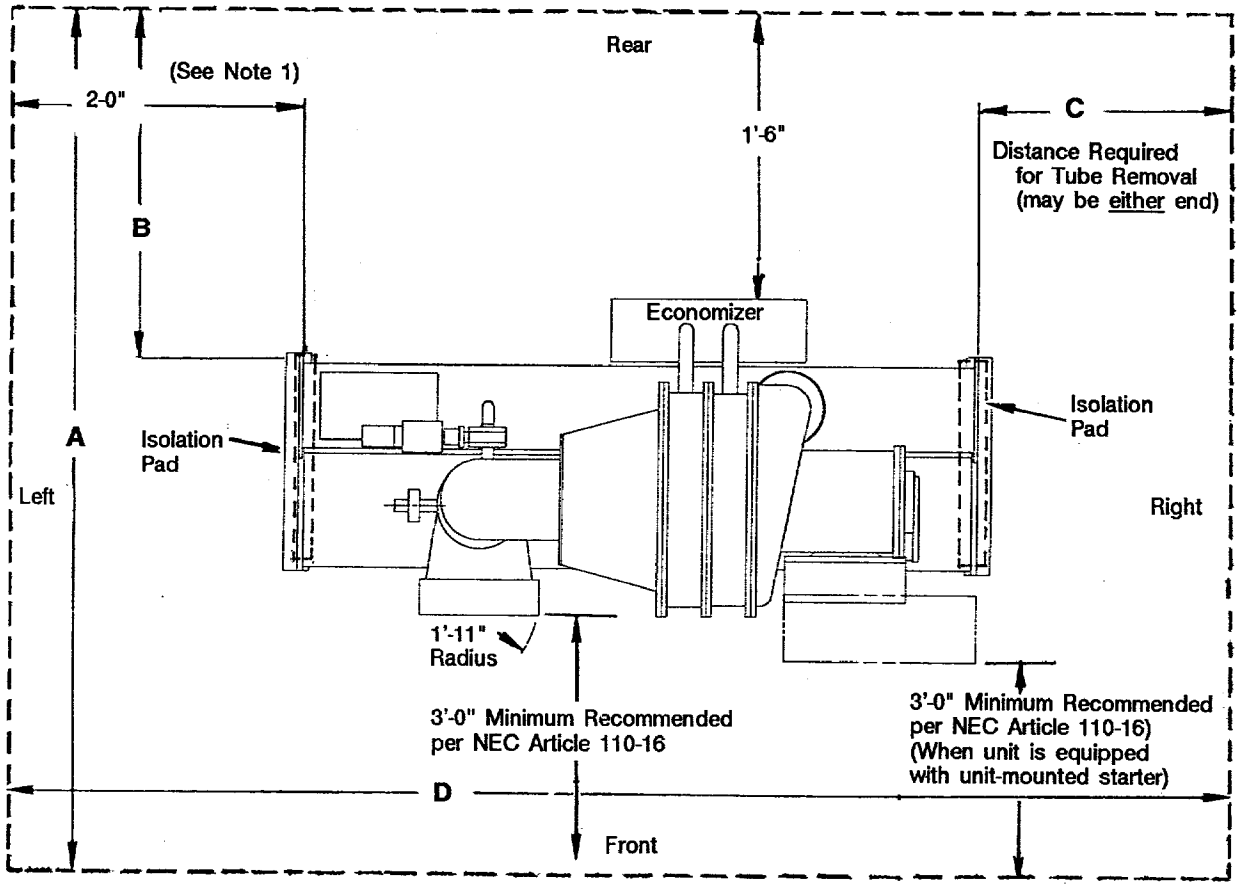
For your convenience, a summary of standard unit shipping and operating weights is provided in Table 2. Table 3 indicates the weights of various chiller options.

Notice that the floor loading for all sizes of CVHE chillers is 50 pounds per square inch.

To assure proper unit operation, the chiller must be level within 1/16" over its length and width when set into place on the mounting surface.

The Trane Company will not assume responsibility for equipment problems resulting from an improperly designed or constructed foundation.

Figure 3
Clearance Requirements for Standard CVHEs



Top View

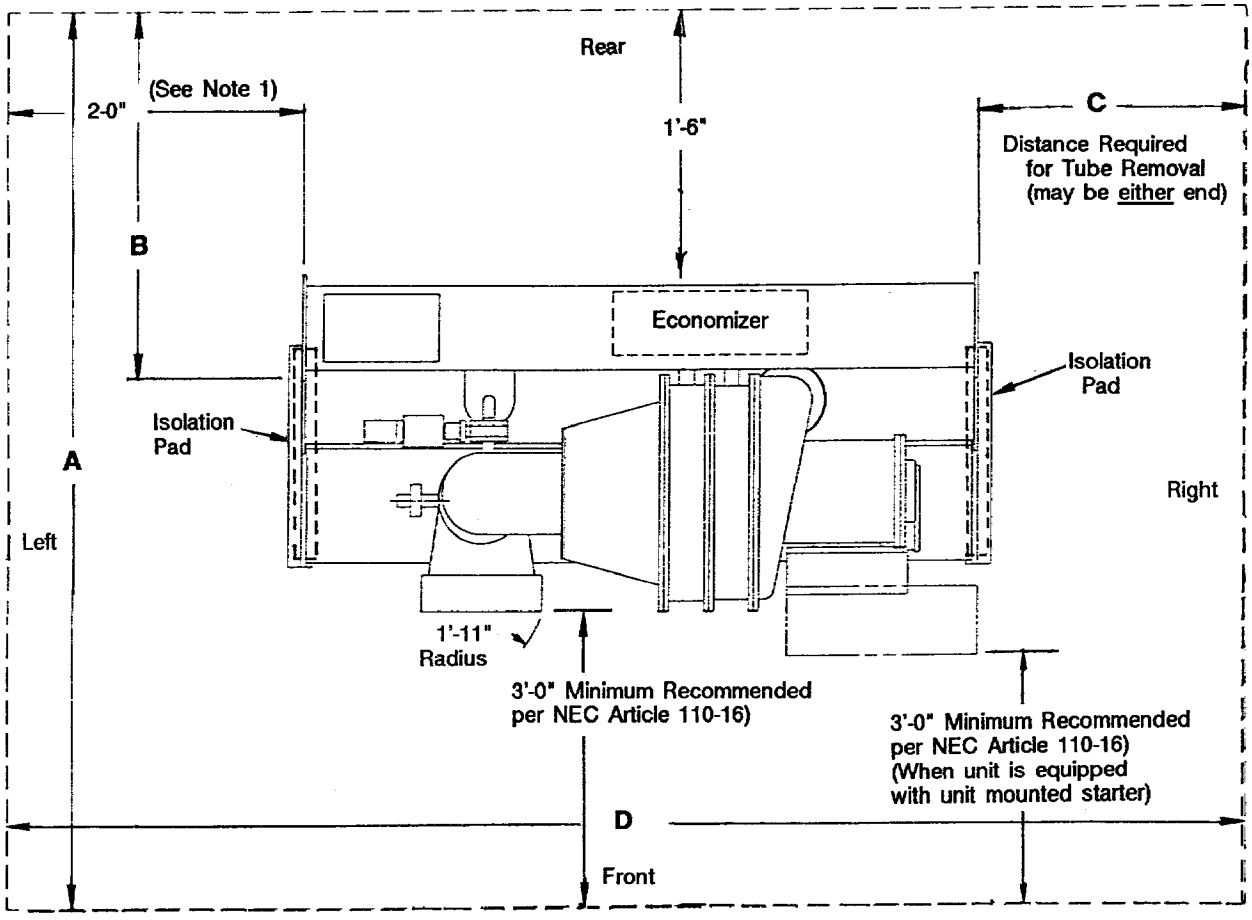
Notes:
1. Does not include water box.
2. Minimum vertical clearance over chiller is 3 feet.

Do not install piping or conduit above compressor motor assembly or behind suction elbow!

Dim.	Shell Comb.	130-200 (EVSZ 020S/L)	230-320 (EVSZ 032S/L)	360-500 (EVSZ 050S/L)	560-800 (EVSZ 080S/L)	890-1250 (EVSZ 125L)	890-1250 (EVSZ 140E)
A	all	9'-8"	10'-3-3/16"	11'-1-11/16"	12'-5-1/4"	14'-7/8"	14'-5-11/16"
B	all	2'-4-5/16"	2'-6-5/8"	2'-10-1/8"	2'-6-7/16"	2'-10-13/16"	3'-3-5/8"
C (2)	S/S	11'-9"	11'-9"	11'-9"	11'-9"	n/a	n/a
	all others	15'-6"	15'-6"	15'-6"	15'-6"	15'-6"	17'-5"
D (3)	S/S	25'-0"	25'-0"	25'-0"	25'-0"	n/a	n/a
	all others	32'-6-1/4"	32'-6-1/4"	32'-6-1/4"	32'-6-1/4"	32'-6-1/4"	36'-3-3/4"

Notes:
1. EVSZ = Evaporator Size, L = Long Shell; S = Short Shell; E = Extended Shell.
2. Clearance requirement to evaporator tube removal does not include water box. Add water box dimension to this figure.
3. Does not include water box. Add water box dimension to this figure.

Figure 4
Clearance Requirements for CVHEs w/Options



Top View

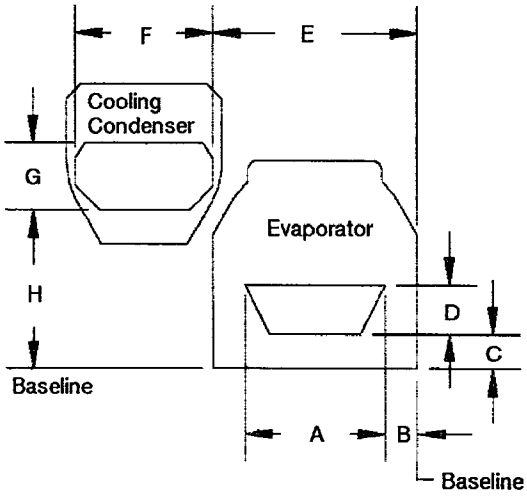
Notes:
1. Does not include water box.
2. Minimum vertical clearance over chiller is 3 feet.

Do not install piping or conduit above compressor motor assembly or behind suction elbow!

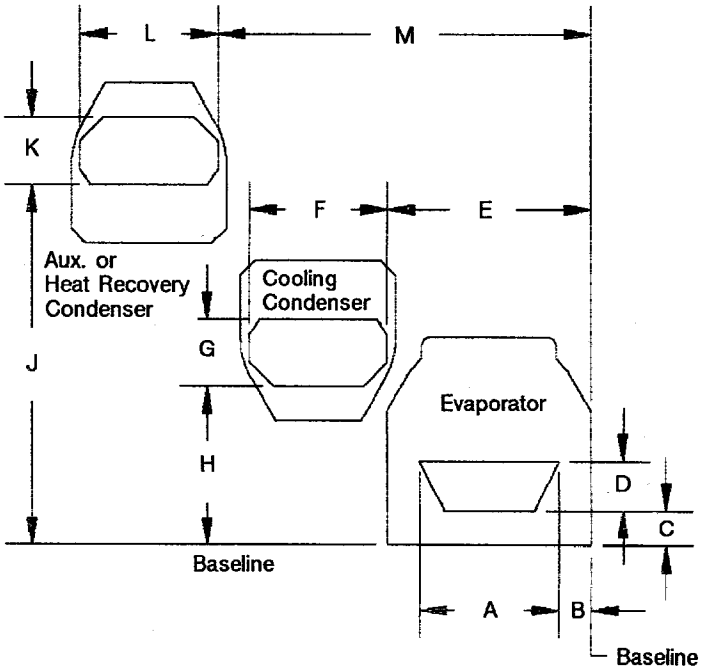
Dim.	Shell Comb.	130-200 (EVSZ 020S/L)	230-320 (EVSZ 032S/L)	360-500 (EVSZ 050S/L)	560-800 (EVSZ 080S/L)	890-1250 (EVSZ 125L)	890-1250 (EVSZ 140E)
A	all	9'-11-1/4"	10'-6-9/16"	11'-2-11/16"	12'-5-3/8"	14'-7/8"	14'-5-11/16"
B	all	2'-7-9/16"	2'-10"	2'-11-1/8"	2'-6-9/16"	2'-11-7/8"	3'-3-5/8"
C (2)	S/S	11'-9"	11'-9"	11'-9"	11'-9"	n/a	n/a
	all others	15'-6"	15'-6"	15'-6"	15'-6"	15'-6"	17'-5"
D (3)	all	2'-0"	2'-0"	2'-0"	2'-0"	2'	2'
	S/S	25'-0	25'-0	25'-0	25'-0	25'-0	n/a
	all others	32'-6-1/4"	32'-6-1/4"	32'-6-1/4"	32'-6-1/4"	32'-6-1/4"	36'-3-3/4"

Notes:
1. EVSZ = Evaporator Size. L = Long Shell; S = Short Shell; E = Extended Shell.
2. Clearance requirement to evaporator tube removal does not include water box. Add water box dimension to this figure.
3. Does not include water box. Add water box dimension to this figure.

Figure 5
Tube Bundle Locations
for Model CVHE 60 Hz units



Cooling Only & Free Cooling Units



Heat Recovery & Auxiliary Condenser Units

Nom. Tons	Cond Shell Size	All Units A	B	C	D	E	F	G	H
130-200	All	1'-6-1/2"	2-3/4"	4"-7/8	5-5/8"	2'-1-3/8"	1'-1-7/8"	0'-8-5/8"	1'-6-1/2"
230-320	All	2'-0-1/4"	2-7/8"	5-1/8"	7-1/4"	2'-8-1/4"	1'-5-5/8"	0'-10-1/4"	1'-8-7/8"
360-500	All	2'-6-3/4"	2-7/8"	6"	8-7/8"	3'-1-1/8"	1'-10-3/8"	1'-1-1/2"	2'-1-1/8"
560-800	All	3'-5-1/8"	4-1/4"	6-1/4"	11-3/8"	3'-7-3/8"	2'-4-7/8"	1'-6-3/8"	3'-7-7/8"
890-1250	125L	3'-10-3/4"	3-3/4"	6-3/4"	1'-2-5/8"	4'-1-5/8"	3'-0-1/2"	1'-11-1/4"	3'-8-1/2"
	140L	3'-10-3/4"	3-3/4"	6-3/4"	1'-2-5/8"	4'-4-3/8"	3'-2-1/2"	2'-0-7/8"	3'-8-3/8"

Nom. Tons	Cond Shell Size	Heat Recovery J	K	L	M	Auxiliary Condenser J	K	L	M
130-200	All	3'-7"	0'-8-5/8"	1'-1-7/8"	3'-3-1/2"	3'-11-5/8"	5-3/8"	1'-1-7/8"	3'-3-1/2"
230-320	All	4'-0-1/2"	0'-10-1/4"	1'-5-5/8"	4'-0-1/2"	4'-2-7/8"	5-3/8"	1'-1-7/8"	4'-0-1/4"
360-500	All	4'-11"	1'-1-1/2"	1'-10-3/8"	4'-6-1/8"	4'-11-1/2"	5-3/8"	1'-1-7/8"	4'-8-7/8"
560-800	All	7'-3-1/4"	1'-6-3/8"	2'-4-7/8"	4'-8-3/8"	7'-0-5/8"	5-3/8"	1'-1-7/8"	5'-8-7/8"
890-1250	125L	7'-11"	1'-11-1/4"	3'-0-1/2"	5'-6-7/8"	7'-11-1/2"	5-3/8"	1'-1-7/8"	6'-11-1/8"
890-1250	140L	Contact CASBU Marketing							

Table 2
Typical Shipping and Operating Weights for Standard CVHEs (See Note 1)

Unit Size Range	Shell Length Designators EVSZ(5)	CDSZ(6)	Maximum Weights Shipping	Operating (2)
CVHE 130 - 200	020S	020S	9,042 lbs.	9,962 lbs.
	020S	020L	9,312 lbs.	10,316 lbs.
	020L	020S	9,417 lbs.	10,523 lbs.
	020L	020L	9,687 lbs.	10,877 lbs.
CVHE 230 - 320	032S	032S	11,437 lbs.	12,927 lbs.
	032S	032L	11,862 lbs.	13,482 lbs.
	032L	032S	12,012 lbs.	13,797 lbs.
	032L	032L	12,437 lbs.	14,352 lbs.
CVHE 360 - 500	032S	050S	14,821 lbs.	17,600 lbs.
	032S	050L	15,451 lbs.	18,013 lbs.
	032L	050S	15,651 lbs.	18,346 lbs.
	032L	050L	16,281 lbs.	19,284 lbs.
CVHE 560 - 800	080S	080S	21,597 lbs.	25,091 lbs.
	080S	080L	22,627 lbs.	26,453 lbs.
	080L	080S	22,962 lbs.	27,089 lbs.
	080L	080L	23,992 lbs.	28,451 lbs.
CVHE 890 - 1250	125L	125L	34,356 lbs.	41,703 lbs.
	140E	140L	38,000 lbs.	46,000 lbs.

Notes:
1. Weights shown above are accurate within ± 3%, and are calculated with non-marine, 150 psig water boxes. Marine-style water boxes may add considerably more weight; contact CASBU Marketing for details.
2. Operating weights include refrigerant, oil and water charges.
3. For more specific data on weights and isolator loading, refer to the unit submittal package.
4. See Table 3 for additional weights associated with various chiller options.
5. EVSZ = Evaporator Shell Size: S = Short Shell; L = Long Shell; E = Extended Length.
6. CDSZ = Condenser Shell Size: S = Short; L = Long Shell.

Table 3
Weights for Typical CVHE Options (See Note 1)

CVHE Size Range	Cooling Cond. Size (CDSZ)	Aux. Cond. Size 80 Ship.	Aux. Cond. Size 80 Oper.	Aux. Cond. Size 130 Ship.	Aux. Cond. Size 130 Oper.	"S" - Heat Rec. Cond. Ship.	"S" - Heat Rec. Cond. Oper.	"L" - Heat Rec. Cond. Ship.	"L" - Heat Rec. Cond. Oper.	Free Cooling Ship.	Free Cooling Oper.
130-200	020S/L	1,049	1,250	1,163	1,423	1,180	1,531	1,450	1,885	400	590
230-320	032S/L	1,049	1,250	1,163	1,423	1,801	2,378	2,226	2,933	500	800
360-500	050S/L	1,049	1,250	1,163	1,423	2,657	3,499	3,187	4,437	750	1,310
560-800	080S/L	1,049	1,250	1,163	1,423	4,415	5,898	5,445	7,260	760	1,430
890-1250	125L	1,049	1,250	1,163	1,423	n/a	n/a	9,569	12,407	1,200	2,150
	140L	1,049	1,250	1,163	1,423	n/a	n/a	Design Special		Design Special	

Notes:
1. Unit-Mounted Starter option = 525 lbs. (shipping and operating).
2. Weights shown are accurate within ± 3%.
3. For more specific information on unit weights and isolator loading, refer to unit submittals.

Note: Be sure to immediately report any unit damage incurred during handling or installation at the job site to the Trane sales office.

Rigging

Lifting is the recommended method for moving CVHE chillers. Suggested lifting arrangements for standard and heat-recovery units are illustrated in Figure 6.

Note that each of the cables used to lift the unit must be capable of supporting the entire weight of the chiller. (See Tables 2 and 3 for unit shipping and operating weights.) Notice, too, that the lifting beam used to rig the unit must be at least 12 feet long.

WARNING: To avoid serious injury and possible equipment damage, lift the chiller horizontally; use the lifting arrangement and rigging shown in Figure 6.

To lift the chiller properly, insert clevis connections at the points indicated in Figure 6; a 2"-diameter lifting hole is provided at each of these points. Next, attach the lifting cables or slings.

Once the lifting cables are in place, attach a safety cable or sling between the first-stage casting of the compressor and the lifting beam. To do this, remove a retaining bolt from the compressor first-stage casting and replace it with an eyebolt.

Note: There should not be tension on this safety cable; it is used only to prevent the unit from rolling during the lift.

When the lift is complete, detach the clevis connections and safety chain; then remove the eyebolt that was used to secure the safety chain to the compressor, and reinstall the retaining bolt in its place.

If the chiller cannot be moved using the conventional rigging method just described, consider these points:

1. If job-site conditions require rigging of the chiller at an angle greater than 45-degrees from horizontal (end-to-end), dowel-pin the compressor and remove it from the unit. Be sure to contact a qualified service organization for specific rigging instructions.

Caution: To prevent tube-sheet or tube damage during lifting procedures, do not tilt the unit more than 45 degrees from horizontal (level); end-to-end. Raising the unit to a vertical or near-vertical position places excessive strain on shell components. If job-site conditions require special lifting procedures, contact your local Trane Sales Office for approval or instructions.

Caution: To prevent oil migration out of the oil tank during lifting procedures, remove the oil from the oil tank if the unit will be lifted at any angle greater than 15 degrees from horizontal end-to-end.

If oil is allowed to run out of the oil tank into other areas of the chiller, it will be extremely difficult to return the oil to the oil tank even during operation.

2. When lifting the chiller is either impractical or undesirable, attach cables or chains to the jacking slots identified in Figure 6; then push or pull the unit across a smooth surface.

It is not necessary to remove the shipping skid from the chiller before sliding it into place.

Caution: Chiller shipping skids are not designed to support the entire weight of the unit at any single point. Improperly supporting the chiller-and-skid assembly may result in equipment damage.

Caution: To prevent possible equipment damage, do not use a fork lift to move the chiller!

3. If removal of the compressor or economizer assembly is necessary to move the chiller into its operating location, contact The Trane Company for special instructions, concerning for chiller disassembly and reassembly procedures.

Caution: Do not remove these components without first consulting The Trane Company. Lifting the compressor/motor assembly from the shells without factory-installed doweling in the compressor casting flanges may result in misalignment of the compressor castings.

Shipping Skid Removal

To detach the skid from the unit once the chiller is set into place:

1. Remove the carriage bolts that fasten the steel straps to the skids. (Carriage bolt locations are shown in Figure 7.)

2. Place jacks in the slots provided at each end of the chiller (Figure 6).

3. Using the jacks installed in Step 2, elevate one end of the chiller at a time; work from end to end in small increments to ensure stability. (The skid will remain on the floor.)

Caution: Shipping skids are not designed to support the entire weight of the unit at any single point. Improperly supporting the chiller-and-skid assembly may result in equipment damage.

4. Once the chiller is elevated sufficiently, disassemble and remove the skid.

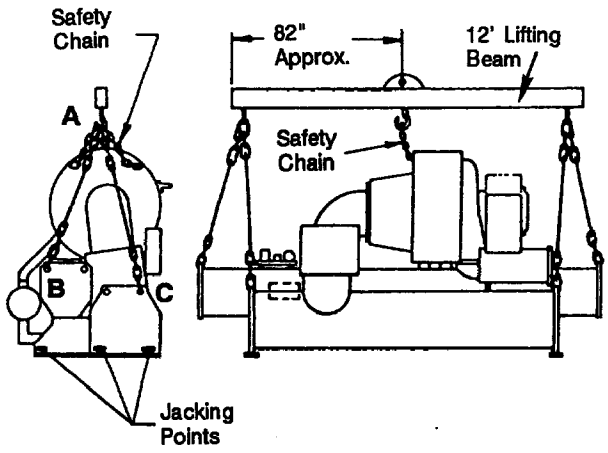
WARNING: Shipping skids are very heavy, and may cause injury if dropped.

5. Position isolator pads (or spring isolators) beneath the chiller feet; see "Unit Isolation" for instructions.

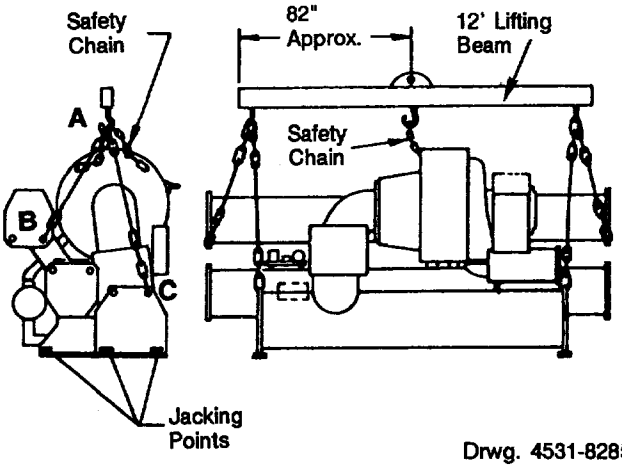
6. Once the isolators are in place, lower the chiller; again, work from end to end in small increments to maintain stability.

