TRANE

Installation Operation Maintenance

RTHA-IOM-1A

Library	Service Literature
Product Section	Refrigeration
Product	Rotary Liquid Chillers - Water-Cooled
Model	RTHA
Literature Type	Installation,Operation, Maintenance
Sequence	1
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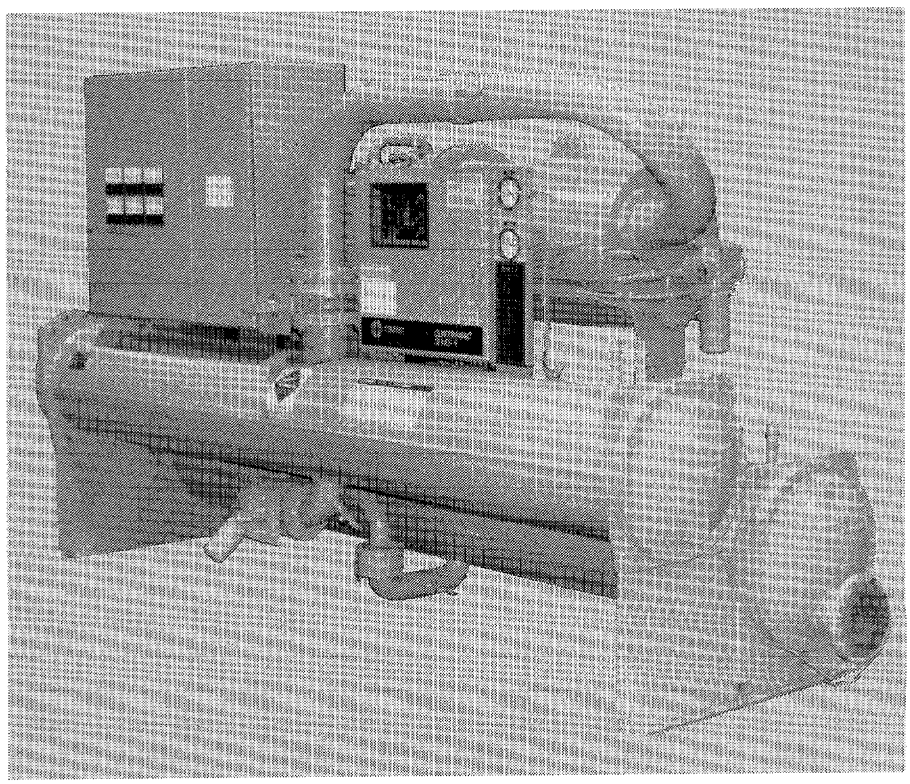
Supercedes	RTHA-IN-1, RTHA-SD-1, RTHA-M-1, RTHA-IOM-1

Series R Water-Cooled Hermetic CenTraVac Rotary Liquid Chillers

Design Sequences A thru SO (Includes extended shell option and oil recovery system)



Models

RTHA 130
RTHA 150
RTHA 180
RTHA 215
RTHA 255
RTHA 300
RTHA 380
RTHA 450

Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and designs without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified,

Part No. X39530103-1

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Important Notices

World environmental scientists have concluded, based on the best currently available evidence, that the ozone in our upper atmosphere is being reduced, due to the release of CFC fully-halogenated compounds.

The Trane Company urges all HVAC servicers, working on Trane and other manufacturers' products, to make every effort to eliminate, if possible, or vigorously reduced emissions of CFC, HCFC and HFC refrigerants into the atmosphere that result 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 operation, maintenance and service procedures, with specific attention to the following:

1. Refrigerant used in any type of air conditioning or refrigerating equipment should be recovered for reuse, recovered and/or recycled for reuse, reprocessed (reclaimed), or properly destroyed, whenever it is removed from equipment. Never release refrigerant into the atmosphere.

2. Always determine possible recycle or reclaim requirements of the recovered refrigerant before beginning recovery by any method. Questions about recovered refrigerants and acceptable refrigerant quality standards are addressed in ARI Standard 700.

3. Use approved containment vessels and safety standards. Comply with all applicable transportation standards when shipping refrigerant containers.

4. In order to assist in reducing power generation emissions, always attempt to improve equipment performance with improved maintenance and operations that will help conserve energy resources.

General Information

Literature Change History

RTHA-IOM-1 (September 1990)

Original manual. Covers installation, operation, and maintenance of "A thru H" design sequence RTHA-130 thru RTHA-300 units.

RTHA-IOM-1A (March 1992)

Manual reissued to update electrical diagrams and make additional changes listed below:

- Incorporate new models.
- Incorporate extended shell option.
- Incorporate oil recovery system.
- Incorporate changes to ice making system.

Unit Identification

When the unit arrives, compare all nameplate data with ordering and shipping information.

Unit Inspection

When the unit is delivered, verify that it is the correct unit and that it is properly equipped. Compare the information which appears on the unit nameplate with the ordering and submittal information. Refer to "Nameplates".

Inspect all exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a "unit damage" notation on the carrier's delivery receipt. Specify the extent and type of damage found and notify the appropriate Trane Sales Office.

Do not proceed with installation of a damaged unit without sales office approval.

Figure 1
Component Layout of Typical RTHA w/Unit-Mounted Starter (Front View)

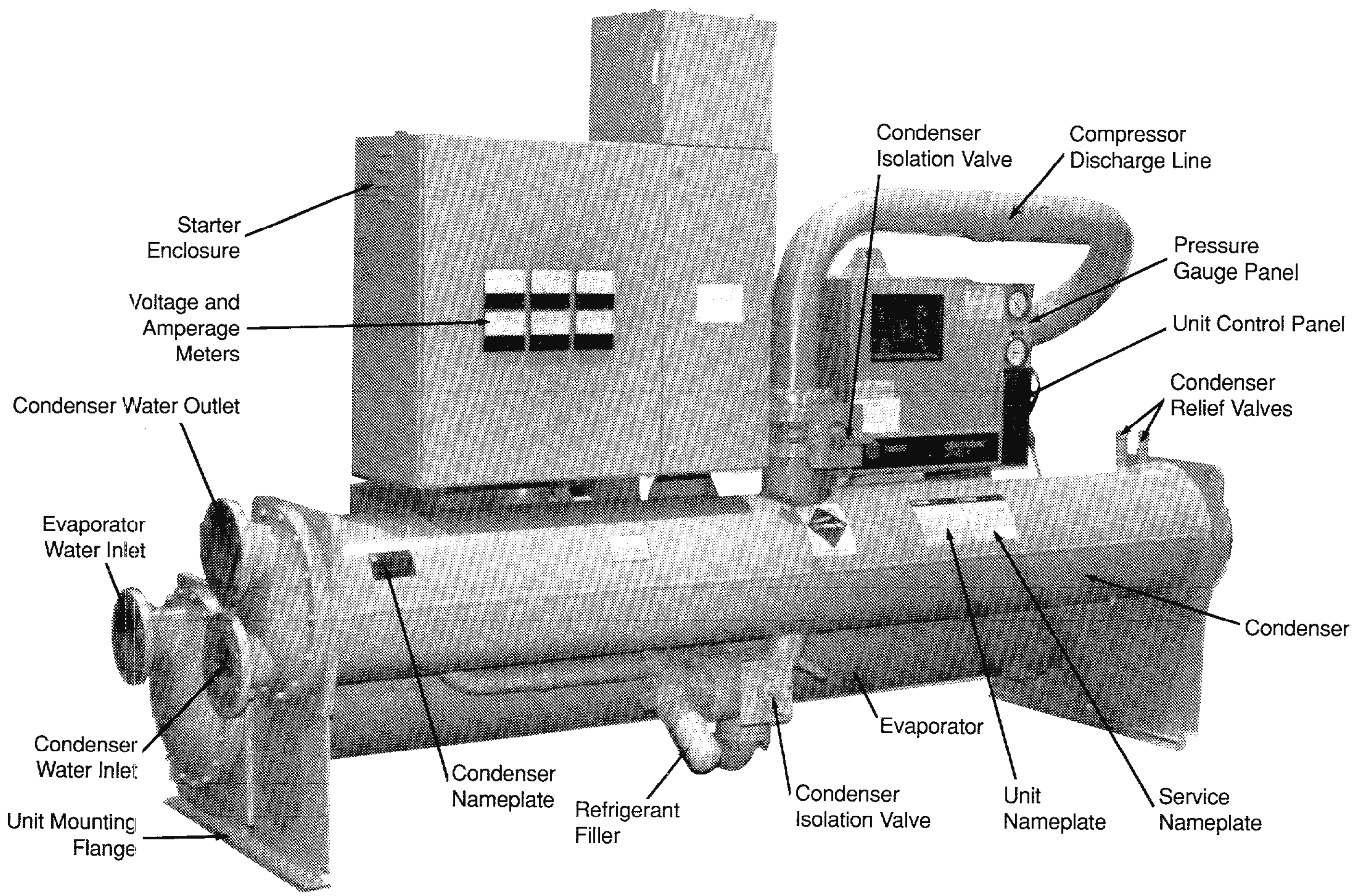


Figure 2
Component Layout of Typical RTHA
(Right End View)

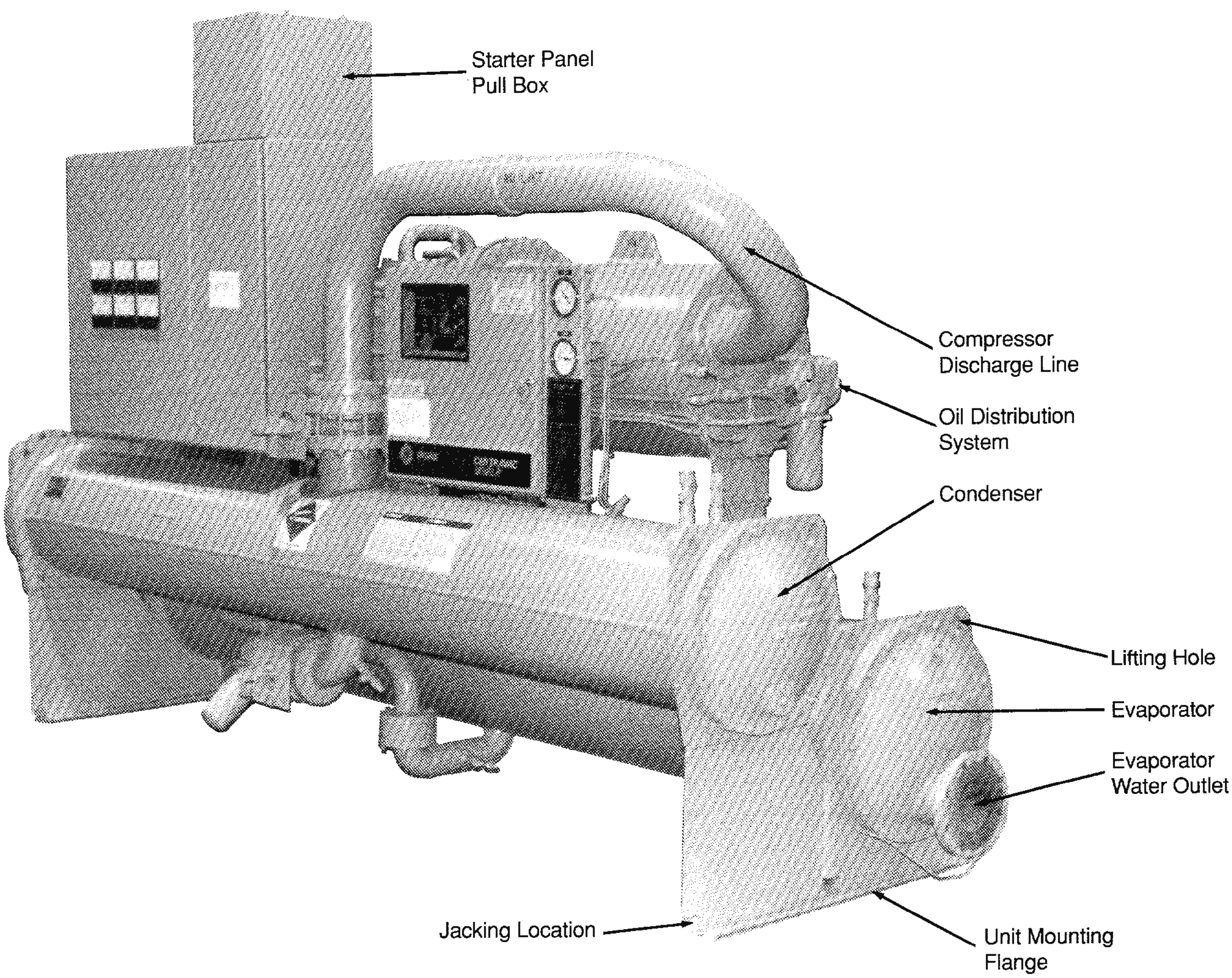
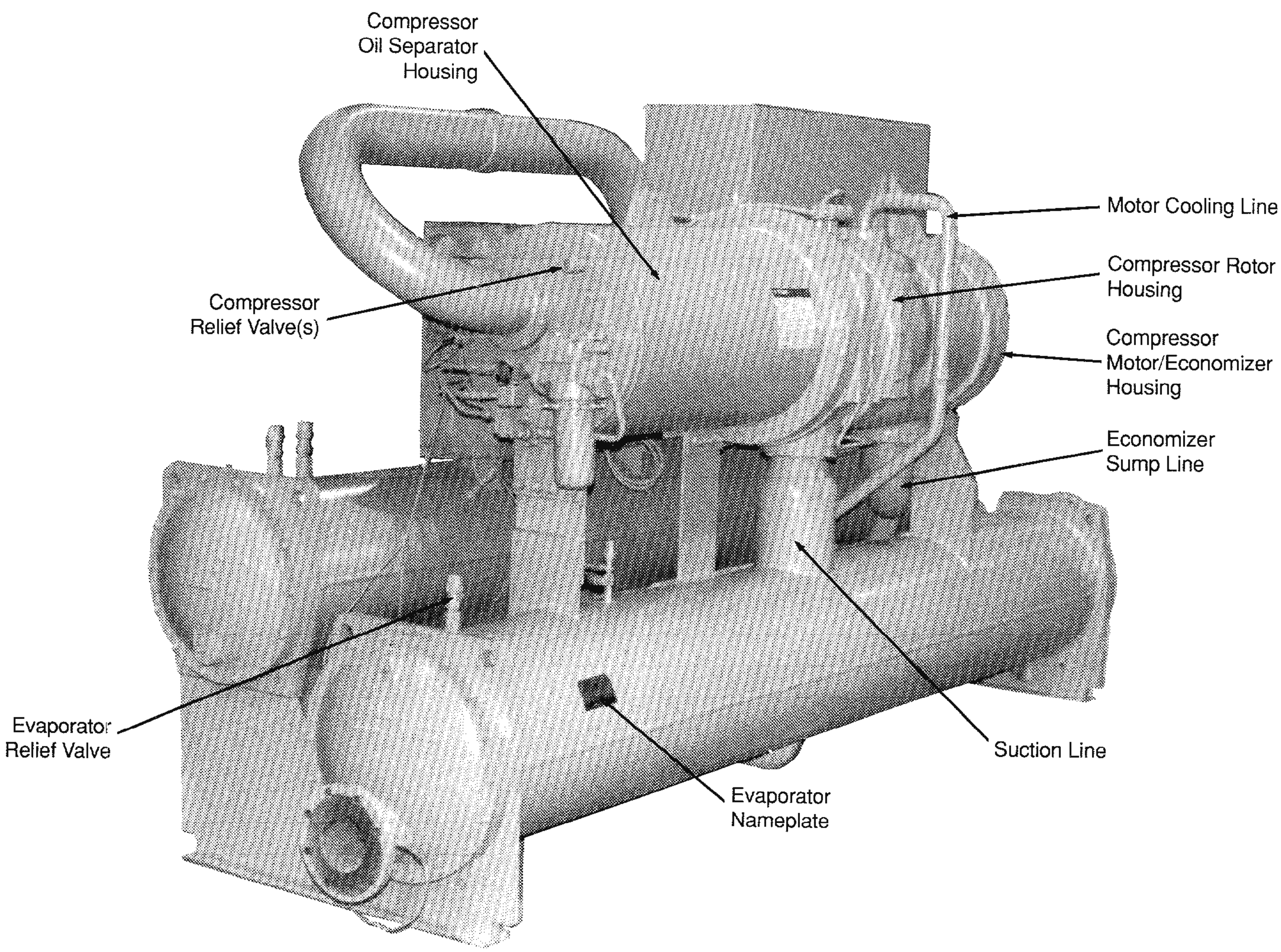


Figure 3
Component Layout of Typical RTHA
(Back View)



Inspection Checklist

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

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

[ ] Inspect the unit for concealed damage as soon as possible after delivery and before it is stored. Concealed damage must be reported within 10 days.

[ ] If concealed damage is discovered, stop unpacking the shipment. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.

[ ] Notify the carrier's terminal of the damage immediately, by phone and by mail. Request an immediate, joint inspection of the damage with the carrier and the consignee.

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

Loose Parts Inventory

Check all items against shipping list. Water vessel drain plugs, isolation pads, rigging and electrical diagrams, service literature and optional water temperature sensors are placed inside the control panel and/or starter panel for shipment. The starter panel wire pullbox, required on some unit-mounted starters, is also shipped on the unit. It may be removed, and subsequently reinstalled, if overhead clearance is required during installation.

Unit Description

The 130 thru 450-ton Model RTHA units are single compressor, helical-rotary type, water-cooled liquid chillers designed for installation indoors. Each unit is a completely assembled hermetic package that is factory-piped, wired, leak-tested, dehydrated, charged, and tested for proper control operation before shipment.

Figures 1 thru 3 show a typical RTHA unit and its components. Water inlet and outlet openings are covered before shipment. The compressor oil tank is factory charged with the proper amount of refrigeration oil. The unit is factory charged with refrigerant. On units with condenser isolation valves, the charge is isolated in the condenser.

Commonly Used Acronyms

The unit-mounted control panel used on the Model RTHA liquid chiller is referred to in this manual as the "UCP". The microprocessor or "micro" is located in the upper portion of the UCP and is designated the "UCM".

Acronyms used in this manual are defined below.

AMB = Outdoor Ambient Temperature
BAS = Building Automation System
BCL = Bidirectional Communications Link
CLS = Current Limit Setpoint
CWR = Chilled Water Reset
CWS = Chilled Water Setpoint
DDT = Design Delta-T (i.e., the difference between entering and leaving chilled water temperatures)
ENT = Entering Chilled Water Temperature
HGBP = Hot Gas Bypass
HVAC = Heating, Ventilating and Air Conditioning
I/O = Input and Output Wiring
LVG = Leaving Chilled Water Temperature
NEC = National Electric Code
PCWS = Front Panel Chilled Water Setpoint
PFCC = Power Factor Correction Capacitors
PSID = Pounds-per-Square-inch Differential (pressure differential)
PSIG = Pounds-per-Square-inch (gauge pressure)
RAS = Reset Action Setpoint
RLA= Rated Load Amps
RCWS = Reset Chilled Water Setpoint (CWR)
RRS = Reset Reference Setpoint (CWR)
Tracer = Type of Trane Building Automation System
SCI = Serial Communications Interface
UCLS = Unit Current Limit Setpoint
UCM = Unit Control Module (Microprocessor)
UCP = Unit-Mounted Control Panel
UCWS = Unit Chilled Water Setpoint

Warnings and Cautions

Warnings and **Cautions** appear in **boldface** type at appropriate points in this manual.

Warnings are provided to alert personnel to potential hazards that can result in personal injury or death; they do **not** replace the manufacturer's recommendations.

Cautions alert personnel to conditions that could result in equipment damage. Your personal safety and reliable operation of this machine depend upon strict observance of these precautions. The Trane Company *assumes no liability for installation or service procedures performed by unqualified personnel.*

Installation Responsibilities

The "Installation Responsibility Chart" on the next page pinpoints responsibility for furnishing and installing all field-provided system components. Generally, the contractor must do the following when installing an RTHA unit:

[ ] Install unit on a flat, level (within 1/16" [1.6 mm]) foundation, strong enough to support unit loading. Place manufacturer-supplied isolation pads under unit.

[ ] Install unit per applicable Trane installation manual.

[ ] Complete all water and electrical connections.

[ ] Tighten all electrical connections in the control panel and starter panel.

[ ] Install any optional sensors in system water piping and make electrical connections at the UCM.

Note: The standard leaving chilled water sensor is factory installed in the evaporator leaving water outlet.

[ ] 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 if water flow is established.

[ ] Furnish and install thermometers and pressure gauges in inlet and outlet piping 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 vent piping from all relief valves to atmosphere.

[ ] Provide and install field wiring.

[ ] 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.

Figure 4
Installation Responsibility Chart for RTHA 130 Thru 450 Units

Type of Requirement	Trane-Supplied, Trane-Installed	Trane-Supplied, Field-Installed	Field-Supplied, Field-Installed
Rigging and Moving			a. safety chains b. clevis connectors c. lifting beam d. equipment jacks and dollies
Isolation		a. isolation pads.	a. isolation
Electrical	a. starter-mounted circuit breaker or disconnect switch b. unit-mounted starter (optional) c. standard evaporator leaving water temp. sensor d. eductor control panel* e. optical sensor*	a. flow switches (optional) b. remote-mounted starter c. system control panel (optional) d. optional matched-pair water temp. sensors e. CWR ambient temp. sensor	a. circuit breakers <u>or</u> fusible disconnects (optional) b. PFCCS (optional) c. terminal lugs d. ground connection(s) e. jumper wires f. BLC wiring (optional) g. external interlock wiring (optional) h. running external interlock wiring (optional) i. alarm relay circuit wiring and components (optional) j. head-relief-request relay circuit wiring and components (optional)
Water Piping	a. standard evaporator leaving water temp. sensor	a. flow switches (optional) b. optional matched-pair water temp. sensors (evaporator and/or evaporator & condenser)	a. thermometers b. water flow pressure gauges c. water pipe strainers d. balancing valves e. isolation valves f. vents and drain valves (for water boxes) g. pressure-relief valves (for water boxes as required) h. 1/4" NPT pipe couplings (to install water temp. sensors)
Refrigerant Relief Valves	a. condenser relief valve(s) b. compressor relief valve(s) c. evaporator relief valve		a. condenser relief valve vent piping b. compressor relief valve vent piping c. evaporator relief valve vent piping
Insulation	a. insulation (optional)		a. insulation

*For Models 380 and 450 and units with extended shell option, only.

Nameplates

Unit Nameplates

The RTHA "unit", "service", and "compressor" nameplates are applied to the exterior surface of the condenser below the UCP (Figure 5). The "unit" nameplate provides the following information:

- Unit model and size descriptor.
- Unit serial number.
- Unit device number.
- Identifies unit electrical requirements.
- Lists correct operating charges of R-22 and refrigerant oil.
- Lists unit test pressures and maximum working pressures.

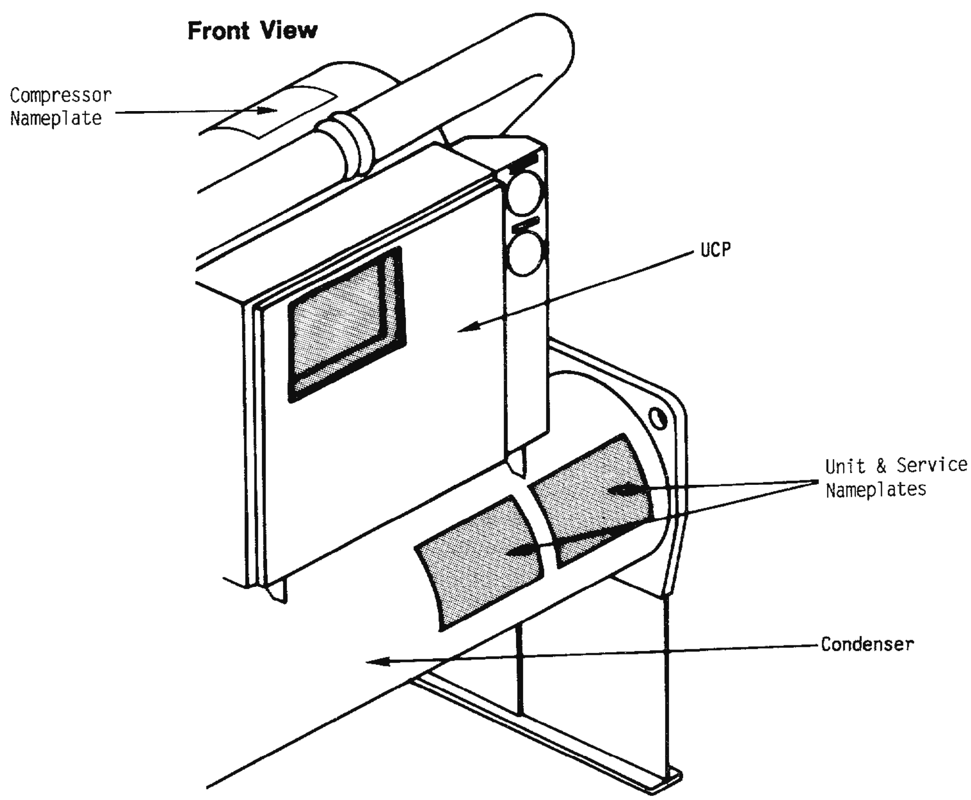
The "service" nameplate provides the following information:

- Unit model and size descriptor.
- Unit serial number.
- Product coding block which identifies all unit components and unit "design sequence" (used to order literature and make other inquiries about the unit).
- Identifies installation, operation and maintenance and service data literature.
- Lists drawing numbers for unit wiring diagrams.

The "compressor" nameplate provides the following information:

- Compressor model and size descriptor.
- Compressor serial number.
- Compressor device number.
- Motor serial number.
- Compressor electrical characteristics.
- Product coding block.
- Recommended operating charges of refrigerant oil.
- Compressor test pressures and maximum working pressures.

Figure 5
Unit Nameplate Locations



Model Number Coding System

The model numbers for the unit, the compressor, and the starter are comprised of numbers and letter which represent features of the equipment. Shown on the chart in Figure 6 are samples of typical unit, compressor, and starter model numbers, followed by the coding system for each.

Each position, or group of positions, in the number is used to represent a feature. For example, in Figure 6, position 08 of the unit model number, Unit Voltage, contains the letter "F". From the chart, it can be seen that an "F" in this position means that the unit voltage is 460/60/3.

Figure 6
Model Number Coding System

The Series R unit model number is as follows:

```
RTHA150FCA0NAUC3LF2LFNNV0AG
0         1         2         3
123456789012345678901234567890  (Digit Position For Above)
```

The digit positions have the following code assignments:

POSITION	FEATURE	DESIGNATOR & MEANING	
01, 02, 03	SERIES R CTV	RTH	= SERIES R CENTRAVAC
04	DEV. SEQUENCE	A	= 1ST MAJOR DEVELOPMENT
05, 06, 07	NOMINAL TONS	130	= 130 NOMINAL TONS
		150	= 150 NOMINAL TONS
		180	= 180 NOMINAL TONS
		215	= 215 NOMINAL TONS
		255	= 255 NOMINAL TONS
		300	= 300 NOMINAL TONS
		380	= 380 NOMINAL TONS
		450	= 450 NOMINAL TONS
08	UNIT VOLTAGE	A	= 200/60/3
		C	= 230/60/3
		M	* 363/50/3
		D	= 380/60/3
		F	= 460/60/3
		N	* 400/50/3
		H	= 575/60/3
		S	= SPECIAL CUSTOMER OPTION
09	UNIT TYPE	C	= STANDARD COOLING, STD PRESS & TEMP CONDENSER
		H	* HEAT RECOVERY
		P	* HIGH PRESS/TEMP CONDENSER
		S	= SPECIAL CUSTOMER OPTION
10, 11	DESIGN SEQUENCE	AO	= FIRST DESIGN, ETC. INCREMENT WHEN PARTS ARE AFFECTED FOR SERVICE PURPOSES.
12	SHELL LENGTH	N	= STANDARD (SHORT) SHELLS
		L	= HIGH EFF. (LONG) SHELLS
		E	= EXTENDED SHELLS
13	MICROPROCESSOR	A	* STANDARD CONTROLS, NO COMM. INTERFACE
		B	= CHILLED WATER RESET CTLS.
		C	= CHILLED WATER RESET CTLS., W/BAS INTFC.
		D	= SERIAL COMM INTERFACE
		S	= SPECIAL CUSTOMER OPTION
14	STARTER TYPE	R	= REMOTE STARTER (SEE STARTER MODEL NUMBER)
		U	= UNIT MOUNTED STARTER (SEE STARTER MODEL NO)
15	EVAP TEMP RANGE	C	= STANDARD COOLING (38 DEG F AND HIGHER)
		L	= LOW TEMP AIR ICE MAKER
		P	+ PROCESS ICEMAKING (0 - 38 DEG F)
		I	= CALMAC ICEMAKING (20 DEG F)
		S	= SPECIAL CUSTOMER OPTION
16	EVAP WATER PASSES	1	= 1 PASS
		2	= 2 PASS
		3	= 3 PASS (STANDARD)
		4	= 4 PASS
17	EVAP WATER PRESS	L	= 150 PSI (STANDARD)
		H	= 300 PSI
		S	= SPECIAL CUSTOMER OPTION
18	EVAP TUBES	F	= STANDARD 06A HIGH-PERF TUBE
		S	= SPECIAL CUSTOMER OPTION
19	COND WATER PASSES	1	* 1 PASS
		2	= 2 PASS (STANDARD)
20	COND WATER PRESS	L	= 150 PSI (STANDARD)
		H	= 300 PSI
		S	= SPECIAL CUSTOMER OPTION
21	COND TUBES	F	= STANDARD I-E FINNED TUBES
		G	= SBCU (SMOOTH-BORE CU TUBES)
		H	+ SB 90/10 TUBES (CU-NI)
		J	+ SB 70/30 TUBES (CU-NI)
		K	+ SBTi TUBES
		S	= SPECIAL CUSTOMER OPTION
22	EVAP ORIFICE	N	= STANDARD HEAD CONDITIONS
		L	+ LOW HEAD CONDITIONS
		M	+ MINIMUM HEAD CONDITIONS
		S	= SPECIAL CUSTOMER OPTION
23	COND ORIFICE	N	= STANDARD HEAD CONDITIONS
		L	+ LOW HEAD CONDITIONS
		M	+ MINIMUM HEAD CONDITIONS
		S	= SPECIAL CUSTOMER OPTION
24	ISOLATION VALVES	O	= NO CONDENSER ISO. VALVES
		V	= WITH CONDENSER CHARGE ISOLATION VALVES
25	HOT GAS BYPASS	O	= WITHOUT HOT GAS BYPASS
		B	* WITH HOT GAS BYPASS
26+	ADD-ON OPTIONS	A	= SOUND ATTENUATOR
		T	= TRACER MONITORING PACKAGE
		C	= CSA LISTED
		U	= UL LISTED
		G	= UNIT GAUGES
		Q	= THERMAL INSULATION

(NOTE - FROM 26 ON CAN BE MULTIPLE, INDEPENDENT ADD-ON OPTIONS)
"*" INSTEAD OF "=" DENOTES THAT THIS OPTION ASSIGNMENT HAS BEEN MADE, BUT IS NOT AVAILABLE AT THIS TIME. "+" DENOTES THAT THIS IS AN AVAILABLE SPECIAL OPTION.

Figure 6 (continued)

The Series R compressor model number is as follows:

CHHA140FAA0N109N
0 1 2
12345678901234567890 (DIGIT POSITION FOR ABOVE)

The digit positions have the following code assignments:

POSITION	FEATURE	DESIGNATOR AND MEANING
01, 02, 03	COMPRESSOR SERIES	CHH = SEMI-HERMETIC HELI-ROTOR COMPRESSOR
04	DEVELOPMENT SEQUENCE	A = FIRST MAJOR DEV
05, 06, 07	CAPACITY (ARI)	120 = 120 TONS @ ARI TEST COND'NS 140 = 140 TONS 170 = 170 TONS 200 = 200 TONS 240 = 240 TONS 280 = 280 TONS 340 * 340 TONS (NOT AVAILABLE) 400 * 400 TONS (NOT AVAILABLE)
08	MOTOR VOLTAGE	A = 200/60/3 C = 230/60/3 M = 363/50/3 D = 380/60/3 F = 460/60/3 N = 400/50/3 H = 575/60/3
09	RELIEF PRESS (USAGE)	A = 300 PSI RELIEF (WATER COOL) J * 400 PSI RELIEF (AIR COOLED) S * SPECIAL CUSTOMER OPTION
10, 11	DESIGN SEQUENCE	AO = FIRST DESIGN, INCREMENT WITH CHANGES THAT AFFECT PARTS
12	CAPACITY LIMIT	N = STANDARD CAPACITY CONTROLS (NONE) A * MINIMUM UNLOAD STOP (SIZE TO BE DETERMINED) B * MINIMUM UNLOAD STOP (SIZE TO BE DETERMINED) S = SPECIAL CUSTOMER OPTION
13-15	MOTOR KW RATING	089 = 89 KW MAX INPUT (130T/50HZ) 100 = 100 KW (150T/50HZ) 107 = 107 KW (130T/60HZ) 108 * 108 KW (150T/50HZOPT) 121 = 121 KW (150T/60HZ) 123 = 123 KW (180T/50HZ) 130 * 130 KW (150T/60HZOPT) 138 = 138 KW (215T/50HZ) 145 = 145 KW (180T/60HZ) 161 = 161 KW (255T/50HZ) 166 = 166 KW (215T/60HZ) 174 * 174 KW (215T/50HZOPT) 185 = 185 KW (300T/50HZ) 197 = 197 KW (255T/60HZ) 209 * 209 KW (215T/60HZOPT) 222 * 222 KW (300T/50HZOPT) 226 = 226 KW (300T/60HZ) 266 * 266 KW (300T/60HZOPT)
16	VOLUME RATIO	N = STANDARD SLIDE VALVE AND VOLUME RATIO A * OPTIONAL SLIDE VALVE AND VOLUME RATIO (TO BE DET.) B * OPTIONAL SLIDE VALVE AND VOLUME RATIO (TO BE DET.) S = SPECIAL S.V. & VOL. RATIO

"*" INSTEAD OF "=" DENOTES THAT THIS OPTION ASSIGNMENT HAS BEEN MADE, BUT IS NOT AVAILABLE AT THIS TIME

The Series R starter model number is as follows:

RTSAX128FA010302
0 1 2
12345678901234567890 (DIGIT POSITION FOR ABOVE)

The digit positions have the following code assignments:

POSITION	FEATURE	DESIGNATOR AND MEANING
1, 2, 3	UNIT TYPE	RTS = SERIES R STARTER
4	DEV. SEQUENCE	A = 1ST MAJOR DEVELOPMENT
5, 6, 7, 8	STARTER SIZE	X128 = X DENOTES NEXT LARGER STARTER SIZE, DIGITS ARE UNIT RLA (SEE SALES ORDER)
9	VOLTAGE	A = 200/60/3 C = 230/60/3 D = 380/60/3 F = 460/60/3 H = 575/60/3 M = 363/50/3 N = 400/50/3 S = SPECIAL
10, 11	DESIGN SEQUENCE	AO = 1ST DES SEQ, INCREMENT AS CHANGES AFFECT SERV.PARTS
12	STARTER TYPE	1 = UNIT MOUNTED STAR-DELTA 2 = UNIT MOUNTED CROSS-LINE A = REMOTE MOUNTED STAR-DELTA B = REMOTE MOUNTED CROSS-LINE C = REMOTE MTD AUTO-TR'FORMER F = REMOTE MTD STAR-DELTA, NEMA 12 ENCLOSURE G = REMOTE MTD CROSS-LINE, NEMA 12 ENCLOSURE H = REMOTE MTD AUTO-TR'FORMER, NEMA 12 ENCLOSURE J = REMOTE MTD STAR-DELTA, NEMA 4 ENCLOSURE K = REMOTE MTD CROSS-LINE, NEMA 4 ENCLOSURE L = REMOTE MTD AUTO-TR'FORMER, NEMA 4 ENCLOSURE S = SPECIAL
13	PANEL CONNECTION	0 = STD TERMINAL BLOCK 1 = DISCONNECT SWITCH 2 = CIRCUIT BREAKER 3 = CKT. BRKR, W/GROUND FAULT 4 = CKT. BRKR, HIGH INTERRUPT 5 = CKT. BRKR, GR FLT + HI INT 6 = CKT. BRKR, W/CURRENT LIMIT 7 = CKT. BRKR, GR FLT+CUR LMT 8 = ISOLATION SWITCH 9 = ISOLATION SWITCH W/GR FLT A = ISO SWITCH, LOAD BREAKING B = ISO SWITCH, LOAD BRK+GR FLT S = SPECIAL
14	METERS	0 = NONE 1 = AMMETERS (3-PHASE) 2 = VOLTMETERS (3-PHASE) 3 = AMMETERS AND VOLTMETERS
15	POWER FACTOR CORRECTION CAPACITORS	0 = NONE A = 10 KVAR B = 15 KVAR C = 20 KVAR D = 25 KVAR E = 30 KVAR F = 35 KVAR G = 40 KVAR H = 45 KVAR J = 50 KVAR K = 60 KVAR L = 70 KVAR M = 75 KVAR N = 80 KVAR P = 90 KVAR Q = 100 KVAR R = 120 KVAR T = 125 KVAR U = 150 KVAR V = 200 KVAR S = SPECIAL
16	AGENCY LISTING	0 = NONE 1 = CSA 2 = UL S = SPECIAL
17+	STARTER OPTIONS (ADD-ON, CAN BE MULTIPLE)	A = WATT-HOUR METER B = WATT-HOUR METER, DEM/PULSE C = OVERLOAD RELAY D = SURGE PROT. CAPACITOR AND LIGHTNING ARRESTORS E = CURRENT TRANSDUCER F = VOLTAGE TRANSDUCER G = WATTAGE TRANSDUCER S = SPECIAL
18	OIL RETURN SYSTEM	N = WITHOUT OIL LEVEL SENSOR W = WITH OIL LEVEL SENSOR

Installation Mechanical

Storage

Extended storage of the chiller prior to installation requires the following precautionary measures:

1. Do not remove the protective coverings from the starter and control panels.

2. Store the chiller in a dry, vibration-free and secure area.

3. Periodically check the condenser pressure gauge (if used) to verify that the refrigerant charge is intact. If it is not, contact a qualified service organization and the appropriate Trane sales office.

Location Requirements

Noise Considerations

Refer to Engineering Bulletin RLC-EB-6 for noise consideration applications.

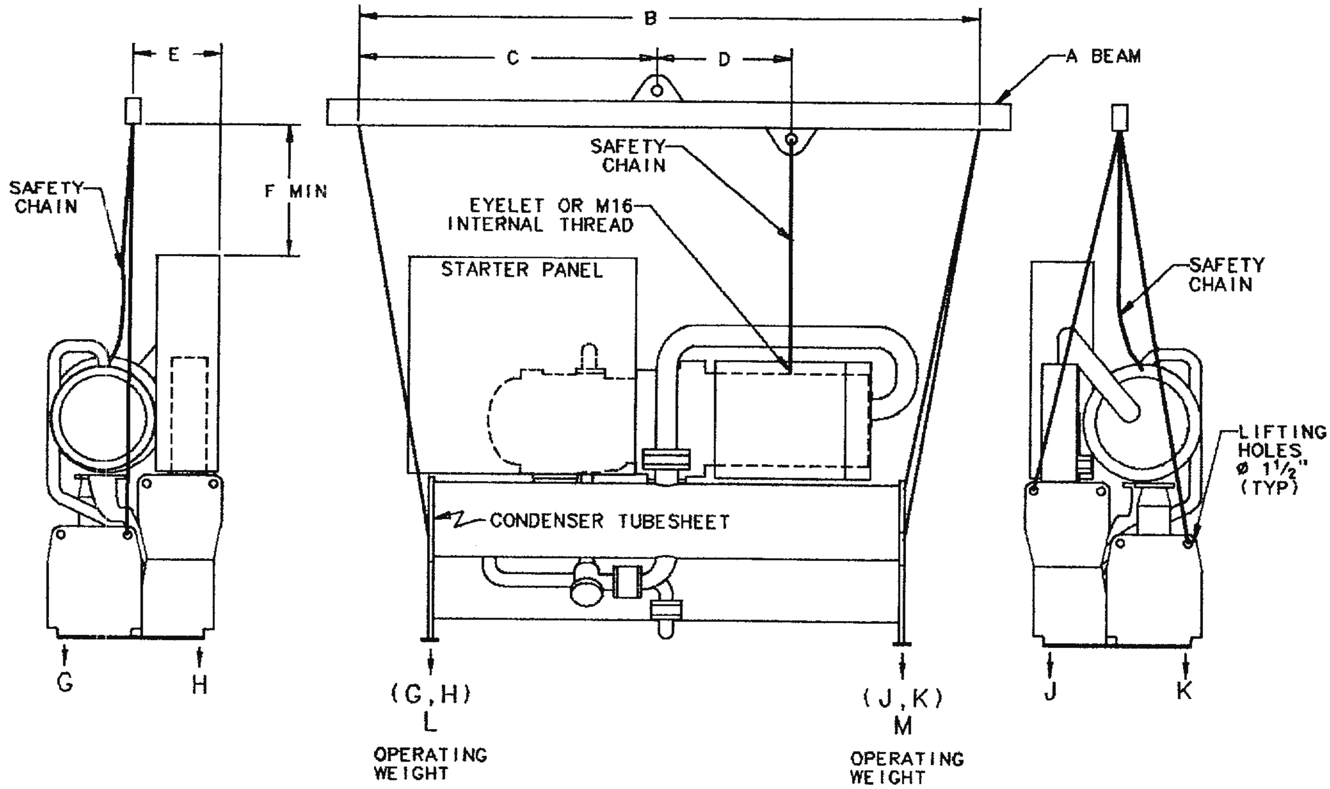
Locate the unit away from sound-sensitive areas. Install the isolation pads under the unit. Refer to "Unit Isolation". Install vibration isolators in all piping and use flexible electrical conduit.

Note: Consult an acoustical engineer for critical applications.

Foundation

Provide rigid, non-warping mounting pads or a concrete foundation of sufficient strength and mass to support the chiller operating weight (i.e., including completed piping, and full operating charges of refrigerant, oil and water). Refer to Figures 7 and 8 for unit operating weights. Once in place, the chiller must be level within 1/16" (1.6 mm) over its length and width. The Trane Company is not responsible for equipment problems resulting from an improperly designed or constructed foundation.

Figure 7
Weights and Rigging for 3-Point Lifting



UNIT SIZE	A	B	C	D	E	F
130/150 STD	11'	10'	4'-9 3/4"	2'-2"	1'-5"	2'-1"
180/215 STD	12'	11'	5'-3 3/4"	2'-2"	1'-7"	2'-3"
255/300 STD	12'	11'	5'-3 3/4"	2'-2"	1'-10"	1'-8"
380/450 STD	12'	11'	5'-3 3/4"	2'-2"	1'-9"	1'-8"

UNIT SIZE	LIFTING WEIGHT	LIFTING WEIGHT (LBS)				OPERATING WEIGHT (LBS) WITH WATER						
		G	H	J	K	G	H	J	K	L	M	TOTAL
130/150 STD	5350	1516	1170	1285	1380	1590	1266	1381	1454	2855	2835	5690
180/215 STD	6900	1946	1517	1666	1772	2060	1650	1799	1886	3710	3685	7395
255/300 STD	9935	2773	2163	2291	2662	2939	2369	2497	2828	5331	5301	10632
380/450 STD	14610	4169	3139	3154	4149	4317	3515	3514	4314	7832	7828	15660

NOTES:

1. LIFTING CHAINS (CABLES) WILL NOT BE THE SAME LENGTH. ADJUST TO KEEP UNIT LEVEL WHILE LIFTING.
2. ATTACH SAFTY CHAIN (CABLE) AS SHOWN WITHOUT TENSION NOT AS A LIFTING CHAIN, BUT TO PREVENT UNIT FROM ROLLING.
3. DO NOT FORK LIFT UNIT.
4. WEIGHTS ARE TYPICAL FOR UNITS WITH R-22 CHARGE

WARNING: DO NOT USE CABLES (CHAINS) OR SLINGS EXCEPT AS SHOWN. OTHER LIFTING ARRANGEMENTS MAY CAUSE EQUIPMENT DAMAGE OR SERIOUS PERSONAL INJURY.

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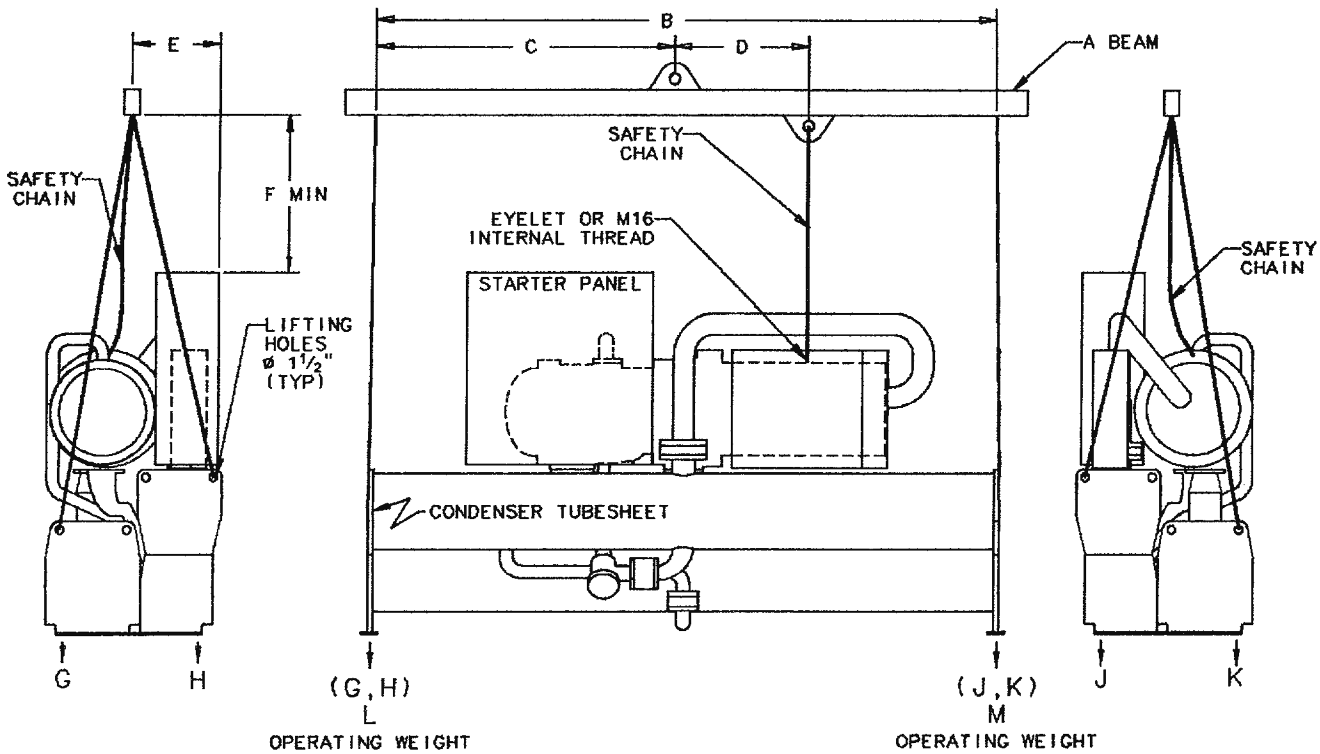
Figure 8
Weights and Rigging for 4-Point Lifting



UNIT SIZE	A	B	C	D	E	F
130/150 STD	11'	10'	4'-9 3/4"	2'-2"	1'-5"	2'-1"
130/150 LONG	11'	10'	4'-9 3/4"	2'-2"	1'-5"	2'-1"
180/215 LONG	11'	10'	4'-9 3/4"	2'-2"	1'-7"	2'-3"
180/215 EXT	11'	10'	4'-9 3/4"	2'-2"	1'-7"	2'-3"
255/300 LONG	11'	10'	4'-9 3/4"	2'-2"	1'-10"	1'-8"
255/300 EXT	11'	10'	4'-9 3/4"	2'-2"	1'-10"	1'-8"
380/450 LONG	11'	10'	4'-9 3/4"	2'-2"	1'-9"	1'-8"

UNIT SIZE	LIFTING WEIGHT	LIFTING WEIGHT (LBS)				OPERATING WEIGHT (LBS) WITH WATER						
		G	H	J	K	G	H	J	K	L	M	TOTAL
130/150 STD	5350	1516	1170	1285	1380	1590	1266	1381	1454	2855	2835	5690
130/150 LONG	5860	1612	1321	1412	1512	1707	1442	1533	1607	3151	3139	6290
180/215 LONG	7610	2081	1731	1845	1952	2225	1900	2014	2096	4125	4110	8235
180/215 EXT	9760	2714	2170	2169	2709	2924	2431	2430	2919	5355	5349	10704
255/300 LONG	10980	2992	2463	2565	2915	3202	2724	2826	3125	5948	5929	11877
255/300 EXT	14185	4226	2852	2853	4254	4544	3187	3205	4555	7731	7760	15491
380/450 LONG	15885	4407	3533	3518	4426	4725	3868	3870	4727	8593	8597	17190

NOTES:

1. LIFTING CHAINS (CABLES) WILL NOT BE THE SAME LENGTH. ADJUST TO KEEP UNIT LEVEL WHILE LIFTING.
2. ATTACH SAFTY CHAIN (CABLE) AS SHOWN WITHOUT TENSION NOT AS A LIFTING CHAIN, BUT TO PREVENT UNIT FROM ROLLING.
3. DO NOT FORK LIFT UNIT.
4. WEIGHTS ARE TYPICAL FOR UNITS WITH R-22 CHARGE

WARNING: DO NOT USE CABLES (CHAINS) OR SLINGS EXCEPT AS SHOWN, OTHER LIFTING ARRANGEMENTS MAY CAUSE EQUIPMENT DAMAGE OR SERIOUS PERSONAL INJURY.

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Clearances

Provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points. Refer to submittal drawings for the unit dimensions. There should be adequate clearance for condenser and compressor servicing. A minimum of three feet is recommended for compressor service and to provide sufficient clearance for the opening of control panel doors. Refer to Figure 9 for minimum clearances required for condenser tube service. In all cases, local codes will take precedence over these recommendations.

Note: Required vertical clearance above the unit is 36" (914.4 mm). There should be no piping or conduit located over the compressor motor.)

Note: If the room configuration requires a variance to the clearance dimensions, contact your Trane Sales Office Representative.

Ventilation

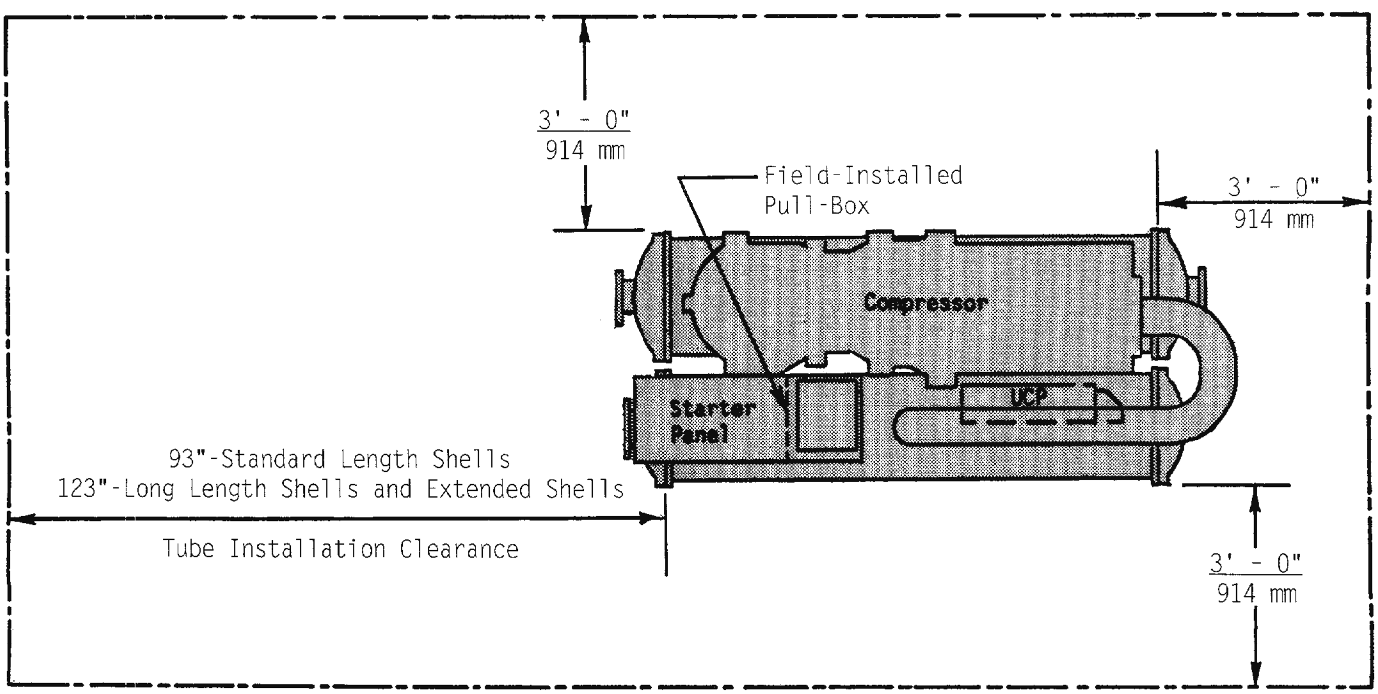
Make provisions to remove heat generated by unit operation from the equipment room. Ventilation must be adequate to maintain an ambient temperature lower than 125 F (52.5 C). The evaporator, condenser and compressor pressure relief valves must be vented in accordance with all local and national codes. Refer to "Pressure Relief Valves".

Make provisions in the equipment room to keep the chiller from being subject to freezing temperatures (32 F/0 C)

Drainage

Locate the unit near a large capacity drain for water vessel drain-down during shutdown or repair. Condensers and evaporators are provided with drain connections. Refer to "Unit Piping". All local and national codes apply.

Figure 9
Recommended Operating and Service Clearances for RTHA Units



Note: Report any damage incurred during handling or installation to the Trane sales office immediately. An Installation Check Sheet is provided on Page 79.

Access Restrictions

The 130 and 150-ton RTHA units will pass through a standard 36-inch doorway. All larger units require additional clearance. Refer to the unit submittals for specific "per unit" dimensional information.

Rigging

The Model RTHA chiller should be moved by lifting. Refer to Figures 7 and 8 for typical unit lifting and operating weights. Refer to the rigging diagram that ships with each unit for specific "per unit" weight data.

WARNING: To prevent injury or death and unit damage, capacity of lifting equipment must exceed unit lifting weight by an adequate safety factor.

Lifting Procedure

[ ] Remove shipping skid. If absolutely necessary, the chiller can be pushed or pulled across a smooth surface as long as it is bolted to the shipping skid.

Caution: To prevent damage do not use a forklift to lift the unit. The skid is not designed to support unit weight at any one point.

Refer to "Shipping Skid Removal" on the next page for skid removal procedure.

[ ] Install clevis connectors in the lifting holes provided on the unit (Figures 7 and 8).

WARNING: To prevent injury or death and unit damage, use horizontal lifting method shown in Figures 7 and 8.

[ ] Attach lifting chains or cables to clevis connectors. Each cable alone must be strong enough to lift the chiller.

[ ] Attach cables to lifting beam. Total lifting weight, lifting weight distribution and required lifting beam dimensions are shown by the rigging diagram shipped with each unit and in Figures 7 and 8. Lifting beam crossbars must be positioned so lifting cables do not contact unit piping or starter panel enclosure.

Caution: To prevent unit damage, position lifting beam so that cables do not contact the unit.

[ ] Connect a safety chain or cable loosely between the lifting beam and the threaded coupling or eyelet provided at the top of the compressor oil separator housing. Use an eyebolt or clevis to secure the safety chain at the coupling or eyelet. This is not a lifting chain, but is a safety device to ensure that the unit cannot roll over during lifting.

WARNING: To prevent injury or death and unit damage, connect untensioned safety chain between lifting beam and compressor before lifting.

Alternate Moving Methods

If it is not possible to rig from above as shown in Figures 7 and 8, the unit may also be moved by jacking each end high enough to move an equipment dolly under each tube sheet support. Once securely mounted on the dollies, the unit may be rolled into position. Proper jacking locations are shown in Figure 10 and by the rigging diagram that ships with the unit.

Optional Shipping Skid (Removal)

The RTHA chillers may be skid-mounted for shipping. After the unit is at its final location, remove the bolts that secure the unit to the skid. Rig the unit properly, as described above, and lift from above or jack the unit at the points shown by the rigging diagram that ships with the unit, or as shown in Figures 7, 8, and 10, and remove the skid.

WARNING: To prevent injury or death and unit damage, do not remove the skid until the unit is in its final location, Use the horizontal lifting method shown in Figures 7 or 8.

Isolation Pads

Four, properly-sized neoprene isolation pads are shipped (as standard) in the control panel or the starter panel.

During final positioning of the unit, place the isolation pads under the evaporator and condenser tube sheet supports as shown in Figure 10. Level the unit as described in the following paragraph.

Note: Durometer values are a measure of resilience. See Figure 10.

The neoprene isolators are adequate for most installations. For additional details on isolation practices, refer to Engineering Bulletin RLC-EB-6.

Unit Leveling

Check unit level end-to-end by placing a level on the top surface of the condenser shell. The unit-mounted starter panel may interfere with leveling. If there is insufficient surface available on the top of the condenser shell, attach a magnetic level to the bottom of the condenser shell to level the unit. Unit should be level to within 1/16" (1.6 mm) over its length. Place the level on the condenser shell tube sheets to check side-to-side (front-to-back) level. Adjust to within 1/16" (1.6 mm) of level front-to-back. Use full-length shims to level the unit.

Note: The control panel side of the unit is designated as the unit "front".

