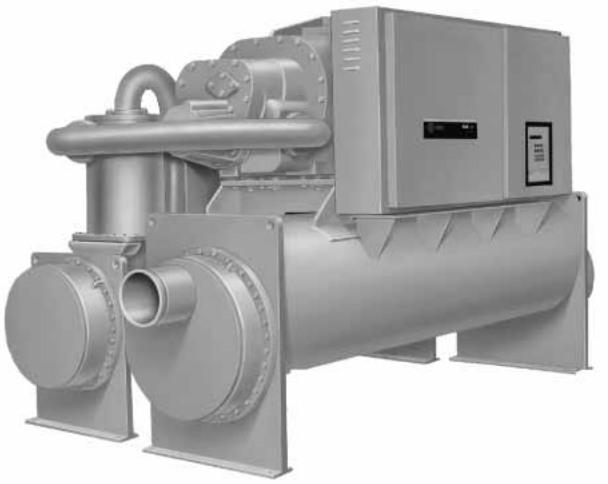
Installation
Operation
Maintenance

RTHC-IOM-1C

Library	**Service Literature**
Product Section	**Refrigeration**
Product	**Rotary Liquid Chillers - W/C**
Model	**RTHC**
Literature Type	**Installation, Operation and Maintenance**
Sequence	**1C**
Date	**August 1999**
File No.	**RTHC-IOM-899**

Series R
Helical Rotary
Liquid Chillers

"E0" Design Sequence



Models RTHC
175-450 ton units (60 Hz)
125-450 ton units (50 Hz)

Part No. X39640508-03

IMPORTANT NOTICES

Effective July 1, 1992, all service operations must use recovery systems to minimize losses of refrigerant to the atmosphere when servicing units with Class I and Class II refrigerants.

Class I (CFC) and Class II (HCFC) refrigerants include CFC-12, HCFC-22, CFC-500, CFC-502, CFC-11, CFC113 and HCFC-123. Deliberate venting is prohibited by Section 608 of the Clean Air Act.

In the normal service of air conditioning systems, there are three major activities mandated by the EPA regulations: recovery, recycling and reclaiming.

1 **Recovery** - the act of removing refrigerant from the air conditioning unit so that losses of refrigerant to the atmosphere are minimized.

Whenever a refrigeration circuit is opened, the recovery of the refrigerant is required. If there is no reason to believe that the refrigerant is “bad”, such as during service of gaskets, expansion valves or solenoid valves, the refrigerant is often returned to the unit without treatment. (Note: Always follow the equipment manufacturers recommendations regarding replacement of unit filter driers during service.)

If there is reason to suspect that the refrigerant is bad, such as with a compressor failure, the refrigerant should either be replaced or recycled,

Recovery is also required when a piece of equipment is decommissioned. This prevents the loss of refrigerant upon disposal of the unit. The recovered refrigerant usually is sold to refrigerant reclaimers rather than reused in the customer's new equipment.

2 **Recycling** - the act of cleaning recovered refrigerant for use in the customer’s equipment.

First, the refrigerant is boiled to separate the oil. Then it is run through a filter drier to separate moisture and acid.

Because of limited field testing capability, the quality and identity of any recycled refrigerant is suspect. For this reason, the EPA will most likely allow recycling of refrigerant only when it is returned to its original owner. Resale of the recycled refrigerant to third parties will not be allowed.

As a result, most servicers will only recycle refrigerant when the quantity of the refrigerant to be recycled and the expertise of the technician make it attractive to do so. Most suspect refrigerant will be sold to a reclaimer rather than be serviced in the field.

3 **Reclaiming** - the act of purifying refrigerant and testing it to ARI 700 “new” refrigerant standards. With reclamation, each batch of refrigerant undergoes extensive laboratory tests and the waste streams are disposed of according to environmental regulations.

Most reclamation will be done at centralized processing facilities because of the testing, waste handling and EPA certification requirements for reclamation. The Trane Company and others offer reclamation services for most refrigerants.

Reclamation is probably the most attractive alternative for users with salvaged and suspect refrigerant.

REFRIGERANT EMISSION CONTROL

Evidence from environmental scientists indicates that the ozone in our upper atmosphere is being reduced, due to the release of CFC fully halogenated compounds.

The Trane Company encourages every effort to eliminate, if possible, or vigorously reduce the emission of CFC, HCFC and HFC refrigerants into the atmosphere that result from installation, operation, routine maintenance, or major services 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 by an EPA certified Type 11 or Universal Technician. 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. To minimize emissions while recovering refrigerant, use recycling equipment. Always use methods which will pull the required vacuum while recovering and condensing refrigerant into containment.
5. When leak checking with a trace of refrigerant and nitrogen, only use R-134a on R-134a units. Be aware of any new leak test methods which eliminate refrigerant as a trace gas, but consult Trane Pueblo technical service before adding any other substance besides R-134a to the system.
6. When cleaning system components or parts, avoid using CFC-11 (R-11) or CFC-113 (R-113). Refrigeration system cleanup methods which use filters and dryers are preferred. Do not use solvents which have ozone depletion factors. Properly dispose of used materials.
7. Take extra care to properly maintain all service equipment that directly supports refrigeration service work, such as gauges, hoses, vacuum pumps and recycling equipment.
8. Stay aware of unit enhancements, conversion refrigerants, compatible parts and manufacturer's recommendations which will reduce refrigerant emissions and increase equipment operating efficiencies. Follow manufacturer's specific guidelines for conversion of existing systems.
9. 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.

READ THESE IMPORTANT NOTICES BEFORE SERVICING THE RTHC

Warnings and Cautions

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.

To prevent injury or death due to electrocution, use care when performing control setup, adjustments or any other service related operation when the electrical power is on. Position all electrical disconnects in the "OPEN" position and lock them.

⚠ WARNING

Disconnect and Lockout or Tagout all electrical power, including remote disconnects, before servicing. Failure to do so can cause severe personal injury or death.

⚠ CAUTION

CAUTION: It is essential to confirm that proper phase rotation is established - Phase A to Ll, Phase B to L2, and Phase C to L3. Phase rotation must be checked with a phase sequence indicator before start-up, otherwise catastrophic damage to the compressor may result.

⚠ CAUTION

CAUTION: Do not check the unit oil level with the unit operating. Severe oil loss will occur. Protective clothing must be worn when checking the oil level.

⚠ CAUTION

CAUTION: The compressor sump heater must be energized for a minimum of 24 hours prior to unit operation, to prevent compressor damage caused by liquid refrigerant in the compressor at start-up.

⚠ CAUTION

CAUTION: Do not use untreated or improperly treated water. To do so may result in equipment damage.

⚠ CAUTION

CAUTION: Proper water flow through the evaporator must be established prior to unit operation.

⚠ CAUTION

CAUTION: Do not charge the compressor with liquid refrigerant.

⚠ CAUTION

CAUTION: When evacuating the refrigerant system *for units with solid state starters*, first disconnect ALL electrical power, including remote disconnects. Power should not be applied to the chiller while the refrigerant system is in a vacuum. Failure to disconnect all electrical power prior to evacuating refrigerant, or applying power while the refrigerant system is in a vacuum, will damage the compressor motor.

Contents

Literature Change History

RTHC-IOM-1 (August 1997)

Describes installation, operation, and maintenance of RTHC units.

RTHC-IOM-1A (August 1998) revised to include C2/ C1 and D2/D1 chiller configurations, information on solid state starters.

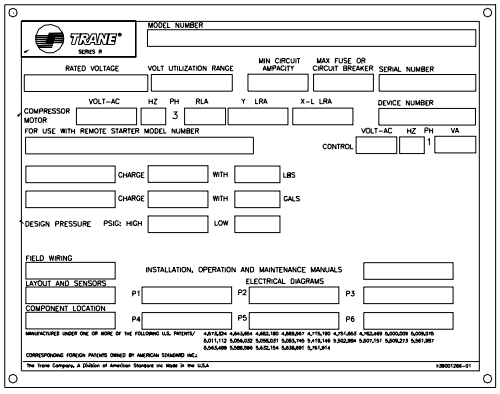
RTHC-IOM-1B (March 1999) revised to include oil protection modifications.

RTHC-IOM-1C (August 1999) revised to include B1 and B2 chiller configurations.

Unit Identification - Nameplates

When the unit arrives, compare all nameplate data with ordering, submittal, and shipping information. A typical unit nameplate is shown in *Figure 1* :

Figure 1
Typical Unit Nameplate



Unit Nameplates

The RTHC “unit” nameplate (*Figure 2* shows location) is applied to the exterior surface of the starter/control panel. The “compressor” nameplate is applied to the compressor. The starter/control panel nameplate is located inside the panel.

The unit nameplate provides the following information:

- ❑ Unit model
- ❑ Unit Serial Number
- ❑ Unit device number. - Identifies unit electrical requirements
  - Lists correct operating charges of HFC-134a and refrigerant oil
  - Lists unit test pressures and maximum working pressures.

The starter/control panel nameplate provides the following information:

- ❑ Panel model number
- ❑ Rated load amps
- ❑ Voltage
- ❑ Electrical characteristics - starter type, wiring
- ❑ Options included.

The compressor nameplate provides the following information:

- ❑ Compressor model descriptor
- ❑ Compressor serial number
- ❑ Compressor device number
- ❑ Motor serial number
- ❑ Compressor electrical characteristics
- ❑ Refrigerant.

Unit Inspection

When the unit is delivered, verify that it is the correct unit and that it is properly equipped.

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.

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 after receipt.
- ❑ 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 Trane sales representative and arrange for repair. Do not repair the unit, however, until damage is inspected by the transportation representative.

Loose Parts Inventory

Check all items against the shipping list. Water vessel drain plugs, isolation pads, rigging and electrical diagrams, service literature and the starter/control panel wire pullbox (required on some starters) are shipped unassembled in the starter control panel.

Unit Description

The RTHC 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 (optional), and tested for proper control operation before shipment.

Figure 2 and *Figure 3* show a typical RTHC unit and its components. Water inlet and outlet openings are covered before shipment. The oil tank is factory charged with the proper amount of refrigeration oil. The unit can be factory charged with refrigerant.

Model Number Coding System

The model numbers for the unit, the compressor, and the starter/control panel are composed of numbers and letters that represent features of the equipment. Shown in the three tables following are samples of typical unit, compressor, and panel model numbers, followed by the coding system for each.

Each position, or group of positions, in the model number is used to represent a feature. For example, in the first table, position 08 of the unit model number, Unit Voltage, contains the letter “F”. An F in this position means that the unit voltage is 460/60/3.

Typical Service Model Number (located on unit nameplate):

Number ⇨	***RTHC***	***1***	***D***	***2***	***F***	***0***	***A***	***0***	***G***	***3***	***L***	***4***	***G***	***3***	***L***	***G***	***0***	***Q***	***U***	***C***	***0***
Digit ⇨	*1,2,3,4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*

Table 1
Model Number for RTHC Chiller

Selection Category	***Description of Selection***	***Model No.***	***Digit***
Chiller Series	*Series R Water-Cooled Chiller*	*RTHC*	*1-4*
Design Control	*WCBU (Pueblo, CO)*	*1*	*5*
	LCBU (Charmes, France)	*2*	
Compressor Frame	*B Frame*	*B*	*6*
	C Frame	*C*	
	D Frame	*D*	
	E Frame	*E*	
Compressor Capacity	*Smaller capacity (minor)*	*1*	*7*
	Larger capacity (major)	*2*	
	Special 50 Hz capacity	*3*	

Table 1
Model Number for RTHC Chiller

Selection Category	Description of Selection	Model No.	Digit
Voltage	200/60/3	A	8
	230/60/3	C	
	380/60/3	D	
	380/50/3	R	
	400/50/3	N	
	415/50/3	U	
	460/60/3	F	
	575/60/3	H	
Specials	None	O	9
	Specials denoted elsewhere	C	
	Specials not denoted elsewhere	S	
Design Sequence	First Design (Factory Input)	AO	10-11
Evaporator Frame	B Frame	B	12
	C Frame	C	
	D Frame	D	
	E Frame	E	
	F Frame	F	
	G Frame	G	
Evaporator Capacity	Tube count #1	1	13
	Tube count #2	2	
	Tube count #3	3	
Evaporator Waterside Pressure	150 psi	L	14
	300 psi	H	
Evaporator Water Pass Configuration	2 pass	2	15
	3 pass	3	
	4 pass	4	
Condenser Frame	B Frame	B	16
	C Frame	C	
	D Frame	D	
	E Frame	E	
	F Frame	F	
	G Frame	G	
Condenser Capacity	Tube count #1	1	17
	Tube count #2	2	
	Tube count #3	3	
Condenser Waterside Pressure	150 psi	L	18
	300 psi	H	
Condenser Tubes	Enhanced Fin Copper	F	19
	Smooth Bore Copper	G	
	Smooth Bore 90/10 Cu/Ni	H	

Table 1
Model Number for RTHC Chiller

Selection Category	Description of Selection	Model No.	Digit
Isolation Valves	Without	0	20
	With	V	
Thermal Insulation	Without	0	21
	With	Q	
C/UL Listing	Without	0	22
	With	U	
Oil Cooler	Without	0	23
	With	C	
Differential Pressure Transducer	Without	0	24
	With	D	

RTHC Compressor Model Number (located on compressor nameplate):

Number ⇨	**CHHC**	**1**	**B**	**1**	**C**	**-**	**AO**
Digit ⇨	1,2,3,4	5	6	7	8	9	10, 11

Table 2
Compressor Model Number for RTHC

Selection Category	Description of Selection	Model No.	Digit
Compressor Series	Semi-Hermetic Heli-Rotor Compressor	CHHC	1-4
Design Control	Pueblo	1	5
Compressor Frame	B Frame	B	6
	C Frame	C	
	D Frame	D	
	E Frame	E	
Compressor Capacity	Smaller capacity (minor)	1	7
	Larger capacity (major)	2	
	Special 50 Hz capacity	3	
Motor	200V/60Hz/3	A	8
	230V/60Hz/3	C	
	380V/60Hz/3	D	
	460V/60Hz/3 or 400V/50Hz/3	F	
	575V/60Hz/3	H	
Specials	No Specials	O	9
	Specials Denoted Elsewhere	C	
	Uncategorized Special not denoted elsewhere	S	

Table 2
Compressor Model Number for RTHC

Selection Category	Description of Selection	Model No.	Digit
Design Sequence	1st Design (Factory Input)	AO	10-11

RTHC Starter/Control Panel Model Number:

Number ⇨	RTSC	####	C	A0	A	B	0	P	0	0	M	E	C
Digit ⇨	1,2,3,4	5, 6, 7, 8	9	10, 11	12	13	14	15	16	17	18	19	20

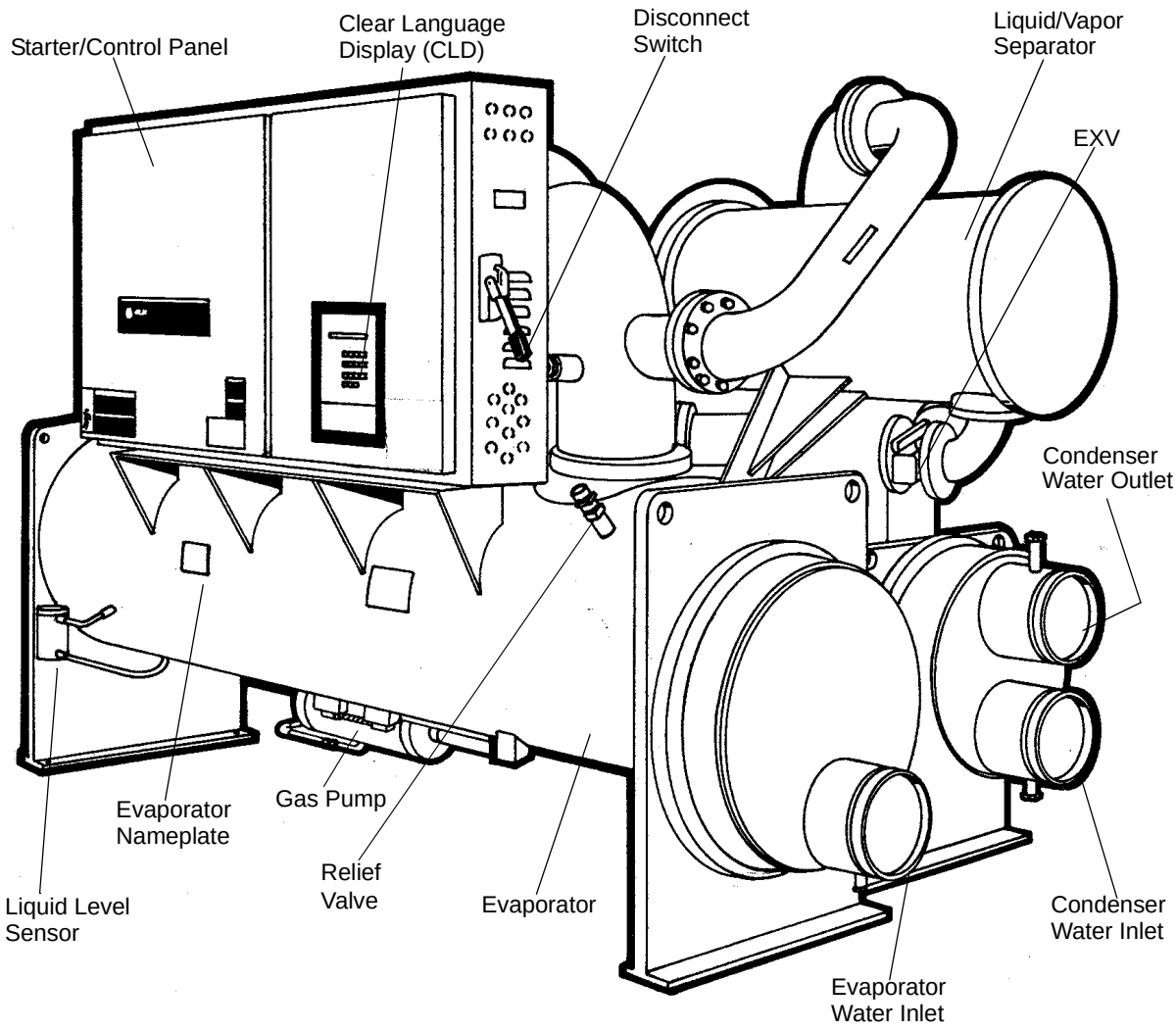
Table 3
Starter/Control Panel Model Number for RTHC

Selection Category	Description of Selection	Model No.	Digit
Panel Series		RTSC	1-4
Rated Load Amps	per sales order	####	5-8
Voltage	200V/60Hz/3	A	9
	230V/60/3	C	
	380V/60/3	D	
	380V/50/3	R	
	400V/50/3	N	
	415V/50/3	U	
	460V/60/3	F	
	575V/60/3	H	
Design Sequence	1st Design (Factory Input)	A0	10-11
Starter Type	Wye-Delta	A	12
	Solid State	B	
Panel Connection	Terminal Block	B	13
	Non-Fused Disconnect	D	
	Circuit Breaker	C	
	Hi Int Circuit Breaker	H	
Potential Transformers	Without	0	14
	With	P	
C/UL Listing	Without	0	15
	With	U	
Options Module	Without	0	16
	With	P	
Printer Interface Module	Without	0	17
	With	P	