Figure 6
Recommended Lifting Arrangements

Standard CVHE



CVHE w/Heat-Recovery Condenser



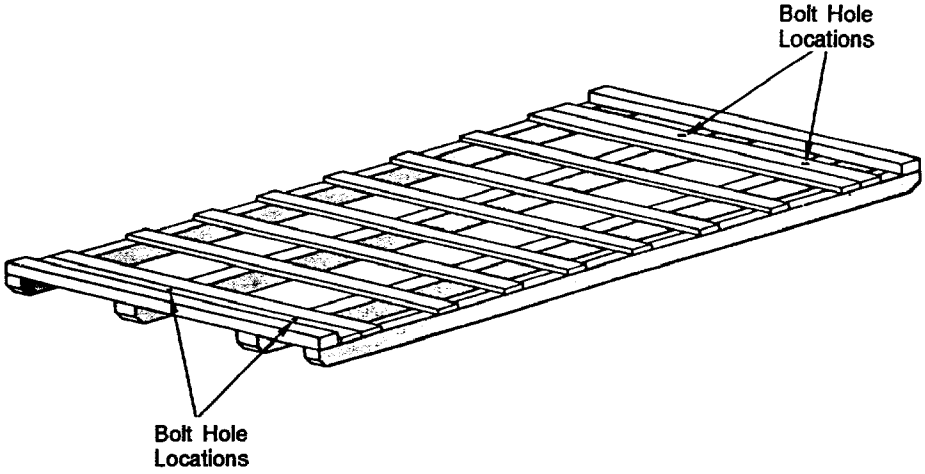
Drwg. 4531-8285B

Notes:

1. Lifting chains (or cables) may or may not be the same length between Points A and B, or between Points A and C. Adjust as necessary for an even lift.
2. Lifting holes provided on chiller to attach chains are 2" in diameter.
3. Attach safety chain (or cable) as shown, and without tension. The safety chain is not used for lifting, but is there to prevent the unit from rolling.
4. Do not forklift the unit!

WARNING: Do not use chains or cables other than as shown. Alternative lifting arrangements may result in serious personal injury and equipment damage.

Figure 7
Shipping Skid



Caution: Chiller shipping skid is NOT designed to support entire weight of unit at any single point. Improperly supporting chiller-and-skid assembly may result in unit damage.

Unit Isolation

To minimize sound and vibration transmission through the building structure---and to assure proper weight distribution over the mounting surface, always install isolation pads or spring isolators under the chiller feet.

Note: Isolation pads (Figure 8) are provided with each chiller unless spring isolators are specified on the sales order.

Specific isolator loading data is provided in the unit submittal package. If necessary, contact your local Trane sales office for further information.

Important! When determining placement of isolation pads or spring isolators, remember that the control panel side of the unit is always designated as the unit front.

Isolation Pads

When the unit is ready for final placement, position isolation pads under the chiller feet as shown in Figure 9.

Remember that the chiller must be level within 1/16" over its length and width after it is lowered onto the isolation pads. In addition, all piping connected to the chiller must be properly isolated and supported so that it does not place any stress on the unit.

Spring Isolators

Spring isolators should be considered whenever chiller installation is planned for an upper story location. Base isolator selection and placement on the information presented in Figure 10. (Notice that 3 types of spring isolators---each with its own maximum loading characteristics---are used with CVHE chillers.)

Spring isolators typically ship assembled and ready for installation. To install and adjust the isolators properly, follow the instructions given.

Note: Do not adjust the isolators until the chiller is piped and charged with refrigerant and water.

1. Position the spring isolators under the chiller as shown in Figures 10 and 11. Make sure that each isolator is centered in relation to the tube sheet.

Note: Spring isolators shipped with the chiller are not identical! Be sure to compare the data provided in the unit submittal package and Figures 9 through 11 to determine proper isolator placement.

2. Set the isolators on the subbase; shim or grout as necessary to provide a flat, level surface at the same elevation for all mountings. Be sure to support the full underside of the isolator base plate; do not straddle gaps or small shims.

Figure 8
Isolation Pad

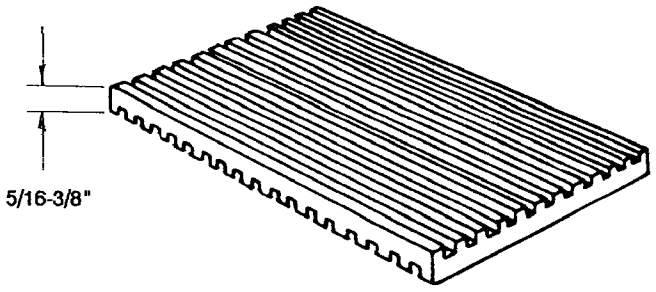
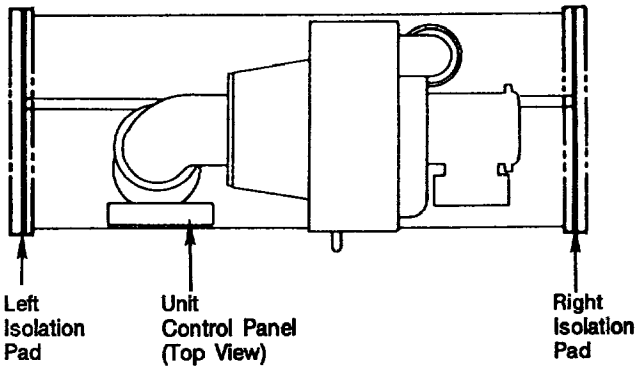


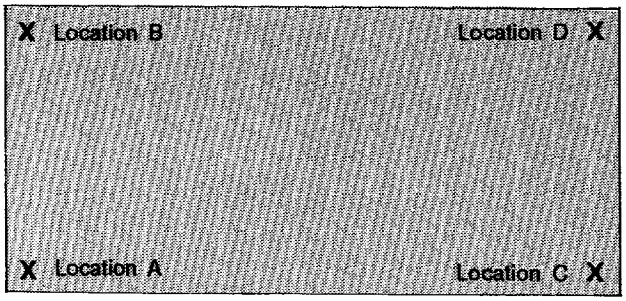
Figure 9
Isolation Pad Placement



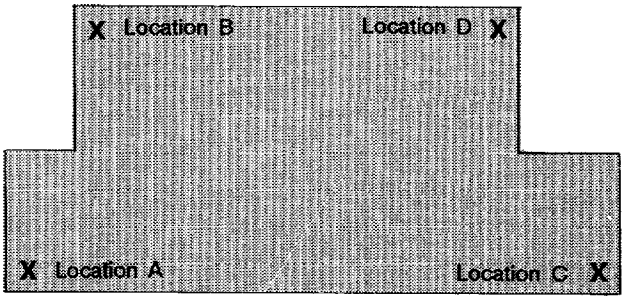
Unit Size Range	Shell Length Designators		Isolator Loading	
	EVSZ	CDSZ	Left Pad	Right Pad
130 - 200	020S	020S	4,089 lbs.	5,873 lbs.
	020S	020L	4,446 lbs.	5,870 lbs.
	020L	020S	4,078 lbs.	6,445 lbs.
	020L	020L	4,529 lbs.	6,348 lbs.
230 - 320	032S	032S	5,305 lbs.	7,622 lbs.
	032S	032S	5,851 lbs.	7,631 lbs.
	032L	032L	5,382 lbs.	8,414 lbs.
	032L	032L	6,065 lbs.	8,286 lbs.
360 - 500	050S	050S	7,472 lbs.	9,604 lbs.
	050S	050L	8,349 lbs.	9,664 lbs.
	050L	050S	7,618 lbs.	10,727 lbs.
	050L	050L	8,578 lbs.	10,706 lbs.
560 - 800	080S	080S	10,737 lbs.	14,354 lbs.
	080S	080S	12,085 lbs.	14,367 lbs.
	080L	080L	11,133 lbs.	15,955 lbs.
	080L	080L	12,603 lbs.	15,848 lbs.
890 - 1250	125L	125L	18,777 lbs.	22,926 lbs.
	140E	140L	20,500 lbs.	25,500 lbs.

Notes:
1. Weights shown above are accurate within ± 3%, and are calculated with non-marine, 150 psig water boxes. Marine-style water boxes may add considerably more weight; contact Trane CASBU Marketing for details.
2. "Isolator loading" values shown are based on the total maximum operating weight values listed in Table 2. Operating weights include refrigerant, oil and water charges. For more specific information on unit weights and isolator loading, refer to the unit submittal package.
3. See Table 3 for additional weights associated with various chiller options.
4. EVSZ = Evaporator Shell Size; S = Short Shell; L = Long Shell; E = Ext. Shell.
5. CDSZ = Condenser Shell Size

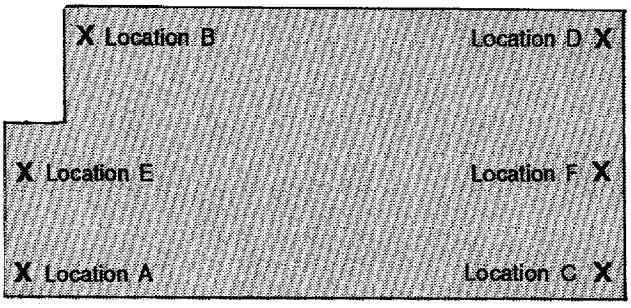
Figure 10
Spring Isolator Placement



Isolator Placement for Standard Units



Isolation Placement for Units w/"S" Condensers and "L" Evaporators



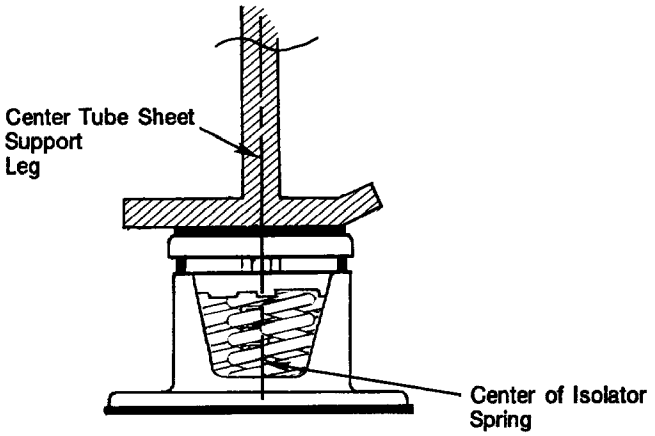
Isolator Placement for EVSZ - 140E

		Estimated Spring Isolator Loading (Lbs.; See Notes)					
CVHE Size Range	EVZS	Location A (Left Front)	Location B (Left Rear)	Location C (Right Front)	Location D (Right Rear)	Location E (Left Mid)	Location F (Right Mid)
130 - 200	020S/L	2,490 - 2,737	1,588 - 1,792	3,590 - 3,901	2,280 - 5,037	n/a	n/a
230 - 320	032S/L	2,847 - 3,249	2,458 - 2,816	4,092 - 4,508	3,530 - 7,249	n/a	n/a
360 - 500	030S/L	3,980	3,492 - 4,029	5,117 - 5,690	4,487	n/a	n/a
560 - 800	080S/L	5,931	4,806 - 5,728	7,927 - 8,706	6,427	n/a	n/a
890 - 1250	125L	10,306	8,471	12,585	10,341	n/a	n/a
890 - 1250	140E	6,600	11,000	6,700	11,500	6,600	6,700

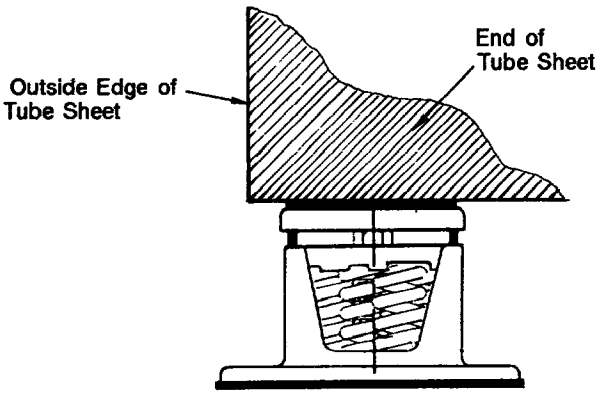
Notes:
1. This table only provides an estimated range of loading at each isolator location. The values given are based on a standard unit with nonmarine water boxes and without a unit-mounted starter. For specific isolator loading information, refer to the submittal package provided for the unit, or contact your local Trane sales office.
2. If the unit is equipped with a unit-mounted starter, add 525 pounds to the isolator load range for isolator location "C".
3. EVZS = Evaporator Size

Figure 11
Chiller Foot/Isolator Orientation

Side View of Unit



End View of Unit



Note: The spring isolator must be centered in relation to the tube sheet. Do not align the isolator with the flat part of the chiller foot since the tube sheet is often off-center.

Note: Place isolators near outside edge of tube sheet as shown.

3. If required, bolt the isolators to the floor through the slots provided, or cement the pads.

Note: Fastening the isolators to the floor is not necessary unless specified.

4. If the chiller must be fastened to the isolators, insert cap screws through the chiller base and into the holes tapped in the upper housing of each isolator. However, do not allow the screws to protrude below the underside of the isolator upper housing. An alternative method of fastening the chiller to the isolators is to cement the neo-prene pads.

5. Set the chiller on the isolators; refer to "Rigging" for lifting instructions.

The weight of the chiller will force the upper housing of each isolator down, perhaps causing it to rest on the isolator's lower housing. (Figure 12 illustrates spring isolator construction.)

6. Check the clearance (labelled **X** in Figure 12) on each isolator. If this dimension is less than 1/4" on any isolator, use a wrench to turn the adjusting bolt one complete revolution upward.

Repeat this operation until a 1/4" clearance is obtained at one or more isolators.

Note: When the load is applied to the isolators (Step 5), the top plate of each isolator moves down to compress the springs until either: (1) the springs support the load; or, (2) the top plate rests on the bottom housing of the isolator.

a. If the springs are supporting the load, screwing down on the adjusting bolt (Step 7) will immediately begin to raise the chiller.

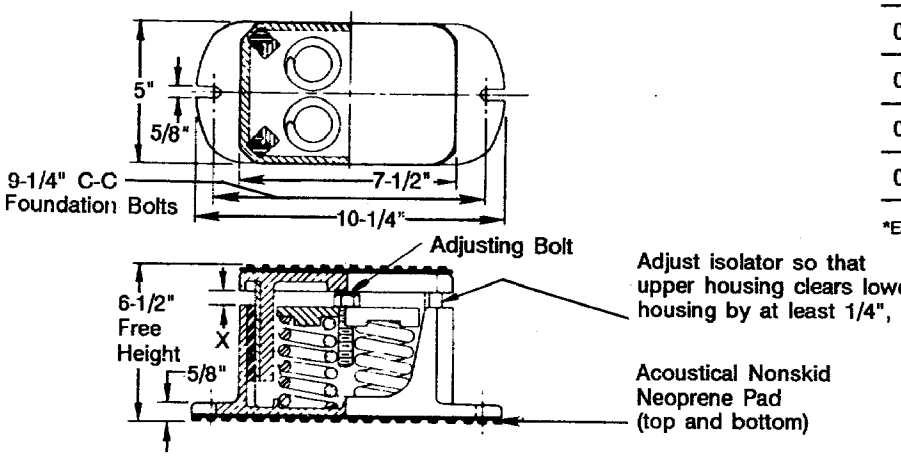
b. If the top plate is resting on the bottom housing of the isolator, screwing down on the adjusting bolt will compress the springs until they support the load. At that point, any additional turning will raise the chiller.

7. Turn the adjusting bolt on each of the remaining isolators to obtain the required minimum clearance at **X** (Figure 12) of 1/4".

8. Once the minimum required clearance is obtained on each of the isolators, level the chiller by turning the adjusting bolt on each of the isolators on the low side of the unit. Be sure to work from one isolator to the next. Remember that the chiller must be level to within 1/16" over its length and width, and that clearance **X** of each isolator must be at least 1/4-inch.

Figure 12
Typical Spring Isolator Types and Construction

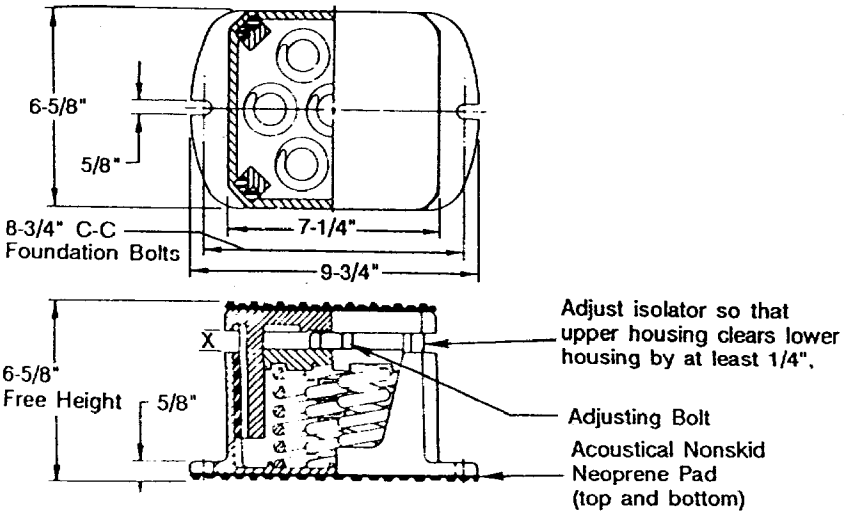
Type CT-4 Spring Isolators



Isolator Type and Size*	Maximum Load (Lbs.)	Deflection (Inches)	Spring Color Coding
CT-4-25	1,800	1.22	Red
CT-4-26	2,400	1.17	Purple
CT-4-27	3,000	1.06	Orange
CT-4-28	3,600	1.02	Green
CT-4-31	4,400	0.83	Gray
CT-4-32	5,200	0.74	White

*Each Type "CT-4" spring isolator has 4 springs.

Type CT-7 Spring Isolators



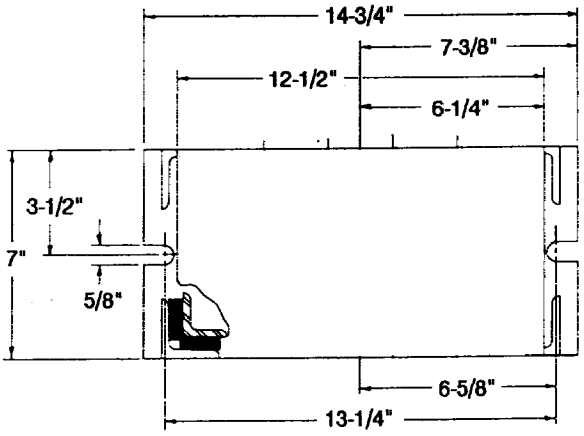
Isolator Type and Size	Maximum Load (Lbs.)	Deflection (Inches)	Spring Color Coding
CT-7-25	3,150	1.22	Red
CT-7-26	4,200	1.17	Purple
CT-7-27	5,250	1.06	Orange
CT-7-28	6,300	1.02	Green
CT-7-31	7,700	0.83	Gray/
CT-7-32	9,100	0.74	White

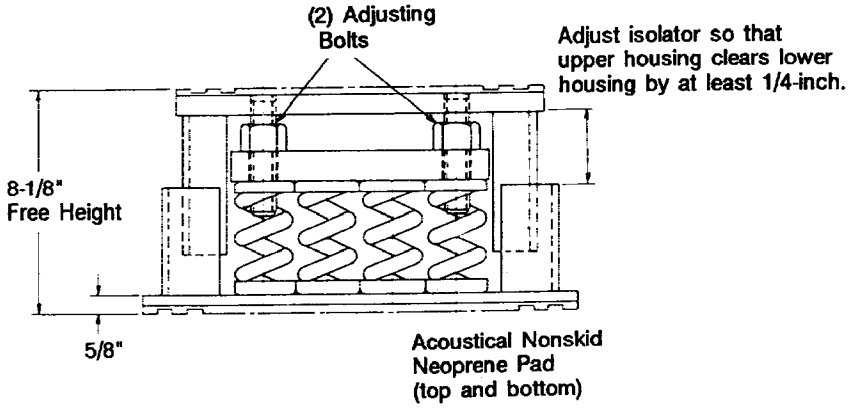
*Each Type "CT-7" spring isolator has 7 springs.

Figure 12 (Cont'd)
Type CT-12
Spring Isolators

Isolator Type and Size	Maximum Load (Lbs.)	Deflection (Inches)	Spring Color Coding
CT-12-25	5,400	1.22	Red
CT-12-26	7,200	1.17	Purple
CT-12-27	9,000	1.06	Orange
CT-12-28	10,800	1.02	Green
CT-12-31	13,200	0.83	Gray
CT-12-32	15,600	0.74	White

*Each Type "CT-12" spring isolator has 12 springs.





Unit Leveling

Follow the instructions outlined below —and illustrated in Figure 13—to determine whether or not the chiller is set level.

1. Measure an equal distance up from each foot of the chiller (identified as **X** in Figure 13), and make a punch mark at each measured distance.

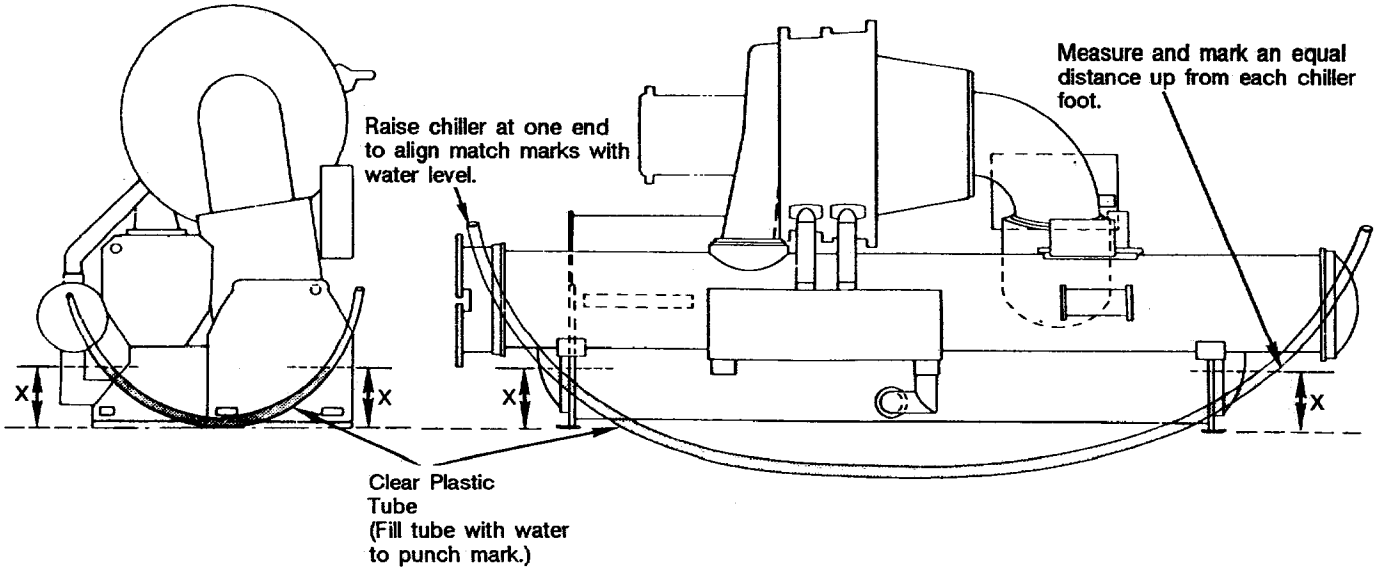
2. Suspend a clear plastic tube along the length of the chiller as shown in Figure 13.

3. Fill the tube with water until the level aligns with the punch mark at one end of the chiller; then check the water level at the opposite punch mark.

If the water level does not align with the punch mark, use full-length shims to raise one end of the chiller until the water level at each end of the tube aligns with the punch marks at both ends of the chiller.

4. Once the unit is level across its length, repeat Steps 1 through 3 to see if unit is level across the width. Remember that the chiller must be level within 1/16" over both its length and width.