Water Piping

Make water piping connections to evaporator and condenser(s). Isolate and support piping to prevent stress on the unit. Construct piping according to local and national codes. Insulate and flush piping before connecting to unit.

Caution: To prevent equipment damage, bypass the unit if using an acidic flushing agent.

Piping Connections

Use gasketed, flange-type connectors for all water piping connections. Evaporator and condenser water inlet and outlet sizes and locations are shown by the unit submittals. See Figures 11 and 12. Use flanged ells or spool pieces to facilitate service procedures.

Reversing Water Boxes

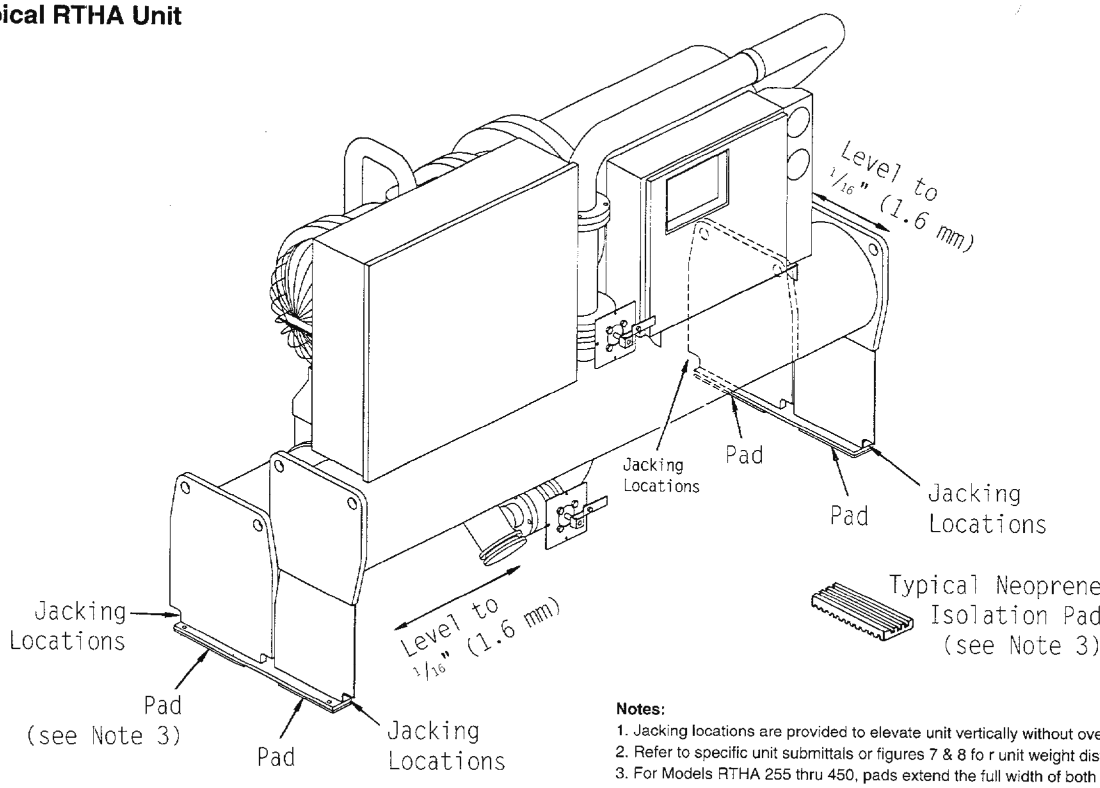
All water boxes may be reversed end-for-end. If evaporator water boxes are reversed and the standard leaving water temperature sensor is being used, remove the sensor from the threaded boss on the leaving water flange before removing the water box. Complete the water box switch procedure and replace the sensor in the leaving water flange of the water box.

Note: Be certain to replace water boxes right-side-up to maintain proper baffle orientation. Use new O-rings.

Condenser Water Temperature

Caution: The minimum acceptable entering water temperature at the condenser must be 15°F above the leaving water temperature at the evaporator. For additional details, refer to Engineering Bulletin RLC-EB-4.

Figure 10
Isolator Pad Placement for Typical RTHA Unit



Notes:
1. Jacking locations are provided to elevate unit vertically without overhead rigging.
2. Refer to specific unit submittals or figures 7 & 8 fo r unit weight distribution.
3. For Models RTHA 255 thru 450, pads extend the full width of both legs.

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ACCEPTABLE PAD CONFIGURATIONS

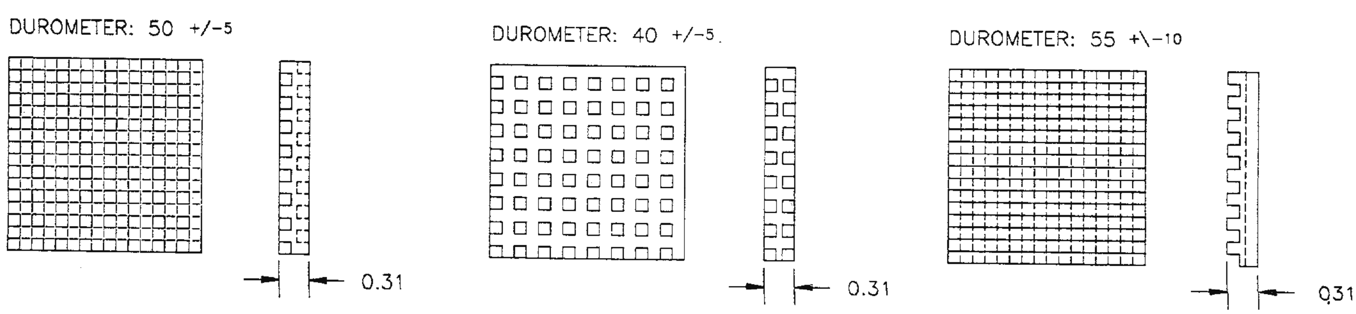
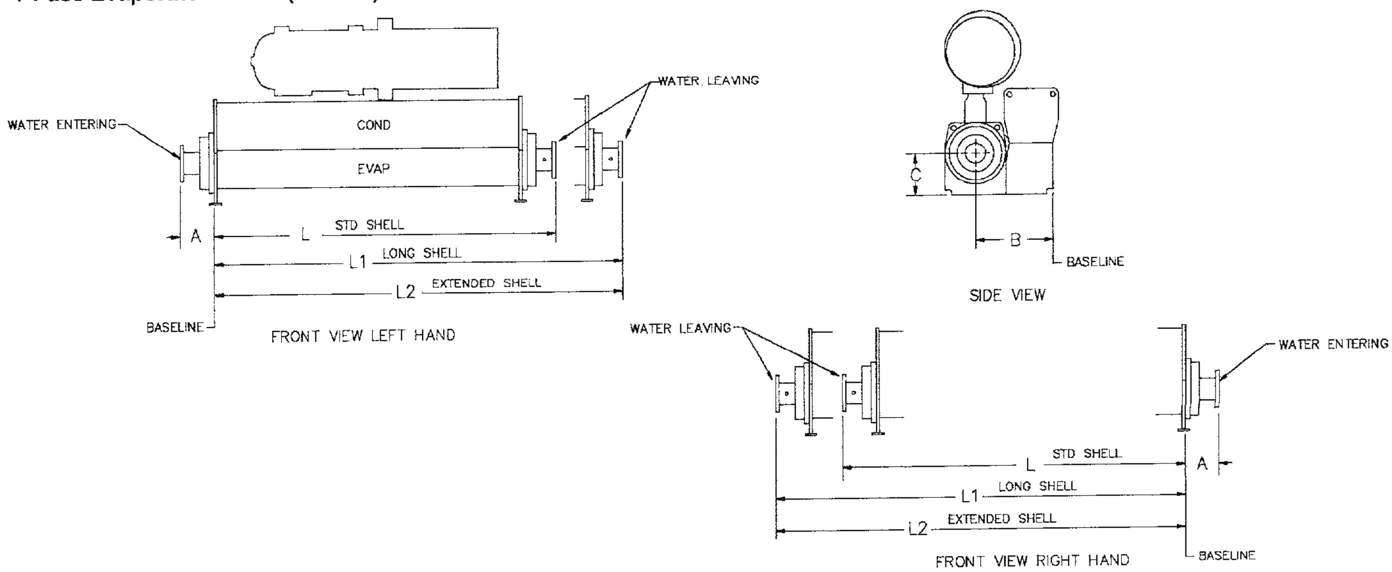


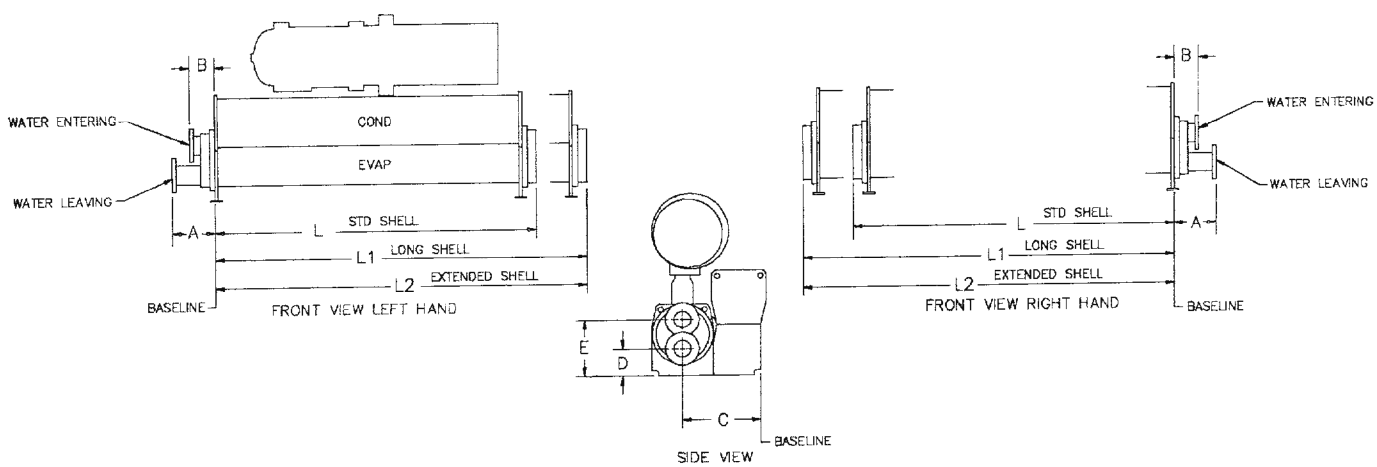
Figure 11
Evaporator Entering and Leaving Water Connections

1-Pass Evaporator Boxes (150 PSI)



	UNIT	A	B	C	L	L1	* L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
150 PSI	130/150 STD/LONG	10 1/8"	1'-11 1/4"	1'-0 1/2"	8'-6"	11'		6	9 1/2"	8	3/4"
	180/215 STD/LONG	10 3/4"	2'-5 5/8"	1'-3"	8'-6 1/2"	11'-0 1/2"		8	11 3/4"	8	3/4"
	180/215 EXTENDED	10 7/8"	2'-9 1/4"	1'-5"			11'-0 5/8"	10	14 1/4"	12	7/8"
	255/300 STD/LONG	10 7/8"	2'-9 1/4"	1'-5"	8'-6 5/8"	11'-0 5/8"		10	14 1/4"	12	7/8"
	255/300 EXTENDED	1'-2 1/8"	3'-6 7/8"	1'-7 7/8"			11'-4"	12	17"	12	7/8"
	380/450 STD/LONG	1'-2 1/8"	3'-6 7/8"	1'-7 7/8"	8'-10"	11'-4"		12	17"	12	7/8"

2-Pass Evaporator Boxes (150 and 300 PSI)

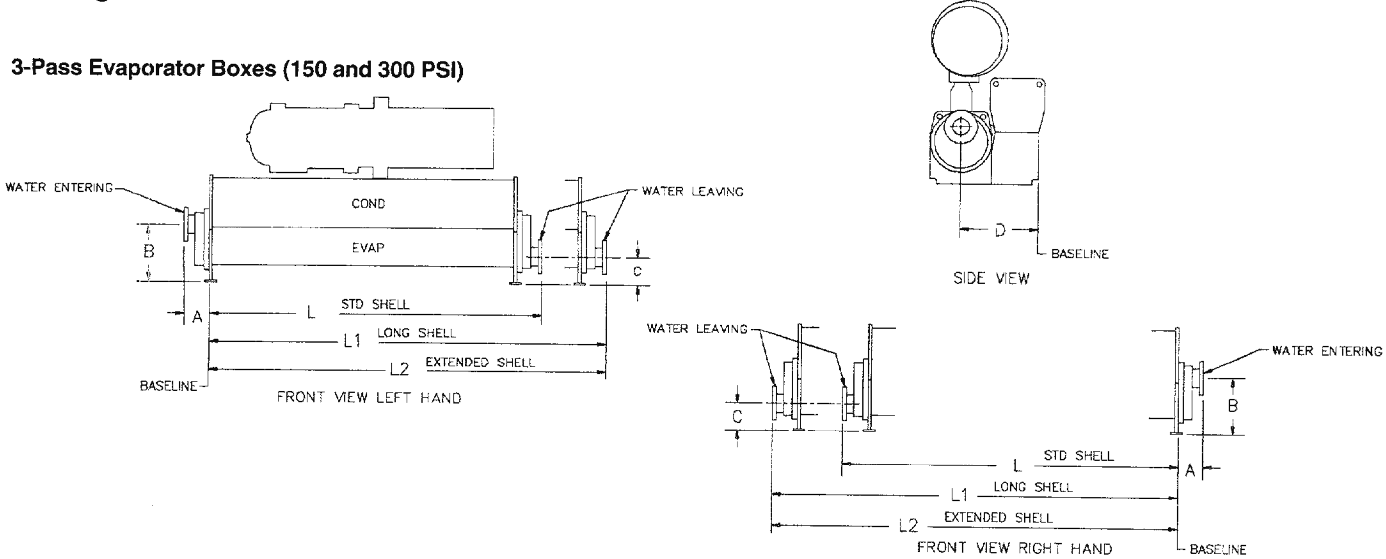


	UNIT	A	B	C	D	E	L	L1	L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
150 PSI	130/150 STD/LONG	1'-4 1/8"	8 5/8"	1'-11 1/4"	8 1/8"	1'-4 7/8"	8'-0 1/8"	10'-6 1/8"		5	8 1/2"	8	3/4"
	180/215 STD/LONG	1'-5 1/4"	9 3/4"	2'-5 5/8"	9 3/4"	1'-8 1/4"	8'-0 7/8"	10'-6 7/8"		6	9 1/2"	8	3/4"
	180/215 EXTENDED	10"	10"	2'-9 1/4"	11"	1'-11"			10'-7 1/8"	6	9 1/2"	8	3/4"
	255/300 STD/LONG	10"	10"	2'-9 1/4"	11"	1'-11"	8'-1 1/8"	10'-7 1/8"		6	9 1/2"	8	3/4"
	255/300 EXTENDED	1'-10 1/4"	1'-1 5/8"	3'-6 7/8"	1'-1 3/8"	2'-2 3/8"			10'-9 1/8"	8	11 3/4"	8	3/4"
	380/450 STD/LONG	1'-10 1/4"	1'-1 5/8"	3'-6 7/8"	1'-1 3/8"	2'-2 3/8"	8'-3 1/8"	10'-9 1/8"		8	11 3/4"	8	3/4"

	UNIT	A	B	C	D	E	L	L1	L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
300 PSI	130/150 STD/LONG	1'-4 1/2"	9"	1'-11 1/4"	8 1/8"	1'-4 7/8"	8'-0 1/8"	10'-6 1/8"		5	9 1/4"	8	3/4"
	180/215 STD/LONG	1'-5 1/2"	10"	2'-5 5/8"	9 3/4"	1'-8 1/4"	8'-0 7/8"	10'-6 7/8"		6	10 5/8"	12	3/4"
	180/215 EXTENDED	1'-5 3/4"	10 1/4"	2'-9 1/4"	11"	1'-11"			10'-7 1/8"	6	10 5/8"	12	3/4"
	255/300 STD/LONG	1'-5 3/4"	10 1/4"	2'-9 1/4"	11"	1'-11"	8'-1 1/8"	10'-7 1/8"		6	10 5/8"	12	3/4"
	255/300 EXTENDED	1'-10 1/4"	1'-1 5/8"	3'-6 7/8"	1'-1 3/8"	2'-2 3/8"			10'-9 1/8"	8	13"	12	7/8"
	380/450 STD/LONG	1'-10 1/4"	1'-1 5/8"	3'-6 7/8"	1'-1 3/8"	2'-2 3/8"	8'-3 1/8"	10'-9 1/8"		8	13"	12	7/8"

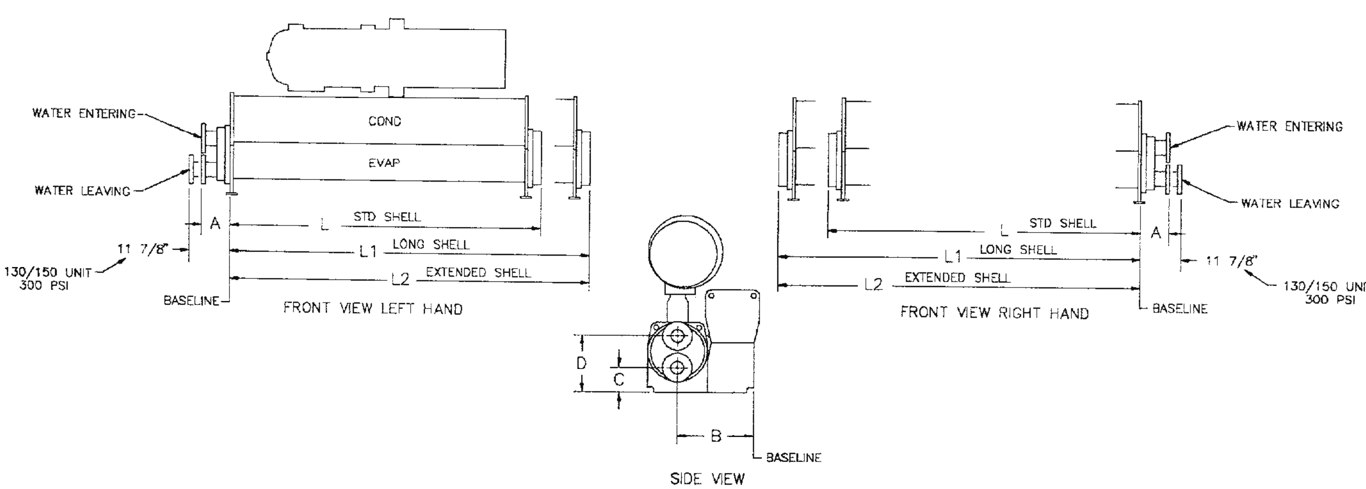
Figure 11 (Continued)
Evaporator Entering and Leaving Water Connections

3-Pass Evaporator Boxes (150 and 300 PSI)



	UNIT	A	B	C	D	L	L1	L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
150 PSI	130/150 STD/LONG	7 1/2"	1'-5 3/8"	7 5/8"	1'-11 1/4"	8'-3 3/8"	10'-9 3/8"		4	7 1/2"	8	5/8"
	180/215 STD/LONG	8 3/8"	1'-9"	9"	2'-5 5/8"	8'-4 1/4"	10'-10 1/4"		5	8 1/2"	8	3/4"
	180/215 EXTENDED	8 7/8"	1'-11 1/2"	10 1/2"	2'-9 1/4"			10'-10 5/8"	5	8 1/2"	8	3/4"
	255/300 STD/LONG	8 7/8"	1'-11 1/2"	10 1/2"	2'-9 1/4"	8'-4 5/8"	10'-10 5/8"		5	8 1/2"	8	3/4"
	255/300 EXTENDED	11 1/2"	2'-3 5/8"	1'-0 1/4"	3'-6 7/8"			11'-1 3/8"	6	9 1/2"	8	3/4"
	380/450 STD/LONG	11 1/2"	2'-3 5/8"	1'-0 1/4"	3'-6 7/8"	8'-7 3/8"	11'-1 3/8"		6	9 1/2"	8	3/4"
300 PSI	130/150 STD/LONG	8 1/4"	1'-5 3/8"	7 5/8"	1'-11 1/4"	8'-4 1/4"	10'-10 1/4"		4	7 7/8"	8	3/4"
	180/215 STD/LONG	10"	1'-8 3/4"	9 1/4"	2'-5 5/8"	8'-5 3/4"	10'-11 3/4"		5	9 1/4"	8	3/4"
	180/215 EXTENDED	10 1/4"	1'-11 1/4"	10 3/4"	2'-9 1/4"			11'	5	9 1/4"	8	3/4"
	255/300 STD/LONG	10 1/4"	1'-11 1/4"	10 3/4"	2'-9 1/4"	8'-6"	11'		5	9 1/4"	8	3/4"
	255/300 EXTENDED	1'-0 3/8"	2'-3 3/8"	1'-0 3/8"	3'-6 7/8"			11'-2 1/8"	6	10 5/8"	12	3/4"
	380/450 STD/LONG	1'-0 3/8"	2'-3 3/8"	1'-0 3/8"	3'-6 7/8"	8'-8 1/8"	11'-2 1/8"		6	10 5/8"	12	3/4"

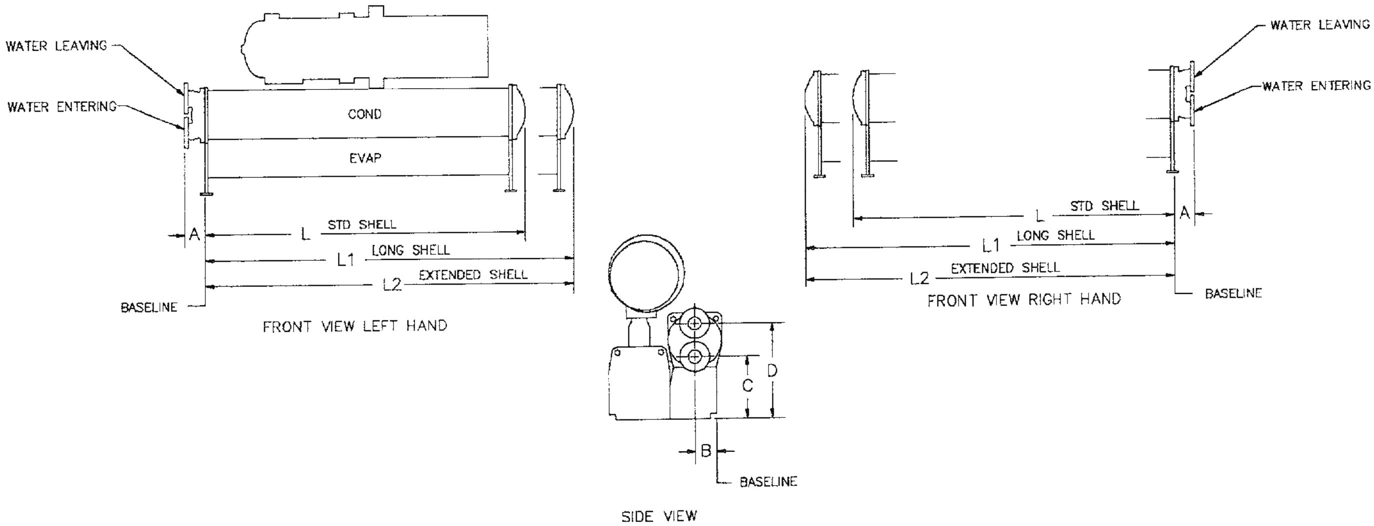
4-Pass Evaporator Boxes (150 and 300 PSI)



	UNIT	A	B	C	D	L	L1	L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
150 PSI	130/150 STD/LONG	8"	1'-11 1/4"	7 5/8"	1'-5 3/8"	8'-0 1/8"	10'-6 1/8"		4	7 1/2"	8	5/8"
	180/215 STD/LONG	9 1/2"	2'-5 5/8"	9 1/4"	1'-8 3/4"	8'-0 7/8"	10'-6 7/8"		5	8 1/2"	8	3/4"
	180/215 EXTENDED	9 3/4"	2'-9 1/4"	10 7/8"	1'-11 1/4"			10'-7 1/8"	5	8 1/2"	8	3/4"
	255/300 STD/LONG	9 3/4"	2'-9 1/4"	10 7/8"	1'-11 1/4"	8'-1 1/8"	10'-7 1/8"		5	8 1/2"	8	3/4"
	255/300 EXTENDED	1'-0 1/4"	3'-6 7/8"	1'-0 5/8"	2'-3 1/8"			10'-9 1/8"	6	9 1/2"	8	3/4"
	380/450 STD/LONG	1'-0 1/4"	3'-6 7/8"	1'-0 5/8"	2'-3 1/8"	8'-3 1/8"	10'-9 1/8"		6	9 1/2"	8	3/4"
300 PSI	130/150 STD/LONG	8 1/4"	1'-11 1/4"	7 5/8"	1'-5 3/8"	8'-0 1/8"	10'-6 1/8"		4	7 7/8"	8	3/4"
	180/215 STD/LONG	10"	2'-5 5/8"	9 1/4"	1'-8 3/4"	8'-0 7/8"	10'-6 7/8"		5	9 1/4"	8	3/4"
	180/215 EXTENDED	10 1/4"	2'-9 1/4"	10 7/8"	1'-11 1/4"			10'-7 1/8"	5	9 1/4"	8	3/4"
	255/300 STD/LONG	10 1/4"	2'-9 1/4"	10 7/8"	1'-11 1/4"	8'-1 1/8"	10'-7 1/8"		5	9 1/4"	8	3/4"
	255/300 EXTENDED	1'-0 3/8"	3'-6 7/8"	1'-0 5/8"	2'-3 1/8"			10'-9 1/8"	6	10 5/8"	12	3/4"
	380/450 STD/LONG	1'-0 3/8"	3'-6 7/8"	1'-0 5/8"	2'-3 1/8"	8'-3 1/8"	10'-9 1/8"		6	10 5/8"	12	3/4"

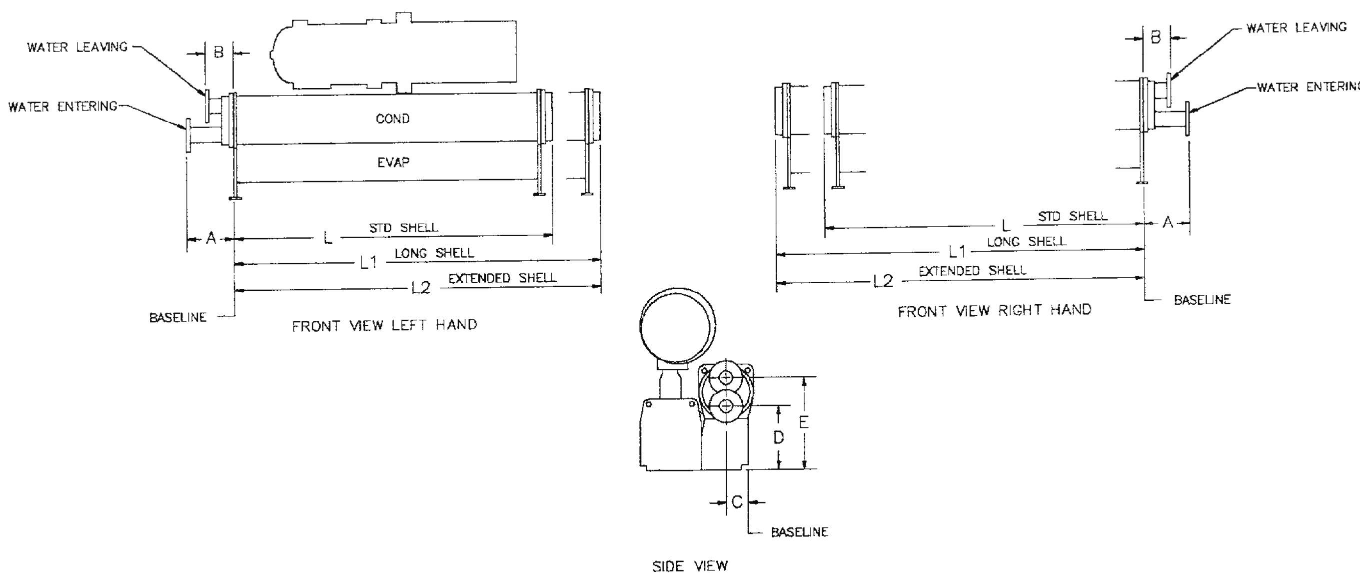
Figure 12
Condenser Entering and Leaving Water Connections

2-Pass Condenser Boxes (150 PSI)



	UNIT	A	B	C	D	L	L1	L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
150 PSI	130/150 STD/LONG	6 1/8"	6 1/2"	1'-6 1/2"	2'-4 1/2"	7'-11 7/8"	10'-5 7/8"		4	7 1/2"	8	5/8"
150 PSI	180/215 STD/LONG	7"	7 5/8"	1'-10"	2'-9"	8'-0 1/2"	10'-6 1/2"		5	8 1/2"	8	3/4"
150 PSI	180/215 EXTENDED	7 5/8"	8 7/8"	2'-2 1/4"	3'-2 1/4"			10'-7"	6	9 1/2"	8	3/4"
150 PSI	255/300 STD/LONG	7 5/8"	8 7/8"	2'-3 1/4"	3'-3 1/4"	8'-1"	10'-7"		6	9 1/2"	8	3/4"
150 PSI	255/300 EXTENDED	9 5/8"	10 7/8"	2'-8 1/2"	3'-11"			10'-8 7/8"	8	11 3/4"	8	3/4"
150 PSI	380/450 STD/LONG	9 5/8"	10 7/8"	2'-8 1/2"	3'-11"	1'-2 7/8"	10'-8 7/8"		8	11 3/4"	8	3/4"

2-Pass Condenser Boxes (300 PSI)



	UNIT	A	B	C	D	E	L	L1	L2	PIPE SIZES	FLANGES BOLT CIRCLE	FLANGES NO. OF BOLTS	FLANGES BOLT SIZE
300 PSI	130/150 STD/LONG	15 1/4"	8"	6 1/2"	1'-7 5/8"	2'-3 1/2"	7'-11 7/8"	10'-5 7/8"		4	7 7/8"	8	3/4"
300 PSI	180/215 STD/LONG	17 1/4"	10"	7 5/8"	1'-11"	2'-8"	8'-0 7/8"	10'-6 7/8"		5	9 1/4"	8	3/4"
300 PSI	180/215 EXTENDED	18 1/4"	10 3/4"	8 7/8"	2'-3 1/8"	3'-1 1/2"			10'-7 1/2"	6	10 5/8"	12	3/4"
300 PSI	255/300 STD/LONG	18 1/4"	10 3/4"	8 7/8"	2'-4 1/8"	3'-2 1/2"	8'-1 1/2"	10'-7 1/2"		6	10 5/8"	12	3/4"
300 PSI	255/300 EXTENDED	22 1/8"	13 3/8"	10 7/8"	2'-9 1/2"	3'-10"			10'-9 1/8"	8	13"	12	7/8"
300 PSI	380/450 STD/LONG	22 1/8"	13 3/8"	10 7/8"	2'-9 1/2"	3'-10"	8'-3 1/8"	10'-9 1/8"		8	13"	12	7/8"

Making Flange Connections

Align the flanges and tighten all bolts snug, following the tightening sequence shown in Figure 13. Repeat the sequence, torquing the 5/8" (16 mm) flange bolts to 150 ft.-lbs (203 N.m). Improperly tightened flanges may leak.

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

Vents and Drains

Install pipe plugs (shipped in spare parts box) in evaporator and condenser water box drain and vent connections before filling the water systems. To drain water, remove vent and drain plugs, install a NPT connector in the drain connection and connect a hose to it.

Evaporator Piping Components

"Piping components" include all devices and controls used to provide proper water system operation and unit operating safety. These components and their general locations are given below.

Entering Chilled Water Piping

[ ] Air vents (to bleed air from system).

[ ] Water pressure gauges with shutoff valves.

[ ] Pipe unions.

[ ] Vibration eliminators.

[ ] Shutoff (isolation) valves.

[ ] Thermometers.

[ ] Cleanout tees.

[ ] Pipe strainer.

[ ] Flow switch.

Caution: To prevent tube damage install strainer in evaporator water inlet piping.

Leaving Chilled Water Piping

[ ] Air vents (to bleed air from system).

[ ] Water pressure gauges with shutoff valves.

[ ] Pipe unions.

[ ] Vibration eliminators.

[ ] Shutoff (isolation) valves.

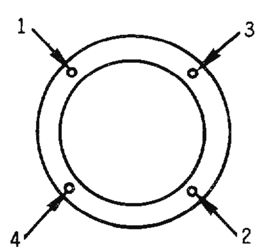
[ ] Thermometers.

[ ] Cleanout tees.

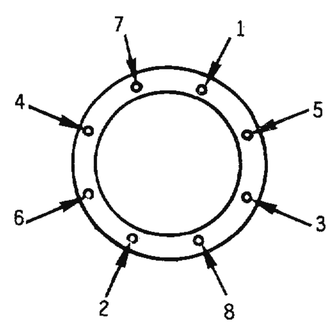
[ ] Balancing valve.

Caution: To prevent evaporator damage, do not exceed 150 psig (10.3 bar) evaporator water pressure for standard water boxes. Maximum pressure for high pressure water boxes is 300 psig (20.7 bar).

Figure 13
Bolt Tightening Sequence for 4-Bolt and 8-Bolt Pipe Flanges



4-Bolt Flange



8-Bolt Flange

Condenser Piping Components

"Piping components" include all devices and controls used to provide proper water system operation and unit operating safety. These components and their general locations are given below.

Cooling Tower System

Entering condenser water piping.

[ ] Air vents (to bleed air from system).

[ ] Water pressure gauges with shutoff valves.

[ ] Pipe unions.

[ ] Vibration eliminators.

[ ] Shutoff (isolation) valves.

[ ] Thermometers.

[ ] Cleanout tees.

[ ] Pipe strainer.

[ ] Flow switch.

Caution: To prevent condenser damage, do not exceed 150 psig (10.3 bar) evaporator water pressure for standard water boxes. Maximum pressure for high pressure water boxes is 300 psig (20.7 bar). Caution: To prevent tube damage install strainer in condenser water inlet piping.

Leaving condenser water piping.

[ ] Air vents (to bleed air from system).

[ ] Water pressure gauges with shutoff valves.

[ ] Pipe unions.

[ ] Vibration eliminators.

[ ] Shutoff (isolation) valves.

[ ] Thermometers.

[ ] Cleanout tees.

[ ] Balancing valve.

[ ] Bypass valve (manual or automatic).

Well (City) Water System

Entering condenser water piping.

[ ] Air vents (to bleed air from system).

[ ] Water pressure gauges with shutoff valves.

[ ] Pipe unions.

[ ] Vibration eliminators.

[ ] Shutoff (isolation) valves. One per each pass.

[ ] Thermometers.

[ ] Cleanout tees.

[ ] Pipe strainer.

[ ] Flow switch.

[ ] Pressure reducing valve.

Caution: To prevent condenser damage, do not exceed 150 psig (10.3 bar) evaporator water pressure for standard water boxes. Maximum pressure for high pressure water boxes is 300 psig (20.7 bar).

Caution: To prevent tube damage install strainer in condenser water inlet piping.

Leaving condenser water piping.

[ ] Air vents (to bleed air from system).

[ ] Water pressure gauges with shutoff valves.

[ ] Pipe unions.

[ ] Vibration eliminators.

[ ] Shutoff (isolation) valves. One per each pass.

[ ] Thermometers.

[ ] Cleanout tees.

[ ] Balancing valve.

Water Regulating Valve

The water regulating valve, for use when cold condenser water temperature is anticipated, maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to compressor discharge pressure. Adjust the valve for proper operation during unit start-up.

Note: See Engineering Bulletin RLC-EB-4 for additional information on tower water control.

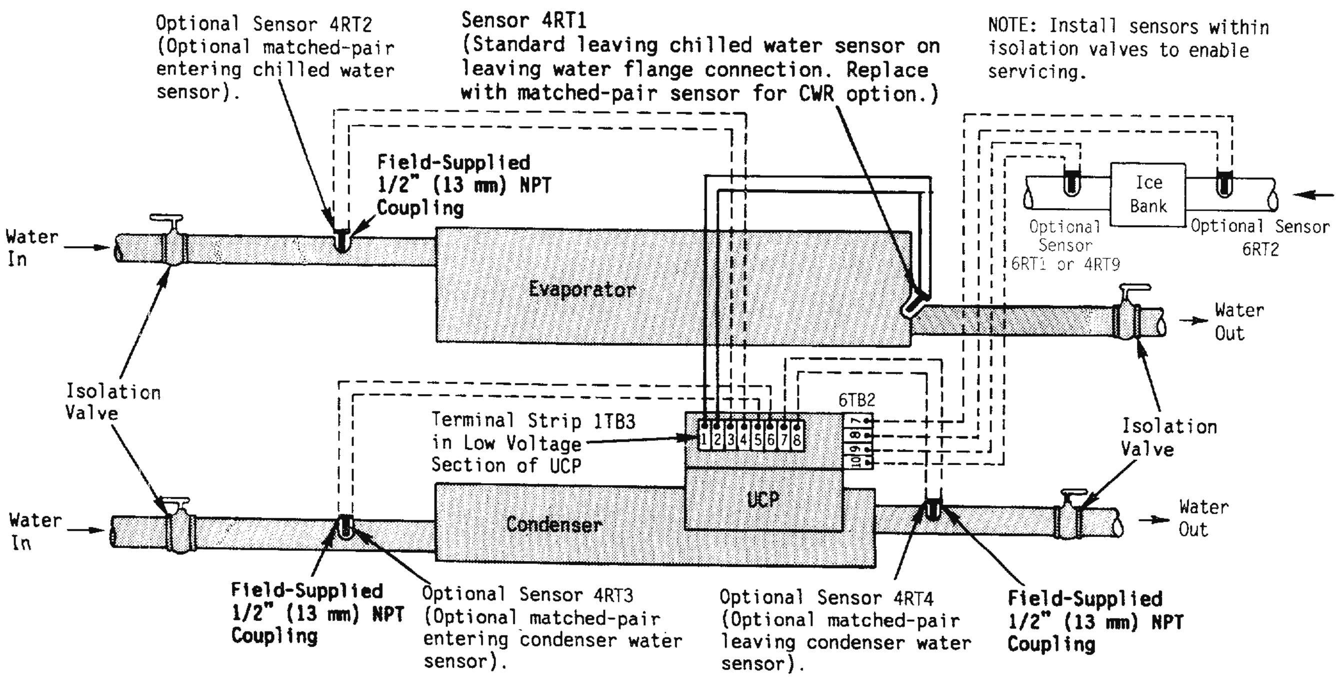
Field-Installed Water Temperature Sensors

Depending on control options selected, 1 to 6 water temperature sensors may have to be installed in the water piping. The sensors are shipped in the starter panel or in the control panel. Proper sensor locations are schematically represented by Figure 14 Connect sensor leads to the proper terminals of the UCM (Refer to "Electrical Wiring").

Figure 14
Sensor Installation Schematic for Typical RTHA Unit

Item Description	Trane Supplied	Contractor Supplied	Contractor Installed	Trane Installed
Standard Leaving Chilled Water Sensor (4RT1)	X			X
Optional (Matched-Pair) Leaving Chilled Water Sensor (4RT1)	X	½" NPT Coupling	X	
Optional (Matched-Pair) Entering Chilled Water Sensor (4RT2)	X	½" NPT Coupling	X	
Optional (Matched-Pair) Entering Condensing Water Sensor (4RT4)	X	½" NPT Coupling	X	
Optional (Matched-Pair) Leaving Condensing Water Sensor (4RT3)	X	½" NPT Coupling	X	
Optional Entering Ice Bank Temperature Sensor (6RT2) (For Design Sequence A thru H_.)	X	½" NPT Coupling	X	
Optional Leaving Ice Bank Temperature Sensor (6RT1 or 4RT9)	X	½" NPT Coupling	X	
Water Pressure Gauges		X	X	
Thermometers		X	X	
Water Box Valves		X	X	
Flow Sensing Devices (Optional)	*	X	X	
Air Vents		X	X	
Drain Valves		X	X	
Isolation Valves		X	X	
Balancing Valves		X	X	
Water Pressure Relief Valves		X	X	

* May be ordered from Trane.
Note: All wiring shown by dotted lines (- - - - -) provided by installer. Solid lines indicate factory wiring.



Standard Sensor

[ ] The standard leaving chilled water temperature sensor is factory-mounted in the water box on the leaving water end of the evaporator (4RT1 location).

Load-based, Setpoint Reset Option

[ ] *If the load-based, chilled* water setpoint reset option is specified, a matched-pair of sensors are provided. Install one of the sensors at the 4RT2 location in the evaporator chilled water inlet piping as shown in Figure 14.

Next, disconnect electrical leads for the standard sensor at terminal strip 1TB3 on the UCM. Refer to "Low Voltage Control Wiring". Remove the sensor from the boss on the evaporator leaving water outlet (4RT1 location) and install the remaining matched pair sensor (no bulbwell required) in its place.

Note: Refer to "Sensor Installation Procedure", below.

The standard sensor (removed from evaporator water box) can be installed in the 4RT6 location as an ambient sensor if ambient-based chilled water setpoint reset is specified. Otherwise, the standard sensor is not used.

Water Temperature Sensing Kit Option

[ ] **A temperature bulb well is not required for temperature sensor installation. Sensors are designed for direct immersion to provide more efficient tracking and system operation. The stainless steel construction of the sensors prevents fatigue failure.**

[ ] When the optional Water Temperature Sensing Kit is specified, two sets of matched-pair sensors are provided. Install one pair as described in "Load-based, Setpoint Reset Option", above.

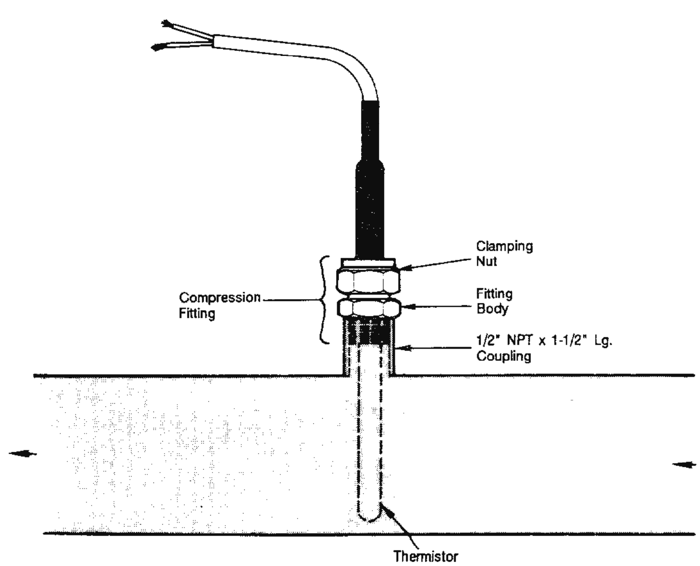
Using the other pair, install one of the sensors at the 4RT3 location in the condenser water outlet piping. Install the second sensor of the pair at the 4RT4 location in the condenser water inlet piping.

Note: Refer to "Sensor Installation Procedure", below.

Sensor Installation Procedure

Field-installed sensors must be properly located to read a good, mixed-water temperature. An installed sensor and fitting are illustrated in Figure 15.

Figure 15
Water Temperature Sensor Installation



1. At each sensor location, cut a properly sized hole in the piping and weld a 1/4 inch NPT half-coupling (field provided) on to the piping.

2. Using teflon tape, install the entire sensor compression fitting into the coupling and tighten securely by turning the hex nut on the fitting body only.

Caution: Do not tighten the clamping nut at this time. This will prevent proper sensor insertion.

3. Insert the sensor into the compression fitting (through the clamping nut) until the plastic coating on the sensor contacts the top of the clamping nut.

4. Use a wrench to carefully tighten the clamping nut until the sensor can no longer be turned by hand.

5. Scribe a reference line on the clamping nut at the "six o'clock" position. Then, while observing this reference point, tighten the nut 1-1/4 additional turns.

Water Treatment

Using untreated or improperly treated water in these units may result in inefficient operation and possible tube damage. Consult a qualified water treatment specialist to determine whether treatment is needed. The following disclamatory label is provided on each RTHA 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.

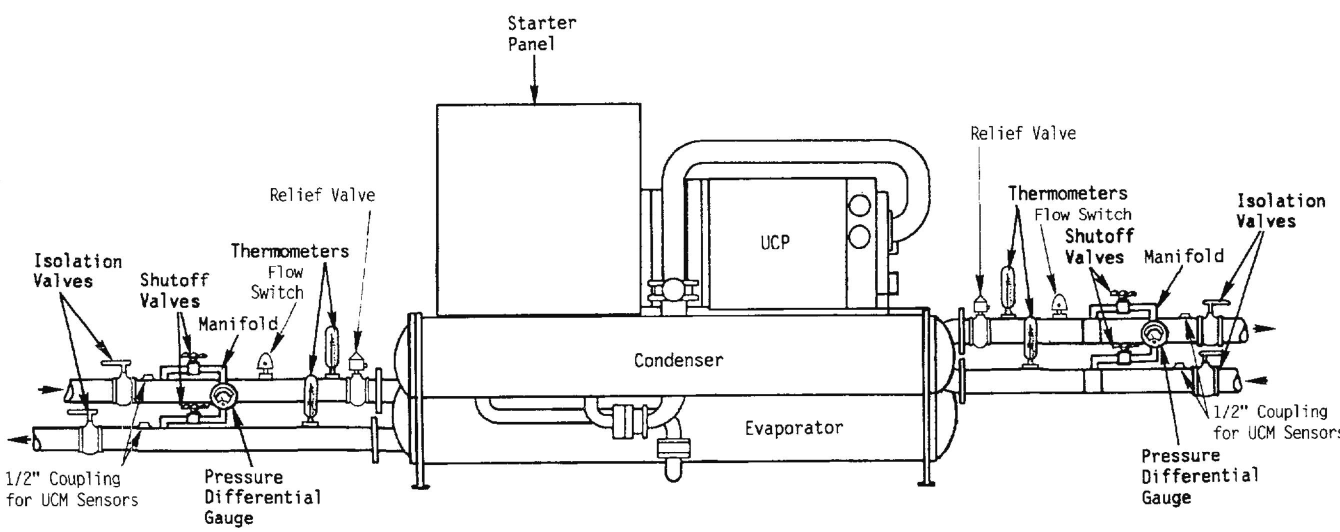
Caution: Do not use untreated or improperly treated water. Equipment damage may occur.

Water Pressure Gauges and Thermometers

Install field-supplied thermometers and pressure gauges (with manifolds, whenever practical) as shown in Figure 16. Locate pressure gauges or taps in a straight run of pipe; avoid placement near elbows, etc. Be sure to install the gauges at the same elevation on each shell if the shells have opposite-end water connections.

To read manifolded pressure gauges, open one valve and close the other (depending upon the reading desired). This eliminates errors resulting from differently calibrated gauges installed at unmatched elevations.

Figure 16
Typical Thermometer, Valving and Manifolded Pressure Gauge Setup



Water Pressure Relief Valves

Install a water pressure relief valve in one of the condenser and one of the evaporator water box drain connections. Water vessels with close-coupled shutoff valves have a high potential for hydrostatic pressure buildup on a water temperature increase. Refer to applicable codes for relief valve installation guidelines.

Caution: To prevent shell damage, install pressure relief valves in both evaporator and condenser water systems.

Flow-Sensing Devices

Use field provided flow switches or differential pressure switches with pump interlocks to sense system water flows. Flow switch locations are schematically shown in Figures 16 and 20.

To provide chiller protection, install and wire flow switches in series with water pump interlocks for both chilled and condenser water circuits (refer to "Electrical Wiring"). Specific connection and schematic wiring diagrams shipped with the unit.

Flow switches must stop or prevent compressor operation if either system water flow drops off drastically. Follow the manufacturer's recommendations for selection and installation procedures. General guidelines for flow switch installation are outlined below:

1. Mount switch upright with minimum 5 pipe diameters straight, horizontal run on each side. Do not install close to elbows, orifices or valves.

Note: The arrow on the switch must point in the direction of water flow.

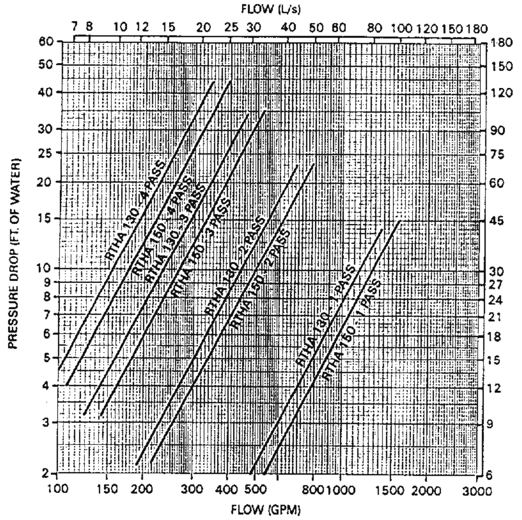
2. To prevent switch fluttering, remove all air from the water systems.

Note: The UCM provides a 2-second time delay before the shutting the unit down on a loss-of-flow diagnostic. Contact a qualified service organization if nuisance machine shutdowns persist.

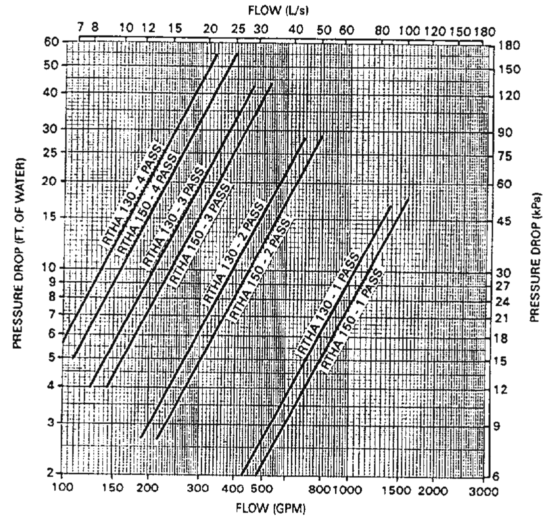
3. Adjust switch to open when water flow falls below nominal. Refer to Table 1 for minimum flow recommendations for specific water pass arrangements. Flow switch contacts are closed on proof of water flow.