Table 3
Starter/Control Panel Model Number for RTHC

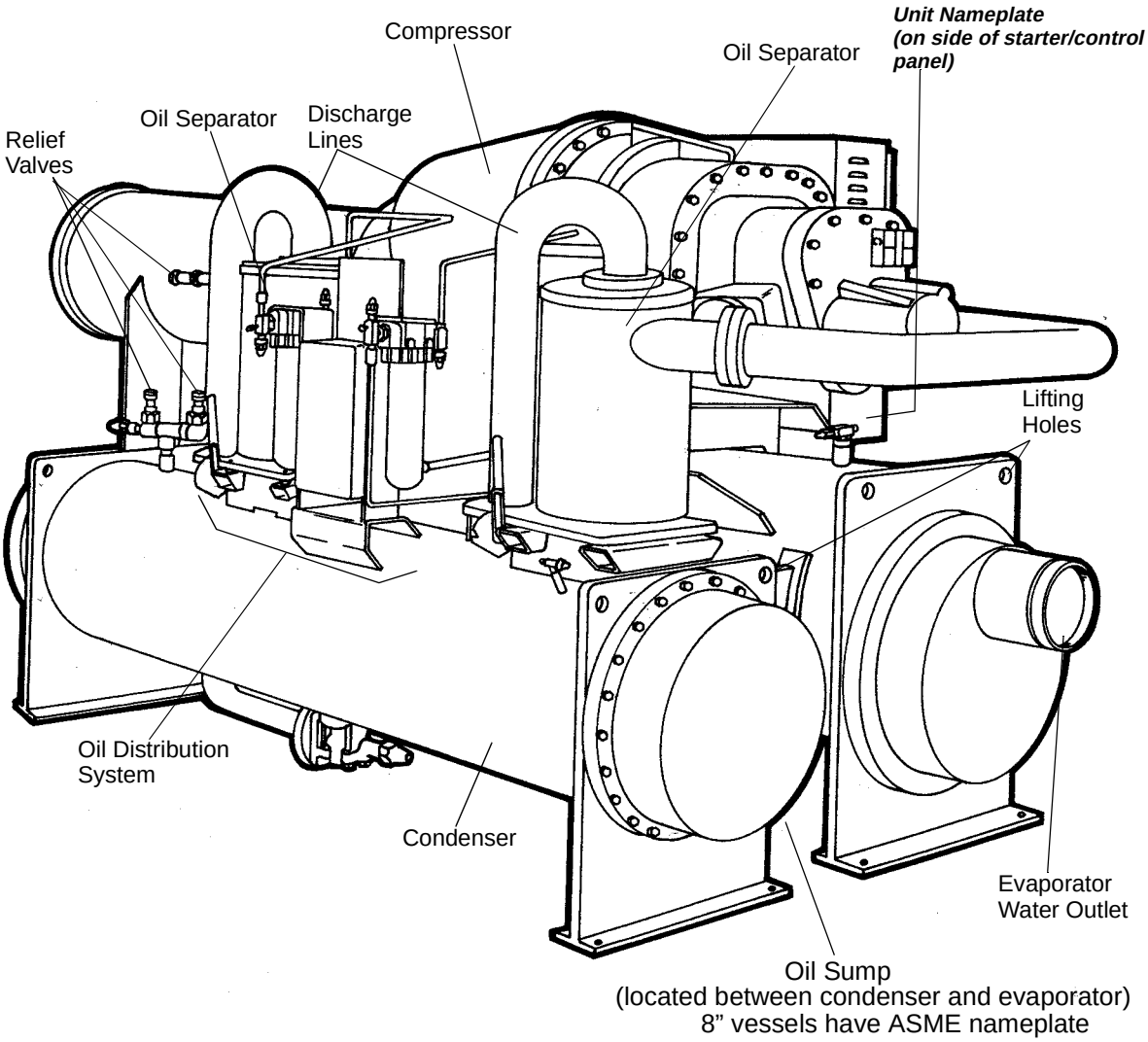
Selection Category	Description of Selection	Model No.	Digit
ICS Interface Module	Without	0	18
	Summit Communications	M	
	Tracer Communications	T	
Operator Interface Module	Std Clear Language Display	E	19
	Complex Character CLD	C	
Specials	No Specials	0	20
	Specials denoted elsewhere	C	
	Uncategorized special not denoted elsewhere	S	

Figure 2
Component Location for Typical RTHC Unit



NOTE: *The evaporator inlets and outlets are located opposite from those on the RTHA and RTHB units. The water inlet must be at the bottom of the shell for proper operation.*

Figure 3
Component Location for Typical RTHC Unit (Back View)



NOTE: *The evaporator inlets and outlets are located opposite from those on the RTHA and RTHB units. The water inlet must be at the bottom of the shell for proper operation.*

Installation Overview

For convenience, *Table 4* summarizes responsibilities that are typically associated with the RTHC chiller installation process.

Table 4
Installation Responsibility Chart for RTHC Units

Requirement	Trane-supplied, Trane-installed	Trane-supplied, Field-installed	Field-supplied, Field-installed
Rigging			*Safety chains* *Clevis connectors* *Lifting beam*
Isolation		*Isolation pads*	*Isolation pads*
Electrical	*Circuit breakers or non-fused disconnects (optional)* *Unit-mounted starter*	*Temperature sensor (optional outdoor air)* *Flow switches (may be field-supplied)* *Condenser water regulating valve controller (optional: may be field-supplied)*	*Circuit breakers or fusible disconnects (optional)* *Terminal lugs* *Ground connection(s)* *Jumper bars* *BAS wiring (optional)* *IPC wiring* *Control voltage wiring* *High condenser pressure interlock wiring* *Chilled water pump contactor and wiring* *Condenser water pump contactor and wiring* *Optional relays and wiring*
Water piping		*Flow switches (may be field-supplied)* *Condenser water regulating valve controller (optional: may be field-supplied)*	*Thermometers* *Water flow pressure gauges* *Isolation and balancing valves water piping* *Vents and drain valves* *Pressure relief valves (for water boxes as required)*
Pressure Relief	*Relief valves*		*Vent line and flexible connector*
Insulation	*Insulation (optional)*		*Insulation*

Refer to the Installation Mechanical and Installation Electrical sections of this manual for detailed installation instructions.

- ❑ Locate and maintain the loose parts, e.g. isolators, temperature sensors, flow sensors or other factory-ordered, field-installed options, for installation, as required. Loose parts are located in the starter/control panel.
- ❑ Install the unit on a foundation with flat support surfaces, level within 1/4” (6.35 mm) and of sufficient strength to support concentrated loading. Place the manufacturer-supplied isolation pad assemblies under the unit.
- ❑ Install the unit per the instructions outlined in the Mechanical Installation section.
- ❑ Complete all water piping and electrical connections.

NOTE: Field piping must be arranged and supported to avoid stress on the equipment. It is strongly recommended that the piping contractor provide at least 3 feet (914 mm) of clearance between the pre-installation piping and the planned location of the unit. This will allow for proper fit-up upon arrival of the unit at the installation site. All necessary piping adjustments can be made at that time. Refer to the current engineering bulletin for further details on installation.

- ❑ Where specified, supply and install valves in the water piping upstream and downstream of the evaporator and condenser water boxes, to isolate the shells for maintenance and to balance/trim the system.
- ❑ Supply and install condenser water control valve(s) per *Trane RLC-EB-4.*
- ❑ Supply and install flow switches or equivalent devices in both the chilled water and condenser water piping. Interlock each switch with the proper pump starter and UCP2, to ensure that the unit can only operate when water flow is established (ref. Section 3).
- ❑ Supply and install taps for thermometers and pressure gauges in the water piping, adjacent to the inlet and outlet connections of both the evaporator and the condenser.
- ❑ Supply and install drain valves on each water box.
- ❑ Supply and install vent cocks on each water box.
- ❑ Where specified, supply and install strainers ahead of all pumps and automatic modulating valves.
- ❑ Supply and install refrigerant pressure relief piping from the pressure relief to the atmosphere.
- ❑ If necessary, supply enough HCFC-134 refrigerant and dry nitrogen (75 psig) for pressure testing.
- ❑ Start the unit under supervision of a qualified service technician.
- ❑ Where specified, supply and insulate the evaporator and any other portion of the unit, as required, to prevent sweating under normal operating conditions.
- ❑ For unit-mounted starters, cutouts are provided at the top of the panel for line-side wiring.
- ❑ Supply and install the wire terminal lugs to the starter.
- ❑ Supply and install field wiring to the line-side lugs of the starter.

Table 5
General Data

	Unit Designator (corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)					
	D1D1E1	***D1F1F2***	***D1G2G2***	***D2D2E2***	***D2F2F3***	***D2G3G3***
General						
Refrigerant Type	*HFC-134a*	*HFC-134a*	*HFC-134a*	*HFC-134a*	*HFC-134a*	*HFC-134a*
Refrigerant Charge (lb (kg))	*575 (261)*	*740 (336)*	*850 (385)*	*575 (261)*	*740 (336)*	*850 (385)*
Oil Charge (gal (l))	*6 (23)*	*10 (35)*	*11 (39)*	*6 (23)*	*10 (35)*	*11 (39)*
Operating Weight (lb (kg))	*15,850 (7189)*	*17,900 (8119)*	*21,400 (9707)*	*15,900 (7212)*	*18,700 (8482)*	*22,100 (10,024)*
Shipping Weight (lb (kg))	*15,000 (6804)*	*16,700 (7575)*	*19,600 (8890)*	*15,000 (6804)*	*17,400 (7892)*	*20,100 (9117)*
Overall Dimensions						
*Length (in (mm))**	*134 (3404)*	*149 (3785)*	*153 (3886)*	*134 (3404)*	*149 (3785)*	*153 (3886)*
*Width (in (mm))**	*68 (1727)*	*69 (1753)*	*70 (1778)*	*68 (1727)*	*69 (1753)*	*70 (1778)*
*Height (in (mm))**	*76 (1930)*	*76 (1930)*	*80 (2032)*	*76 (1930)*	*76 (1930)*	*80 (2032)*
Evaporator						
Water Storage (gal (l))	*69 (261)*	*102 (386)*	*144 (545)*	*74 (280)*	*107 (405)*	*159 (602)*
Minimum Flow (gpm (l/s))	*454 (29) for 2-pass*	*626 (39) for 2-pass*	*606 (38) for 3-pass*	*498 (31) for 2-pass*	*669 (42) for 2-pass*	*690 (43) for 3-pass*
	303 (19) for 3-pass	*417 (26) for 3-pass*	*454 (29) for 4-pass*	*332 (21) for 3-pass*	*446 (28) for 3-pass*	*518 (33) for 4-pass*

Table 5
General Data

	Unit Designator (corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)					
	D1D1E1	***D1F1F2***	***D1G2G2***	***D2D2E2***	***D2F2F3***	***D2G3G3***
Maximum Flow (gpm (l/s))	*1666 (105) for 2-pass*	*2292 (144) for 2-pass*	*2221 (140) for 3-pass*	*1827 (115) for 2-pass*	*2453 (154) for 2-pass*	*2531 (154) for 3-pass*
	1111 (70) for 3-pass	*1528 (96) for 3-pass*	*1666 (72) for 4-pass*	*1218 (72) for 3-pass*	*1636 (103) for 3-pass*	*1898 (119) for 4-pass*
Condenser			*(all are 2-pass)*			
Water Storage (gal (l))	*44 (166)*	*57 (216)*	*91 (344)*	*47 (178)*	*61 (231)*	*97 (367)*
Minimum Flow (gpm (l/s))	*348 (22)*	*425 (27)*	*644 (40)*	*380 (24)*	*463 (29)*	*708 (45)*
Maximum Flow (gpm (l/s))	*1276 (80)*	*1558 (98)*	*2360 (148)*	*1392 (88)*	*1699 (107)*	*2597 (164)*

Notes*: All weights ±3%, include standard 150 psig water boxes.*

Operating weights include refrigerant, oil, and water charges.
If oil cooler is installed, add 1.0 gal (4 liters) to the oil charge value given

** Overall dimensions are based on 3-pass evap/2 pass cond and LH/RH water connections. Refer to submittals for exact job configurations*

Table 6
General Data

	Unit Designator (corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)					
	D3D2E2	***D3F2F3***	***D3G3G3***	***E3D2E2***	***E3F2F3***	***E3G3G3***
General						
Refrigerant Type	*HFC-134a*	*HFC-134a*	*HFC-134a*	*HFC-134a*	*HFC-134a*	*HFC-134a*
Refrigerant Charge (lb (kg))	*575 (261)*	*740 (336)*	*850 (385)*	*575 (261)*	*740 (336)*	*850 (385)*
Oil Charge (gal (l))	*6 (23)*	*10 (35)*	*11 (39)*	*6 (23)*	*10 (35)*	*11 (39)*
Operating Weight (lb (kg))	*15,900 (7189)*	*18,700 (8482)*	*22,100(10,024)*	*16,150 (7326)*	*18,950 (8596)*	*22,350 (10,138)*
Shipping Weight (lb (kg))	*15,000 (6804)*	*17,400 (7892)*	*20,100 (9117)*	*15,250 (6917)*	*17,650 (8006)*	*20,350 (9231)*
Overall Dimensions						
Length (in (mm))	*134 (3404)*	*149 (3785)*	*153 (3886)*	*137 (3480)*	*149 (3785)*	*153 (3886)*
Width (in (mm))	*69 (1753)*	*69 (1753)*	*70 (1778)*	*69 (1753)*	*69 (1752)*	*70 (1778)*
Height (in (mm))	*76 (1930)*	*76 (1930)*	*80 (2032)*	*76 (1930)*	*76 (1930)*	*80 (2032)*
Evaporator						
Water Storage (gal (l))	*74 (280)*	*107 (405)*	*159 (602)*	*74 (280)*	*107 (405)*	*159 (602)*
Minimum Flow (gpm (l/s))	*498 (31) for 2-pass*	*669 (42) for 2-pass*	*690 (43) for 3-pass*	*498 (31) for 2-pass*	*669 (42) for 2-pass*	*690 (43) for 3-pass*
	332 (21) for 3-pass	*446 (28) for 3-pass*	*518 (33) for 4-pass*	*332 (21) for 3-pass*	*446 (28) for 3-pass*	*518 (33) for 4-pass*
Maximum Flow (gpm (l/s))	*1827 (115) for 2-pass*	*2453 (154) for 2-pass*	*2531 (154) for 3-pass*	*1827 (115) for 2-pass*	*2453 (154) for 2-pass*	*2531 (154) for 3-pass*
	1218 (72) for 3-pass	*1636 (103) for 3-pass*	*1898 (119) for 4-pass*	*1218 (72) for 3-pass*	*1636 (103) for 3-pass*	*1898 (119) for 4-pass*
Condenser			*(all are 2-pass)*			
Water Storage (gal (l))	*47 (178)*	*61 (231)*	*97 (367)*	*47 (178)*	*61 (231)*	*97 (367)*
Minimum Flow (gpm (l/s))	*380 (24)*	*463 (29)*	*708 (45)*	*380 (24)*	*463 (29)*	*708 (45)*
Maximum Flow (gpm (l/s))	*1392 (88)*	*699 (107)*	*597 (164)*	*1392 (88)*	*699 (107)*	*597 (164)*

	Unit Designator (corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)				
	C1B2C1	C1B3C2	C1E1F1	C2B3C2	C2D3E3
General					
Refrigerant Type	HFC-134a	HFC-134a	HFC-134a	HFC-134a	HFC-134a
Refrigerant Charge (lb (kg))	420 (191)	420 (191)	600 (272)	420 (191)	575 (261)
Oil Charge (gal (l))	6 (23)	6 (23)	10 (35)	6 (23)	6 (23)
Operating Weight (lb (kg))	13,900 (6307)	14,250 (6466)	16,700 (7574)	14,175 (6430)	15,550 (7055)
Shipping Weight (lb (kg))	13,300 (6034)	13,600 (6171)	15,600 (7076)	13,500 (6124)	14,600 (6624)
Overall Dimensions					
Length (in (mm))*	129 (3277)	129 (3277)	145 (3683)	129 (3277)	129 (3277)
Width (in (mm))*	68 (1727)	68 (1727)	68 (1727)	68 (1727)	68 (1727)
Height (in (mm))*	72 (1829)	72 (1829)	76 (1930)	72 (1829)	76 (1930)
Evaporator					
Water Storage (gal (l))	45 (170)	52 (197)	82 (311)	52 (197)	78 (295)
Minimum Flow (gpm (l/s))	319 (20) for 2-pass	386 (24) for 2-pass	499 (31) for 2-pass	386 (24) for 2-pass	542 (34) for 2-pass
	213 (13) for 3-pass	257 (16) for 3-pass	332 (21) for 3-pass	257 (16) for 3-pass	362 (23) for 3-pass
Maximum Flow (gpm (l/s))	1171 (74) for 2-pass	1413 (89) for 2-pass	1827 (115) for 2-pass	1413 (89) for 2-pass	1989 (125) for 2-pass
	781 (49) for 3-pass	942 (59) for 3-pass	1218 (77) for 3-pass	942 (59) for 3-pass	1326 (84) for 3-pass
Condenser			(all are 2-pass)		
Water Storage (gal (l))	29 (110)	32 (121)	50 (189)	32 (121)	47 (178)
Minimum Flow (gpm (l/s))	248 (16)	293 (18)	450 (28)	293 (18)	387 (24)
Maximum Flow (gpm (l/s))	908 (57)	1074 (68)	1640 (103)	1074 (68)	1421 (90)

***Notes**: All weights ±3%, include standard 150 psig water boxes.*

Operating weights include refrigerant, oil, and water charges.

If oil cooler is installed, add 1.0 gal (4 liters) to the oil charge value given

** Overall dimensions are based on 3-pass evap/2 pass cond and LH/RH water connections. Refer to submittals for exact job configurations*

Table 7
General Data

	Unit Designator (corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)				
	C2G1G1	B1B1B1	B1C1D1	B2B2B2	B2C2D2
General					
Refrigerant Type	HFC-134a	HFC-134a	HFC-134a	HFC-134a	HFC-134a
Refrigerant Charge (lb (kg))	850 (386)	410 (186)	450 (204)	410 (186)	450 (204)
Oil Charge (gal (l))	11 (39)	4.5 (17.0)	4.5 (17.0)	4.5 (17.0)	4.5 (17.0)
Operating Weight (lb (kg))	20,150 (9142)	10,250 (4649)	11,000 (4990)	10,400 (4717)	11,200 (5080)
Shipping Weight (lb (kg))	18,500 (8394)	9700 (4400)	10,300 (4672)	9800 (4445)	10,450 (4740)
Overall Dimensions					
Length (in (mm))*	149 (3785)	125 (3175)	143 (3632)	125 (3175)	143 (3632)
Width (in (mm))*	70 (1778)	65 (1651)	65 (1651)	65 (1651)	65 (1651)
Height (in (mm))*	80 (2032)	71 (1803)	71 (1803)	71 (1803)	71 (1803)
Evaporator					

	Unit Designator ***(corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)***				
	C2G1G1	***B1B1B1***	***B1C1D1***	***B2B2B2***	***B2C2D2***
Water Storage (gal (l))	*136 (515)*	*41 (155)*	*55 (208)*	*45 (170)*	*58 (220)*
Minimum Flow (gpm (l/s))	*558 (35) for 3-pass*	*275 (17) for 2-pass*	*352 (22) for 2-pass*	*319 (20) for 2-pass*	*385 (24) for 2-pass*
	419 (26) for 4-pass	*184 (12) for 3-pass*	*234 (15) for 3-pass*	*213 (13) for 3-pass*	*257 (16) for 3-pass*
Maximum Flow (gpm (l/s))	*2046 (129) for 3-pass*	*1010 (64) for 2-pass*	*1292 (82) for 2-pass*	*1171 (74) for 2-pass*	*1414 (89) for 2-pass*
	1535 (96) for 4-pass	*673 (42) for 3-pass*	*862 (54) for 3-pass*	*781 (49) for 3-pass*	*942 (59) for 3-pass*
Condenser	*(all are 2-pass)*				
Water Storage (gal (l))	*79 (299)*	*28 (114)*	*31 (117)*	*29 (110)*	*34 (129)*
Minimum Flow (gpm (l/s))	*553 (34)*	*232 (15)*	*232 (15)*	*254 (16)*	*254 (16)*
Maximum Flow (gpm (l/s))	*1956 (123)*	*852 (54)*	*852 (54)*	*933 (59)*	*933 (59)*

Notes*: All weights ±3%, include standard 150 psig water boxes.*

Operating weights include refrigerant, oil, and water charges.

If oil cooler is installed, add 1/4 gal (1 liter) to the oil charge value given for ***B family*** *units; add 1.0 gal (4 liters) for all other units.*

** Overall dimensions are based on 3-pass evap/2 pass cond and LH/RH water connections. Refer to submittals for exact job configurations*

Storage

If the chiller is to be stored at least one month prior to installation, observe the following precautions:

- ❑ Do not remove the protective coverings from the electrical panel.
- ❑ Store the chiller in a dry, vibration-free, secure area.
- ❑ At least every three months, attach a gauge and manually check the pressure in the refrigerant circuit. If the refrigerant pressure is below 71 psig at 70°F (or 46 psig at 50°F), call a qualified service organization and the appropriate Trane sales office.