Figure 13
Checking Unit Levelness



Water Piping

Overview

Several water piping circuits must be installed and connected to the chiller:

Note: Field piping must be arranged and supported to avoid stress on the equipment. It is strongly recommended that the piping contractor refrain from piping closer than 3'-0" minimum to the equipment. This will allow for proper fit-up upon arrival of the unit at the job site. Any adjustment that is necessary can be made to the piping at that time.

(1) pipe the evaporator into the chilled water circuit;

(2) pipe the cooling condenser into the cooling tower water circuit; and,

(3) pipe the purge condenser across the chilled water pump—and to a separate water supply. (The separate water supply is needed to allow purge operation while the unit is shut down.) Depending on the options present other water circuits may be required:

(4) a heat-recovery condenser water circuit,

(5) an auxiliary condenser water circuit,

Piping suggestions for each of the 6 water circuits listed above are outlined later in this section. General recommendations for the installation of field-supplied piping components (e.g., valves, flow switches, etc.) common to most chiller water circuits are listed below.

Water Treatment

Since the use of untreated or improperly treated water in a CenTraVac may result in inefficient operation and possible tube damage, be sure to engage the services of a qualified water treatment specialist to determine whether treatment is needed. A label with the following disclamatory note is affixed to each CVHE unit:

CUSTOMER NOTE

"The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is advisable. The Trane Company warranty specifically excludes liability for corrosion, erosion or deterioration of Trane equipment. Trane assumes no responsibilities for the results of the use of untreated or improperly treated water, or saline or brackish water."

Caution: Do not use untreated or improperly treated water, or equipment damage may occur.

Pressure Gauges

Locate pressure gauge taps in a straight run of pipe. Place tap a minimum of one pipe diameter downstream of any elbow, orifice etc. Example, for a 6" pipe, the tap would be at least 6" from any elbow, orifice, etc.

Valves

1. Install field-supplied air vents and drain valves on the water boxes. Each water box is provided with a 3/4" vent hole and a 3/4" NPT drain outlet.

Plastic plugs are factory-installed in both openings for shipment; remove and discard these plugs as you install the water box vents and drain valves.

2. If necessary for the application, install pressure-relief valves at the drain connections on the evaporator and condenser water boxes. To do so, add a tee—with the relief valve attached —to the drain valve.

To determine whether or not pressure-relief valves are needed for a specific application, keep in mind that:

a. Vessels with close-coupled shutoff valves may cause high, potentially damaging hydrostatic pressures as fluid temperature rises; and,

b. Relief valves are required by ASME codes when the shell waterside is ASME. Follow ASME guidelines or other applicable codes to assure proper relief valve installation.

Caution: Failure to install pressure-relief valves in the condenser and evaporator water circuits may result in shell damage due to hydrostatic expansion.

Strainers

Install a strainer in the entering side of each piping circuit to avoid possible tube plugging in the chiller with debris.

Caution: Failure to install strainers in all water piping entering the chiller can result in tube plugging conditions that damage unit components.

Flow-Sensing Devices

Use either flow switches—or differential pressure switches—in conjunction with the pump interlocks to verify evaporator and condenser water flows.

To assure adequate chiller protection, wire the chilled-water and condenser-water flow switches in series with the appropriate water pump interlock. Refer to the wiring diagrams that shipped with the unit for specific electrical connections.

Unless stated otherwise, all flow-sensing devices must be field-supplied. Be sure to follow the manufacturer's recommendations for device selection and installation. Also, review the general flow switch installation guidelines listed below.

1. Mount the flow switch upright in a horizontal section of pipe. Allow at least 5 pipe diameters of straight, horizontal run on each side of the switch.

Avoid locations adjacent to elbows, orifices and valves whenever possible.

2. To assure that the flow switch operates as designed, adjust the length of the flow switch paddle to compensate for the pipe diameter and the height of the coupling tee used to install the switch.

3. Install the flow switch using a coupling that is large enough to allow the insertion of a bushing one pipe diameter larger than the flow switch base (Figure 14). This will prevent interference with the flow switch paddle.

4. Verify that the direction-of-flow arrow on the switch points in the same direction as actual water flow through the piping circuit.

5. Remove all air from the piping circuit to prevent possible flow switch "fluttering".

6. Adjust the flow switch to open when water flow is less than nominal.

Bulbwell Installation

Depending on the unit control options selected, 1 to 4 water temperature sensor bulbwells must be installed in the unit water piping. A field- supplied 1/2" NPT coupling is required to install each bulbwell.

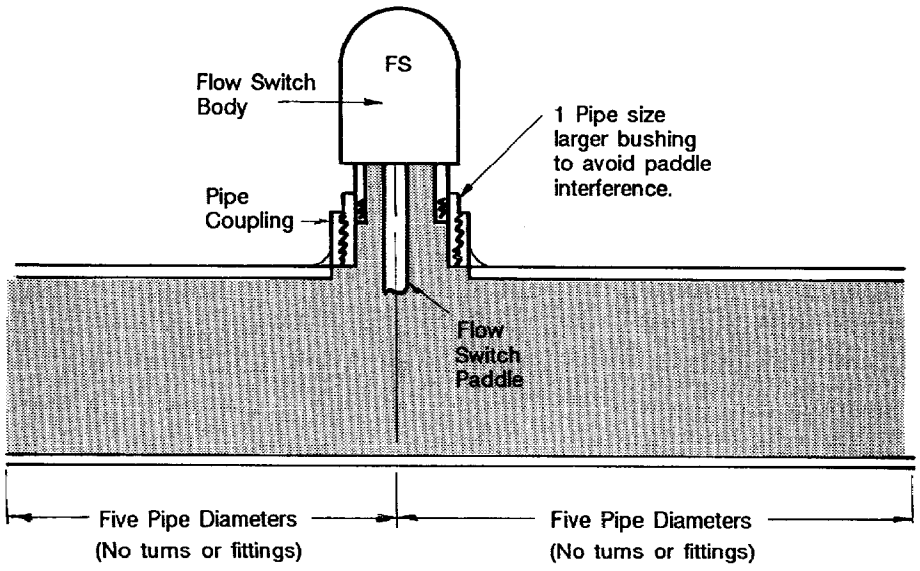
Leaving evaporator water temperature sensor 4RT1 ships inside the unit control panel, and must be installed in the chilled water piping carrying water from the evaporator.

An additional sensor bulbwell must be field-installed if the optional entering evaporator water temperature sensor, 4RT2, will be used to monitor the temperature of the water returning to the evaporator. (Sensor 4RT2 is typically used with the load-based chilled water reset option.)

Field installation of 2 bulbwells in the condenser water piping is also required if optional sensors will be used to monitor water temperatures entering and leaving the condenser.

Regardless of which water temperature sensors are required for a particular chiller installation, always position the bulbwells far enough from the evaporator or condenser to ensure that the sensors read a good, mixed water temperature.

Figure 14
Flow Switch Installation



Evaporator and Condenser Water Piping

Figures 15 and 16 illustrate the typical water piping arrangements recommended for the evaporator and condenser(s).

Note: It is strongly recommended that the piping contractor refrain from piping closer than 3'-0" minimum to the equipment. This will allow for proper fit-up upon arrival of the unit at the job site. Any adjustment that is necessary can be made to the piping at that time.

Water piping connection sizes are identified in Tables 4 and 5. Remember that entering and leaving evaporator water can be piped to either water box connection since the tube bundles are split vertically.

Note: To assure that the evaporator water piping is clear, check it after the chilled water pump is operated but before initial chiller start-up. If any partial blockages exist, they can be detected and removed to prevent possible tube damage resulting from evaporator freeze-up or erosion.

Note: Arrange the condenser water piping so that the water supply enters the shell at the lower connection, and exits from the top connection. (Single-pass condenser shells may be piped as desired since both connections are at the same level.)

For applications that include an "infinite source" or "multiple-use", cooling condenser water supply, install a valved bypass "leg" (optional) between the supply and return pipes; see Figure 16. This valved bypass allows the operator to short-circuit water flow through the cooling condenser when the supply water temperature is too low.

Caution: To prevent operating problems. Condenser water supply temperature should not fall below 55 F.

Note: Whenever a CVHE unit is equipped with an auxiliary condenser, use a bypass valve system to avoid circulating water through the auxiliary shell during unit shutdown.

Water Box Locations

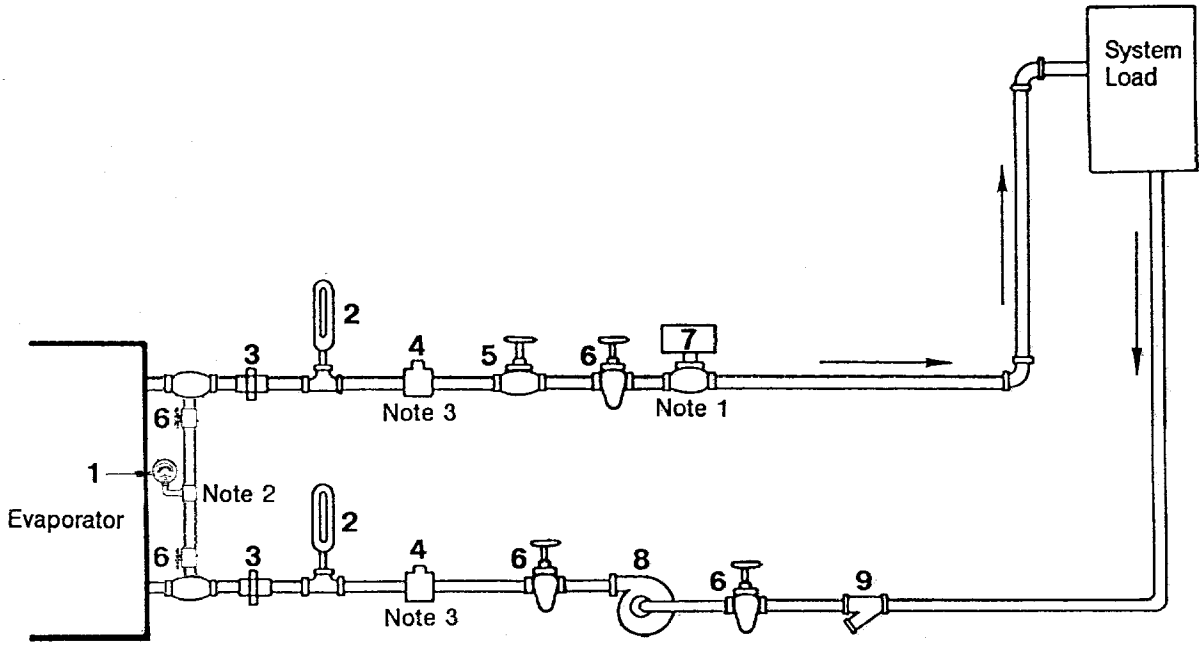
If necessary, the nonmarine water boxes on each shell—whether evaporator or condenser—can be switched end-for-end to obtain the desired piping arrangement. Contact Trane CASBU Marketing for switching of marine-style boxes.

Caution: To prevent altering the designed waterflow piping configuration in the unit; do not exchange positions of marine water boxes. This will prevent proper unit operation.

To accommodate lifting apparatus, a nut is welded to each evaporator water box to enable attachment of a 3/4" eyebolt (field-supplied). Condenser water boxes are provided with 1/2" tapped holes that allow installation of the eyebolt included in the unit's loose parts-box.

If the water boxes on any of the shells are exchanged end-for-end, be sure to reinstall them right side up to maintain the correct baffle arrangements. Use a new gasket with each water box cover.

Figure 15
Typical Evaporator
Water Piping Circuit

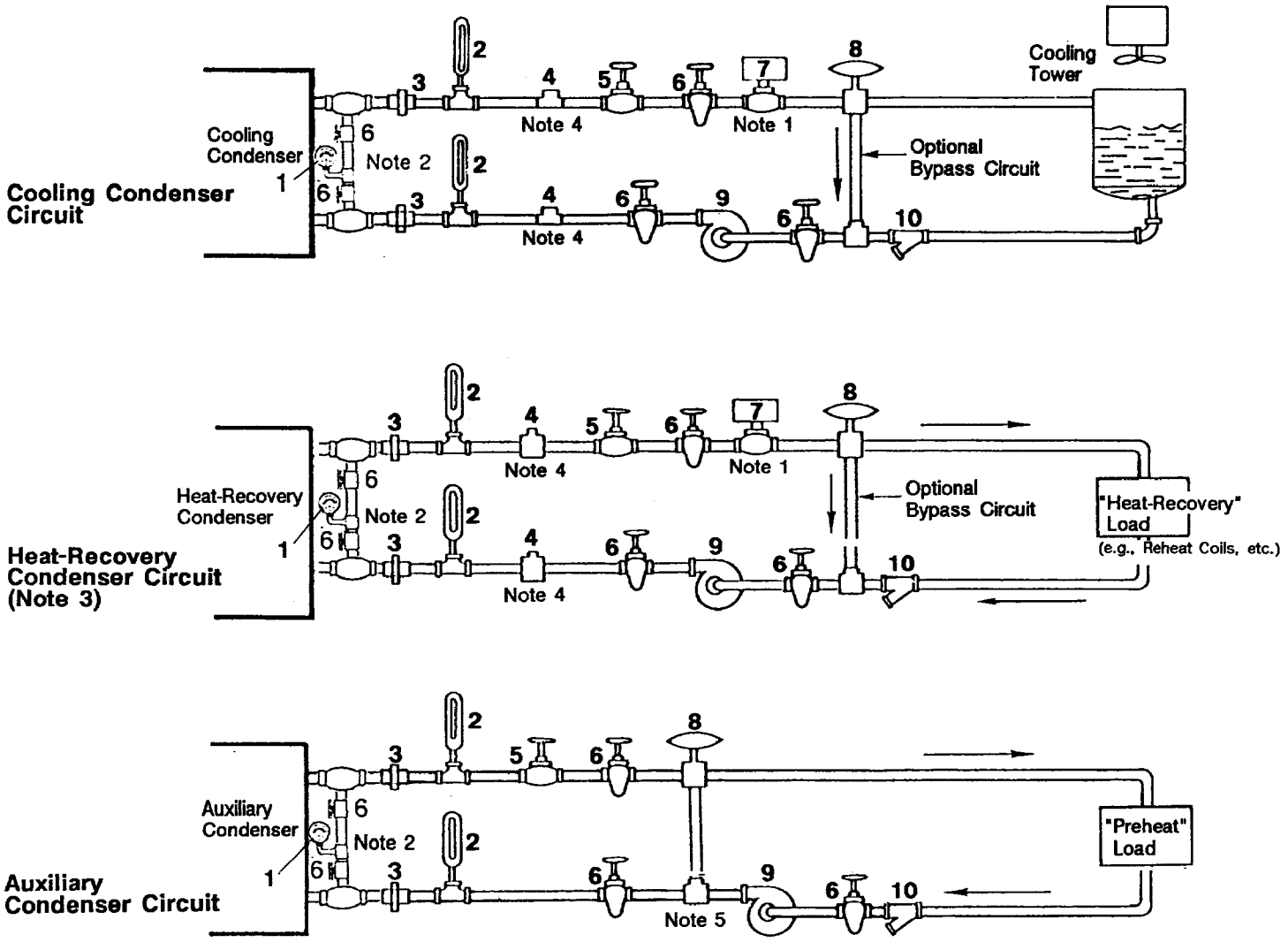


Legend
(Field-Supplied/-Installed Components)

1 - Pressure Gauge
2 - Thermometer(s)
3 - Union(s) or Flanged Connection(s)
4 - 1/2" NPT Coupling(s)
5 - Balancing Valve
6 - Gate (Isolation) Valve(s)
7 - Chilled Water Flow Switch (5S2)
8 - Chilled Water Pump
9 - Strainer

Notes:
1. Flow switch 5S2 may be installed in either the entering or leaving leg of the chilled water circuit.
2. It is recommended to pipe 1 gauge between entering and leaving pipes. A shutoff valve on each side of the gauge allows the operator to read either entering or leaving water pressure.
3. One 1/2" NPT coupling must be installed in the leaving line for leaving evaporator water temperature sensor 4RT1. If optional entering evaporator water temperature sensor 4RT2 is ordered with the unit, a 1/2" NPT coupling must be installed in the entering line, too.

Figure 16
Typical Condenser Water Piping Circuits



Legend
(Field-Supplied/-Installed Components)

1 - Pressure Gauge
2 - Thermometer(s)
3 - Union(s) or Flanged Connection(s)
4 - 1/2" NPT Coupling(s)
5 - Balancing Valve
6 - Gate (Isolation) Valve(s)
7 - Condenser Water Flow Switch
8 - 3-Way Valve (Optional)
9 - Condenser Water Pump
10 - Strainer

Notes:
1. Install the flow switch in either the entering or leaving leg of the condenser water circuit.
2. It is recommended to pipe 1 gauge between entering and leaving pipes. A shutoff valve on each side of the gauge allows the operator to read either entering or leaving water pressure.
3. Some type of field-supplied temperature control device may be required to regulate the temperature of the heat-recovery condenser water circuit. For application recommendations, see Trane Application Manual AM-FND8, entitled "Heat-Recovery Engineering Seminar".
4. 1/2" NPT couplings are required to install the entering and leaving condenser water temperature sensors (4RT3, 4RT4). This sensor pair may be installed in either the cooling or heat-recovery condenser circuit (or both, if an additional sensor pair is ordered), as appropriate for the application.
5. Install a bypass valve system to avoid circulating water through the auxiliary shell when the unit is shut down.

Table 4
Evaporator Water Piping Connection Sizes

Unit Size Range	EVSZ (1)	Connection Size 1-Pass	2-Pass	3-Pass
CVHE 130-200	020S/020L	6"	5"	4"
CVHE 230-320	032S/032L	8"	6"	5"
CVHE 360-500	050S/050L	10"	8"	6"
CVHE 560-800	080S/080L	12"	10"	8"
CVHE 890-1250	125L	16"	12"	10"
CVHE 890-1250	140E	16"	12"	10"

Note: EVSZ = Evaporator Shell Size; S = Short Shell; L = Long Shell; E = Extended Shell.

Table 5
Condenser Water Piping Connection Sizes (See Note 1)

Unit Size Range	CDSZ (2)	2-Pass Shells
CVHE 130-200	020S/020L	5"
CVHE 230-320	032S/032L	6"
CVHE 360-500	050S/050L	8"
CVHE 560-800	080S/080L	10"
CVHE 890-1250	125L	12"
CVHE 890-1250	140L	12"

Notes:
1. Connection sizes shown above apply to both cooling and heat-recovery condensers. Auxiliary condenser water piping connections are 5" NPS for 2-pass shells, and 8" NPS for 1-pass shells.
2. CDSZ = Condenser Shell Size; S = Short Shell; L = Long Shell.

Auxiliary Water Supply

Purge Condenser Water Piping

Pipe the purge condenser (or drum) across the chilled water pump to provide an adequate water supply. All purge condenser water connections are 1/2" NPT, internal.

Also, be sure to pipe a separate water supply to the drum so that the purge system can operate while the chiller is off; city water may be used for this purpose.

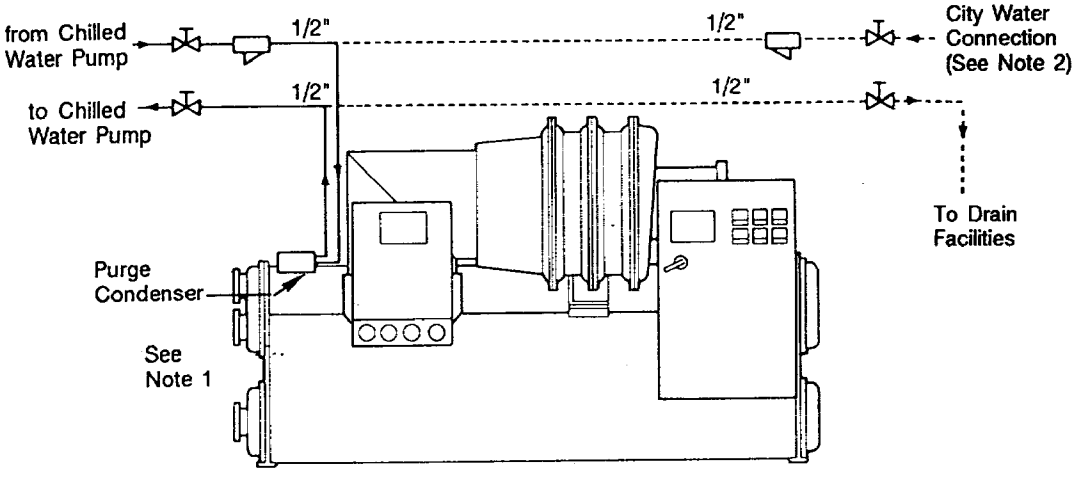
Typical purge condenser water piping is illustrated in Figure 17.

Note: Be sure to install the strainers and valves shown in Figure 17. These devices, as well as the auxiliary water piping and fittings, must be furnished, installed and insulated by the installing contractor.

Caution: To prevent equipment damage resulting from debris entering the purge drum, install a strainer in the drum's entering water piping.

A flow rate of at least 5 gpm is required to assure correct operation. In addition, the auxiliary water supply temperature must not exceed 80 F (26 C).

Figure 17
Typical Purge Condenser Water Piping Circuit



Notes:
1. Maximum test pressure on water side of any machine must not exceed design working pressure.
2. Use separate water supply for purging during shutdown. Consult local codes for requirements.

Bolt-Tightening Sequence for Water Piping Connections

A bolt-tightening sequence for flanges with flat gaskets or o-rings is described below and shown in Figure 18. Remember that improperly tightened flanges may leak!

Note: Before tightening any of the bolts, align the flanges. Flange bolt torque requirements are given in Table 6.

[ ] **Flanges with 4, 8 or 12 Bolts.** See Figure 18. Tighten all bolts to a snug tightness, following the appropriate numerical sequence for the flange. Repeat this sequence to apply the final torque to each bolt.

[ ] **Flanges with 16, 20 or 24 Bolts.** See Figure 18. Following the appropriate numerical sequence, tighten only the first half of the total number of bolts to a snug tightness. Next, sequentially tighten the remaining half of the bolts to their final torque. Apply final torque to the first half of the bolts in the proper order.

[ ] **Flanges with More than 24 Bolts.** Refer to Figure 18 and sequentially tighten the first 12 bolts to a snug tightness. Tighten the next 12 consecutively numbered bolts, in sequence, to the final torque.

Then, apply final torque to the first 12 bolts and the bolts not yet tightened (i.e., unnumbered bolts in Figure 18). Be sure to start with bolt "1" and move progressively around the flange in a clockwise direction.

[ ] **Evaporator Water Box Covers.** See Figure 18. Ensure that the water box head rests tightly against the tube sheet; then snugly tighten the 26 bolts in sequential order.

If excessive tube sheet crown prevents the head from contacting the tube sheet, tighten the bolts located where the greatest gaps occur. Be sure to use an equal number of bolt turns from side to side.

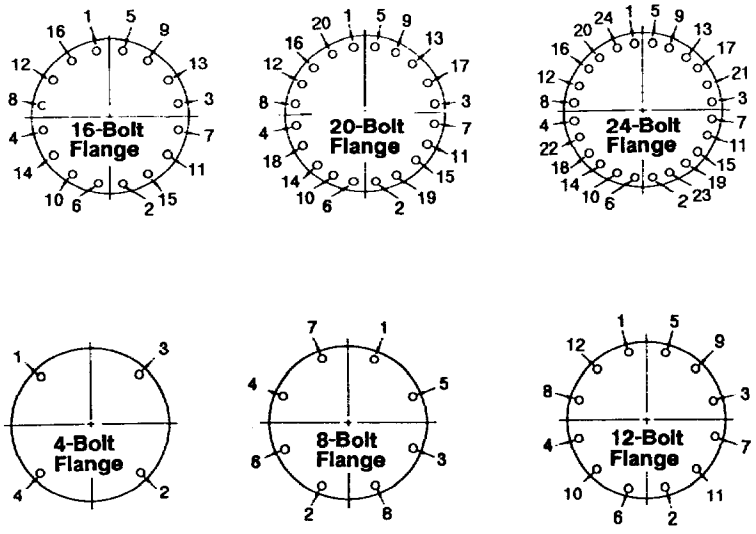
Finally, apply final torque to each bolt in sequential order. (Each bolt is identified by number in Figure 18.)

Table 6
Flange Bolt Torque Recommendations for O-Ring and Flat-Gasket Piping Connections (See Note).