Table 1
RTHA 130 Thru 300 Evaporator and Condenser Data

RTHA 130-150



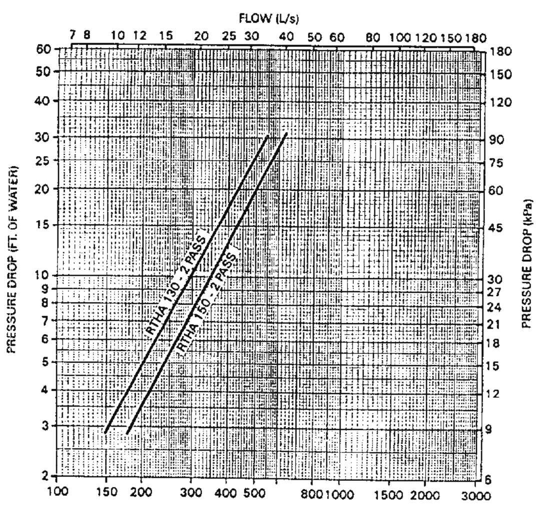
Standard Length Evaporators



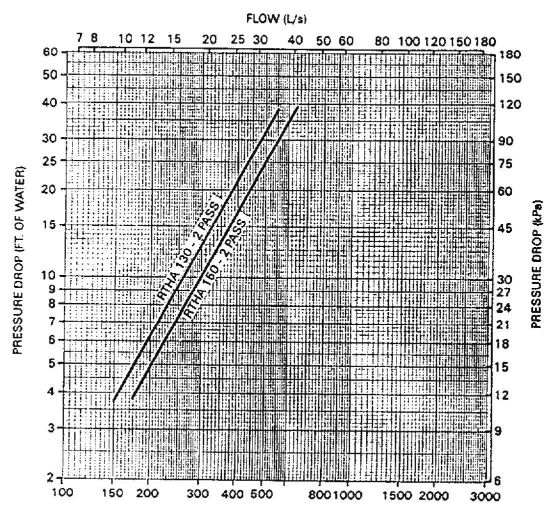
Long Length Evaporators

Evaporator Data

		RTHA 130								RTHA 150							
		Standard Shell				Long Shell				Standard Shell				Long Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage Capacity	(gal)	17	17	17	17	22	22	22	22	19	19	19	19	25	25	25	25
	(L)	64	64	64	64	83	83	83	83	72	72	72	72	95	95	95	95
Minimum Flow Rate	(GPM)	376	188	125	94	376	188	125	94	430	215	143	107	430	215	143	107
	(L/s)	24	12	8	6	24	12	8	6	27	14	9	7	27	14	9	7
Maximum Flow Rate	(GPM)	1374	687	458	344	1374	687	458	344	1576	788	525	394	1576	788	525	394
	(L/s)	87	43	29	22	87	43	29	22	99	50	33	25	99	50	33	25
Connection Size	(IN)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4



Standard Length Condensers



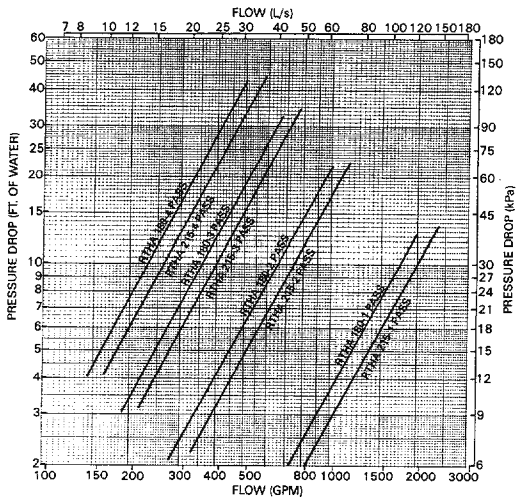
Long Length Condensers

Condenser Data

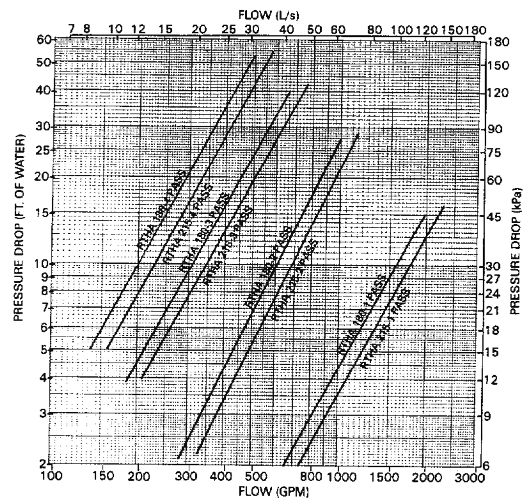
		RTHA 130		RTHA 150	
		Standard Shell	Long Shell	Standard Shell	Long Shell
		2 Pass	2 Pass	2 Pass	2 Pass
Storage Capacity	(gal)	13	17	15	20
	(L)	49	64	57	76
Minimum Flow Rate	(GPM)	149	149	173	173
	(L/s)	9	9	11	11
Maximum Flow Rate	(GPM)	545	545	636	636
	(L/s)	34	34	40	40
Connection Size	(IN)	4	4	4	4

Table 1 (Continued)
RTHA 130 Thru 450 Evaporator and Condenser Data

RTHA 180-215



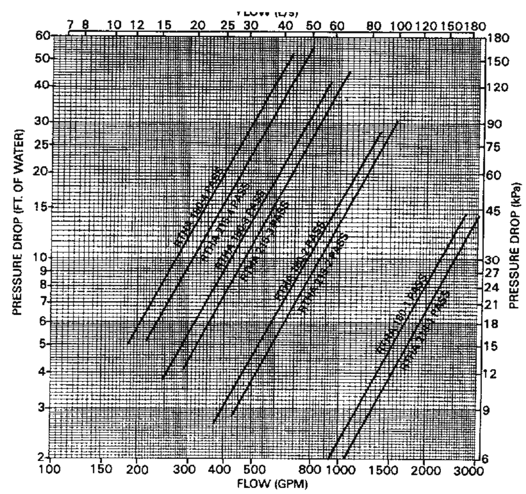
Standard Length Evaporators



Long Length Evaporators

180 Evaporator Data

		RTHA 180											
		Standard Shell				Long Shell				Extended Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage	(gal)	23	23	23	23	30	30	30	30	43	43	43	43
Capacity	(L)	87	87	87	87	114	114	114	114	163	163	163	163
Minimum	(GPM)	528	269	180	135	528	269	180	135	738	369	246	185
Flow Rate	(L/s)	33	17	11	6	33	17	11	6	47	25	16	12
Maximum	(GPM)	1938	969	646	485	1938	969	646	485	2710	1355	903	677
Flow Rate	(L/s)	122	61	41	31	122	61	41	31	171	84	57	43
Connection Size	(IN)	8	5	5	5	8	5	5	5	10	5	5	5



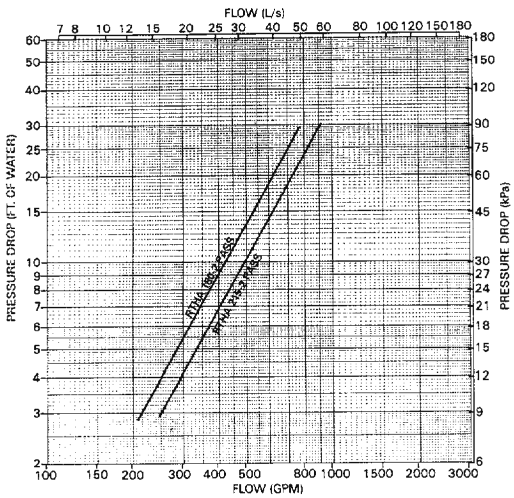
Extended Length Evaporators

215 Evaporator Data

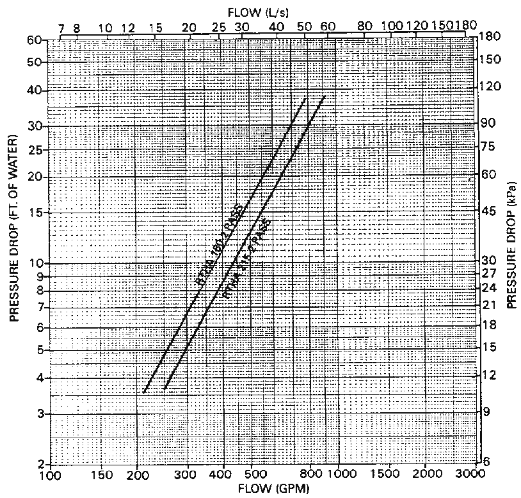
		RTHA 215											
		Standard Shell				Long Shell				Extended Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage	(gal)	27	27	27	27	35	35	35	35	49	49	49	49
Capacity	(L)	102	102	102	102	132	132	132	132	185	185	185	185
Minimum	(GPM)	618	309	206	155	618	309	206	155	858	429	286	215
Flow Rate	(L/s)	40	19	13	10	40	19	13	10	54	27	18	14
Maximum	(GPM)	2262	1131	754	566	2262	1131	754	566	3150	1575	1050	788
Flow Rate	(L/s)	143	71	48	36	143	71	48	36	199	99	66	50
Connection Size	(IN)	8	5	5	5	8	5	5	5	10	5	5	5

Table 1 (Continued)
RTHA 130 Thru 450 Evaporator and Condenser Data

RTHA 180-215



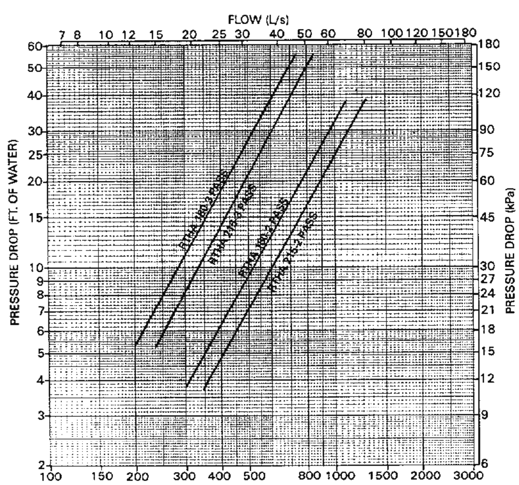
Standard Length Condenses



Long Length Condensers

Condenser Data

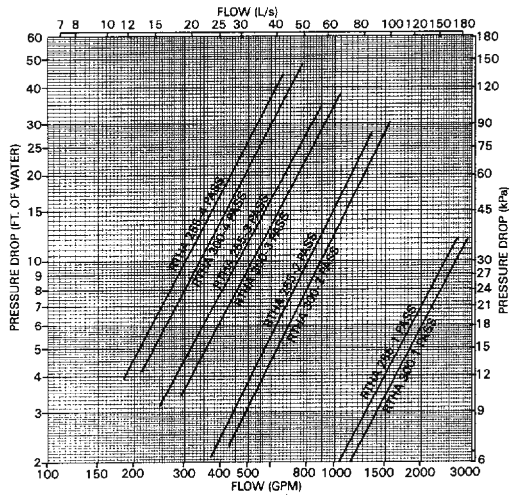
		RTHA 180				RTHA 215			
		Standard Shell	Long Shell	Extended Shell	Extended Shell	Standard Shell	Long Shell	Extended Shell	Extended Shell
		2 Pass	2 Pass	2 Pass	3 Pass	2 Pass	2 Pass	2 Pass	3 Pass
Storage	(gal)	19	25	35	35	22	29	40	40
Capacity	(L)	72	95	132	132	83	110	151	151
Minimum	(GPM)	210	210	297	198	247	247	347	234
Flow Rate	(L/s)	13	13	19	13	16	16	22	15
Maximum	(GPM)	772	772	1089	731	906	906	1272	854
Flow Rate	(L/s)	49	49	69	47	57	57	80	55
Connection Size	(IN)	5	5	6	6	5	5	6	6



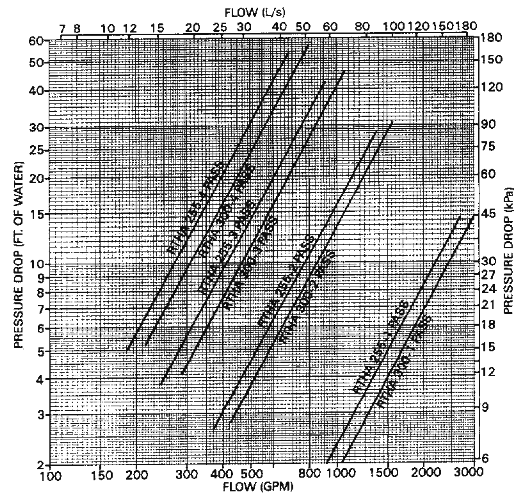
Extended Length Condensers

Table 1 (Continued)
RTHA 130 Thru 450 Evaporator and Condenser Data

RTHA 255-300



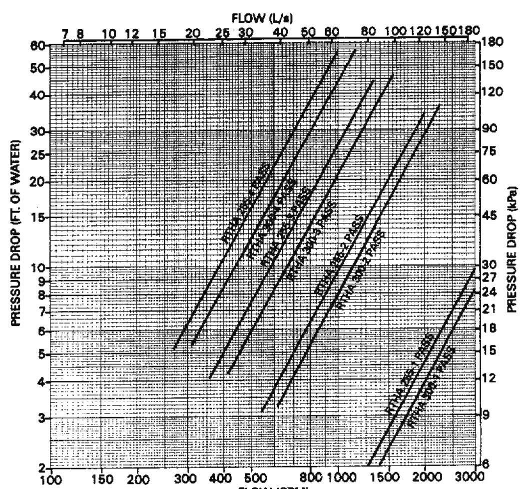
Standard Length Evaporators



Long Length Evaporators

255 Evaporator Data

		RTHA 255											
		Standard Shell				Long Shell				Extended Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage	(gal)	33	33	33	33	43	43	43	43	61	61	61	61
Capacity	(L)	125	125	125	125	163	163	163	163	230	230	230	230
Minimum	(GPM)	738	369	246	185	738	369	246	185	1080	540	360	270
Flow Rate	(L/s)	47	25	16	12	47	25	16	12	69	35	23	17
Maximum	(GPM)	2710	1355	903	677	2710	1355	903	677	3955	1978	1318	989
Flow Rate	(L/s)	171	84	57	43	171	84	57	43	253	127	84	63
Connection Size	(IN)	10	6	5	5	10	6	5	5	12	8	6	6



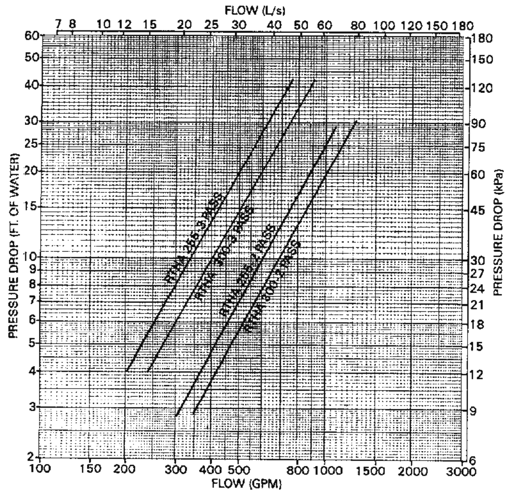
Extended Length Evaporators

300 Evaporator Data

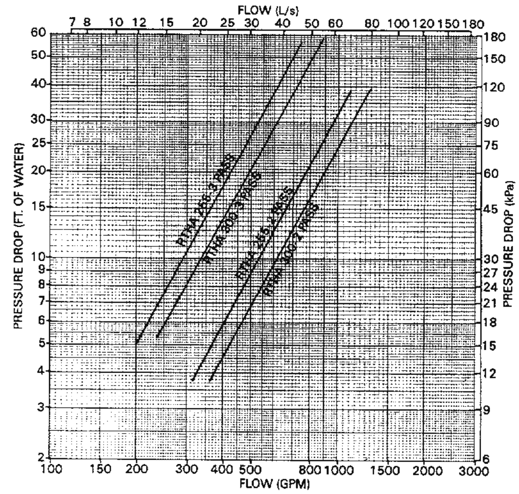
		RTHA 300											
		Standard Shell				Long Shell				Extended Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage	(gal)	38	38	38	38	49	49	49	49	69	69	69	69
Capacity	(L)	144	144	144	144	185	185	185	185	263	263	263	263
Minimum	(GPM)	858	429	286	215	858	429	286	215	1234	618	412	309
Flow Rate	(L/s)	54	27	18	14	54	27	18	14	79	40	26	20
Maximum	(GPM)	3150	1575	1050	788	3150	1575	1050	788	4525	2262	1507	1130
Flow Rate	(L/s)	199	99	66	50	199	99	66	50	290	145	96	72
Connection Size	(IN)	10	6	5	5	10	5	5	5	12	8	6	6

Table 1 (Continued)
RTHA 130 Thru 450 Evaporator and Condenser Data

RTHA 255-300



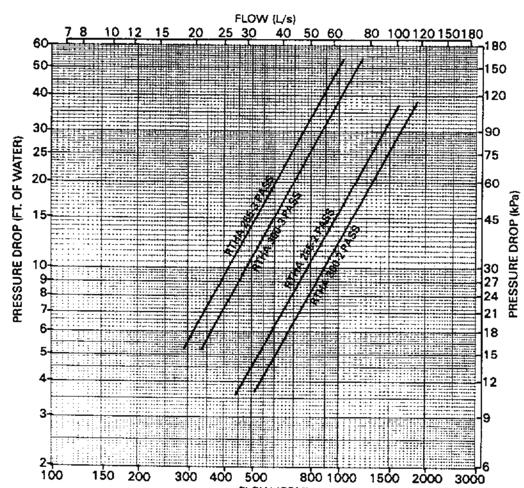
Standard Length Condensers



Long Length Condensers

255 – 300 Condenser Data

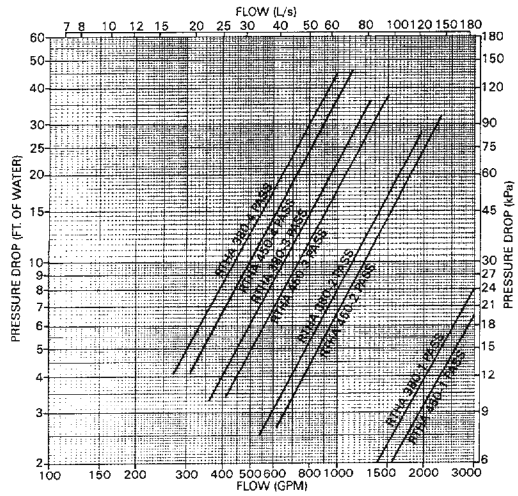
		RTHA 255						RTHA 300					
		Standard Shell	Long Shell	Extended Shell	Standard Shell	Long Shell	Extended Shell	Standard Shell	Long Shell	Extended Shell	Standard Shell	Long Shell	Extended Shell
		2 Pass	2 Pass	2 Pass	3 Pass	3 Pass	3 Pass	2 Pass	2 Pass	2 Pass	3 Pass	3 Pass	3 Pass
Storage	(gal)	27	35	50	27	35	50	31	40	57	31	40	57
Capacity	(L)	102	132	189	102	132	189	117	151	217	117	151	217
Minimum	(GPM)	297	297	433	198	198	288	347	347	497	234	234	332
Flow Rate	(L/s)	19	19	28	13	13	18	22	22	32	15	15	21
Maximum	(GPM)	1089	1089	1585	731	731	1056	1272	1272	1822	854	854	1215
Flow Rate	(L/s)	69	69	101	46	46	68	80	80	117	54	54	78
Connection Size	(IN)	6	6	8	6	6	6	6	6	8	6	6	6



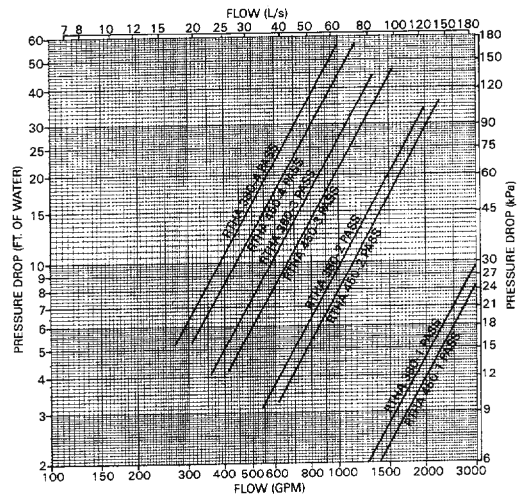
Extended Length Condensers

Table 1 (Continued)
RTHA 130 Thru 450 Evaporator and Condenser Data

RTHA 380-450



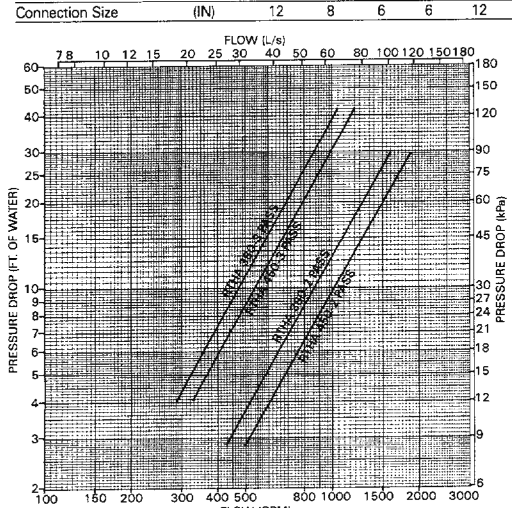
Standard Length Evaporators



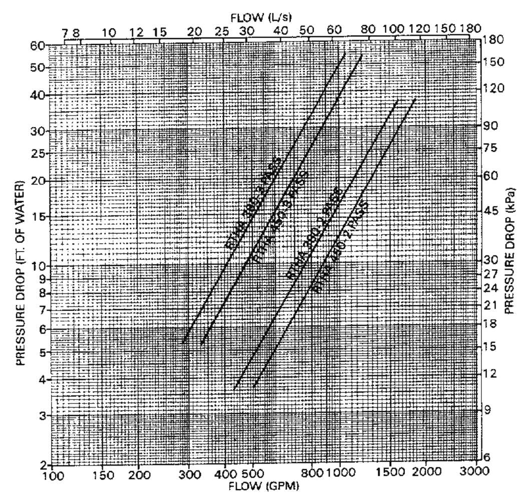
Long Length Evaporators

380 – 450 Evaporator Data

		RTHA 380								RTHA 450							
		Standard Shell				Long Shell				Standard Shell				Long Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage Capacity	(gal)	47	47	47	47	61	61	61	61	54	54	54	54	69	69	69	69
	(L)	117	117	117	117	230	230	230	230	203	203	203	203	263	263	263	263
Minimum Flow Rate	(GPM)	1080	540	360	270	1080	540	360	270	1234	618	412	309	1234	618	412	309
	(L/s)	69	35	23	17	69	35	23	17	79	40	26	20	79	40	26	20
Maximum Flow Rate	(GPM)	3955	1978	1318	989	3955	1978	1318	989	4525	2262	1507	1130	4525	2262	1507	1130
	(L/s)	253	127	84	63	253	127	84	63	290	145	96	72	290	145	96	72
Connection Size	(IN)	12	8	6	6	12	8	6	6	12	8	6	6	12	8	6	6



Standard Length Condensers



Long Length Condensers

380 – 450 Condenser Data

		RTHA 380				RTHA 450			
		Standard Shell	Long Shell	Standard Shell	Long Shell	Standard Shell	Long Shell	Standard Shell	Long Shell
		2 Pass	2 Pass	3 Pass	3 Pass	2 Pass	2 Pass	3 Pass	3 Pass
Storage Capacity	(gal)	39	50	39	50	44	57	44	57
	(L)	146	189	146	189	168	217	168	217
Minimum Flow Rate	(GPM)	433	433	288	288	497	497	332	332
	(L/s)	27	27	18	18	31	31	21	21
Maximum Flow Rate	(GPM)	1585	1585	1056	1056	1822	1822	1215	1215
	(L/s)	100	100	68	68	115	115	78	78
Connection Size	(IN)	8	8	6	6	8	8	6	6

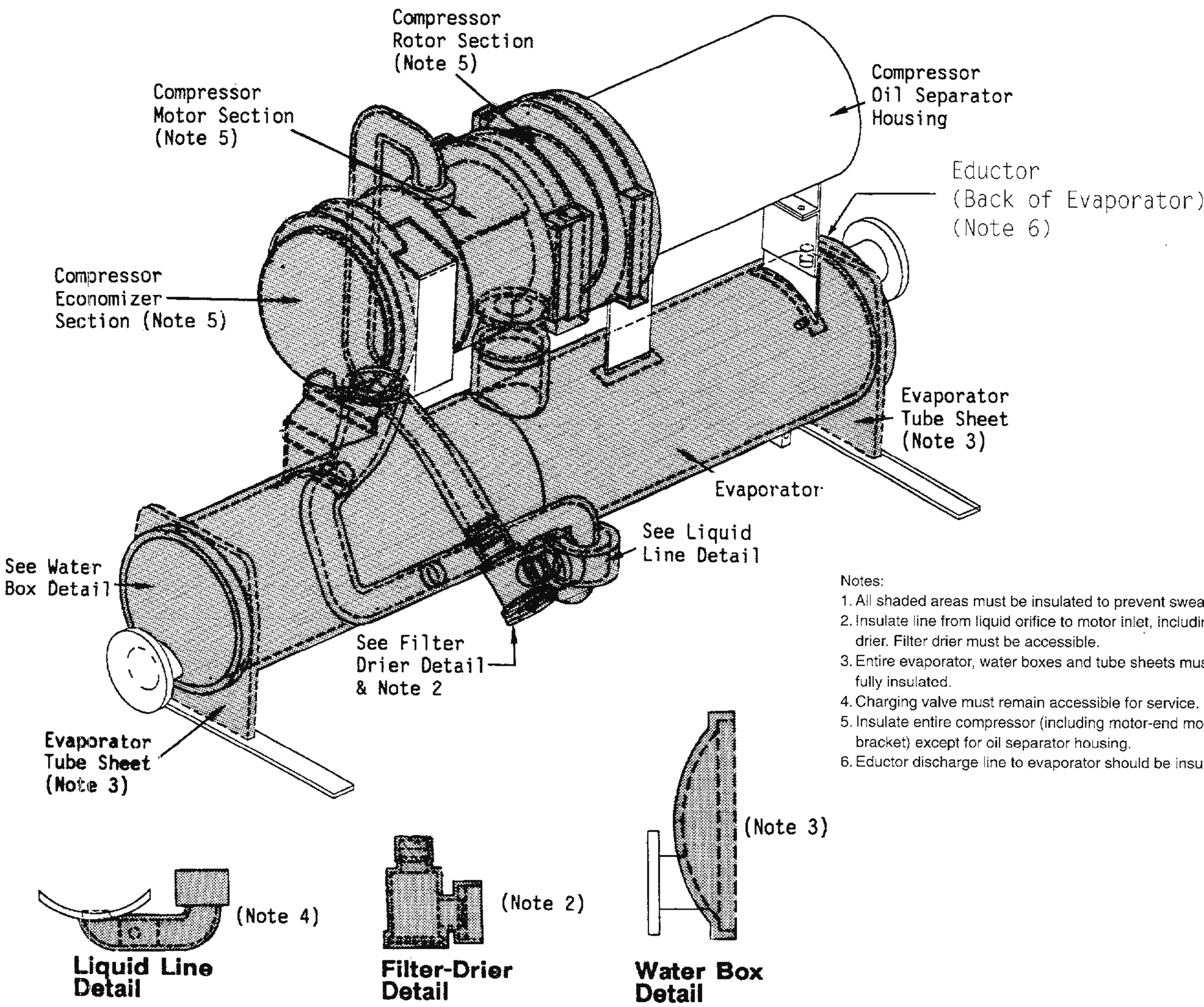
Thermal Insulation

All RTHA units are available with optional factory-installed thermal insulation. If the unit is not factory-insulated, install insulation over the areas shaded in Figure 17. Refer to Table 2 for types and quantities of insulation required.

Note: Liquid line filter, refrigerant charging valves, water temperature sensors, drain and vent connections when insulated must remain accessible for service.

Caution: To prevent insulation shrinkage, use only water-base latex paint on factory-applied insulation.

Figure 17
Typical RTHA Insulation Requirements Excluding Condenser



Notes:
1. All shaded areas must be insulated to prevent sweating.
2. Insulate line from liquid orifice to motor inlet, including filter drier. Filter drier must be accessible.
3. Entire evaporator, water boxes and tube sheets must be fully insulated.
4. Charging valve must remain accessible for service.
5. Insulate entire compressor (including motor-end mounting bracket) except for oil separator housing.
6. Eductor discharge line to evaporator should be insulated.

5706-1818A

Table 2
RTHA Insulation Requirements

Unit Size	Shell Length	Sheet Insulation (Sq. Ft.) 3/4" Wall (Note 1)	Sheet Insulation (Sq. Ft.) 3/8" Wall (Note 2)	Tubing Insulation (Lin. Ft.) Econ. Tube (Note 3)	Tubing Insulation (Lin. Ft.) Liq. Line (Note 4)	Tubing Insulation (Lin. Ft.) Evap. Inlet (Note 5)
RTHA-130 & 150	Std.	50	44	6' (1.90")	6' (2-3/8")	3' (2-7/8")
	Long	65	44	6' (1.90")	6' (2-3/8")	3' (2-7/8")
RTHA-180 & 215	Std.	63	44	6' (1.90")	6' (2-7/8")	3' (3-1/2")
	Long	73	44	6' (1.90")	6' (2-7/8")	3' (3-1/2")
	Ext.	92	44	6' (1.90")	6' (2-7/8")	3' (3-1/2")
RTHA-255 & 300	Std.	82	54	10' (2-1/8")	10' (3-1/8")	3' (3-1/2")
	Long	92	54	10' (2-1/8")	10' (3-1/8")	3' (3-1/2")
	Ext.	117	54	10' (2-5/8")	7' (4")	3' (4-1/2")
RTHA-380 & 450	Std.	100	46	10' (2-5/8")	7' (4")	3' (4-1/2")
	Long	117	46	10' (2-5/8")	7' (4")	3' (4-1/2")

Notes:
1. Evaporator, suction connection and isolation valve.
2. Motor/economizer area, refrigerant filter and motor outlet/sump reducer.
3. Motor cooling (liquid) line from condenser to top of motor housing.
   (First dimension given is linear length of tubing required. Second dimension is tubing ID.)
4. Liquid return line; "stepdown" to evaporator orifice.
   (First dimension given is linear length of tubing required. Second dimension is tubing ID.)
5. Evaporator inlet; evaporator orifice to evaporator.
   (First dimension given is linear length of tubing required. Second dimension is tubing ID.)
6. All tubing insulation closed-cell; 1/2-inch wall.
7. Bulbells, valves, vents and drain connections must remain accessible after insulating.
8. Do not glue insulation over ASME evaporator nameplate. Cut out area over nameplate and friction-fit insulation into area.
9. N/A = data not available at time of publication.

Refrigerant Pressure Relief Valve Venting

Note: All relief valve venting is the responsibility of the installing contractor.

All RTHA units utilize evaporator, compressor and condenser pressure relief valves (Figure 18) which must be vented to the outside of the building. The relief valves have 3/4 inch FPT connections.

Relief valve connection sizes and locations are shown in the unit submittals. Refer to local codes for relief valve vent line sizing information.

Note: Vent line length must not exceed code recommendations. If line length would exceed code recommendations for the outlet size of the valve, install a vent line of the next larger pipe size.

Caution: To prevent capacity reduction and relief valve damage, do not exceed vent piping code specifications.

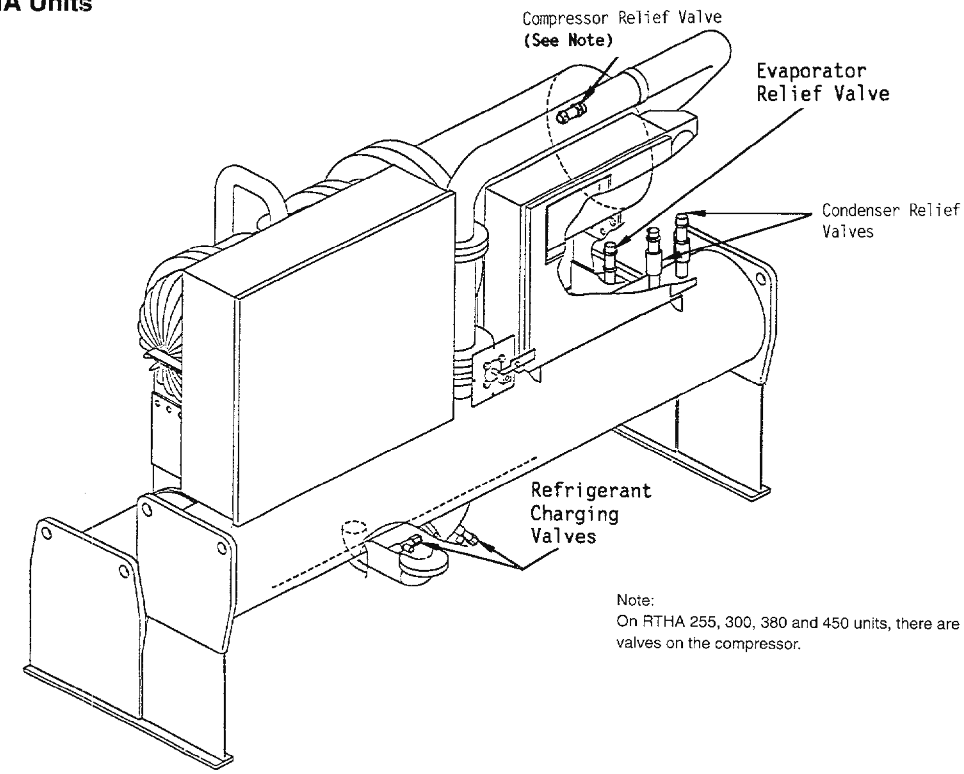
Relief valve discharge setpoints are given in Table 3. Once the relief valve has opened, it will reclose when pressure is reduced to a safe level.

Pipe each relief valve on the unit into a common vent line. Provide an access valve on the common line to connect the vacuum pump discharge so that, when servicing of the unit is required. All refrigerant can be reclaimed. The access valve must be located at the low point of the vent piping to enable draining of any condensate that may accumulate in the piping.

WARNING: To prevent injury due to inhalation of R-22 gas, do not discharge refrigerant within the mechanical room or to the atmosphere.

If multiple chillers are installed, each unit must have separate venting for its relief valves. Consult local regulations for any special relief line requirements.

Figure 18
Refrigerant Charging and Relief Valve Locations for Typical RTHA Units



Note:
On RTHA 255, 300, 380 and 450 units, there are two relief valves on the compressor.

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Table 3
Pressure Relief Valve Discharge Setpoints for RTHA 130 thru 450 Units

Unit Type	Valve Location		
	Compressor (1)	Condenser (1)	Evaporator (1)
Standard	300 [2069]	300 [2069]	300 [2069
Heat Recovery	400 [2758]	400 [2758]	300 [2069]

1. Pressures In: Psig [kPa]

Relief Rates for Various Relief Valves (C-Factors)

Valve	300 Psig	400 Psig
Henery	35.9 Lba/min	47.3 Lba/min
Superior	46.6 Lba/min	61.4 Lba/min

Note:
All relief rates are based on the following size: 3/4" male x 3/4" FPT.

Installation – Electrical

General Recommendations

For proper electrical component operation, do not locate the unit in areas exposed to dust, dirt, corrosive fumes, or excessive humidity. If any of these conditions exist, corrective action must be taken.

WARNING: To prevent injury or death, disconnect electrical power source before completing wiring connections to the unit.

All wiring must comply with local and national electric codes. Minimum circuit ampacities and other unit electrical data is on the unit nameplate. See the unit order specifications for actual electrical data. A typical field wiring diagram is shown in Figures 19 and 21. Specific electrical schematics and connection diagrams were shipped with the unit.

Caution: To avoid corrosion and overheating at terminal connections, use copper conductors only.

Do not allow conduit to interfere with other components, structural members or equipment. All conduit must be long enough to allow compressor and starter removal.

Control voltage (115V) wiring in conduit must be separate from conduit carrying low voltage (<30V) wiring.

Caution: To prevent control malfunctions, do not run low voltage wiring (<30V) in conduit with conductors carrying more than 30 volts.

Installer-Supplied Components

The installer must provide the following components if not ordered with the unit.

[ ] Power supply wiring (in conduit) for all field-wired connections.

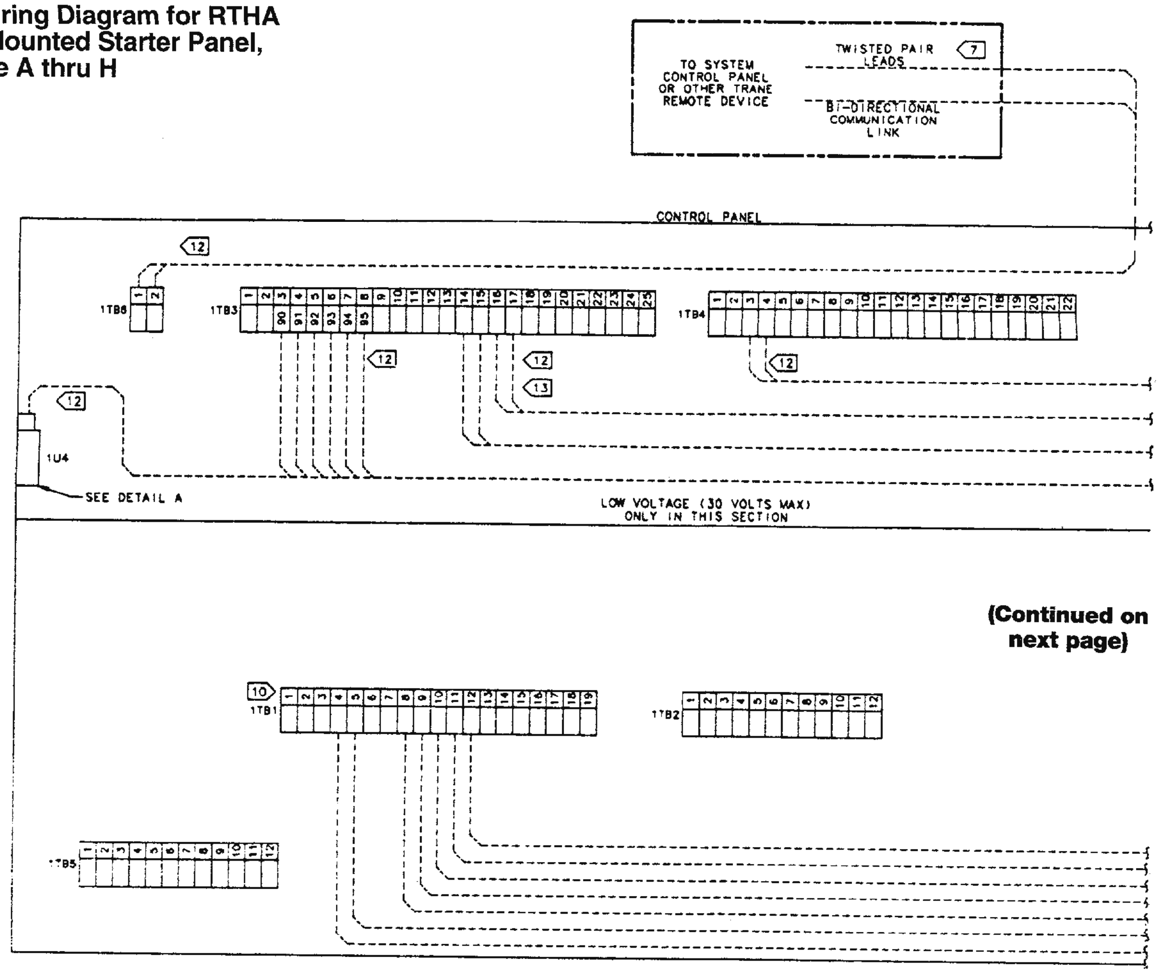
[ ] All control (interconnecting) wiring (in conduit) for field supplied devices.

[ ] Circuit breakers or fused disconnect switches.

[ ] Jumper wires (X-L or AUTOTRANSFORMER start only).

[ ] Power factor correction capacitors (optional).

Figure 19
Typical Field Wiring Diagram for RTHA Unit with Unit-Mounted Starter Panel, Design Seqence A thru H



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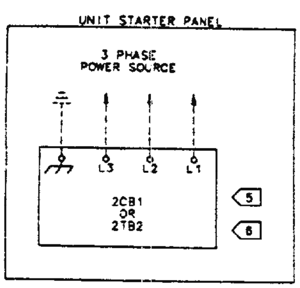

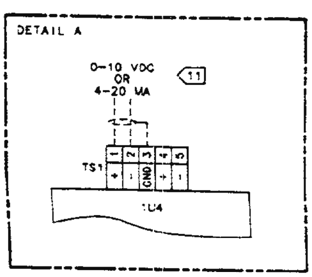

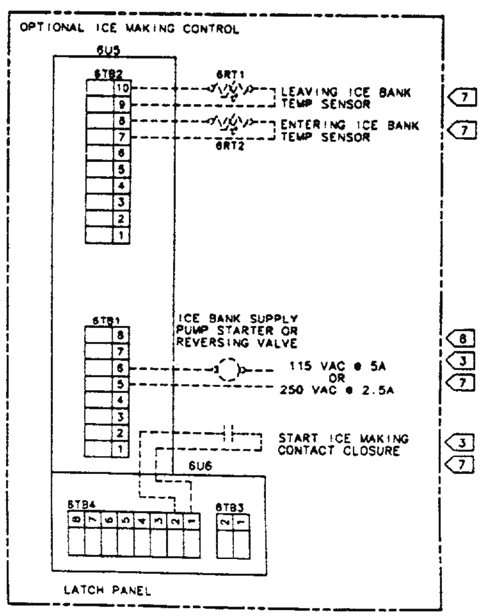

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

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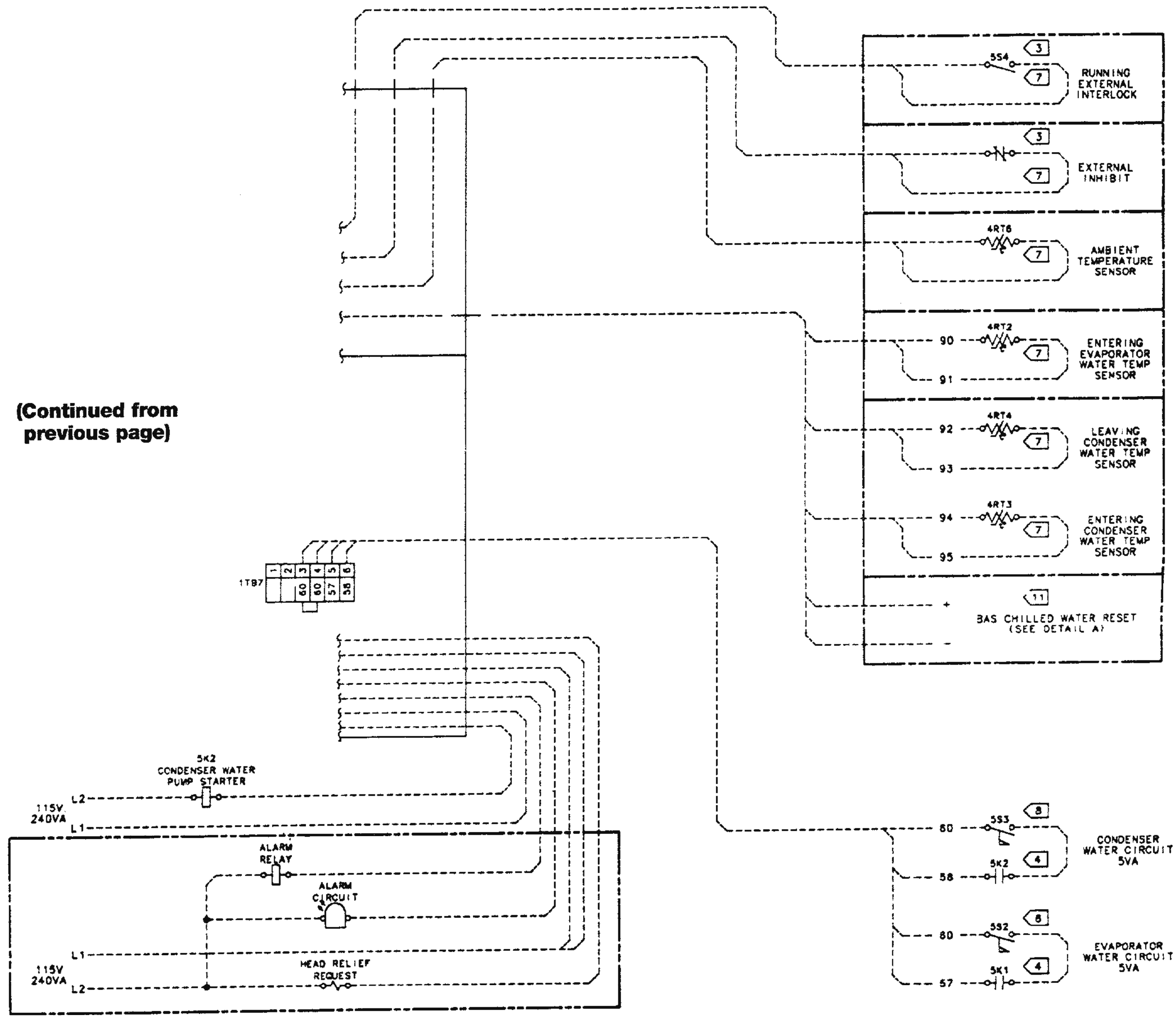

CUSTOMER NOTE:

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, 45MA. GOLD PLATED CONTACTS RECOMMENDED.

4. RECOMMENDED CIRCUIT: COMPONENTS SUPPLIED BY OTHERS. 5K1 AND 5K2 ARE AUX CONTACTS ON PUMP STARTERS: 5S2 AND 5S3 ARE FLOW SWITCHES IN APPROPRIATE WATER CIRCUITS.

5. RETIGHTEN TERMINALS A MINIMUM OF 24 HOURS AFTER INITIAL INSTALLATION. DO NOT OVER TIGHTEN.

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

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.

10. FIELD WIRED ELECTRICAL LOADING IS NOT TO EXCEED THE FOLLOWING CONTACT 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

11. NEGATIVE SIGNAL INPUTS ARE GROUNDED TO UCP ENCLOSURE. FOR CORRECT OPERATION, EXTERNAL EQUIPMENT SIGNALS SHALL BE ISOLATED OR FLOATING WITH RESPECT TO UCP ELECTRICAL SERVICE GROUND AND ISOLATED FROM EACH OTHER. SPECIAL CONSIDERATION MUST BE GIVEN TO 4-20 MA SIGNALS. IF THE CURRENT SOURCE REGULATES CURRENT FLOW ON THE NEGATIVE LEAD, USE A SEPARATE POWER SUPPLY FOR EACH CHANNEL. IN SOME APPLICATIONS IT MAY BE NECESSARY TO INSTALL A LOOP ISOLATOR IN EACH CHANNEL TO PREVENT LOOP INTERFERENCE.

12. USE TWISTED, SHIELDED PAIR 18 AWG WIRE (BELDEN 8760 OR EQUIVALENT) OR CLASS 1 WIRING ONLY.

13. WHEN EXTERNAL INHIBIT IS USED AND ICE MAKING CONTROL IS SUPPLIED ON UNIT, EXTERNAL INHIBIT CONTACT MUST BE WIRED IN SERIES WITH 6U6 - 6TB4-7.

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Figure 20
Field Wiring and Remote Sensor Layout for Typical RTHA Unit, Design Sequence A thru H

NOTES:

1. DASHED LINES INDICATE 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 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 TRIPOUTS.
4. THE FOLLOWING CAPABILITIES ARE OPTIONAL – THEY ARE IMPLIMENTED AND WIRED AS REQUIRED FOR A SPECIFIC SYSTEM APPLICATION.
   - A: CHILLED WATER RESET – REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT1 AND 4RT2. IF AMBIENT TEMP BASED CHILLED WATER RESET IS REQUIRED, USE THE STANDARD SUPPLIED LEAVING EVAP WATER TEMP SENSOR (4RT1) FOR 4RT6 AS AN AMBIENT TEMP SENSOR.
   - C: ENTERING EVAP TEMP SENSOR – REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT1 AND 4RT2.
   - D: ENTERING AND LEAVING CONDENSER WATER TEMP SENSORS MATCHED PAIR OF THERMISTORS FOR 4RT3 AND 4RT4.
   - E: TRACER MONITORING PACKAGE INCLUDES OPTIONS "C" AND "D". IF AMBIENT TEMP BASED CHILLED WATER RESET IS REQUIRED, USE THE STANDARD SUPPLIED LEAVING EVAP WATER TEMP SENSOR (4RT1) FOR 4RT6 AS AN AMBIENT TEMP SENSOR.
   - F: ICE MAKING OPTION INCLUDES 6U5, 6U6, 6RT1 & 6RT2.
5. FOR SENSOR DESCRIPTION SEE 5706-0917.

WIRING REQUIREMENTS:

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

REQUIRED WIRING:

- 21: 8 WIRES #14 AWG 600V
- 22: 8 WIRES #14–#16 AWG 600V, RUN IS SEPARATE CONDUIT. USE #16 AWG UP TO 250 FT ONEWAY OR #14 AWG UP TO 400 FT ONEWAY.
- 23: COPPER WIRE ONLY SIZED PER NEC 1984 BASED ON NAMEPLATE RLA SEE TABLE 1. (IF UNIT IS SUPPLIED WITH MOUNTED STARTER, WIRING BETWEEN UNIT AND STARTER IS NOT REQUIRED)
- 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 5000 FT. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.
- 32: IF UNIT IS SUPPLIED WITH MOUNTED STARTER, FIELD WIRING BETWEEN UNIT AND STARTER IS NOT REQUIRED.

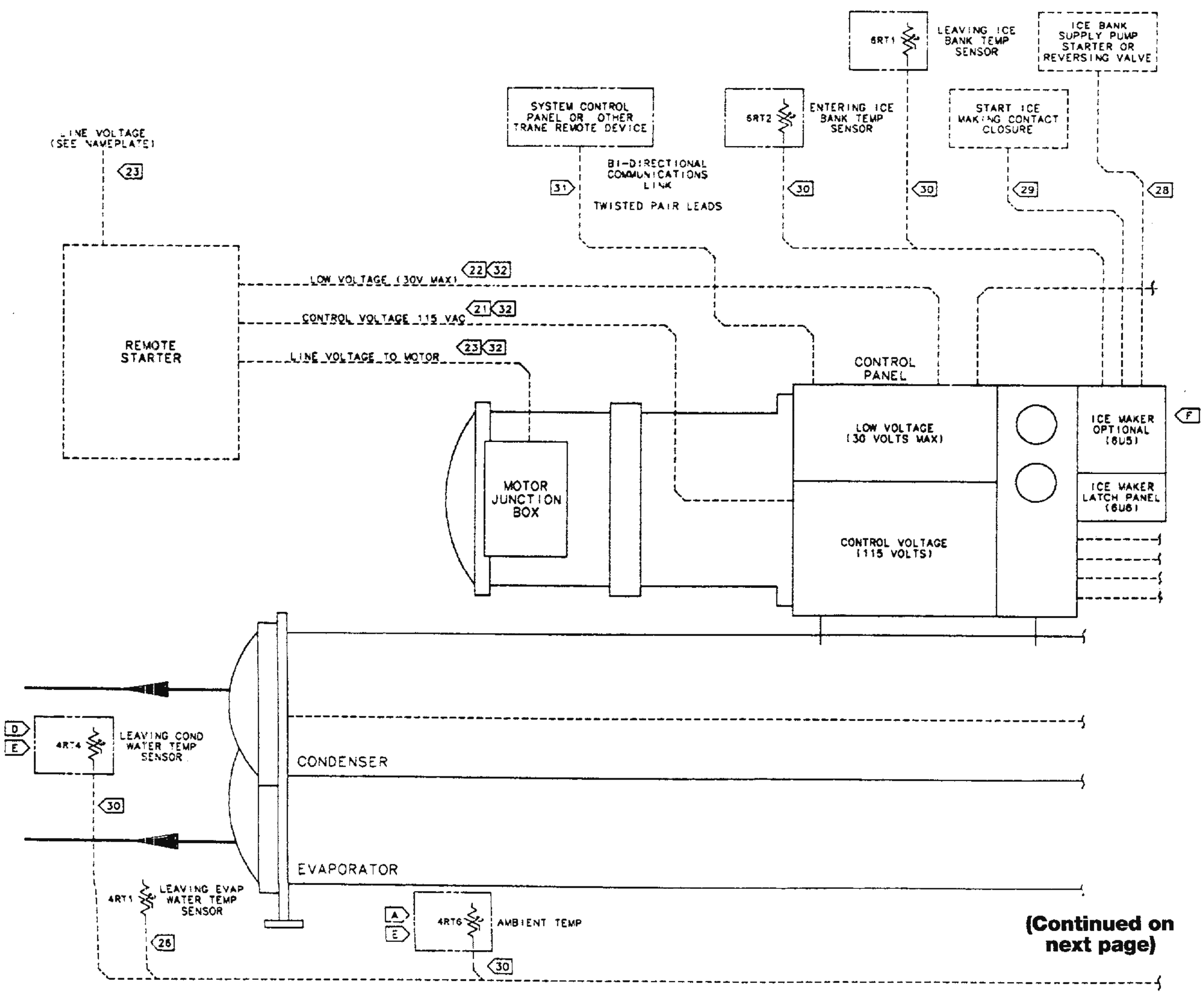

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TABLE 1

RECOMMENDED WIRE SELECTION TABLE (REF. NEC 1984)

MIN WIRE SIZE COPPER 75°C	RATED LOAD CURRENT (NAMEPLATE): 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	1 CONDUIT 6 WIRES	2 CONDUITS 3 WIRES EA	1 CONDUIT 6 WIRES
8	40	N/A	N/A	68.2	55.4
6	52	N/A	N/A	90.0	72.0
4	68	N/A	N/A	117.8	94.1
3	80	N/A	N/A	138.4	110.7
2	92	N/A	N/A	159.2	127.3
1	104	N/A	N/A	179.9	143.9
0	120	240	192.0	207.8	166.1
00	140	280	224.0	242.2	193.8
000	160	320	256.0	276.8	221.4
0000	184	368	294.4	318.3	254.7
250	204	408	328.4	352.9	282.3
300	228	456	384.8	394.4	315.8
350	248	498	396.8	429.0	343.2
400	268	538	428.8	483.6	370.9
500	304	608	486.4	525.9	420.7
600	336	672	537.8	581.3	465.0

TABLE 2

WIRE SIZE	MAXIMUM LENGTH [illegible] SENSOR LEADS
14 AWG	5000 FT
16 AWG	2000 FT
18 AWG	1000 FT

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

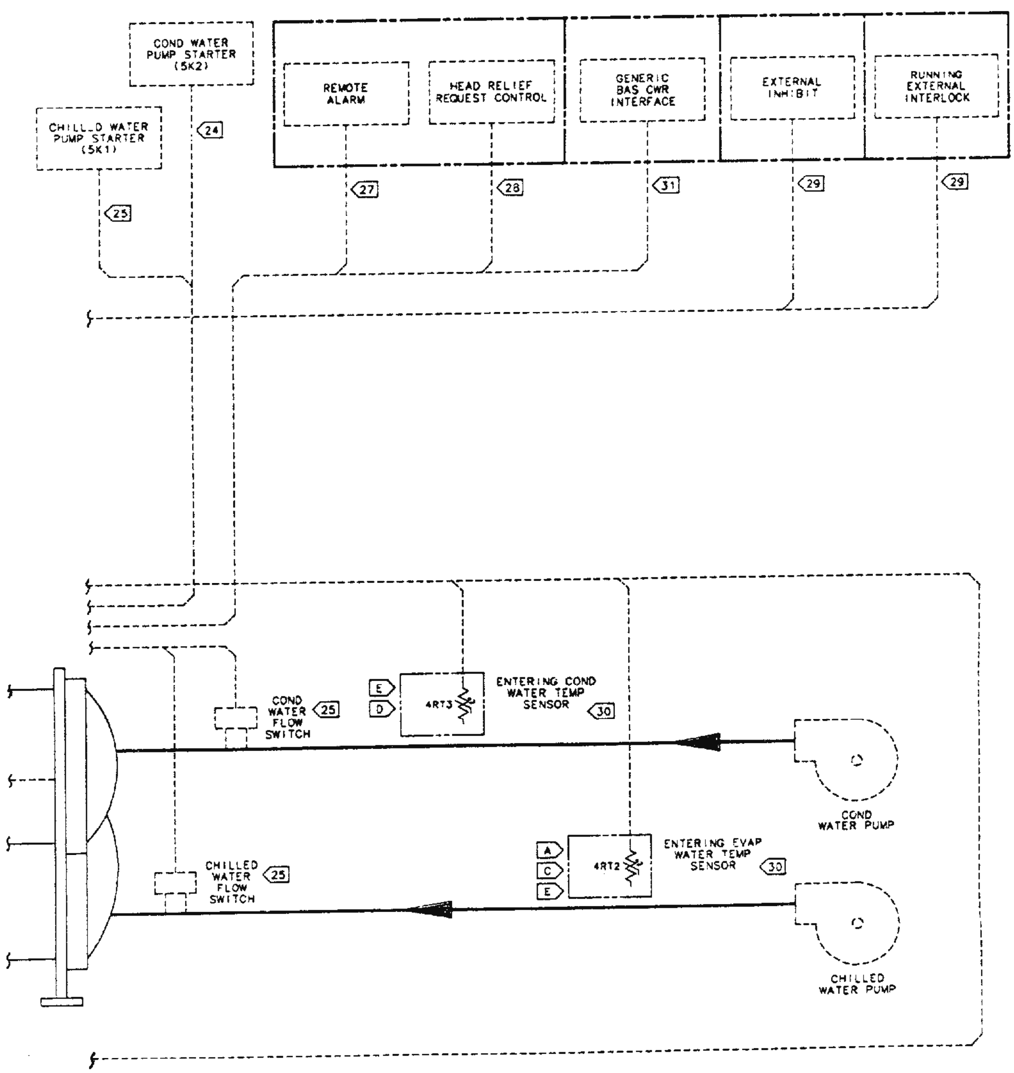

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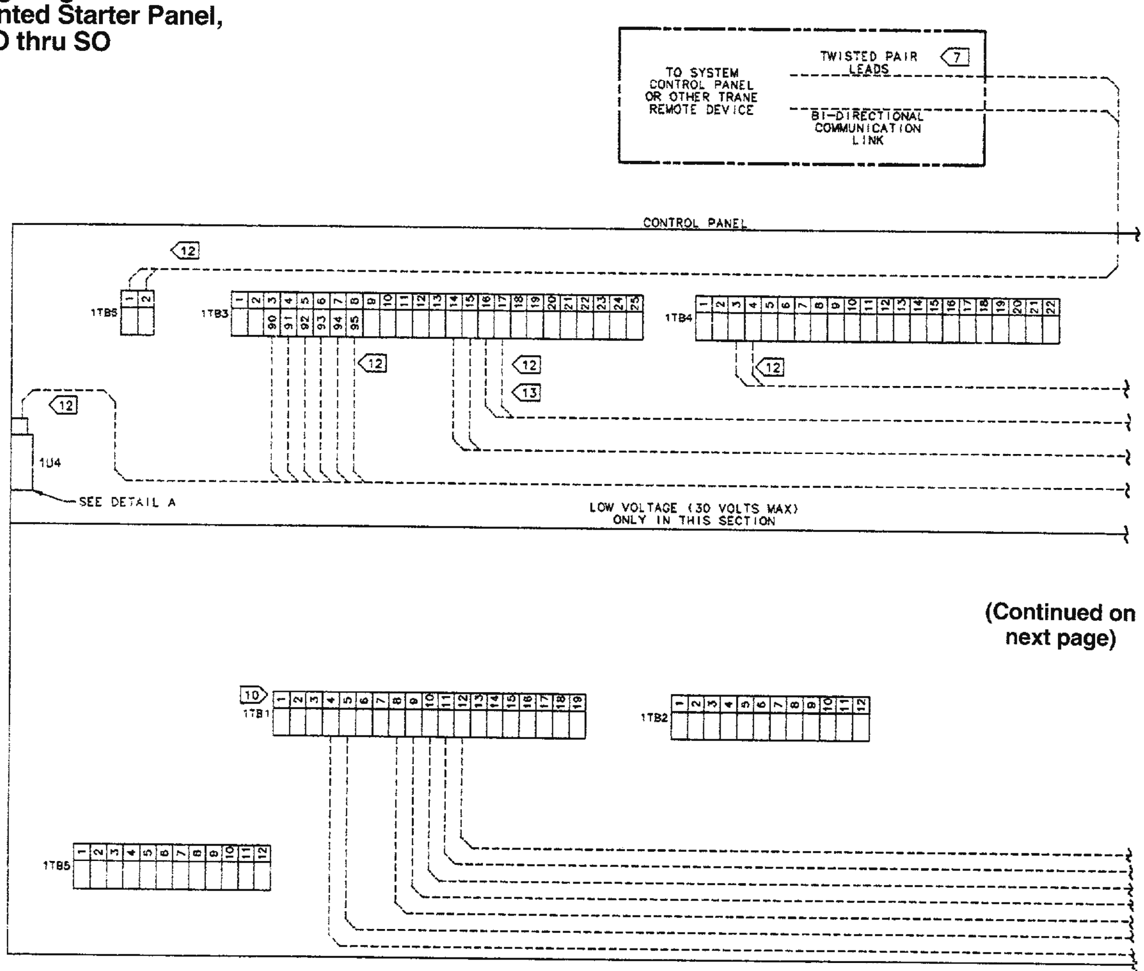
Figure 21
Typical Field Wiring Diagram for RTHA Unit with Unit-Mounted Starter Panel, Design Seqence JO thru SO



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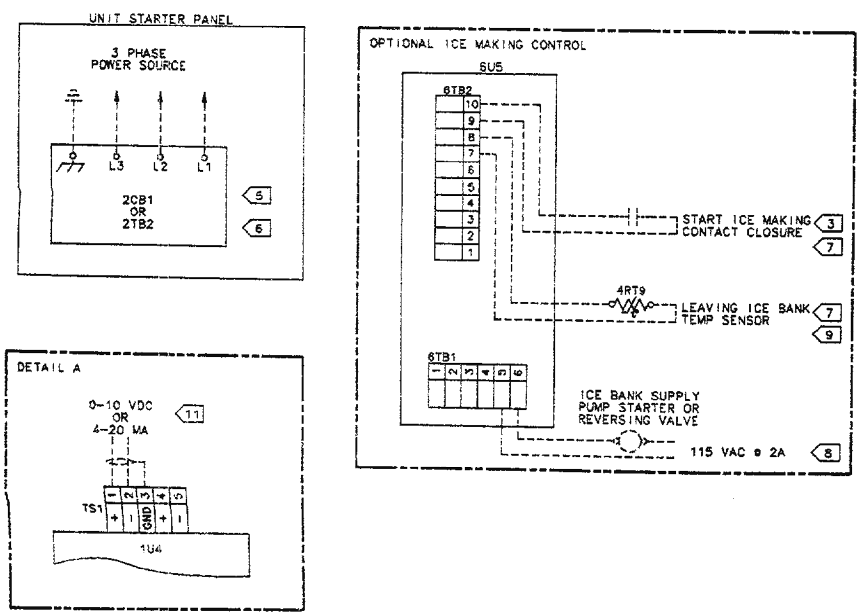

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CAUTION
Use copper conductors only to prevent equipment damage

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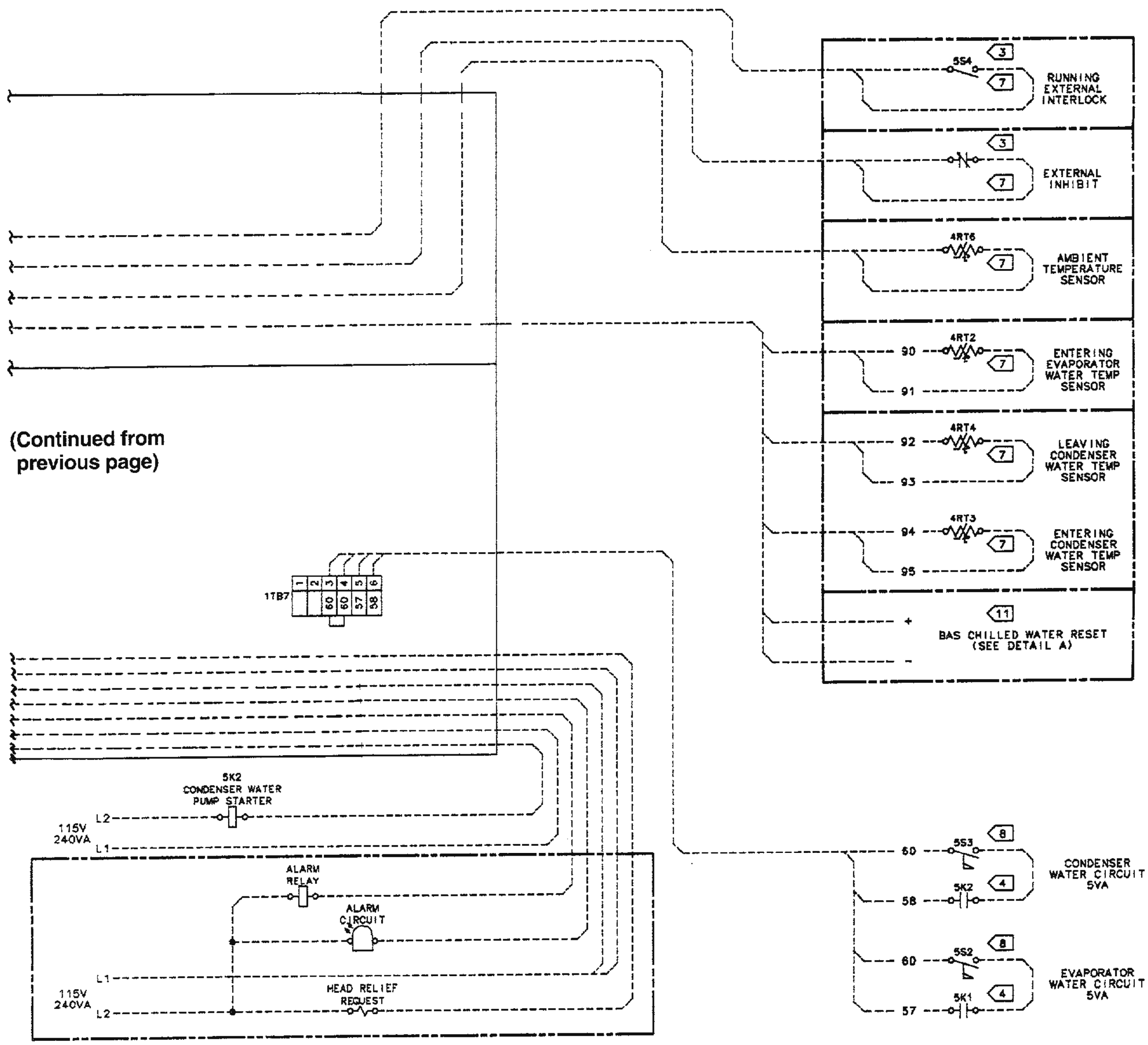

CUSTOMER NOTE:

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, 45MA. GOLD PLATED CONTACTS RECOMMENDED.