NOTE: Pressure will be approximately 20 psig if shipped with the optional nitrogen charge.

Location Requirements

Noise Considerations

Refer to Trane Engineering Bulletin RLC-EB-3 for sound consideration applications.

- ❑ Locate the unit away from sound-sensitive areas.
- ❑ Install the isolation pads under the unit. Refer to “Unit Isolation.”
- ❑ Install rubber vibration isolators in all water piping.
- ❑ Use flexible electrical conduit for final connection to the UCP2.

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 (including completed piping and full operating charges of refrigerant, oil and water). Refer to *Table 8* and *Table 7* for unit operating weights.

Once in place, level the chiller within 1/4” (6.35 mm) over its length and width.

The Trane Company is not responsible for equipment problems resulting from an improperly designed or constructed foundation.

Vibration Eliminators

- ❑ Provide rubber boot type isolators for all water piping at the unit.
- ❑ Provide flexible conduit for electrical connections to the unit.
- ❑ Isolate all pipe hangers and be sure they are not supported by main structure beams that could introduce vibration into occupied spaces.
- ❑ Make sure that the piping does not put additional stress on the unit.

NOTE: Do not use metal braided type eliminators on the water piping. Metal braided eliminators are not effective at the frequencies at which the unit will operate.

Clearances

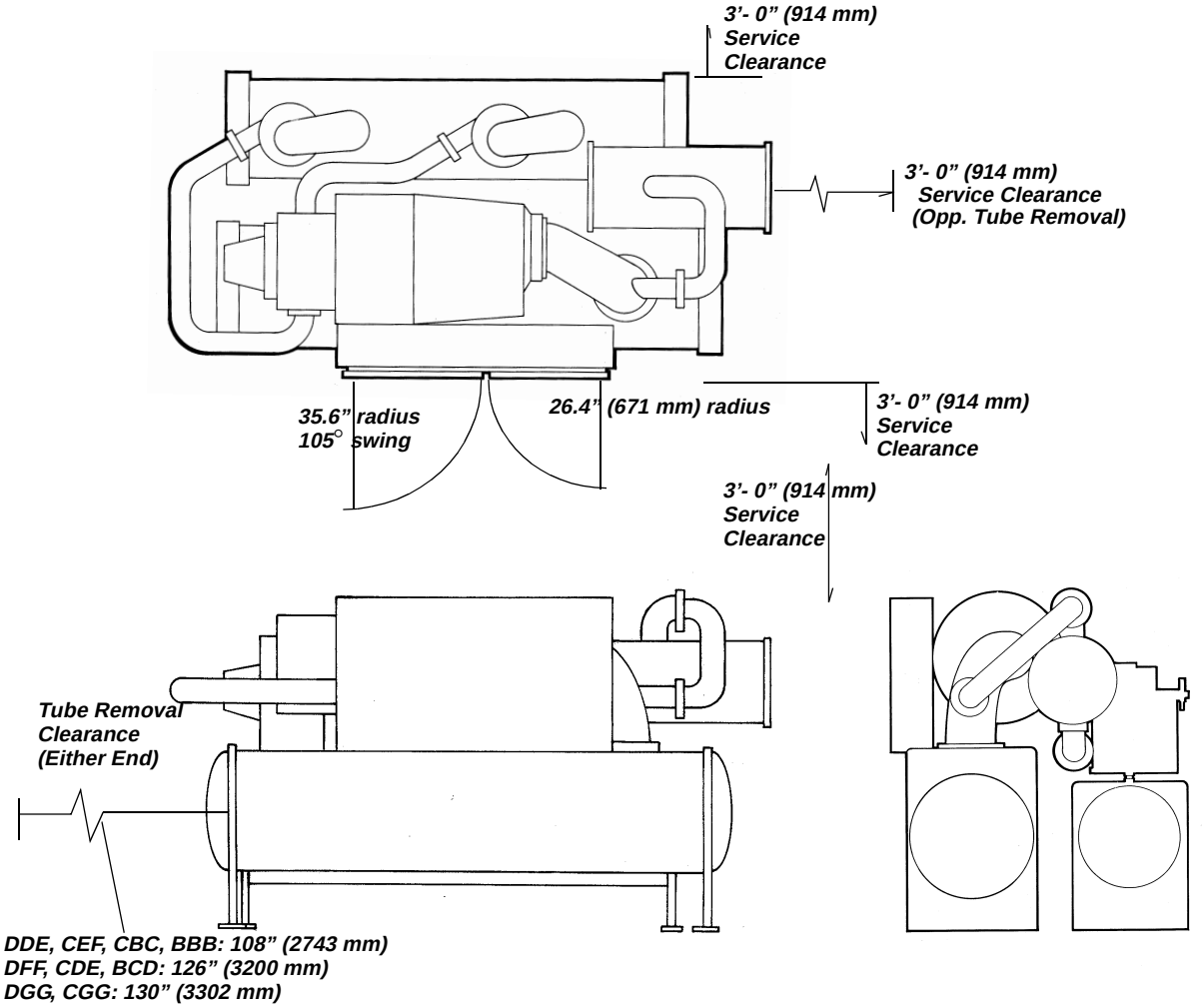
Provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points. Refer to submittal drawings for the unit dimensions.

Allow 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 4* for minimum clearances required for condenser tube service. In all cases, local codes will take precedence over these recommendations.

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

If the room configuration requires a variance to the clearance dimensions, contact your Trane sales office representative.

Figure 4
Recommended Operating and Service Clearances



NOTE: Maximum clearances are given. Depending on the unit configuration, some units may require less clearance than others in the same category.

Ventilation

The unit produces heat even though the compressor is cooled by the refrigerant. Make provisions to remove heat generated by unit operation from the equipment room. Ventilation must be adequate to maintain an ambient temperature lower than 122°F (50°C).

Vent the evaporator, condenser and compressor pressure relief valves 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 exposed to freezing temperatures (32°F/0°C).

Water 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 "Water Piping." All local and national codes apply.

Access Restrictions

Door clearances for the RTHC units are given in *Figure 4* . Refer to the unit submittals for specific "per unit" dimensional information.

Moving and Rigging

The Model RTHC chiller should be moved by lifting at designated lift points only. Refer to *Figure 5* and *Table 8* and *Table 7* for typical unit lifting and operating weights. Refer to the rigging diagram that ships with each unit for specific “per unit” weight data.

⚠ WARNING

Always use lifting equipment with a capacity exceeding unit lifting weight by an adequate safety factor. (+10%). Follow the procedures and diagrams in this manual and in the submittal. Failure to do so can result in personal injury or death.

Figure 5
Unit Weights and Dimensions for Rigging

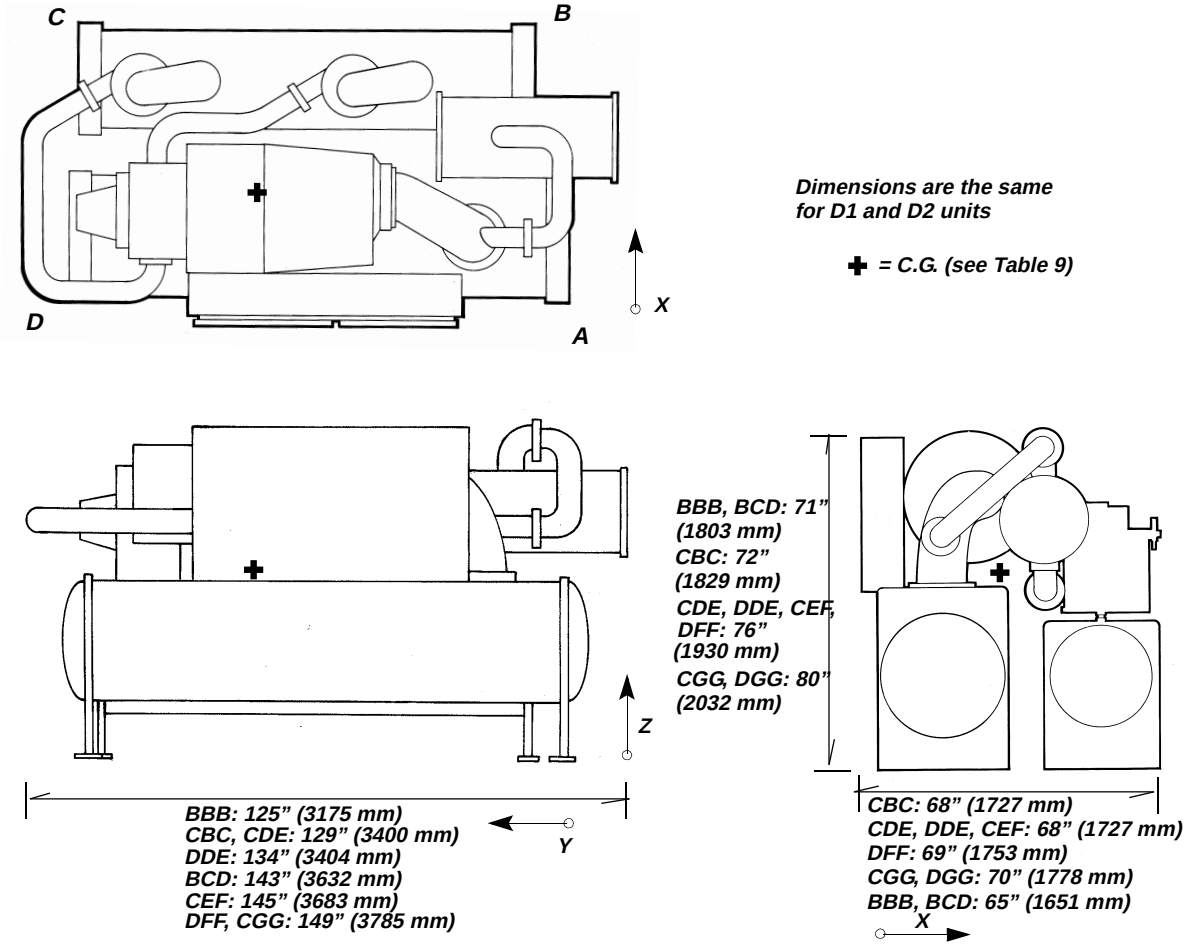


Table 6
Unit Weights (lb(kg)) (see Figure 5)

	Unit Designator ***(corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)***							
Location (Point)	***B1B1B1***	***B1C1D1***	***B2B2B2***	***B2C2D2***	***C1B2C1***	***C1B3C2***	***C1E1F1***	***C2B3C2***
A	*2599 (1179)*	*3274 (1485)*	*2624 (1190)*	*3309 (1501)*	*3460 (1569)*	*3523 (1598)*	*4438 (2013)*	*3504 (1589)*
B	*2051 (930)*	*2369 (1075)*	*2076 (942)*	*2411 (1094)*	*2533 (1149)*	*2602 (1180)*	*3250 (1474)*	*2583 (1172)*
C	*1979 (898)*	*1823 (827)*	*2002 (908)*	*1860 (844)*	*2940 (1334)*	*3009 (1365)*	*3404 (1544)*	*2991 (1357)*
D	*3049 (1383)*	*2818 (1278)*	*3076 (1395)*	*2855 (1295)*	*4350 (1973)*	*4416 (2003)*	*4507 (2044)*	*4397 (1994)*
Unit Wt (without water)	*9678 (4390)*	*10284 (4665)*	*9778 (4435)*	*10435 (4733)*	*13283 (6025)*	*13550 (6146)*	*15599 (7076)*	*13475 (6112)*
Est. Water Wt	*572 (259)*	*716 (325)*	*622 (282)*	*765 (347)*	*617 (280)*	*700 (318)*	*1101 (499)*	*700 (318)*
Total Installed Wt	*10250 (4649)*	*11000 (4990)*	*10400 (4717)*	*11200 (5080)*	*13900 (6307)*	*14250 (6466)*	*16700 (7574)*	*14175 (6431)*

Table 7
Unit Weights (lb(kg)) (see Figure 5)

	Unit Designator ***(corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)***							
Location (Point)	***C2D3E3***	***C2G1G1***	***D1D1E1***	***D1F1F2***	***D1G2G2***	***D2D2E2***	***D2F2F3***	***D2G3G3***
A	*3742 (1697)*	*5043 (2288)*	*3846 (1745)*	*4634 (2102)*	*5310 (2409)*	*3841 (1742)*	*4870 (2209)*	*5445 (2470)*
B	*2844 (1290)*	*4155 (1885)*	*2879 (1306)*	*3535 (1603)*	*4420 (2005)*	*2880 (1306)*	*3670 (1665)*	*4559 (2068)*
C	*3263 (1480)*	*4038 (1832)*	*3340 (1515)*	*3702 (1679)*	*4305 (1953)*	*3343 (1516)*	*3833 (1739)*	*4431 (2010)*
D	*4656 (2112)*	*5123 (2324)*	*4837 (2194)*	*4705 (2134)*	*5411 (2454)*	*4832 (2192)*	*4931 (2237)*	*5535 (2511)*
Unit Wt (without water)	*14505 (6579)*	*18359 (8328)*	*14902 (6760)*	*16576 (7519)*	*19446 (8821)*	*14896 (6757)*	*17304 (7849)*	*19970 (9058)*
Est. Water Wt	*1045 (474)*	*1791 (812)*	*948 (430)*	*1324 (601)*	*1954 (886)*	*1004 (455)*	*1396 (633)*	*2130 (966)*
Total Installed Wt	*15550 (7055)*	*20150 (9142)*	*15850 (7189)*	*17900 (8119)*	*21400 (9707)*	*15900 (7189)*	*18700 (8482)*	*22100 (10024)*

Table 8
Unit Weights (lb (kg)) (see Figure 5)

	Unit Designator (corresponds to digits 6, 7, 12, 13, 16, 17 of unit model number)					
Location (Point)	***D3D2E2***	***D3F2F3***	***D3G3G3***	***E3D2E2***	***E3F2F3***	***E3G3G3***
A	*3841 (1742)*	*4870 (2209)*	*5445 (2470)*	*3906 (1772)*	*4940 (2241)*	*5489 (2490)*
B	*2880 (1306)*	*3670 (1665)*	*4559 (2068)*	*2919 (1324)*	*3715 (1685)*	*4588 (2081)*
C	*3343 (1516)*	*3833 (1739)*	*4431 (2010)*	*3397 (1541)*	*3886 (1763)*	*4505 (2043)*
D	*4832 (2192)*	*4931 (2237)*	*5535 (2511)*	*4924 (2234)*	*5013 (2274)*	*5638 (2557)*
Unit Wt (without water)	*14896 (6757)*	*17304 (7849)*	*19970 (9058)*	*15146 (6870)*	*17554 (7962)*	*20220 (9172)*
Est. Water Wt	*1004 (455)*	*1396 (633)*	*2130 (966)*	*1004 (455)*	*1396 (633)*	*2130 (966)*
Total Installed Wt	*15900 (7189)*	*18700 (8482)*	*22100 (10024)*	*16150 (7325)*	*18950 (8596)*	*22350 (10138)*

Table 9
Center of Gravity (in) (see Figure 5)

****Unit Configuration***	***X***	***Y***	***Z***
E3G3G3	*30.80*	*63.81*	*37.62*
E3F2F3	*27.64*	*63.46*	*38.33*
E3D2E2	*25.90*	*60.05*	*40.50*
D2G3G3	*30.85*	*63.48*	*37.44*
D2F2F3	*27.70*	*63.40*	*38.14*
D2D2E2	*25.97*	*59.95*	*40.31*
D1G2G2	*30.77*	*63.55*	*37.72*
D1F1F2	*27.92*	*63.47*	*38.70*
D1D1E1	*25.91*	*60.00*	*40.47*
C2G1G1	*30.58*	*63.46*	*38.15*
C2D3E3	*26.13*	*59.74*	*40.08*
C2B3C2	*24.81*	*59.96*	*40.52*
C1E1F1	*26.36*	*63.49*	*40.95*
C1B3C2	*24.81*	*59.96*	*40.52*
C1B2C1	*24.71*	*60.01*	*40.78*
B2C2D2	*22.40*	*58,29*	*33.51*
B2B2B2	*22.88*	*58.11*	*35.43*
B1C1D1	*22.32*	*58,23*	*33.65*
B1B1B1	*22.84*	*58.13*	*35.59*

**Designator corresponds to digits 6, 7, 12, 13, 16, 17 of model number*

Lifting Procedure

⚠ CAUTION

CAUTION: Unit Moving!
Never use a forklift to move the unit. The skid is not designed to support the unit at any one point and using a forklift to move the equipment may cause unit damage.

NOTE: If absolutely necessary, the chiller can be pushed or pulled across a smooth surface if it is bolted to wood shipping mounts.

⚠ WARNING

Do not remove the wood mounts until the unit is in its final location. Removal of wood shipping mounts prior to unit final locating could result in injury or death and equipment damage.

1 When the unit is at its final location, remove the shipping bolts that secure the unit to the wood base mounts.

2 Rig the unit properly and lift from above or jack the unit (alternate moving method). Use the points shown on the rigging diagram that ships with the unit as shown in *Figure 6* . Remove the base mounts.

⚠ WARNING

Do not use the threaded holes in the compressor to lift or assist in lifting the unit. They are not intended for that purpose and could create a dangerous situation.

3 Install clevis connectors in lifting holes provided on the unit. Attach lifting chains or cables to clevis connectors as shown in *Figure 6* . Each cable alone must be strong enough to lift the chiller.

⚠ CAUTION

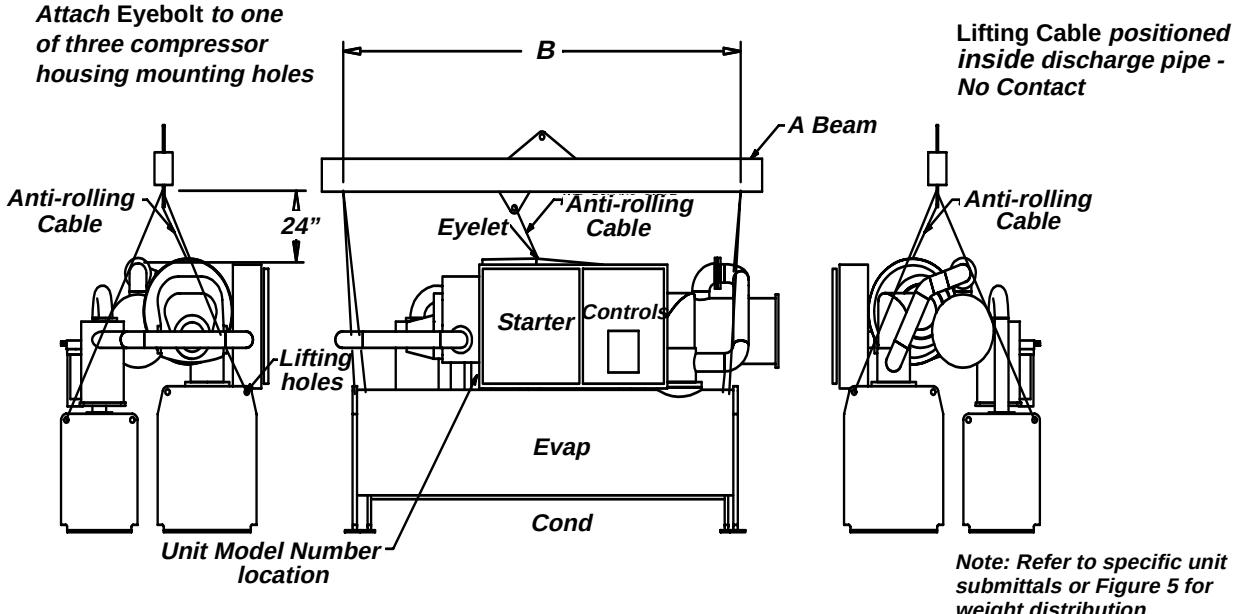
CAUTION: Lifting Beam Location! Always position the lifting beam so that cables do not contact the unit. Failure to do so may result in unit damage.