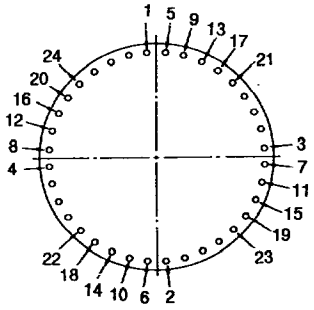
Bolt Size (In.)	Gasket Type	
	O-Ring	Flat
3/8	25 (34)	12-18 (16-24)
1/2	70 (95)	33-50 (45-68)
5/8	150 (203)	70-90 (95-122)
3/4	250 (339)	105-155 (142-210)

Note: Torques provided in ft./lbs. (Newton/Metres).

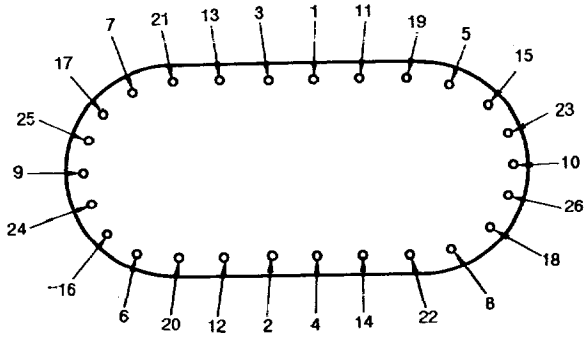
Figure 18
Bolt Tightening Sequences for Water Piping Flanges and Waterboxes



Flanges w/More than 24 Bolts



Evaporator Water Box Covers



Rupture Disc Vent Installation

All CenTraVac chillers are equipped with carbon rupture discs. A cross-section of the rupture disc assembly appears in Figure 19; this illustration also indicates the location of the rupture disc on the suction elbow.

If refrigerant pressure within the evaporator exceeds 15 psig, the rupture disc breaks; shell pressure is relieved as refrigerant escapes from the chiller.

When constructing the rupture disc vent line, be sure to consult local codes for applicable guidelines and constraints. The rupture disc should be vented outside the equipment room.

Several general recommendations for rupture disc vent line installation are outlined below.

1. Verify that the vacuum support side of the rupture disc is positioned as shown in the cross-section view that appears in Figure 19.

Note: If the rupture disc was removed for any reason, it must be reinstalled as shown.

2. Do not apply threading torque to the outside pipe assembly when installing the connecting pipe!

Caution: Applying threading torque to the outside pipe may damage the rupture disc assembly.

3. Support the vent piping; use a flexible connection to avoid placing stress on the rupture disc. (Stress can alter rupture pressure and cause the disc to break prematurely.)

See Figure 20 for a recommended relief piping arrangement.

Important! Vent pipe size must conform to ANSI/ASHRAE Standard 15-1989, which discusses vent pipe sizing. Use Table 7 and then Figure 21 to determine proper vent pipe size.

Note: To determine the total "C" value for a specific unit, add the appropriate "C" values for the evaporator, standard condenser and economizer. If the unit is equipped with any options (e.g., heat recovery, free cooling, or an auxiliary condenser), add the ap- plicable "C" value(s) to this total. With this new sum, refer to Figure 21 to determine the vent line pipe diameter needed to handle flow.

Note: If piping multiple rupture discs (multiple units) to a common vent line, first determine the total "C" value for each unit, and then; add all "C" values together and apply the result to the "vent pipe sizing chart" in Figure 21.

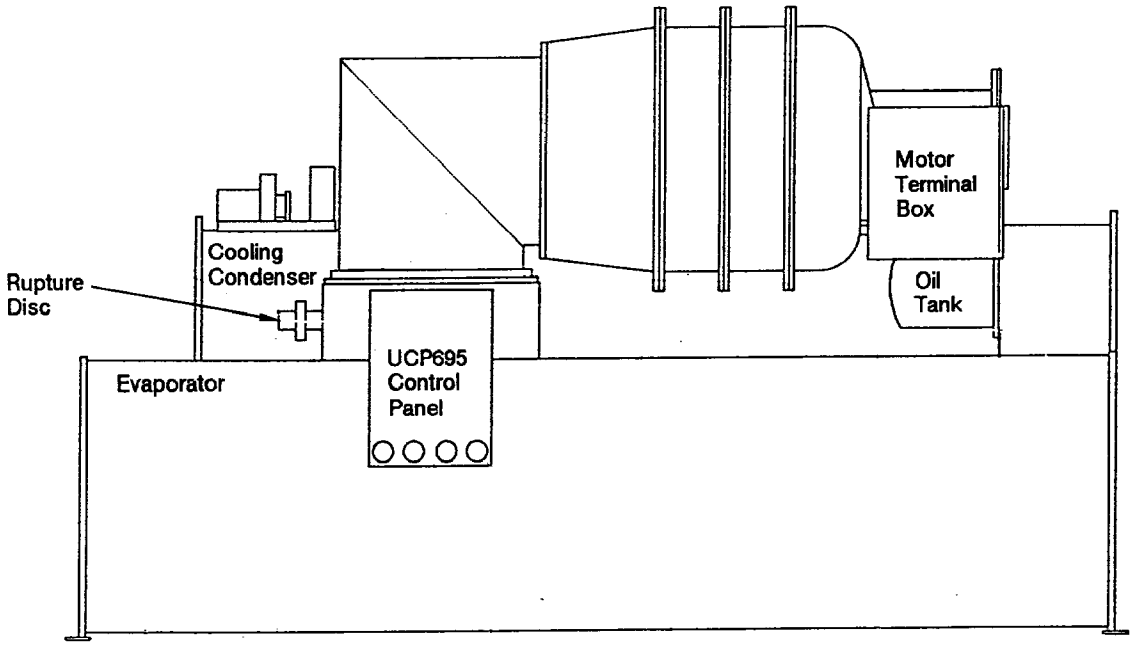
4. Drill drain holes at low points in the vent piping to prevent condensate from accumulating on the rupture disc. Provide a 1/8" drain hole at any point where water may accumulate. See Figure 20.

5. Normally, where multiple chillers are used, install a separate rupture disc vent line for each unit.

6. Consult local regulations for any special relief line requirements.

Figure 19
Rupture Disc

Rupture Disc Location



Cross Section of Rupture Disc

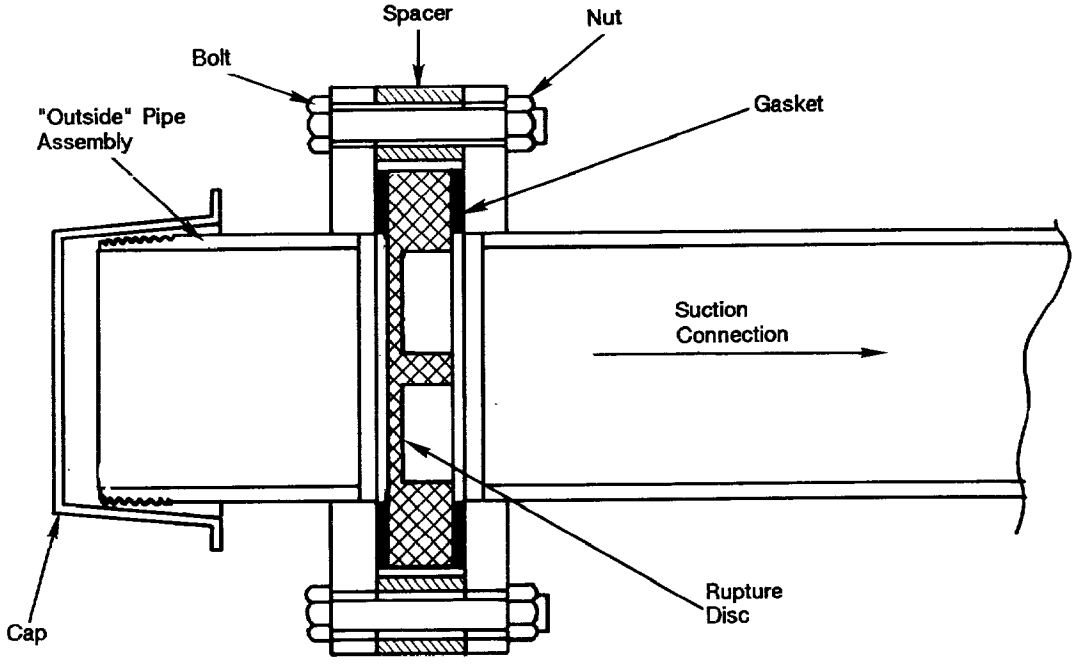


Figure 20
Recommended Arrangement for Rupture Disc Relief Piping

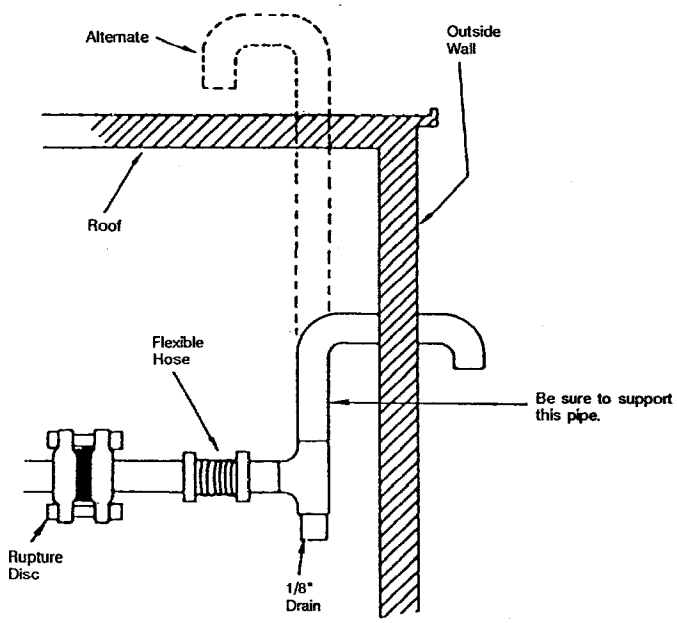
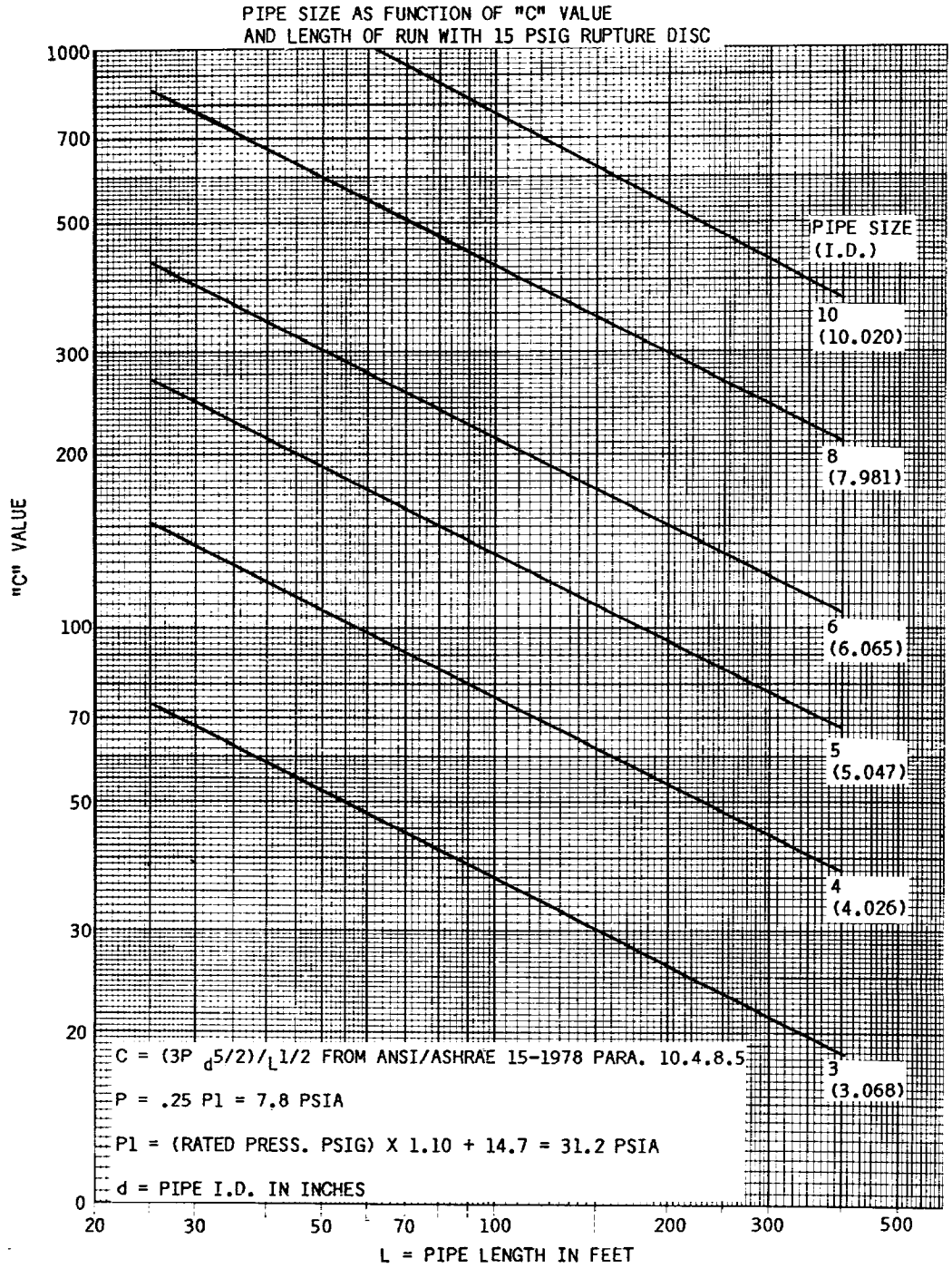


Table 7
"C" Values Used to Determine Rupture Disc Vent Line Sizes

CVHE Size Range	Evap Size (EVSZ)(3)	Cond Size (CDSZ)(4)	Rupt. Disc Dia.	"C" Values for Unit Components: Evap.	Std. Cond.	Econ.	Short H.R. Cond.	Long H.R. Cond.	Aux. Cond.	With Free Cool
130 thru 200	020S	020S	2"	20.81	15.28	3.28	15.28	20.40	15.28	3.15
	020L	020S		28.01	15.28					
	020S	020L		20.81	20.40					
	020L	020L		28.01	20.40					
230 thru 320	032S	032S	3"	26.25	18.87	4.85	18.87	25.19	15.28	4.16
	032L	032S		35.04	18.87					
	032S	032L		26.25	25.19					
	032L	032L		35.04	25.19					
360 thru 500	050S	050S	3"	33.05	23.56	7.44	23.56	31.45	15.28	6.16
	050L	050S		44.13	23.56					
	050S	050L		33.05	31.45					
	050L	050L		44.13	31.45					
560 thru 800	080S	080S	3"	45.59	29.06	11.63	29.06	38.80	15.28	5.87
	080L	080S		60.86	29.06					
	080S	080L		45.59	38.80					
	080L	080L		60.86	38.80					
890 thru 1250	125L	125L	3"	65.86	48.50	15.80	n/a	48.50	15.28	8.10
890 thru 1250	140E	140E	3"	74.30	50.50	17.40	n/a	Des. Spec.	15.28	Des. Spec.

Notes:
1. To determine the total "C" value for a specific unit, add the appropriate "C" values for the evaporator, standard condenser and economizer. If the unit is equipped with any options (e.g., heat recovery, free cooling, or an auxiliary condenser), add the applicable "C" value(s) to this total. With this new sum, refer to Figure 21 to determine the vent line pipe diameter needed to handle flow.
2. If piping multiple rupture discs (multiple units) to a common vent line, first determine the total "C" value for each unit, and then; add all "C" values together and apply the result to the "vent pipe sizing chart" in Figure 21.
3. EVSZ = Evaporator Shell Size; S = Short Shell; L = Long Shell; E = Extended Shell.
4. CDSZ = Condenser Shell Size; S = Short Shell; L = Long Shell; E = Extended Shell.

Figure 21
Rupture Disc Vent Pipe Sizing



Unit Insulation Requirements

Factory-installed insulation is available as an option for all CVHE units.

In those instances where the chiller is not factory-insulated, install insulation over the areas shaded in Figure 22. It may also be necessary to insulate the compressor suction cover and motor barrel if the unit is installed in an area subjected to high humidities.

The quantities of insulation required—based on unit size and insulation thickness—are listed in Table 8. Insulation thickness is determined at normal design conditions which are:
- 85 F Dry Bulb Ambient Temperature
- 75 % Relative Humidity

Note: If the unit is not factory-insulated: Install insulation around the evaporator bulbwells; and, ensure that the bulbwells and connections for the water box drains and vents are still accessible after insulation is applied.

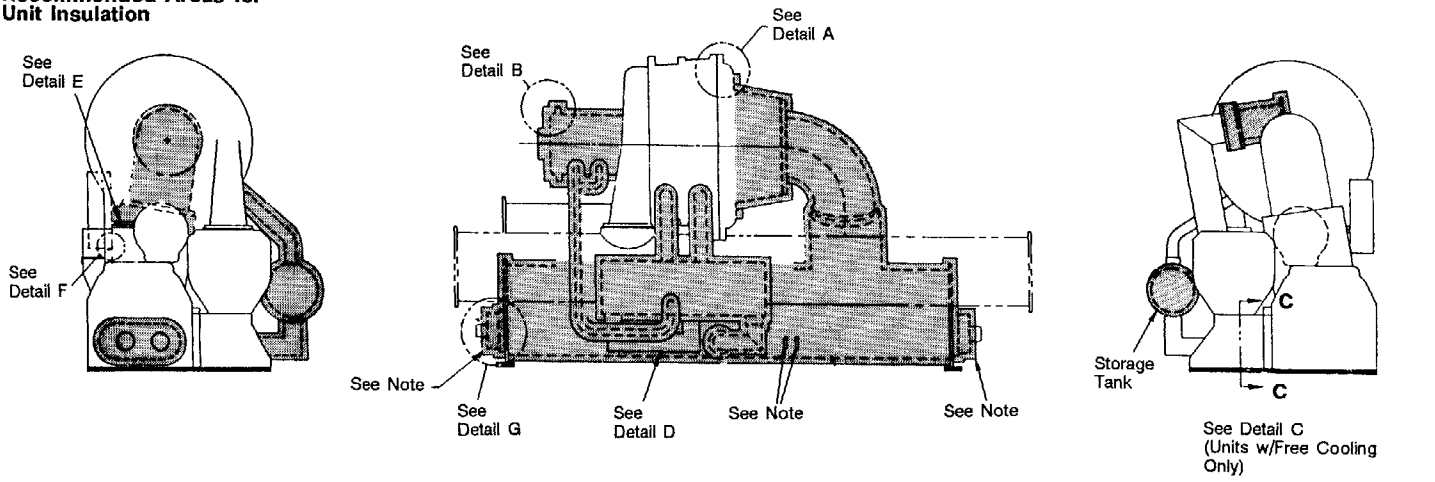
Caution: If the insulation will be painted in the field, use only water-based latex paints! Thinners and solvents used in other types of paints may cause seams in the insulation to open as a result of shrinkage.

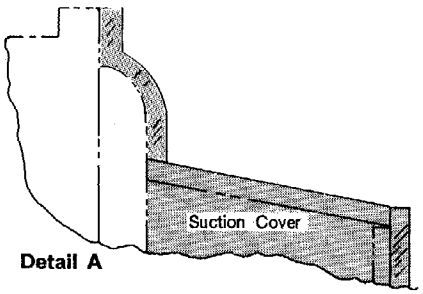
Table 8
CVHE Evaporator Insulation Requirements

		Standard Unit		Add for Free Cooling	
Unit Size Range	EVSZ (Note 1)	3/4" Insulation (Note 2)	3/8" Insulation (Note 3)	3/4" Insulation (Note 2)	3/8" Insulation (Note 3)
CVHE 130 thru 200	020S	156 sq. ft.	12 sq. ft.	12 sq. ft.	12 sq. ft.
	020L	216 sq. ft.	12 sq. ft.	12 sq. ft.	12 sq. ft.
CVHE 230 thru 320	032S	192 sq. ft.	24 sq. ft.	12 sq. ft.	24 sq. ft.
	032L	216 sq. ft.	24 sq. ft.	12 sq. ft.	24 sq. ft.
CVHE 360 thru 500	050S	216 sq. ft.	36 sq. ft.	12 sq. ft.	24 sq. ft.
	050L	252 sq. ft.	36 sq. ft.	12 sq. ft.	24 sq. ft.
CVHE 560 thru 800	080S	288 sq. ft.	48 sq. ft.	12 sq. ft.	24 sq. ft.
	080L	348 sq. ft.	48 sq. ft.	12 sq. ft.	24 sq. ft.
CVHE 890 thru 1250	125L	384 sq. ft.	96 sq. ft.	12 sq. ft.	36 sq. ft.
	140E	460 sq. ft.	115 sq. ft.	15 sq. ft.	45 sq. ft.

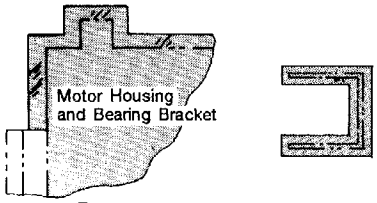
Notes:
1. EVSZ = Evaporator Shell Size, L = Long Shell, S = Short Shell; E = Extended Shell.
2. 3/4" sheet insulation is installed on the evaporator, evaporator water boxes, compressor motor, suction elbow, and suction cover as indicated in Figure 22.
3. 3/8" sheet insulation is installed on all economizers. All liquid lines and other pipes require the use of 1/2"-wall pipe insulation, or 3/8" sheet insulation.

Figure 22
Recommended Areas for Unit Insulation

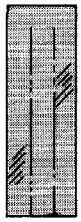




Detail A

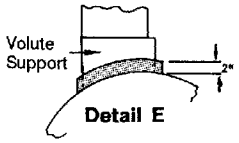


Detail B

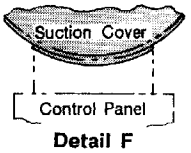


Condenser Support

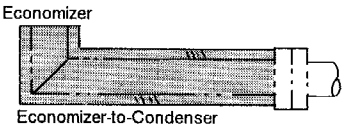
Detail C



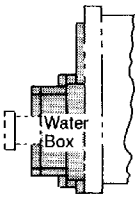
Detail E



Detail F



Detail D



Detail G

Note: Bulbwells, drain and vent connections must be accessible after insulating.

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Electrical Wiring

Note: Unit-mounted starters are available as an option on CVHEs with RLAs of 600 amps or less, and with a nominal voltage of no more than 600 volts.

While this control option eliminates most field-installed wiring requirements, the electrical contractor must still complete the electrical connection for: (1) the temperature sensors, (2) power supply wiring to the starter, (3) other unit control options present, and (4) any field-supplied control devices.

General Recommendations

WARNING: To prevent injury or death due to electrical shock or contact with moving parts, lock supply power and chiller disconnect switches open.

An overall layout (including control options) of the field wiring required to install a CVHE appears in Figure 23). As you review this diagram, along with the wiring instructions presented in this section, keep in mind that:

. . . typical field connection requirements for unit-mounted or remote-mounted starters are shown in Figures 24 and 25, respectively, and summarized in Table 9.

. . . all field-installed wiring must conform to NEC guidelines, as well as to any applicable state and local codes. Be sure to satisfy any special grounding requirements that may be necessary.

. . . compressor motor electrical data—including motor kw, voltage utilization range, rated load amps and locked rotor amps—is listed in Tables 10 through 14 for your reference.

. . . all field-installed wiring should be checked for proper terminations, and for possible shorts or grounds.

. . . use of flexible conduit when wiring the control panel and motor junction box will assure a vibration-free installation.

Note: The typical customer connection diagrams shown in Figures 24 and 25 are representative of standard CVHEs, and are provided only for general reference. Because these illustrations may not reflect the actual wiring of your unit, always refer to the wiring diagrams that shipped with the chiller for specific electrical schematic and connection information.

Figure 23
Typical CVHE Field Wiring Layout

WARNING:
Disconnect electrical power supply to prevent injury or death due to electrical shock.

Caution:
Unless otherwise specified, use only copper conductors to prevent equipment damage.