4. RECOMMENDED CIRCUIT: COMPONENTS SUPPLIED BY OTHERS. 5K1 AND 5K2 ARE AUX CONTACTS ON PUMP STARTERS: 5S2 AND 5S3 ARE FLOW SWITCHES IN APPROPRIATE WATER CIRCUITS.

5. RETIGHTEN TERMINALS A MINIMUM OF 24 HOURS AFTER INITIAL INSTALLATION. DO NOT OVER TIGHTEN.

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

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.

9. LEAVING ICE BANK TEMP. SENSOR SUPPLIED BUT MUST BE FIELD INSTALLED AND CONNECTED.

10. FIELD WIRED ELECTRICAL LOADING IS NOT TO EXCEED THE FOLLOWING CONTACT 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

11. NEGATIVE SIGNAL INPUTS ARE GROUNDED TO UCP ENCLOSURE. FOR CORRECT OPERATION, EXTERNAL EQUIPMENT SIGNALS SHALL BE ISOLATED OR FLOATING WITH RESPECT TO UCP ELECTRICAL SERVICE GROUND AND ISOLATED FROM EACH OTHER. SPECIAL CONSIDERATION MUST BE GIVEN TO 4-20 MA SIGNALS. IF THE CURRENT SOURCE REGULATES CURRENT FLOW ON THE NEGATIVE LEAD, USE A SEPARATE POWER SUPPLY FOR EACH CHANNEL. IN SOME APPLICATIONS IT MAY BE NECESSARY TO INSTALL A LOOP ISOLATOR IN EACH CHANNEL TO PREVENT LOOP INTERFERENCE.

12. USE TWISTED, SHIELDED PAIR 18 AWG WIRE (BELDEN 8760 OR EQUIVALENT) OR CLASS 1 WIRING ONLY.

13. WHEN EXTERNAL INHIBIT IS USED AND ICE MAKING CONTROL IS SUPPLIED ON UNIT, EXTERNAL INHIBIT CONTACT MUST BE WIRED IN SERIES WITH 6U5 - 6TB2-3.

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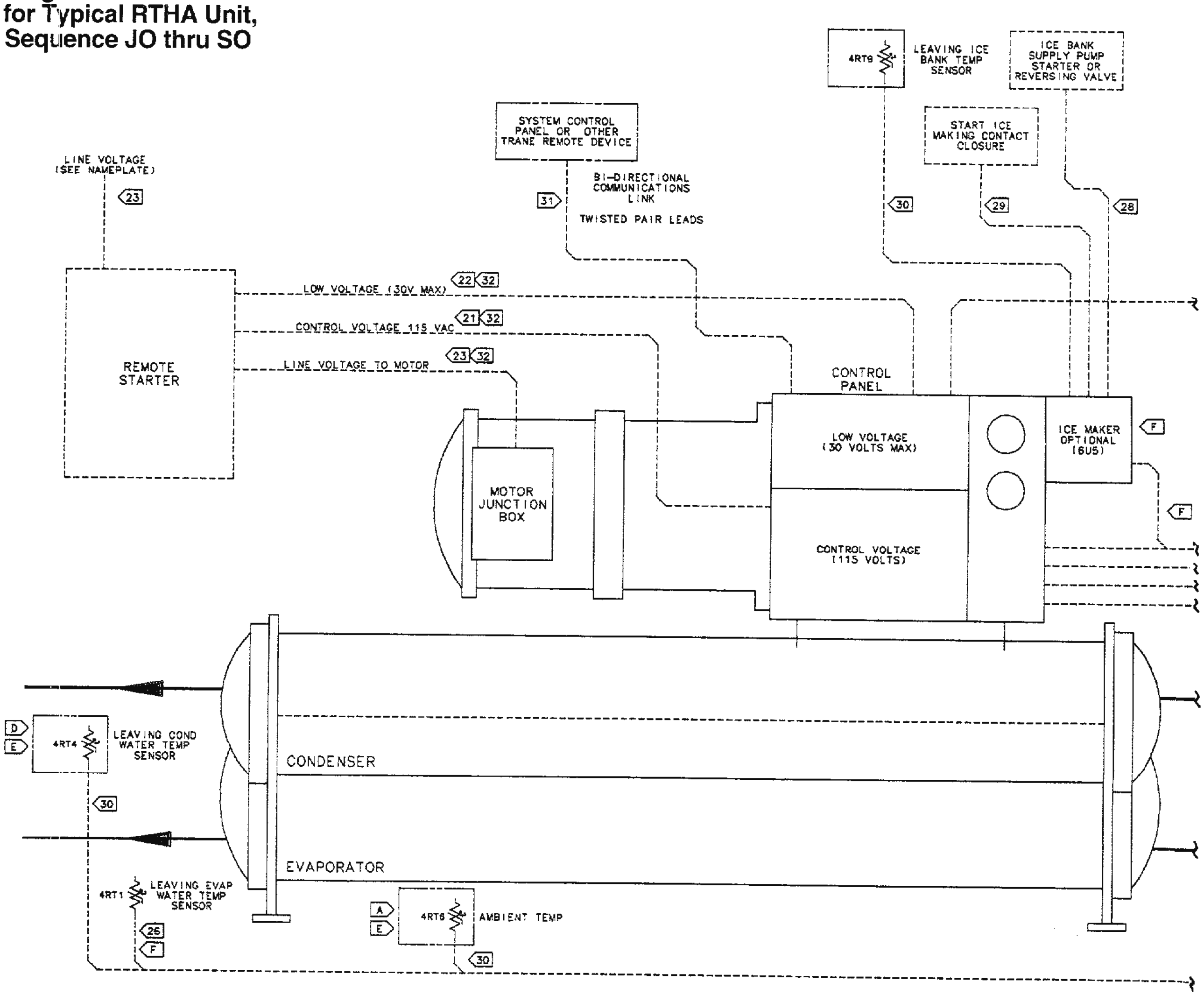
Figure 22
Field Wiring and Remote Sensor Layout for Typical RTHA Unit, Design Sequence JO thru SO



NOTES:

1. DASHED LINES INDICATE 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 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 TRIPOUTS.

4. THE FOLLOWING CAPABILITIES ARE OPTIONAL - THEY ARE IMPLIMENTED AND WIRED AS REQUIRED FOR A SPECIFIC SYSTEM APPLICATION.
   - A CHILLED WATER RESET - REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT1 AND 4RT2. IF AMBIENT TEMP BASED CHILLED WATER RESET IS REQUIRED, USE THE STANDARD SUPPLIED LEAVING EVAP WATER TEMP SENSOR (4RT1) FOR 4RT6 AS AN AMBIENT TEMP SENSOR.
   - C ENTERING EVAP TEMP SENSOR - REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT1 AND 4RT2.
   - D ENTERING AND LEAVING CONDENSER WATER TEMP SENSORS MATCHED PAIR OF THERMISTORS FOR 4RT3 AND 4RT4.
   - E TRACER MONITORING PACKAGE INCLUDES OPTIONS "C" AND "D". IF AMBIENT TEMP BASED CHILLED WATER RESET IS REQUIRED, USE THE STANDARD SUPPLIED LEAVING EVAP WATER TEMP SENSOR (4RT1) FOR 4RT6 AS AN AMBIENT TEMP SENSOR.
   - F ICE MAKING OPTION INCLUDES 6U5, AND 4RT9. 4RT1 IS CONNECTED TO THE ICE MAKER CONTROL PANEL (6U5) WHEN ICE MAKING OPTION IS PRESENT.
5. FOR SENSOR DESCRIPTION SEE 5706-0917.

WIRING REQUIREMENTS:

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

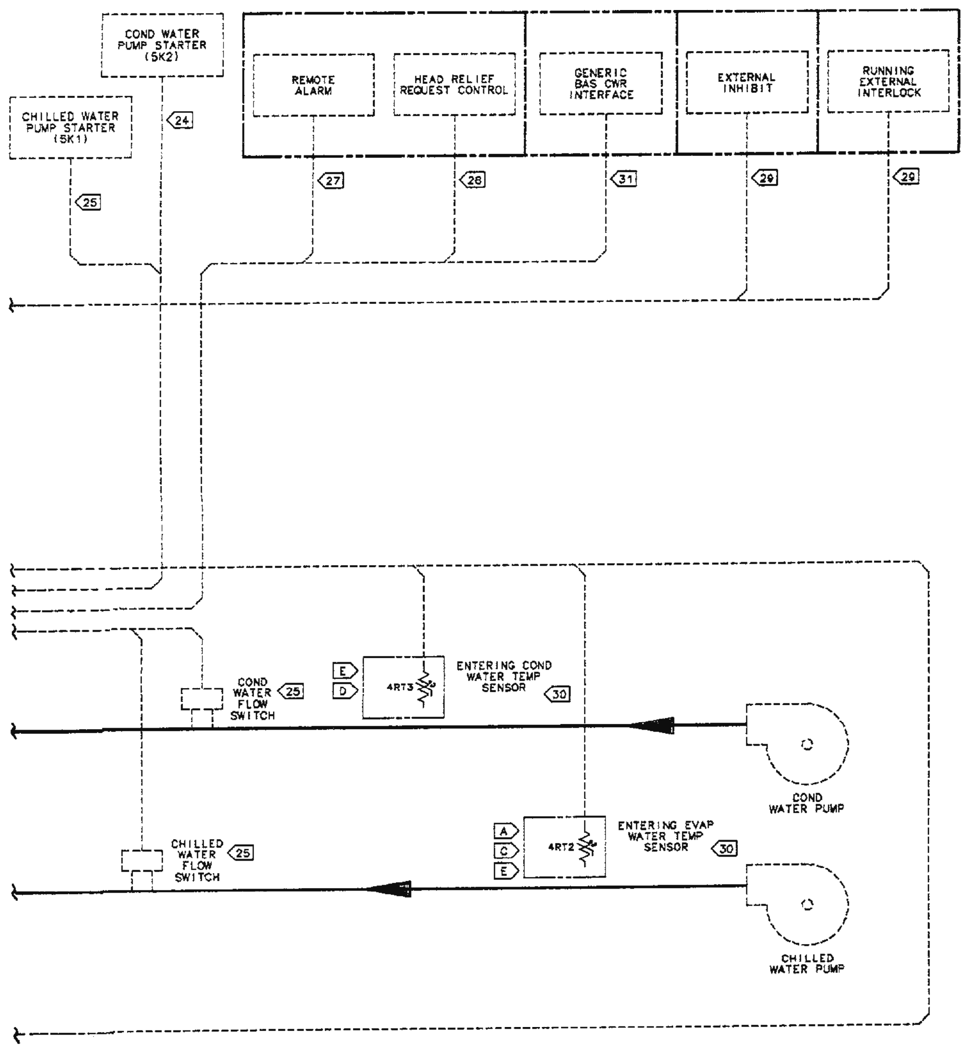
REQUIRED WIRING:

- 21 8 WIRES #14 AWG 600V
- 22 8 WIRES #14-#16 AWG 600V, RUN IS SEPARATE CONDUIT. USE #16 AWG UP TO 250 FT ONEWAY OR #14 AWG UP TO 400 FT ONEWAY.
- 23 USE COPPER WIRES ONLY. READ TABLE 1 DIRECTLY IN UNIT NAMEPLATE RLA TO DETERMINE WIRE SIZE AND ARRANGEMENT. UNIT MOUNTED STARTERS DO NOT REQUIRE ANY MOTOR LEADS.
- 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 5000 FT. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.
- 32 IF UNIT IS SUPPLIED WITH MOUNTED STARTER, FIELD WIRING BETWEEN UNIT AND STARTER IS NOT REQUIRED.

(Continued on next page)



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WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

X39530079A

Power Supply Wiring

Model RTHA chillers are designed according to NEC Article 310-15; therefore, all power supply wiring must be sized and selected accordingly by the project engineer.

A complete discussion of the use of conductors can be found in Trane Engineering Bulletin EB-MSCR-40.

Water Pump Power Supply

Provide power supply wiring with fused disconnect for both the chilled water and condenser water pumps.

Control Power Supply

Unit-mounted starter panels are provided with the 115V control power transformer. When the unit-mounted starter panel is supplied, all control wiring between the starter and the UCP is factory provided. With remote-mounted starters, however, it is necessary to run appropriate leads between the 115V terminal strip in the starter panel to the control power (lower) section of the UCP. Refer to Figures 19 thru 22.

Starter Panel Power Supply

The specified electrical configuration of the unit and options ordered determine if the unit-mounted or the remote-mounted starter panel is provided. Power supply wiring for either starter panel consists of the following:

1. Run line voltage wiring in conduit to access opening(s) on starter panel or pull-box. See Table 4 for wire sizing and selection information. Figures 23 and 24 show typical electrical connection sizes and locations. Refer to submittal information for specific per unit specifications.

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

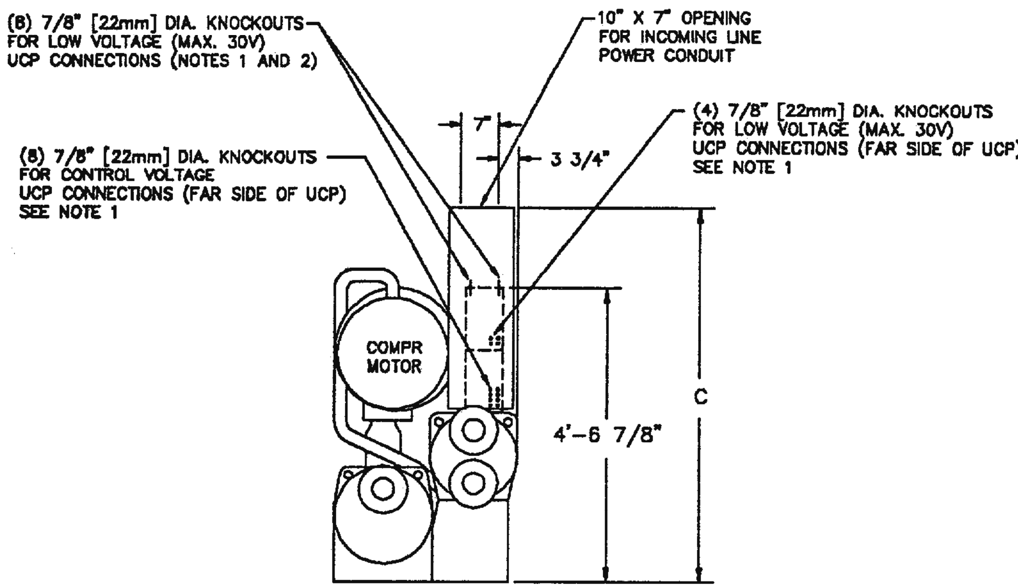
2. Connect line-side power leads to proper terminals of the circuit breaker, disconnect switch or line voltage terminal block in the starter panel as shown in Figures 19 and 21. Retighten these connections after allowing a minimum of 24 hours to elapse. Do not overtighten the connections. A typical equipment room layout schematic is shown in Figure 25. To provide proper phasing of 3-phase input, make connections as shown in Figure 26 and as stated on the yellow WARNING label in the starter panel.

⚠ WARNING

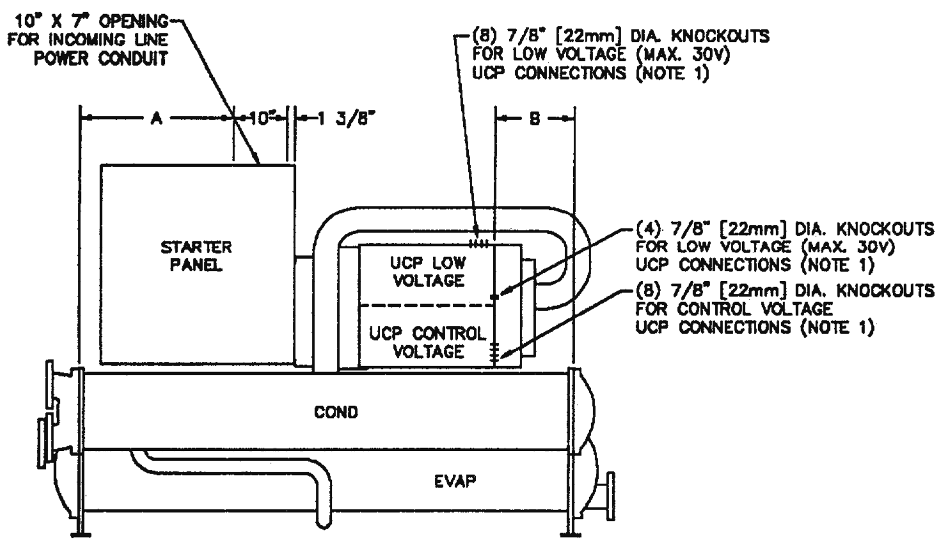
IT IS IMPERATIVE THAT L1-L2-L3 IN THE STARTER BE CONNECTED IN THE A-B-C PHASE SEQUENCE TO PREVENT EQUIPMENT DAMAGE DUE TO REVERSE ROTATION.

X39530037

Figure 23
Electrical Connection Sizes and Locations for RTHA 130 and RTHA 150



END VIEW

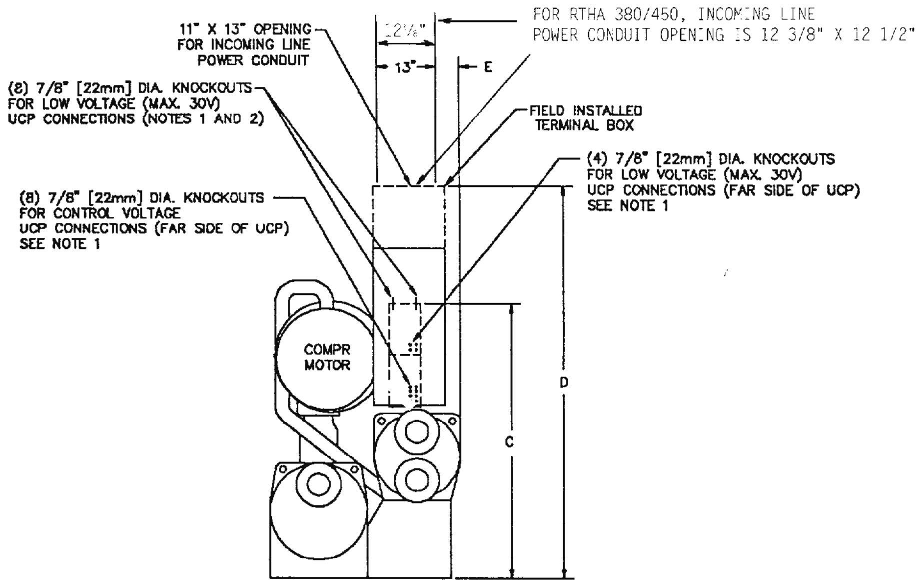


FRONT VIEW

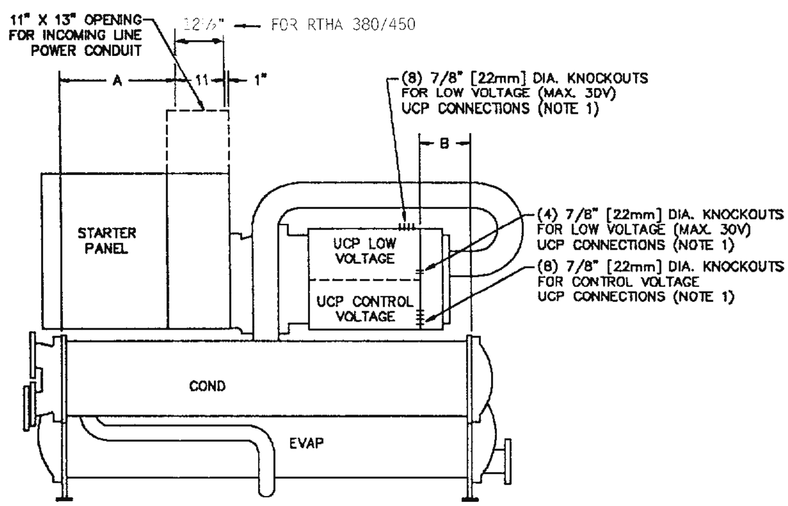
TONS	LENGTH	STARTER	A	B	C
130/150	STANDARD	460/575V	2'-4 5/8" [727mm]	1'-2 3/4" [375mm]	5'-9 1/2" [1765mm]
130/150	STANDARD	200/230V	2'-4 5/8" [727mm]	1'-2 3/4" [375mm]	6'-2 1/2" [1892mm]
130/150	LONG	460/575V	3'-7 5/8" [1108mm]	2'-5 3/4" [756mm]	5'-9 1/2" [1765mm]
130/150	LONG	200/230V	3'-7 5/8" [1108mm]	2'-5 3/4" [756mm]	6'-2 1/2" [1892mm]

NOTES:
1. ALL UCP CONNECTIONS USE 1/2" [13mm] CONDUIT.
2. *TWO ROWS OF 4 KNOCKOUTS ARE PROVIDED. USE EITHER FRONT OR BACK ROW, DEPENDING ON LOCATION OF* DISCHARGE LINE ABOVE UCP.

Figure 24
Electrical Connection Sizes and Locations for RTHA 180 thru RTHA 450



END VIEW



FRONT VIEW

TONS	LENGTH	A	B	C	D	E
180/215	STANDARD	2'-2" [660mm]	11 3/8" [289mm]	5'-1 5/8" [1565mm]	7'-4 1/4" [2242mm]	5 3/8" [137mm]
180/215	LONG	3'-5" [1041mm]	2'-2 3/8" [670mm]	5'-1 5/8" [1565mm]	7'-4 1/4" [2242mm]	5 3/8" [137mm]
180/215	EXTENDED	3'-3 1/2" [1003mm]	2'-3/8" [619mm]	5'-5 3/8" [1661mm]	7'-3 3/4" [2219mm]	9 3/8" [238mm]
255/300	STANDARD	2'-3 1/4" [692mm]	11 3/4" [298mm]	5'-8 5/8" [1743mm]	7'-10" [2388mm]	6 5/8" [168mm]
255/300	LONG	3'-6 1/4" [1073mm]	2'-2 3/4" [679mm]	5'-8 5/8" [1743mm]	7'-10" [2388mm]	6 5/8" [168mm]
255/300	EXTENDED	3'-2 1/4" [972mm]	2'-3 7/8" [708mm]	5'-8 1/2" [1740mm]	7'-8" [2337mm]	1'-4 1/2" [419mm]
380/450	STANDARD	1'-8 7/8" [530mm]	1'-1 3/4" [349mm]	5'-8 1/2" [1740mm]	7'-10" [2388mm]	1'-2" [356mm]
380/450	LONG	2'-11 7/8" [911mm]	2'-4 3/4" [730mm]	5'-8 1/2" [1740mm]	7'-10" [2388mm]	1'-2" [356mm]

NOTES:
1. All UCP connections use 1/2" [13mm] conduit.
2. Two rows of 4 knockouts are provided. Use either front or back row, depending on location of discharge line above UCP.

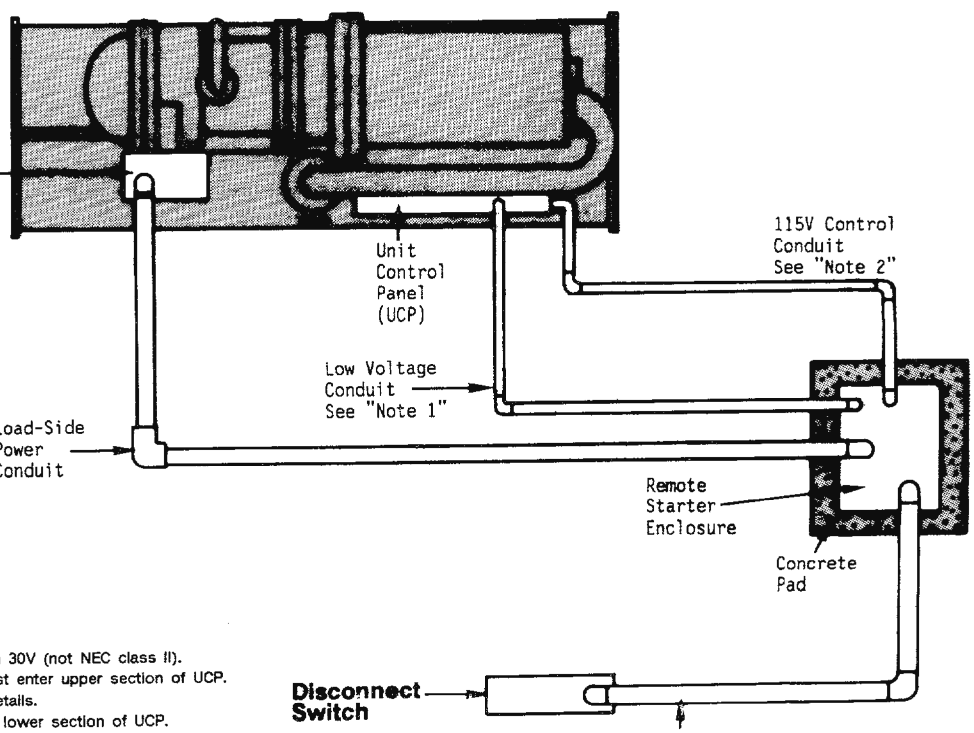
Table 4
Wire Selection Chart for RTHA Compressor Motor and Remote Starter Leads

Min. Wire Size Copper 90°C	0 to 2000 Volts Supply Leads for All Starters Motor Leads for Across-The-Line, Auto-Transformer or Primary Reactor Type Starters								0 to 2000 Volts Motor Leads for Star Delta Starter					
	1 Conduit 3 Wires	1 Conduit 6 Wires	2 Conduits 3 Wires Ea.	3 Conduits 3 Wires	2 Conduits 6 Wires	4 Conduits 3 Wires	5 Conduits 3 Wires	6 Conduits 3 Wires	1 Conduit 6 Wires	2 Conduits 3 Wires	2 Conduits 4 Wires	4 Conduits 3 Wires	3 Conduits 4 Wires	6 Conduits 3 Wires
8	44	*	*	*	*	*	*	*	50	75	*	*	*	*
6	60	*	*	*	*	*	*	*	52	103	*	*	*	*
4	75	*	*	*	*	*	*	*	104	131	*	*	*	*
3	88	*	*	*	*	*	*	*	121	151	*	*	*	*
2	104	*	*	*	*	*	*	*	143	179	*	*	*	*
1	120	*	*	*	*	*	*	*	165	206	*	*	*	*
0	136	217	272	408	435	544	580	816	187	234	375	468	562	703
00	156	249	312	468	499	624	780	935	215	258	430	537	645	806
000	180	288	360	540	576	720	900	1080	248	310	496	520	744	931
0000	208	332	416	524	665	832	1040	1248	286	358	573	717	860	1075
250	232	371	464	695	742	928	1160	1392	320	400	640	800	960	1200
300	256	409	512	768	819	1024	1280	1536	353	441	704	882	1059	1324
350	260	448	560	840	895	1120	1400	1680	386	482	772	965	1158	1448
400	304	486	608	912	972	1215	1520	1824	419	524	838	1048	1257	1572
500	344	550	688	1032	1100	1378	1720	2064	474	593	948	1186	1423	1770
600	380	608	760	1140	1216	1520	1900	2280	524	655	1048	1310	1572	1963

Notes:

* Conductors to the starter and motor connected in parallel (electrically joined at both ends to form a single conductor) must be sized ±0 (1/0) or larger (NEC 310-4). Each phase must be equally represented in each conduit.

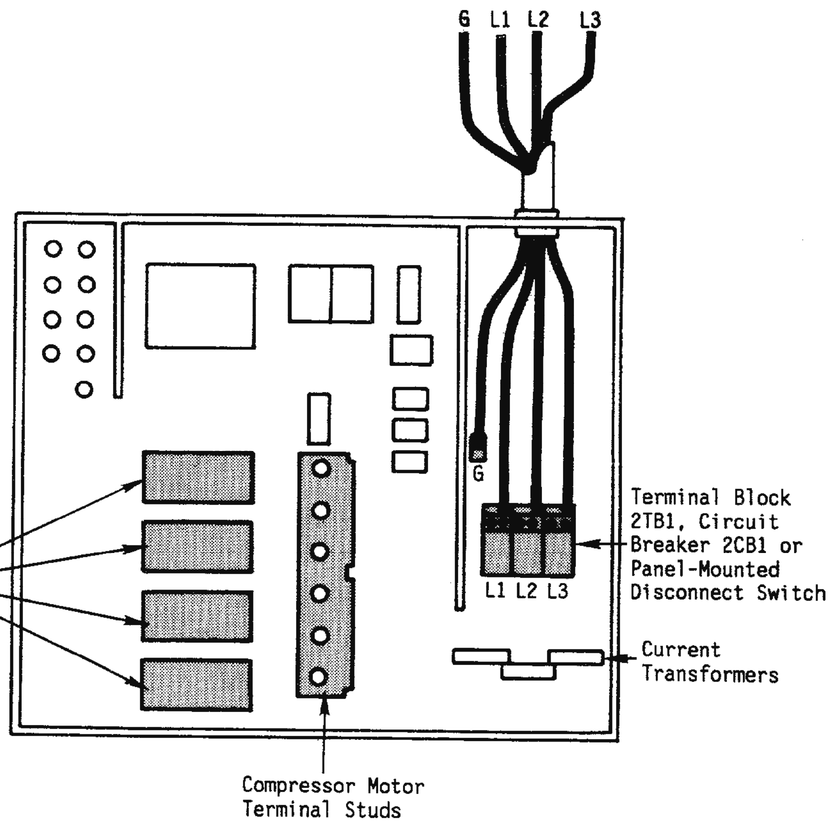
Figure 25
Typical Equipment Room Layout for 150-Ton RTHA Unit with Remote-Mounted Starter Panel



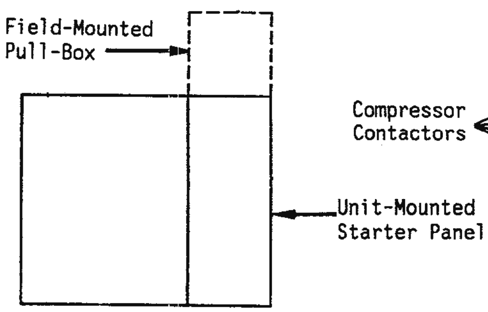
Notes:
1. "Low voltage" = less than 30V (not NEC class II). Low voltage conduit must enter upper section of UCP. Refer to Figure 12 for details.
2. 115V conduit must enter lower section of UCP. Refer to Figure 12 for details.

Figure 26
Proper Phasing for Supply Power Wiring to Typical Unit-Mounted Starter Panel

One Conduit - 3 Wire



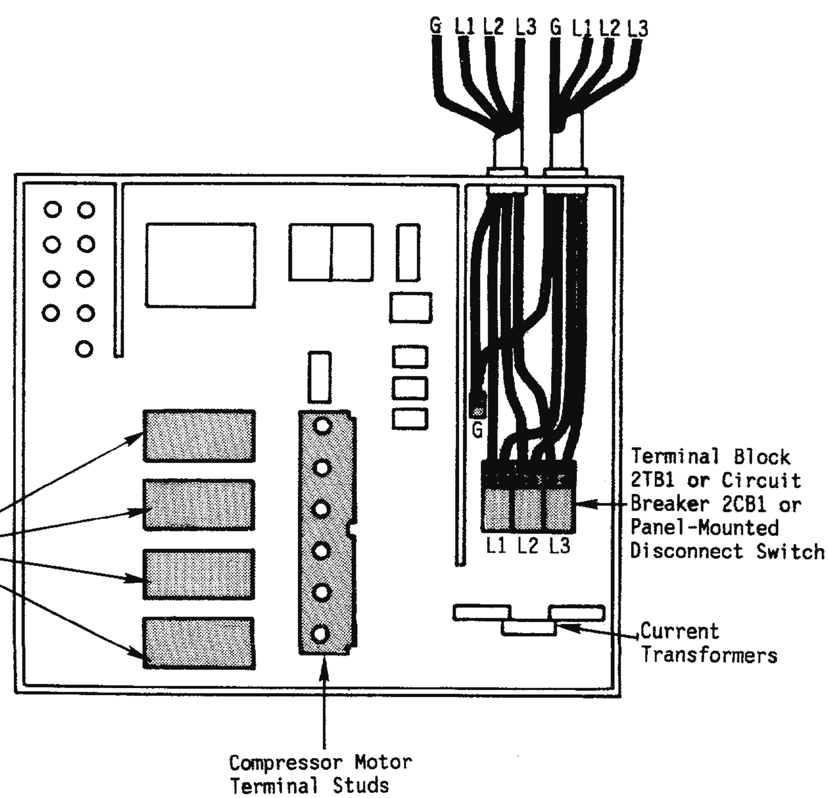
Detail A



⚠ WARNING

IT IS IMPERATIVE THAT L1-L2-L3 IN THE STARTER BE CONNECTED IN THE A-B-C PHASE SEQUENCE TO PREVENT EQUIPMENT DAMAGE DUE TO REVERSE ROTATION.

Two Conduit - 6 Wire



Other Supply Power Components

Power Factor Correction Capacitors (Optional)

Provide power factor correction for the motor by adding the optional power factor correction capacitors (PFCCs) to the motor starter.

Caution: To avoid motor damage due to loss of overload protection, PFCCs must be wired correctly.

Connect PFCCs before the overload current transformers (Figure 27) except:

1. When PFCC leads run through the overload current transformers (Figure 27).

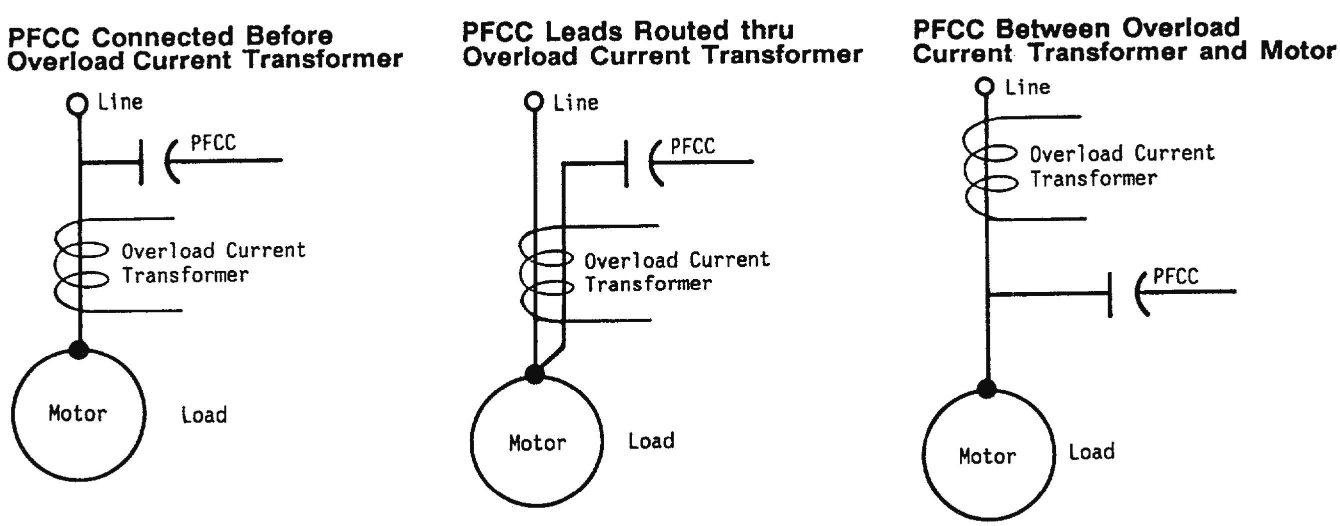
2. When the overload is recalibrated to compensate for revised current level resulting from PFCC addition (Figure 27).

Note: Factory provided PFCCs are set at the correct overload setting. However, no matter if PFCC's are factory installed or field installed, contact a qualified service organization to check the overload setting.

Note: Use the table below to select proper PFCC.

PFCC Nameplate Voltage	Compressor Motor Voltage
240	200, 208, 230
480	363, 380, 400 or 460
600	575

Figure 27
Typical PFCC Configurations



Note: In this case, overload function must be recalibrated to compensate for new current value resulting from addition of PFCC.

Disconnect Switches

Size fused disconnects in accordance with NEC Article 440-22(a) which 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 percent of the compressor motor design RLA for dual-element fuses or 225 percent for non-time delay fuses".

Interconnecting Wiring

Remote Starter Panel

Starter-panel-to-motor interconnection involves providing compressor power wiring from the starter panel to the compressor motor junction box and providing low voltage and control voltage wiring from the starter panel to the unit control panel. (Figures 20, 22 and 26). Refer to starter panel submittals for electrical access opening sizes and locations. Refer to the electrical diagrams provided with the unit for proper designation of connection terminals.

Compressor Motor Power Wiring

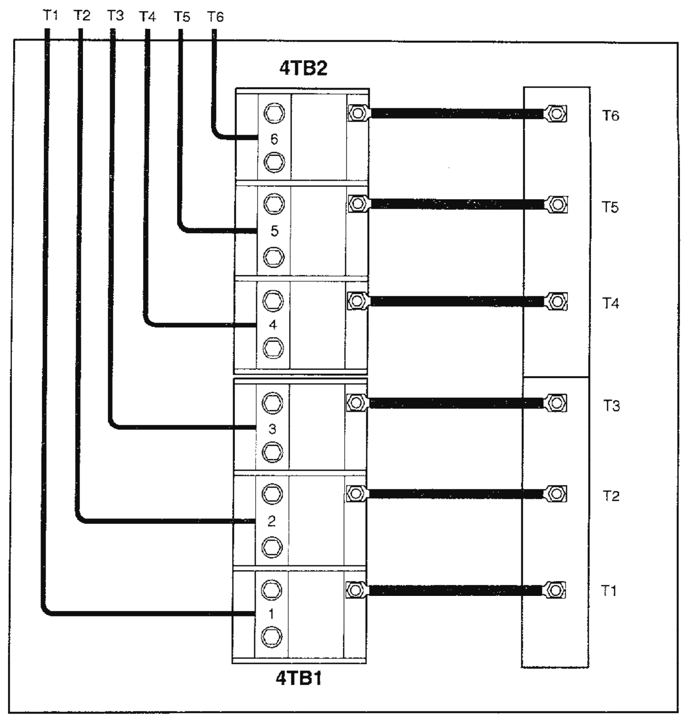
Provide line voltage wiring from the starter panel to the proper terminals in the compressor motor junction box (Figures 20, 22, 25 and 28). Refer to Table 4 for motor wire sizing information.

Terminal Lugs

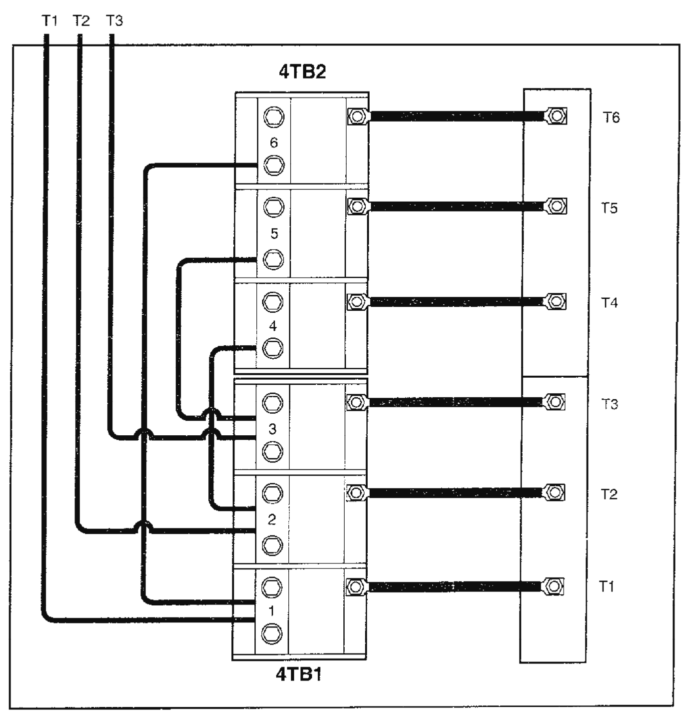
Note: Proper starter panel line-side lug sizes are specified by the starter submittals. These lug sizes must be compatible with conductor sizes specified by the electrical engineer or contractor. Standard lug sizes are provided unless other lug sizes were specified on the sales order.

Jumper Wires. Install jumper wires across the 6 motor terminals of across-the-line, primary-resistor, or auto-transformer starting equipment as shown in Figure 28.

Figure 28
Motor Terminal Junction Box Wiring for Remote Mounted Starters



WYE - Delta Remote Starter



Cross - The - Line and Autotransformer Remote Starter

Table 5
RTHA Field Wiring Requirements

Power Supply Circuit(s)		
Description of Circuit(s)	**Starter Panel Terminations**	**UCP Terminations**
Standard Circuits:		
3-Phase Power Supply Terminal Block	2TB1: G, L3, L2 and L1	n/a
Starter/Motor Junction Box Interconnection	T1 thru T6 (as applicable by starter type)	n/a
Circuit Options:		
3-Phase Power Supply Circuit Breaker	2CB1: G, L3, L2 and L1	n/a
120 VAC Control Circuit(s)		
Standard Circuits:		
Chilled Water Interlock	n/a	1TB7-3, -5 (incl. 5S2, 5K1)
Condenser Water Interlock	n/a	1TB7-4, -6 (incl. 5S3, 5K2)
Auxiliary 120V Power Supply for Condenser Water Pump Contactor	n/a	1TB1-4, -5 (In series w/5K2)
Master Solenoid Valve	2TB1-8	1TB5-9
* UCP Ground Connection	n/a	G
* 120V Power Supply to UCP	2TB2-1, -2	1TB5-11, -2
* Start Signal	2TB1-3, 4, 6	1TB5-4, -10; 1TB2-8
* Transition Signal	2TB1-5, 6	1TB2-5, -6
Circuit Options (Relay Package Option):		
Alarm Relay	n/a	1TB1-8, -9, -10
Head Relief Request Relay	n/a	1TB1-11, -12
<30 VAC Control Circuit(s)		
Standard Circuits:		
Lvg. Evaporator Water Temp. Sensor (4RT1)	n/a	1TB3-1, -2
* Transition Complete	2TB3-7, -8	1TB4-5, -6
* Current Transformer Outputs	2TB1-12 thru 17	1TB4-7 thru -12
Circuit Options:		
**Lvg. & Ent Evaporator Water Temp. Sensors (4RT1 & 4RT2)	n/a	1TB3-1, -2 1TB3-3, -4
**Ent. & Lvg. Condenser Water Temp. Sensors (4RT3 & 4RT4)	n/a	1TB3-5, -6; 1TB3-7, -8
Ambient Temperature Sensor (4RT6)	n/a	1TB3-14, -15
External Inhibit	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, -3 (Grd)

*Field wiring connections required only for units with remote-mounted starters.
**Included in optional water temperature sensing kit.

Ice Making Option For Design Sequences A thru H__.

Description	UCP Term.
Leaving Ice Bank Temp sensor 6 RT 1	6TB2-9, -10
Entering Ice Bank Temp Sensor 6RT2	6TB2-7, -8
Start Ice Making Command	6TB4-1, -2
Ice Bank Supply Pumps Starter or Reversing Value	6TB1-5, -6

Ice Making Option For Design Sequences J and Later.

Description	UCP Term.
Leaving Ice Bank Temp sensor 4RT9	6TB2-7, -8
Start Ice Making Command	6TB2-9, -10
Ice Bank Supply Pumps Starter or Reversing Value	6TB1-5, -6

Note: Entering Ice Bank Temp. Sensor is only used on Design Sequences A thru H__.

Active Oil Return System

The active oil return system is required on Series R chillers with the extended shell option and on 380/450 Ton units. Units with oversized (extended) shells, and units where the internal refrigerant flow is low, may require an active oil return system. These units do not have enough lift in the normal, passive oil return system to return oil at full and part load conditions.

Series R units with standard and long shell options do have enough refrigerant flow to manage oil circulation without the assistance of the oil return feature.

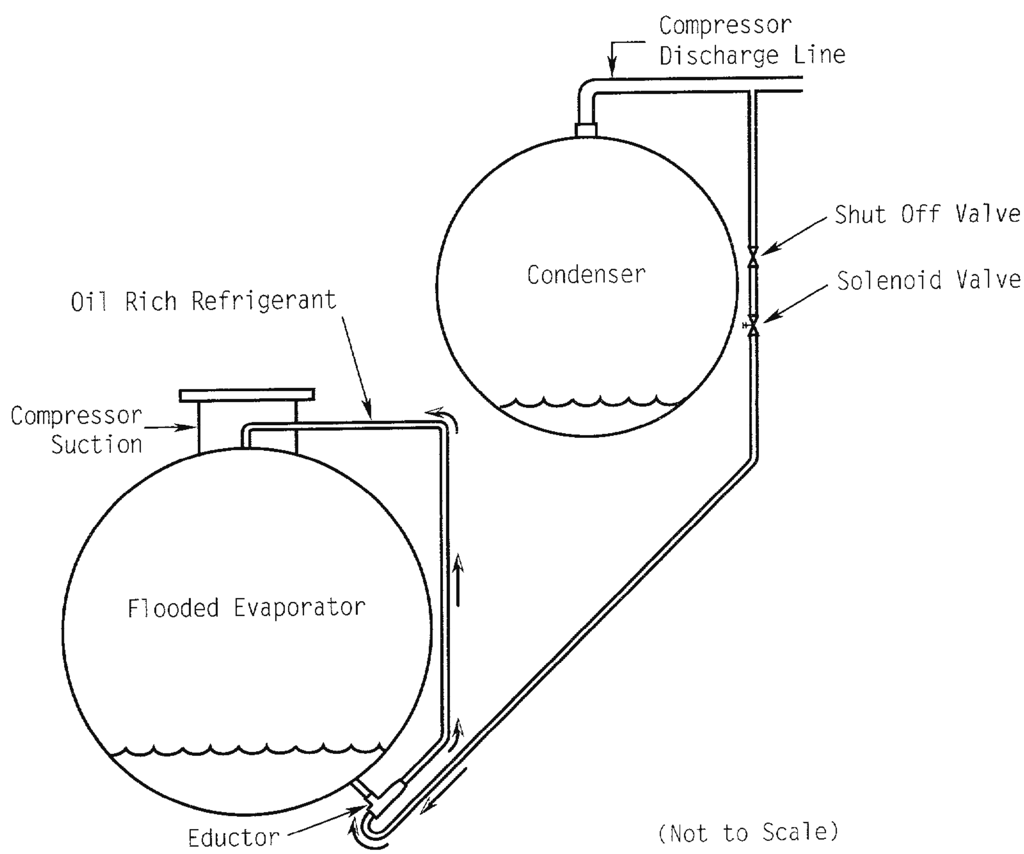
The active oil return utilizes added lift to return accumulated oil from the evaporator to the compressor. See Figure 29. The system includes an eductor system, a controller and an optical sensor. The system discharges hot gas from the discharge line to help move oil-rich refrigerant from the evaporator to the evaporator suction.

Only under certain conditions will the active oil return system be activated. The controller can be field-modified to operate from 3 to 18 minutes, but is factory set at 12 minutes. This time span will dictate how long the active oil return system will be in operation, once the optical sensor detects a low oil level.

The controller is a factory-mounted control panel. This controller initiates active oil return when the optical sensor registers a low oil condition in the sump tank. The controller opens the solenoid valve, allowing hot gas to move through the eductor and lift the oil-rich refrigerant from the bottom of the evaporator to the top.

After the selected time in minutes expires, the controller then checks the optical sensor to see if oil is present in the oil tank. If the optical sensor detects the presence of oil, the unit will return to normal operation. However, if the sensor detects no oil after the time has expired, the chiller will shut down on a manually resettable diagnostic (low oil flow - bF2) and a red LED will light inside the controller. When the red LED is illuminated, this will be an indication that not enough oil was returned to the oil sump.

Figure 29
Active Oil Return System
Piping Configuration

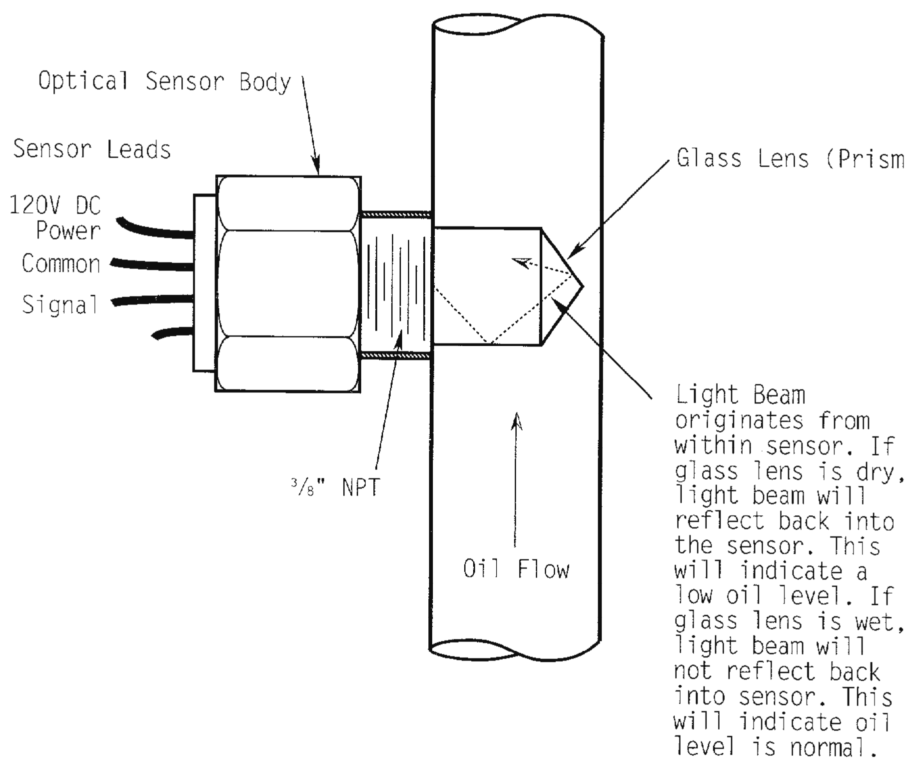


Optical Sensor

The oil level sensor uses an optical method of detecting the presence or absence of an oil level in the sump. A light beam originates from within the sensor and is directed at a prism (glass lens) on the tip of the sensor. See Figure 30.

If the sensor is uncovered (dry), the light beam is reflected at 90o angles off of the glass lens and back into the sensor, where an optical sensor detects the light source being present. This means that there is a minimum oil level and a signal is sent to the controller and then to the hot gas solenoid. At this time, the active oil return is put into operation. The system will remain in active oil return until the time setting in minutes expires. When oil is returned to the sump, the sensor prism will now be covered and the machine will return to normal passive oil return.

Figure 30
Optical Sensor for Active Oil System



Eductor

The eductor, as shown in Figure 31, permits hot gas to be injected into the motive end (A1) of the eductor. Because of the velocity at A2, the pressure at A3 is greatly reduced, causing a suction reaction at A4. This pulls oil-rich refrigerant from the evaporator. A mixture of oil and refrigerant is discharged to the compressor suction at A5.

Active Oil Return Control Unit

The active oil return controller in mounted on the lower right side of the control panel. See Figures 32 and 52. The controller will interpret signals sent from the optical sensor and oil flow switch or differential pressure switch. The controller will send these signals on to the UCP for processing. There are two LEDs that will illuminate if a given condition exists.

1. The red LED will be illuminated if the oil recovery system did not recover enough oil to the oil tank. This will lock out the system. Once the system problem has been corrected, the reset button(s) should be depressed, to re-energize the controller.

2. The green LED will be illuminated during the oil recovery period.

Figure 31
Eductor Cross-sectioned View

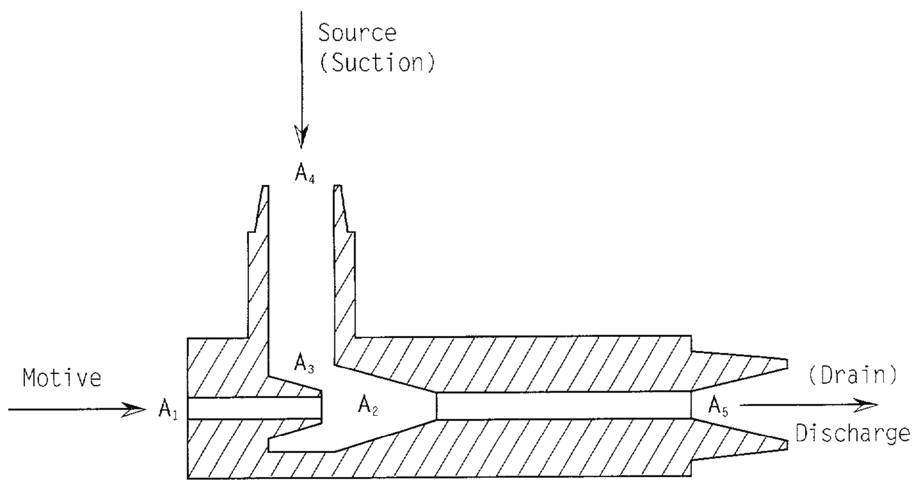
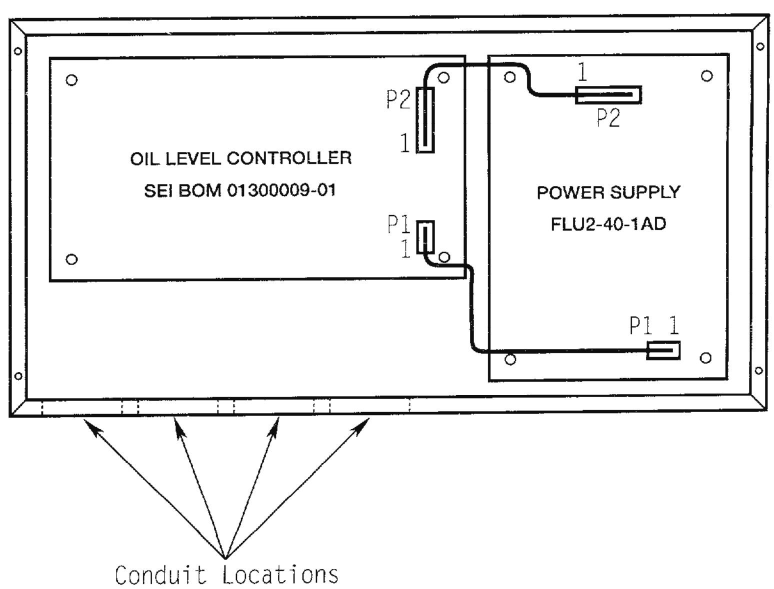


Figure 32
Active Oil Return Control Unit



The test button(S3) on the controller will allow the system to go into the oil recovery mode only during a compressor OFF condition. This will allow the optical sensor to energize all systems pertaining to the active oil return for troubleshooting purposes. See Table 6.