Table 10
Weights and Rigging (Use with Figure 6)

Unit Model Number*	Lifting Weight (lb)	Dimension (ft) (Fig. 6)	
		A	B
E3G3G3	20400	12	11
E3F2F3	17700	12	11
E3D2E2	15300	10	9
D3G3G3	20100	12	11
D3F2F3	17400	12	11
D3D2E2	15000	10	9
D2G3G3	20100	12	11
D2F2F3	17400	12	11
D2D2E2	15000	10	9
D1G2G2	19600	12	11
D1F1F2	16700	12	11
D1D1E1	15000	10	9
C2G1G1	18500	12	11
C2D3E3	14600	10	9
C2B3C2	13500	10	9
C1E1F1	15600	12	11
C1B3C2	13600	10	9
C1B2C1	13300	10	9
B2C2D2	10500	12	11
B2B2B2	9800	10	9
B1C1D1	10300	12	11
B1B1B1	9700	10	9

**Designator corresponds to digits 6, 7, 12, 13, 16, 17 of model number*

Figure 6
Lifting the Unit



Note: Refer to specific unit submittals or Figure 5 for weight distribution

⚠ WARNING

To prevent personal injury or equipment damage, refer to Trane RTHC-SB-2 for units that must be disassembled due to limited access.

4 Attach cables to lifting beam. Total lifting weight, lifting weight distribution and required lifting beam dimensions are shown in the rigging diagram shipped with each unit and in *Figure 6* . The lifting beam crossbar must be positioned so the lifting cables do not contact unit piping or electrical panel enclosure.

⚠ WARNING

Connect an anti-rotation strap between the lifting beam and compressor before lifting unit. Failure to do so may result in personal injury or death should a lifting cable fail.

5 Connect an anti-rotation strap or cable loosely between the lifting beam and the threaded coupling or eyelet provided at the top of the compressor. Use an eyebolt or clevis to secure the strap at the coupling or eyelet.

NOTE: The anti-rotation strap is not a lifting chain, but a safety device to ensure that the unit cannot tilt during lifting.

Alternate Moving Method

6 If it is not possible to rig from above as shown in the figures, 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 6* and by the rigging diagram that ships with the unit.

Isolation Pads

NOTE: The elastomeric pads shipped (as standard) are adequate for most installations. For additional details on isolation practices, refer to Trane Engineering Bulletin RLC-EB-3, or consult an acoustical engineer for sound-sensitive installations.

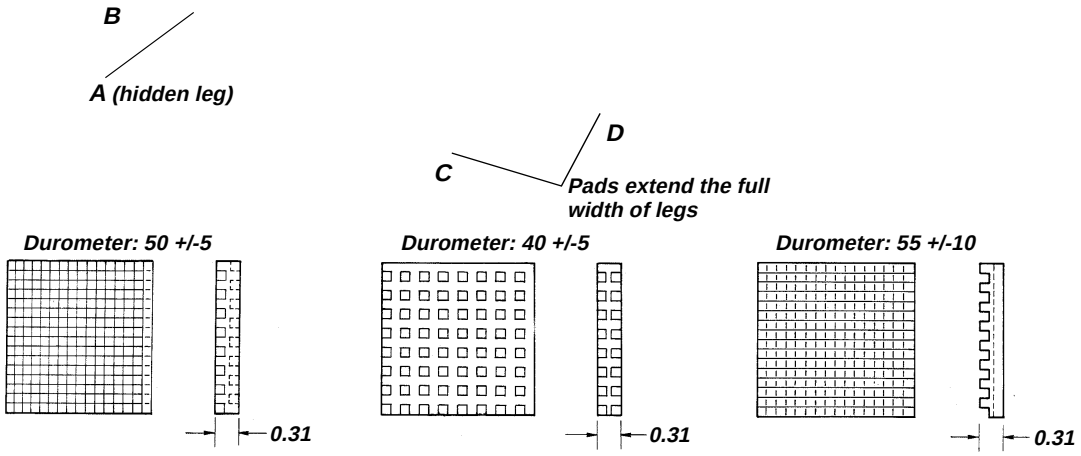
7 During final positioning of the unit, place the isolation pads under the evaporator and condenser tube sheet supports as shown in *Figure 7* . Level the unit as described in the next main paragraph.

NOTE: Durometer values for isolator pads are a measure of resilience. See Figure 7 .

Figure 7
Isolator Pad Placement

Note: Level unit to 1/4” (6.35 mm) across width and length

Typical Elastomeric Isolation Pad



Acceptable Pad Configurations

8 The unit is shipped with four spacers (only three on B family) on the compressor mount that protect the isolation pads during shipping and in handling. Remove these spacers *(Figure 9)* before the unit is operated.

9 Remove the shipping brackets from the bottom sides of the oil separator(s) (see *Figure 8*).

NOTE: Once shipping bracket(s) is removed, the oil separator is only supported by the discharge line.

Figure 8
Oil Separator with Shipping Bracket Installed

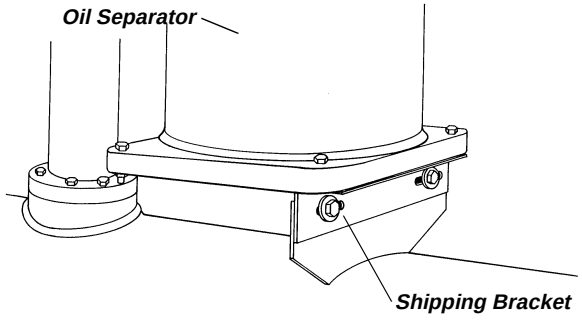
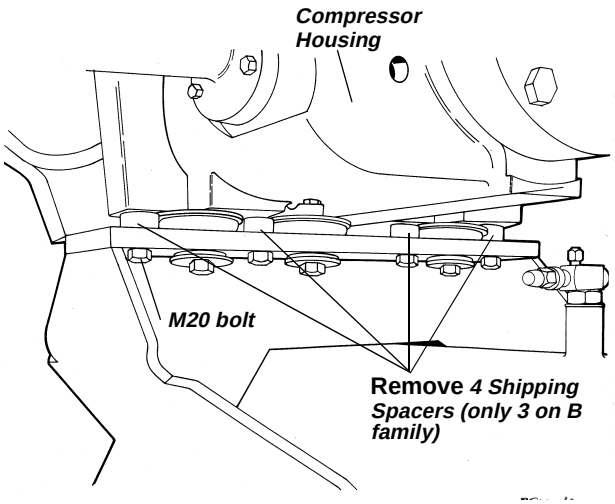


Figure 9
Shipping Spacer Removal



Unit Leveling

NOTE: The electrical panel side of the unit is designated as the "front" of the unit.

1 Check unit level end-to-end by placing a level on the top surface of the evaporator shell.

2 If there is insufficient surface available on the top of the evaporator shell, attach a magnetic level to the bottom of the shell to level the unit. The unit should be level to within 1/4" (6.35 mm) over its length.

3 Place the level on the evaporator shell tube sheet support to check side-to-side (front-to-back) level. Adjust to within 1/4" (6.35 mm) of level front-to-back.

NOTE: The evaporator MUST be level for optimum heat transfer and unit performance.

4 Use full-length shims to level the unit.

Water Piping

Piping Connections

⚠ CAUTION

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

Make water piping connections to the evaporator and condenser. 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.

Use grooved pipe connectors for all water piping connections. Evaporator and condenser water inlet and outlet sizes and locations are shown by the unit submittals and in *Figure 10* through *Figure 12* . The designation in the tables corresponds to the compressor frame code followed by the evaporator shell code followed by the condenser shell code as given in the unit model number, digits 6, 7, 12, 13, 16, and 17. *Table 11* gives additional water connection information.

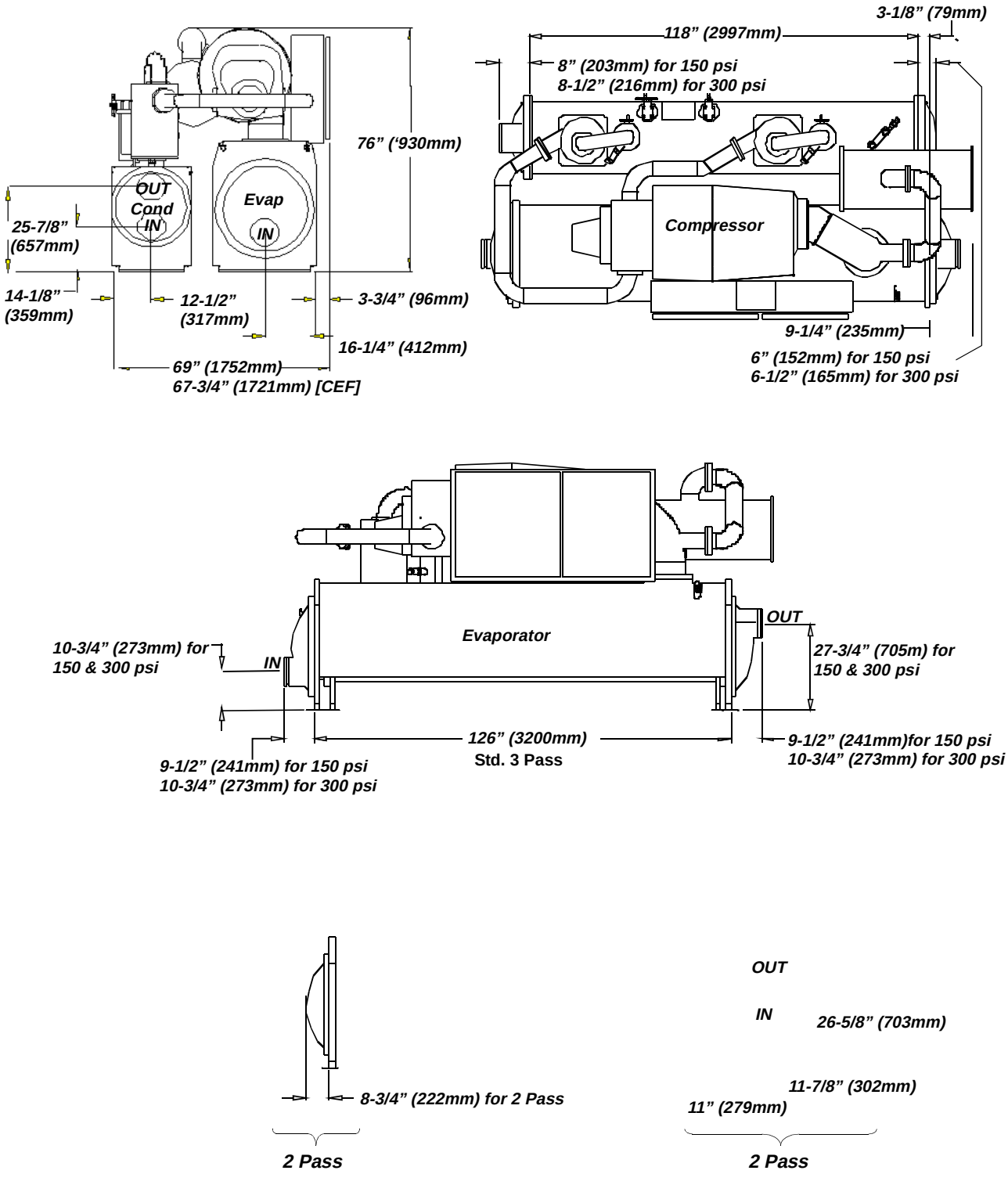
Reversing Water Boxes

All water boxes may be reversed end-for-end. Do not rotate water boxes. Remove the sensors from the wells before removing the water box. Complete the water box switch procedure and replace the sensors. See *Figure 10* through *Figure 12* for correct orientation of the water inlet and outlet.

If the water boxes are reversed, be sure to properly rewire the water temperature sensors in the control panel.

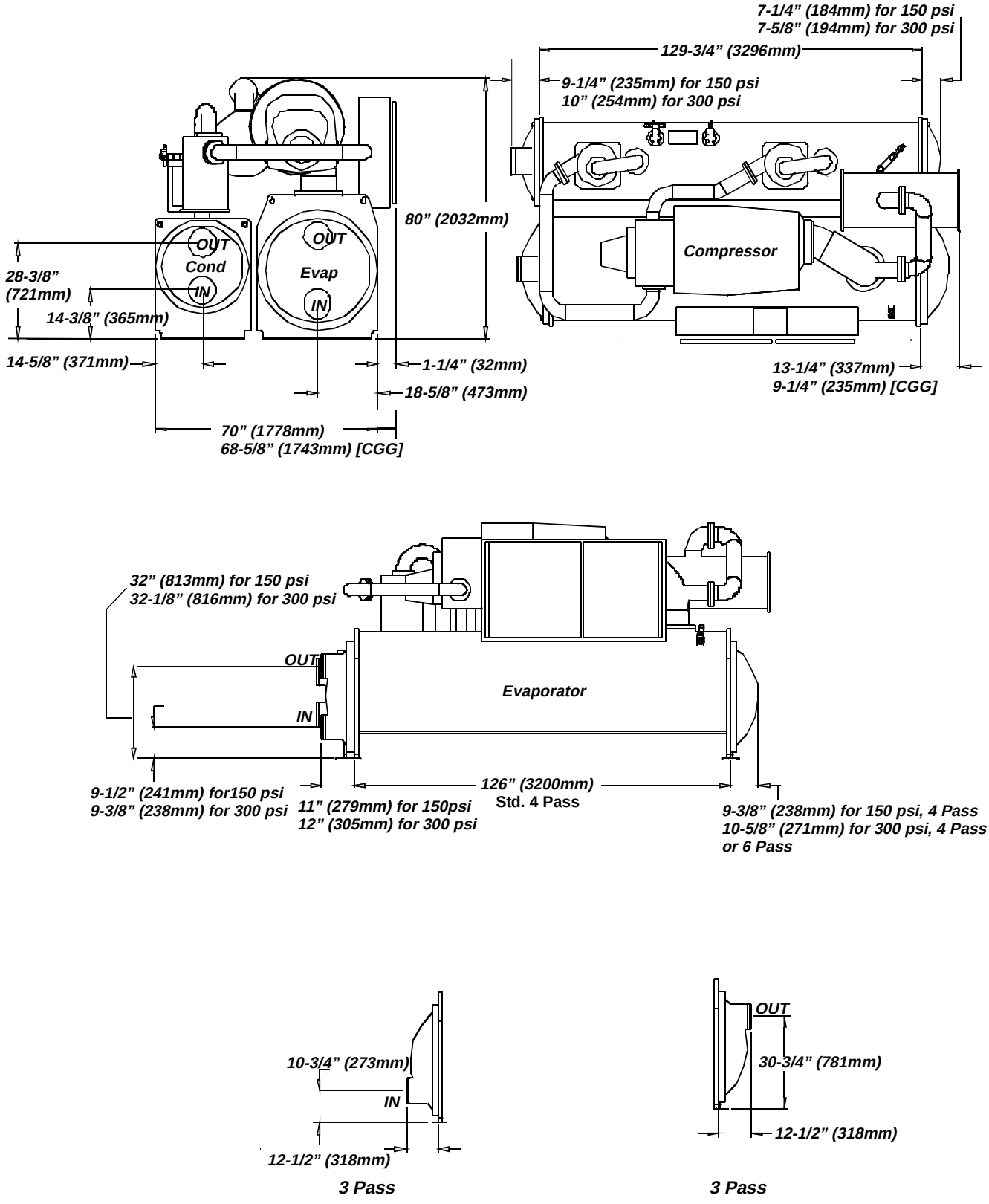
NOTE: Be certain to replace water boxes right-side-up to maintain proper baffle orientation. Use new o-rings.

Figure 10
Condenser and Evaporator Water Connections - *D1F1F2, D2F2F3, D3F2F3, C1E1F1, and E3F2F3*



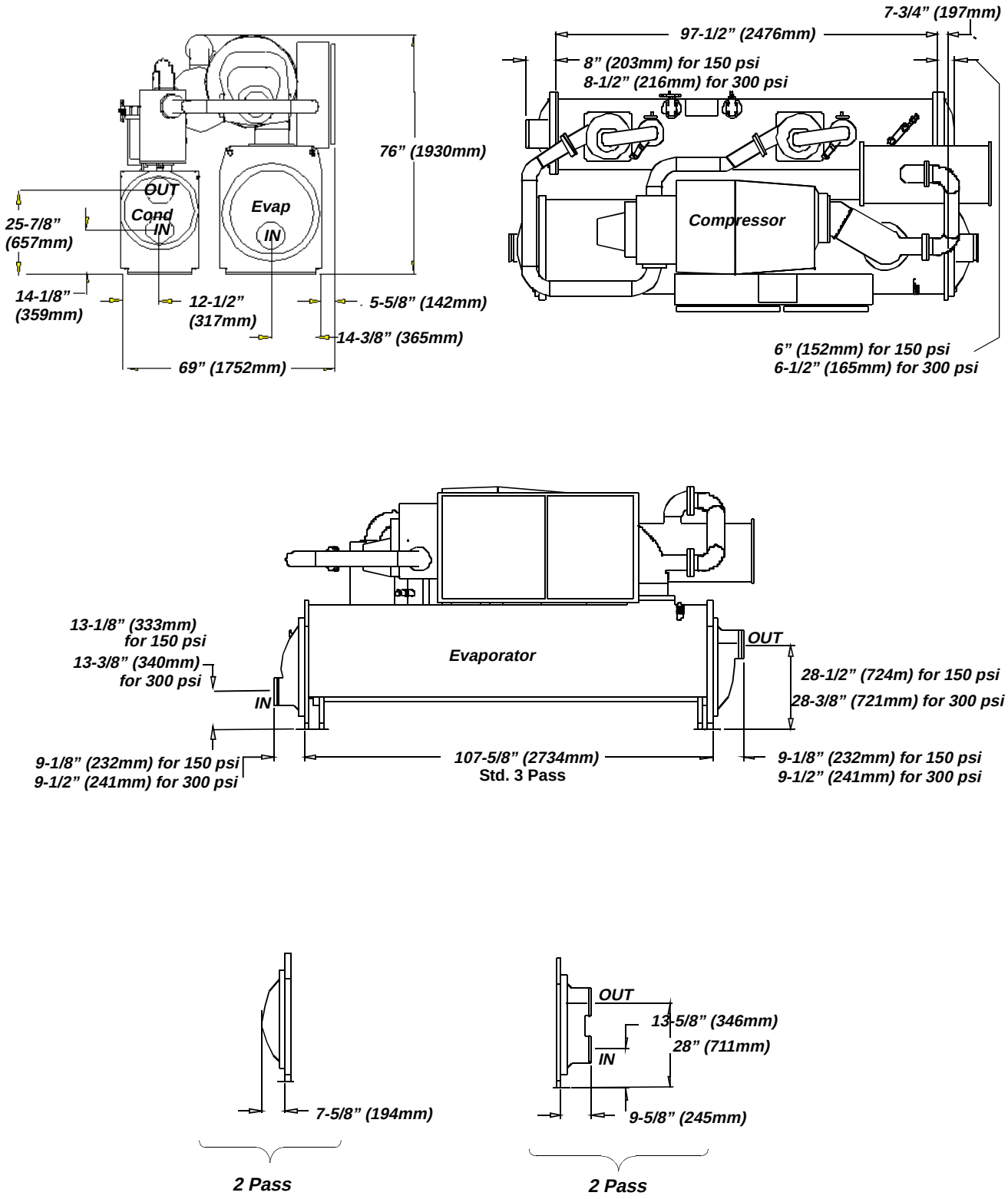
Connection Configuration (Left or Right Hand)
Depends on Water Inlet

Figure 11
Condenser and Evaporator Water Connections - *C2G1G1, D2G3G3, D1G2G2, D3G3G3, and E3G3G3*