NOTES:

1. DASHED LINES INDICATE FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTION. CHECK 5.3 TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.
3. AUXILIARY CONTROLS FOR A CUSTOMER SPECIFIED OR INSTALLED LATCHING SAFETY TRIP-OUTS.
4. THE FOLLOWING CAPABILITIES ARE OPTIONAL – THEY ARE IMPLEMENTED AND WIRED AS REQUIRED FOR A SPECIFIC SYSTEM APPLICATION.
   - A: CHILLED WATER RESET – REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT1 & 4RT2. IF AMBIENT TEMP BASED CHILLED WATER RESET IS REQUIRED, USE STD SUPPLIED LEAVING EVAP WATER TEMP SENSOR (4RT1) FOR 4RT8 AS AN AMBIENT TEMP SENSOR.
   - B: RELAY PACKAGE – INCLUDES HEAD RELIEF REQUEST AND REMOTE ALARM CIRCUIT.
   - C: ENTERING EVAP TEMP SENSOR – REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT3 & 4RT2.
   - D: ENTERING AND LEAVING CONDENSER WATER TEMP SENSORS MATCHED PAIR OF THERMISTORS FOR 4RT3 & 4RT4.
   - E: TRACER MONITORING PACKAGE (60HZ UNITS ONLY). INCLUDES OPTIONS D AND B PLUS THERMISTOR FOR 4RT6 TO BE USED AS CONDENSER REFRIGERANT TEMP SENSOR.
5. FOR SENSOR DISCRIPTION SEE 64533-1210.

WIRING REQUIREMENTS

DO NOT RUN LOW VOLTAGE WIRE (30 VOLTS MAX) IN CONDUIT OR RACEWAY WITH HIGHER VOLTAGE WIRE.

REQUIRED WIRING:

21 9 WIRES #12-#10 AWG 600V, 7-#14 AWG 600V

22 8 WIRES #14-#16 AWG 600V. RUN IS SEPARATE COUDUIT. USE #16 AWG UP TO 250 FT ONEWAY OR #14 AWG UP TO 400 FT ONEWAY

23 COPPER WIRE ONLY SIZED PER N.E.C. 1984 BASED ON NAMEPLATE RLA SEE TABLE 1

24 4 WIRES #14 AWG 600V, SEPARATE 115 VAC POWER IS REQUIRED TO STARTER

25 2 WIRES #14 AWG 600V

26 2 WIRES #14-#18 AWG 600V, DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE SEE TABLE 2

OPTIONAL WIRING:

27 3 WIRES #14 AWG 600V, SEPARATE 115 VAC POWER SUPPLY IS REQUIRED

28 2 WIRES #14 AWG 600V, SEPARATE 115 VAC POWER SUPPLY IS REQUIRED

29 2 WIRES #14 AWG 600V

30 2 WIRES #14-#18 AWG 600V, DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE SEE TABLE 2

31 SHIELDED TWISTED PAIR, 30V OR LESS #14-#18 AWG 600V. MAX LENGTH 5000FT DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.

32 IF UNIT IS SUPPLIED WITH UNIT MOUNTED STARTER, FIELD WIRING BETWEEN UNIT AND STARTER IS NOT REQUIRED.

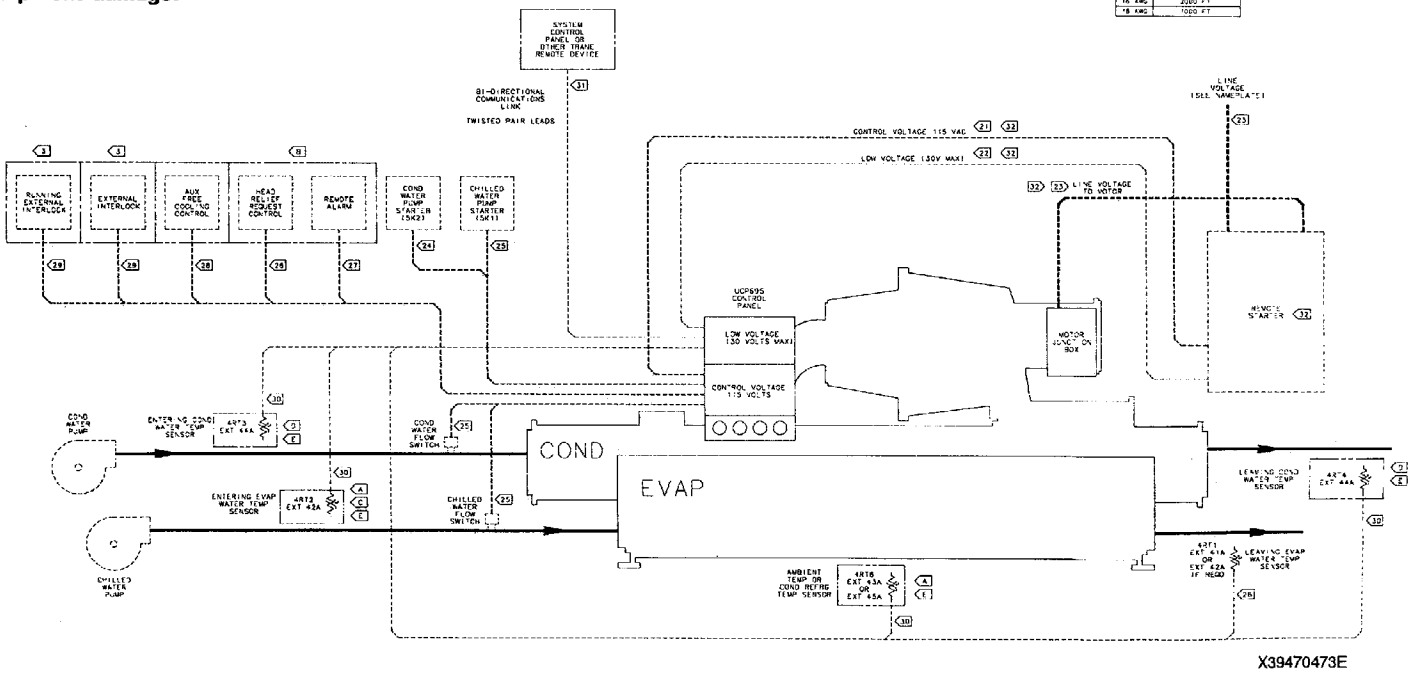
TABLE 1

RECOMMENDED WIRE SELECTION TABLE (REF. NEC 1984)
RATED LOAD (MAX. CURRENT TRANSFER RATE)

WIRE SIZE COPPER 75° C	SUPPLY LEADS OR MOTOR LEADS FOR ACROSS-THE-LINE, AUTO-TRANS STARTER OR PRIMARY REACTOR STARTER			MOTOR LEADS FOR STAR DELTA STARTER	
	1 CONDUIT 3 WIRES	2 CONDUITS 3 WIRES EA	3 CONDUITS 3 WIRES EA	2 CONDUITS 3 WIRES EA	3 CONDUITS 3 WIRES EA
8	45	N/A	N/A	63.3	55.4
6	52			90.9	72.0
4	88			117.6	94.1
3	101			135.4	103.3
2	93			156.5	122.8
1	104			178.9	143.9
0	120	240	192.0	207.5	158.7
00	140	280	224.0	242.2	93.8
000	160	320	256.0	276.5	221.4
0000	184	368	294.4	318.3	254.7
250	204	408	326.4	352.9	282.3
300	228	456	364.8	394.4	315.6
350	248	496	396.8	429.0	343.2
400	268	536	428.8	463.6	370.9
500	304	608	486.4	526.1	420.9
600	336	672	537.6	581.3	465.0

TABLE 2

WIRE SIZE	MAX LENGTH FOR SENSOR LEADS
14 AWG	5000 FT
16 AWG	2080 FT
18 AWG	1000 FT



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Note: A copy of this drawing is provided inside the unit control panel.

Figure 24
Typical Field Connections for CVHEs w/Unit-Mounted Starters

(Continued next page)

CUSTOMER NOTE:

1. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTION. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.

<3> CUSTOMER SUPPLIED CONTACTS MUST BE COMPATIBLE WITH DRY CIRCUIT 12 VDC, 45 mA. GOLD PLATED CONTACTS RECOMMENDED.

<4> RECOMMENDED CIRCUIT; COMPONENTS SUPPLIED BY OTHERS, 5K1 & 5K2 ARE AUX CONTACTS ON PUMP STARTERS; 5S2 & 5S3 ARE FLOW SWITCHES IN APPROPRIATE WATER CIRCUITS;SIZED TO CONTROL A LOAD RATED 115 VAC,19 VA.

<5> RETIGHTEN TERMINALS A MINIMUM OF 24 HOURS AFTER INITAL INSTALLATION. DO NOT OVER TIGHTEN.

<6> COPPER WIRE, SIZED PER N.E.C., BASED ON UNIT NAMEPLATE RLA PLUS TRANSFORMER LOAD IN L1 & L2. PHASING OF 3 PHASE INPUT: L1 TO A, L2 TO B, L3 TO C WHERE ABC REPRESENTS STANDARD PHASE ROTATION.

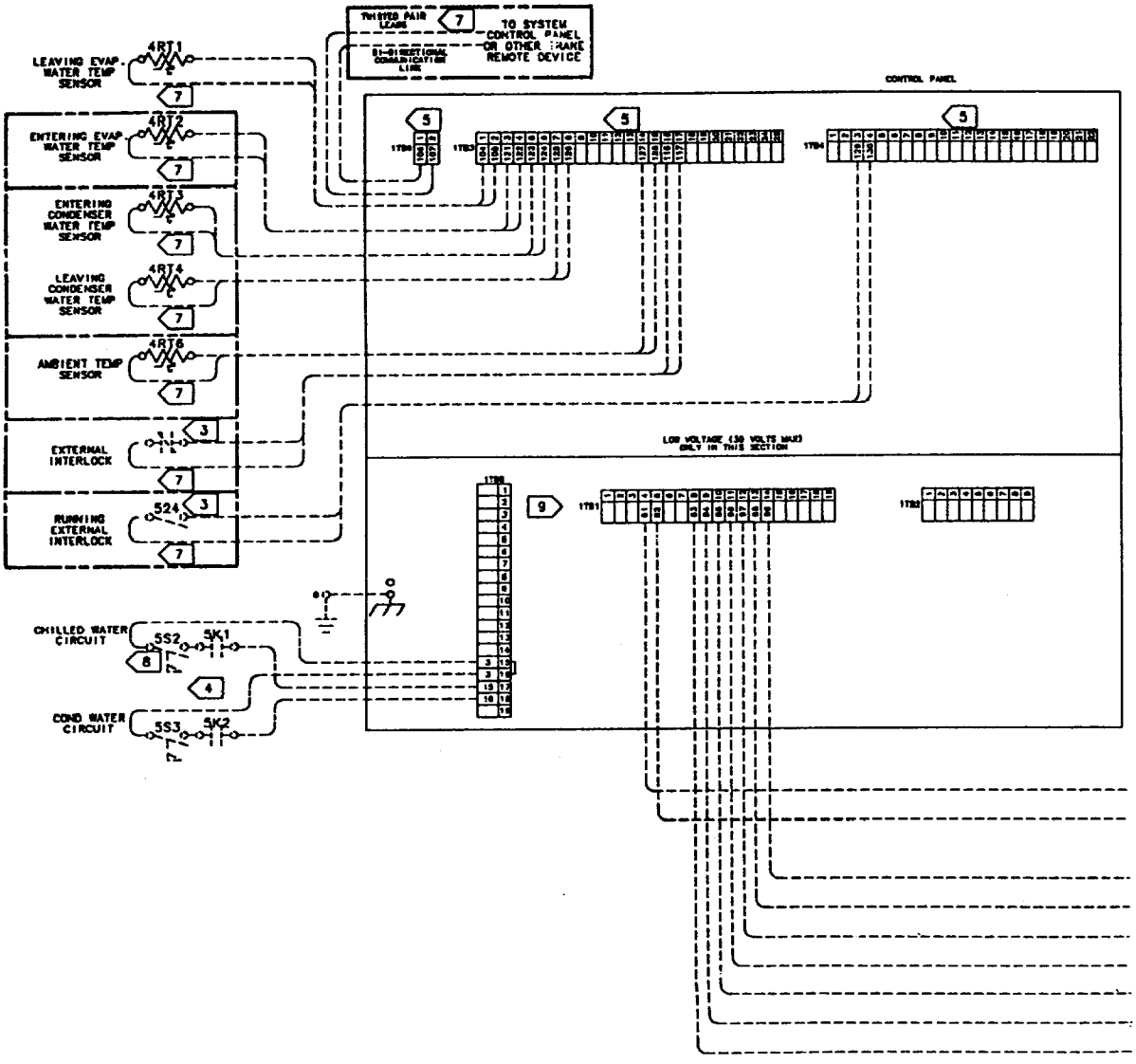


Figure 24 (Continued)

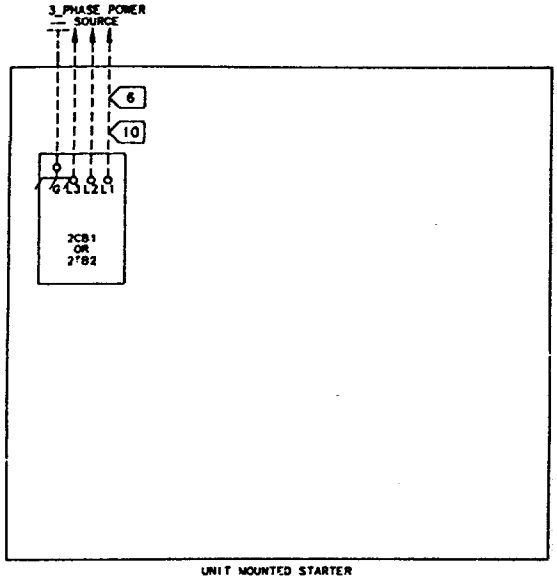
7 30V OR LESS #14–18 AWG 600V WIRE. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.

8 115V AC. #14 AWG 600V WIRE, MAX FUSE SIZE 15A.

9 FIELD WIRED ELECTRICAL LOADING IS NOT TO EXCEED THE FOLLOWING CONTECT RATINGS:

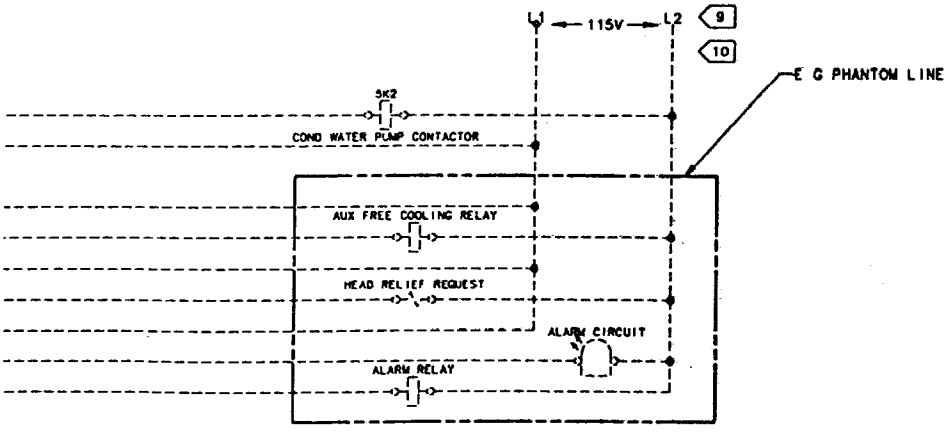
TERMINALS	DEVICE	RATED VOLTAGE (VAC)	RATED V/A
1TB1–4,5	1U1K6	120	240
1TB1–8,10	1U1K4–2	120	240
1TB1–9,10	1U1K4–1	120	240
1TB1–11,12	1U1K3	120	240
1TB1–13,14	1U2K2	120	120

10 FOR CANADIAN INSTALLATION (CSA) ONLY. LOCAL INSPECTION ATHORITIES MAY REQUIRE SINGLE POWER SOURCE DISCONNECTING MEANS.



Caution:
Unless otherwise specified, use only copper conductors to prevent equipment damage.

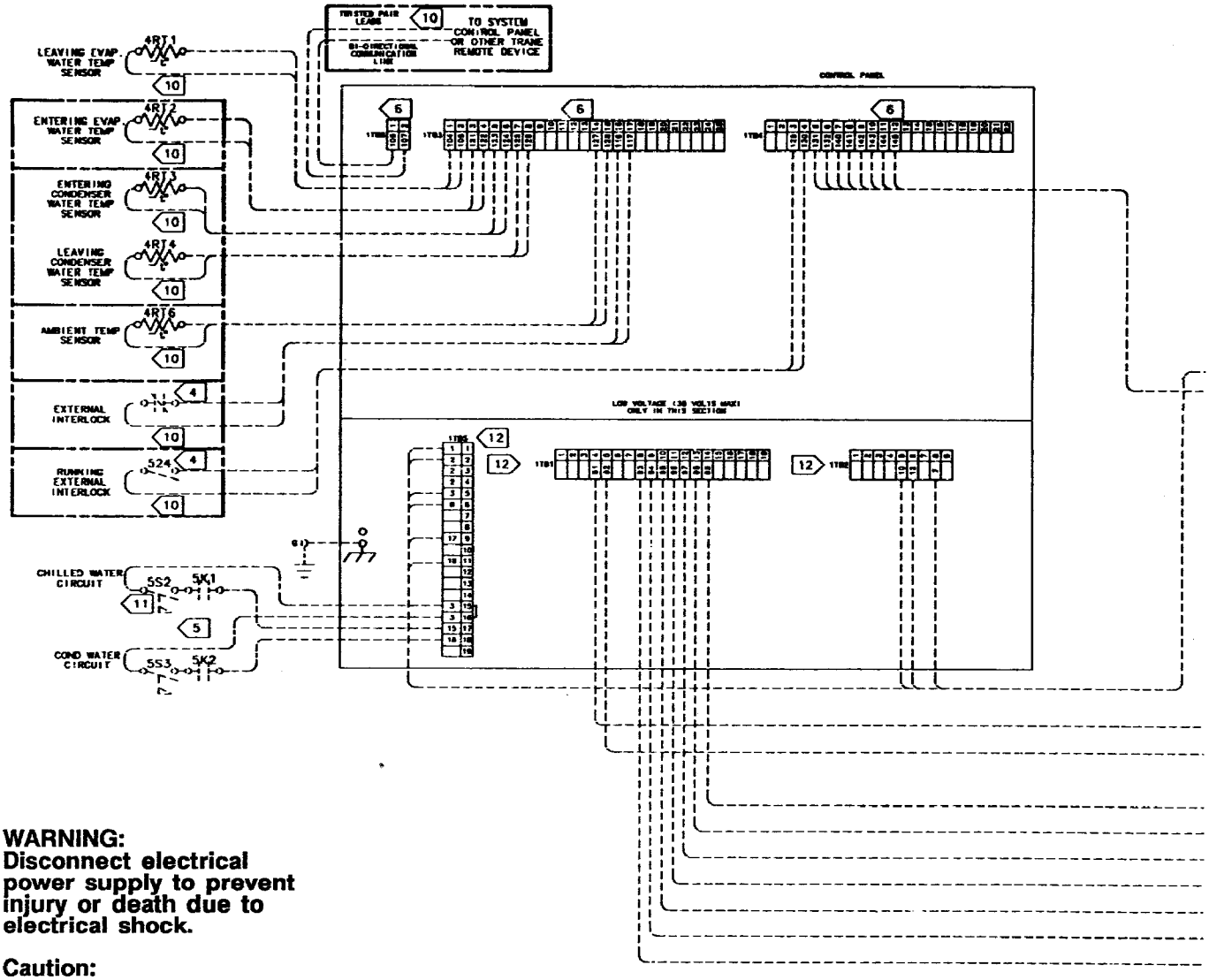
WARNING:
Disconnect electrical power supply to prevent injury or death due to electrical shock.



X39470502C

Figure 25
Typical Field Connections
for CVHEs w/Remote-Mounted Starters

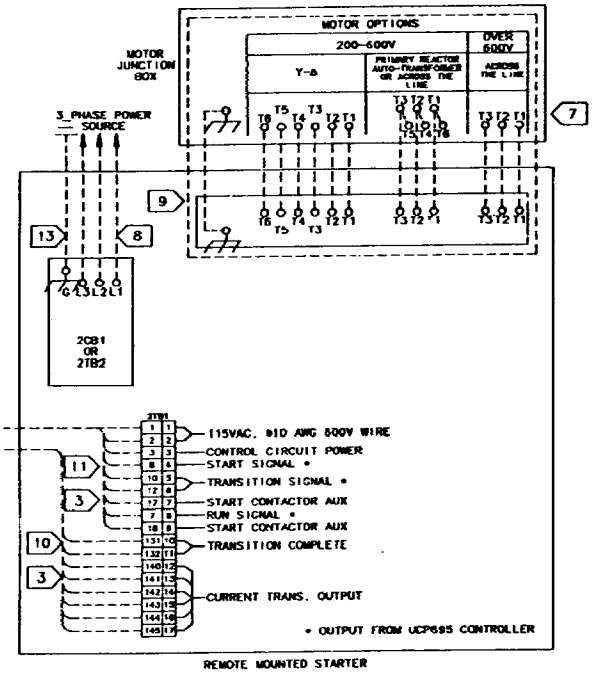
(Continued next page)



WARNING:
Disconnect electrical power supply to prevent injury or death due to electrical shock.

Caution:
Unless otherwise specified, use only copper conductors to prevent equipment damage.

Figure 25 (Continued)



CUSTOMER NOTE:

1. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTION. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.

[3] CONTROL VOLTAGE WIRING (115 VAC) TERMINALS 1 THRU 9 AND LOW VOLTAGE WIRING (30 VOLTS MAX) TERMINALS 10 THRU 17 MUST BE KEPT SEPERATE BOTH INSIDE OF STARTER AND IN RUNS TO CONTROL PANEL

[4] CUSTOMER SUPPLIED CONTACTS MUST BE COMPATIBLE WITH DRY CIRCUIT 12 VDC, 45 mA. GOLD PLATED CONTACTS RECOMMENDED.

[5] RECOMMENDED CIRCUIT; COMPONENTS SUPPLIED BY OTHERS, 5K1 & 5K2 ARE AUX CONTACTS ON PUMP STARTERS; 5S2 & 5S3 ARE FLOW SWITCHES IN APPROPRIATE WATER CIRCUITS;SIZED TO CONTROL A LOAD RATED 115 VAC,19 VA.

[6] RETIGHTEN TERMINALS A MINIMUM OF 24 HOURS AFTER INITAL INSTALLATION. DO NOT OVER TIGHTEN.

[7] BUS BARS NOT INCLUDED – MUST BE ORDERED SEPARATELY.

[8] COPPER WIRE, SIZED PER N.E.C., BASED ON UNIT NAMEPLATE RLA PLUS TRANSFORMER LOAD IN L1 & L2. PHASING OF 3 PHASE INPUT: L1 TO A, L2 TO B, L3 TO C WHERE ABC REPRESENTS STANDARD PHASE ROTATION.

[9] COPPER WIRE ONLY, SIZED PER N.E.C., BASED ON NAMEPL..TE RLA.

[10] 30V OR LESS #14–18 AWG 600V WIRE. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.

[11] 115V AC. #14 AWG 600V WIRE, MAX FUSE SIZE 15A.

[12] FIELD WIRED ELECTRICAL LOADING IS NOT TO EXCEED THE FOLLOWING RATINGS:

TERMINALS	DEVICE	RATED VOLTAGE (VAC)	RATED V/A
1TB1–4,5	1U1K6	120	240
1TB1–8,10	1U1K4–2	120	240
1TB1–9,10	1U1K4–1	120	240
1TB1–11,12	1U1K3	120	240
1TB1–13,14	1U2K2	120	120
1TB2–5,6	1U2K5	120	240
1TB5–6	1U2K4	120	120
1TB2–8	1U2K1,2,3	120	120

[13] FOR CANADIAN INSTALLATION (CSA) ONLY. LOCAL INSPECTION AUTHORITIES MAY REQUIRE SINGLE POWER SOURCE DISCONNECTING MEANS.