Table 6
Troubleshooting Guide For Active Oil Return System Control Unit

INPUTS								OUTPUTS	
Case #'S	6TB3-1 to 2 120VAC to Controller	6TB3-3 to 2 120VAC Comp. Running Signal	6TB4-5 to 6 Pressure Switch To Controller Signal	6TB4-1 to 2 12VDC Supply To Optical Sensor	S1 Test Button	Lights Red Green		6TB3-4 to 5 120VAC Solenoid	6TB4-7 to 8 Controller To UCM (Oil Flow Switch)
1	OFF	ANY	ANY	ANY	ANY	NONE	↔	OFF	OPEN
2	ON	OFF	CLOSED	.7VDC	OPEN	NONE	↔	OFF	CLOSED
3	ON	OFF	CLOSED	.7VDC	CLOSED	NONE	↔	OFF	CLOSED
4	ON	OFF	CLOSED	12VDC	OPEN	NONE	↔	OFF	CLOSED
5	ON	OFF	CLOSED	12VDC	CLOSED	NONE	↔	ON	OPEN
6	ON	OFF	OPEN	.7VDC	OPEN	NONE	↔	OFF	OPEN
7	ON	OFF	OPEN	.7VDC	CLOSED	NONE	↔	OFF	CLOSED
8	ON	OFF	OPEN	12VDC	OPEN	NONE	↔	OFF	OPEN
9	ON	OFF	OPEN	12VDC	CLOSED	NONE	↔	ON	CLOSED
10	ON	ON	CLOSED	.7VDC	OPEN	NONE	↔	ON	CLOSED
11	ON	ON	CLOSED	.7VDC	CLOSED	NONE	↔	ON	CLOSED
12	ON	ON	CLOSED	12VDC	OPEN	GREEN	↔	OFF	CLOSED
13	ON	ON	CLOSED	12VDC	OPEN	RED	↔	OFF	OPEN
14	ON	ON	CLOSED	12VDC	CLOSED	GREEN	↔	OFF	CLOSED
15	ON	ON	OPEN	.7VDC	OPEN	NONE	↔	ON	OPEN
16	ON	ON	OPEN	.7VDC	CLOSED	NONE	↔	ON	OPEN
17	ON	ON	OPEN	12VDC	OPEN	GREEN	↔	OFF	OPEN

NOTES:
(1) If all inputs are verified for a particular case number, then both conditions in the output table need to be met.
(2) If the compressor is running both test (S1) and reset (S2) buttons are inactive.
(3) .7VDC implies oil is not present at the optical sensor. 12 VDC implies oil is present.
(4) Test button will energize optical sensor only when the compressor is off and a temporary jumper between 4S7-3 and 6TB4-3 is installed. This jumper will need to be removed after test is complete.
(5) S1 implies circuit test for table above.

The timing function in the controller has four different time functions that can be set in the field. The controller is factory set at 12 minutes, but can be reset for 3 minutes, 6 minutes or 18 minutes. If the unit runs at low loads a lot of the time, then a longer setting in minutes would be appropriate. Shown in Figure 33 is a diagram of the controller time setting function which located inside the controller. The MTA jumper can be removed and inserted on another timing pin, as long as one end of the MTA jumper is on COMMON.

Figure 33
Active Oil Return Time Setting

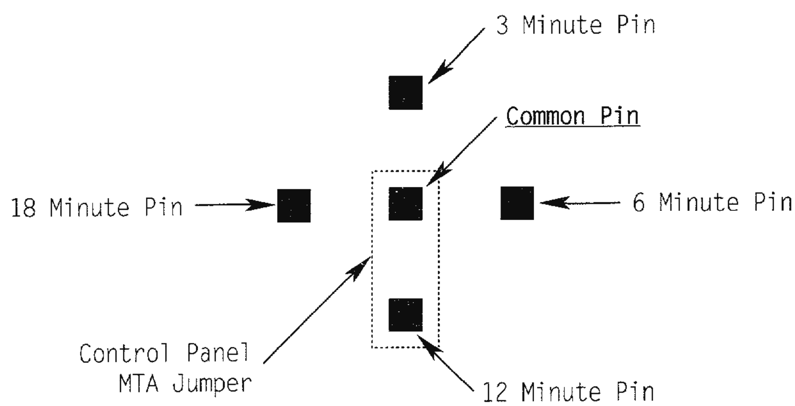
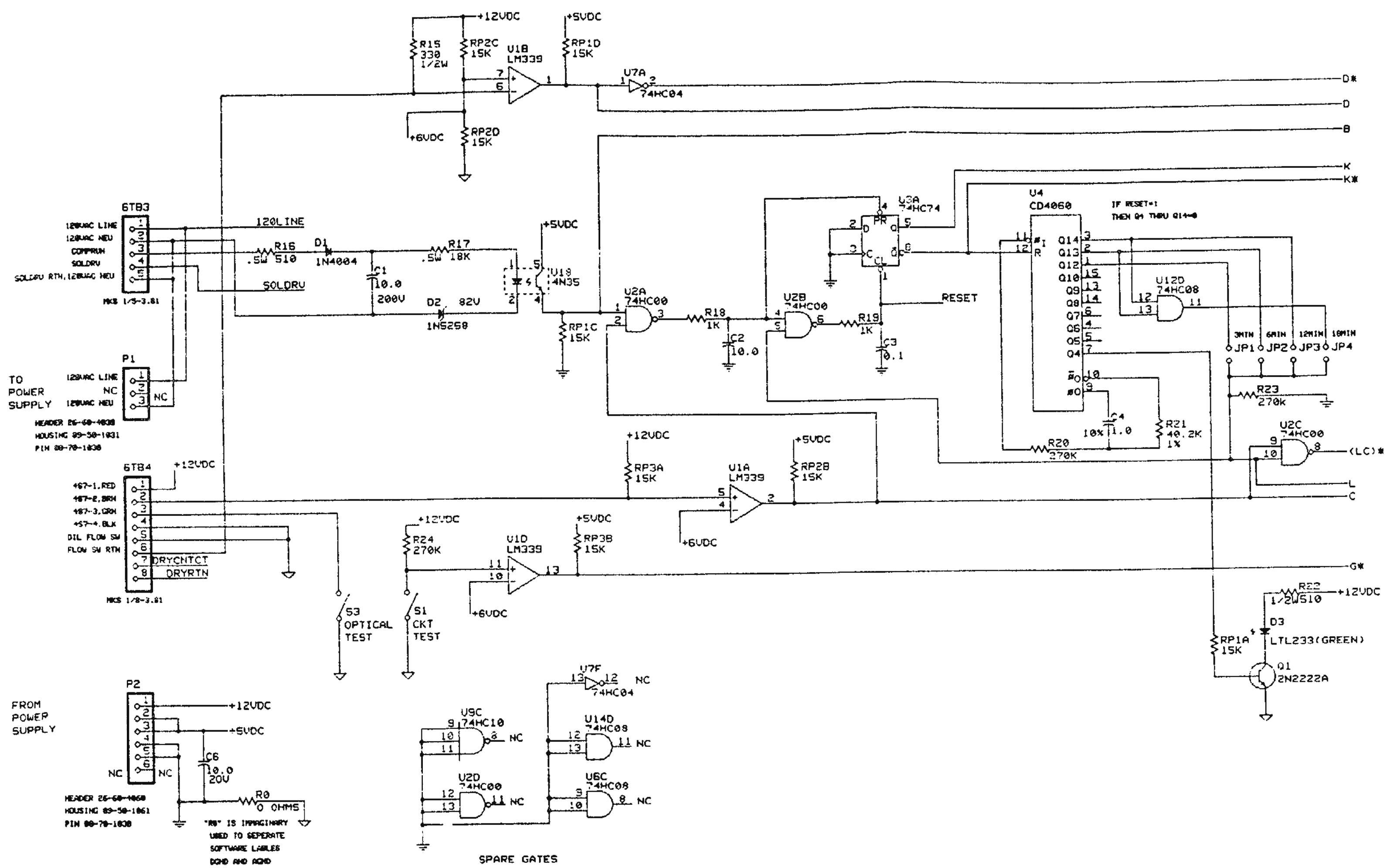


Figure 34
Active Oil Return Control Unit Wiring



Ice Making

The RTHA ice making control panel is an optional, factory- mounted, auxiliary control that operates with the unit control panel. It provides for chiller control during ice making without affecting standard unit control machine protection functions.

Ice Making Panel Operation for Design Sequences AO thru H__

When ice making is called for by a contact closure between 6TB4- 1 and 6TB4-2, the ice making control will place a resistor in parallel with the leaving chiller water temperature sensor located on the outlet of the evaporator. This will bias the existing temperature upward and cause the chiller to run fully loaded.

At this time, a contact closure is made between 6TB1-5 and 6TB1- 6, which can be used to engage a pump starter in the ice bank loop. This can also shut down peripheral equipment when ice making is complete, to prevent heat input to the ice bank.

The field-installed leaving ice bank temperature sensor (6RT1) will monitor the solution being returned to the chiller from the ice bank. During ice making, it will read a temperature that has been pulled down to 32 F or lower. The leaving ice bank temperature sensor is field adjustable.

The entering ice bank temperature sensor (6RT2) serves as a backup low temperature cutout and can be adjusted via the UCM controller. The low temperature cutout is a 3-position switch that can be set at 10 F, 15 F or 20 F.

Note: Both low temperature cutouts (one on the UCM and the other on in the ice making control panel) must be set to accommodate the ice making option.

Once the ice bank has become fully charged and the leaving temperature has been reached, ice making will be terminated. The compressor will unload for 60 seconds, after which contacts 6TB1- 5 and 6TB1- 6 will open, shutting down the circulation pump and chiller.

The chiller will not re-enter the ice making mode until the command signal a 6TB4-1 and 6TB4-2 is opened and then reclosed.

Note: The low temperature cutout can be set lower than the ice bank termination set point. This setting can remain during normal cooling mode, provided the glycol solution can accommodated this temperature setting.

Ice Making Panel Operation for Design Sequences JO and Later

The chiller will operate in its normal cooling mode until put into ice making mode, either automatically or manually. The chiller will continue to run fully loaded until the ice making temperature is reached.

Caution: It is essential to keep the chiller a full load and the current limit at 100% during the entire process. If the chiller is allowed to unload during ice making, the oil return becomes greatly reduced and catastrophic damage to the compressor can occur.

The control panel also directs the machine to unload prior to termination of ice making, thus enabling the check valve to close under lower pressures.

Operation

When ice making is called for by a contact closure at 6TB2-9 and 6TB2-10, the ice making control places a resistor in parallel with the leaving chilled water temperature sensor (4RT1). This will bias the existing temperature reading upward, causing the chiller to run at full load. At this time, a contact closure between 6TB1-5 and 6TB1-6 can be used to energize a pump start and/ or a diverting valve in the ice bank loop (if installed). This can also be used to shut down the same peripheral equipment when ice making is complete.

The field-installed leaving ice bank temperature sensor (6RT1), which monitors the temperature of the fluid leaving the ice bank and returning to the chiller, will become the ice termination sensor. During ice making, this sensor will read a temperature that has been pulled down to setpoint. The sensor is adjustable between 25 F and 32 F. Once this sensor is satisfied and termination is acknowledged, a contact closure between 6TB1-3 and 6TB1-4 will occur. This will cause the chiller to unload for 60 seconds. After that time, the following will occur:

1. The ice making fluid pump will de-energize (6TB1-5 and 6TB1- 6).

2. The external inhibit opens (1TB3-16 and 1TB3-17).

3. The leaving fluid temperature sensor is no longer biased (6TB2-1 and 6TB2-2).

The unit will remain off and will not return to normal cooling until the ice making contacts to make ice are opened. When this occurs, the unit will wait until the leaving water temperature reaches or exceeds the front panel chilled water setpoint. Normal operation will then continue until the next call for ice making.

If an alternate means of ice making termination is necessary, place a contact in series with the ice termination sensor 4RT9. Customer-supplied contacts (silver or gold 12 VDC) for ice termination via the ice termination sensor must be compatible with the dry circuit. Open contacts will terminate ice making.

Note: The above example assumes that the ice termination sensor was satisfied and then a time clock opened the ice making contact. If the time clock opens the contacts before the ice termination sensor is satisfied, the unit automatically returns to normal cooling mode. Refer to Figures 35 and 36 for operation sequences controlled by either sensor and time clock.

Figure 35
Ice Termination By Sensor

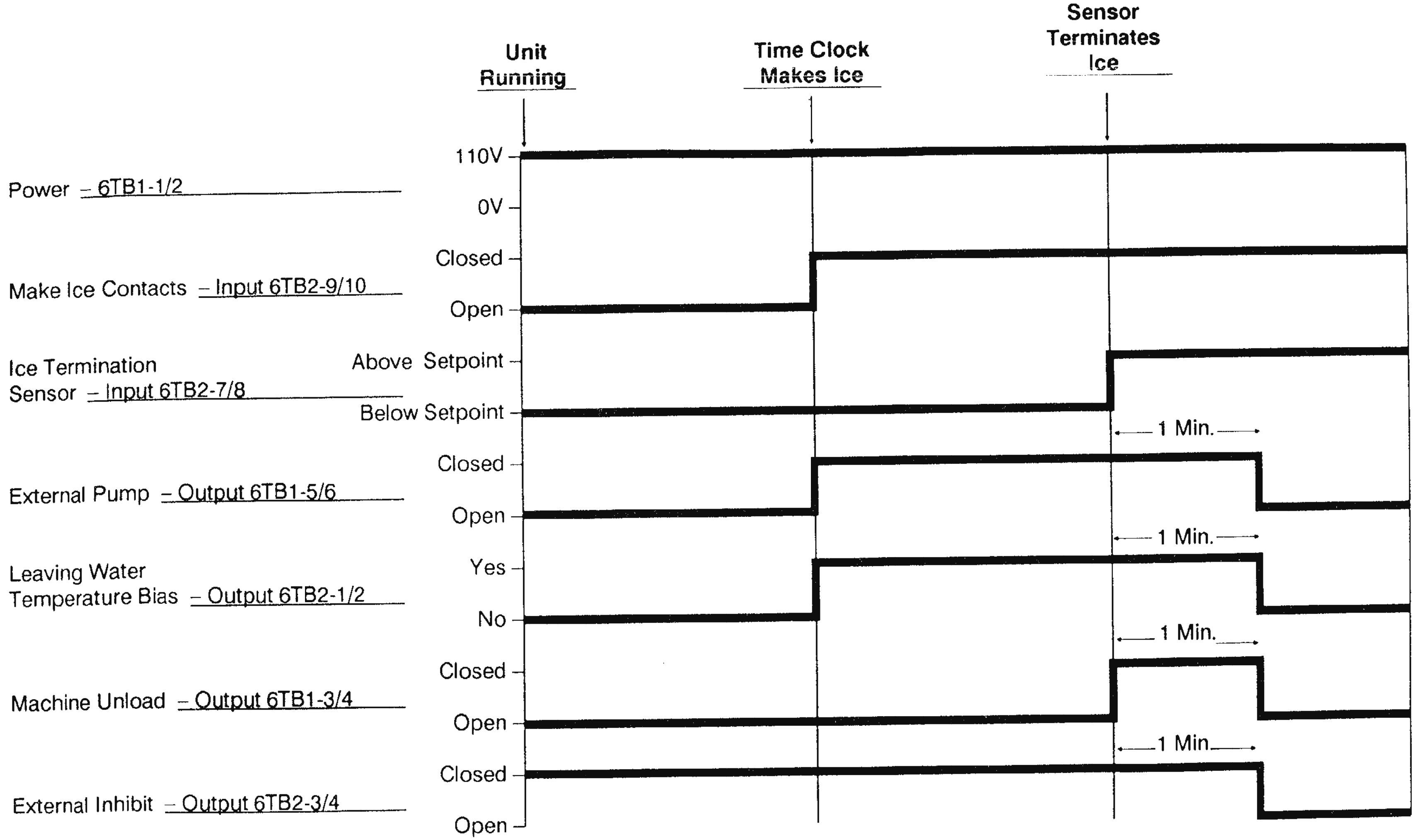
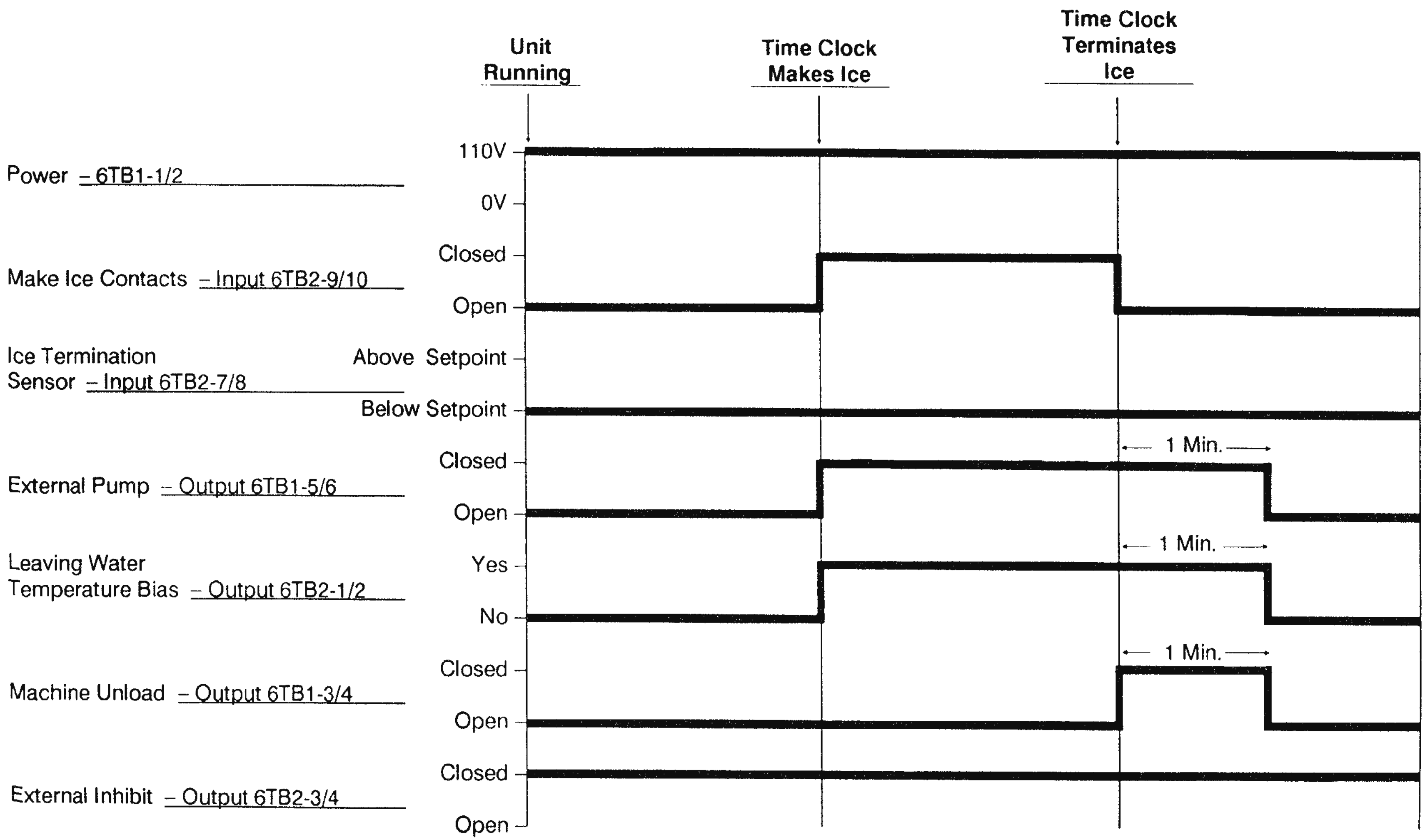


Figure 36
Ice Termination By Time Clock

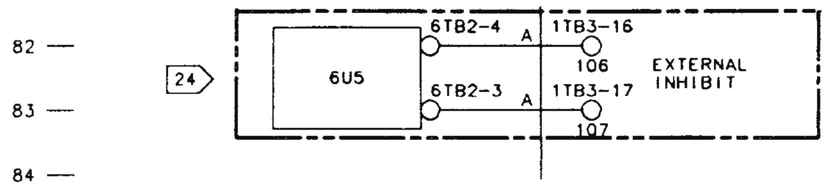


Input/Output Characteristics for Ice Making Panel Design Sequence JO thru SO

External Inhibit (Output)

When ice making is installed, remove the jumper from 1TB3-16 and 1TB3-17.

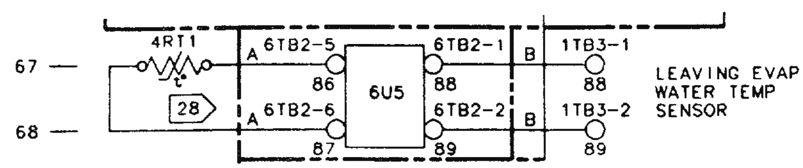
Figure 37
External Inhibit



Leaving Evaporator Water Temperature Sensor (4RT1 Output) 6TB2-1 and 6TB2-2

This allows the ice making panel to offset the leaving water temperature sensor signal upward by 20 F, in order to keep the chiller fully loaded.

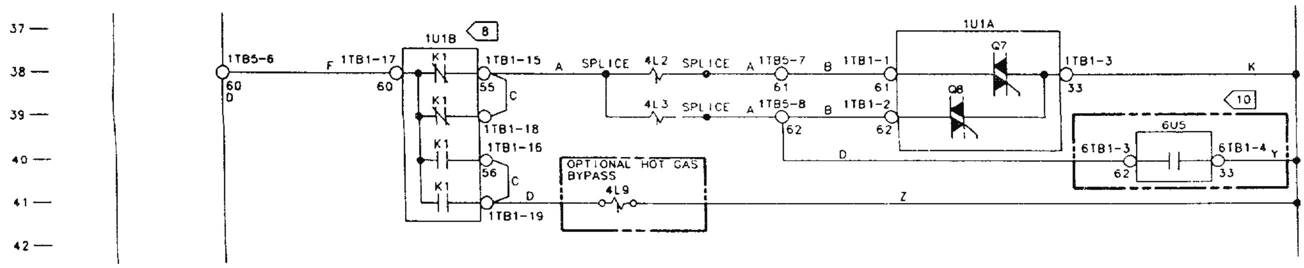
Figure 38
Leaving Evaporator Water Temperature Sensor



Machine Unload (Output 6TB1-3 and 6TB1-4)

When ice making is complete, this output is used to energize the unload solenoid for 60 seconds prior to shut down.

Figure 39
Machine Unload



Ice Bank Leaving Temperature Sensor (4RT9 Input) 6TB2-7 and 6TB2- 8

This sensor reads the temperature of the brine leaving the ice bank and returning to the chiller. It is used to terminate ice making when the ice bank is charged. Conversion data for 4RT9 is shown in Table 7.

Make Ice Contact Closure (Input 6TB2-9 and 6TB2-10)

This will detect a switch or contact closure from a remote timer or energy management system and can be used to initiate ice making.

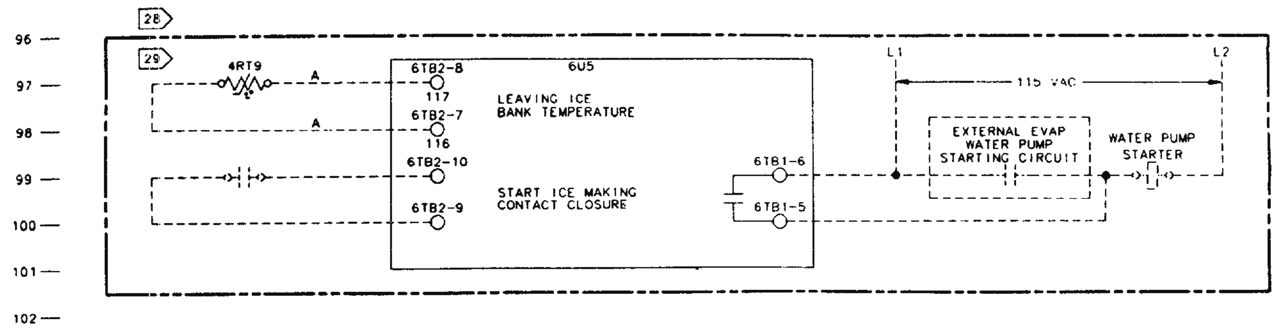
Table 7
Sensor Conversion Data Ice Termination (4RT9)

Temperature F	KOHMS	VDC
20	46.8	2.882
21	45.5	2.852
22	44.2	2.817
23	42.9	2.782
24	41.6	2.747
25	40.4	2.707
26	39.2	2.669
27	38.1	2.634
28	37.0	2.598
29	35.9	2.561
30	34.8	2.522
31	33.8	2.487
32	32.8	2.449
33	31.9	2.414
34	31.0	2.379
35	30.2	2.347
36	29.3	2.308
37	28.5	2.274
38	27.7	2.237
39	26.9	2.203
40	26.2	2.171
41	25.5	2.138
42	24.8	2.105
43	24.1	2.071
44	23.5	2.039
45	22.8	2.003
46	22.2	1.971
47	21.6	1.938
48	21.1	1.911
49	20.5	1.878
50	20.0	1.849
55	17.4	1.692
60	15.3	1.553
65	13.4	1.415
70	11.8	1.282

External Pump (Output 6TB1-5 and 6TB1-6)

This may be used to shut off a chilled liquid circulating pump or switch a mixing valve when ice making is complete.

Figure 40 External Pump

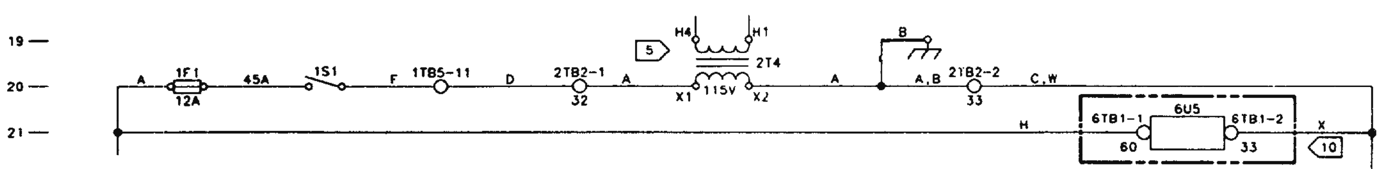


Drawing X39530057

Power Panel (6TB1-1 and 6TB1-2)

These terminals are connection points for power to the panel.

Figure 41 Power Panel



Drawing X39530056

Note: The DIP switch setting for extended temperature range on the chiller UCM must be on when ice making is used. The evaporator refrigerant trip setpoint must be reset to accommodate the brine temperature.

Note: Current Limit must be set to 100%.

If external inhibit is utilized to start and stop the unit, a dry set of contacts must be put in series between 1TB3-16 and 6TB2- 4. When utilizing remote start and stop contacts, be sure that the contacts are closed prior to entering and throughout the entire ice making process. The unit must not be controlled from this external inhibit in ice making mode. Only during normal cooling operation is this set of contacts to be used for starting and stopping.

Mount the leaving ice bank temperature sensor at the inlet to the chiller evaporator. This will ensure that the chiller is protected against a malfunctioning valve between the ice bank and the chiller. It is not necessary for sensor leads to be of any extra length.

Chilled Water Flow Switch (5S2)

Provide interconnecting wiring between unit control panel, chilled water pump control (5K1) auxiliary contacts and chilled water flow switch (5S2). Connect 5S2 pump interlock circuit to proper terminals of terminal block 1TB7 in the unit control panel.

Condenser Water Flow Switch (5S3)

Provide interconnecting wiring between unit control panel, condenser water pump control (5K2) auxiliary contacts and condenser water flow switch (5S3). Connect 5S3 pump interlock circuit to proper terminals of terminal block 1TB7 in the unit control panel.

Optional Head Relief Request and Alarm

Provide interconnecting wiring between optional head relief request and remote alarm relay and alarm indicator light and proper terminals of 1TB1 in the control voltage section of the unit control panel.

Low Voltage Control Wiring

This refers to all field-provided low voltage (30V max.) wiring shown on the typical field wiring diagram (Figures 19 thru 21) and on the field wiring and sensor layout schematic (Figures 20 thru 22). Refer to the electrical diagrams that shipped with the unit for specific information. See Table 5 for a complete list of standard and optional control panel features that require field electrical connections.

Chilled Water Temperature Sensors

The standard leaving chilled water temperature sensor 4RT1 is factory wired. If optional entering and leaving chilled water sensing is desired, the standard sensor must be disconnected at terminal strip 1TB3 in the control panel. Once the optional matched-pair sensors (4RT1, 4RT2) are installed (See "Field Installed Temperature Sensors"), connect their leads to 1TB3 as shown in Figures 19 thru 22.

Caution: To avoid sensor malfunction due to electrical "noise", run sensor wires in conduit. Do not route sensor leads in conduit with other conductors carrying 30 or more volts!

Note: (Sensor leads are not polarized.)

Condensing Water Sensors

If optional entering and leaving condensing water temperature sensing is desired, install the matched-pair of sensors provided (4RT3, 4RT4) in the condenser water piping as described in "Field Installed Temperature Sensors". Then, connect their leads to 1TB3 as shown in Figures 19 thru 22.

Caution: To avoid sensor malfunction due to electrical "noise", run sensor wires in conduit. Do not route sensor leads in conduit with other conductors carrying 30 or more volts!

Optional Chilled Water Reset Sensors

Load-based or ambient based chilled water reset (CWR) is used to alter chilled water setpoint during unit operation.

CWR components ship with the unit. Each package contains a thermistor pair, two compression fittings, and two strain relief clamps. The same package is used for both load-based and ambient-based CWR.

For load-based CWR, install leaving and entering chilled water temperature sensors (refer to "Field Installed Temperature Sensors") according to the instructions provided with the CWR package. Remove and discard the standard leaving water temperature sensor. Connect sensor leads at the control panel (Refer to "Chilled Water Sensors").

For ambient-based CWR, install one of the sensors (4RT5) from the CWR package in the fresh air intake of the building, or on the north wall of the building. Protect the sensor from direct sunlight and shelter from the elements. (Discard the remaining CWR sensor.) Specific ambient sensor mounting instructions are provided in the CWR package. Connect sensor leads at the control panel (Figures 19 thru 22).

Note: If both load- and ambient-based CWR is required, install the sensor pair as described above for a typical load-based CWR application. Use the discarded standard leaving water temperature sensor for ambient reset.

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 a RTHA unit is ordered with this option, a "chilled water reset interface module" (1U4) is factory-installed inside the UCP to the left of the UCM (1U3).

The unit electrical installer must make connections between the generic BAS and 1U4 in the control panel. 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 42.

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.

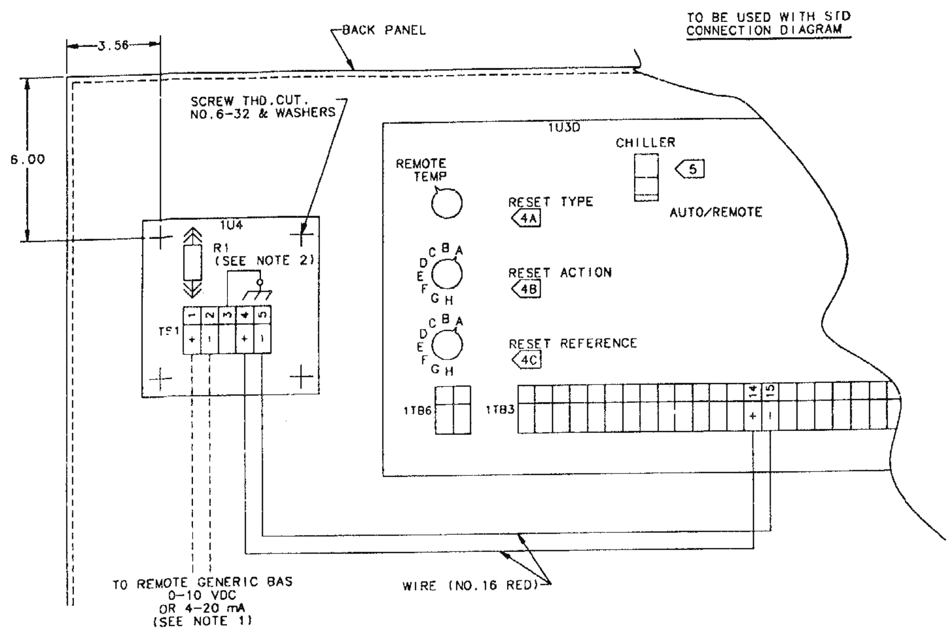
Caution: To prevent electrical noise interference, do not run this circuit in conduit with other circuits carrying more than 30 volts.

Interface module 1U4 translates a 1-10 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 (See Figure 42).

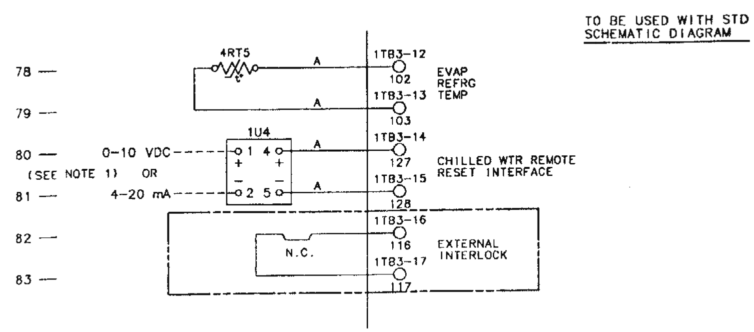
Note: If a 0-10 VDC signal input is used, remove resistor R1 from 1U4.
See Figure 42.

Figure 42
Remote Generic BAS/CWR Interface Option

CONNECTION DIAGRAM



SCHEMATIC DIAGRAM



NOTES:

1. NEGATIVE SIGNAL INPUTS ARE GROUNDED TO UCP ENCLOSURE. FOR CORRECT OPERATION, EXTERNAL EQUIPMENT SIGNALS SHALL BE ISOLATED OR FLOATING WITH RESPECT TO UCP ELECTRICAL SERVICE GROUND.

2. REMOVE RESISTOR (R1) WHEN 0-10 VDC INPUT IS USED.

3. ---------- FIELD WIRING.

4. TO ACTIVATE THE REMOTE GENERIC BAS CHILLED WATER RESET INTERFACE THE MICRO MODULE (1U3D) CHILLED WATER RESET MUST BE SET AS FOLLOWS:

   A SET "RESET TYPE" TO POSITION "REMOTE TEMP."

   B SET "RESET ACTION" TO POSITION "A","B","C",OR "D". SEE CHART BELOW TO DETERMINE SETTING.

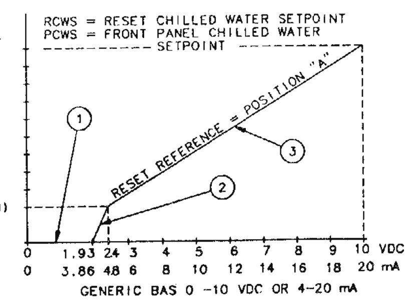
RESET ACTION (*)

RCWS-PCWS °F(°C)

SW. POS. (*)	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(8.9)
		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)
	.45(.25)	.90(.05)	1.35(.75)	1.80(1.0)
	0	0	0	0

NOTE: THE CHILLED WATER SETPOINT WILL BE RESET IN INTERGER °F ONLY.

RCWS-PCWS VERSES 0-10 VDC OR 4-20 mA



① RCWS = PCWS

② RCWS - PCWS = RESET ACTION [-18.3 + 9.50 (VDC)]
RCWS - PVWS = RESET ACTION [-18.3 + 4.74 (mA)]

③ RCWS - PCWS = RESET ACTION [-9.9 + 6.010 (VDC)]
RCWS - PVWS = RESET ACTION [-9.9 + 3.005 (mA)]

C SET "RESET REFERENCE" TO POSITION "A"

5. TO ENABLE THE REMOTE GENERIC BAS CHILLED WATER RESET INTERFACE, THE "CHILLER" SWITCH MUST BE SET TO "AUTO/REMOTE" WHEN THE CHILLER IS SET TO AUTO.

6. MAXIMUM CONTINUOUS INPUT : 15 VDC
30 mA

MINIMUM CONTINUOUS INPUT : -4 VDC
-8 mA

BELOW THESE VALUES DIAGNOSTIC CODE AE WILL OCCUR AT THE MICRO MODULE (1U3D) DISPLAY.

7. WHEN THE CHILLER IS NOT RUNNING THE MICRO MODULE(1U3D) SETPOINT WILL STEP TOWARDS THE DESIRED GENERIC BAS SETPOINT AT A RATE OF APPROX. 1°F (.55°C) PER SECOND. WHEN THE CHILLER IS RUNNING THE MICRO MODULE(1U3D) SETPOINT WILL BE CHANGED BY 1°F (.55°C) ONLY WHEN THE CHILLED WATER TEMP IS "IN CONTROL" FOR 75 SEC. "IN CONTROL" IS DEFINED AS MICRO MODULE (1U3D) SETPOINT ± X WHERE X VARIES FROM .8°F(.44°C) TO 1.6°F(.88°C) DEPENDING ON THE MICRO MODULE (1U3D) START DIFFERENTIAL SETTING.

4533-2379

Optional Bidirectional Communications Link (BCL)

This option allows the microprocessor module in the unit control panel to exchange information (i.e., operating setpoints and Auto/Standby commands) with a higher level control device, such as a System Control Panel or **Tracer**®. Figure 43 illustrates a typical communication/control network. Twisted-pair connectors establish the bidirectional communications link between unit control panel and the system controller. (These twisted-pair conductors must be run in separate conduit.)

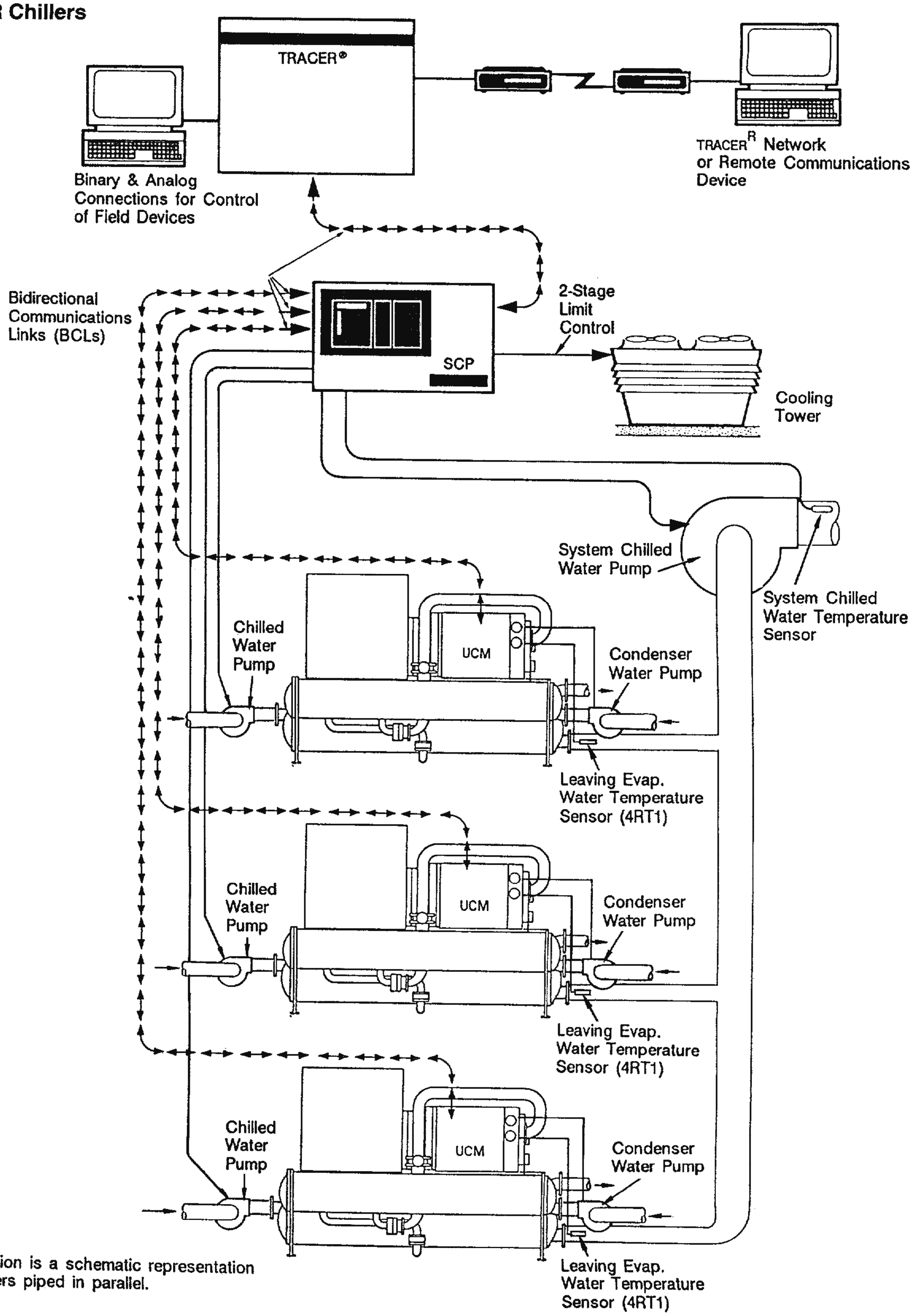
Note: The BCL and CWR control options are mutually exclusive; that is, a RTHA unit cannot be equipped with both bidirectional communications link and chilled water reset. If the BCL option is used, CWR can be provided at the system control level.

Unit Start-Up

All phases of the initial RTHA chiller start-up must be conducted under the supervision of a qualified local service engineer; this includes electrical checks, chiller start-up and checkout and operating instruction.

Complete the "Model RTHA Check Sheet and Request for Serviceman" form (Form No. 1-27.161) and forward it to your local Trane Service Company. A facsimile of this form is provided on the following page. Advance notification is required to allow scheduling of initial chiller start-up as close to the requested date as possible.

Figure 43
Typical BCL Network for SCP and Three Series R Chillers



Note: This illustration is a schematic representation of three RTHA chillers piped in parallel.

For further information on this product or other Trane products, refer to the "Trane Service Literature Catalog", ordering number IDX-IOM-1. This catalog contains listings and prices for all service literature sold by Trane. The catalog may be ordered by sending a $20.00 check to: The Trane Company, Service Literature Sales, 3600 Pammel Creek Road, La Crosse, WI 54601.

TRANE™

Model RTHA Check Sheet and Request for Serviceman

TO: ________________________________ TRANE SERVICE COMPANY

____

PROJECT NAME: ________________________________

THE FOLLOWING ITEMS ARE BEING INSTALLED
AND WILL BE COMPLETE BY (DATE) ________________________________

1. CenTraVac

[ ] Unit in place and piped. (Do not insulate CenTraVac or adjacent piping.)

2. Piping

Chilled water piping connected to:
[ ] CenTraVac (Evaporator)
[ ] Air Handling Units
[ ] Pumps

Condenser piping connected to:
[ ] CenTraVac (Condenser)
[ ] Cooling Tower

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

3. Flow Balancing Valves

[ ] Installed in leaving chilled water.
[ ] Installed in leaving condenser water.

4. Wiring

[ ] Power is available.
[ ] External interlocks complete (flow switches, water pump aux., etc.)
[ ] Chilled water pump motor connected.
[ ] Condenser water pump motor connected.
[ ] Cooling tower fan rotation checked.
[ ] 115V AC power available.
[ ] All controls and sensors installed and connected.
[ ] All magnetic starters installed and connected.

5. Pneumatic Controls (Special)

[ ] Installed and/or piped.

6. Pressure Gauges, Thermometers and Air Vents

[ ] Installed, both sides of evaporator.
[ ] Installed, both sides of condenser.

7. System Operational

[ ] Building system can be operated under load conditions.

8. Required Personnel

[ ] Electrician, system control and contractor representatives are available to enable system and test unit operation under serviceman's supervision.

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 ARE COMPLETE.

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

CHECK LIST COMPLETED BY: ________________

____

____

SIGNED: ________________

DATED: ________________

*Advance notification is required to allow scheduling start-up as close to the requested date as possible.

Operating Principles – Mechanical

This section describes the operation and maintenance of Series R CenTraVac chillers equipped with microcomputer-based control systems. The first portion of this manual describes the overall operating principles of the Series R CenTraVac design.

The rest of the manual provides specific operating instructions, detailed descriptions of unit controls and options, and maintenance procedures that must be performed regularly to keep the unit in top condition. Diagnostic information is provided at the end of this manual to allow the operator to identify system malfunctions. (If problems do occur, contact a qualified service organization to ensure proper diagnosis and repair of the unit.)

For all extended shell options and RTHA 380/450 units, include the previous components plus the following:

- eductor solenoid
- eductor
- oil level sensor
- shut off valve
- controller
- oil cooler (380/450 ton, only)

General

The 130 thru 450-ton Model RTHA units are single-compressor, helical-rotary type water-cooled liquid chillers. These units are available with either unit-mounted or remote-mounted unit starter panels.

The basic components of an RTHA unit are:

- Unit control panel (UCP):
- Unit-mounted or remote starter panel;
- helical-rotary compressor;
- flooded evaporator;
- water-cooled condenser;
- economizer;
- oil supply system (hydraulic and lubrication), and;
- related interconnecting piping.

Components of a typical RTHA unit are identified in Figures 1 thru 3.

Refrigeration (Cooling) Cycle

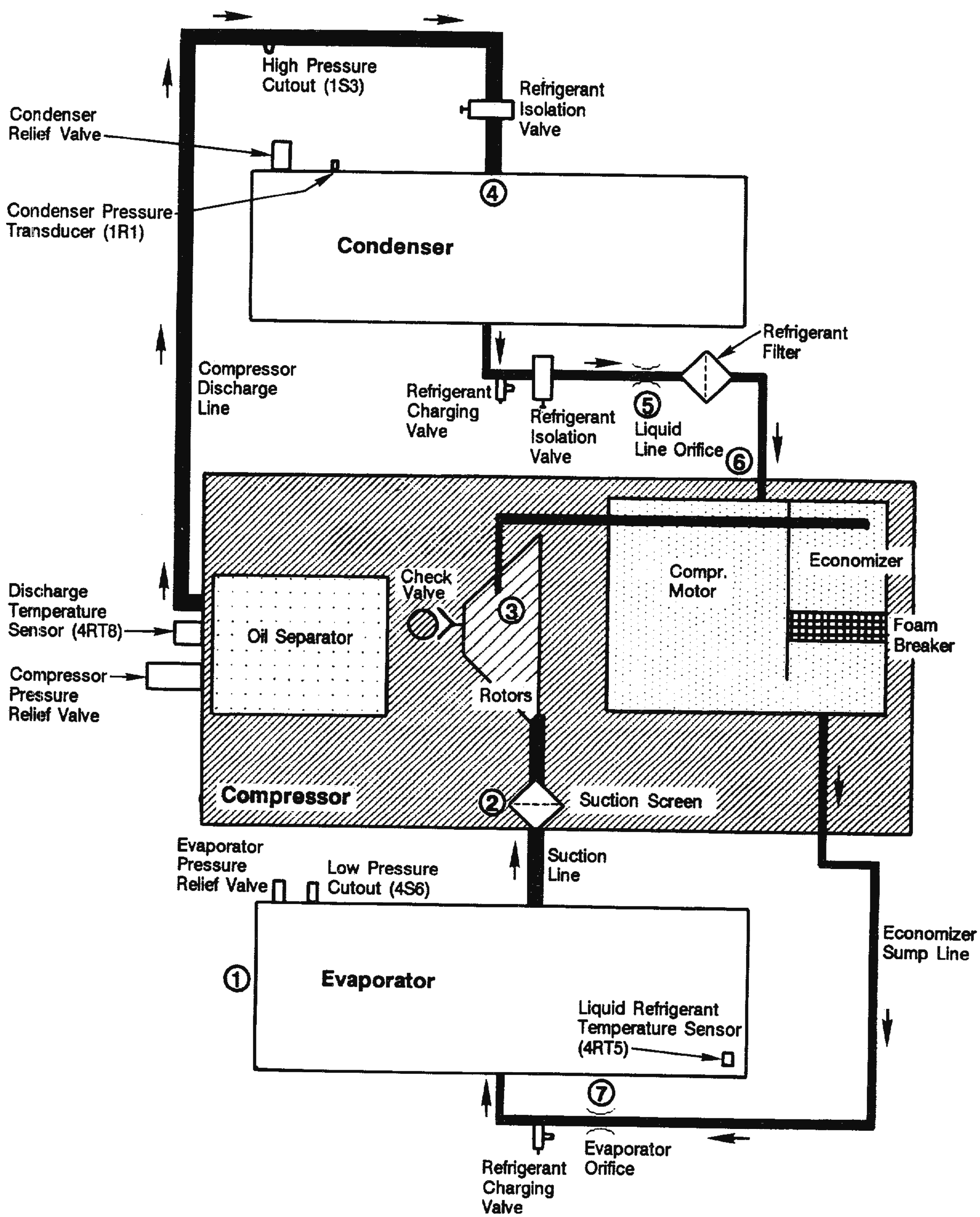
Overview

The refrigeration cycle of the Series R CenTraVacR chiller is conceptually identical to that of other Trane CenTraVac units.

The basic characteristics of the Series R refrigeration cycle provide these units with distinct operational and reliability advantages over other types of units in their size range.

The RTHA "2-stage refrigeration cycle" allows use of an efficiency-enhancing economizer; the flooded evaporator provides the unit with cleanable evaporator tubes; liquid-refrigerant motor cooling allows continuous full-load operation at lower motor temperatures; fixed orifice refrigerant metering uses no moving parts, unlike expansion valve systems; and direct-drive, low-speed compression experiences no efficiency losses inherent to gear drives.

Figure 44
RTHA Refrigerant Flow Schematic



Cycle Description

Refer to points 1 thru 7 in the "refrigeration cycle schematic" provided in Figure 44 and in the "refrigeration cycle enthalpy chart" shown in Figure 45.

During operation, liquid refrigerant is distributed along the bottom of the evaporator, uniformly coating each tube. The refrigerant vaporizes as it cools the system water flowing through the evaporator tubes (Point 1, Figure 43). The gaseous refrigerant is then drawn up through the suction baffle at the top of the evaporator and into the compressor where the compression process begins (Point 2).

Partially compressed refrigerant vapor entering the compressor from the evaporator is joined by vapor produced during the motor cooling process (economizer cycle) at an intermediate point in the compression cycle (Point 3). The combined refrigerant vapor streams are then fully compressed, and the hot refrigerant vapor is discharged to the condenser (Point 4).

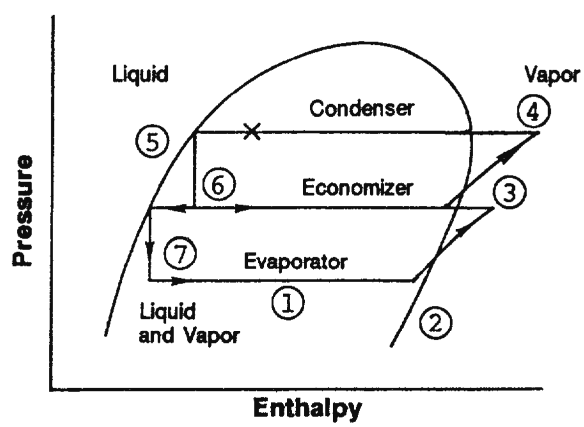
Baffles within the condenser shell distribute the compressed refrigerant gas evenly across the condenser tube bundle. Cooling tower water, circulating through the condenser tubes, absorbs heat from this refrigerant and condenses it.

As the liquid refrigerant leaves the bottom of the condenser (Point 4), it passes through the a control orifice (Point 5). The pressure drop created by the orifice vaporizes some of the liquid refrigerant. The resulting mixture of liquid and gaseous refrigerant then enters the motor housing (Point 6), where it uniformly surrounds and cools the motor. Motor heat absorbed by the refrigerant causes more of the liquid refrigerant to "flash" to a gas.

At this point, all of the refrigerant vapor available is "economized"; routed directly to the rotor section of the compressor housing (Point 3). All remaining liquid refrigerant leaves the motor section through the bottom of the housing, where it passes through another control orifice (Point 7) and returns to the evaporator (Point 1).

The enthalpy of the refrigerant returning to the evaporator from the motor is reduced by removing the vapor produced during the motor cooling process and by the first orifice system. This increases the heat absorption capacity of the evaporator and enhances the overall efficiency of the refrigeration cycle.

Figure 45
RTHA Refrigerant Cycle Diagram



Compressor Description

The compressor used by the Model RTHA Series "R" CenTraVac consists of three distinct components: the motor, the rotors and the oil separator. Refer to Figure 46.

Compressor Motor

A two-pole, hermetic, squirrel-cage induction motor directly drives the compressor rotors. The motor is cooled by liquid refrigerant directly from the condenser entering the top of the motor housing through the motor cooling line (Figure 46).

Compressor Rotors

Each Series R CenTraVac uses a semihermetic, direct-drive helical rotary type compressor. Excluding the bearings, each compressor has only 3 moving parts: 2 rotors - "male" and "female" - provide compression, and a slide valve controls capacity. See Figure 46. The male rotor is attached to, and driven by, the motor, and the female rotor is, in turn, driven by the male rotor. Separately housed bearing sets are provided at each end of both rotors. The slide valve is located above (and moves) along the top of the rotors.

The helical rotary compressor is a positive displacement device. As shown in Figure 44, refrigerant from the evaporator is drawn into the suction opening at the bottom of the compressor rotor section (closer to the motor end of the rotors). The gas is then compressed and discharged directly into the oil separator.

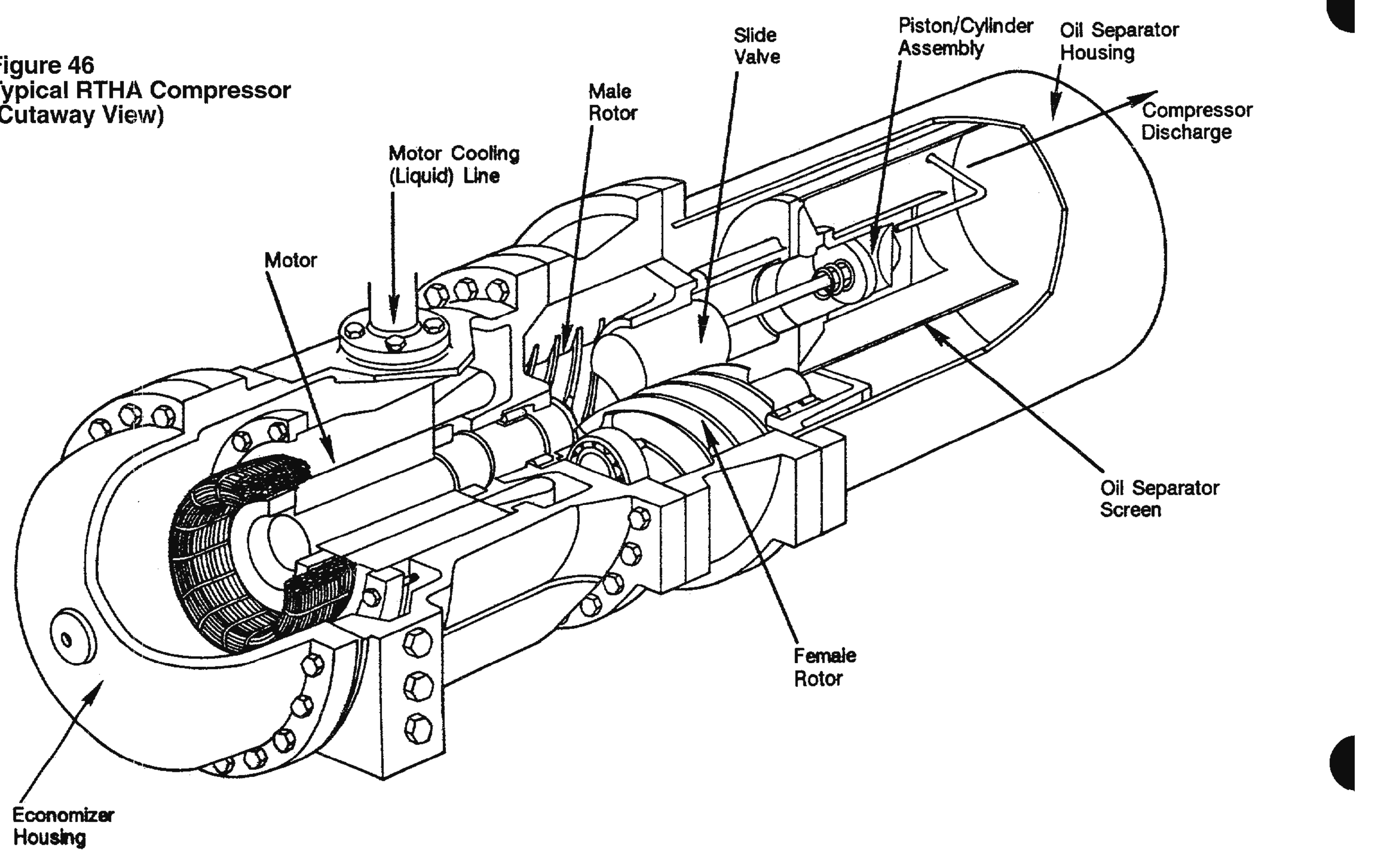
There is no physical contact between the rotors and compressor housing. The rotors contact each other at the point where the driving action between the male and female rotors occurs. Oil is injected along the top of the compressor rotor section, coating both rotors and the compressor housing interior. Although this oil does provide rotor lubrication, its primary purpose is to seal the clearance spaces between the rotors and compressor housing.

A positive seal between these internal parts enhances compressor efficiency by limiting leakage between the high pressure and low pressure cavities.

Capacity control is accomplished by means of a slide valve assembly located in the rotor/oil-separator sections of the compressor. Positioned along the top of the rotors, the slide valve is driven by a piston/cylinder along an axis that parallels those of the rotors (Figure 46).

Compressor load condition is dictated by the position of the slide valve over the rotors. When the slide valve is fully extended over the rotors and away from the oil separator, the compressor is fully loaded. Unloading occurs as the slide valve is drawn towards the oil separator. Slide valve unloading lowers refrigeration capacity by reducing the compression surface of the rotors.