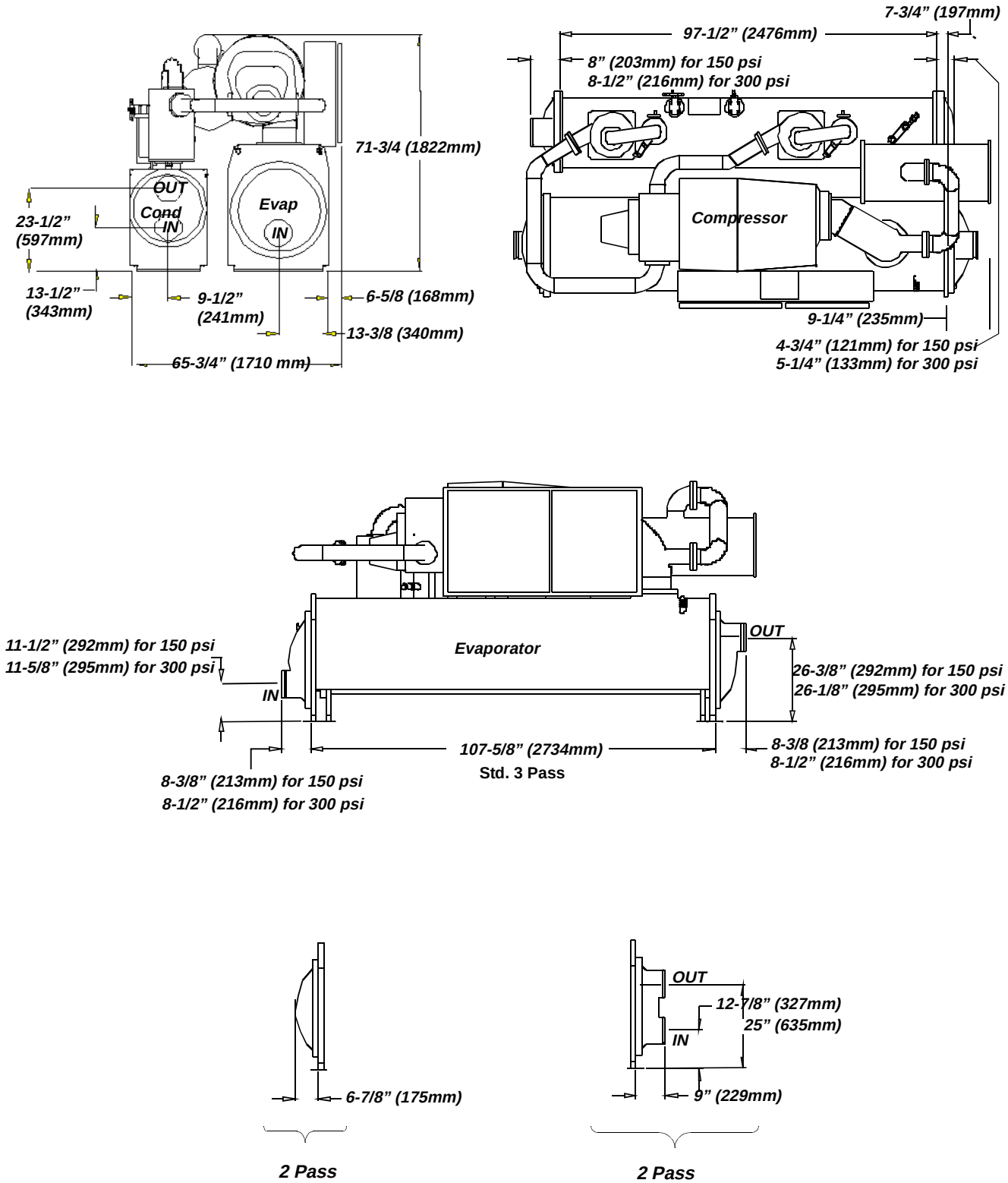
Connection Configuration (Left or Right Hand)
Depends on Water Inlet

Figure 12
Condenser and Evaporator Water Connections - *D1D1E1, D2D2E2, D3D2E2, C2D3E3, and E3D2E2*



Connection Configuration (Left or Right Hand)
Depends on Water Inlet

Figure 13
Condenser and Evaporator Water Connections - *C1B2C1, C1B3C2, and C2B3C2*



Connection Configuration (Left or Right Hand)
Depends on Water Inlet

Figure 14Condenser and Evaporator Water Connections - *B1B1B1/B2B2B2*

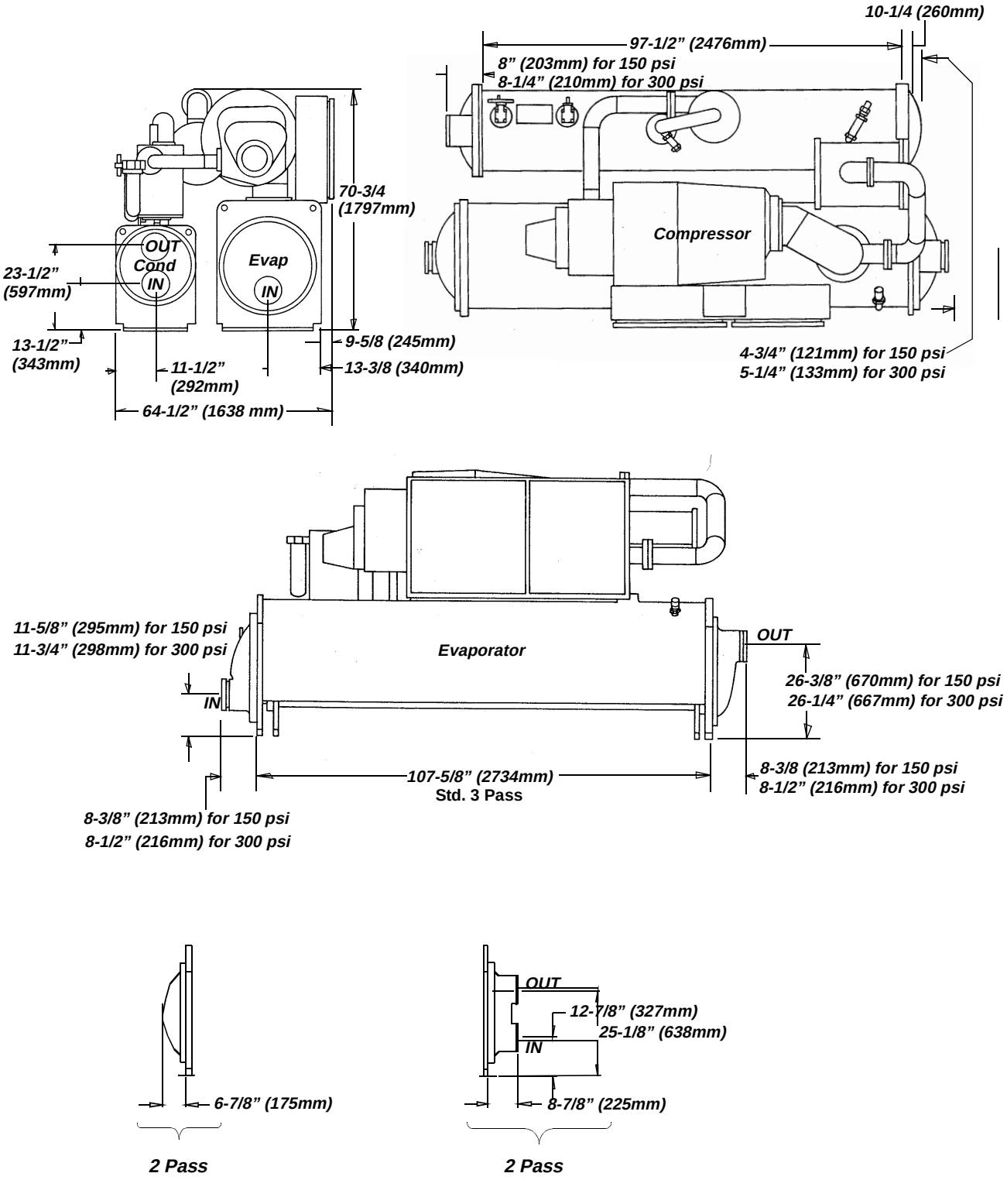


Figure 15Condenser and Evaporator Water Connections - *B1C1D1/B2C2D2*

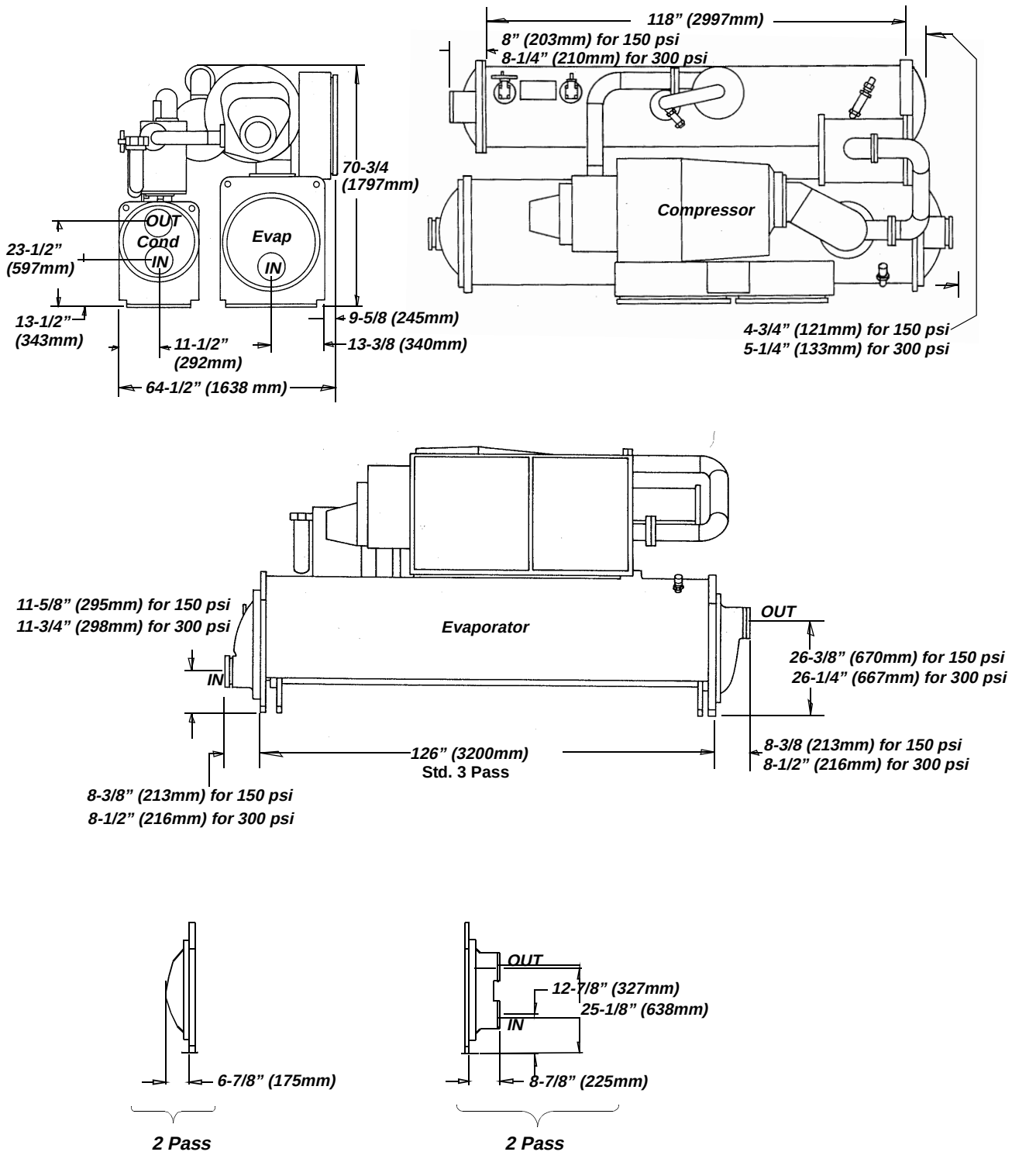


Table 11
Evaporator and Condenser Data

Compressor Frame Code (Digit 6,7 of Model No.)	Evap Shell Code (Digits 12, 13 of Model No.)	Evap. Shell Diameter (in)	Nominal Connector size (NPS)*			Cond Shell Code (Digits 16,17 of Model No.)	Cond. Shell Diameter (in)	Nom. Conn. Size (NPS)*
			2-Pass	3-Pass	4-Pass			2-Pass
E3	D2	26.5	8	8	-	E2	22.0	8
	F2	29.0	8	8	-	E2	22.0	8
	G3	33.5	-	10	8	G3	25.75	8
D3	D2	26.5	8	8	-	E2	22.0	8
	F2	29.0	10	8	-	F3	22.0	8
	G3	33.5	-	10	8	G3	25.75	8
D2	D2	26.5	8	8	-	E2	22.0	8
	F2	29.0	10	8	-	F3	22.0	8
	G3	33.5	-	10	8	G3	25.75	8
D1	D1	26.5	8	8	-	E1	22.0	8
	F1	29.0	10	8	-	F2	22.0	8
	G2	33.5	-	10	8	G2	25.75	8
C2	B3	23.0	8	6	-	C2	18.75	6
	D3	26.5	8	8	-	E3	22.0	8
	G1	33.5	-	10	8	G1	25.75	8
C1	B2	23.0	8	6	-	C1	18.75	6
	B3	23.0	8	6	-	C3	18.75	6
	E1	33.5	8	8	-	F1	22.0	8
B2	C2	23.0	-	6	-	D2	18.75	6
	B2	23.0	-	6	-	B2	18.75	6
B1	C1	23.0	-	6	-	D1	18.75	6
	B1	23.0	-	6	-	B1	18.75	6

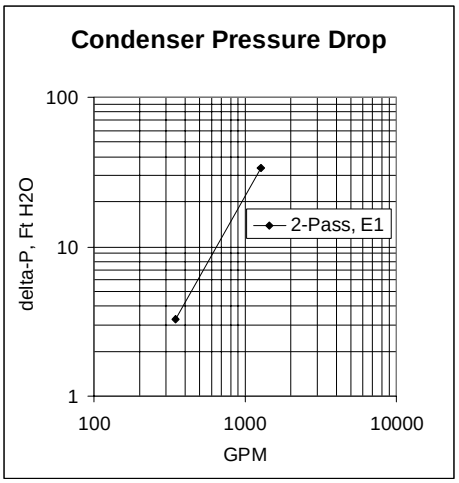
**Note: Metric Conversion is*

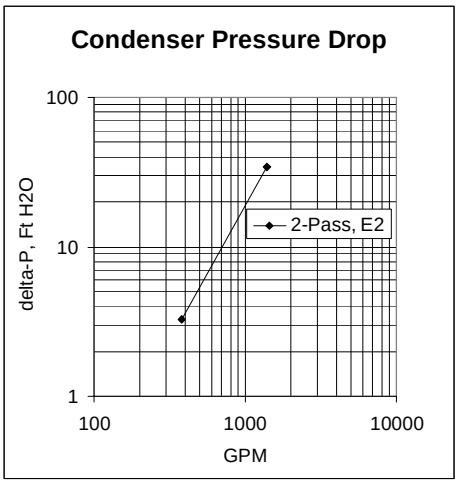
6 NPS = 150 mm nominal

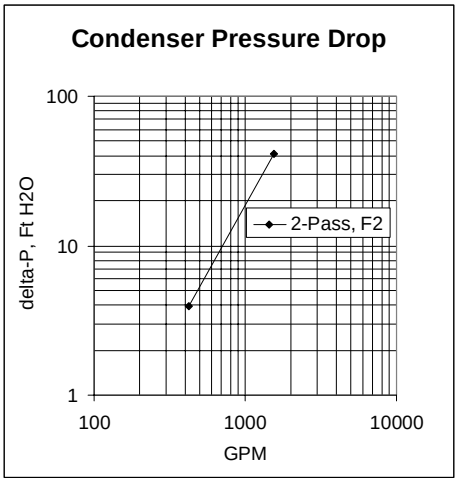
8 NPS = 200 mm nominal

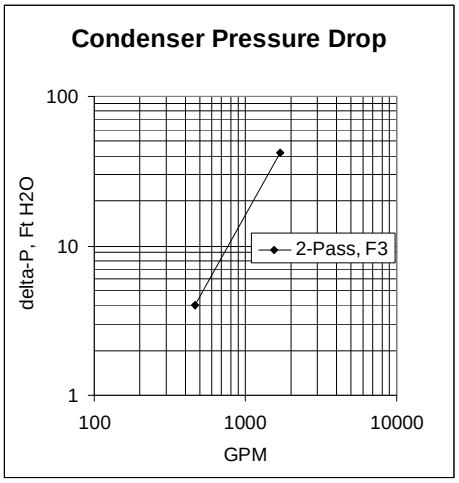
10 NPS = 250 mm nominal

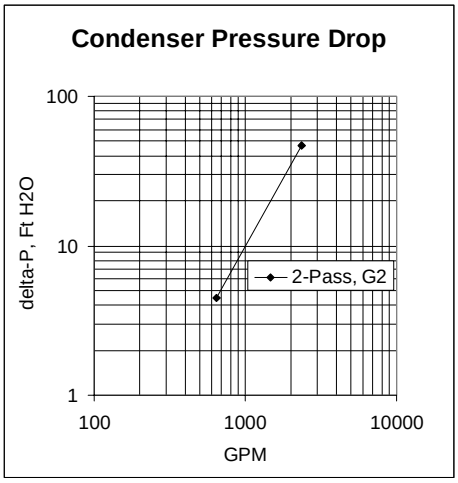
Water Pressure Drop Data

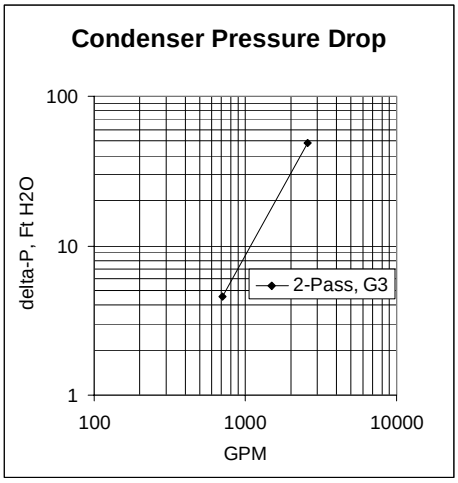




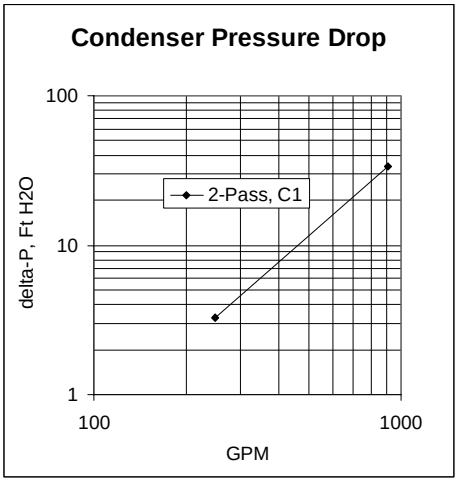


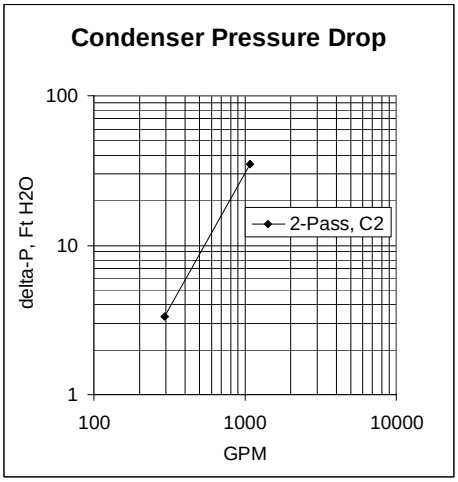


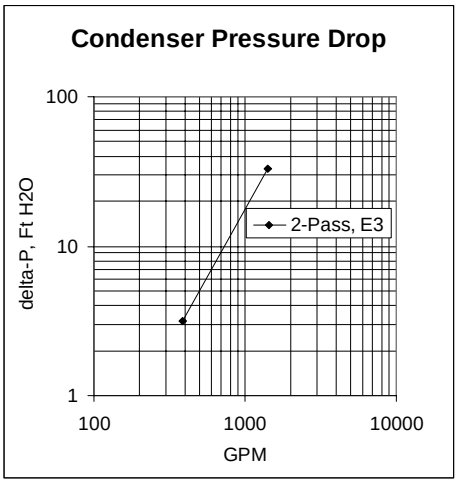


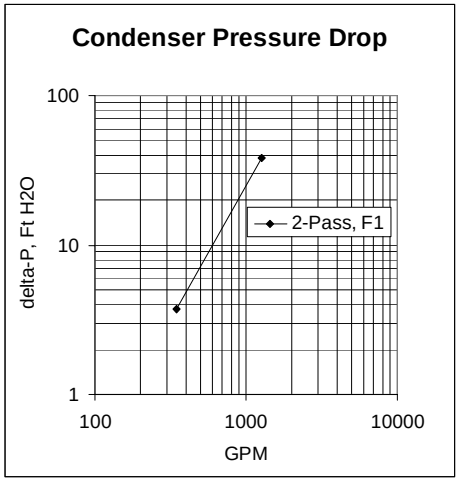


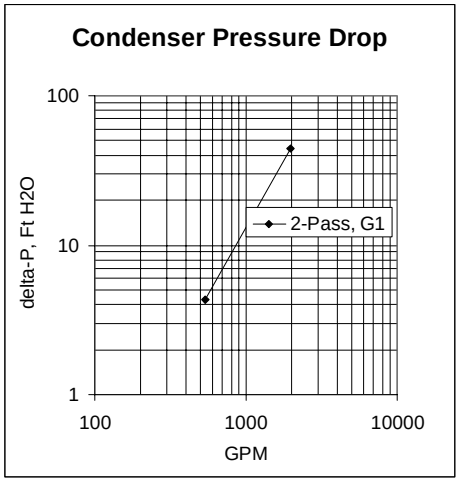
Water Pressure Drop Data (continued)