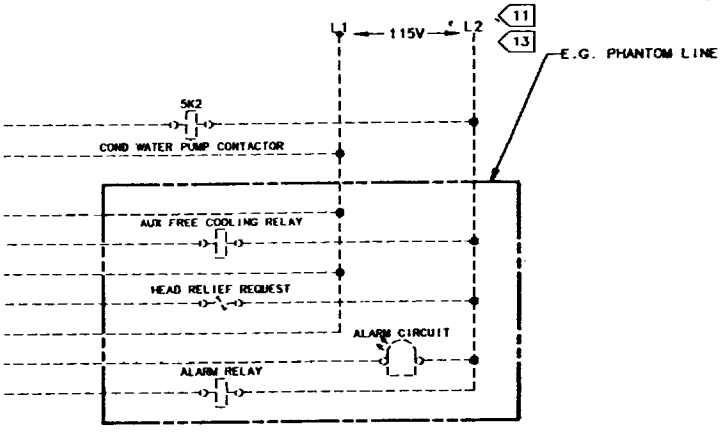


Table 9
CVHE Field Wiring Requirements (See Figures 24 and 25)

Description of Circuit(s)	Starter Panel Terminations	UCP Terminations
Power Supply Circuit(s)		
Standard Circuits:		
3-Phase Power Supply	2TB2: G, L3, L2 and L1	n/a
Starter/Motor Junction Box Interconnections (Note 2)	T1 thru T6 (as applicable by starter type)	T1 thru T6 (as applicable by starter type)
Circuit Options:		
3-Phase Power Supply	2CB1: G, L3, L2 and L1	n/a
120 VAC Control Circuit(s)		
Standard Circuits:		
Chilled Water Interlock	n/a	1TB5-15, -17 (incl. 5S2, 5K1)
Condenser Water Interlock		1TB5-16, -18 (incl. 5S3, 5K2)
Auxiliary 120V Power Supply for Condenser Water Pump Contactor	n/a	1TB1- 4, - 5 (incl. 5K2)
* UCP Ground Connection	n/a	G
* 120V Power Supply to UCP	2TB1- 1, - 2	1TB5- 1, - 2
* Start Signal	2TB1- 3, - 4, - 8	1TB5- 5, - 6; 1TB2- 8
* Transition Signal	2TB1- 5, - 6	1TB2- 9, - 11
* Start Contactor Auxiliary	2TB1- 7, - 9	1TB5- 8, -10
Circuit Options (Relay Package Option):		
Alarm Relay	n/a	1TB1- 8, - 9, -10
Head Relief Request Relay	n/a	1TB1-11, -12
Auxiliary Free Cooling Relay	n/a	1TB1-13, -14
<30 VAC Control Circuit(s)		
Standard Circuits:		
Lvg. Evaporator Water Temp. Sensor (4RT1)	n/a	1TB3- 1, - 2
* Transition Complete	2TB1-10, -11	1TB4- 5, - 6
* Current Transformer Outputs	2TB1-12 thru -17	1TB4- 7 thru -12
Circuit Options:		
Ent. Evaporator Water Temp. Sensor (4RT2)	n/a	1TB3- 3, - 4
Lvg. & Ent. Condenser Water Temp. Sensors (4RT3 & 4RT4)	n/a	1TB3- 5, - 6; 1TB3- 7, - 8
Ambient or Condenser Refrigerant Temp. Sensor (4RT6)	n/a	1TB3-14, -15
External Interlock	n/a	1TB3-16, -17
Running External Interlock	n/a	1TB4- 3, - 4
BCL (Interface with SCP)	n/a	1TB6- 1, - 2
4-20 mA or 0-10 VDC Signal from Remote Generic BAS for CWR	n/a	1U4 - 1, - 2

*Field wiring connections required only for units with remote-mounted starters.

Table 10
60 Hz CVHE 130 thru 200
Compressor Motor Electrical Data

Compressor CPKW	Electrical Characteristics (Note 2)	Compressor Voltage 200	208	380	440	460	480	575	600
96	RLA	302	296	160	136	132	130	104	101
	LRAY	763	794	423	329	344	359	250	261
	LRAD	2350	2452	1304	1010	1059	1103	767	803
	PFCC	15	15	20	15	15	15	10	10
106	RLA	332	324	176	150	145	141	115	111
	LRAY	763	794	423	329	344	359	250	261
	LRAD	2350	2452	1304	1010	1059	1103	767	803
	PFCC	15	15	20	15	15	15	10	10
119	RLA	372	362	197	168	163	158	129	124
	LRAY	763	794	423	329	344	359	250	261
	LRAD	2350	2452	1304	1010	1059	1103	767	803
	PFCC	15	15	20	15	15	15	10	10
131	RLA	411	398	217	186	179	174	143	137
	LRAY	763	794	423	389	344	359	250	261
	LRAD	2350	2452	1304	1251	1305	1369	1079	1131
	PFCC	15	15	25	15	15	15	15	15
142	RLA	444	469	255	220	210	202	168	163
	LRAY	1030	1071	565	408	426	447	352	367
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131
	PFCC	15	15	25	15	15	15	15	15
154	RLA	483	469	255	220	210	202	1688	163
	LRAY	1030	1071	565	408	426	447	362	367
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131
	PFCC	15	15	25	15	15	15	15	15
171	RLA	536	518	282	243	232	223	186	179
	LRAY	1030	1071	565	408	426	447	352	367
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131
	PFCC	15	15	25	15	15	15	15	15

Notes:

1. Motor furnished must have a CPKW rating greater than or equal to the full load kw determined from Trane's computer selection program. Motor selections must correspond to available component combinations.
2. N/A = not available
   RLA = Rated Load Amps (Maximum values shown.)
   LRAY = Locked Rotor Amps for Wye Configuration (Maximum values shown.)
   LRAD = Locked Rotor Amps for Delta Configuration (Maximum values shown.)
   PFCC = Power Factor Correction Capacitor Size (KVARs). PFCCs are selected for the design voltage of the PFCCs shown in Table 15. Do not exceed these values.

Table 11
60 Hz CVHE 230 thru 320
Compressor Motor Electrical Data

Compressor CPKW	Electrical Characteristics (Note 2)	Compressor Voltage												
		200	208	380	440	460	480	575	600	2300	2400	3300	4000	4160
142	RLA	444	434	234	200	192	185	155	150	n/a	n/a	n/a	n/a	n/a
	LRAY	1030	1071	565	408	426	447	352	367	n/a	n/a	n/a	n/a	n/a
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131	n/a	n/a	n/a	n/a	n/a
	PFCC	15	15	25	15	15	15	15	15	n/a	n/a	n/a	n/a	n/a
154	RLA	483	469	255	220	210	202	168	163	n/a	n/a	n/a	n/a	n/a
	LRAY	1030	1071	565	408	426	447	352	367	n/a	n/a	n/a	n/a	n/a
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131	n/a	n/a	n/a	n/a	n/a
	PFCC	15	15	25	15	15	15	15	15	n/a	n/a	n/a	n/a	n/a
171	RLA	536	518	282	243	232	223	186	179	n/a	n/a	n/a	n/a	n/a
	LRAY	1030	1071	565	408	426	447	352	367	n/a	n/a	n/a	n/a	n/a
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131	n/a	n/a	n/a	n/a	n/a
	PFCC	15	15	25	15	15	15	15	15	n/a	n/a	n/a	n/a	n/a
187	RLA	590	563	307	268	257	243	205	195	n/a	n/a	n/a	n/a	n/a
	LRAY	1030	1071	565	408	426	447	352	367	n/a	n/a	n/a	n/a	n/a
	LRAD	3174	3314	1741	1251	1305	1369	1079	1131	n/a	n/a	n/a	n/a	n/a
	PFCC	15	15	25	15	15	15	15	15	n/a	n/a	n/a	n/a	n/a
204	RLA	655	640	342	294	282	272	226	217	56	54	39	32	31
	LRAY	1329	1380	629	504	529	554	396	414	n/a	n/a	339	242	252
	LRAD	4151	4311	1966	1575	1652	1731	1234	1293	421	436	n/a	n/a	n/a
	PFCC	45	45	40	30	30	30	30	30	25	25	50	25	25
231	RLA	741	720	387	338	320	309	256	246	63	60	44	37	35
	LRAY	1329	1380	629	504	529	554	396	414	n/a	n/a	339	242	252
	LRAD	4151	4311	1966	1575	1652	1731	1234	1293	421	436	n/a	n/a	n/a
	PFCC	45	45	40	30	30	30	30	30	25	25	50	25	25
257	RLA	826	800	438	373	360	360	287	277	70	67	49	40	39
	LRAY	1452	1520	861	677	711	746	522	548	n/a	n/a	339	242	252
	LRAD	4713	4933	2681	2105	2216	2325	1627	1709	421	436	n/a	n/a	n/a
	PFCC	60	60	75	50	50	50	40	40	25	25	50	25	25

Notes:

1. Motor furnished must have a CPKW rating greater than or equal to the full load kw determined from Trane's computer selection program. Motor selections must correspond to available component combinations.
2. N/A = not available
   RLA = Rated Load Amps (Maximum values shown.)
   LRAY = Locked Rotor Amps for Wye Configuration (Maximum values shown.)
   LRAD = Locked Rotor Amps for Delta Configuration (Maximum values shown.)
   PFCC = Power Factor Correction Capacitor Size (KVARs). PFCCs are selected for PFCC design voltage (Table 15). Do not exceed these values.

Table 12
60 Hz CVHE 360 thru 500
Compressor Motor Electrical Data

Compressor CPKW	Electrical Characteristics (Note 2)	Compressor Voltage												
		200	208	380	440	460	480	575	600	2300	2400	3300	4000	4160
	RLA	658	640	349	297	288	283	228	222	56	54	39	32	31
204	LRAY	1452	1520	861	677	711	746	522	548	n/a	n/a	339	242	252
	LRAD	4713	4933	2681	2105	2216	2325	1627	1709	421	436	n/a	n/a	n/a
	PFCC	60	60	75	50	50	50	40	40	25	25	50	25	25
	RLA	740	720	394	337	324	315	257	248	63	60	44	37	35
231	LRAY	1452	1520	861	677	711	746	522	548	n/a	n/a	339	242	252
	LRAD	4713	4933	2681	2105	2216	2325	1627	1709	421	436	n/a	n/a	25
	PFCC	60	60	75	50	50	50	40	40	25	25	50	25	n/a
	RLA	826	800	438	373	360	350	287	277	70	67	55	40	39
257	LRAY	1452	1520	861	677	711	746	522	548	n/a	n/a	339	242	252
	LRAD	4713	4933	2681	2105	2216	2325	1627	1709	421	436	n/a	n/a	n/a
	PFCC	60	60	75	50	50	50	40	40	25	25	50	25	25
	RLA	925	892	488	419	403	389	321	309	78	75	55	45	43
287	LRAY	1452	1520	861	677	711	746	522	548	n/a	n/a	339	242	252
	LRAD	4713	4933	2681	2105	2216	2325	1627	1709	421	436	n/a	n/a	n/a
	PFCC	60	60	75	50	50	50	40	40	25	25	25	25	25
	RLA	1033	1003	546	468	451	439	359	346	89	86	62	51	49
323	LRAY	1958	2040	1054	849	889	929	649	679	n/a	n/a	376	285	296
	LRAD	6078	6332	3281	2638	2763	2888	2020	2112	496	513	n/a	n/a	n/a
	PFCC	75	75	80	60	60	60	50	50	25	25	50	25	25
	RLA	1150	1116	607	521	502	488	399	385	99	96	71	57	56
361	LRAY	1958	2040	1054	849	889	929	649	679	n/a	n/a	452	334	347
	LRAD	6078	6332	3281	2638	2763	2888	2020	2112	581	601	n/a	n/a	n/a
	PFCC	75	75	80	60	60	60	50	50	50	50	50	50	50
	RLA	1278	1245	683	582	561	545	445	430	111	108	79	64	63
403	LRAY	3190	3329	1387	1060	1110	1160	803	839	n/a	n/a	504	391	407
	LRAD	9590	9991	4167	3185	3336	3487	2412	2521	680	704	n/a	n/a	n/a
	PFCC	75	75	100	60	60	60	50	50	50	50	50	50	50
	RLA	1443	1406	759	649	626	607	498	481	126	122	88	72	70
453	LRAY	3190	3329	1647	1283	1346	1410	1016	1063	n/a	n/a	504	391	407
	LRAD	9590	9991	4954	3866	4049	4233	3059	3197	680	704	n/a	n/a	n/a
	PFCC	75	75	90	60	60	60	50	50	50	50	50	50	50

Notes:

1. Motor furnished must have a CPKW rating greater than or equal to the full load kw determined from Trane's computer selection program. Motor selections must correspond to available component combinations.
2. N/A = Not available
   RLA = Rated Load Amps (Maximum values shown.)
   LRAY = Locked Rotor Amps for Wye Configuration (Maximum values shown.)
   LRAD = Locked Rotor Amps for Delta Configuration (Maximum values shown.)
   PFCC = Power Factor Correction Capacitor Size (KVARs). *PFCCs are selected for PFCC design voltage (Table 15). Do not exceed these values.*

Table 13
60 Hz CVHE 560 thru 800
Compressor Motor Electrical Data

Compressor CPKW	Electrical Characteristics (Note 2)	Compressor Voltage 200	208	380	440	460	480	575	600	2300	2400	3300	4000	4160
	RLA	1033	1003	546	465	449	439	353	342	89	86	62	51	49
323	LRAY	1958	2040	1387	1060	1110	1160	803	839	n/a	n/a	376	285	296
	LRAD	6078	6332	4167	3185	3336	3487	2412	2512	496	513	n/a	n/a	n/a
	PFCC	75	75	100	60	60	60	50	50	25	25	50	25	25
	RLA	1150	1116	610	517	499	487	396	382	99	96	71	57	56
361	LRAY	1958	2040	1387	1060	1110	1160	803	839	n/a	n/a	452	334	347
	LRAD	6078	6332	4167	3185	3336	3487	2412	2521	581	601	n/a	n/a	n/a
	PFCC	75	75	100	60	60	60	50	50	50	50	50	50	50
	RLA	1278	1245	683	582	561	545	445	430	111	108	79	64	63
403	LRAY	3190	3329	1387	1060	1110	1160	803	839	n/a	n/a	504	391	407
	LRAD	9590	9991	4167	3185	3336	3487	2412	2521	680	704	n/a	n/a	n/a
	PFCC	75	75	100	60	60	60	50	50	50	50	50	50	50
	RLA	1443	1406	759	649	626	607	498	481	126	122	88	72	70
453	LRAY	3190	3329	1647	1283	1346	1410	1016	1063	n/a	n/a	504	391	407
	LRAD	9590	9991	4954	3866	4049	4233	3059	3197	680	704	n/a	n/a	n/a
	PFCC	75	75	90	60	60	60	50	50	50	50	50	50	50
	RLA	n/a	n/a	873	750	719	694	573	551	145	139	101	84	81
512	LRAY	n/a	n/a	1292	975	1022	1069	761	796	n/a	n/a	490	380	396
	LRAD	n/a	n/a	4068	3072	3219	3367	2397	2507	661	685	n/a	n/a	n/a
	PFCC	n/a	n/a	125	90	90	90	80	80	50	50	150	50	5
	RLA	n/a	n/a	996	849	820	798	651	631	167	160	117	96	9
588	LRAY	n/a	n/a	1709	1316	1379	1443	1043	1091	n/a	n/a	559	422	43
	LRAD	n/a	n/a	5361	4130	4329	4529	3269	3420	734	760	n/a	n/a	n/a
	PFCC	n/a	n/a	150	100	100	100	100	100	100	100	150	100	10
	RLA	n/a	n/a	1101	945	911	886	722	695	186	179	130	107	10
653	LRAY	n/a	n/a	1849	1485	1556	1628	1087	1138	n/a	n/a	618	509	53
	LRAD	n/a	n/a	5795	4649	4872	5097	3413	3572	885	917	n/a	n/a	n/a
	PFCC	n/a	n/a	150	100	100	100	100	100	100	100	200	100	10

Notes:

1. Motor furnished must have a CPKW rating greater than or equal to the full load kw determined from Trane's computer selection program. Motor selections must correspond to available component combinations.
2. N/A = Not available
   RLA = Rated Load Amps (Maximum values shown.)
   LRAY = Locked Rotor Amps for Wye Configuration (Maximum values shown.)
   LRAD = Locked Rotor Amps for Delta Configuration (Maximum values shown.)
   PFCC = Power Factor Correction Capacitor Size (KVARs). PFCCs are selected for PFCC design voltage (Table 15). Do not these values.

Table 14
60 Hz CVHE 890 thru 1250
Compressor Motor Electrical Data

Compressor CPKW	Electrical Characteristics (Note 2)	Compressor Voltage										
		380	440	460	480	575	600	2300	2400	3300	4000	4160
512	RLA	900	750	738	730	580	570	147	140	102	84	81
	LRAY	1943	1462	1533	1604	1170	1224	n/a	n/a	559	2422	439
	LRAD	5998	4560	4780	5001	3610	3777	734	760	n/a	n/a	n/a
	PFCC	200	125	125	125	125	125	100	100	150	100	100
588	RLA	1020	858	835	821	650	645	167	160	117	96	93
	LRAY	1943	1462	1533	1604	1170	1224	n/a	n/a	559	422	439
	LRAD	5998	4560	4780	5001	3610	3777	734	760	n/a	n/a	n/a
	PFCC	200	125	125	125	125	125	100	100	150	100	100
653	RLA	1101	945	911	886	722	695	186	179	130	107	103
	LRAY	1849	1485	1555	1628	1087	1138	n/a	n/a	618	509	530
	LRAD	5795	4649	4872	5097	3413	3572	885	917	n/a	n/a	n/a
	PFCC	150	100	100	100	80	80	100	100	200	100	100
745	RLA	1237	1068	1023	989	817	789	210	203	147	121	117
	LRAY	2043	1659	1739	1821	1371	1435	n/a	n/a	802	620	646
	LRAD	6388	5124	5370	5622	4238	4436	1078	1118	n/a	n/a	n/a
	PFCC	125	100	100	100	100	100	150	150	200	150	150
856	RLA	1426	1221	1170	1131	935	899	242	232	169	139	134
	LRAY	2648	1954	2048	2143	1514	1584	n/a	n/a	892	667	694
	LRAD	8193	6042	6333	6626	4684	4900	1160	1201	n/a	n/a	n/a
	PFCC	180	100	100	100	100	100	100	150	150	150	150
957	RLA	1588	1366	1307	1260	1044	1002	270	259	189	155	149
	LRAY	2931	2162	2266	2371	1689	1767	n/a	n/a	1029	736	767
	LRAD	9074	6691	7014	7338	5229	5471	1280	1327	n/a	n/a	n/a
	PFCC	160	120	120	120	100	100	150	150	200	150	150

Notes:

1. Motor furnished must have a CPKW rating greater than or equal to the full load kw determined from Trane's computer selection program. Motor selections must correspond to available component combinations.
2. N/A = Not available
   RLA = Rated Load Amps (Maximum values shown.)
   LRAY = Locked Rotor Amps for Wye Configuration (Maximum values shown.)
   LRAD = Locked Rotor Amps for Delta Configuration (Maximum values shown.)
   PFCC = Power Factor Correction Capacitor Size (KVARs). PFCC = Power Factor Correction Capacitor Size (KVARs). PFCCs are selected for PFCC design voltage (Table 15). Do not exceed these values.

Power Supply Wiring

To assure that power supply wiring to the starter panel is properly installed and connected, review and follow the guidelines outlined below.

3-Phase Power Source

1. Verify that the starter nameplate ratings are compatible with the power supply characteristics—and with the electrical data on the CVHE nameplate.

2. If the starter enclosure must be cut to provide electrical access, exercise care to prevent debris from falling inside the enclosure.

Caution: Debris inside the starter panel may cause an electrical short that seriously damages the starter components.

3. Use copper wire to connect the 3-phase power supply to the remote- or unit-mounted starter panel.

Caution: To avoid corrosion or overheating, use only copper conductors for terminal connections.

4. Size the power supply wiring in accordance with NEC, using the RLA value stamped on the chiller nameplate and transformer load on L1 and L2.

For further information on sizing power supply wiring for heavy refrigeration equipment, see Trane Engineering Bulletin EB-MSCR-40.

Note: All CVHE units are designed to comply with NEC Article 310-15.

5. Make sure that the incoming power wiring is properly phased; each power supply conduit run to the starter must carry the correct leads to ensure equal phase representation. See Figure 26.

6. As you install the power supply conduit, make sure that its position does not interfere with the serviceability of any of the CVHE's components, nor with structural members and equipment.

Also, assure that the conduit is long enough to simplify any servicing that may be necessary in the future (e.g., starter removal).

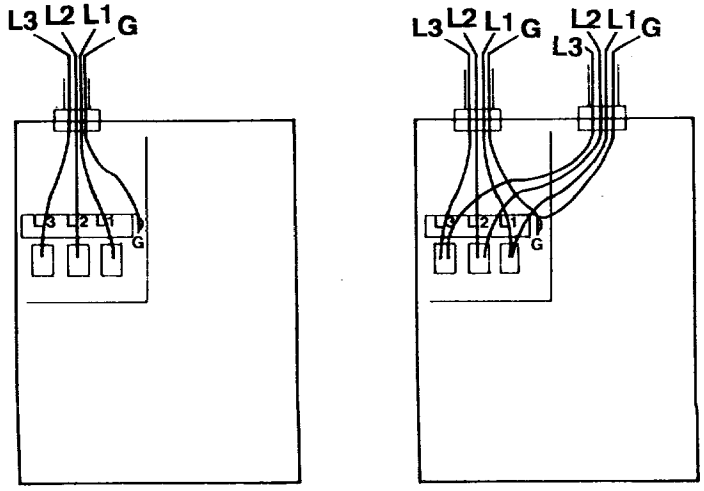
Note: Use flexible conduit to enhance serviceability and minimize vibration transmission.

Circuit Breakers and Fusible Disconnects

Size the circuit breaker—or fused disconnect—in accordance with NEC Article 440-22(a).

In short, this article states that the short circuit and ground fault protective device must be "... capable of carrying the motor starting current, and provide the required protection when rating of the device does not exceed 175% for dual-element fuses—or 300% for nontime delay fuses—of the compressor motor design RLA ... ".

Figure 26
Proper Phasing for Starter Power Supply Wiring



Optional PFCCs

Power factor correction capacitors (PFCCs) are designed to provide power factor correction for the compressor motor. Available as an option for unit-mounted starters, PFCCs can also be field-added to remote-mounted starter panels.

Note: Remember that the PFCC nameplate voltage rating may not equal the compressor voltage rating stamped on the unit nameplate. See Table 15 to determine what size PFCC is appropriate for each compressor voltage application.

Caution: PFCCs must be wired into the starter correctly! Misapplication of these capacitors could result in a loss of motor overload protection and---subsequently ---motor damage.

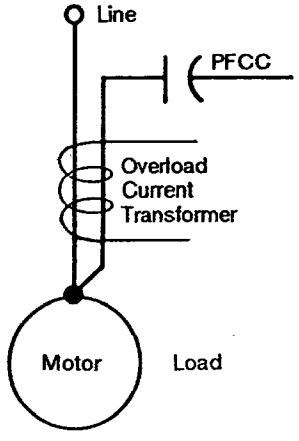
PFCCs are wired as shown in Figure 27 where the capacitor leads are run through the overload transformer.

Table 15
PFCC Sizing per Compressor Voltage Application

PFCC Design Voltage	Compressor Motor Voltage (See CVHE Nameplate)
240V/60Hz	200V/60 Hz 208V/60 Hz
480V/60Hz	380V/60 Hz 440V/60 Hz 460V/60 Hz 480V/60 Hz
600V/60Hz	575V/60 Hz 600V/60 Hz
2400V/60Hz	2300V/60 Hz 2400V/60 Hz
4160V/60Hz	3300V/60 Hz 4000V/60 Hz 4160V/60 Hz

Note: See price sheets for maximum capacitor size selection at PFCC design volts above.