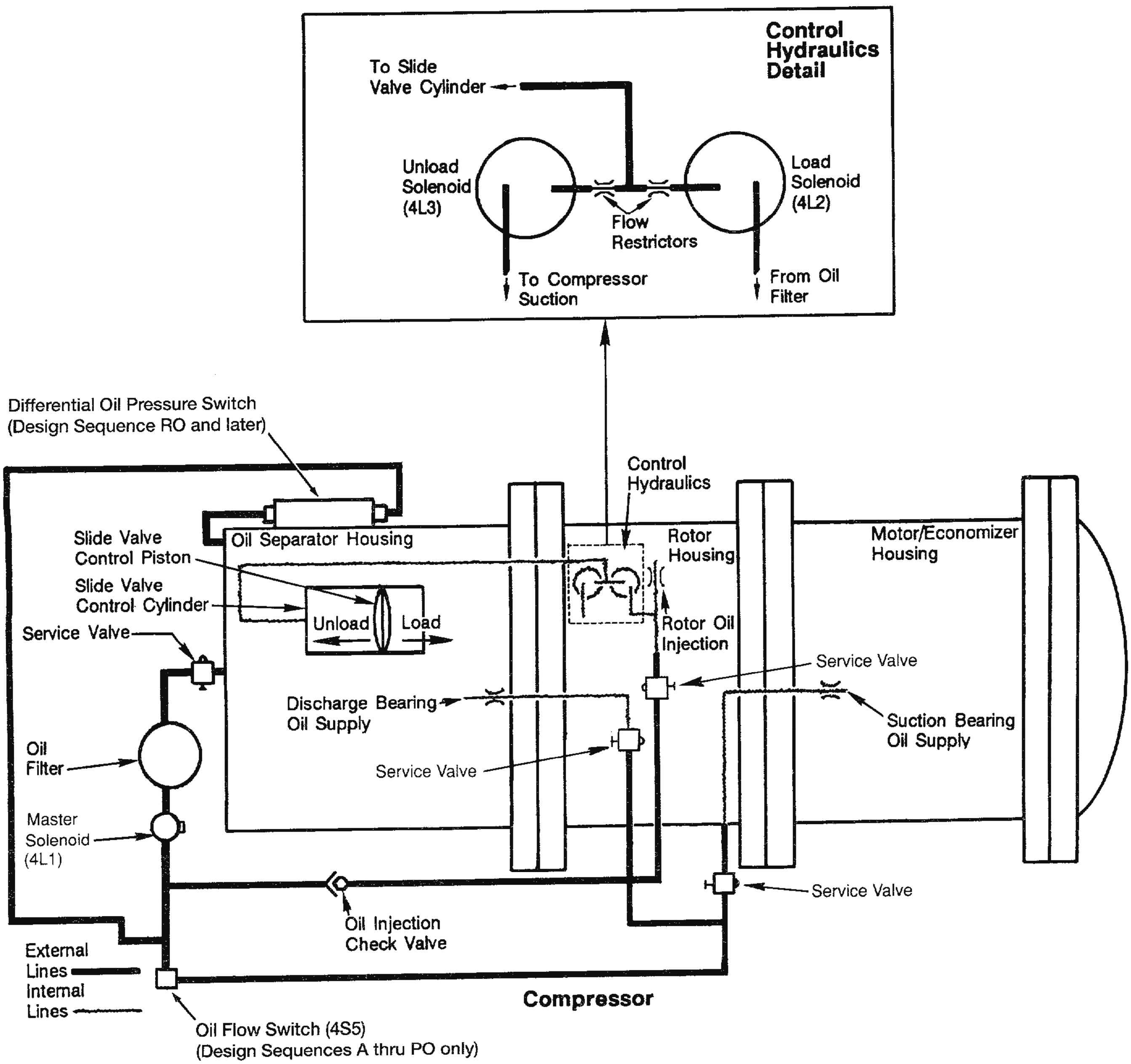
Figure 46
Typical RTHA Compressor (Cutaway View)



Oil Separator

As shown in Figure 47, the oil separator consists of a perforated cylinder surrounding a helical passageway. Once oil is injected into the compressor rotors (Figure 47), it mixes with compressed refrigerant vapor and is discharged directly into the oil separator. As the refrigerant-and-oil mixture is discharged into this passageway, the oil is forced outward, collects on the walls of the cylinder, and passes through perforations to the cylinder's exterior. The oil accumulates on this surface, then runs off the cylinder and collects in the oil sump located at the bottom of the separator housing. The compressed refrigerant vapor, stripped of oil droplets, is discharge into the condenser.

Figure 47
RTHA Compressor Oil Supply System Schematic



Oil System Operation

Overview (Design Sequence E and Later)

Oil that collects in the oil tank sump is at condensing pressure during compressor operation; therefore, oil is constantly moving to lower pressure areas.

Refer to Figures 47 and 49. As the oil leaves the oil sump, it passes through the oil filter and the master solenoid valve. Oil flow then follows 3 distinct paths, each performing a separate function:
(1) compressor bearing lubrication,
(2) compressor oil injection, and (3) slide valve movement.

If the compressor stops for any reason, the master solenoid valve closes; this isolates the oil charge in the sump during "off" periods.

To ensure proper lubrication and minimize refrigerant condensation in the oil sump, a heater is mounted on the side of the oil separator housing. A signal from the UCP energizes this heater during the compressor Off cycle to maintain proper oil temperature. The heater element is continuously energized and does not cycle on temperature.

Compressor Bearing Lubrication

Oil following this supply circuit first passes through flow switch (4S5) or the differential pressure switch that is monitored by the unit control module (UCM) in the control panel. The UCM automatically shuts down compressor operation, the oil angle valve is closed, the oil filter is clogged or the master solenoid malfunctions.

Oil is injected into the bearing housings located at each end of both the male and female rotors. Each bearing housing is vented to compressor suction so oil leaving the bearings returns through the compressor rotors to the oil separator.

Note: The differential oil pressure switch should be set to "OPEN" on a pressure rise of 50 PSID. This switch is installed on units of Design Sequence RO and later. This pressure switch can be retrofitted on an existing system, if not already incorporated. (See RTHA-SB-11 for instructions)

Compressor Oil Injection

Oil following this supply circuit first passes through the oil injection check valve to the top of the compressor rotor housing. There it is injected along the top of the rotors to seal clearance spaces between the rotors and rotors and compressor housing and; lubricate the rotors.

Slide Valve Movement

Movement of the slide valve piston (Figure 47) determines slide valve position which, in turn, regulates compressor capacity. Oil flow into and out of the cylinder governs piston movement, and is controlled by the load and unload solenoid valves, 4L2 and 4L3. See Figures 47, 48, and 49.

The solenoid valves receive momentary pulsating "load" and "unload" voltage signals from the UCM based on system cooling requirements. To load the compressor, the UCM opens the load solenoid valve and closes the unload solenoid valve. The pressurized oil flow then enters the cylinder and forces the piston toward the rotors.

The compressor is unloaded when the load solenoid valve (4L2) is closed and the unload solenoid valve (4L3) is open. Oil "trapped" within the cylinder is drawn out into the lower-pressure suction area of the compressor. As the pressurized oil leaves the cylinder, the slide valve gradually moves away from the rotors.

When both solenoid valves are closed, the present level of compressor loading is maintained.

On compressor shutdown, the unload solenoid valve is energized. A spring forces the slide valve to the fully-unloaded position, so the unit always starts fully unloaded.

Oil Filter

All RTHA units are equipped with a replaceable-element oil filter mounted on the oil separator housing. See Figures 47, 48 and 49. The filter removes any impurities that could foul the solenoid valve orifices and compressor internal oil supply galleries. This also prevents excessive wear of compressor rotor and bearing surfaces. Refer to the maintenance portion of this manual for recommended filter element replacement intervals.

RTHA Oil Cooler

The oil cooler is a plate heat exchanger located below the compressor oil tank (see Figure 50). It is designed to transfer approximately 1 ton of heat from the oil to the suction side of the system. It uses the economizer as the cooling source.

Not all installations require an oil cooler. The oil cooler is standard on the RTHA 380 and 450 models. It may be required on units running at heat recovery or extremely low process temperatures. The high discharge temperatures in these applications increase oil temperature above the recommended limits for adequate lubrication and compromise the viscosity of the oil.

Units requiring oil coolers are typically special-process machines and require engineering design review prior to specification.

Motor Cooling System

RTHA compressor motors are cooled by a mixture of gaseous and liquid refrigerant ("Point 6" in Figure 44).

The liquid refrigerant flowing from the condenser sump toward the compressor motor, passes through an orifice plate in the motor cooling line. This vaporizes part of the refrigerant.

The resulting mixture of liquid and refrigerant gas enters the top of the compressor motor housing, flowing down, around the motor and through cooling galleries in the motor stator. As the liquid refrigerant contacts the warmer motor components, additional refrigerant flashes to a gas and cools the motor.

At this point, all gaseous refrigerant in the motor housing is drawn into the rotor section of the compressor and compressed along with the suction gas from the evaporator.

All remaining liquid refrigerant exits at the bottom of the motor housing, passes through another orifice plate and returns to the evaporator.

Figure 48
Typical RTHA Compressor
Oil Supply System
Design Sequence A - D

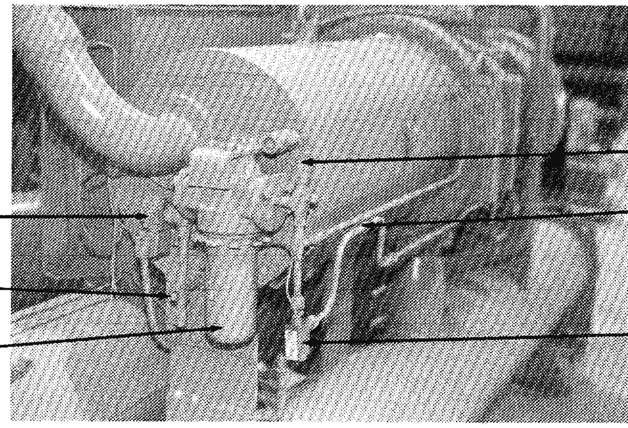
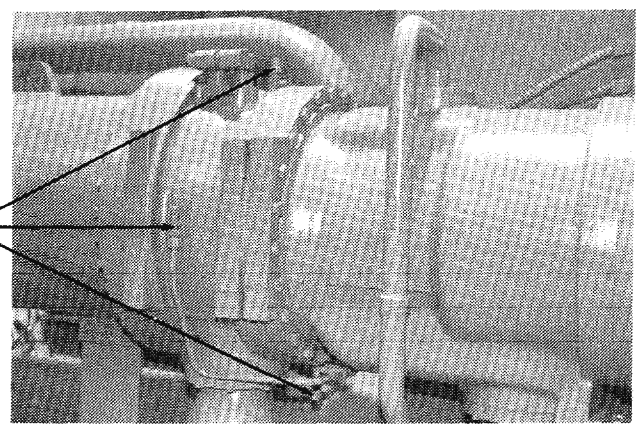
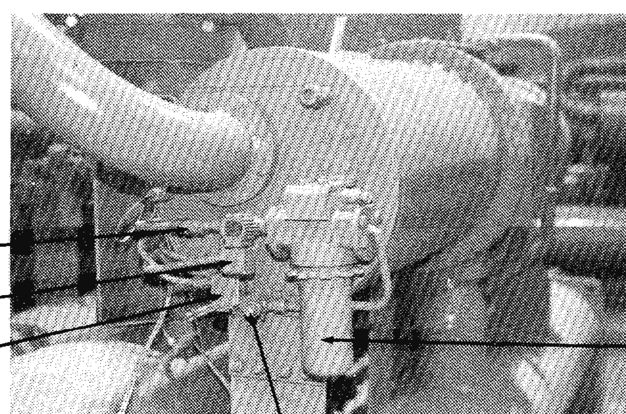


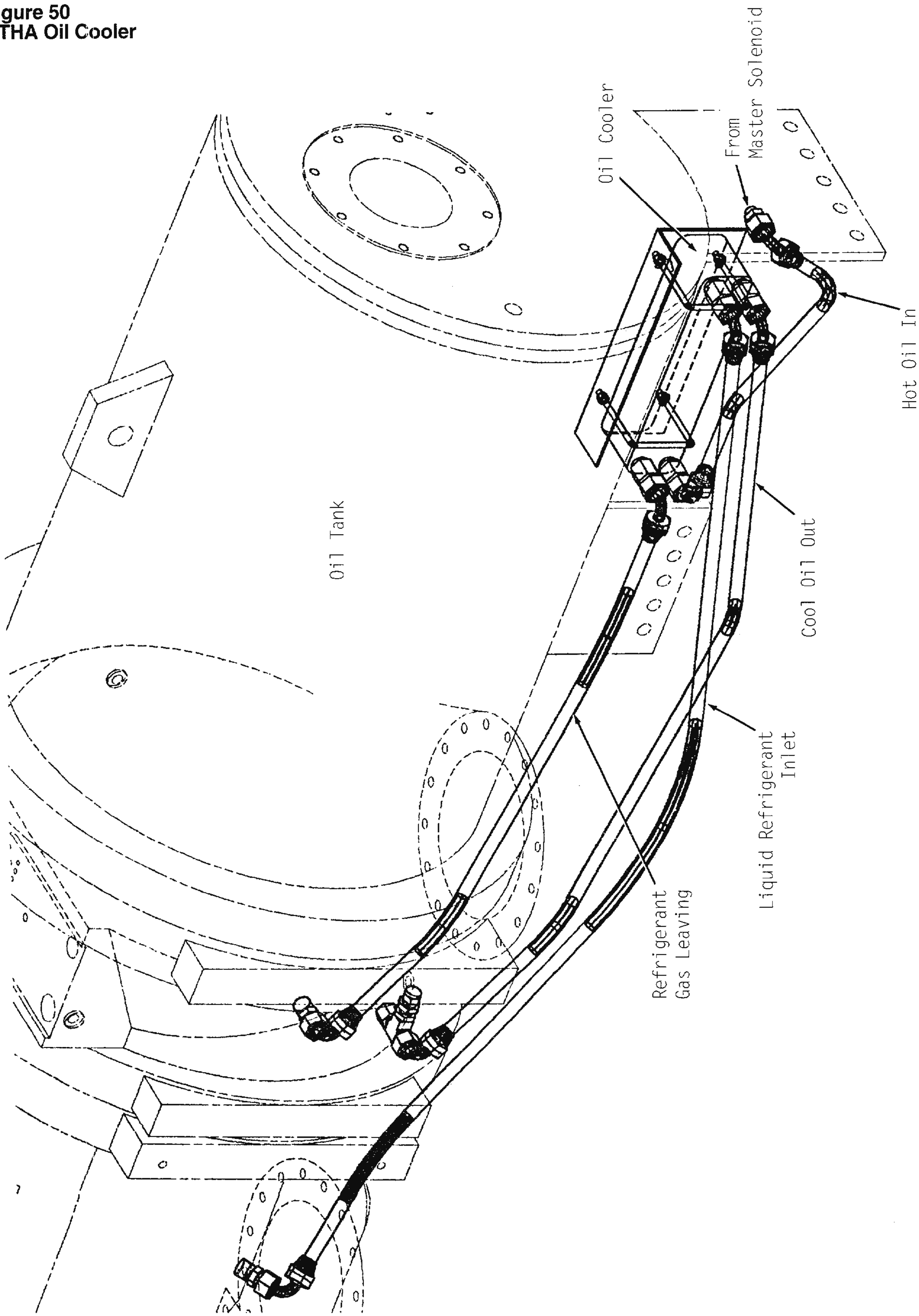
Figure 49
Typical RTHA Compressor
Oil Supply System
Design Sequence E – PO





Note:
For Design Sequence RO and later, see Figure 46.

Figure 50
RTHA Oil Cooler



Operating Principles - Electrical

Chiller Control System

Unit Control Panel

RTHA safety and operating controls are housed in the unit control panel (UCP). See Figure 51. Internal panel layout is illustrated by Figure 52.

Based on control function, the UCP is partitioned into 2 major "sections":

1. the "microcomputer-based" controls, which include the relay output module (1U1), power supply output module (1U2) and micro module (or "UCM"; 1U3); and,

2. the electromechanical control devices (e.g., pressure switches, gauges, counters).

Major components within each of these control groups are described below.

Relay Output Module (1U1)

Consisting of terminal strip 1TB1, this module allows control of the following electrical circuits using relay contact closures:

[ ] "head relief" request;

[ ] alarm relay;

[ ] condenser water pump;

[ ] slide valve - load;

[ ] slide valve - unload;

Connection points of standard and optional UCM output signals are indicated on the typical electrical schematic provided in the "Electrical Sequence of Operation" section of this manual.

Power Supply Output Module (1U2)

Like 1U1, power supply output module 1U2 also uses relay contact closures to enable UCM control of the following electrical circuits:

[ ] reset relay;

[ ] stop relay;

[ ] overload relay;

[ ] compressor start relay;

[ ] compressor transition relay; and,

[ ] oil heater relay.

Figure 51
External Components of Typical UCP Used On RTHA Units

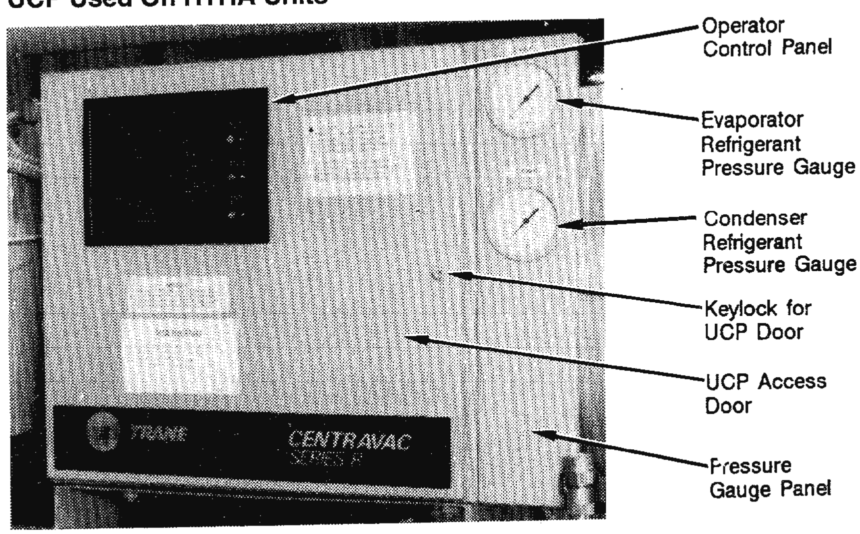
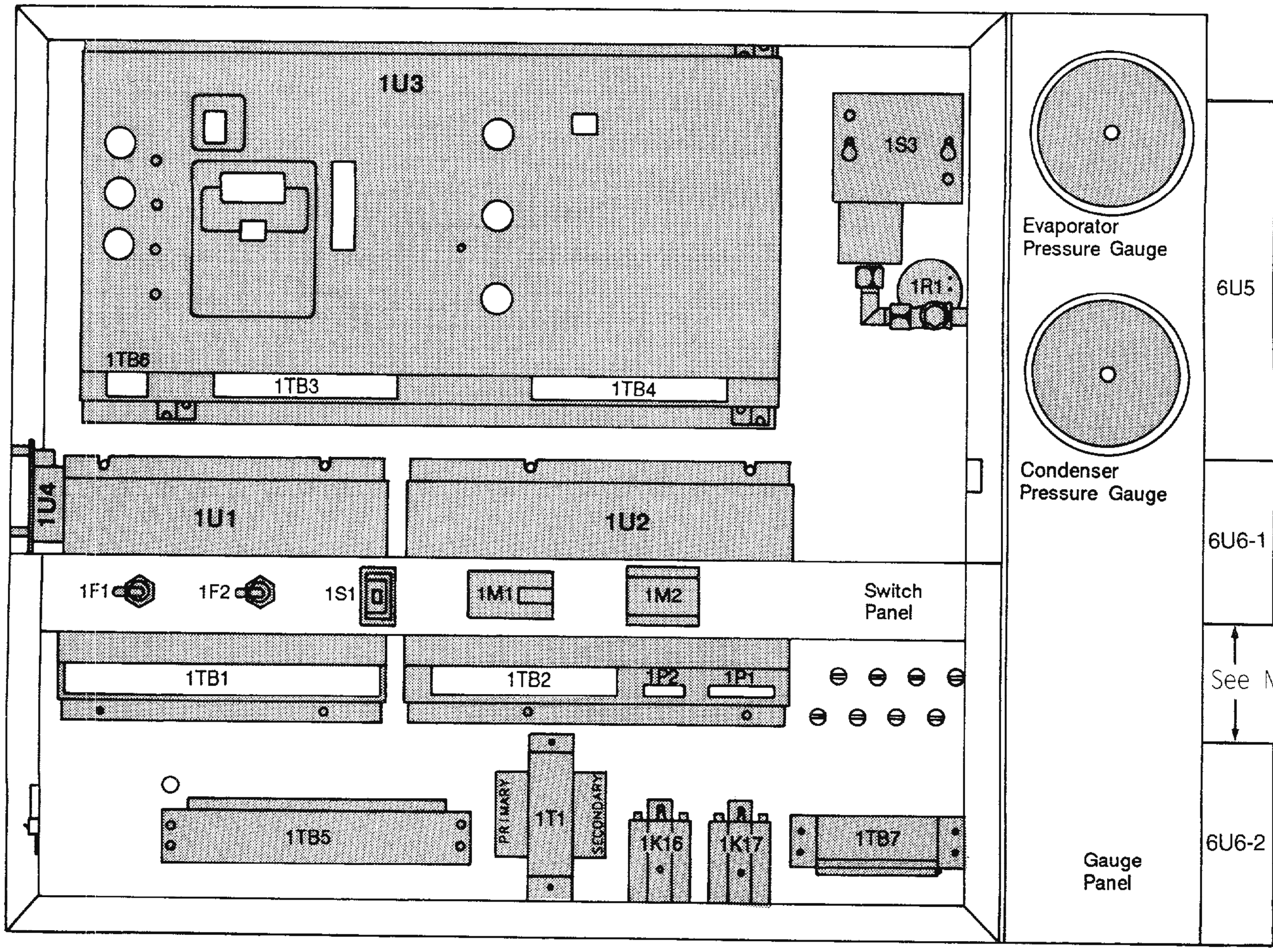


Figure 52
Typical UCP Layout for RTHA Units (Door Removed)



Legend

1F1 = Control Circuit Fuse
1F2 = 1T1 Primary Fuse
1K16 = Chilled Water Flow Switch Relay
1K17 = Condenser Water Flow Switch Relay
1M1 = Hour Meter
1M2 = Start Counter
1R1 = Condenser Pressure Transducer
1P1 = 1U2 Power Supply Plug
1P2 = 1U2 Power Supply Plug
1S1 = Unit Service Switch
1S3 = High Pressure Cutout

1T1 = Power Supply Transformer
1TB1 = 1U1 Terminal Block
1TB2 = 1U2 Terminal Block
1TB3 = 1U3 Terminal Block
1TB4 = 1U3 Terminal Block
1TB5 = Control Voltage Terminal Block
1TB6 = 1U3 Terminal Block
1TB7 = Control Voltage Terminal Block
1U1 = Relay Output Module
1U2 = Power Supply Output Module
1U3 = Micro Module
1U4 = Chilled Water Reset Interface Module

6U5 = Ice Maker Optional
6U6-1 = Ice Maker Latch Panel
6U6-2 = Active Oil System Controlled

5706-0925D

Note:
6U6-1 is available on Design Sequences AO thru H__. It is not installed on any unit that utilizes the active oil system controller (6U6-2).

Micro Module (or UCM; 1U3)

Consisting of terminal strips, 1TB3, 1TB4 and 1TB6, the input portion of this module "accepts" voltage signals from a variety of standard sources:

1TB3

[ ] entering and leaving chilled and condenser water and evaporator refrigerant temperature sensors;

[ ] condenser refrigerant pressure sensor;

[ ] chilled water and condenser water flow interlock circuits.

[ ] ambient temperature sensor

[ ] external inhibit

[ ] low pressure cutout control

1TB4

[ ] compressor bearing oil supply flow switch;

[ ] compressor motor winding temperature sensors;

[ ] compressor discharge gas temperature sensor.

[ ] transition complete

[ ] running external interlock

1TB6

[ ] connections for bidirectional communications link (BCL) to system control panel (SCP).

Based on these inputs, micro module 1U3:

a. controls chilled water temperature in response to the setpoint by modulating the position of the slide valve;

b. monitors key chiller operating parameters and "acts" to prevent the chiller from reaching—and shutting down on—an operating limit;

c. provides compressor/motor protection; and,

d. executes the start sequence.

The operator interface of micro module 1U3 (the UCM) is accessed through the opening provided in the UCP door. This interface consists of a "display advance" PushButton, "unit status" indicator lights and a series of control potentiometers and switches.

These devices enable the operator to establish chiller control settings, and monitor chiller operating and diagnostic conditions.

Additional information on these components is provided later in this section under "Operator Interface" and "Service Interface".

In addition to the standard micro module features just described, three mutually exclusive control options are also available at the micro module level:

1. Optional Bidirectional Communication Link (BCL). The BCL provides an intelligent interface with a Trane System Control Panel (SCP), allowing the chiller to not only accept setpoints and commands from a remote location, but also communicate condition and diagnostic information to the SCP.

2. Optional Chilled Water Reset (CWR). CWR enables the UCM to reset the chilled water setpoint based on load (i.e., evaporator return water temperature) or ambient temperature. (See the "Control Options" for further information.)

3. Chilled Water Reset Interface (CWRI). CWRI enables the chilled water setpoint to be reset from a remote generic building automation system using either 4-20 mA or 0-10 VDC.

Note: Option 3 uses the same micro-module (1U3) as option 2 but requires the addition of the Generic BAS Reset Module (1U4).

Electromechanical Controls

Other control devices located in the UCP (but separate from the microcomputer based controls) are described below.

See Table 8 for control cut-in and cutout setpoints. (Unit time delays and nominal fault timeout periods are also included.)

Table 8
Unit Time Delays and Safety Control Cutout Settings

Operating Controls: "Timers"		Timing Interval	System Reset	Operating Code (1)
Restart Inhibit (2):	Winding Temp. < 165 F	1 minute	n/a	A 70
	Winding Temp. ≥ 165 F	5 minutes	n/a	A 70
	Since Last Start	5 minutes	n/a	A 70
Transition-from-Start Completion		2.5 seconds	n/a	A 72
Stop-Minimum Off Time		1 minute	n/a	A 70
Transition Completion Overdue		2 seconds	manual	b F0
Condenser Water Flow Overdue		3 minutes	manual	b dC
No Evaporator Water Flow		2 seconds max. w/o flutter	auto	b Ed
Low Oil Flow - Case 1 (For units with oil flow switch)		30 seconds from start - 2 sec. max. w/o flutter	manual	b F2
Low Oil Flow - Case 2 (For units with differential oil pressure switches)		Oil return system did not bring oil back to the oil tank within 3 to 18 minutes, field adjustable interval. See Note 3.	manual	b F2
Safety Controls: Unit Cutouts		**Control "Trip" Point**	**System Reset**	**Diagnostic Code**
Winding Temp. Run Inhibit		265 ± 5 F	manual	b E7
Evaporator Refrigerant Temperature		29-34F std. range only	manual	b Fb
High Discharge Temperature		200 ± 5 F	manual	b 84
Low Pressure Cutout		26 ± 10 psig	manual	b b5
High Pressure Cutout	Standard Units	270 ± 5 psig	manual	b F5
	Heat Recovery Units	360 ± 5 psig	manual	b F5

Notes:
1. Unit operating and diagnostic codes appear in the display window on the front of the control panel. See Tables 7 and 9 for a complete listing of these codes.
2. Regardless of motor temperature, there is always 5 minutes between compressor starts.
3. If a b F2 diagnostic occurs, first remove the oil controller cover to determine if the red LED is illuminated. The LED should illuminate only when the active oil return system operation has timed out before sufficient oil has returned. If the LED is ON, refer to the Maintenance Procedures section to check oil and refrigerant levels and add as necessary. If the LED is OFF, check the oil filter, oil flow switch and refrigerant and the condenser inlet water temperature. For additional information, refer to the Troubleshooting Chart.

Operating Principles – UCM

UCM Power Monitor Feature

The UCM used on RTHA units will protect the compressor motor from momentary power loss, phase imbalance, and phase loss. A unit shutdown is initiated if one of these electrical power faults occur.

A diagnostic code (Table 9) appears at the operator display to identify the fault condition.

Table 9
Unit Diagnostic Codes

3-Character Code	Diagnostic Description	System Reset
b A3	Evaporator Refrigerant Temp. Range	Manual
b A4	Sensor Failure - Motor Temp. Sensor #1	Manual
b A7	Sensor Failure - Motor Temp. Sensor #2	Manual
b A8	Sensor Failure - Motor Temp. Sensor #3	Manual
b Ab	Sensor Failure - Evap. Leaving Water Temperature Sensor	Manual
b Ac	Sensor Failure - Condenser Refrigerant Pressure Sensor (Opt.)	Manual
b Ad	Sensor Failure - Evaporator Refrigerant Temperature Sensor	Manual
b AE	Sensor Failure - Ambient Temperature Sensor (Opt.)	Manual
b 80	Sensor Failure - Discharge Gas Temp. Sensor (Opt.)	Manual
b b5	Low Evaporator Refrigerant Pressure	Manual
b d9	Extended Power Loss	Automatic
b dC	Condenser Water Flow Overdue	Manual
b E2	Momentary Power-Loss	Automatic
b E3	Phase Imbalance	Manual
b E4	Phase Loss	Manual
b E5	Phase Reversal	Manual
b E7	High Motor Temperature	Manual
b E8	Oil Flow Switch Closed	Manual
b E9	Stop Relay	Manual
b Ec	Running Overload	Manual
b Ed	Chilled Water Flow Failure	Automatic
b F0	Starter Transition Failure	Manual
b F1	Running External Interlock (Opt.)	Manual
b F2	Low Oil Flow - 2 cases. See Table 8.	Manual
b F5	High Condenser Refrigerant Pressure	Manual
b F7	Condenser Water Flow Failure	Automatic
b F8	Improper Unit Identification	Manual
b Fb	Low Evaporator Refrigerant Temperature	Manual
b FF	Unit Control Module	Manual
b 84	High Discharge Gas Temperature	Manual

Notes:
1. Check the "Manual Reset Required" status indicator light to determine if manual reset is necessary.
2. It is not possible to clear a latching diagnostic condition (i.e., one requiring manual system reset) at the unit from a higher level device (e.g., a system control panel, Tracer, or generic BAS)

Operator Interface

All control and monitoring devices used during normal chiller operation are located on the operator's panel (Figure 53) and are accessible without opening the UCP access door. These devices are part of unit control module 1U3 (the UCM). A description of these devices and their function follows:

Chiller Switch

This three-position rocker switch is used to select chiller control mode. The three switch functions are:

[ ] **Standby/Reset.** When power is applied to the unit with the chiller switch set at STANDBY/RESET, the UCP is activated but unit operation is prohibited; operating code **A 0** appears on the display.

This switch position is used to clear a latching diagnostic (i.e., fault that requires manual reset).

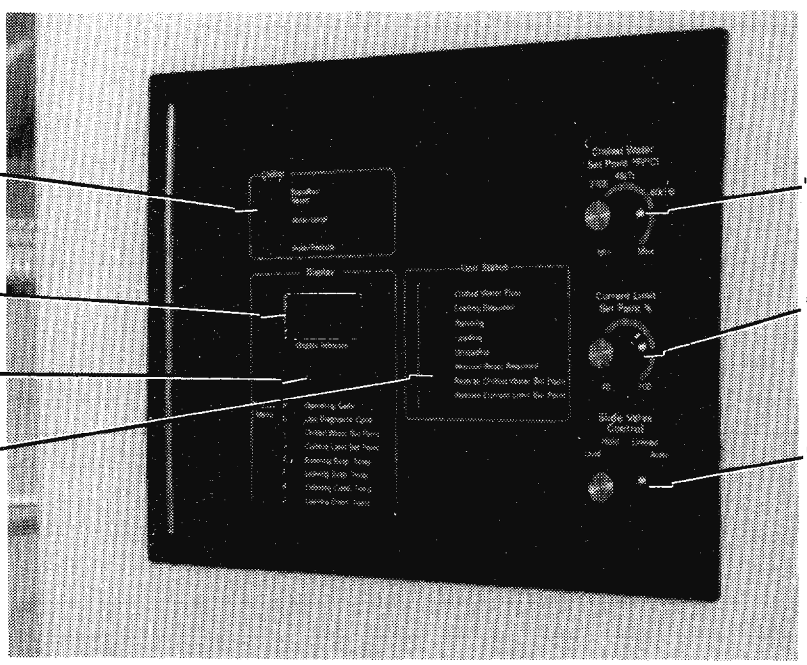
[ ] **Auto/Local.** This switch position allows the chiller to run automatically, using the operational setpoints set at the **UCM.**

[ ] **Auto/Remote.** With the chiller switch in this position, the unit runs automatically using the setpoints established at a **remote** device and communicated to the chiller with the optional bidirectional communication link (BCL).

If no setpoints are sent by the remote controller, the UCM uses the operational setpoints set at the unit.

Note: If the unit is equipped with the BCL option, a remote device can place the unit in the **Standby/Reset** mode even though the chiller switch is in AUTO/REMOTE position. However, **a latching diagnostic condition must be cleared at the unit.** It is not possible to reset a latching diagnostic condition that occurred at unit level from a remote device.

Figure 53
UCM Operator Panel



Chilled Water Setpoint Potentiometer

The chilled water setpoint potentiometer (Figure 53) is used to set the desired leaving chilled water temperature. Dial settings range from MIN to MAX, with intermediate temperatures indicated in degrees (F), as well as degrees (C).

To display "unit level" chilled water setpoint, turn the slide valve control switch to HOLD and press the display advance PushButton until code prefix " I– " appears on the display.

The UCM's chilled water setpoint (in increments of 1 F or 1 C) will appear to the right of code prefix " I– "

Standard operating range is 37 F to 60 F. The temperature range for extended operation is 20 F to 70 F.

Note: The **active** chilled water setpoint can be displayed by checking the entry for code prefix **C** of the operator's menu. When the chiller is in **Auto/Remote** mode, the setpoint displayed is being dictated by the remote system control panel.

The remote chilled water setpoint status light will be energized if the UCM is using a setpoint communicated by the remote system panel.

Current Limit Setpoint Potentiometer

The current limit setpoint potentiometer is used to set the desired current limit setpoint. Dial settings range from 40% to 100% of the compressor rated load amps (RLA) value.

To display unit-level current limit setpoint, turn the slide valve control switch to HOLD and press the display advance PushButton until code prefix " — " appears.

The UCM's current limit setpoint will appear in the display (in increments of 1%) to the right of code prefix " — ".

Note: The **active** current limit setpoint can be displayed by checking the entry for code prefix " **d** " of the operator's menu. When the chiller is in **Auto/Remote** mode, the setpoint displayed is being dictated by a remote system control panel.

The remote current limit setpoint status light will be energized if the UCM is using a setpoint communicated by the remote system panel.

Operation. The UCM (1U3) of a unit approaching current limit setpoint will initiate a "corrective action" control sequence to minimized any occurrence of unit lockout on the compressor overloads.

First, the UCM will limit slide valve loading. If operation continues to approach current limit, additional slide valve loading is prohibited. If this trend continues, the UCM initiates modulated "unloading". When operation reaches current limit, 1U3 issues a "hard unload" command (slide valve to fully unloaded position).

If the overload condition continues, the UCM will shut the unit down on latching diagnostic "**b Ec**" (Running Overload).

Slide Valve Control Switch

A 4-position, compressor slide valve control switch is located beneath the current limit setpoint control. Each switch position is described below.

[ ] **Load.** With the switch in LOAD position, the slide valve load relay (1U1Q7) is continuously energized, manually loading the compressor. Manual load overrides automatic slide valve control during **Normal Run** mode (**A 74**).

Manual load will not override automatic slide valve control during three other running modes. They are:

Operating Code	Operating Mode
A 75	Run - Current Limit
A 76	Run - Condenser Limit
A 77	Run - Evaporator Limit

[ ] **Hold.** With the slide valve control switch in HOLD position, both slide valve - load relay (1U1Q7) and slide valve - unload relay (1U1Q8) are deenergized. The slide valve remains in present position. HOLD over-rides automatic slide valve control during **Normal Run** mode (**A 74**).

HOLD will not override automatic slide valve control during three other running modes. They are:

Operating Code	Operating Mode
A 75	Run - Current Limit
A 76	Run - Condenser Limit
A 77	Run - Evaporator Limit

Note: Turning the slide valve control switch to HOLD changes UCM display from Operators Menu to Serviceman's Menu. (See "Display" and Table 8.)

[ ] **Unload.** With slide valve control switch in UNLOAD position, slide valve unload relay (1U1Q8) is continuously energized. Manual unload over-rides all other operating modes.

[ ] **Auto.** With slide valve control switch in AUTO (normal operating position), slide valve position is automatically controlled by the UCM.

Table 10
Display Menus

Operator's Menu		Serviceman's Menu (1, 3) (Slide Valve Control Switch at "Hold")	
Code Prefix	Parameter Description and Display Range	Code Prefix	Parameter Description, Diagnostic Code and Display Range
A	Operating Mode (see Table 9)	A	Operating Mode (see Table 9)
b	Last Diagnostic (see Table 7)	b	Last Diagnostic (see Table 7)
C	Active Chilled Water Setpoint Standard-range: 37 thru 60 F Extended-range: 20 thru 70 F	1-	Panel Chilled Water Setpoint Range: ---, Std. - 37 to 60F Ext. - 20-70F
d	Active Current Limit Setpoint Range: 40 thru 100% RLA)	—	Panel Current Limit Setpoint Range: ---, 40 thru 100% RLA,---
E	Entering Evaporator Water Temperature (Opt.) Range: ---, 12 thru 91 F, ---	_	Evaporator Refrigerant Temp.(2) Diag. Code: b Ad Range: -4 thru 42 F, ---
F	Leaving Evap. Water Temp. Diag. Code: b Ab Range: 12 F thru 91 F, ---	I_	Control Response Setpoint Range: 1 thru 237
H	Entering Condenser Water Temperature (Opt.) Range: ---, 28 thru 142 F, ---	[‾_]	Start Differential Setpoint Range: 2 thru 10 F
J	Leaving Condenser Water Temperature (Opt.) Range: ---, 28 thru 142 F,---	P	Condenser Limit Setpoint Range: 80 thru 110% HPC
(Blank)		I_I	Evaporator Refrigerant "Trip" Setpoint (Diag. Code: b A3) Standard-range = 29 thru 34 F Extended-range = 0 thru 34 F

Notes:
1. To switch from "operator's menu" to the "serviceman's menu" on the UCM display, turn the Slide Valve Control Switch to "Hold". To switch back to "operator's menu", turn the switch to any position other than "Hold".
2. Actual measured temperature of refrigerant in the evaporator.
3. For further information on any of the items listed in the serviceman's menu, contact a qualified service organization.

Unit Status Lights

Eight status indicator lights are located in the center of the UCM operator's panel. These blue lights—along with the operating and diagnostic information found on the display—allow the operator to monitor chiller operations. The purpose of each status indicator light is described below:

[ ] **Chilled Water Flow.** Light energized indicates chilled water flow switch 5S2 is closed.

[ ] **Cooling Required.** Light energizes when the UCM proves chilled water flow and detects a cooling requirement (i.e., leaving chilled water temperature exceeds the chilled water setpoint by a value greater than the differential-to-start criteria).

[ ] **Running.** Light energized indicates 3 things:

1. the unit is running (or is in a **Run** mode);

2. the chiller switch is set at AUTO/LOCAL or AUTO/REMOTE;

3. start sequence (transition) is complete. Light remains energized through chiller's normal shutdown cycle.

[ ] **Loading.** Light energizes when UCM is loading the compressor (i.e., the slide valve is advancing) and slide valve load relay 1U1Q7 is energized.

[ ] **Unloading.** Light energizes when UCM is unloading the compressor (i.e., slide valve is retracting) and slide valve unload relay 1U1Q8 is energized.

Note: Loading and unloading status lights normally flash on and off in short pulses.

[ ] **Manual Reset Required.** Light energized indicates UCM detects a latching diagnostic condition. The chiller shuts down. Manual reset at the UCM is required to resume operation.

To reset the UCM, turn chiller switch to STANDBY/RESET and back to AUTO/LOCAL or AUTO/REMOTE.

[ ] **Remote Chilled Water Set-point.** Light energized indicates present UCM operation is based on chilled water setpoint entered from a remote source (e.g., system control panel (SCP) or **Tracer**®).

The remote setpoint overrides the setpoint indicated by the chilled water setpoint potentiometer on the UCP. If remote communications are severed and the chiller switch is set at AUTO/REMOTE, the UCM "defaults" to the control value of the chilled water setpoint potentiometer.

[ ] **Remote Current Limit Set-point.** Light energized indicates present UCM operation is based on a current limit setpoint communicated from a remote source (e.g., system control panel, generic BAS or **Tracer**®).

The remote setpoint overrides the setpoint indicated by the current limit setpoint potentiometer on the UCM. If remote communications are interrupted and the chiller switch is set at AUTO/REMOTE, the UCM "defaults" to the control value of the current limit setpoint potentiometer.

Table 11
Codes for Unit Operating Modes

3-Character Code	Description of Operating Mode
Blank	Power Off
A 0	Standby/Reset
A 1	Auto (Local or Remote)
A 70	Restart Inhibit
A 71	Establish Condenser Water Flow
A 72	Start
A 74	Run: Normal
A 75	Run: Current Limit (1)
A 76	Run: Condenser Limit (2)
A 77	Run: Evaporator Limit (3)
A 7A	Run: Hot Gas Bypass
A 100	External Inhibit
A 7C	Stop: Minimum Off Time
A 88	Reset

Notes:
1. As the current limit setpoint is approached, the UCM restricts further advancing of the compressor slide valve.
2. As the condenser limit setpoint is reached, the UCM restricts additional compressor loading to avoid shutdown on high condenser pressure (b F5), and initiates a "head relief request" (i.e., optional relay).
3. The UCM restricts further retraction of the compressor slide valve to avoid a unit shutdown on low evaporator refrigerant temperature (b Fb).

"Unit Condition" Display

The UCM display window is located on the left side of the operator panel below the chiller switch. It consists of a blue, 4-digit vacuum fluorescent display and "Display Advance" PushButton. See Figure 53.

The **first place** of the 4-character display shows the (**code prefix**). This letter identifies the type of data shown in the display window. The code prefixes are explained in Table 8. A shorter version of this list appears on the face of the UCM, below the display advance PushButton.

The **second place** in the 4-character display is a **blank space** between the code prefix and the 2 remaining characters of the display.

The two alphanumeric characters that appear in the **third and fourth place** in the display indicate unit **operating mode, diagnostic condition, setpoints or actual temperatures** as defined by the code prefix. Table 9 explains unit operating modes and Table 7 translates unit diagnostic codes.

Code prefix **A** or **b** is always followed by a space and a 2-digit operating code (Table 9) or diagnostic code (Table 7).

Note: If the UCM detects a diagnostic condition, the display alternately flashes the diagnostic code and unit operating mode at the time of unit shutdown.

Code prefixes **C** or **d** are followed by the chilled water or current limit setpoint value respectively, that is controlling the chiller (Table 8).

If the chiller switch is in the AUTO/LOCAL position, the setpoint values displayed are those set at the potentiometers on the UCM. If the chiller switch is in the AUTO/REMOTE position and REMOTE CWS and/or REMOTE CLS status indicator lights are on, the displayed setpoint values were set at a remote device (e.g., an SCP or **Tracer**®).

Code prefixes **E**, **F**, **H** and **J** are followed by an existing system parameter (e.g., entering evaporator water temperature). (Code prefixes **E**, **H** and **J** represent sensor options; if these sensors are **not** installed, a bar **[- - -]** appears on the display.)

Turning the slide valve control switch to HOLD displays the serviceman's menu (Table 8). Turn the switch back to LOAD, UNLOAD, or AUTO and the display switches back to the operator's menu.

Under the serviceman's menu, the code prefixes indicate local (or unit) chilled water and current limit setpoints, actual evaporator refrigerant temperature, and settings for control response, start differential, condenser limit and evaporator refrigerant trip point. See Table 8.

Note: Code prefixes **A** and **b** display the same information under either menu.

Note: While using the serviceman's menu, all values displayed for the unit-level chilled water, condenser limit and evaporator refrigerant trip setpoints represent the entire adjustment range for these potentiometers.

However, unless the chiller is specifically designed for "extended range" operation, the UCP will adhere to the operating parameters established for "standard range" chillers.

Use the "Display Advance" PushButton to scroll through each entry of the operator's menu. Pressing this button once advances the display to the next item on the menu. A blank display indicates the end of the menu; to return to the top of the menu, press the display advance PushButton once.

Important! When reviewing either the operator or serviceman's menus for the last AUTO RESET diagnostic encountered by the unit, be careful not to advance past that last diagnostic entry, unless it is all right to clear the diagnostic code from memory. Advancing past this point in **either menu** automatically clears the code from the UCM memory!

Service Interface

Following is a description of UCP control components that are accessed by opening the control panel door. Each of these devices, shown in Figure 54, must be set at initial unit start-up by a qualified service technician.

WARNING: To prevent injury or death due to electrical shock, always open unit disconnect switch before opening control panel door.

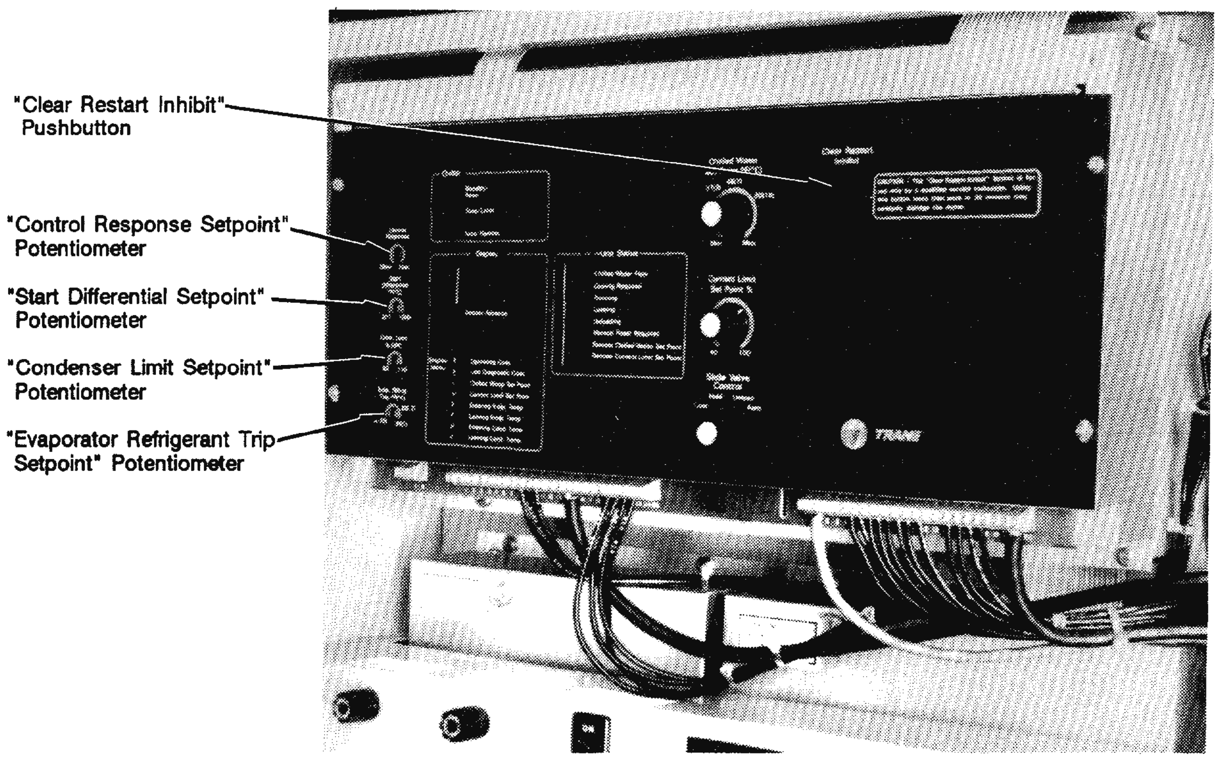
Caution: To ensure proper chiller operation, never tamper with any UCP controls located behind the panel door without first consulting a qualified service technician.

Clear Restart Inhibit PushButton

Press to clear the restart inhibit timer. This is normally done only by a **qualified service technician.** PushButton location is shown in Figure 54.

Caution: Only qualified technicians should use the clear restart inhibit PushButton. Using this button more than once in 5 minutes may seriously damage the motor.

Figure 54
UCM Service Interface Controls (Qualified Technicians Only)



Control Response Setpoint Potentiometer

The control response setpoint potentiometer (Figure 54) is used to control slide valve response time. Settings for this control range from 1 thru 237. (The units used to delimit these settings are arbitrary.)

The position of this control directly affects the slide valve response time to changes in cooling requirements; the lower the control response setting the slower the slide valve responds to load and unload commands from the UCM.

To display the control response setting, turn the slide valve control switch to HOLD and press the display advance PushButton until code prefix " I_ " appears.

Use the following equation to determine the recommended control response setting for a particular unit application:

Recommended Control Response Setpoint=

$$\frac{250}{\text{Design Delta-T}} \times \frac{\text{Actual Flow Rate}}{\text{Design Flow Rate.}}$$

where "design delta-T" is the design temperature drop in the evaporator. For example, if a unit is designed for a 55 F entering evaporator temperature and a 45 F leaving evaporator temperature, its "design delta-T" is 10 F.

Start Differential Setpoint Potentiometer

The start differential setpoint potentiometer (Figure 54) is used to establish the number of degrees that leaving chilled water temperature must rise above setpoint before the unit will start. (It also determines the actual compressor "stop" point. (See "Electrical Sequence of Operation".)

This control has an adjustment range of 2 F (1 C) to 10 F (6 C).

To display the start differential setpoint, turn the slide valve control switch to HOLD and press the display advance PushButton until code prefix " [| " appears.

Recommended start differential setpoints—along with the corresponding compressor shutdown points—are indicated in Table 12.

Condenser Limit Setpoint Potentiometer (% HPC)

Designed to prevent high refrigerant pressure trip-outs during critical periods of chiller operation, condenser limit control consists of:

(1) the manually adjustable condenser limit potentiometer on micro module 1U3 (Figure 54);

(2) pressure transducer 1R1; and

(3) the associated interconnecting piping and wiring.

The UCP monitors condenser pressure registered by pressure transducer 1R1, and compares it to the setting of the condenser limit potentiometer. Based on these inputs, the UCP operates load and unload solenoid valves 4L2 and 4L3 respectively, to keep the chiller on-line as long as possible (as the high pressure safety limit is approached).

Note: If the relay package is utilized, the head relief request relay may signal for further corrective action (e.g., lowering entering condenser water temperature).

Condenser limit control is provided in addition to the protection already provided by condenser high pressure cutout switch 1S3.

Dial Setpoint - This potentiometer (Figure 40) can be set at any point from 80% to 110% of the rated high pressure control trip point. For standard units (HPC cutout = 270 psig), the condenser limit setting range is 216 to 297 psig. The range for heat recovery units (HPC cutout = 360 psig) is 288 to 396 psig.

Operation - Once this value is established, the UCM compares it with condenser refrigerant (head) pressure through condenser resistor pressure transducer 1R1.

When head pressure reaches 90-96 percent of condenser limit setpoint, the UCM slows loading (retards slide valve advance), but allows normal unloading (slide valve withdrawal).

Note: Recommended setting for this control is 93 percent of the high pressure cutout (1S3) setting for the unit.

Table 12
RTHA Compressor "Stop" Points

Chiller Delta-T	Rec. Start Differential Setpoint	Chiller Shutdown Point* (Degrees F below Setpoint)
4 F or less	2 F	CWS - 2.0 F
5 F or 6 F	3 F	CWS - 2.0 F
7 F or 8 F	4 F	CWS - 2.0 F
9 F or 10 F	5 F	CWS - 2.0 F
11 F or 12 F	6 F	CWS - 2.0 F
13 F or 14 F	7 F	CWS - 2.0 F
15 F or 16 F	8 F	CWS - 2.4 F
17 F or 18 F	9 F	CWS - 3.2 F
19 F or more	10 F	CWS - 4.0 F

*Note: "Chiller shutdown point" refers to actual leaving chilled water temperature with respect to the chilled water setpoint (CWS).

If condenser pressure continues to rise to within 96-100 percent of condenser limit setpoint, 1U3 prevents any further loading but allows unloading to continue.

If condenser pressure actually reaches the condenser limit setpoint, 1U3 initiates regulated unloading of the compressor until condenser pressure is under control.

Note: The UCM does not issue a "hard unload" signal (slide valve to maximum unloaded position) at this time.

Should this controlled unloading sequence fail to bring condenser pressure under control, the unit will shut down on latching diagnostic **b F5** (i.e., high condenser refrigerant pressure) when its cutout setpoint is reached.

To display condenser limit setpoint, turn slide valve control switch to HOLD and press the display advance PushButton until code prefix **P** appears.

Evaporator Refrigerant Trip Setpoint Potentiometer

The evaporator refrigerant trip setpoint potentiometer (Figure 54) is used to establish the chiller's low refrigerant temperature trip point. It has a standard adjustment range of 29 F (-2 C) to 34 F (1 C) and an optional "extended range" of 0 F (-18 C) to 34 F (1 C).

Dial Setpoint - Normally, this potentiometer should be set at approximately 1 F below design refrigerant temperature (i.e., set at 33 F unless design refrigerant temperature is less than 34 F).

To display the control setting, turn the slide valve control switch to HOLD and press display advance until code prefix " I_I " appears.

Note: Setting the evaporator refrigerant trip point below the minimum range value results in a latching diagnostic. (The operating code and diagnostic code **b A3** will flash alternately on the display any time the minimum range value is exceeded.)

Caution: To assure proper chiller operation, adjustment of this control must always be performed by a qualified service technician.

Operation - The evaporator refrigerant temperature limit function is similar to condenser pressure limit operation since the UCM initiates a "limiting control sequence" as evaporator refrigerant temperature approaches the limit setpoint. The limit control point for this function is 2 F above the "trip" setpoint indicated by the potentiometer dial.

Once this value is established, the UCM compares it with actual evaporator refrigerant temperature through evaporator refrigerant temperature sensor 4RT5 (See Figures 56, 58 and 60). As refrigerant temperature falls toward the limit setpoint, the UCM limits additional loading (retards slide valve advance), but allows normal unloading (slide valve withdrawal).

If evaporator refrigerant temperature continues to fall toward the low limit, 1U3 prevents any further loading but allows unloading to continue.

If evaporator refrigerant temperature continues to fall, 1U3 initiates regulated unloading of the compressor until pressure rises above the limit.

If evaporator refrigerant temperature actually reaches the limit, 1U3 issues a "hard unload" signal (slide valve to maximum unloaded position) until pressure rises above the limit.

Should this unloading sequence fail to bring evaporator refrigerant temperature under control, the unit will shut down on latching diagnostic **b Fb** (i.e., low evaporator refrigerant temperature) when its cutout setpoint is reached.

This unloading sequence maintains chiller operation at the maximum capacity allowable without excessive slide valve modulation. The duration of each of the unloading steps is dependent upon the rate of evaporator refrigerant temperature change.

Electrical Sequence of Operation

General

Use this section to become familiar with the control logic governing the RTHA chiller operating system. Refer to the typical wiring schematic shown in Figures 56 and 58.

Note: The wiring diagrams in this manual are representative of standard design units. Use them for reference only. They may not reflect the actual wiring of your unit.

For specific electrical schematic and connection information, refer to the wiring diagrams that shipped with the chiller.

Series R Compressor Motor Phase Sequencing

General

It is important that proper rotation of the Series R compressor motor be established before the machine is started. Proper motor rotation requires confirmation of the electrical phase sequence of the power supply. The motor is internally connected for clockwise rotation with the inlet power supply phased A,B,C.

⚠ WARNING

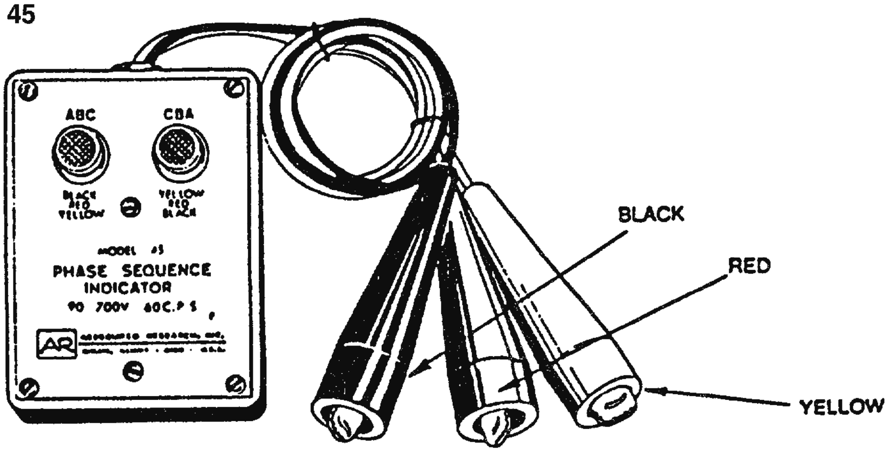
IT IS IMPERATIVE THAT L1-L2-L3 IN THE STARTER BE CONNECTED IN THE A-B-C PHASE SEQUENCE TO PREVENT EQUIPMENT DAMAGE DUE TO REVERSE ROTATION.

To confirm the correct phase sequence (ABC), use a Model 45 Associated Research Phase Indicator <u>or</u> <u>equivalent.</u> See Figure 55.

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

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

Figure 55
Associated Research Model 45 Phase Sequence Indicator



Correcting Improper Electrical Phase Sequence

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

1. Turn Chiller switch on the UCM to STOP/RESET position.

2. Open the electrical disconnect or circuit protection switch that provides line power to the line power terminal block in the starter panel (or to the unit-mounted disconnect).

3. Connect the phase sequence indicator leads to the line power terminal block (or the unit mounted disconnect) as follows:

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

4. Turn power on by closing the unit supply power fused disconnect switch.

5. Read the phase sequence displayed on the indicator. The "ABC" LED on the face of the phase indicator will glow if phase sequence is ABC.

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

6. If the "CBA" indicator glows instead, open the unit main power disconnect and switch two line leads on the line power terminal block (or the unit mounted disconnect). Reclose the main power disconnect and recheck phasing.

7. Reopen the unit disconnect and disconnect the phase indicator.

System Power Supply

Closing the supply power disconnect switch (or circuit breaker 2CB1) in the starter panel, provides control power to the UCP from the 120V secondary of control power transformer 2T4 in the starter panel through 2T4 primary fuses 2F1 and 2F2. See Lines 13, 14 and 20 in Figures 56 and 58.