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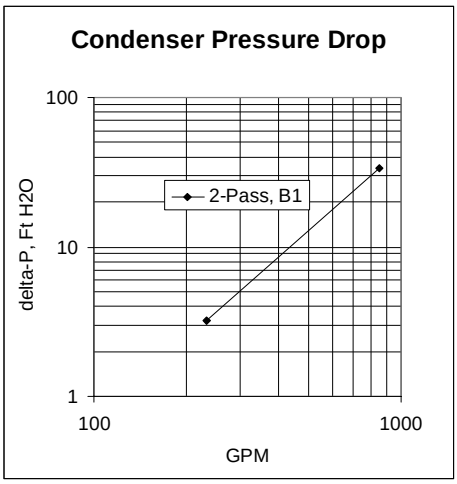

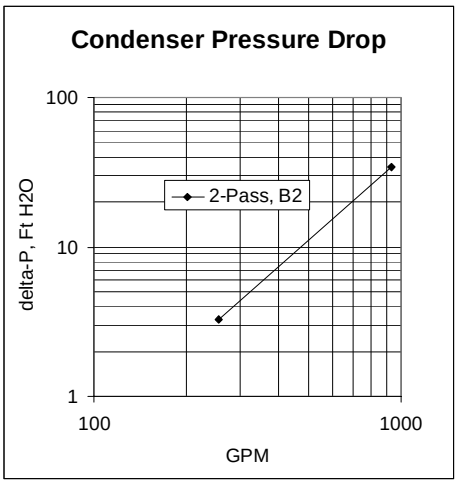

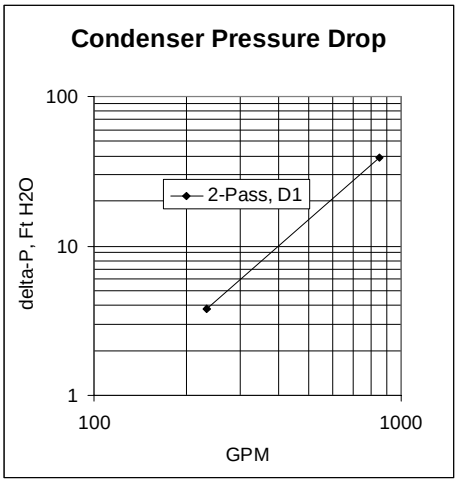

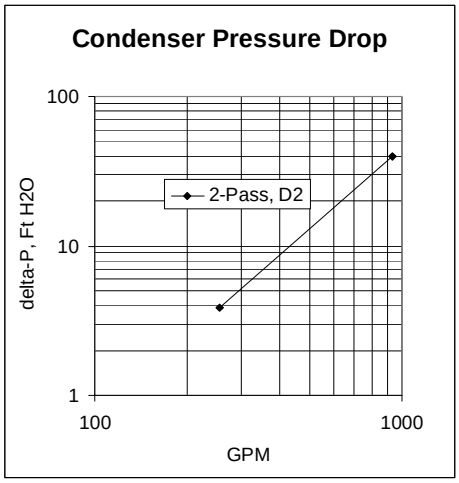

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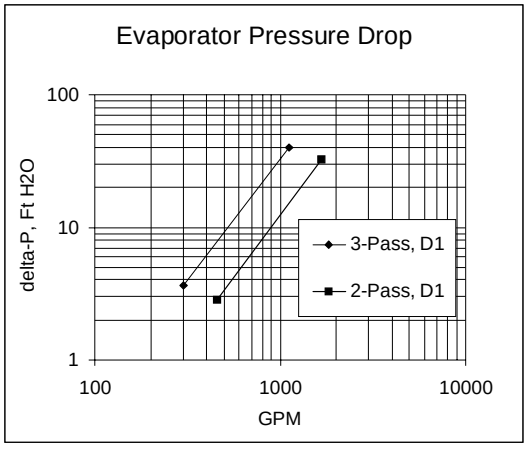
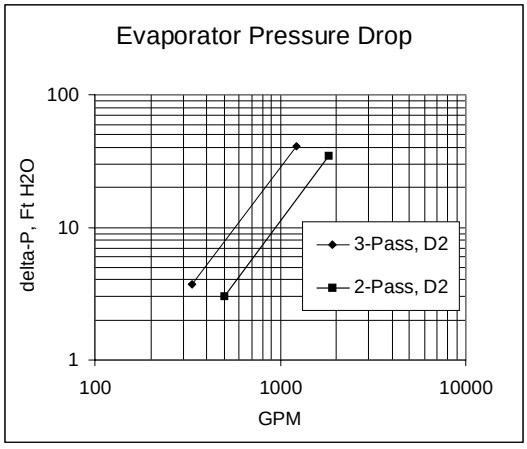
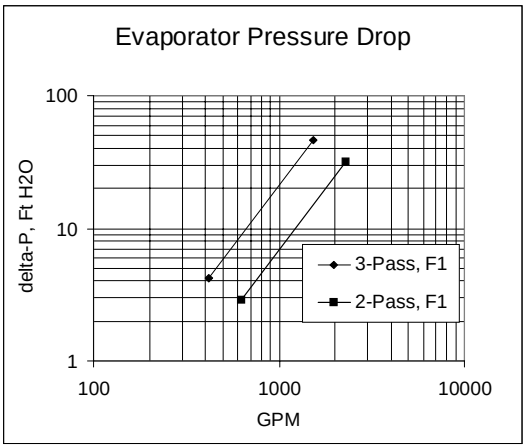
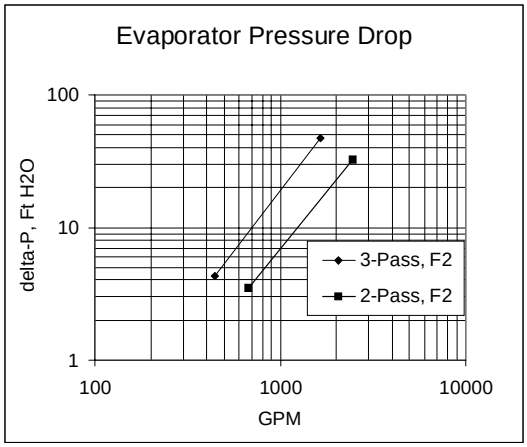
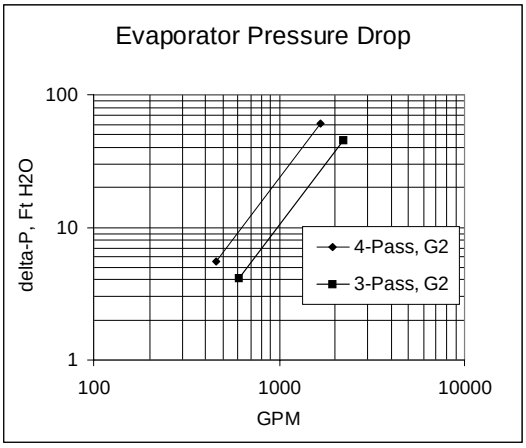
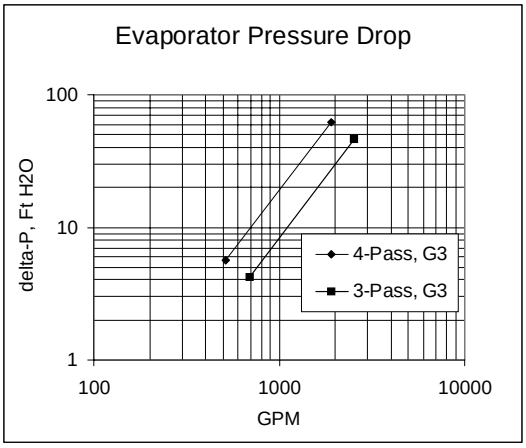




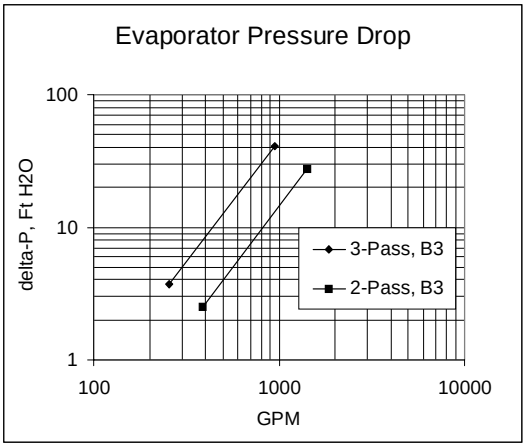


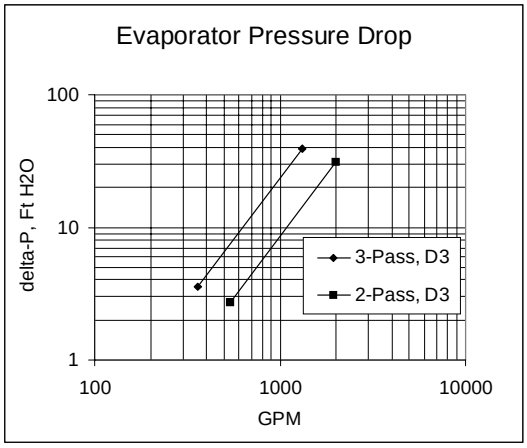


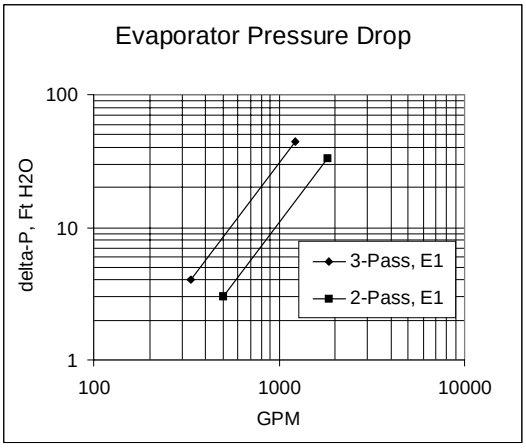


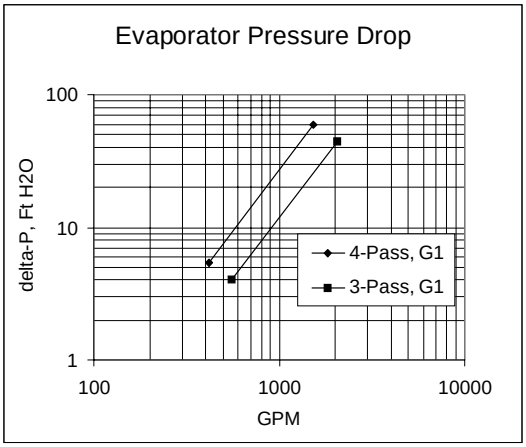


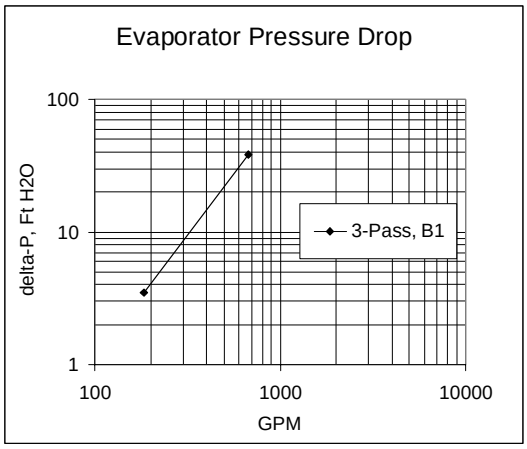
Water Pressure Drop Data (continued)

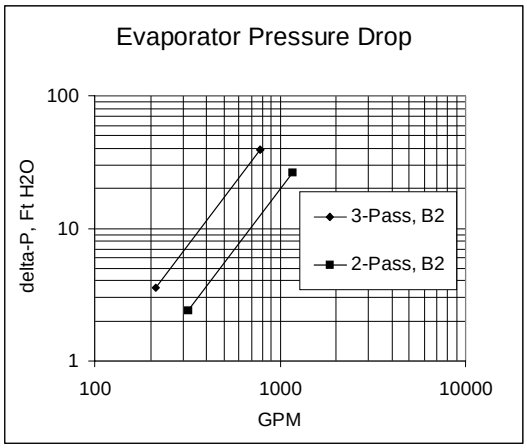




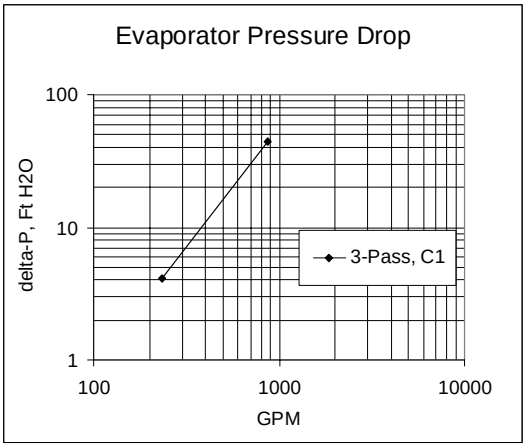


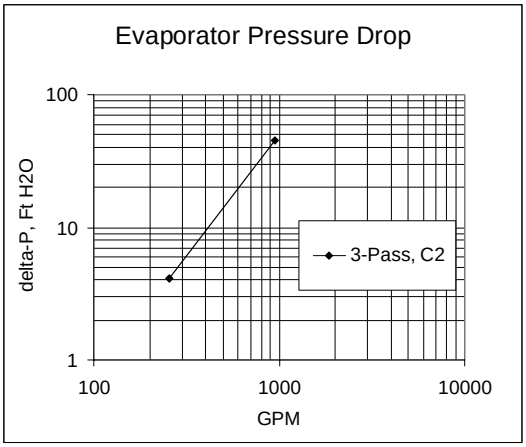






Water Pressure Drop Data (continued)





Making Grooved Pipe Connections

⚠ CAUTION

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

NOTE: Make sure that all piping is flushed and cleaned prior to starting the unit.

⚠ CAUTION

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

Vents and Drains

Install pipe plugs 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

NOTE: Make sure all piping components are between the shutoff valves, so that isolation can be accomplished on both the condenser and the evaporator.

"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 (rubber boots)
- ❑ Shutoff (isolation) valves
- ❑ Thermometers
- ❑ Cleanout tees
- ❑ Pipe strainer
- ❑ Flow switch

Leaving Chilled Water Piping

- ❑ Air vents (to bleed air from system)
- ❑ Water pressure gauges with shutoff valves
- ❑ Pipe unions
- ❑ Vibration eliminators (rubber boots)
- ❑ Shutoff (isolation) valves
- ❑ Thermometers
- ❑ Cleanout tees
- ❑ Balancing valve
- ❑ Pressure relief valve

⚠ CAUTION

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). Refer to digit 14 of the Model No.

To prevent tube damage, install a strainer in the evaporator water inlet piping.

To prevent tube corrosion, ensure that the initial water fill has a balanced pH.

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.

Entering condenser water piping.

- ❑ Air vents (to bleed air from system)
- ❑ Water pressure gauges with shutoff valves
- ❑ Pipe unions
- ❑ Vibration eliminators (rubber boots)
- ❑ Shutoff (isolation) valves. One per each pass
- ❑ Thermometers

- ❑ Cleanout tees
- ❑ Pipe strainer
- ❑ Flow switch

Leaving condenser water piping.

- ❑ Air vents (to bleed air from system)
- ❑ Water pressure gauges with shutoff valves
- ❑ Pipe unions
- ❑ Vibration eliminators (rubber boots)
- ❑ Shutoff (isolation) valve - one per each pass
- ❑ Thermometers
- ❑ Cleanout tees
- ❑ Balancing valve
- ❑ Pressure relief valve.

⚠ CAUTION

CAUTION: To prevent condenser damage, do not exceed 150 psig (10.3 bar) water pressure for standard water boxes. Maximum pressure for high pressure water boxes is 300 psig (20.7 bar). Refer to digit 18 of the Model No.

To prevent tube damage, install a strainer in condenser water inlet piping.

To prevent tube corrosion, ensure that the initial water fill has a balanced pH.

Condenser Water Regulating Valve

The water regulating valve is used when the condenser water temperature is expected to fall below 60°F. It maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to condenser pressure or differential system pressures.

Adjust the valve for proper operation during unit start-up.

Condenser Water Regulating Valve Adjustment

Refer to *Trane RTHC-SB-7* for installation and adjustment of the optional condenser water regulating valve.

Water Treatment

⚠ CAUTION

CAUTION: Water Treatment!
Do not use untreated or improperly treated water. Use of untreated or improperly treated water may result in equipment damage.

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 RTHC unit:

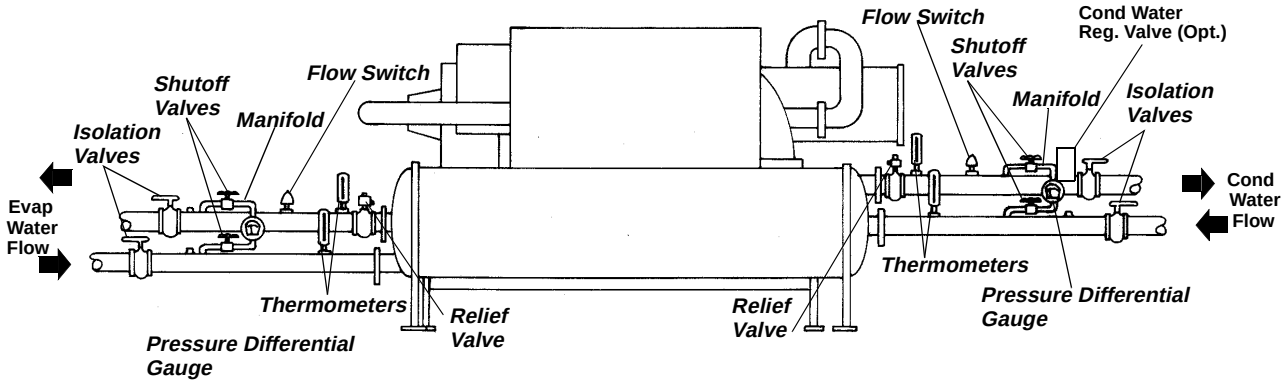
The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is advisable. The Trane Company warranty specifically excludes liability 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.

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 water 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 Manifold Pressure Gauge Set-up



NOTE: Refer to Trane Engineering Bulletin RLC-EB-3 for sound-sensitive applications.

Water Pressure Relief Valves

⚠ CAUTION

CAUTION: Install a pressure relief valve in both evaporator and condenser water systems. Failure to do so could result in shell damage.

Install a water pressure relief valve in one of the condenser and one of the evaporator water box drain connections or on the shell side of any shutoff valve. 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.