Figure 27
PFCC Leads Routed thru Overload Current Transformer

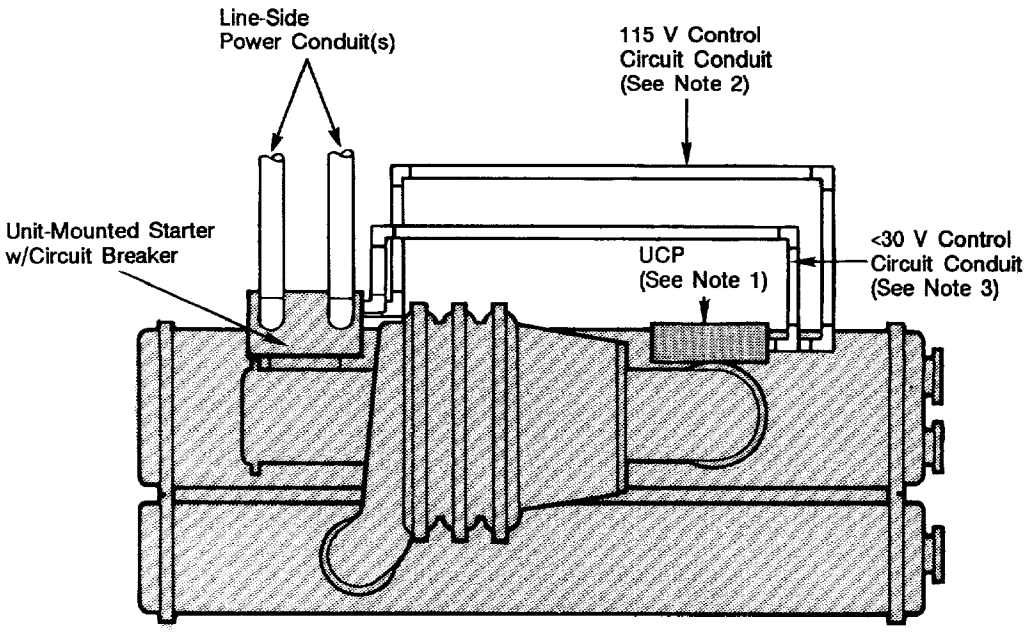


Interconnecting Wiring

Typical equipment room conduit layouts for CVHEs with and without unit-mounted starters are shown in Figures 28 and 29, respectively.

Keep in mind that the interconnecting wiring between the starter panel, compressor and UCP695 control panel is factory-installed on CVHEs with unit-mounted starters (Figure 28), but must be field-installed when a remote- mounted starter is used (Figure 29).

Figure 28
Typical Equipment Room Layout for CVHE w/Unit-Mounted, Wye-Delta Starter



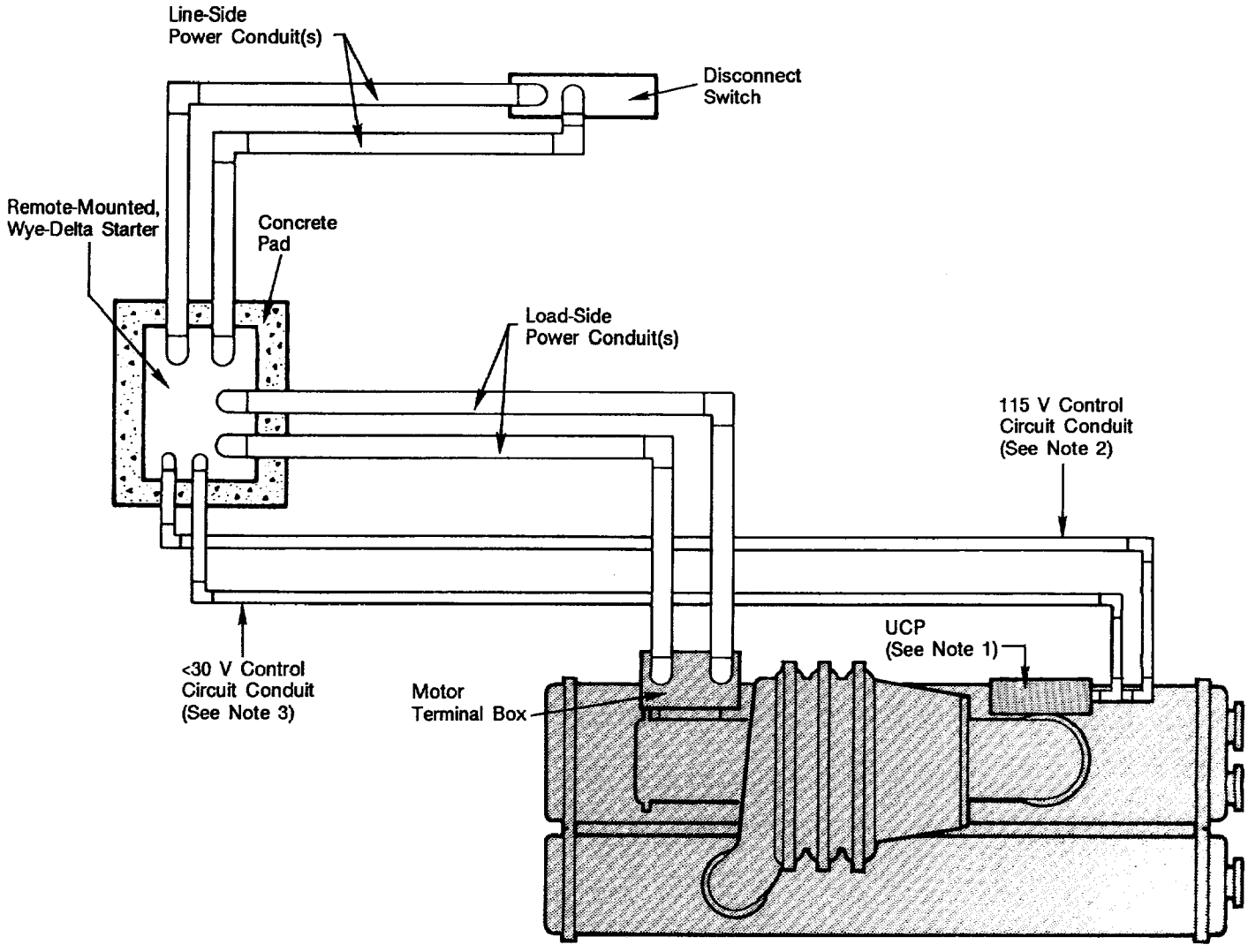
Notes:

1. Refer to the unit field connection diagram (Figure 24) for approximate UCP knockout locations.

Caution: To prevent damage to the UCP's components, do NOT route control circuit conduit into the top of the UCP enclosure.

2. 115-Volt conduit must enter the lower portion of the unit control panel (UCP).
3. Low-voltage (<30 volts) conduit must enter upper portion of the UCP.

Figure 29
Typical Equipment Room Layout for CVHE w/Remote-Mounted, Wye-Delta Starter



Notes:

1. Refer to the unit field connection diagram (Figure 25) for approximate UCP knockout locations.

Caution: To prevent damage to the UCP's components, do NOT route control circuit conduit into the top of the UCP enclosure.

2. 115-Volt conduit must enter the lower portion of the unit control panel (UCP).

3. Low-voltage (<30 volts) conduit must enter upper portion of the UCP.

Starter to Motor (Remote-Mounted Starters Only)

Ground Wire Terminal Lugs. Ground wire lugs are provided in the motor terminal box, as well as in the starter panel.

Terminal Clamps. In addition, terminal clamps are supplied with the motor terminals to accommodate either bus bars or standard motor terminal wire lugs. These terminal clamps provide additional surface area to minimize the possibility of improper electrical connections.

Wire Terminal Lugs. Wire Terminal lugs must be field-supplied.

1. Use field-provided crimp-type wire terminal lugs properly sized for duty.

Note: Suggested sizes for the starter line- and load-side wire lugs are listed on the submittals provided by the starter manufacturer. Carefully review the submitted wire lug sizes for compatibility with the conductor sizes specified by the electrical engineer or contractor.

2. A terminal clamp with a 3/8" bolt is provided on each motor terminal stud; use the factory-supplied Belleville washers on the wire lug connections.

Figure 30 illustrates the juncture between a motor connection pad and the wire terminal lug.

3. Tighten each bolt to 24 foot-pounds.

4. Install—but do not connect! —the power leads between the starter and compressor motor. (These connections will be completed under supervision of a qualified Trane service engineer after the prestart inspection.)

Bus Bars. Install bus bars between the motor terminals when a low-voltage "across-the-line", "primary reactor/resistor" or "autotransformer" starter is used.

Be sure to jumper motor Terminal T1 to T6, T2 to T4, and T3 to T5. See Figure 25.

Bus bars and extra nuts are available as a Trane option.

Note: Bus bars are not needed in high-voltage applications since only 3 terminals are used in the motor and starter.

Starter to UCP (Remote-Mounted Starters Only)

Electrical connections required between the remote-mounted starter and the chiller control panel (UCP) are shown in Figure 25 and outlined in Table 9. A point-to-point starter-to-UCP connection schematic is shown in Figure 31.

Note: Install conduit between the lower portion of the UCP and the starter for the 115-volt circuits; and between the upper portion of the UCP and the starter for circuits carrying less than 30 volts (Figure 29).

Caution: To avoid damaging UCP components, never route conduit into the top of the control panel enclosure!

When sizing and installing the electrical conductors for these circuits, follow these guidelines:

1. If the starter enclosure must be cut to provide electrical access, exercise care to prevent debris from falling inside the enclosure.

Caution: Debris inside the starter panel may cause an electrical short that seriously damages the starter components.

2. Use 16 AWG, 600-volt copper wire for the current transformer (CT) output circuits if the distance between the starter and UCP does not exceed 250'(or 500' round trip).

If the distance between the starter and UCP is 400' (or as much as 800'round trip), use 14 AWG, 600-volt copper wire for the CT output circuits.

3. Separate low-voltage (less than 30V) wiring from the 115V wiring by running each in its own conduit.

4. Bundle together the low-voltage wiring connected to starter terminal strip 2TB1. As you route this bundle out of the starter enclosure, make sure that it is at least 6" from all wires carrying a higher voltage.

Caution: To ensure that electrical noise does not distort the signals carried by the low-voltage wiring, maintain at least 6" between low-voltage (<30V) and 115V circuits!

UCP Electrical Specifications

Following is a list of the electrical and environmental constraints for micro module 1U3 in the UCP695 control panel.

Note that 1U3 is designed to receive input power from either: (1) the secondary of a power transformer in the starter panel, or (2) a separate building circuit.

1. **Nominal Voltage:** 115 VAC, with an operating range of 98 to 132 VAC, inclusive.

2. **Maximum vA:** 1725 vA (15-amp fuse).

3. Power input wiring must be at least 6" from low-voltage (i.e., less than 30V) wiring.

4. All signal inputs are low-voltage (i.e., less than 30V).

5. **UCP Storage Range:** -40 F to 158 F (-40 C to 70 C) (i.e., not applicable for chiller).

Figure 30
Terminal Stud, Clamp and Lug Assembly

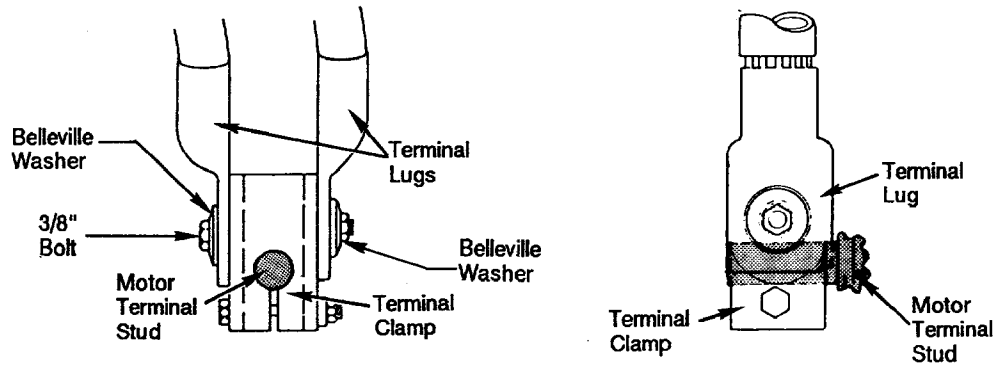
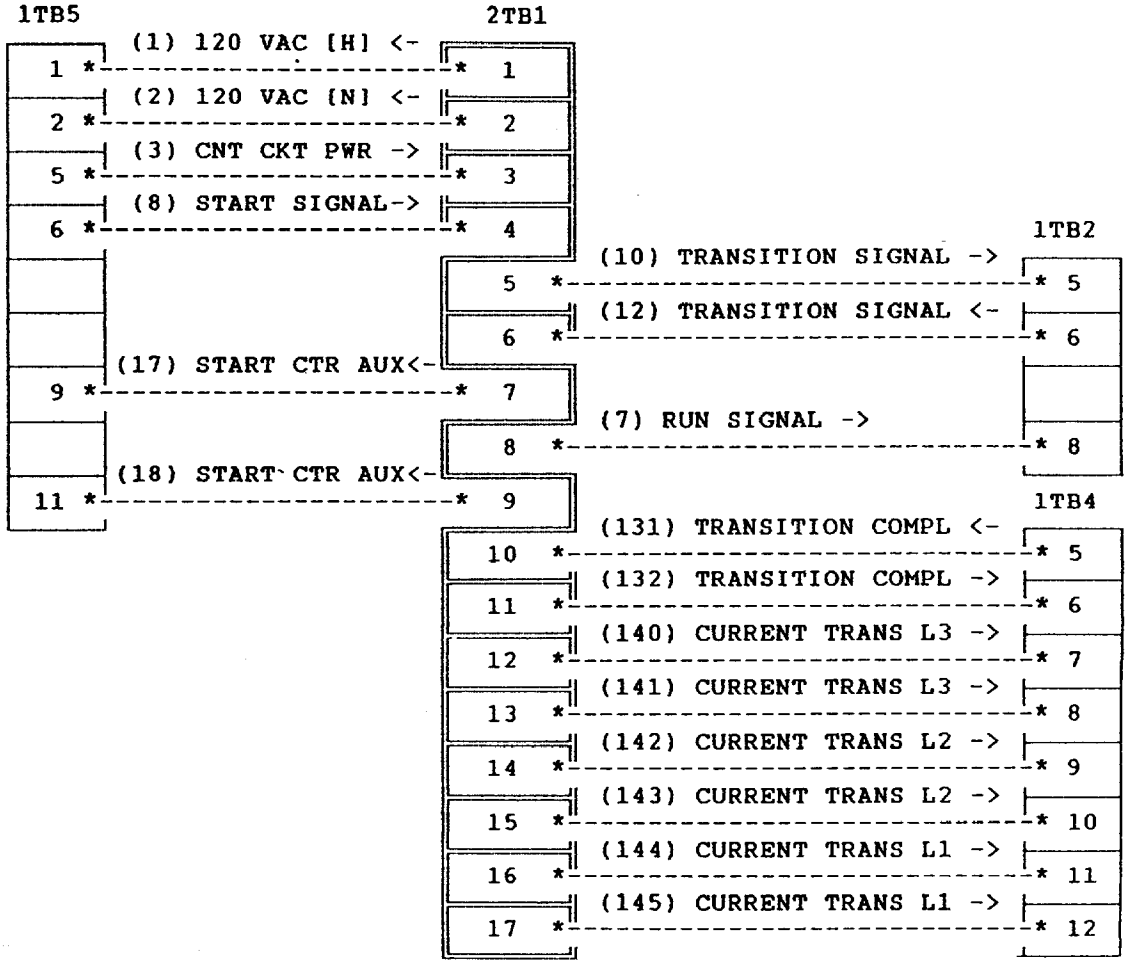


Figure 31
Remote Starter/UCP Control Panel Connections



Control Circuit Wiring

Interlock Circuits

Chilled Water Flow. Wire the auxiliary contacts of the evaporator water pump contactor (5K1) in series with the flow switch (5S2) installed in the evaporator supply pipe. Use 14 AWG, 600-volt copper wire.

Connect this circuit to UCP Terminals 1TB5-14 and -16 as shown in Figure 24 or 25.

If installed properly, the chilled water interlock circuit will only allow compressor operation if the evaporator pump is running and providing at least the minimum water flow required.

Condenser Water Flow. Wire the condenser water pump contactor (5K2) to a separate 120-volt, single-phase power supply with 14 AWG, 600-volt wire; then connect this circuit to UCP Terminals 1TB1-4 and -5.

Next, use 14 AWG, 600-volt copper wire to connect the auxiliary contacts of the condenser water pump contactor (5K2) in series with the flow switch (5S3) installed in the condenser supply pipe.

Connect this circuit to UCP Terminals 1TB5-15 and -17 as shown in Figure 24 or 25.

If installed properly, the condenser water interlock circuit will only allow the compressor to operate if the condenser pump is running and providing at least the minimum water flow required.

Remote On/Off Control. To start and stop the chiller from a remote location, wire a set of normally-open contacts (field-supplied) between the auxiliary contacts of evaporator water pump contactor 5K1 and Terminal 1TB5-17 in the UCP. See Figure 32.

Placement of these contacts in the chilled water interlock circuit assures that the unit cannot run unless directed to do so by the remote controller---even if chilled water flow is proven.

As long as the "remote on/off" contacts are open, unit operation is locked out on nonlatching diagnostic b Ed (chilled water flow). When these contacts close, unit operation resumes automatically—provided that all other start criteria are met.

Note: To use this method of remote chiller control, the chiller switch on the UCP must be set at one of the "Auto" positions.

Important! Do not attempt to use either "external interlock" or "running external interlock" for remote chiller on/off control. Because both of these inputs shut down the unit on latching diagnostics, the unit cannot resume operation until the micro module is reset manually at the UCP.

Optional External Interlock. UCP Terminals 1TB3-16 and 17 (Figure 24 or 25) accept a 2-position switch input that can be used to indicate a system fault detected by a customer- supplied remote device.

As long as the switch is closed, unit operation continues normally. However, if the UCP "sees" that this switch is open, it shuts down unit operation on latching diagnostic b Fd ("external interlock").

Note: A jumper is factory-installed between the external interlock terminals (1TB3-16 and -17). The unit will not operate unless these terminals are shorted.

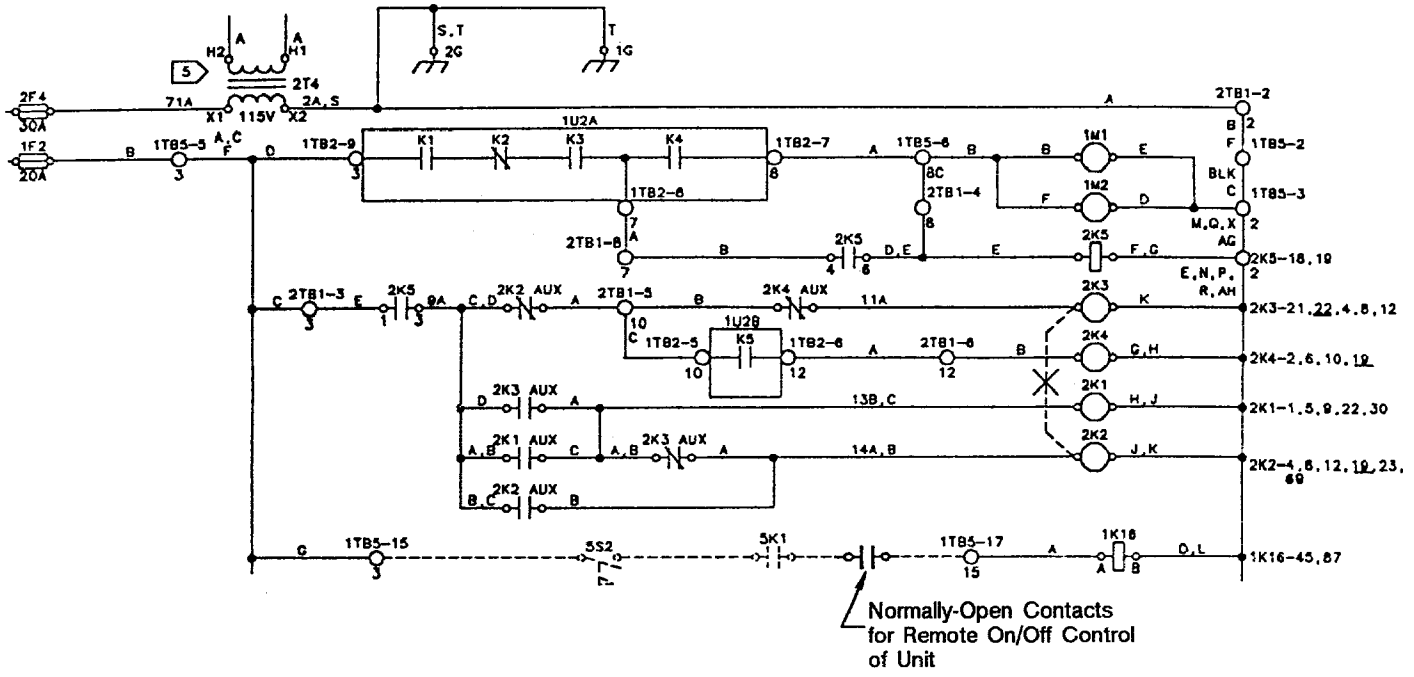
Optional Running External Interlock. UCP Terminals 1TB4-3 and -4 (Figure 25 or 26) accept a switch input that can be used to shut down the unit when a customer-supplied remote device detects a system fault. This function is only active when the unit is running and transition is complete.

As long as the input circuit between Terminals 1TB4-3 and -4 is open, the unit will continue to operate normally. However, the UCP will shut down the unit on latching diagnostic b F1 if this circuit closes.

Note: Use an isolation relay in this circuit to limit noise interference, and to reduce the risk of feeding voltage into the UCP's micro module (1U3).

If your CVHE includes the hot gas bypass option, the "running external interlock" input is used for discharge temperature switch 4S5.

Figure 32
Remote On/Off Chiller Control

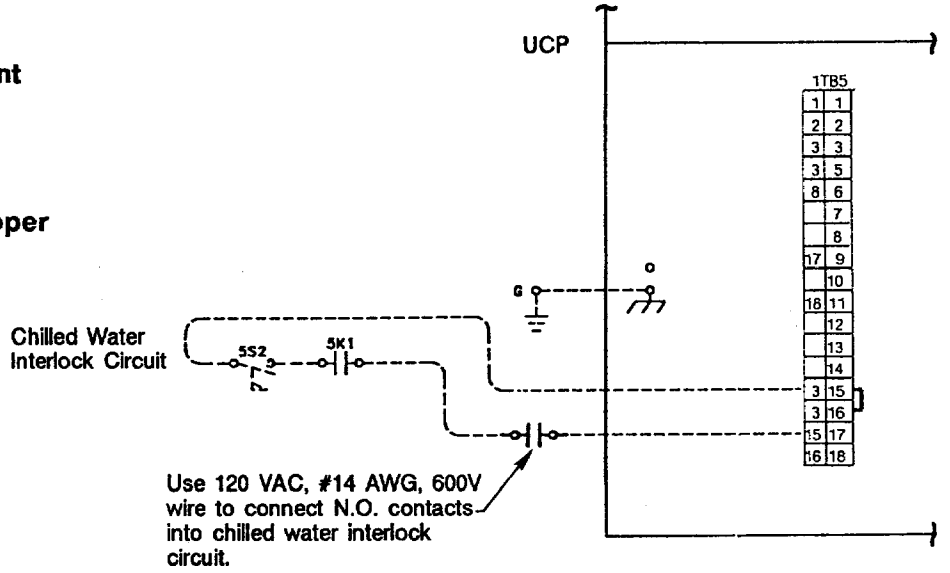


Electrical Schematic

WARNING
Disconnect electrical power supply to prevent injury or death due to electrical shock.

Caution
Unless otherwise specified, use only copper conductors to prevent equipment damage.

Field Connections



Note: If flow switch 5S2, auxiliary contacts 5K1, or the "remote on/off" contacts open while the unit is running, the UCP will shut down operation on nonlatching diagnostic b Ed (i.e., the "loss of chilled water flow" diagnostic). The unit will restart automatically once the condition that triggered the diagnostic clears.

Temperature Sensor Circuits

To install UCP's temperature sensors—whether standard or optional, refer to Table 16, Figure 33 and the general guidelines outlined below:

1. All field-installed temperature sensors are identified by a vendor code and serial number that appear on the sensor body. Notice, too, that both sensors of a matched pair are marked with the same serial number.

For your reference, the vendor codes associated with UCP sensors are included in Table 16.

2. Add thermostatic paste (provided) to each bulbwell before inserting the sensor.

3. Ensure that the sensor "bottoms out" at the base of the bulbwell.

4. If the leads on a sensor do not reach all the way back to the UCP:

a. Route the sensor leads to a junction box mounted in a convenient location.

b. Splice the leads to 14-18 AWG, 600V wires of sufficient length inside the junction box.

c. Route the added length of wire to the UCP in conduit (unless it is shielded).