Note: 2T4 primary fuse sizes depend on unit electrical characteristics.

Current flows to terminal 1TB5-11 in the UCP from terminal 2TB2-1 in the starter panel, to service switch 1S1, which must be closed to power up the UCP. Current then flows through the 12-amp control circuit fuse 1F1 (Line 20, Figures 56 and 58).

From this point, control voltage flows to:

[ ] **Low voltage transformer 1T1**, through 1T1 primary fuse 1F2.

[ ] **Relay output module 1U1** which provides contact closures for energizing solenoid valves 4L2 and 4L3 (loading and unloading the compressor).

[ ] **Water pump interlocks** for condenser and evaporator water flow.

[ ] **Oil tank heater 4HR1**, providing that relay output module 1U2 K6 contacts (oil heater relay) are closed.

[ ] **Starter control circuit** for the compressor motor.

Although these circuits energize simultaneously, the functions occurring in each circuit are described separately in the following paragraphs.

Micro Module 1U3 and Relay Output Module 1U2

120-Volt control power passing through fuse 1F2 travels to power supply transformer 1T1 which provides low voltage (30V maximum) power to micro module 1U3, relay output module 1U1 and power supply output module 1U2.

Water Pump Interlock Circuits

Control voltage passing through fuse 1F1 energizes the evaporator and condenser water pump interlock circuits. Closure of flow switches 5S2 and 5S3—along with the auxiliary contacts of water pump contactors 5K1 and 5K2—in the interlock circuits, energizes the chilled and condenser water pump relays (1K16, 1K17).

The normally-open, "proof-of-flow" contacts for chilled water pump relay 1K16, are located in a low voltage (30V maximum) input circuit connected between terminals 1TB3-20 and 1TB3-21 of the UCM (1U3). See Line 87 in Figures 56 and 58.

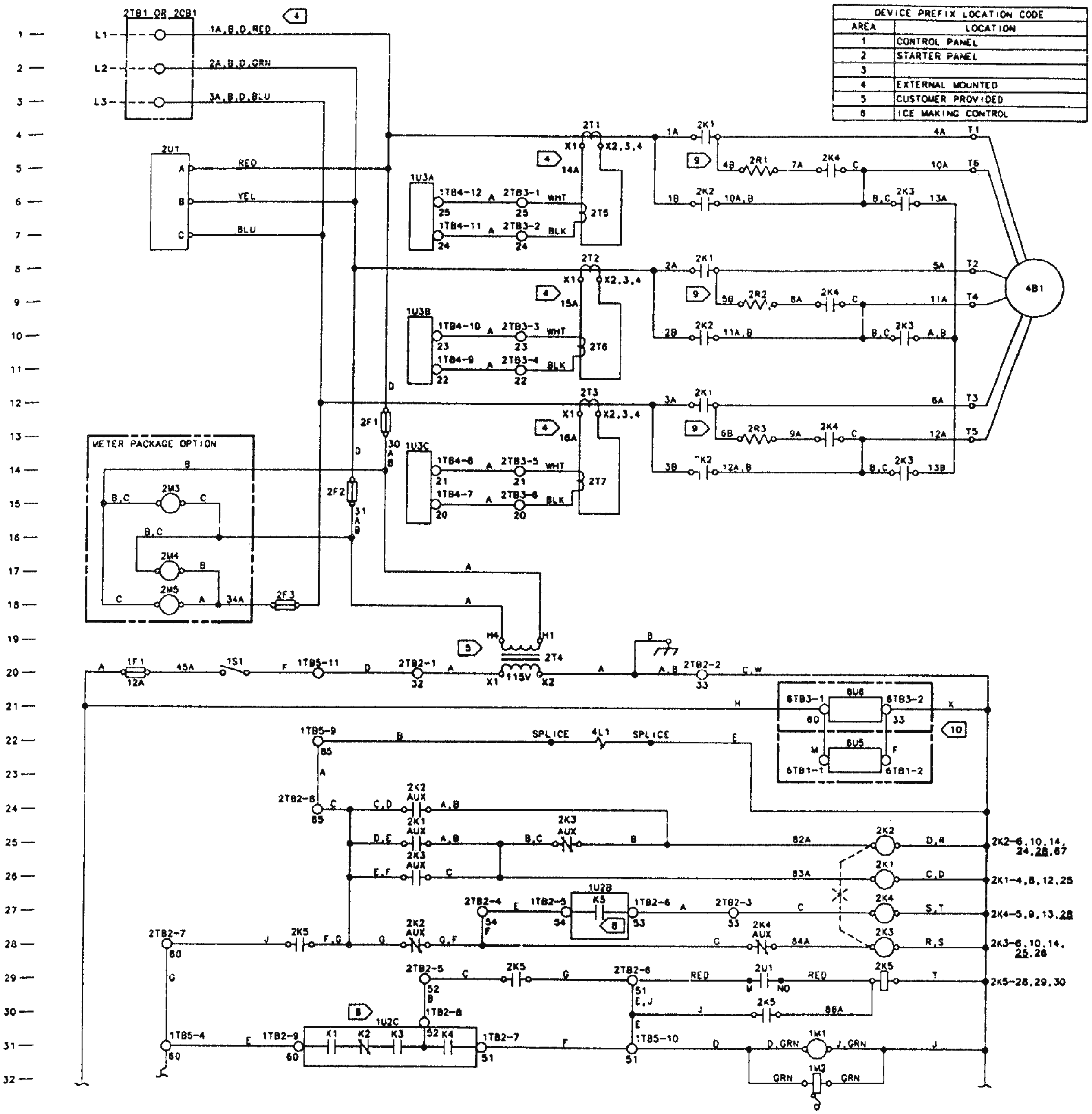
The "proof-of-flow" signal for the condenser water circuit is provided by normally-open contacts of condenser water pump relay 1K17. This set of contacts is also connected to the UCM (1U3), at terminals 1TB3-22 and 1TB3-23 (Line 89 in Figures 56 and 58).

Oil Tank Heater (4HR1 and 4HR2)

Oil tank heaters 4HR1 and 4HR2 are energized via the normally-open K6 (oil tank heater relay) contacts of power supply output module 1U2. The status of these contacts - open or closed - is determined by the UCM.

Note: UCP control logic is designed to energize the oil tank heater when the compressor is not running. At compressor start-up, 1U2-K6 contacts open, deenergizing the heater.

Figure 56
Electrical Schematic for RTHA 130 Thru 300 Units w/Unit-Mounted Starter, Design Sequence A thru H



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	CONTROL PANEL
2	STARTER PANEL
3	
4	EXTERNAL MOUNTED
5	CUSTOMER PROVIDED
6	ICE MAKING CONTROL

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1F1	FUSE, CONTROL CIRCUIT	20
1F2	FUSE, 1T1 PRIMARY	33
1J1-1J4	JACK	
1P1-1P4	PLUG	
1K16	RELAY 5S2 INTERFACE	45
1K17	RELAY 5S3 INTERFACE	46
1M1	HOUR METER	32
1M2	START METER	31
1R1	COND. PRESS. TRANSDUCER	75
1S1	SERVICE SWITCH	20
1S3	HIGH PRESSURE CUTOUT	96
1T1	POWER SUPPLY TRANSFORMER	33
1TB1	TERM BLOCK REL OUTPUT	
1TB2	TERM BLOCK POWER SPLY	
1TB3	TERM BLOCK MICRO-MOD INPUT	
1TB4	TERM BLOCK MICRO-MOD INPUT	
1TB5	TERM BLOCK CONTROL PNL	
1TB6	TERM BLOCK MICRO-MOD INPUT	
1TB7	TERM BLOCK CUSTOMER CONNECT	
1U1A-C	RELAY, OUTPUT MOD	SHEET 2
1U1 K1	RELAY, HOT GAS BYPASS ENABLE	38
1U1 K3	RELAY, HEAD RELIEF REQUEST	88
1U1 K4	RELAY, ALARM	85
1U1 K6	RELAY, COND. WATER PUMP	82
1U1 Q7	SLIDE VALVE-LOAD	38
1U1 Q8	SLIDE VALVE-UNLOAD	39
1U2A-E	POWER SUPPLY OUTPUT MODULE	SHEET 2
1U2 K1	RESET RELAY	31
1U2 K2	STOP RELAY	31
1U2 K3	OVERLOAD RELAY	31
1U2 K4	COMPR. START RELAY	31
1U2 K5	COMP. TRANSITION RELAY	27
1U2 K6	OIL HEATER RELAY	48
1U3A-D	MICRO MODULE	SHEET 2
1U4	BAS CHILLED WTR RESET	80
2CB1	STARTER CIRCUIT BREAKER	1
2F1,2F2,2F3	FUSE, 2T4 PRIMARY	17-18
2K1	START CONTACTOR	26
2K2	RUN CONTACTOR	25
2K3	SHORTING CONTACTOR	28
2K4	TRANSITION CONTACTOR	27
2K5	PILOT RELAY	29
2M3,4,5	VOLT METER	15,17,18
2M6,7,8	AMP METER	51,54,57
2R1-9	TRANSITION RESISTOR	5,9,13
2T1-3	CURRENT TRANSFORMER, LARGE	4,8,12
2T4	CONTROL POWER TRANSFORMER	19
2T5-7	CURRENT TRANSFORMER, SMALL	6,10,14
2TB1	LINE TERMINAL BLOCK	1
2TB2	CONTROL TERMINAL BLOCK	
2TB3	LOW VOLTAGE TERMINAL BLOCK	
2U1	PHASE REVERSAL MONITOR	4
4B1	COMPRESSOR MOTOR	8
4B1R2,3,4	MOTOR WINDING TEMP SENSOR	72,73,75
4HR1	OIL TANK HEATER	47
4HR2	OIL TANK HEATER	48
4L1	MASTER SOLENOID VALVE	22
4L2	LOAD SOLENOID VALVE	38
4L3	UNLOAD SOLENOID VALVE	39
4L9	HOT GAS BYPASS VALVE	40
4S5	OIL FLOW SWITCH	65
4S6	LOW PRESSURE CUTOUT	67
4RT1	LEAVING EVAP SENSOR	102
4RT2	ENTERING EVAP SENSOR	69
4RT3	ENTERING COND SENSOR	71
4RT4	LEAVING COND SENSOR	73
4RT5	EVAP REF TEMP SENSOR	78
4RT6	AMBIENT TEMP SENSOR	80
4RT8	DISCHARGE TEMP SENSOR	76
5K1	EVAP WATER PUMP CONT AUX	45
5K2	COND WATER PUMP CONT AUX	82
5S2	WATER FLOW SWITCH	45
5S3	WATER FLOW SWITCH	46
5S4	RUN SPARE FAULT SWITCH	88

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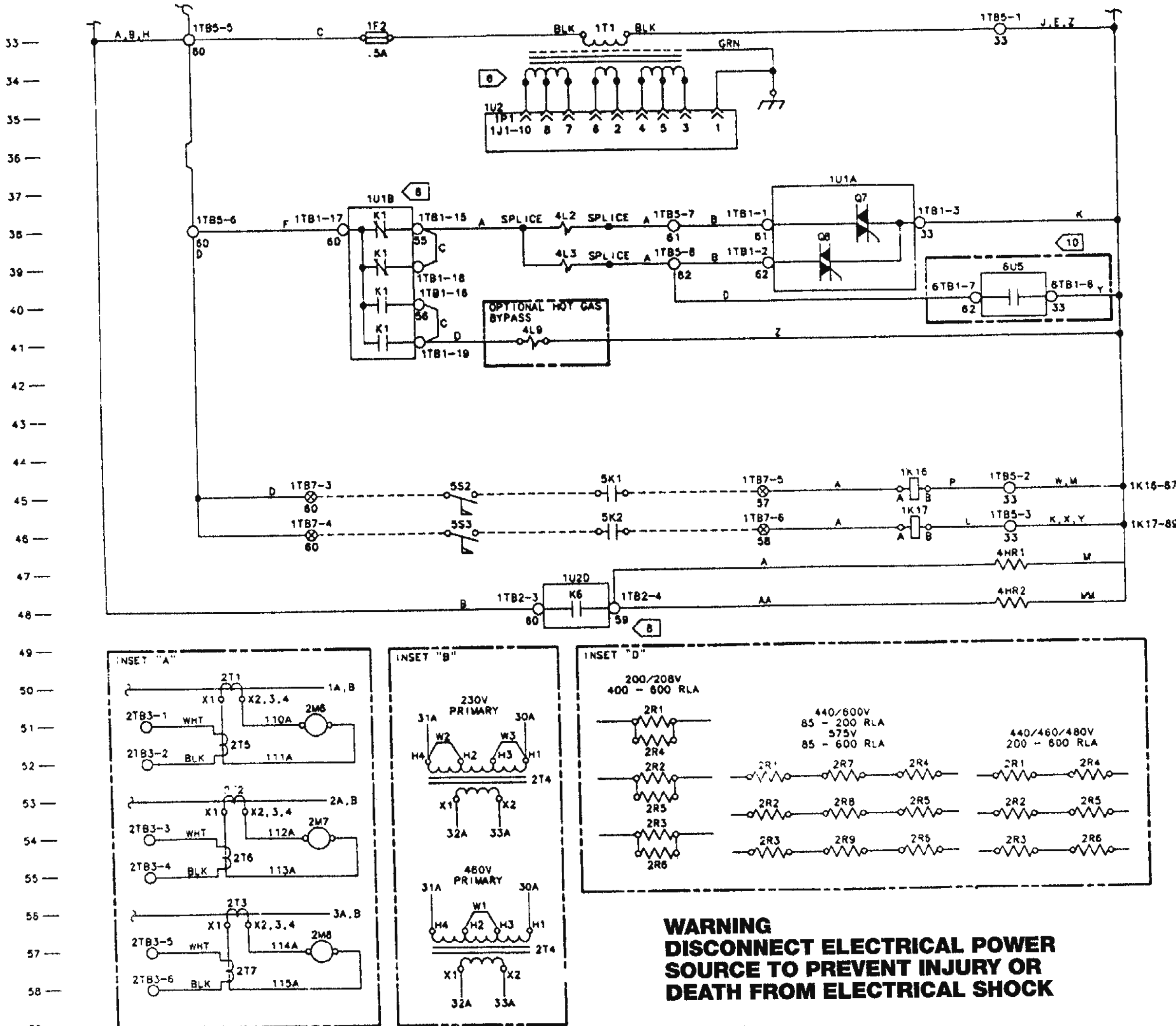
Figure 56 (Cont'd.)
Electrical Schematic for RTHA 130 Thru 300 Units w/Unit-Mounted Starter, Design Sequence A thru H



6RT1	LEAVING ICE BANK TEMP SENSOR	97
6RT2	ENTERING ICE BANK TEMP SENSOR	99
6U5	ICE MAKING CONTROL	22,40 67,97
6U6	ICE MAKING LATCH PANEL	21,62 104
6TB1	TERM BLOCK HIGH VOLTAGE	22,40 99,104
6TB2	TERM BLOCK CONTROL SIGNAL	67,68 97,99
6TB3	TERM BLOCK POWER INPUT	21
6TB4	TERM BLOCK INPUT/OUTPUT	82,83 103

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25°C (77°F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF AND AFTER A NORMAL SHUTDOWN HAS OCCURED.
2. SOLID LINES INDICATE TRANE WIRING. DASHED LINES INDICATE FIELD WIRING. PHANTOM LINES INDICATE OPTIONAL FEATURES.
3. NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF THE CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT. AN OPEN ARROWHEAD BELOW THE LINE NUMBER POINTING UPWARD INDICATES A TIMED CONTACT WHICH BEGINS TIMING WHEN ENERGIZED.

4. IF METER PACKAGE OPTION IS REQUIRED SEE INSET "A".

5. 200/575 VOLT PRIMARY SHOWN. SEE INSET "B" FOR OTHER VOLTAGES.

6. SEE SERVICE MANUAL FOR INDIVIDUAL SECONDARY VOLTAGES.

7. THREE PHASE POWER SUPPLY VOLTAGE SEE UNIT NAMEPLATE.

8. RELAY COILS NOT SHOWN. CONTACTS ARE CONTROLLED BY THE LOGIC OF THE MICRO-MODULE (1U3). SEE SEQUENCE OF OPERATION LINES 102-115 PAGE 2.

9. RESISTOR SHOWN FOR 200/208V AND 200-400 RLA. FOR OTHER VOLTAGES AND RLA SEE INSET "D".

10. OPTIONAL ICE MAKING CONTROL(6U5, 6U6).

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

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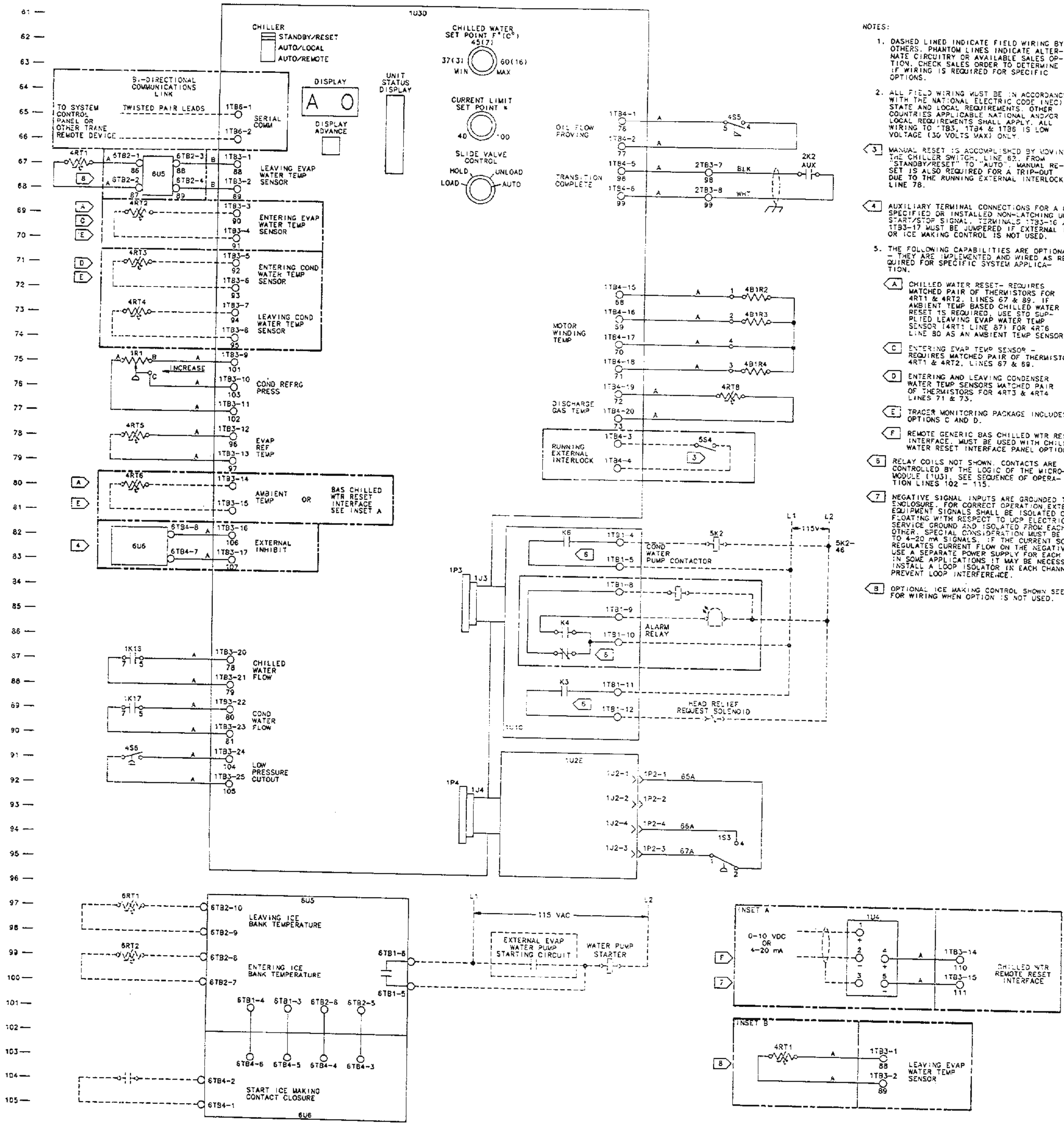
Figure 56 (Cont'd)
Electrical Schematic for RTHA 130 thru 300 Units w/Unit-Mounted Starter, Design Sequence A thru H



NOTES:

1. DASHED LINED INDICATE 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 ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY. ALL WIRING TO 1TB3, 1TB4 & 1TB6 IS LOW VOLTAGE (30 VOLTS MAX) ONLY.
3. MANUAL RESET IS ACCOMPLISHED BY MOVING THE CHILLER SWITCH, LINE 62, FROM "STANDBY/RESET" TO "AUTO". MANUAL RESET IS ALSO REQUIRED FOR A TRIP-OUT DUE TO THE RUNNING EXTERNAL INTERLOCK, LINE 78.
4. AUXILIARY TERMINAL CONNECTIONS FOR A CUSTOMER SPECIFIED OR INSTALLED NON-LATCHING UNIT START/STOP SIGNAL. TERMINALS 1TB3-16 AND 1TB3-17 MUST BE JUMPERED IF EXTERNAL INTERLOCK OR ICE MAKING CONTROL IS NOT USED.
5. THE FOLLOWING CAPABILITIES ARE OPTIONAL - THEY ARE IMPLEMENTED AND WIRED AS REQUIRED FOR SPECIFIC SYSTEM APPLICATION.
   - A. CHILLED WATER RESET- REQUIRES MATCHED PAIR OF THERMISTORS FOR 4RT1 & 4RT2, LINES 67 & 89. IF AMBIENT TEMP BASED CHILLED WATER RESET IS REQUIRED, USE STD SUPPLIED LEAVING EVAP WATER TEMP SENSOR (4RT1 LINE 87) FOR 4RT6 LINE 80 AS AN AMBIENT TEMP SENSOR.
   - C. ENTERING EVAP TEMP SENSOR - REQUIRES MATCHED PAIR OF THERMISTORS 4RT1 & 4RT2, LINES 67 & 69.
   - D. ENTERING AND LEAVING CONDENSER WATER TEMP SENSORS MATCHED PAIR OF THERMISTORS FOR 4RT3 & 4RT4 LINES 71 & 73.
   - E. TRACER MONITORING PACKAGE INCLUDES OPTIONS C AND D.
   - F. REMOTE GENERIC BAS CHILLED WTR RESET INTERFACE. MUST BE USED WITH CHILLED WATER RESET INTERFACE PANEL OPTION.
6. RELAY COILS NOT SHOWN. CONTACTS ARE CONTROLLED BY THE LOGIC OF THE MICRO-MODULE (1U3). SEE SEQUENCE OF OPERATION LINES 102 - 115.
7. NEGATIVE SIGNAL INPUTS ARE GROUNDED TO UCP ENCLOSURE. FOR CORRECT OPERATION, EXTERNAL EQUIPMENT SIGNALS SHALL BE ISOLATED OR FLOATING WITH RESPECT TO UCP ELECTRICAL SERVICE GROUND AND ISOLATED FROM EACH OTHER. SPECIAL CONSIDERATION MUST BE GIVEN TO 4-20 mA SIGNALS. IF THE CURRENT SOURCE REGULATES CURRENT FLOW ON THE NEGATIVE LEAD USE A SEPARATE POWER SUPPLY FOR EACH CHANNEL. IN SOME APPLICATIONS IT MAY BE NECESSARY TO INSTALL A LOOP ISOLATOR IN EACH CHANNEL TO PREVENT LOOP INTERFERENCE.
8. OPTIONAL ICE MAKING CONTROL SHOWN SEE INSET B FOR WIRING WHEN OPTION IS NOT USED.

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

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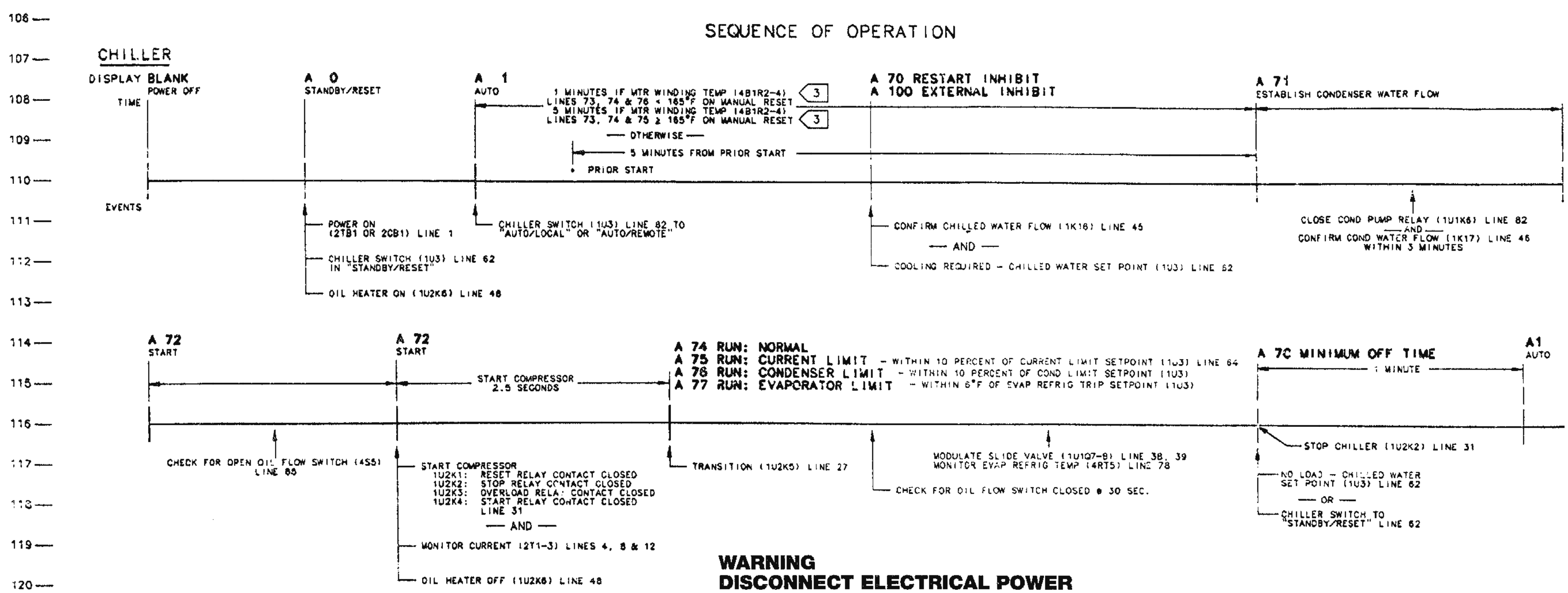
Figure 57
Sequence of Operation Schematic for RTHA 130 Thru RTHA 300 Units, Design Sequence A thru H



WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

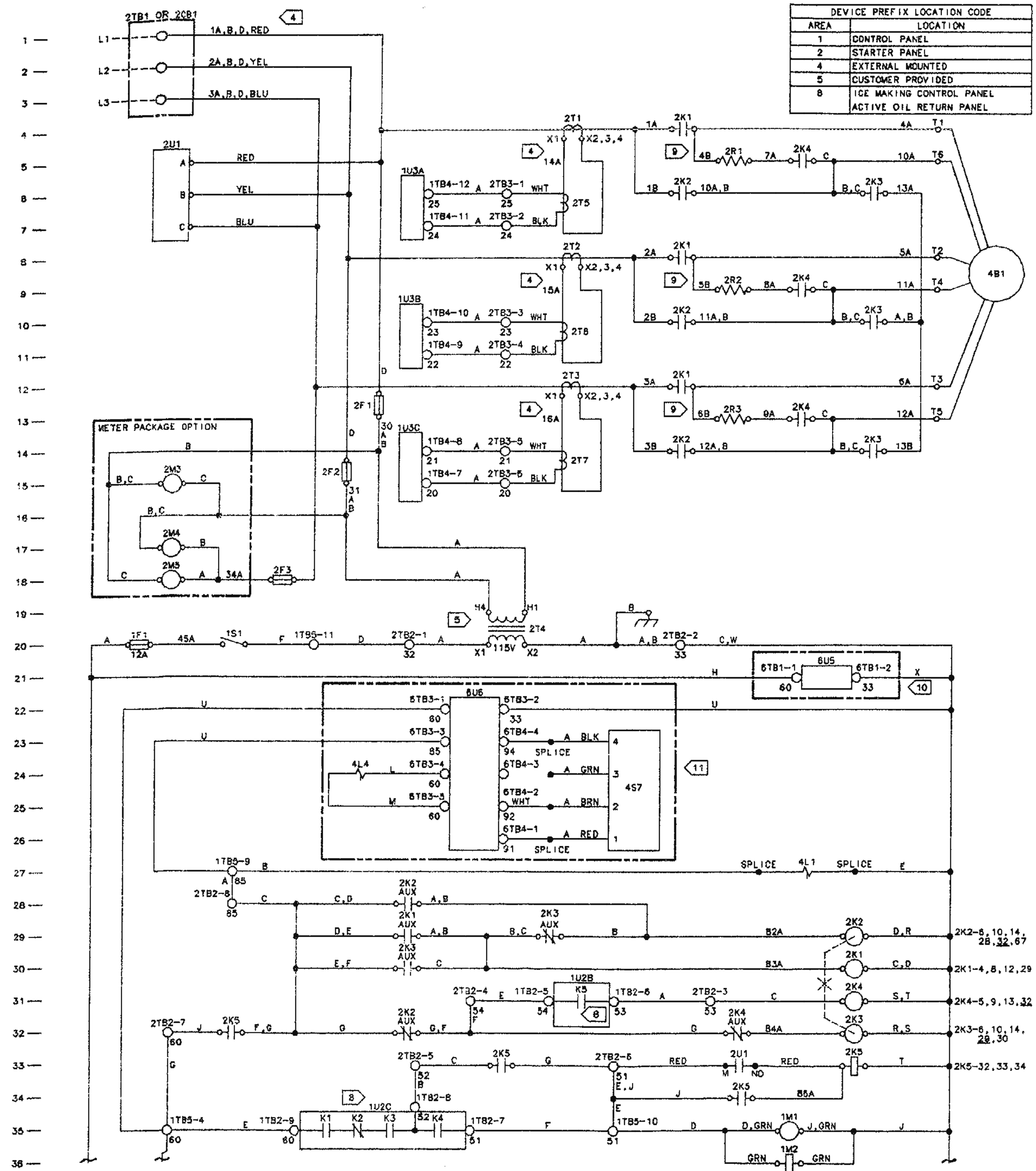
CAUTION
Use copper conductors only to prevent equipment damage

<3 MANUAL RESET IS ACCOMPLISHED BY MOVING THE CHILLER SWITCH, LINE 62, FROM "STANDBY/RESET" TO "AUTO". MANUAL RESET IS ALSO REQUIRED FOR A TRIP-OUT DUE TO THE RUNNING EXTERNAL INTERLOCK, LINE 78.

X39530029C

Figure 58
Electrical Schematic for RTHA 130 thru 450 Units w/Unit-Mounted Starter, Design Sequence JO and Later

(Continued on next page)



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	CONTROL PANEL
2	STARTER PANEL
4	EXTERNAL MOUNTED
5	CUSTOMER PROVIDED
8	ICE MAKING CONTROL PANEL
	ACTIVE OIL RETURN PANEL

	LEGEND	
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1F1	FUSE, CONTROL CIRCUIT	20
1F2	FUSE, 1T1 PRIMARY	37
1J1-1J4	JACK	
1P1-1P4	PLUG	
1K16	RELAY 5S2 INTERFACE	45
1K17	RELAY 5S3 INTERFACE	46
1M1	HOUR METER	35
1M2	START METER	36
1R1	COND. PRESS. TRANSDUCER	75
1S1	SERVICE SWITCH	20
1S3	HIGH PRESSURE CUTOUT	93
1T1	POWER SUPPLY TRANSFORMER	37
1TB1	TERM BLOCK REL OUTPUT	
1TB2	TERM BLOCK POWER SPLY	
1TB3	TERM BLOCK MICRO-MOD INPUT	
1TB4	TERM BLOCK MICRO-MOD INPUT	
1TB5	TERM BLOCK CONTROL PNL	
1TB6	TERM BLOCK MICRO-MOD INPUT	
1TB7	TERM BLOCK CUSTOMER CONNECT	
1U1A-C	RELAY, OUTPUT MOD	SHEET 2
1U1 K1	RELAY, HOT GAS BYPASS ENABLE	41
1U1 K3	RELAY, HEAD RELIEF REQUEST	88
1U1 K4	RELAY, ALARM	85
1U1 K6	RELAY, COND, WATER PUMP	82
1U1 Q7	SLIDE VALVE-LOAD	41
1U1 Q8	SLIDE VALVE-UNLOAD	42
1U2A-E	POWER SUPPLY OUTPUT MODULE	SHEET 2
1U2 K1	RESET RELAY	35
1U2 K2	STOP RELAY	35
1U2 K3	OVERLOAD RELAY	35
1U2 K4	COMPR. START RELAY	35
1U2 K5	COMP. TRANSITION RELAY	31
1U2 K6	OIL HEATER RELAY	48
1U3A-D	MICRO MODULE	SHEET 2
1U4	BAS CHILLED WTR RESET	99
2CB1	STARTER CIRCUIT BREAKER OR NON-FUSED MECHANICAL DISCONNECT SWITCH	1
2F1,2F2,2F3	FUSE, 2T4 PRIMARY	13,15,18
2K1	START CONTACTOR	29
2K2	RUN CONTACTOR	28
2K3	SHORTING CONTACTOR	30
2K4	TRANSITION CONTACTOR	31
2K5	PILOT RELAY	33
2M3,4,5	VOLT METER	15,17,18
2M6,7,8	AMP METER	51,54,57
2R1-9	TRANSITION RESISTOR	5,9,13
2T1-3	CURRENT TRANSFORMER, LARGE	4,8,12
2T4	CONTROL POWER TRANSFORMER	19
2T5-7	CURRENT TRANSFORMER, SMALL	6,10,14
2TB1	LINE TERMINAL BLOCK	1
2TB2	CONTROL TERMINAL BLOCK	
2TB3	LOW VOLTAGE TERMINAL BLOCK	
2U1	PHASE REVERSAL MONITOR	5
4B1	COMPRESSOR MOTOR	8
4B1R2,3,4	MOTOR WINDING TEMP SENSOR	72,73,75
4HR1	OIL TANK HEATER	47
4HR2	OIL TANK HEATER	48
4L1	MASTER SOLENOID VALVE	27
4L2	LOAD SOLENOID VALVE	41
4L3	UNLOAD SOLENOID VALVE	42
4L4	OIL RETURN SOLENOID VALVE	24
4L9	HOT GAS BYPASS VALVE	44
4S6	LOW PRESSURE CUTOUT	91
4S7	OPTICAL SENSOR	24
4S8	OIL DIFFERENTIAL PRESSURE SW	65,104
4RT1	LEAVING EVAP SENSOR	104
4RT2	ENTERING EVAP SENSOR	69
4RT3	ENTERING COND SENSOR	71
4RT4	LEAVING COND SENSOR	73
4RT5	EVAP REF TEMP SENSOR	78
4RT6	AMBIENT TEMP SENSOR	80
4RT8	DISCHARGE TEMP SENSOR	76
4RT9	LEAVING ICE BANK TEMP SENSOR	97
5K1	EVAP WATER PUMP CONT AUX	45
5K2	COND WATER PUMP CONT AUX	82
5S2	WATER FLOW SWITCH	45
5S3	WATER FLOW SWITCH	46
5S4	RUN SPARE FAULT SWITCH	78

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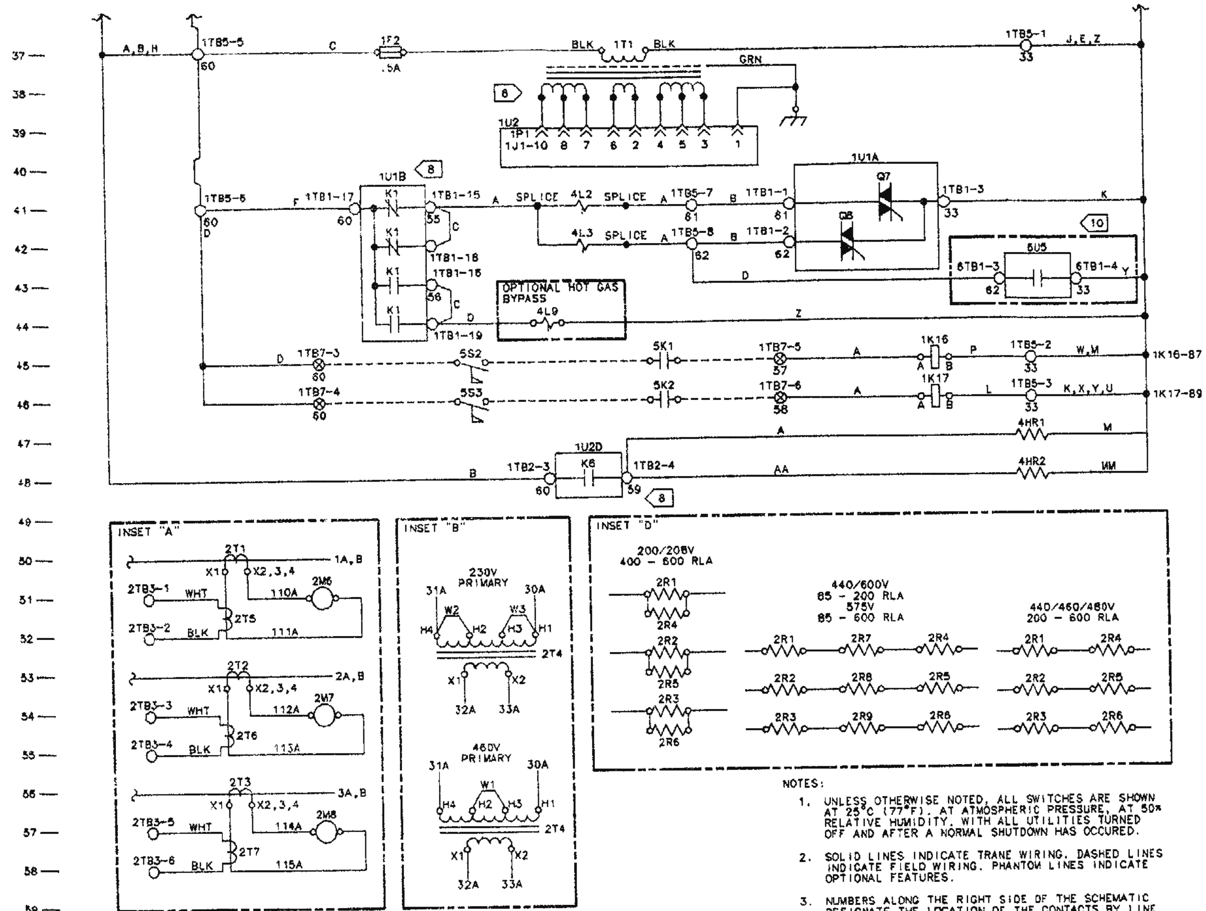
(Continued from previous page)

6U5	ICE MAKING CONTROL PANEL	21,43 67,82,97
6U6	ACTIVE OIL RETURN CONTROL PANEL	22,65
6TB1	TERM BLOCK HIGH VOLTAGE ICE CONTROL	21,43 97
6TB2	TERM BLOCK CONTROL SIGNAL ICE CONTROL	67,97 82
6TB3	TERM BLOCK HIGH VOLTAGE ACTIVE OIL RETURN	22
6TB4	TERM BLOCK CONTROL SIGNAL ACTIVE OIL RETURN	65,23



NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25°C (77°F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF AND AFTER A NORMAL SHUTDOWN HAS OCCURED.
2. SOLID LINES INDICATE TRANE WIRING. DASHED LINES INDICATE FIELD WIRING. PHANTOM LINES INDICATE OPTIONAL FEATURES.
3. NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF THE CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT. AN OPEN ARROWHEAD BELOW THE LINE NUMBER POINTING UPWARD INDICATES A TIMED CONTACT WHICH BEGINS TIMING WHEN ENERGIZED.

4 IF METER PACKAGE OPTION IS REQUIRED SEE INSET "A".

5 200/575 VOLT PRIMARY SHOWN. SEE INSET "B" FOR OTHER VOLTAGES.

6 SEE SERVICE MANUAL FOR INDIVIDUAL SECONDARY VOLTAGES.

7 THREE PHASE POWER SUPPLY VOLTAGE SEE UNIT NAMEPLATE.

8 RELAY COILS NOT SHOWN. CONTACTS ARE CONTROLLED BY THE LOGIC OF THE MICRO-MODULE (1U3). SEE SEQUENCE OF OPERATION LINES 102-115 PAGE 2.

9 RESISTOR SHOWN FOR 200/208V AND 200-400 RLA. FOR OTHER VOLTAGES AND RLA SEE INSET "D".

10 OPTIONAL ICE MAKING CONTROL(6U5).

11 OPTIONAL ACTIVE OIL RETURN (6U6).

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

X39530099A

Figure 58 (Cont'd)
Electrical Schematic for RTHA 130 thru 450 Units w/Unit-Mounted Starter, Design Sequence JO and Later

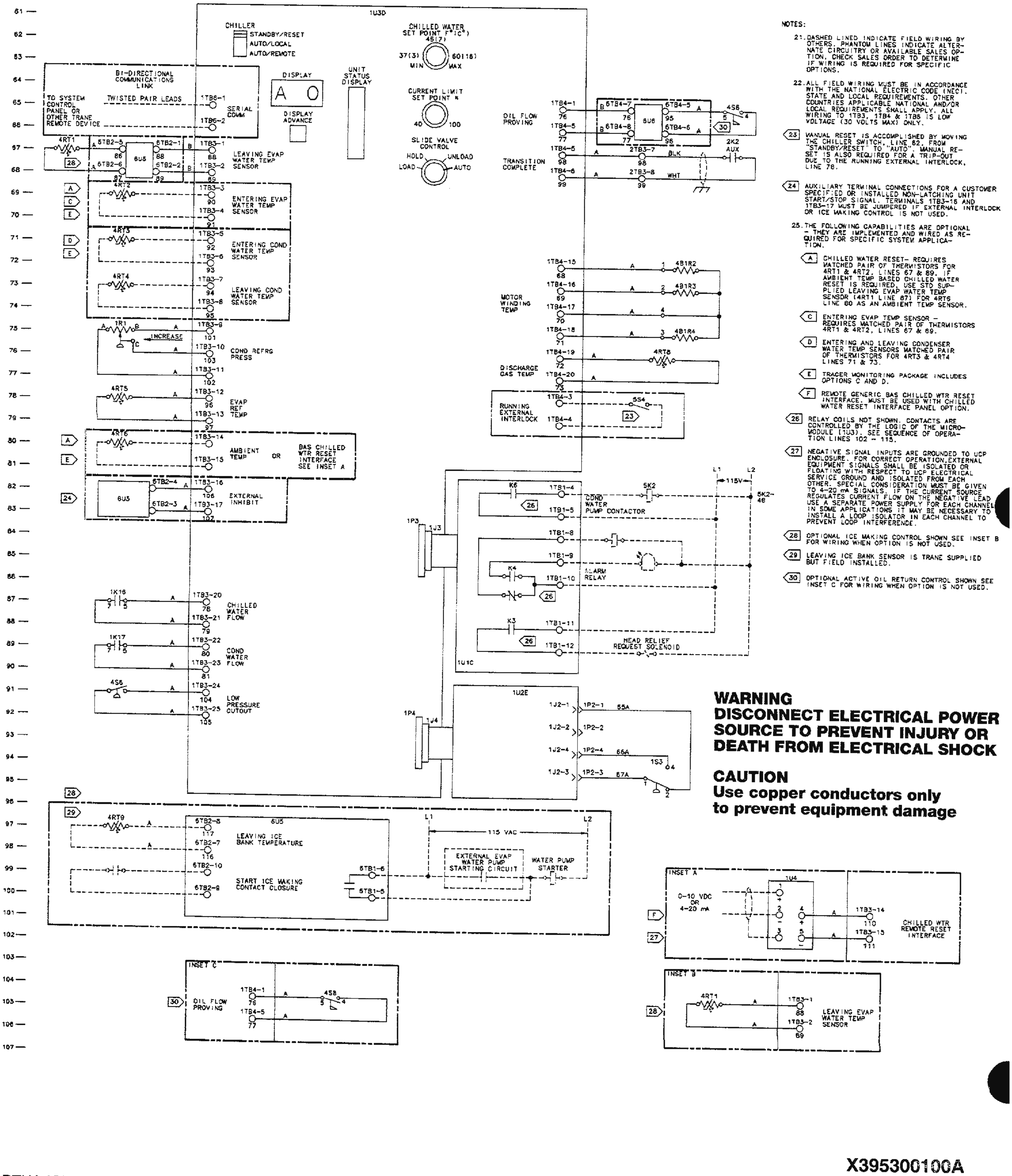
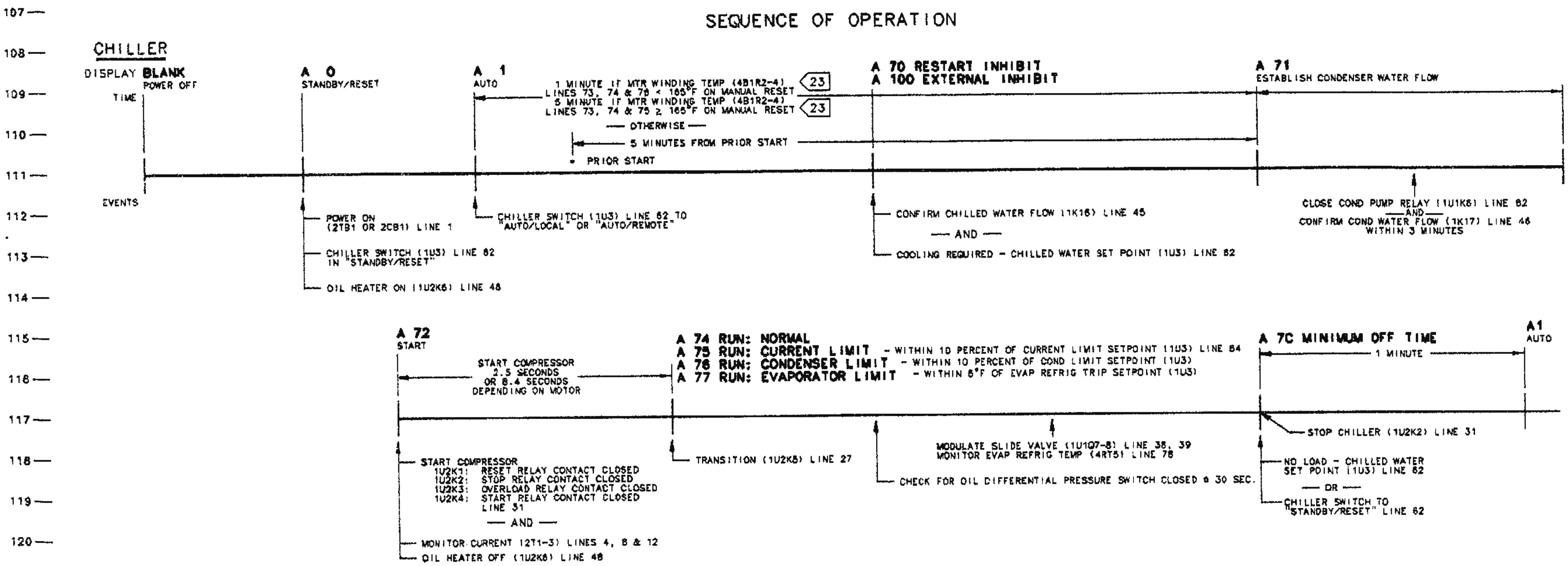


Figure 59
Sequence of Operation Schematic
for RTHA 130 thru RTHA 450 Units,
Design Sequence JO and Later



WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

X395300100A

Micro Module and "Wye-Delta" Unit-Mounted Starter Control Circuits

While the micro module 1U3 and "wye-delta"-type starter control subcircuits are separate, their functions are closely coordinated and are discussed together in the following paragraphs.

120-Volt control power enters power supply output module 1U2 at Terminal 1TB2-9. (See Line 31 or 35, Figures 56 and 58.) Logic circuits within micro module 1U3 determine the "state" (i.e., open or closed) of reset relay K1 and overload relay K3 contacts based on input signals sent to 1U3 and its timers.

Individual access to the K1, K2 and K3 relays is not possible; however, the net state of all 3 relays is available between Terminals 7 and 8 on terminal block 1TB2. When the "net state" of the K1, K2 and K3 contacts - along with UCM Service Switch 1S1 - **is closed**, control voltage passes to compressor start relay K4.

If cooling is required and all of the conditions required for start-up are met, UCM 1U3 sends a signal to power supply output module 1U2 to close the K4 contacts. This allows control voltage to flow to hour meter 1M1 and start counter 1M2. At the same time, a "start" signal is sent to starter pilot relay 2K5, provided phase reversal relay 2U1 contacts are closed.

Notice that starter pilot relay 2K5 has 3 sets of normally-open contacts. The first set (Line 29 or 33; Figures 56 and 58) closes to lock the pilot relay into the control circuit around the K4 contacts.

The second set of 2K5 contacts (Line 28 or 32) also closes, enabling control voltage to flow through the normally closed auxiliary contacts of starter contactors 2K2 (run; 2M). The 3rd set of 2K5 contacts is in parallel with 2U1 contacts (Line 30 or 34).

When shorting contactor 2K3 energizes, its normally-open, auxiliary contacts (Line 26 or 30) close; this allows control voltage to flow to the coil of the starter contactor 2K1 (start; 1M).

With 2K1 now energized, its normally- open, auxiliary contacts (Line 25 or 29) close; this locks starter contactor 2K1 into the control circuit around the auxiliary 2K3 contacts in Line 26 or 30. Power is now supplied to the "wye" ("star") windings of compressor motor (4B1) in the WYE connection through 2K3 and 2K1 contactors. Starting event timing is illustrated in Figures 57 and 59.

After the transition time has elapsed, UCM 1U3 sends a signal to power supply output module 1U2 to close the normally-open contacts of compressor transition relay K5. This energizes the coil of transition contactor 2K4 and causes its normally- closed set of auxiliary contacts (Line 28 or 32) to open.

With the circuit to shorting contactor 2K3 now open, 2K3 deenergizes and its normally-closed, auxiliary contacts (Line 25 or 29) reclose to allow control power to reach the coil of run contactor 2K2. An auxiliary set of normally-open 2K2 contacts in Line 24 closes, locking run contactor 2K2 into the control circuit around the normally-open 2K3 and 2K1 auxiliary contacts (Lines 25 and 26 or 29 and 30).

Also, a normally-closed set of auxiliary 2K2 contacts on Line 28 or 32 opens to interrupt control voltage to transition contactor 2K4.

The compressor (4B1) is operating in its normal "run" mode; it will continue to do so until the "net state" of the K1, K2 and K3 contacts in the power supply output module (1U2) "open". Once this "open" condition occurs, voltage to starter pilot relay 2K5 is lost and its contacts reopen.

Any of the following conditions will result in a "net state" of "open" for contacts K1, K2 and K3, and stop compressor operation:

1. Turning the chiller switch to STANDBY/RESET;

2. UCM detection of a latching or nonlatching diagnostic condition; or,

3. Satisfaction of the cooling requirement (i.e., building load drops to the point where machine operation is no longer practical). This condition is detected when chilled water temperature is more than 2.0 F below the chilled water setpoint for 90-degree F-seconds. seconds.

Solenoid Control

Control power flows through 1TB5-6 and 1TB1-17, through HGBP enable relay 1U1B (K1) to load and unload solenoid valves 4L2 and 4L3.

Control of the load and unload solenoid valves is achieved via 2 Triac switches (Q7, slide valve load; Q8, slide valve unload) located in relay output module 1U1. Functionally, Q7 and Q8 each operate like a simple set of contacts.

While the operation of both Triacs is automatically governed by micro module 1U3, manual control is possible by positioning the slide valve control switch at LOAD, HOLD or UNLOAD.

Note: Manual loading or holding does not take precedence over the current limit (**A 75**), condenser limit (**A 76**) or evaporator limit (**A 77**) modes of operation.

Pressure Gauges

The evaporator and condenser pressure gauges are located in a panel that mounts on the right side of the UCP (Figures 1 and 51). The gauges enable the operator to monitor condenser and evaporator refrigerant pressure during operation.

Relay Package

This control provides the UCP with an additional 2 relays which are built into relay output module 1U1: they are alarm relay K4 and "head-relief request" relay K3.

Alarm relay 1U1K4 activates whenever the UCP detects a latching diagnostic condition (i.e., one that requires manual reset), and provides the electrical access needed for field- installation of a customer-supplied alarm.

See Lines 84 through 87 in Figures 56 and 58. Notice that the customer-provided alarm relay (5K3) can either be field-connected between Terminals 1TB1-9 and 1TB1-10 for normally-open contacts, or between Terminals 1TB1-8 and 1TB1-10 for normally-closed contacts.

"Head-relief" request relay 1U1K3 is designed to be used in conjunction with the UCP's condenser limit control feature. Its normally-open relay contacts (Figures 56 and 58, Line 88) are field-accessible at Terminals 1TB1-11 and -12, and can be used to control - or signal for a reduction in - entering condenser water temperature.

Control Options

Note: The typical system schematics shown in Figures 56 and 58 are representative of standard-design units. They should be used for reference only. They may not reflect the actual wiring of your unit. For specific electrical schematic and connection information, refer to the wiring diagrams that shipped with the chiller.

Water Temperature Sensor Kit

This control option is recommended for chillers that will be interfaced with a **Tracer**® system or reading temperature at the UCM.

A temperature bulb well is not required for temperature sensor installation. Sensors are designed for direct immersion to provide more efficient tracking and system operation. The stainless steel construction of the sensors prevents fatigue failure.

The Water Temperature Sensor Kit includes these field-installed temperature sensors:

Note: These sensors must be matched-pair thermistors.

[ ] **Entering and Leaving Evaporator Water (4RT1,4RT2).** Entering and leaving chilled water temperature sensors (4RT1, 4RT2) are installed in the entering and leaving evaporator water by the installer.

The standard leaving water temperature sensor 4RT1 (factory-installed in the water box on the leaving-water end of the evaporator) is disconnected, removed from the water box and replaced with one of the matched-pair sensors. Reconnect the sensor leads between Terminals 1TB3-1 and 1TB3-2 on micro module 1U3.

Matched-pair sensor 4RT2 is installed in the water piping entering the evaporator, and is connected between Terminals 1TB3-3 and 1TB3-4 on micro module 1U3.

[ ] **Entering and Leaving Condenser Water (4RT3,4RT4).** Entering and leaving condenser water temperature sensors (4RT3, 4RT4) are installed in the entering and leaving condensing water by the installer.

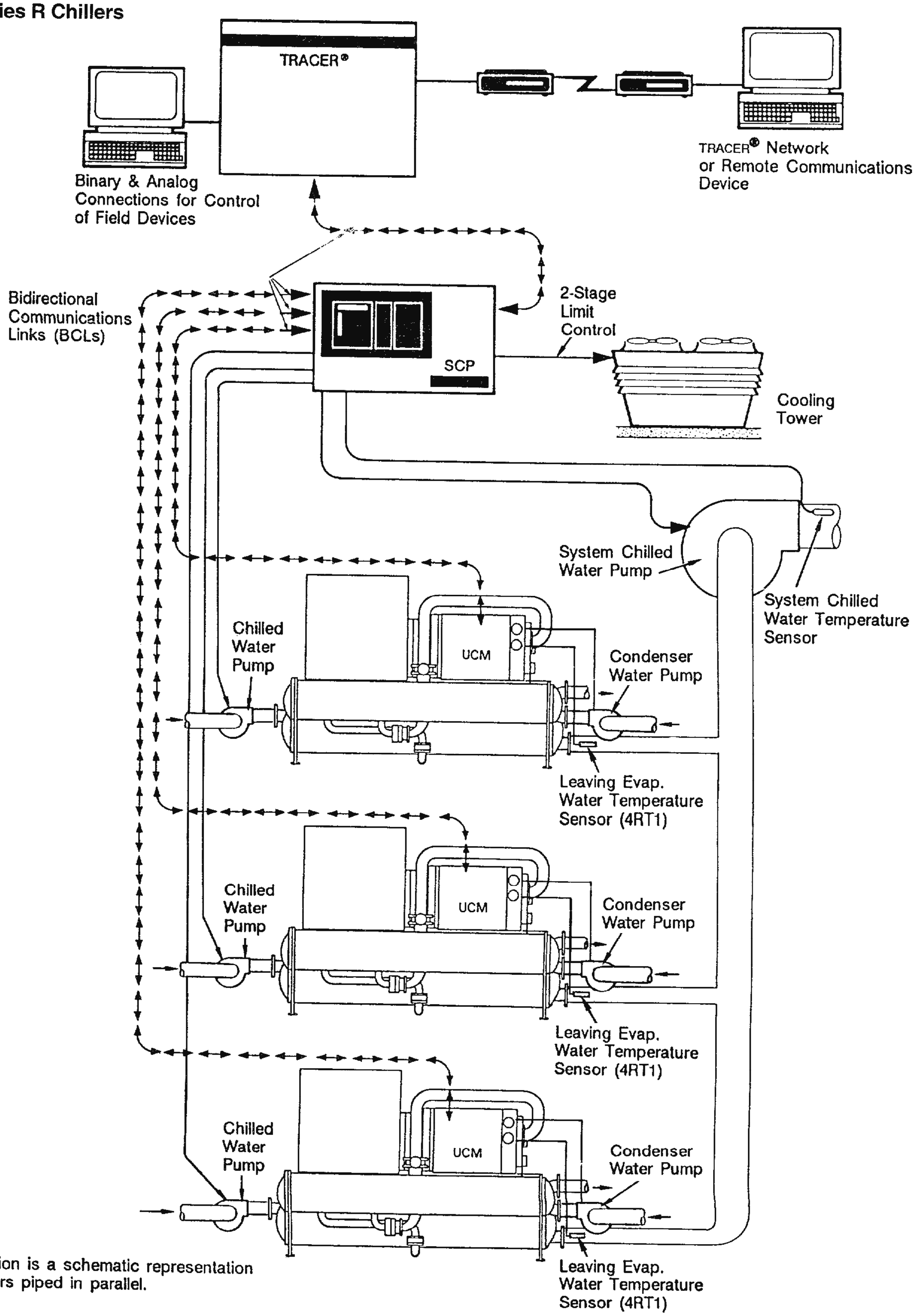
Entering condenser water temperature sensor 4RT3 is connected between Terminals 1TB3-5 and -6. Leaving condenser water temperature sensor 4RT4 is connected to Terminals 1TB3-7 and -8.