Flow Sensing Devices

Use field-provided flow switches or differential pressure switches with pump interlocks to sense system water flow. Flow switch locations are schematically shown in *Figure 16* .

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

Flow switches must stop or prevent compressor operation if either system water flow drops off below the required minimum shown on the pressure drop curves. Follow the manufacturer's recommendations for selection and installation procedures. General guidelines for flow switch installation are outlined below.

- ❑ Mount the switch upright, with a minimum of 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 the water flow.

- ❑ To prevent switch fluttering, remove all air from the water system

NOTE: The UCP2 provides a 6-second time delay on the flow switch input before shutting down the unit on a loss-of-flow diagnostic. Contact a qualified service organization if nuisance machine shutdowns persist.

- ❑ Adjust the switch to open when water flow falls below nominal. Refer to the General Data table in Section 1 for minimum flow recommendations for specific water pass arrangements. Flow switch contacts are closed on proof of water flow.

Refrigerant Pressure Relief Valve Venting

⚠ WARNING

To prevent injury due to inhalation of HFC-134 gas, do not discharge refrigerant anywhere. If multiple chillers are installed, each unit must have separate venting for its relief valves. Consult local regulations for any special relief line requirements.

NOTE: Vent pipe size must conform to the ANSI/ASHRAE Standard 15 for vent pipe sizing. All federal, state, and local codes take precedence over any suggestions stated in this manual.

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

All RTHC units use evaporator, compressor, and condenser pressure relief valves (*Figure 17*) that must be vented to the outside of the building.

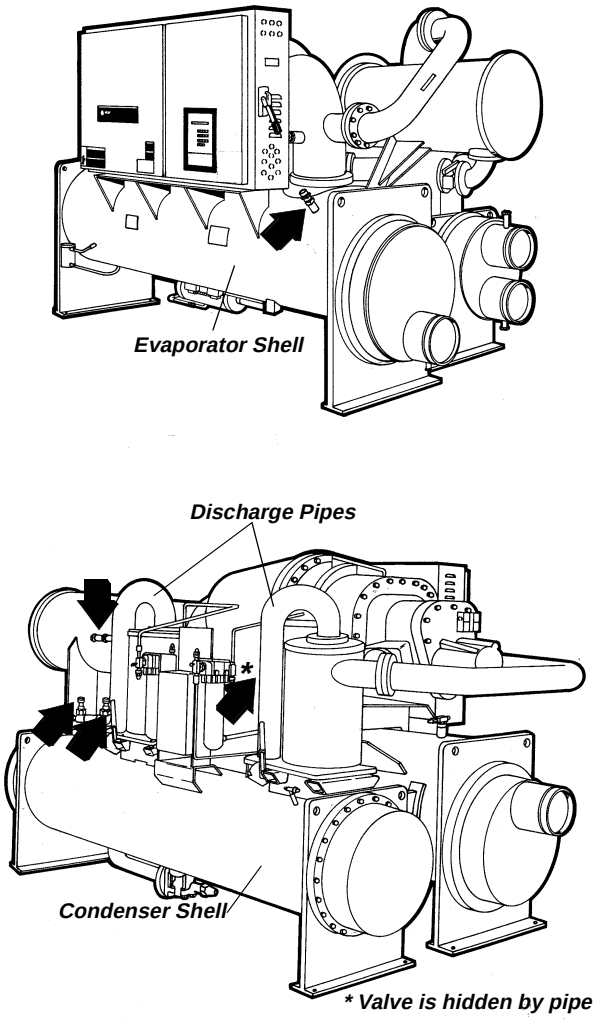
Relief valve connection sizes and locations are shown in the unit submittals. Refer to local codes for relief valve vent line sizing information.

⚠ CAUTION

CAUTION: Do not exceed vent piping code specifications. Failure to heed specifications could result in capacity reduction, unit damage and/or relief valve damage.

Relief valve discharge setpoints and relief rates are given in *Table 12* . Once the relief valve has opened, it will reclose when pressure is reduced to a safe level.

Figure 17
Relief Valve Locations



NOTE: Once opened, relief valves tend to leak and must be replaced.

Pressure relief valve discharge setpoints and relief rates will vary with shell diameter and length and also compressor displacement. Relief rates should be calculated as required by ASHRAE Standard 15-94

.

Table 12
Pressure Relief Valve Data

Valve Location	Number of Valves	Rated Capacity per Relief Valve (lba/min)	Pipe Size (in NPT)
Evap - B1	*1*	*43.5*	*1*
Evap - B2	*1*	*43.5*	*1*
Evap -B3	*1*	*43.5*	*1*
Evap -C1	*1*	*43.5*	*1*
Evap - C2	*1*	*43.5*	*1*
Evap - D1	*1*	*43.5*	*1*
Evap - D2	*1*	*43.5*	*1*
Evap - D3	*1*	*43.5*	*1*
Evap - F1	*1*	*43.5*	*1*
Evap - F2	*1*	*43.5*	*1*
Evap - E1	*1*	*43.5*	*1*
Evap - G1	*1*	*76.2*	*1-1/4*
Evap - G2	*1*	*76.2*	*1-1/4*
Evap - G3	*1*	*76.2*	*1-1/4*
Cond - B1	*1*	*43.5*	*1*
Cond - B2	*1*	*43.5*	*1*
Evap - C1	*1*	*43.5*	*1*
Evap - C2	*1*	*43.5*	*1*
Cond - D1	*1*	*43.5*	*1*
Cond - D2	*1*	*43.5*	*1*
Cond - E1	*2*	*43.5*	*1*
Cond - E2	*2*	*43.5*	*1*
Cond - E3	*1*	*43.5*	*1*
Cond - F1	*1*	*43.5*	*1*
Cond - F2	*2*	*43.5*	*1*
Cond - F3	*2*	*43.5*	*1*
Cond - G1	*1*	*43.5*	*1*
Cond - G2	*2*	*43.5*	*1*
Cond - G3	*2*	*43.5*	*1*
*Comp - B1/B2**	*2*	*76.2*	*1-1/4*
*Comp - C1/C2**	*3*	*76.2*	*1-1/4*
*Comp - D1/D2/D3**	*3*	*76.2*	*1-1/4*
Comp -E3	*3*	*76.2*	*1-1/4*

** Only used with isolation valve option*

Thermal Insulation

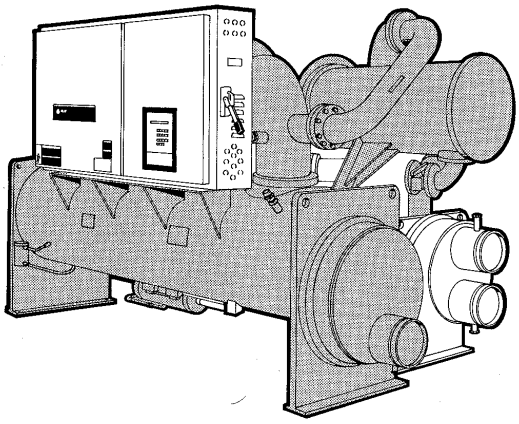
All RTHC units are available with optional factory installed thermal insulation. If the unit is not factory insulated, install insulation over the areas shaded in *Figure 18* . Refer to *Table 13* for types and quantities of insulation required.

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

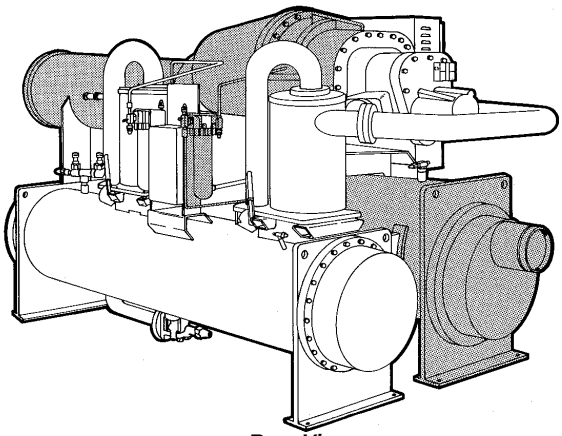
Use only water-base latex paint on factory-applied insulation. Failure to do so may result in insulation shrinkage.

More (thicker insulation may be required in areas with high humidity.

Figure 18
Typical RTHC Insulation Requirements



Front View



Rear View

Table 13
Recommended Insulation Types

Location	*Type*	*Sq. Feet*
1	*3/4" wall*	*90*
2	*3/4" wall*	*25*
3	*3/4" wall*	*160*

1 = evaporator and liquid vapor separator

2 = compressor

3 = all components and piping on low side of system (gas pump, return oil line, filter from pump)

NOTE: Units in environments with higher humidity may require thicker insulation.

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

Hazardous Voltage! Disconnect all electrical power, including remote disconnects before servicing. Failure to disconnect power before servicing can cause severe personal injury or death.

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. Specific electrical schematics and connection diagrams are shipped with the unit.

NOTE: typical wiring diagrams are in the back of this manual.

⚠ CAUTION

CAUTION: It is strongly recommended that only copper conductors be used! Unit terminals are not designed to accept other types of conductors. Failure to do so may cause damage to the equipment.

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.

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

Power Supply Wiring

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

For a complete discussion on the use of conductors, see Trane Engineering Bulletin EB-MSCR-40.

Refer to Trane Engineering Bulletin CTV-EB-93 for power wire sizing.

Water Pump Power Supply

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

Electrical Panel Power Supply

Power supply wiring instructions for the starter/control panel are:

1. Run line voltage wiring in conduit to access opening(s) on starter/control panel or pull-box. See CTV-EB-93 for wire sizing and selection information and refer to *Table 12* and *Figure 22* that show typical electrical connection sizes and locations. Always refer to submittal information for your actual unit specifications.

Table 12
Wire Selection Chart for Starter Panels

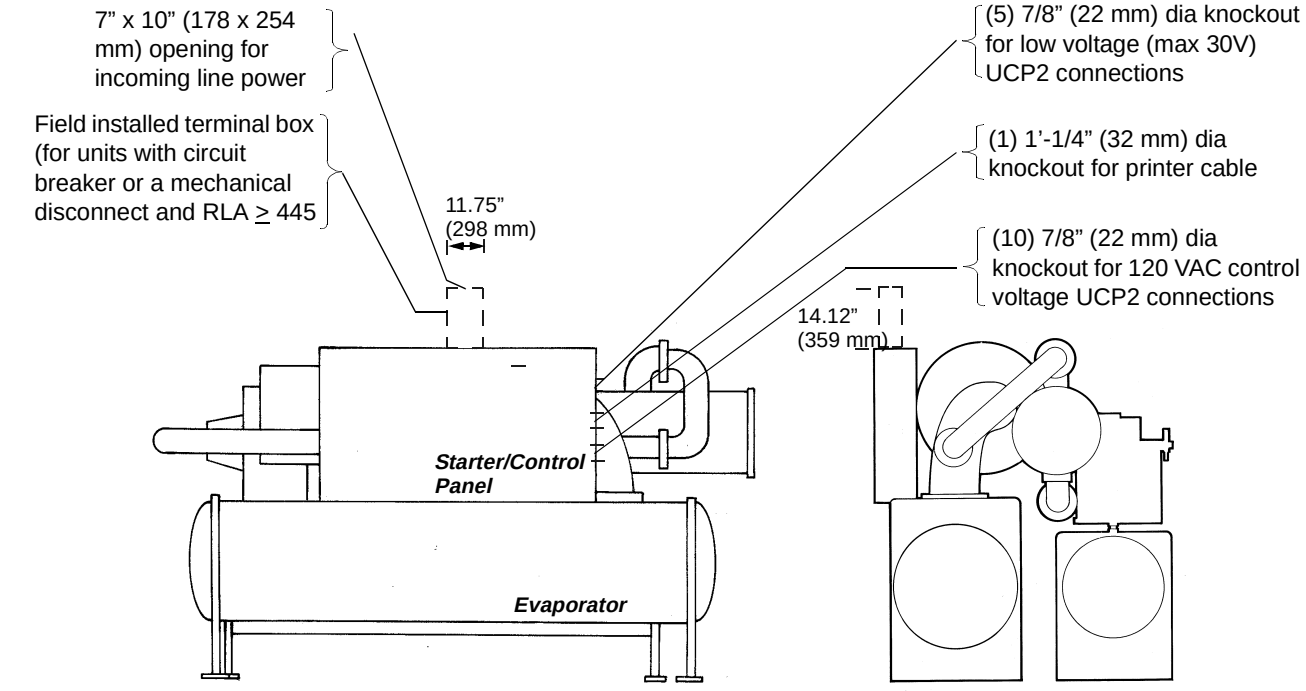
Min. Wire Size Copper 75°C	*Supply Leads for All Starters (0 - 2000 Volts)*						
	1 Conduit 3 Wire	*1 Conduit 6 Wire*	*1 Conduit 9 Wire*	*2 Conduits 6 Wire*	*2 Conduits 12 Wire*	*3 Conduits 9 Wire*	*4 Conduits 12 Wire*
8	*40*	*	*	*	*	*	*
6	*52*	*	*	*	*	*	*
4	*68*	*	*	*	*	*	*
3	*60*	*	*	*	*	*	*

Table 12
Wire Selection Chart for Starter Panels

Min. Wire Size Copper 75°C	Supply Leads for All Starters (0 - 2000 Volts)						
	1 Conduit 3 Wire	1 Conduit 6 Wire	1 Conduit 9 Wire	2 Conduits 6 Wire	2 Conduits 12 Wire	3 Conduits 9 Wire	4 Conduits 12 Wire
2	92	*	*	*	*	*	*
1	104	*	*	*	*	*	*
0	120	192	252	360	384	360	480
00	140	224	294	420	448	420	560
000	160	256	336	480	512	480	640
0000	184	294	386	552	589	552	736
250	204	326	428	612	653	612	816
300	228	356	479	684	730	684	912
350	248	397	521	744	794	744	992
400	268	429	563	804	858	804	1072
500	304	486	638	912	973	912	1216

** 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 per NEC 310-4. Each phase must be equally represented in each conduit.*

Figure 17
Electrical Installation



Other Supply Power Components

Fused Disconnect Switches

Size fused disconnects in accordance with NEC Article 440-22(a).

Compressor Motor Phase Sequencing

Always verify that proper rotation of the Series R compressor is 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 incoming power supply phased A, B, C.

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

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.

Correcting Improper Electrical Phase Sequence

Proper compressor motor electrical phasing can be quickly determined and corrected before starting the unit. If using an Associated Research Model 45 Phase Sequence Indicator, follow this procedure:

1. Press the STOP button to insure the unit will not attempt to start the compressor.
2. Open the electrical disconnect or circuit protection switch that provides line power to the line power terminal block in the control 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	*1TB1 Terminal*
Black (Phase A)	*L1*
Red (Phase B)	*L2*
Yellow (Phase C)	*L3*

4. Turn power on by closing the unit supply power disconnect switch.
5. Read the phase sequence on the indicator. The “ABC” indicator on the face of the phase indicator will glow if phase is “ABC”.

⚠ WARNING

Hazardous Voltage! Disconnect all electrical power, including remote disconnects before servicing. Failure to disconnect power before servicing can cause severe personal injury or death.

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.

Compressor Motor Power Wiring

Provide line voltage wiring from the starter/control panel to the proper terminals in the compressor motor junction box. See *Figure 22* and *Table 12* for motor wire sizing information.

Terminal Lugs.

Proper starter/control panel line-side lug sizes are specified on the starter submittals. These lug sizes must be compatible with conductor sizes specified by the electrical engineer or contractor. Appropriate lug sizes are provided.

Rated Load Ampacity (RLA)

The compressor motor RLA for a particular chiller is determined by the field selection program and indicated on the compressor nameplate.

Minimum Circuit Ampacity (MCA)

The MCA is equal to 1.25 x the compressor RLA (on nameplate).

Maximum Fuse/Circuit Breaker Size

The maximum fuse/circuit breaker size is equal to 2.25 x the compressor RLA in accordance with UL 1995, para. 36.15.

The recommended dual element (RDE) fuse size is equal to 1.75 x RLA in accordance with NEC Table 430-152.

For recommended field connection lug sizes (RTHC starters) see *Table 13* .

Table 13
Recommended Field Connection Starter Lug Sizes

Starter/Control Panel Connection	*RLA Range*	*Lug Size L1 - L3 (each phase)*
Terminals only	*000-760*	*(2) #4-500 MCM*
	761-935	*(4) #4/0-500 MCM*
Main Circuit Breaker or Non-fused Disconnect Switch	*000-185*	*(1) #4-350 MCM*
	186-296	*(2) 2/0-250 MCM*
	297-444	*(2) 3/0-350 MCM*
	445-592	*(2) #1-500 MCM*
	593-888	*(4) 4/0-500 MCM*

Note: Lug sizes are dependent on starter type

Application Of Solid-state Starters

The starter is a pre-wired platform consisting of a 3-pole bypass contactor mounted in parallel with three triacs (each composed of a pair of back to back Silicon Controlled Rectifiers (SCRs)), and two gating/ logic/controller PC boards. The SCRs control the inrush currents to the motor until it is up to speed, through cycle by cycle “switching” of the voltage applied to the motor winding. Such a reduced voltage starting method reduces, significantly, the high inrush currents normally associated with an across the line starting method. This in turn reduces the voltage dips that would otherwise be experienced by the power system during startup, as well as limiting starting torque and motor stator heat up rates and their accompanying motor stresses.

The current is controlled according to a factory preset ramp time and current limit settings on the starter. Once the motor is fully up to speed, the contactor closes, which bypasses the SCRs. The bypassing of the SCRs eliminates the inefficiencies and heating that would result if they carried current continuously. The contactor, however, will experience greatly reduced contact wear and increased life, since it only has to carry running currents and neither has to make or break the inductive motor load.

In the unlikely event that the motor does not come up to speed within the factory Maximum Acceleration time, the contactor will be pulled in by the UCP2 starter module and the motor will be put directly across the line for full starting torque availability. However, if the associated transient to the power system is unacceptable, UCP2 can be programmed to instead abort the start upon failure to accelerate. Refer to Section 4 for UCP2 settings and descriptions.

On RTHC chillers, solid-state starters are connected “inside the delta” of the motor connection. This means that, whereas most solid-state starters may be applied “in the line connection”, on the RTHC chiller each SCR pair is connected in series with a motor winding coil. When applied in this fashion the solid-state starter provides reduced inrush starting with smaller, more economical controls, which will see about 57% of the line current. The connections between the line, the main circuit breaker, the solid-state starter, and the compressor motor terminals is illustrated in *Figure 18* .

Starters are selected and control settings are made for a given compressor motor maximum amp rating, voltage and frequency. Selected starters are from the Eaton Eazy-Start EA product family. In general the nominal ratings were reduced about 10% to allow operation in ambients up to 122°F. These control settings should not be reduced for the same model chiller, which happens to have a lower nameplate marking because of different application conditions.

All chillers must be capable of starting under the worst-case starting conditions (typically 90° F entering the chiller). Under these conditions the starter must provide the necessary torque to start the motor. For a given motor design, regardless of the chiller’s nameplate marking, the required starting current is a prescribed value. The solid-state starter selected for each chiller has taken this into account, and control settings have been prescribed so the chiller starts reliably.

If the starter control settings are lowered, chances are that the motor may not come up to full speed in the available time, and the motor will then momentarily draw full locked rotor current when the

bypass contactor closes. This would result in line voltage dips and dimming of lights whenever the chiller starts, and should be avoided. Following the prescribed selections and control settings will result in reliable chiller starting, while maximizing motor and contactor life.

Selections in the following table are based on the following startup ramp. The initial current is limited to 200% of the max compressor rated load amps. Over a period of 5 seconds the inrush is allowed to increase to a value approximately equal to 300% of the max load amps. These settings produce reliable starting over the chiller's operating range. For the controller settings prescribed, the compressor motor comes up to full speed consistently within the Maximum Acceleration Time as factory set on UCP2. See Section 5 for factory settings of the Maximum Acceleration Timer.