Note: If shielded cable is used to extend the sensor leads, be sure to tape off the shield wire at the junction box and ground it at the UCP. If the added length is run in conduit, do not run them in the same conduit with other circuits carrying 30 or more volts.

Caution: To prevent possible sensor malfunction due to electrical noise, never route low-voltage sensor leads with other conductors carrying 30 or more volts!

5. All of the water temperature sensors used in the UCP control system are accurate to within ± 1.0 F, and are typically offered as "matched" pairs.

The term "matched sensor pair" indicates that both sensors in a given pair have the same accuracy. For example, a sensor that registers a temperature that is 0.5 degrees higher than the "actual" value is paired with another sensor that also registers 0.5 degrees high.

If entering and leaving water temperature sensors are not "matched", the accuracy of the temperature readings displayed on the face of the UCP is reduced.

6. Evaporator Water Temperature Sensors. All CVHEs with UCP695 panels ship with the standard leaving evap- orator water temperature sensor, regard- less of what other control options are ordered.

Therefore, if either the chilled water reset (CWR) or matched-pair evaporator sensors are specified, the unit will ship with an extra evaporator water sensor.

If the unit was ordered with the CWR option, install the extra sensor (i.e., the standard leaving evaporator sensor) in the outside air and wire it to the micro module's ambient temperature input. See Table 16.

If the chiller was ordered with the matched-pair of evaporator sensors but does not include CWR, discard the extra sensor (i.e., the standard leaving evaporator sensor).

Be sure to review Table 16, Figure 33 and the field connection diagram that shipped with the unit for specific sensor installation instructions.

Optional Relay Circuits

Auxiliary Free Cooling Relay. If desired, this optional relay output circuit can be used to control water flow through the cooling tower during the free-cooling cycle. Actual use of the auxiliary free-cooling (FC) relay circuit may vary from one chiller application to the next.

Wire a field-supplied relay to Terminals 1TB1-13 and -14 on the UCP's relay output module (1U1). The normally-open contacts used to energize the auxiliary FC relay are internal to 1U1. (See either Figure 24 or 25.)

Alarm Relay Package. The optional alarm relay package includes 2 relay output circuits:

a. Alarm Relay Output Circuit. Wiring a field-supplied SPDT relay and alarm into this output circuit enables the UCP to activate a remote alarm whenever the unit shuts down on a latching diagnostic.

Refer to Figure 24 or 25; notice that 2 circuits are available for an alarm output. Wire the alarm to Terminals 1TB1-8 and -10 to use the normally- closed, open-on-alarm set of contacts. To use the normally-open, close-on-alarm set of contacts, wire the alarm to Terminals 1TB1-9 and -10.

b. Head Relief Request Relay Output Circuit. This relay output circuit can be used to control—or signal for a reduction in—condenser water tempera- (Actual use may vary with any given chiller application.)

A set of normally-open 1U1 contacts is included in the head relief request circuit; electrical access is provided at Terminals 1TB1-11 and -12. (See either Figure 24 or 25.)

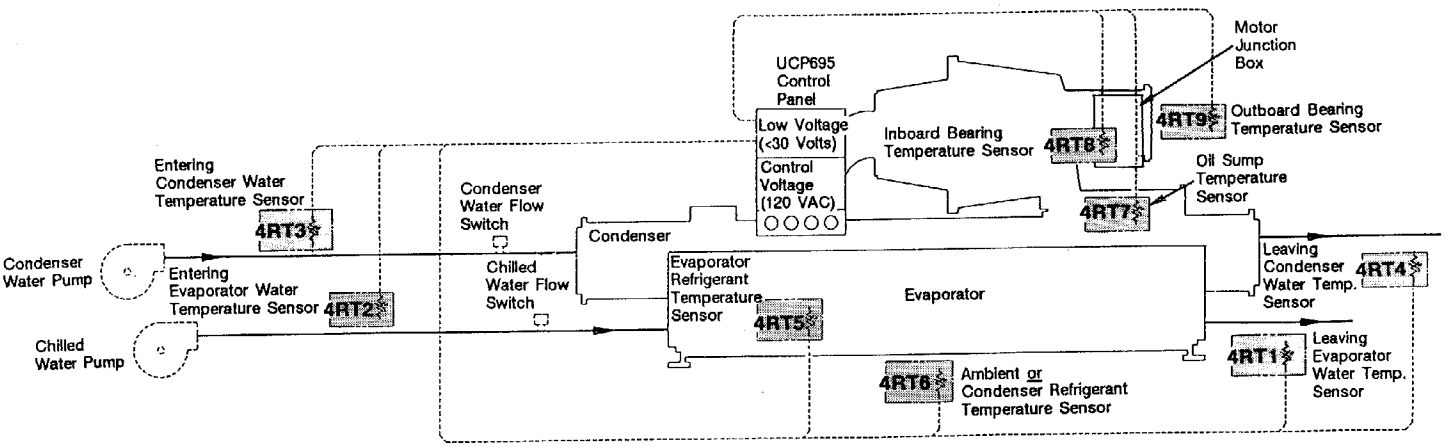
Table 16
UCP695 Temperature Sensors
(See Figure 33)

Sensor Characteristics			Elec. Connections		Sensor Part Nos. (1)	
Description	Elec. Desig.	Physical Location	Wire Nos.	Cont. Panel Terminations	Trane Mnemonic	Vendor Code
Leaving Evaporator Water Temperature Sensor Only (2) (Standard w/UCP)	4RT1	Field-installed: Insert in bulbwell in connecting water piping (water out).	104 105	1TB3- 1 1TB3- 2	SEN-113 or SEN-132	X13790002-02 or X13790057-01
Optional Ent. Evaporator Water Temperature Sensor Plus	4RT2	Field-installed: Insert in well in connecting water piping (water in).	121 122	1TB3- 3 1TB3- 4	SEN-118 or SEN-131	X13790002-06 or X13790057-04
Optional Lvg. Evaporator Water Temperature Sensor	4RT1	Field-installed: Insert in well in connecting water piping (water out).	104 105	1TB3- 1 1TB3- 2	(See Note 3)	
Optional Ent. Condenser Water Temperature Sensor Plus	4RT3	Field-installed: Insert in well in connecting water piping (water in).	123 124	1TB3- 5 1TB3- 6	SEN-118 or SEN-131	X13790002-06 or X13790057-04
Optional Lvg. Condenser Water Temperature Sensor	4RT4	Field-installed: Insert in well in connecting water piping (water out).	125 126	1TB3- 7 1TB3- 8	(See Note 3)	
Evaporator Refrigerant Temperature Sensor (Standard w/UCP)	4RT5	Factory-installed in lower evaporator well.	102A 103A	1TB3-12 1TB3-13	SEN- 96 or SEN-136	X13790002-03 or X13790057-02
Oil Sump Temperature Sensor (Standard w/UCP)	4RT7	Factory-installed in oil sump well.	110A 111A	1TB4-13 1TB4-14	SEN-114 or SEN-137	X13790002-05 or X13790057-03
Optional "Inboard" Bearing Temperature Sensor Plus	4RT8	Factory-installed in well in compressor-end oil return line.	133 134	1TB4-19 1TB4-20	SEN-114 or SEN-137	X13790002-05 or X13790057-03
Optional "Outboard" Bearing Temperature Sensor	4RT9	Factory-installed in well in opposite-compressor-end oil return line.	135 136	1TB4-21 1TB4-22	SEN-114 or SEN-137	X13790002-05 or X13790057-03
Optional Ambient Temperature Sensor (4) (for Ambient-Based Chilled Water Reset)	4RT6	Field-installed: Mount in fresh air intake, or on north wall of building.	127 128	1TB3-14 1TB3-15	SEN-113 or SEN-132	X13790002-02 or X13790057-01
Optional Condenser Refrigerant Temperature Sensor (4)	n/a	Field-installed: Wire-tie and epoxy to refrigerant line between condenser and condenser/ economizer flange; wrap with Armaflex insulation.	127 128	1TB3-14 1TB3-15	SEN-113 or SEN-132	X13790002-02 or X13790057-01

Notes:

1. Trane's mnemonic part number appears on the outside of the box containing the sensor(s); the vendor code is stamped on the sensors. Any additional components required to field-install water temperature sensors (e.g., bulbwells, junction boxes, etc.) are included with the sensors.
2. This sensor ships with each CVHE, regardless of whether or not the matched pair of evaporator water temperature sensors is ordered. See Item 6 under "Temperature Sensor Circuits".
3. Notice that SEN-118 and SEN-131 are matched-pair sensors. Sensors used as a matched pair must be replaced as a pair; do not replace an individual sensor from a pair!
4. Ambient temperature sensor 4RT6 and the condenser refrigerant temperature sensor are mutually exclusive; that is, a unit cannot be equipped with both of these sensors.

Figure 33
Locations of UCP695
Temperature Sensors



Notes:
1. For sensor identification see Table 18. (Sensor electrical connections are shown on the field connection diagrams in Figures 24 and 25.)

Optional Serial Communication Interface

This control option allows the UCP's micro module (1U3) to exchange information—such as chiller status and operating setpoints—with a Model SCP699 System Control Panel.

Figure 34 illustrates how such a communication/control network might appear. Notice that twisted-pair conductors are used to establish this serial communication interface (SCI) between UCP Terminals 1TB6-1 and -2 and the SCP.

Note: This circuit must be run in separate conduit to prevent electrical noise interference!

Additional information about the SCI option is published in the installation manual and operator's guide that ship with the SCP.

Note: The SCI and chilled water reset (CWR) control options are mutually exclusive. That is, a CVHE cannot be equipped with both SCI and CWR.

Generic BAS/CWR Interface Option

This UCP control option allows a remote, generic building automation system (BAS) to reset the unit's chilled water setpoint.

When the CVHE is ordered with this option, a "chilled water reset interface module" (1U4) is factory-installed inside the unit control panel, to the left of micro module 1U3. See Figure 35.

Interface module 1U4 translates a 0-10 VDC (or 4-20 mA) control signal issued by the generic BAS into an "ambient temperature" input that the UCP uses to calculate a new chilled water setpoint.

It is recommended that the 4-20 mA source be isolated from the 1U4 module to prevent ground-loop problems.

Note: If a 0-10 VDC signal input is used, remove resistor R1 from 1U4. See Figure 35.

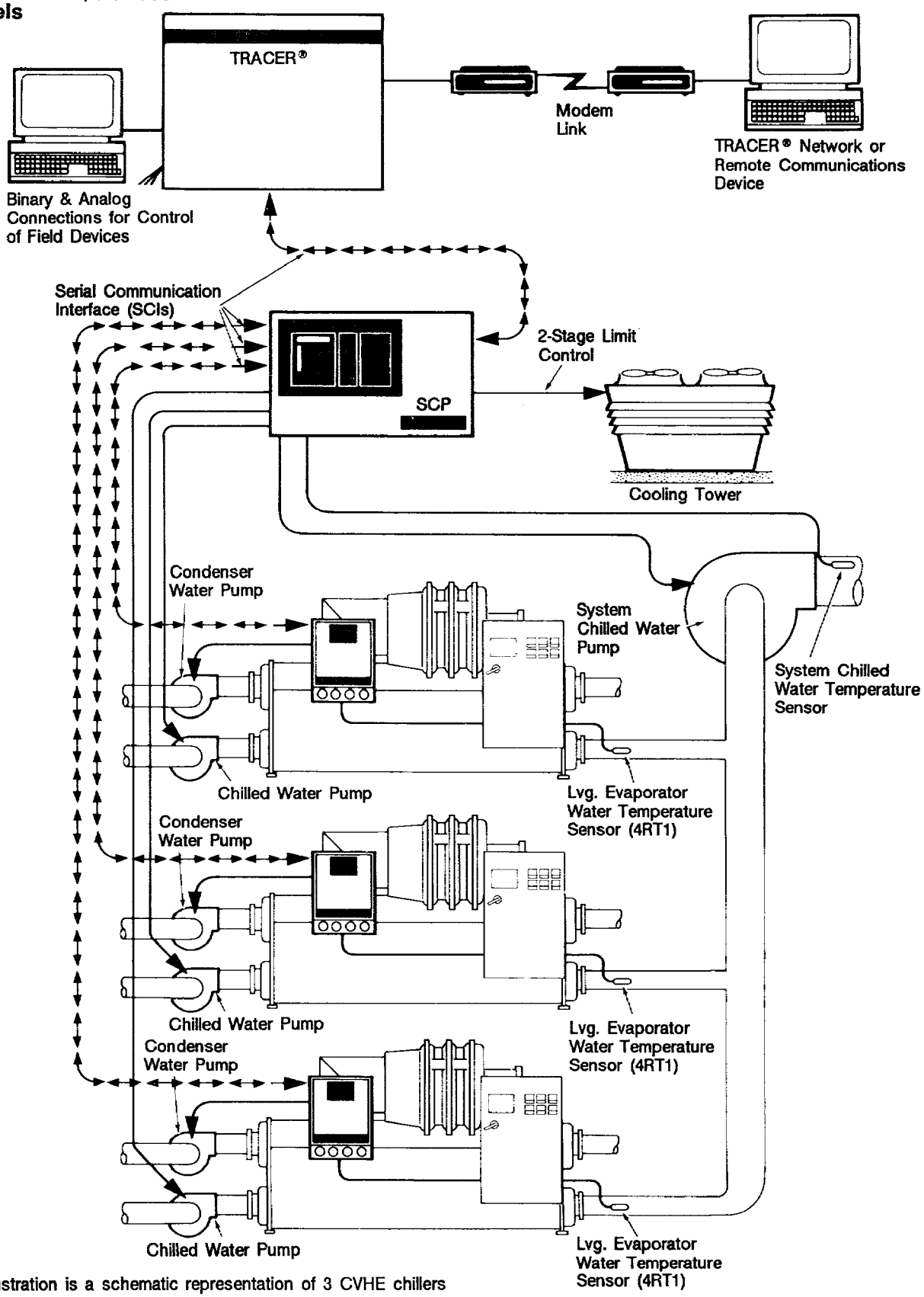
To link the generic BAS to 1U4, use 14-18 AWG, 600V shielded twisted-pair conductors; the maximum recommended length of run is 500'. Connect these wires to 1U4 Terminals TS1-1 and -2, as shown in Figure 35.

Note: Be sure to ground the negative signal input to the UCP enclosure. It is also important to isolate or "float" any external equipment signals with respect to the UCP's electrical service ground.

Caution: To prevent electrical noise interference, do not run this circuit in conduit with other circuits carrying more than 30 volts.

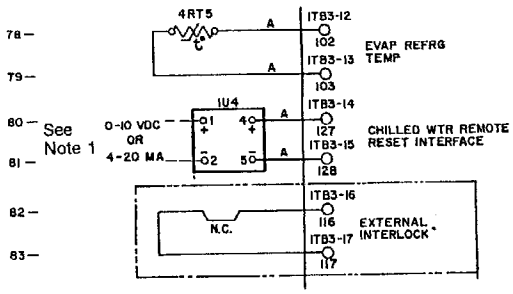
Figure 35 is a reproduction of the special "customer information" drawing that ships with the unit when the generic BAS/CWR option is ordered. Notice that this drawing not only includes installation information, but also describes operation.

Figure 34
Typical SCI Network for SCP and 3 CVHEs w/UCP695 Control Panels

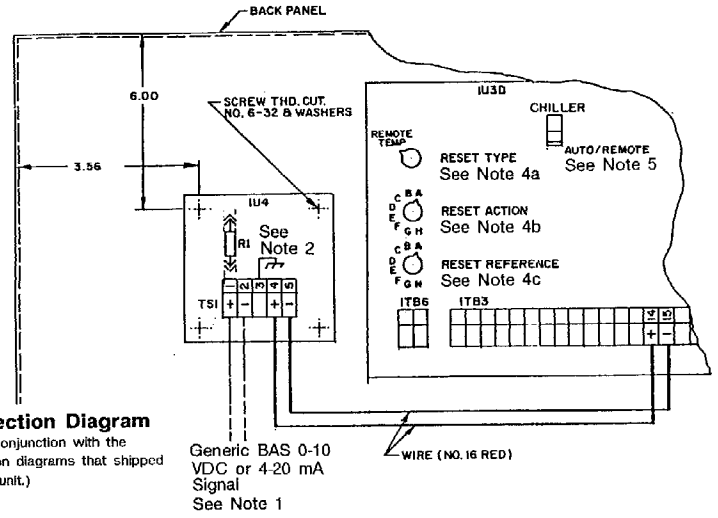


Note: This illustration is a schematic representation of 3 CVHE chillers piped in parallel.

Figure 35
Remote Generic BAS/CWR Interface Option



Schematic Diagram
(Use in conjunction with the schematic diagrams that shipped with the unit.)

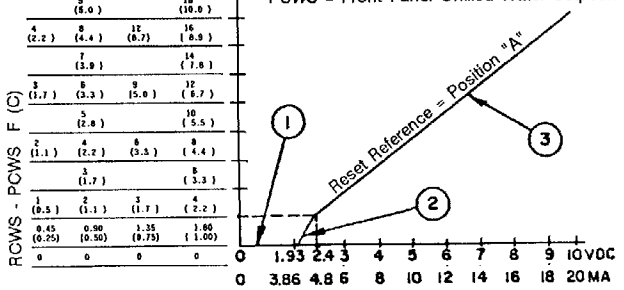


Connection Diagram
(Use in conjunction with the connection diagrams that shipped with the unit.)

Reset Action (%) Switch Position			
D (+10)	C (+20)	B (+30)	A (+40)
5 (2.8)	10 (5.5)	15 (8.3)	20 (11.1)
	9 (5.0)		18 (10.0)
4 (2.2)	8 (4.4)	12 (6.7)	16 (8.8)
	7 (3.9)		14 (7.8)
3 (1.7)	6 (3.3)	9 (5.0)	12 (6.7)
	5 (2.8)		10 (5.5)
2 (1.1)	4 (2.2)	6 (3.3)	8 (4.4)
	3 (1.7)		6 (3.3)
1 (0.5)	2 (1.1)	3 (1.7)	4 (2.2)
0.45 (0.25)	0.90 (0.50)	1.35 (0.75)	1.80 (1.00)
0	0	0	0

Note: The chilled water setpoint will be reset in integer F only.

RCWS = Reset Chilled Water Setpoint
PCWS = Front Panel Chilled Water Setpoint



(1) RCWS = PCWS

(2) RCWS - PCWS = (Reset Action) x (-18.3 + 9.50 VDC)
or,
RCWS - PCWS = (Reset Action) x (-18.3 + 4.75 mA)

(3) RCWS - PCWS = (Reset Action) x (-9.9 + 6.010 VDC)
or,

Notes:

1. Negative signal inputs are grounded to the UCP's enclosure. For correct operation, external equipment signals must be isolated or floating with respect to the UCP's electrical service ground.

2. Remove resistor R1 when a 0-10 VDC input is used.

3. Dashed lines (- - - -) represent field-installed wiring.

4. To activate the remote generic BAS/CWR interface, complete these micro module (1U3D) control adjustments:

a. Set "Reset Type" at the "Remote Temp." position.

b. Set "Reset Action" to "A", "B", "C" or "D". (Refer to the chart at left to determine the appropriate setting.)

c. Set "Reset Reference" to the "A" position.

5. To enable the remote generic BAS/CWR interface, the UCP's chiller switch must be set at "Auto/Remote".

6. Maximum continuous input = 15 VDC (30 mA); minimum continuous input = -4 VDC (-8 mA). (Below these values, diagnostic code b AE will appear on the micro module [1U3D] display.)

7. When the chiller is not running, the micro module (1U3D) setpoint "steps" toward the desired generic BAS setpoint at a rate of approximately 1 F (0.55 C) per second.

When the chiller is running, 1U3D's setpoint is changed by 1 F (0.55 C) only when chilled water temperature is "in control" for 75 seconds. ("In control" is defined as the 1U3 setpoint ± X, where X varies from 0.8 to 1.6 F (0.44 to 0.88 C) based on the micro module's differential-to-start setting.

Unit Start-Up

All phases of initial unit start-up must be conducted under the supervision of a qualified local service engineer. This includes pressure testing, evacuation, electrical checks, refrigerant charging, actual start-up, and operator instruction.

Complete the "CenTraVac Check Sheet and Request for Serviceman" form found at the end of this manual, and forward it to your local Trane Service Company. Advance notification is required to assure that initial start-up is scheduled as close to the requested date as possible.

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MODEL CVHE CENTRAVAC
CHECK SHEET AND REQUEST FOR SERVICEMAN

TO: _____ TRANE SERVICE COMPANY

_____

PROJECT NAME: _____

THE FOLLOWING ITEMS ARE BEING INSTALLED AND WILL BE COMPLETE BY _____

1. CENTRAVAC:

In place and piped. Do not insulate CenTraVac or adjacent piping. The contractor is responsible for any foreign material left in the unit ..... ☐

2. PIPING:

Chilled water piping connected to:

- CenTraVac ..... ☐
- Air Handling Units ..... ☐
- Pumps ..... ☐
- Purge System (Across chilled water pump) ..... ☐
- Oil Cooler (If equipped) ..... ☐

Condenser and Heat Recovery Condenser (as applicable) piping connected to:

- CenTraVac ..... ☐
- Pumps ..... ☐
- Cooling Tower ..... ☐
- Heating Loop ..... ☐

Make-up water connected to cooling tower ..... ☐
Water supply connected to filling system ..... ☐
Systems filled ..... ☐
Pumps run, air bled from system ..... ☐
Strainers cleaned ..... ☐

3. FLOW BALANCING VALVES INSTALLED:

Leaving chilled water ..... ☐
Leaving condenser water ..... ☐
Heat Recovery condenser leaving water ..... ☐

4. WIRING:

Compressor Motor Starter has been furnished by or approved by The Trane Company, La Crosse, WI ..... ☐
Power available ..... ☐
Interconnecting wiring, starter to control panel ..... ☐
External interlock (flow switches, water pump aux., etc.) .. ☐

Motors connected on:

- CenTraVac* ..... ☐
- Chilled water pump ..... ☐

Cooling Tower fan rotation checked ..... ☐
Condenser water pump ..... ☐
Heat Recovery condenser water pump (as applicable) ..... ☐
Power available for vacuum pump ..... ☐
(115V AC) ..... ☐
All controls installed and connected ..... ☐
All magnetic starters installed and connected ..... ☐

5. TESTING:

Dry nitrogen available for pressure testing ..... ☐
Refrigerant-12 available for leak testing (25 lbs.) ..... ☐

6. REFRIGERANT ON JOB SITE ..... ☐

7. PNEUMATIC CONTROLS (When Ordered)

Installed and/or piped ..... ☐

8. GAUGES, THERMOMETERS AND AIR VENTS

Installed on both sides of evaporator ..... ☐
Installed on both sides of condenser and heat recovery condenser (as applicable) ..... ☐

9. SYSTEM CAN BE OPERATED UNDER LOAD CONDITIONS ..... ☐

10. ELECTRICIAN, CONTROL MAN AND CONTRACTOR'S REPRESENTATIVE ARE AVAILABLE TO EVACUATE, CHARGE AND TEST THE CENTRAVAC UNDER SERVICEMAN'S SUPERVISION ..... ☐

*NOTE: Do not make final connections to compressor motor until requested by Trane service representative.

1-27 08-2—(483)
Supersedes 1-27 08-2—(1081)

IN ACCORDANCE WITH YOUR QUOTATION AND OUR PURCHASE ORDER NUMBER _____

WE WILL THEREFORE REQUIRE YOUR SERVICEMAN ON THE JOB BY*_____

THIS IS TO CERTIFY THAT THE CENTRAVAC(S) HAS BEEN PROPERLY AND COMPLETELY INSTALLED AND THE APPLICABLE ITEMS LISTED ABOVE HAVE BEEN COMPLETED.

ADDITIONAL TIME REQUIRED TO COMPLETE THE START-UP AND ADJUSTMENT DUE TO INCOMPLETENESS OF THE INSTALLATION WILL BE INVOICED AT PREVAILING RATES.

CHECK LIST COMPLETED BY: _____

_____

_____

SIGNED: _____

DATED: _____

*ADVANCE NOTIFICATION IS REQUIRED TO ALLOW SCHEDULING OF THE START-UP AS CLOSE TO THE REQUESTED DATE AS POSSIBLE.

1-27 08-2—(Back)—(483)
Supersedes 1-27 08-2—(1081)