Serial Communications Interface (SCI)

This UCP control option allows micro module 1U3 to exchange information (e.g., operating parameters, setpoints and commands) with a system control panel (SCP) and, in turn, a **Tracer**®. Figure 60 illustrates how such a communication control network might appear. Notice that twisted-pair connectors are used to establish the communication link between the unit(s) and the SCP.

Note: The SCI and chilled water reset (CWR) options are mutually exclusive; that is, an RTHA unit cannot be equipped with both SCI and CWR.

Figure 60
Typical BCL Network for SCP and Three Series R Chillers



Note: This illustration is a schematic representation of three RTHA chillers piped in parallel.

Chilled Water Reset (CWR)

Chilled water reset is designed for those applications where the design chilled water temperature is not required at part load. In these cases, the leaving chilled water temperature setpoint can be reset upward using the chilled water reset option.

Optional chilled water reset (CWR) consists of a CWR module in the unit control panel and a field- installed temperature sensor. Sensor location is dependent on whether "load" or "ambient" chilled water setpoint reset is desired:

[ ] If **"load" CWR** is selected, the CWR sensor (4RT2) is field-installed in the return chilled water piping, and connected to Terminals 1TB3-3 and -4 of micro module 1U3.

Note: 4RT1 and 4RT2 must be a matched pair of sensor. See "Field-Installed Water Temperature Sensors".

[ ] With selection of **"ambient" CWR,** the sensor is connected to 1U3 terminals 1TB3-14 and -15, and is typically field-installed just inside the building's fresh air intake duct, or on the north exterior wall of the building. In either case, shelter the sensor from direct sunlight and the elements.

The unit operator can select type of chilled water reset desired at the unit control panel. To access the chilled water reset controls, open the control panel door; the CWR reset type, action and reference potentiometers are located at the far left of micro module 1U3. See Figure 61.

The conversion tables used to determine CWR control settings (i.e., Tables A and B) are provided on the face of the micro module, to the right of the current limit setpoint potentiometer (Figure 61).

WARNING: To prevent injury or death due to electrocution, use care when performing control set-ups, adjustments or other service-related operations with power on.

Load-Based CWR

When load-based chilled water reset is desired, set the CWR controls at the following positions:

[ ] **Reset Type Switch:** Set at EVAP. DELTA-T.

[ ] **Reset Reference Switch:** Set at the design delta-T (DDT) for the unit. Use Table B (Figure 61) to convert the unit DDT to a letter code (A thru H).

Note: In those instances where the DDT value falls between the values listed, always use the next lower value.

Example: Chiller A is designed to operate with an entering chilled water temperature (CWT) of 56 F, and a leaving chilled water temperature of 44 F.

a. Determine design delta-T for Chiller A.

DDT = Design Ent. CWT - Design Lvg. CWT
DDT = 56 F - 44 F
DDT = 12 F

b. Convert the DDT for Chiller A to a letter code. Locate 12 F DDT in Table B under EVAP. DELTA-T; 12 F DDT = E.

c. Turn reset reference switch to control setting E.

[ ] **Reset Action Switch:** Set at the amount of reset desired. Use the following equation and Table A (Figure 61) to determine the amount of reset desired; then convert this amount to a letter code (i.e., A thru H).

RCWS = PCWS + RAS [DDT-(ENT-LVG)],

where:
RCWS = Reset Chilled Water Setpoint
PCWS = Front Panel Chilled Water Setpoint
RAS = Reset Action Setpoint
DDT = Design Delta-T
ENT = Entering Chilled Water Temp.
LVG = Leaving Chilled Water Temp.

Notes about this equation:

1. To convert the reset action values in Table A from percentages to decimal values, divide by 100. Decimal values must be used for the RAS variable in the equation.

2. System control will not allow chilled water reset downward even though it is possible in this equation.

3. Increasing the reset action setpoint (RAS) to a larger number results in more reset.

4. If the required amount of chilled water reset is known (RCWS), along with the DDT, ENT and LVG, the equation can be rearranged to solve for the reset action setpoint (RAS):

$$RAS = \frac{RCWS - PCWS}{[DDT - (ENT - LVG)]}$$

Example #1:
DDT = 10.0 F
PCWS = 45.0 F
RAS = 0.5 (i.e., "50" in Table A)

When the unit is operating at full load, ENT is 55 F and LVG is 45 F, so:

RCWS = 45 F + 0.5 [10 F-(55 F-45 F)]
RCWS = 45 F + 0 F
RCWS = 45 F

Since LVG and RWCS are equal (i.e., both are 45 F), there is no reset at this full load condition.

If this same unit is only half loaded (i.e., ENT - LVG = 5 F), then:
RCWS = 45 F + 0.5 [10 F - 5 F]
RCWS = 45 F + 2.5
RCWS = 47.5 F

In this situation, the chilled water setpoint will be reset 2.5 F upward, and the chiller will operate with an entering chilled water temperature of 52.5 F and a leaving chilled water temperature of 47.5 F.

Example #2:
DDT = 10.0 F
PCWS = 45.0 F
RAS = 1.0 (i.e., "100" in Table A)

Chiller B is operating at full load, and the delta-T across the evaporator (ENT - LVG) is 10 F, so:

RCWS = 45 F + 1.0 [10 F - 10 F]
RCWS = 45 F + 0 F
RCWS = 45 F

Under this full load condition, LVG and RWCS are again equal (i.e., both are 45 F), so there is no reset.

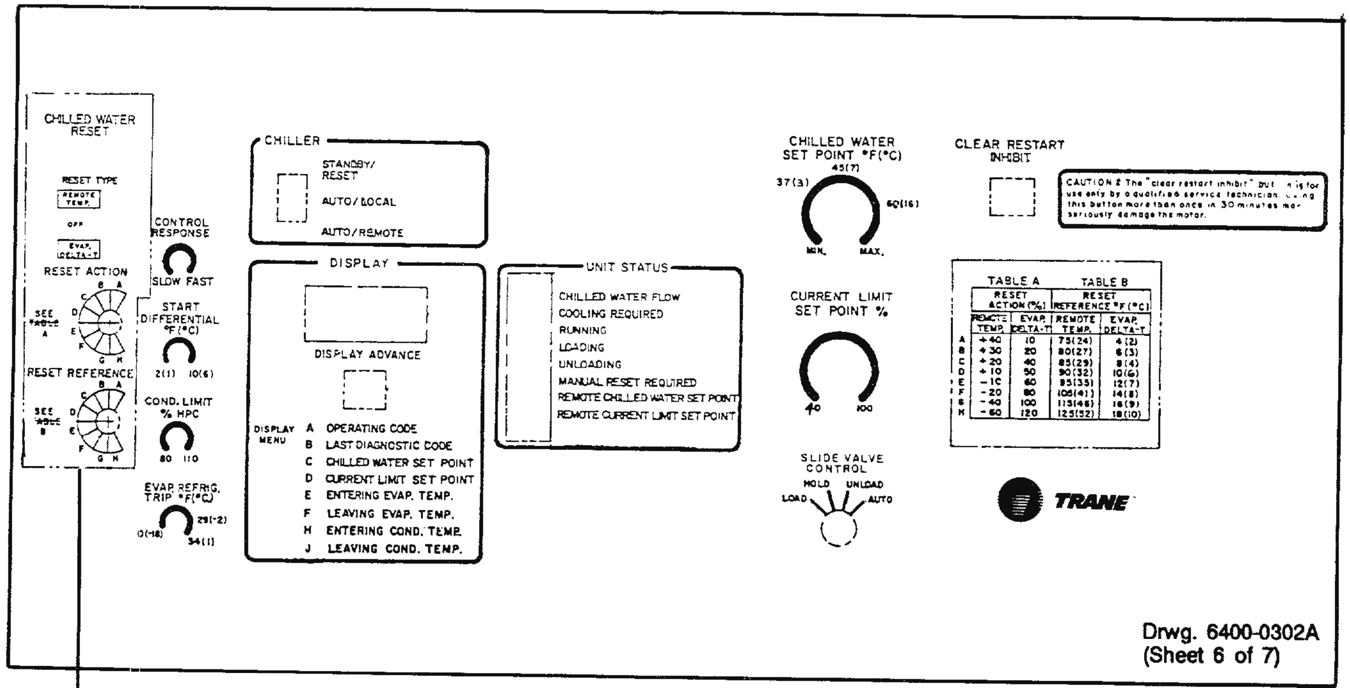
If this same unit is only half loaded (i.e., ENT - LVG = 5 F), then:

RCWS = 45 F + 1.0 [10 F - 5 F]
RCWS = 45 F + 1.0 [5]
RCWS = 50 F

In this situation, the chilled water setpoint will be reset 5 F upward, and the chiller will operate with an entering chilled water temperature of 55 F and a leaving chilled water temperature of 50 F.

Notice that an RAS of 1.0 yields a constant return temperature; as unit load varies, the leaving chilled water setpoint is reset so that the entering chilled water temperature is always 55 F.

Figure 61
Micro Module 1U3 Equipped with Chilled Water Reset Option



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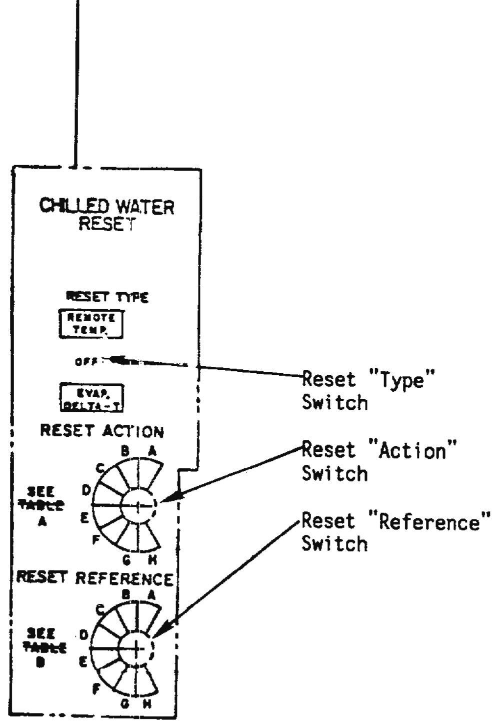


Notes:

1. Chilled water reset features for 1U32 are shown enclosed in phantom-line boxes.
2. Tables "A" and "B" located on 1U3 panel are shown in larger type below.

Table A / **Table B**

	Reset Action (%)		Reset Reference F (C)	
	Remote Temp.	Evap. Delta-T	Remote Temp.	Evap. Delta-T
A	+ 40	10	75 (24)	4 (2)
B	+ 30	20	80 (27)	6 (3)
C	+ 20	40	85 (29)	8 (4)
D	+ 10	50	90 (32)	10 (6)
E	- 10	60	95 (35)	12 (7)
F	- 20	80	105 (41)	14 (8)
G	- 40	100	115 (46)	16 (9)
H	- 60	120	125 (52)	18 (10)

Ambient-Based CWR

When ambient-based chilled water reset is desired, set the CWR controls at the following positions:

[ ] **Reset Type Switch:** Set at REMOTE TEMP.

[ ] **Reset Reference Switch:** This switch is used to set the temperature below or above which reset begins (i.e., design ambient). Use Table B (Figure 61) to convert the desired design ambient temperature to a letter code (i.e., A thru H).

Example: design ambient temperature for Chiller A is 90 F (i.e., chilled water reset is desired if the ambient temperature falls below 90 F).

a. Convert the design ambient for Chiller A to a letter code. Locate 90 F in

Table B under REMOTE TEMP; 90 F = D.

b. Turn reset reference switch to control setting D.

[ ] **Reset Action Switch:** Set at the amount of reset desired. Use the following equation and Table A (Figure 61) to determine the amount of reset desired; then convert this amount to a letter code (i.e., A thru H).

RCWS = PCWS + RAS (RRS - AMB)

where:
RCWS = Reset Chilled Water Setpoint
PCWS = Front Panel Chilled Water Setpoint
RAS = Reset Action Setpoint
RRS = Reset Reference Setpoint
AMB = Outdoor Ambient Temperature

Notes about this equation:

1. To convert the reset action values in Table A from percentages to decimal values, divide by 100. Decimal values must be used for the RAS variable in the equation.

2. Increasing the RAS to a larger number results in more reset.

3. Using a negative RAS causes the chilled water setpoint to be reset upward whenever the ambient temperature exceeds the design ambient. System control will not allow the chilled water setpoint to be reset downward even though it is possible in this equation.

Review Example 3 below to ensure that you understand the correlation between the reset action setting and the reset chilled water setpoint in ambient-based chilled water reset.

Example #3:
PCWS = 45.0 F
RAS = 0.2 (i.e., "20" in Table A)
RRS = 90.0 F

When the outdoor air temperature is 80 F, then:

RCWS = 45 F + 0.2 (90 F - 80 F)
RCWS = 45 F + 2 F
RCWS = 47 F

If the outdoor air temperature drops to 70 F, then:

RCWS = 45 F + 0.2 (90 F - 70 F)
RCWS = 45 F + 4 F
RCWS = 49 F

Thus, a RAS of 0.2 (i.e., +20%) provides 2 F of reset for every 10 F drop in outdoor air temperature below the design ambient.

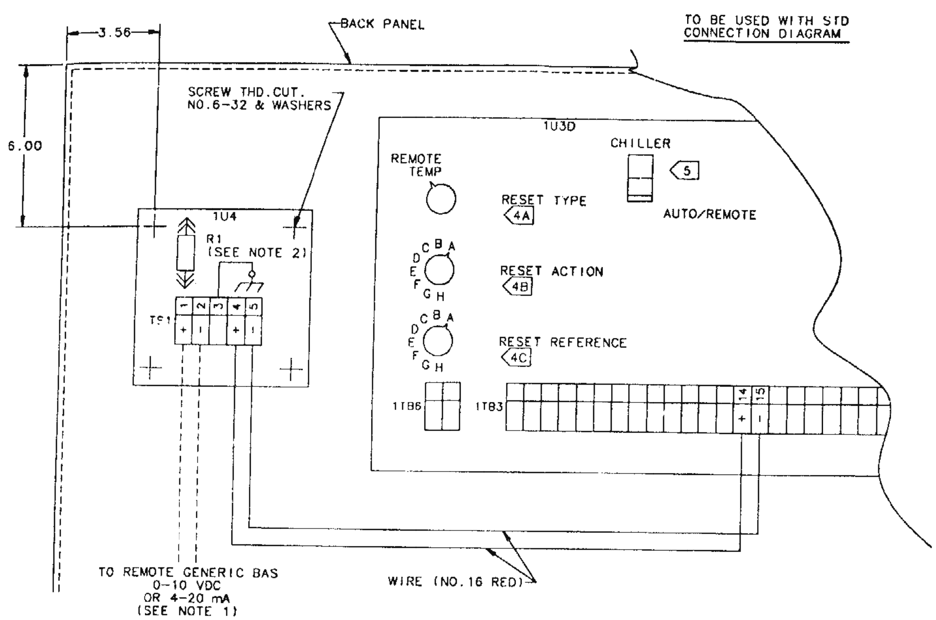
Remote Generic BAS/CWR Interface (CWRI)

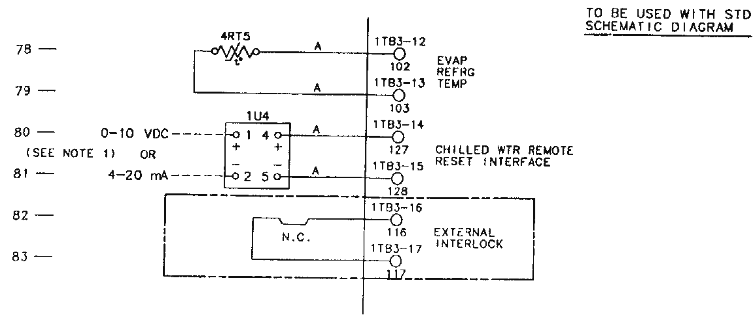
In Series R chiller applications that require use of a generic building automation system (BAS) to reset the chilled water setpoint, a "chilled water reset interface" module (1U4) is installed in the UCP to the left of the UCM (1U3).

Once installed, the interface module "converts" a 0-10 VDC (or a 4-20 mA) output signal from the generic BAS to a usable input for the CWR module.

A special "customer information" drawing accompanies each RTHA unit equipped with the generic BAS/CWR interface option. The wiring information and operational data included on this drawing are shown in Figure 63.

Figure 62
Remote Generic BAS/CWR Interface Option





NOTES:

1. NEGATIVE SIGNAL INPUTS ARE GROUNDED TO UCP ENCLOSURE. FOR CORRECT OPERATION, EXTERNAL EQUIPMENT SIGNALS SHALL BE ISOLATED OR FLOATING WITH RESPECT TO UCP ELECTRICAL SERVICE GROUND.

2. REMOVE RESISTOR (R1) WHEN 0-10 VDC INPUT IS USED.

3. ---------- FIELD WIRING.

4. TO ACTIVATE THE REMOTE GENERIC BAS CHILLED WATER RESET INTERFACE THE MICRO MODULE (1U3D) CHILLED WATER RESET MUST BE SET AS FOLLOWS:

A SET "RESET TYPE" TO POSITION "REMOTE TEMP."

B SET "RESET ACTION" TO POSITION "A", "B", "C", OR "D". SEE CHART BELOW TO DETERMINE SETTING.

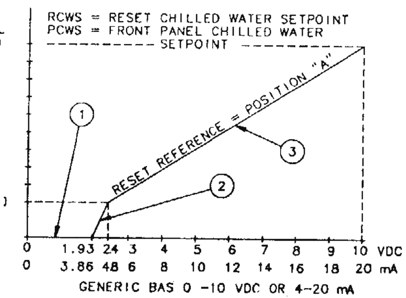
RESET ACTION (*)

RCWS-PCWS °F (°C)

SW. POS. (*)	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(8.9)
		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)
	.45(.25)	.90(.05)	1.35(.75)	1.80(1.0)
	0	0	0	0

NOTE: THE CHILLED WATER SETPOINT WILL BE RESET IN INTERGER °F ONLY.

RCWS-PCWS VERSES 0-10 VDC OR 4-20 mA



① RCWS = PCWS

② RCWS - PCWS = RESET ACTION [-18.3 + 9.50 (VDC)]
RCWS - PVWS = RESET ACTION [-18.3 + 4.74 (mA)]

③ RCWS - PCWS = RESET ACTION [-9.9 + 6.010 (VDC)]
RCWS - PVWS = RESET ACTION [-9.9 + 3.005 (mA)]

C SET "RESET REFERENCE" TO POSITION "A"

5. TO ENABLE THE REMOTE GENERIC BAS CHILLED WATER RESET INTERFACE, THE "CHILLER" SWITCH MUST BE SET TO "AUTO/REMOTE" WHEN THE CHILLER IS SET TO AUTO.

6. MAXIMUM CONTINUOUS INPUT : 15 VDC
30 mA
MINIMUM CONTINUOUS INPUT : -4 VDC
-8 mA
BELOW THESE VALUES DIAGNOSTIC CODE AE WILL OCCUR AT THE MICRO MODULE (1U3D) DISPLAY.

7. WHEN THE CHILLER IS NOT RUNNING THE MICRO MODULE (1U3D) SETPOINT WILL STEP TOWARDS THE DESIRED GENERIC BAS SETPOINT AT A RATE OF APPROX. 1°F (.55°C) PER SECOND. WHEN THE CHILLER IS RUNNING THE MICRO MODULE (1U3D) SETPOINT WILL BE CHANGED BY 1°F (.55°C) ONLY WHEN THE CHILLED WATER TEMP IS "IN CONTROL" FOR 75 SEC. "IN CONTROL" IS DEFINED AS MICRO MODULE (1U3D) SETPOINT ± X WHERE X VARIES FROM .8°F (.44°C) TO 1.6°F (.88°C) DEPENDING ON THE MICRO MODULE (1U3D) START DIFFERENTIAL SETTING.

4533-2379

Unit Start-Up Procedures

Daily Unit Start-Up

1. Start the chilled water pump if it was turned off at the end of the previous day.

While the chiller switch is positioned at STANDBY/RESET, the UCM checks for closure of the chilled water flow switch (5S2). The chilled water flow status indicator light energizes when flow is established.

2. Verify that the slide valve control switch is set at AUTO.

3. Check the chilled water setpoint and readjust it, if necessary. (Setpoint value can be observed by pressing the advance menu button until code prefix **C** appears on the display.)

4. If necessary, readjust the current limit setpoint. (To determine the setpoint value, press the advance menu PushButton until code prefix **d** appears on the display.)

5. Adjust the 3-position chiller switch from STANDBY/RESET to AUTO/LOCAL or AUTO/REMOTE. (The displayed operating code changes from **A 0** to **A 1**.)

At this time, the UCP sends a signal to reset the restart inhibit timer.

If flow switch 5S2 fails to close - or if it reopens following a closure - diagnostic **b Ed** appears on the display.

This cycle is repeated as long as: (1) there is chilled water flow, and (2) the Chiller switch is positioned at either AUTO/LOCAL or AUTO/REMOTE.

The UCM checks compressor motor winding temperature. A 2-minute delay is initiated if winding temperature is < 165 F. If it is > 165 F, however, a 5-minute delay period begins. Regardless of winding temperature, a minimum of 5 minutes must elapse between compressor starts.

The UCM checks leaving evaporator water temperature and compares it to the chilled water setpoint. If the difference between these values is <u>less</u> than the start differential setpoint, cooling is <u>not</u> required.

If the UCM determines that the difference between evaporator leaving water temperature and the chilled water setpoint <u>exceeds</u> the start differential setpoint, the unit enters **restart inhibit mode A 70** and the cooling required status indicator light energizes.

At the end of the restart inhibit period, the UCP issues a signal to start the condenser water pump. The displayed operating code changes from **A 70** to **A 71** as the UCM checks for condenser water flow. If flow is not proven (i.e., flow switch 5S3 does not close) within 3 minutes, the unit is locked out. Latching diagnostic **b dC** will flash alternately with operating code **A 71** on the display.

Once condenser water flow is proven, the unit enters **start mode (A 72).** The UCM sends a signal to the starter panel to start the compressor motor and to open master solenoid valve 4L1, providing oil flow to load and unload solenoids 4L2 and 4L3 and to the bearing oil supply system.

If the compressor motor starts and accelerates successfully, operating code **A 74 (Run: Normal)** is displayed and the running status indicator light energizes.

Sufficient oil flow (0.45 GPM) through the bearing oil supply system must be confirmed within 30 seconds by closing oil flow switch 4S5, or the unit locks out on low oil flow. (Latching diagnostic **b F2** will flash alternately with operating code **A 74** on the display.)

Note: If 4S5 is closed before compressor start-up, **b E8** is displayed. This checks for a defective oil flow switch.

Transition from START to RUN must occur within 2.5 seconds and proof of transition must occur within 2 seconds of transition initiation, or unit start-up is aborted. (If this occurs, the compressor stops and latching diagnostic **b FO** (starter transition failure) is displayed.

Note: Whenever the UCM detects a latching diagnostic condition during start-up, it locks out unit operation. Manual reset is required to restart the unit. If the fault condition is not cleared, the UCM will <u>not</u> permit restart. **A manual reset erases any diagnostic code identifying a fault.** After reset, operating code **A 0** is displayed with no indication of a previous operating problem.

When the cooling requirement is satisfied, the UCM originates a "stop" signal and the unit enters a 1-minute **stop/minimum off-time mode (A 7c).** The compressor motor and condenser water pump starters deenergize immediately. The running status and cooling required indicator lights remain energized during this period. Once the shutdown cycle is complete, the unit returns to the **auto (A 1)** mode.

Seasonal Unit Start-Up Procedure

1. Close all drain valves, and reinstall the drain plugs in the evaporator and condenser headers.

2. Service the auxiliary equipment according to the start-up/maintenance instructions provided by the respective equipment manufacturers.

3. Vent and fill the cooling tower, if used, as well as the condenser and piping. At this point, all air must be removed from the system (including each pass). Then close the vents in the condenser water boxes.

4. Open all of the valves in the evaporator chilled water circuits.

5. If the evaporator was previously drained, vent and fill the evaporator and chilled water circuit. When all air is removed from the system (including each pass), install the vent plugs in the evaporator water boxes.

Caution: Insure that oil heaters have been operating for a minimum of 24 hours before starting.

6. Check the adjustment and operation of each safety and operating control.

7. Close all disconnect switches.

8. Start the chilled water pump. While the chiller switch is set at STANDBY/RESET, the UCM checks for closure of the chilled water flow switch (5S2). Illumination of the chilled water flow status indicator light indicates that flow is established.

If flow switch 5S2 fails to close—or if it reopens following a closure— diagnostic **b Ed** is displayed.

9. Verify that the slide valve control switch is in AUTO position.

10. Check chilled water setpoint and readjust, if necessary. (Setpoint value can be observed by pressing the advance menu button until code prefix **C** is displayed.)

11. If necessary, readjust the current limit setpoint. (To determine the setpoint value, press the advance menu PushButton until code prefix **d** is displayed.)

12. Adjust the 3-position chiller switch from STANDBY/RESET to AUTO/LOCAL or AUTO/REMOTE position.

Unit Shutdown Procedures

Daily Unit Shutdown

1. Turn the chiller switch to STANDBY/RESET.

2. If desired, turn off the chilled water pump.

Seasonal Unit Shutdown

1. Turn the chiller switch STANDBY/RESET.

Note: Do not open the starter panel disconnect switch. This must remain closed to provide control power from the control power transformer in the starter panel to the oil sump heater.

Caution: Starter panel disconnect switch must remain closed to allow oil sump heater operation. This prevents refrigerant migration into the compressor oil.

2. Stop the chilled water pump at the pump pushbutton station. (Or, stop chilled water flow by the means devised for the particular application.)

3. Drain the condenser piping and cooling tower, if used.

4. Remove the drain and vent plugs from the condenser headers to drain the condenser.

5. Once the unit is secured, perform the maintenance procedures described under "Annual Maintenance" in the Periodic Maintenance section of this manual.

Periodic Maintenance

Overview

This section describes chiller preventive maintenance procedures and intervals.

Use a periodic maintenance program to ensure maximum performance and efficiency of the Series R CenTraVac.

An important aspect of the chiller maintenance program is the regular completion of the "CenTraVac Operating Log"; an example of this log is provided in this manual. When filled out properly the completed logs can be reviewed to identify any developing trends in the chiller's operating conditions.

For example, if the machine operator notices a gradual increase in condensing pressure during a month's time, he can systematically check—then correct—the possible cause(s) of this condition (e.g., fouled condenser tubes, non-condensibles in the system, etc.).

Daily Maintenance and Checks

[ ] Log the chiller.

[ ] Check evaporator and condenser pressures at the gauges on the unit. Pressure readings should fall within the following range:
Evaporator Pressure: 65-75 psig (448-517 kPa).
Condenser Pressure: 130-200 psig (896-1397 kPa).

Note 1: Condenser pressure is dependent on condenser water temperature, and should equal the saturation pressure of R-22 at a temperature 2 to 5 F above that of leaving condenser water at full load.

Note 2: Evaporator pressure is dependent on evaporator water temperature, and should equal the saturation pressure of R-22 at a temperature 2 to 5 F above that of leaving evaporator water at full load.

[ ] Inspect refrigerant filter. Frost formation at this location indicates a restricted filter element. A restricted filter can also cause improper evaporator pressure in Note 2, above. Be sure to log approach temperature at start-up.

[ ] Visually inspect oil filter pressure drop ("dirty-filter") indicator. Replace oil filter if required. Refer to "Service Procedures".

Weekly Maintenance

[ ] Review operating log.

Every 3 Months

WARNING: To prevent injury or death due to electrical shock or contact with moving parts, lock unit disconnect switch in open position.

[ ] Review operating log.

[ ] Check oil level and refrigerant charge. Refer to "Maintenance Procedures".

[ ] Clean all water strainers in both the chilled and condensing water piping systems.

[ ] Check oil level and refrigerant charge. Refer to "Maintenance Procedures".

[ ] Check refrigerant filter temperature drop at full load conditions.

Every 6 Months

[ ] Review operating log.

[ ] Have a qualified laboratory perform a compressor oil analysis to determine system moisture content and acid level. This analysis is a valuable diagnostic tool.

[ ] Tighten all electrical connections in the control panel and starter panel.

Annual Maintenance

WARNING: To prevent injury or death due to electrical shock or contact with moving parts, lock unit disconnect switch in open position.

Shut down the chiller once each year to check the items listed below.

[ ] Replace oil filter element. Refer to "Maintenance Procedures".

Note: It is not necessary or recommended that the oil be changed, unless the results of the oil analysis indicate contaminated oil.

[ ] Test vent piping of all relief valves for presence of refrigerant to detect improperly sealed relief valves. Replace any leaking relief valve.

[ ] Test the differential pressure switch setting. Make sure switch opens on a pressure rise of 50 PSID.

[ ] Inspect the condenser tubes for fouling; clean if necessary. Refer to "Maintenance Procedures".

[ ] Measure the compressor motor winding resistance to ground; a qualified service technician should conduct this check to ensure that the findings are properly interpreted.

[ ] Check oil level and refrigerant charge. Refer to "Maintenance Procedures".

[ ] Contact a qualified service organization to leak-test the chiller, to check operating and safety controls, and to inspect electrical components for deficiencies.

Scheduling Other Maintenance

[ ] Use a nondestructive tube test to inspect the condenser and evaporator tubes at 3-year intervals.

Note: It may be desirable to perform tube tests on these components at more frequent intervals, depending upon chiller application. This is especially true of critical process equipment.

[ ] Depending on chiller duty, contact a qualified service organization to determine when to conduct a complete examination of the unit to determine the condition of the compressor and internal components.

CenTraVac Operating Log

An operating log (below) appears on the back of Form No. 1-27.90, entitled "Test Log: Water-Cooled CenTraVacs w/Micro-Computer-Based Control Panels". While this form is specifically intended for use by service technicians at initial start-ups and annual inspections, it can also be used by RTHA owner/operators to record unit operating characteristics.

Initial Start-Up and 12-Month Inspection

Operating Log

Operating Characteristic		Cooling Mode At 15 min.	Cooling Mode At 30 min.	Cooling Mode At 45 min.	Heat-Recovery Mode At 15 min.	Heat-Recovery Mode At 30 min.	Heat-Recovery Mode At 45 min.
Voltage	A-B						
	A-C						
	C-B						
Amperage at Motor Leads	T-1						
	T-2						
	T-3						
	T-4						
	T-5						
	T-6						
Condenser Water Temp.	In (F)						
	Out (F)						
Condenser Pressure Drop	Design		psid (see Sales Order)			psid (see Sales Order)	
	Actual		psid			psid	
Condenser Flow Rate	Design		gpm (see Sales Order)			gpm (see Sales Order)	
	Actual		gpm			gpm	
[1]Condenser Refrig. Temp	(F)						
Condenser Refrig. Pressure	(Psig)						
Evaporator Water Temp.	In (F)						
	Out (F)						
Evaporator Pressure Drop	Design		psid (see Sales Order)			psid (see Sales Order)	
	Actual		psid			psid	
Evaporator Flow Rate	Design		gpm (see Sales Order)			gpm (see Sales Order)	
	Actual		gpm			gpm	
[1]Evaporator Refrig. Temp	(F)						
Evaporator Refrig. Pressure	(Psig)						
Net Oil Pressure (CVHE/B Units Only)	(psig)						
Oil Tank Temperature (CVHE/B Units Only)	(F)						
Bearing Oil Supply Temp. (CVHE/B Units Only)	(F)						
Compressor Discharge Temp. (RTHA Units Only)	(F)						
[2]Compressor Discharge Pressure (RTHA Units Only)	(psig)						

Notes:
1. To determine condenser refrigerant temperature for an **RTHA** unit, use a strap-on sensor.
2. To determine discharge pressure, install gauge on oil charge valve port and slightly open.

Motor Insulation Megohm Readings

With the unit **shut down**, record the megohm readings described below.

T1 to Ground ______	T1 to T2 ______	T1 to T4 ______
T2 to Ground ______	T1 to T3 ______	T2 to T5 ______
T3 to Ground ______	T2 to T3 ______	T3 to T6 ______

______ Hours on Job

______ Date Started

______ Signature of Service Engineer — Date

______ Signature of Owner's Representative — Date

Control Data

Record the control settings listed below.

HPC (1S1)
Cut-In = ______ psig
Cutout = ______ psig

LPC (HS6) (RTHA Units Only)
Cut-In = ______ psig
Cutout = ______ psig

Micro Module (1U3)
Control Response = ______
Start Differential = ______ F
Condenser Limit (Opt.) = ______ % HPC
Evap. Refrig. Trip Point = ______ F

Oil Cooler
Temperature In = ______ F
Temperature Out = ______ F

OPC (1S2) (CVHE/B Units Only)
Cut-In = ______ psid
Cutout = ______ psid

Purge Controls (CVHE/B Units Only)
Extend-Run Pressure Switch (351):
Cut-In = ______ psig
Cutout = ______ psig
Safety Pressure Switch (352):
Cut-In = ______ psig
Cutout = ______ psig

1-27.90—(Back)—(588)
Supersedes 1-27.90—(Back)—(887)

Refrigerant Charge

Note: Do not check superheat during an oil recovery program.

Follow the procedures listed below to determine if the refrigerant charge is proper for fully-loaded operation:

1. With the unit operating under fully-loaded conditions, set the temperature of the water entering the condenser at 85 F and the temperature of the chilled water leaving the evaporator at 44 F.

2. Measure the refrigerant pressure in the condenser and convert this to temperature T(Cond).

3. Remove the compressor discharge temperature sensor (4RT8) and at that point measure the temperature T(4RT8).

4. Determine the discharge superheat temperature T(Dis):

T(Dis) = T(4RT8) - T(Cond)

Table 13
RTHA Discharge Superheat Parameters

Unit Size	Design Sequence	Superheat Temperature (F)
130/150	A and Later	18 to 22
180/215	A and Later	18 to 22
255/300	A thru LO	18 to 22
255/450	MO and Later	26 to 32

Checking the Oil Level

Note: Always check the refrigerant charge level before checking the oil level (see instructions above). A low refrigerant charge may cause less than normal return of oil from the evaporator. This may cause a false low oil level reading.

Refer to Figure 63 and follow the steps listed below:

1. Operate the unit as closely as possible to fully-loaded conditions for ten minutes.

2. Turn off the unit.

3. Disconnect the condenser gauge line and attach the hoses and sight glass to the oil sump charging valve and the condenser gauge angle valve, as shown in Figure 63. Purge to remove non-condensibles.

Note: Do not use the Schrader valve on the condenser gauge for checking oil. Remove all depressors from hoses before completing this procedure.

4. After the unit has been off for ten minutes, open the oil sump charging valve and the condenser gauge angle valve.

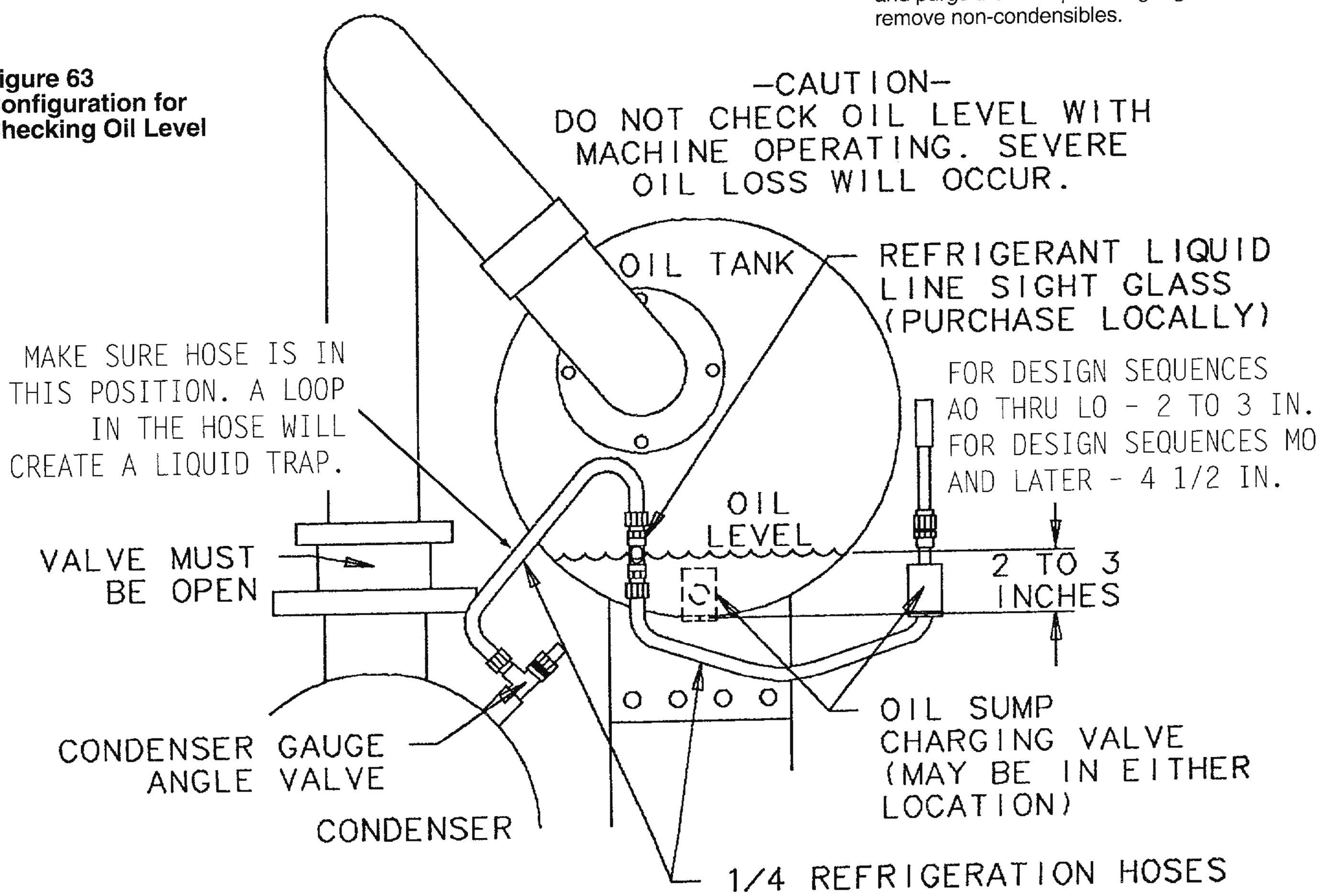
5. Move the sight glass up and down until the level can be seen.

6. After the level has been determined, close the oil sump charging valve and the condenser gauge angle valve.

7. Remove the sight glass and hoses.

8. Reconnect the condenser gauge line and purge the line up to the gauge to remove non-condensibles.

Figure 63
Configuration for Checking Oil Level



Cleaning the Condenser

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

Condenser tube fouling is indicated when the "approach" temperature (i.e., the difference between the refrigerant condensing temperature and the leaving water temperature) is higher than predicted.

If the annual condenser tube inspection indicates that the tubes are fouled, 2 cleaning methods—mechanical and chemical—can be used to rid the tubes of contaminants.

[ ] The mechanical cleaning method is used to remove sludge and loose material from smooth-bore condenser tubes.

(To clean internally-enhanced tubes, consult a qualified service organization for recommendations.)

Mechanical Cleaning Procedure

1. Remove the retaining bolts from the water boxes at each end of the condenser. Use a hoist to lift the water boxes.

2. Work a round nylon- or brass- bristled brush (attached to a rod) in and out of each of the condenser water tubes to loosen the sludge.

3. Thoroughly flush the condenser water tubes with clean water.

Chemical Cleaning Procedure

[ ] Scale deposits are best removed by chemical means. Consult a qualified local chemical supplier (i.e., one that knows the local water supply chemical/ mineral content) for a recommended cleaning solution suitable for the job. (A standard condenser water circuit is composed solely of copper, cast iron and steel.) A typical chemical cleaning setup is illustrated in Figure 64.

Caution: Improper chemical cleaning can damage tube walls.

All of the materials used in the external circulation system, the quantity of the solution, the duration of the cleaning period, and any required safety precautions should be approved by the company furnishing the materials or performing the cleaning.

Note: Chemical tube cleaning must always be followed by mechanical tube cleaning.

Figure 64
Typical Condenser/Evaporator Chemical Cleaning Setup

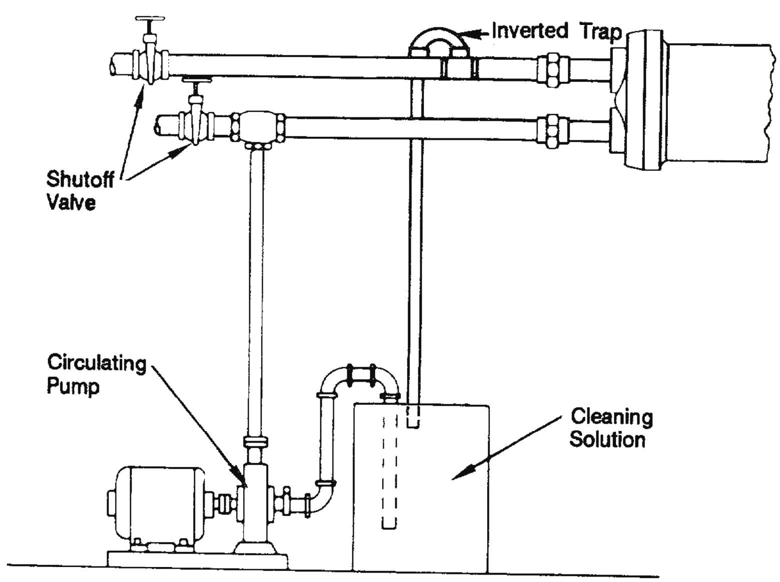


Table 14
Refrigerant and Oil Charging Data for RTHA Units

Unit Size	Shell Length	Refrigerant Charge (1) lb	Refrigerant Charge (1) kg	Oil Charge (2) Pints	Oil Charge (2) Liters
RTHA 130	Std	260	118	35	16.6
	Long	330	150	35	16.6
RTHA 150	Std	260	118	35	16.6
	Long	330	150	35	16.6
RTHA 180	Std	370	168	45	21.3
	Long	415	188	45	21.3
	Extended	605	275	48	22.8
RTHA 215	Std	370	168	45	21.3
	Long	415	188	45	21.3
	Extended	605	275	48	22.8
RTHA 255 Design Seq. A thru L	Std	450	204	45	21.3
	Long	570	259	45	21.3
	Extended	N/A	N/A	N/A	N/A
RTHA 255 Design Seq. M thru Later	Std	440	200	70	33.3
	Long	605	275	70	33.3
	Extended	815	370	70	33.3
RTHA 300 Design Seq. A thru L	Std	450	204	45	21.3
	Long	570	259	45	21.3
	Extended	N/A	N/A	N/A	N/A
RTHA 300 Design Seq. M thru Later	Std	440	200	70	33.3
	Long	605	275	70	33.3
	Extended	815	370	70	33.3
RTHA 380	Std	570	259	80	38.1
	Long	815	370	80	38.1
RTHA 450	Std	570	259	80	38.1
	Long	815	370	80	38.1

(1) Refrigerant type for all units is R-22.
(2) Recommended refrigeration oil for units operating above 38 F leaving chilled water temperature is "TRANE OIL 15". Recommended refrigeration oil for units operating at or below 38 F leaving chilled water temperature is "TRANE OIL 31".

Cleaning the Evaporator

Since the evaporator is typically part of a closed circuit, it does not accumulate appreciable amounts of scale or sludge. However, if cleaning is deemed necessary, use the same cleaning methods described for the condenser tubes.

Compressor Oil

Caution: To prevent oil tank heater burnout, open the unit main power disconnect switch before removing all oil from the compressor.

Recommended refrigerant oil types and proper charge amounts are given in Table 11.

Note: Use an oil transfer pump to charge the compressor motor oil regardless of chiller pressure.

Removing Compressor Oil

The oil in the compressor oil tank is under a constant positive pressure at ambient temperature. To remove oil, open the oil charging service valve located on the oil supply line, on the outlet of the oil sump, (Figures 48 and 49) and drain the oil into a suitable container using the procedure outlined below:

1. Connect a line to the oil charging valve.

2. Open the valve and allow the desired amount of oil to flow into the container and close the charging valve.

3. Calculate (or measure) the exact amount of oil removed from the unit.

Oil Charging the Compressor

Use the procedure outlined below to add compressor oil. Charge the oil into the compressor directly from its shipping container to prevent oil contamination.

Recommended refrigerant oil types and proper charge amounts are given in Table 13.

Charging Procedure

1. Loosely connect oil pump to compressor oil charging valve.

2. Operate oil charging pump until oil appears at the charging valve connection; then tighten the connection.

Caution: To keep air from entering the oil, charging valve connection must be airtight.

3. Open the oil charging valve and pump oil until all oil previously removed from the unit is replaced.

Caution: To keep air from entering the oil, tubing must remain submerged in oil during entire charging process.

4. Close charging valve and then remove tubing from oil container.

Caution: To keep air from entering the oil, close charging valve while tubing is submerged in oil.

5. Once proper amount of oil is charged, close the control panel disconnect switch to energize the oil tank heater.

Replacing the Oil Filter

The filter element of the unit-mounted oil filter must be changed anytime the pressure drop indicator on the oil filter "pops-out". See Figures 47, 48 and 49 for location of components.

Under normal operating conditions the element should be replaced every year, at a minimum.

Filter Replacement - Design Sequence A thru D.

1. Install a manifold gauge on the service valve that is downstream of the oil filter.

2. Isolate the oil filter by closing the two service valves located before and after the filter.

3. Relieve the pressure on the oil filter through the manifold gauge valve.

4. Use a rubber mallet to break loose the star screw that secures the oil filter bowl to the filter manifold.

5. Turn the star screw until the filter bowl detaches from the manifold. The filter element is spring-loaded and will fall into the filter bowl.

6. Remove the filter element and calculate (or measure) the exact amount of oil contained in the filter bowl and element.

7. Clean the filter bowl.

8. Insert a new filter element into the filter bowl and fill the bowl with the proper amount of refrigerant oil (see Step 4). Install the bowl and element back on the filter manifold. Turn the star screw counterclockwise and tighten securely.

9. Evacuate the filter to 500 microns.

10. Close the valve on the manifold gauge.

11. Open the two service valves to the oil supply system.

12. Remove the manifold gauge set.

Filter Replacement - Design Sequence E and above.

1. Install a manifold gauge on the service valve that is upstream of the oil filter. Then close the service valve.

2. Close the oil injection service valve and the two service valves at the bearings.

3. Place a drip pan under the oil filter to collect any spilled or drained oil.

4. Relieve the pressure on the oil filter through the manifold gauge valve into the drip pan.

5. Use a rubber mallet to break loose the star screw that secures the oil filter bowl to the filter manifold.

6. Turn the star screw until the filter bowl detaches from the manifold. The filter element is spring-loaded and will fall into the filter bowl.

7. Remove the filter element and calculate (or measure) the exact amount of oil contained in the filter bowl and element and the oil collected in the drip pan.

8. Clean the filter bowl.

9. Insert a new filter element into the filter bowl and fill the bowl with the proper amount of refrigerant oil (see Step 7). Install bowl and element back on the filter manifold. Turn the star screw counterclockwise and tighten securely.

10. Evacuate the filter to 500 microns.

11. Clove the valve on the manifold gauge.

12. Open the 4 service valves that were closed in Steps 1 and 2.

13. Remove the manifold gauge set.

Control Settings and Adjustments

A list of RTHA time delays and safety control cutout settings is provided in Table 6 in the "Chiller Control System" section of this manual. For control calibration and checkout, contact a qualified service organization.

Trouble Analysis

Note: The troubleshooting charts in this manual are provided solely as a guide for determining the cause of a mechanical failure or equipment malfunction. When operational problems do occur, always contact a qualified service organization to ensure proper diagnosis and repair of the chiller.

Control System

As described in the "Chiller Control System" section of this manual, the micro module visually indicates operating and diagnostic codes at the display.

If the UCM detects a diagnostic condition, the display alternately flashes the unit operating mode (code prefix **A** at the time the unit shut down and the diagnostic code (code prefix **b.** Complete listings of the codes used to identify RTHA operating modes and diagnostic conditions are provided in Tables 7 and 9. (See "Operator Interface: Display" in Chiller Control System.)

Organization of the UCP troubleshooting charts on the following pages is based on the possible 3-digit diagnostic codes that may appear on the display at one time or another.

Notice that each diagnostic code is classed by type ("latching" or "nonlatching"); the condition that generated the diagnostic is then described briefly. Suggested actions for correcting the problem are provided under "Recommended Action".

Note: **Nonlatching diagnostics** allow **automatic restart** as soon as the diagnostic condition clears, while **latching diagnostics require manual reset** before unit operation can resume. The manual reset required status indicator light energizes whenever a latching diagnostic occurs.

Troubleshooting Charts

UCP-Generated Diagnostics

3-Digit Diagnostic Code	Type (1)	Diagnostic Description	Recommended Action
b A3	L	Evaporator Refrigerant Temperature Range	Check evaporator "trip" setting.
b A4	L	Motor Temperature Sensor #1 (4B1R2)	Check sensor connections.
b A7	L	Motor Temperature Sensor #2 (4B1R3)	Check sensor connections.
b A8	L	Motor Temperature Sensor #3 (4B1R4)	Check sensor connections.
b Ab	L	Leaving Water Temperature Sensor 4RT1	Check sensor connections.
b AC	L	Condenser Refrigerant Pressure Sensor 1R1 (optional)	Check sensor connections.
b Ad	L	Evaporator Refrigerant Temperature Sensor 4RT5 (optional)	Check sensor connections.
b AE	L	Ambient Temperature Sensor 4RT6 (optional)	Check sensor connections.
b b5	L	Low Evaporator Refrigerant Pressure	Contact a qualified service organization.
b d9	NL	Extended Power Loss	None. Power lost; unit restarted normally when power was restored.
b dC	L	Condenser Water Flow Overdue	Check condenser water flow switch, valves and pump contactor.
b E2	NL	Momentary Power Loss	None. Power lost briefly; unit re-started normally when power was restored.
b E3	L	Phase Imbalance	Contact a qualified service organization.
b E4	L	Phase Loss	Contact a qualified service organization.
b E5	L	Phase Reversal	Contact a qualified service organization.
b E7	L	High Motor Temperature	Contact a qualified service organization.
b E8	L	Oil Flow Switch (4S5) Closed	Contact a qualified service organization.
b E9	L	Stop Relay 1U2K2	Contact a qualified service organization.
b EC	L	Running Overload (1U2K3)	Contact a qualified service organization.
b Ed	NL	Chilled Water Flow	Check chilled water flow switch, values and pump interlock.
b F0	L	Transition	Contact a qualified service organization.
b F1	L	Running External Interlock (optional)	Identify and correct problem that triggered interlock.
b F2	L	Low Oil Pressure (1S2) (2 Cases - See Page 92 Table 8)	Check refrigerant level and oil level in oil sump and oil filter. See Table 8.
b F5	L	High Condenser Refrigerant Pressure (1R1)	Check for proper operation. Also check for dirty tubes and air in condenser.
b F7	NL	Condenser Water Flow	Check condenser water flow switch valves and pump interlock circuit.
b F8	L	Improper Unit Identification	Contact a qualified service organization.
b Fb	L	Low Evaporator Refrigerant Temperature (4RT5)	Contact a qualified service organization.
b FF	L	Unit Control Module (1U3)	Contact a qualified service organization.
b 80	L	Discharge Gas Temperature Sensor (4RT8)	Check sensor connections.
b 84	L	High Discharge Gas Temperature	Contact a qualified service organization.

Notes:
1. Latching diagnostic conditions (L) require manual reset; "Manual Reset Required" status indicator light illuminates whenever a latching diagnostic condition occurs. Nonlatching diagnostic conditions (NL) do not require a manual reset; the unit automatically restarts as soon as the diagnostic condition clears.
2. *It is not possible to clear a latching diagnostic condition from a higher-level, supervisory control device (e.g., SCP, or Tracer).*
For further information on this product or other Trane products, refer to the "Trane Service Literature Catalog", ordering number IDX-IOM-1. This catalog contains listings and prices for all service literature sold by Trane. The catalog may be ordered by sending a $20.00 check to: The Trane Company, Service Literature Sales, 3600 Pammel Creek Road, La Crosse, WI 54601.

Table 9
Unit Diagnostic Codes

3-Character Code	Diagnostic Description	System Reset
b A3	Evaporator Refrigerant Temp. Range	Manual
b A4	Sensor Failure - Motor Temp. Sensor #1	Manual
b A7	Sensor Failure - Motor Temp. Sensor #2	Manual
b A8	Sensor Failure - Motor Temp. Sensor #3	Manual
b Ab	Sensor Failure - Evap. Leaving Water Temperature Sensor	Manual
b Ac	Sensor Failure - Condenser Refrigerant Pressure Sensor (Opt.)	Manual
b Ad	Sensor Failure - Evaporator Refrigerant Temperature Sensor	Manual
b AE	Sensor Failure - Ambient Temperature Sensor (Opt.)	Manual
b 80	Sensor Failure - Discharge Gas Temp. Sensor (Opt.)	Manual
b b5	Low Evaporator Refrigerant Pressure	Manual
b d9	Extended Power Loss	Automatic
b dC	Condenser Water Flow Overdue	Manual
b E2	Momentary Power-Loss	Automatic
b E3	Phase Imbalance	Manual
b E4	Phase Loss	Manual
b E5	Phase Reversal	Manual
b E7	High Motor Temperature	Manual
b E8	Oil Flow Switch Closed	Manual
b E9	Stop Relay	Manual
b Ec	Running Overload	Manual
b Ed	Chilled Water Flow Failure	Automatic
b F0	Starter Transition Failure	Manual
b F1	Running External Interlock (Opt.)	Manual
b F2	Low Oil Flow - 2 cases. See Table 8.	Manual
b F5	High Condenser Refrigerant Pressure	Manual
b F7	Condenser Water Flow Failure	Automatic
b F8	Improper Unit Identification	Manual
b Fb	Low Evaporator Refrigerant Temperature	Manual
b FF	Unit Control Module	Manual
b 84	High Discharge Gas Temperature	Manual

Notes:
1. Check the "Manual Reset Required" status indicator light to determine if manual reset is necessary.
2. It is not possible to clear a latching diagnostic condition (i.e., one requiring manual system reset) at the unit from a higher level device (e.g., a system control panel, Tracer, or generic BAS)

Table 10
Display Menus

Operator's Menu		Serviceman's Menu (1, 3) (Slide Valve Control Switch at "Hold")	
Code Prefix	Parameter Description and Display Range	Code Prefix	Parameter Description, Diagnostic Code and Display Range
A	Operating Mode (see Table 9)	A	Operating Mode (see Table 9)
b	Last Diagnostic (see Table 7)	b	Last Diagnostic (see Table 7)
C	Active Chilled Water Setpoint Standard-range: 37 thru 60 F Extended-range: 20 thru 70 F	I-	Panel Chilled Water Setpoint Range: ---, Std. - 37 to 60F Ext. - 20-70F
d	Active Current Limit Setpoint Range: 40 thru 100% RLA)	—	Panel Current Limit Setpoint Range: ---, 40 thru 100% RLA,---
E	Entering Evaporator Water Temperature (Opt.) Range: ---, 12 thru 91 F, ---	—	Evaporator Refrigerant Temp.(2) Diag. Code: b Ad Range: -4 thru 42 F, ---
F	Leaving Evap. Water Temp. Diag. Code: b Ab Range: 12 F thru 91 F, ---	I_	Control Response Setpoint Range: 1 thru 237
H	Entering Condenser Water Temperature (Opt.) Range: ---, 28 thru 142 F, ---	[̄]I	Start Differential Setpoint Range: 2 thru 10 F
J	Leaving Condenser Water Temperature (Opt.) Range: ---, 28 thru 142 F,---	P	Condenser Limit Setpoint Range: 80 thru 110% HPC
(Blank)		I_I	Evaporator Refrigerant "Trip" Setpoint (Diag. Code: b A3) Standard-range = 29 thru 34 F Extended-range = 0 thru 34 F

Notes:
1. To switch from "operator's menu" to the "serviceman's menu" on the UCM display, turn the Slide Valve Control Switch to "Hold". To switch back to "operator's menu", turn the switch to any position other than "Hold".
2. Actual measured temperature of refrigerant in the evaporator.
3. For further information on any of the items listed in the serviceman's menu, contact a qualified service organization.

Table 11
Codes for Unit Operating Modes

3-Character Code	Description of Operating Mode
Blank	Power Off
A 0	Standby/Reset
A 1	Auto (Local or Remote)
A 70	Restart Inhibit
A 71	Establish Condenser Water Flow
A 72	Start
A 74	Run: Normal
A 75	Run: Current Limit (1)
A 76	Run: Condenser Limit (2)
A 77	Run: Evaporator Limit (3)
A 7A	Run: Hot Gas Bypass
A 100	External Inhibit
A 7C	Stop: Minimum Off Time
A 88	Reset

Notes:
1. As the current limit setpoint is approached, the UCM restricts further advancing of the compressor slide valve.
2. As the condenser limit setpoint is reached, the UCM restricts additional compressor loading to avoid shutdown on high condenser pressure (b F5), and initiates a "head relief request" (i.e., optional relay).
3. The UCM restricts further retraction of the compressor slide valve to avoid a unit shutdown on low evaporator refrigerant temperature (b Fb).