Solid-state Starter Controller Settings

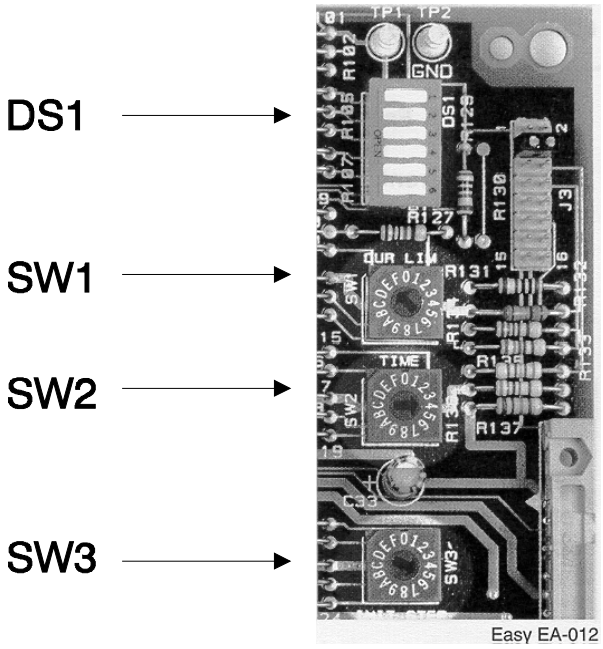


Table 14
Solid State Starter Selections

SOLID STATE STARTER SELECTIONS AND SETUP INFORMATION FOR RTHC PRODUCTS

ISSUE DATE: 6/18/98
REV DATE: 9/13/99

COMPRESSOR DATA				STARTER MODEL NUMBER & SETUP INFORMATION								COMPRESSOR ELECTRICAL INFORMATION			
TONS	SIZE	VOLTS	Hertz	MODEL NUMBER	CURRENT CALIBRATION	CURRENT LIMIT			RAMP TIME		INITIAL STEP	MAX RATED LOAD AMPS		LOCKED ROTOR AMPS	
					DS1 SETTINGS Switch 1,2,3,4,5,6 0 = open; 1 = closed	SW1 SETTING	Amps @ Setting	300 % AMPS Calculated	SW2 SETTING	Seconds	SW3 SETTING	% Max Amps	LINE	DELTA	LINE	DELTA
180 & 200	B1, B2	200	60	EA360	1,1,0,1,0,0	A	978	975.2	3	5	F	200	563	325.1	2599	1500.6
		230	60	EA360	1,0,1,0,1,0	9	889	848.7	3	5	F	200	490	282.9	2191	1265.0
		380	60	EA270	0,1,1,1,0,0	6	580	512.7	3	5	F	200	296	170.9	1234	712.5
		460	60	EA270	0,1,0,1,0,0	4	420	424.4	3	5	F	200	245	141.5	1062	613.2
		575	60	EA270	0,0,1,1,0,0	3	360	339.5	3	5	F	200	196	113.2	831	479.8
		400	50	EA270	0,1,0,0,1,0	4	420	405.3	3	5	F	200	234	135.1	1078	622.4
250 & 300	C1, C2	200	60	Not available				1406.5	3	5	F	200	812	468.8	3634	2098.2
		230	60	Not available				1193.4	3	5	F	200	689	397.8	2901	1674.9
		380	60	EA270	1,1,0,1,0,0	8	720	729.2	3	5	F	200	421	243.1	1727	997.1
		460	60	EA270	1,0,0,1,1,0	6	580	604.5	3	5	F	200	349	201.5	1453	838.9
		575	60	EA270	0,1,1,0,1,0	5	500	483.3	3	5	F	200	279	161.1	1162	670.9
		400	50	EA270	1,0,0,1,1,0	6	580	604.5	3	5	F	200	349	201.5	1488	859.1
						0										
360 & 400	D1, D2	200	60	Not available				1813.5	3	5	F	200	1047	604.5	5477	3162.2
		230	60	Not available				1590.1	3	5	F	200	918	530.0	4966	2867.2
		380	60	Not available				950.9	3	5	F	200	549	317.0	2755	1590.6
		460	60	EA360	1,0,0,1,0,0	8	800	788.1	3	5	F	200	455	262.7	2366	1366.1
		575	60	EA360	1,0,1,0,1,0	7	660	635.7	3	5	F	200	367	211.9	1984	1145.5
		400	50	EA360	1,0,0,1,0,0	8	800	788.1	3	5	F	200	455	262.7	2424	1399.5
400	E3	400	50	EA360	1,0,1,0,1,0	9	889	848.7	3	5	F	200	490	282.9	2424	1399.5

COMMMENTS

Suggest you hide columns B,J,K,L,P,R and greater to minimize space requirements and field confusion.

STARTER RATINGS

MODEL	RLA	20 sec amps	
EA270	270	1350	The Trane starter rating = 0.9 * Catalog starter RLA * 1.732
EA360	360	1500	Using this calculation the max amp rating which will fit the panel is 561 amps
			There are larger sizes available however these larger sizes won't fit size restraints for the unit control panel
			Different starter callouts are reqd for 50 and 60 hz applications because of unit control logic.

DS1 SETTINGS

Switches 1 thru 5 are current calibration, switch 6 is overload calibration
Current calibration set for the next highest amp value above the max compressor amps after adjusting to delta current
Per Eaton the overload trip setting is 20% above the current calibration
Starter overload function is active and set to a Class 10 trip curve. It's set high enough to prevent interference with the Trane UCM current protectio and limit functions.

COMPRESSOR ELECTRICAL INFO

The 490 max amp rating for the E3 compressor hasn't been confirmed by lab testing to date.

INFORMATION SOURCES

Compressor info from D. Beekman email dated 6/18/98
Starter info from Eaton Easy-Start Instruction Manual Dated Aug 97

Precautions When Using Solid-State Starters

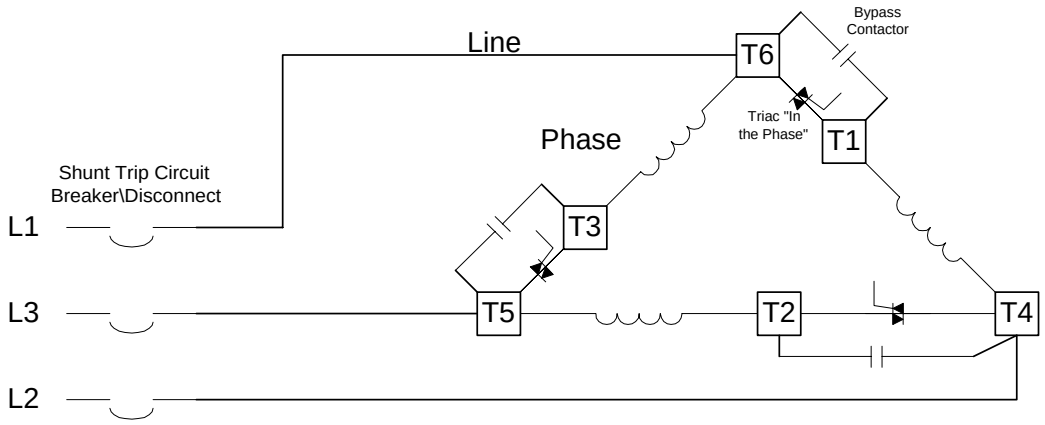
When using solid-state starters, there are two precautions servicing personnel need to be aware of.

⚠ WARNING

STARTER AND MOTOR TERMINALS REMAIN “HOT” AT HIGH VOLTAGE EVEN WHEN MOTOR AND STARTER ARE “OFF.” Be Certain To Disconnect All Power To The Unit Before Performing Any Work In The Starter Panel.

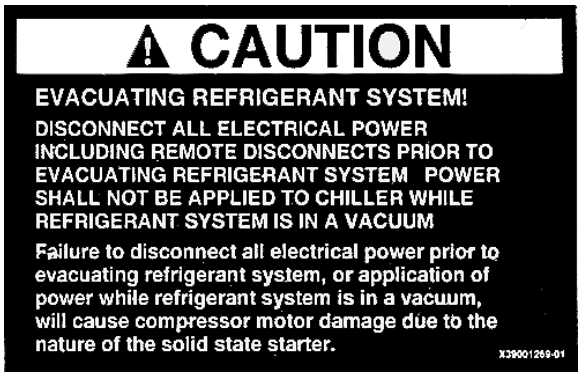
The “In the Phase” starter does not remove voltage from any of the six motor leads when it is off. Three of the six motor leads remain directly connected to line voltage with respect to ground. The remaining three terminals are pulled up to the line voltage through the motor impedance of each phase. See *Figure 18* .

Figure 18
Solid State Starter Connections



Note that even a Solid State Starter with its triacs “in the line” represent a similar hazard. Should a person contact any of the motor terminals, even with the motor off, the triac “off-state” leakage and finite snubber impedance would be enough to cause a severe, even fatal, electrical shock. In the case of the “in the phase” starter, the currents available could be quite high, as little or no impedence would be in series with the voltage source.

Figure 19
Caution label on starters panels equipped with solid-state starters



⚠ WARNING

Contacting any of the motor terminals, even with the motor off can cause a severe, potentially fatal, shock.

<u>IMPORTANT</u>! WHEN EVACUATING THE CHILLER’S REFRIGERANT SYSTEM, ALWAYS HAVE THE MAIN POWER DISCONNECT/CIRCUIT BREAKER OPENED.
EVEN WHEN THE COMPRESSOR IS NOT RUNNING, VOLTAGE IS PRESENT AT THE COMPRESSOR MOTOR TERMINALS, PROVIDING THE POTENTIAL FOR CURRENT TO FLOW THROUGH A LOW IMPEDANCE PATH.

As the chiller is evacuated below atmospheric pressure, the dielectric strength (resistance to arcing) of the gaseous atmosphere is significantly reduced. Because the SCRs are connected “inside the delta,” three of the motor terminals are connected directly to the line voltage. An “arc over” can occur between motor terminals under conditions seen in the evacuation process. If this occurs the circuit breaker (or other external protective devices) will trip in response to high fault currents, and motor damage may also occur. This can be avoided through being certain that the chiller is ***fully disconnected from all power sources before beginning pumpdown or evacuation procedures***, as well as guaranteeing that the disconnect cannot be accidentally closed while the chiller is in a vacuum.

Figure 20
Y-D Starter Panel showing cables to compressor motor terminals

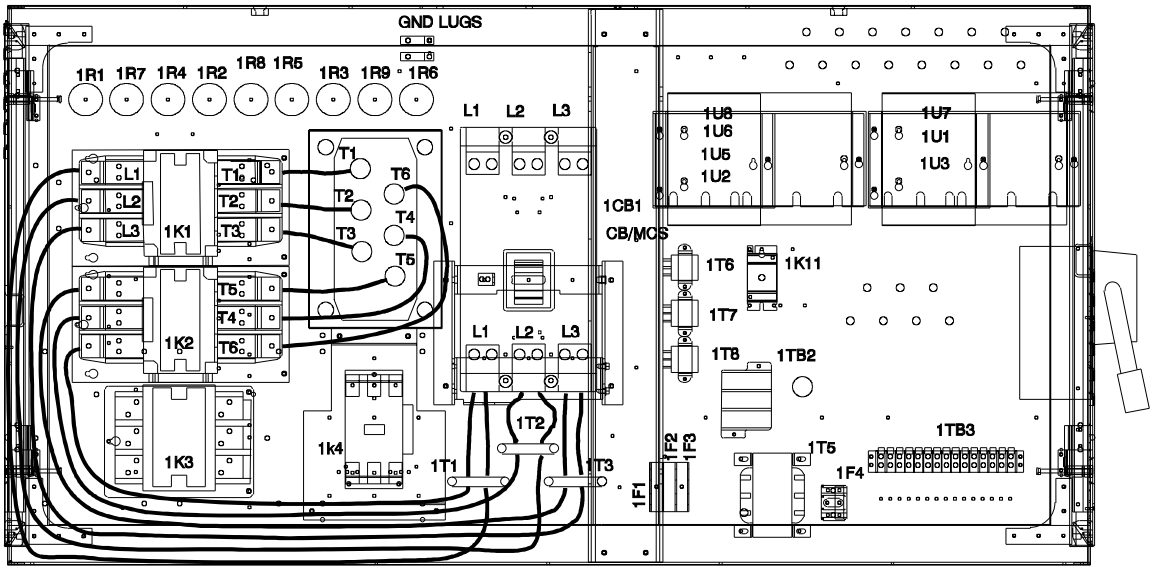


Figure 21
Solid State Starter Panel showing cables to compressor motor terminals

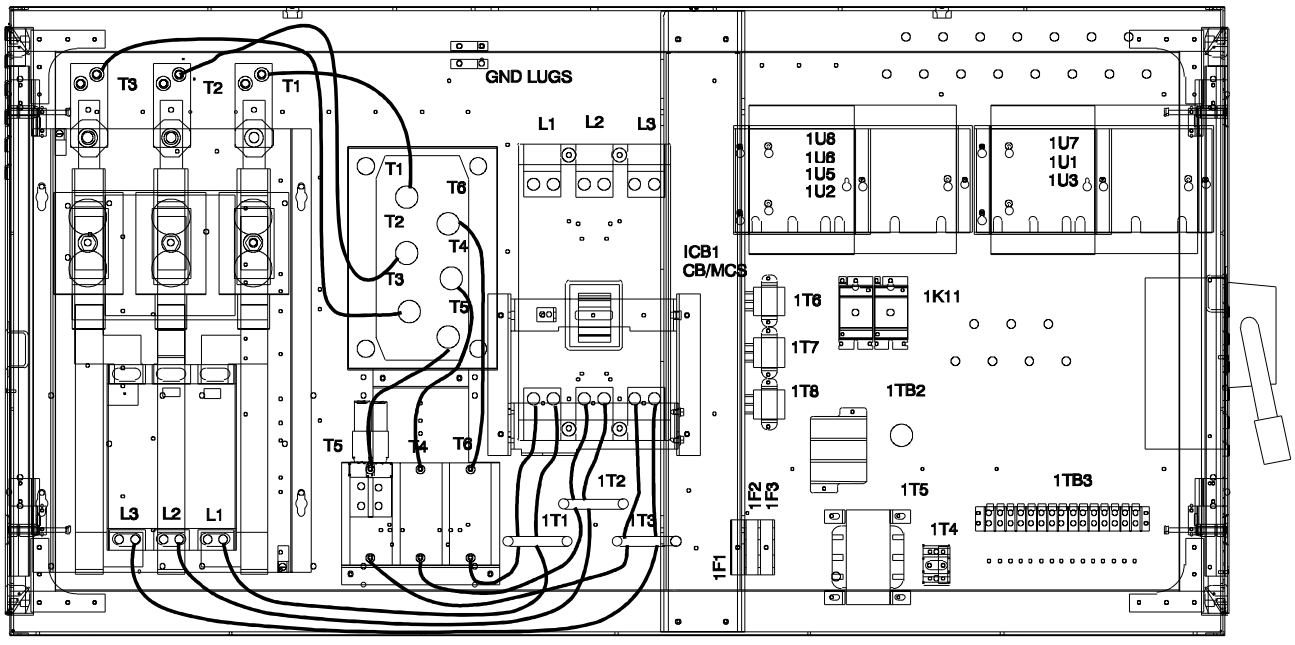
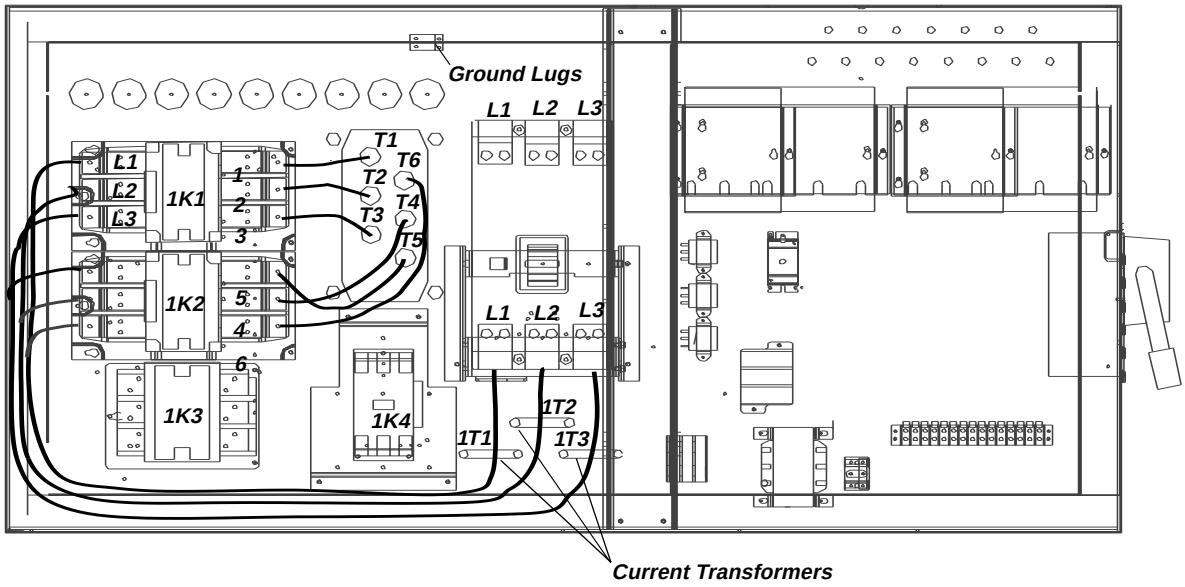


Figure 22
Motor Terminal Junction Box Wiring (Wye Delta Starter)



Module Connections for Interconnecting Wiring

All connectors can be unplugged or the wires can be removed from the screw assembly. If an entire plug is removed, make sure the plug and the associated jack are marked for proper location identification during reinstallation.

⚠ CAUTION

CAUTION: Plugs and jacks must be clearly marked before disconnecting, because specific plugs will fit into other jacks. Possible damage to equipment may occur if the plugs are reversed with the jacks.

Interconnecting Wiring (Field Wiring Required)

Important*: Do not turn chiller on or off using the chilled water pump interlocks.*

When making field connections, refer to the appropriate field layout, wiring, schematics and controls diagrams that ship with the unit. The diagrams in this manual are typical only and may not match the unit.

Whenever a contact closure (binary output) is referenced, the electrical rating is:

At 120 VAC	*7.2 amp resistive*
	2.88 amp pilot duty
	1/3 hp, 7.2 FLA, 43.2 LRA
At 240 VAC	*5.0 amp resistive*
	2.0 amp pilot duty
	1/3 hp, 3.6 FLA, 21.6 LRA

Whenever a dry contact input (binary input) is referenced, the electrical rating is 24VDC, 12 mA.

Whenever a control voltage contact input (binary input) is referenced, the electrical rating is 120 VAC, 5mA.

NOTE: Asterisked connections require the user to provide an external source of power. The 115V control power transformer is not sized for additional load.

Chilled Water Pump Control*

The chiller module (1U1) provides a contact closure output (J12-1, J12-2) to control the chilled water pump starter. This contact closure pulls in when the

external auto stop input is closed and opens when the timeout period, specified in the Service Settings group, expires after the external auto stop input opens.

Chilled Water Flow Interlock

The chiller module (1U1) requires a control voltage contact input (1TB3-14, J26-1) through a flow proving switch (5S1) and an auxiliary contact (5K1 AUX) from the chilled water pump starter that provides proof of flow.

IMPORTANT! DO NOT cycle the chiller through starting and stopping the chilled water pump. This will cause the compressor to shut down fully loaded. Use the externalstop/start input to cycle the chiller.

Condenser Water Pump Control*

The chiller module (1U1) provides a contact closure output (J14-1, J14-2) to control the condenser water pump starter. This contact closure pulls in anytime the UCP2 generates a need for cooling based on the leaving chilled water temperature versus setpoint and opens when the compressor is stopped.

Condenser Water Flow Interlock

The chiller module (1U2) requires a control voltage contact input (1TB3-15, J28-2) through a flow proving switch (5S2) and an auxiliary contact (5K2 AUX) from the condenser water pump starter that provides proof of flow.

NOTE: The following three connections have programmable functions. Each relay can be configured individually as an alarm contact, compressor contact, or a limit warning contact. Their default functions are described as follows.

See Section 5, Service Settings for details on other functions that can be assigned to these contacts.

Relay 1 - Programmable*

The chiller module (1U1) provides a normally open (J16-3, J16-1) and a normally closed (J16-3, J16-2) contact closure output that may be used to remotely indicate the compressor is running in any mode except Run Unload.

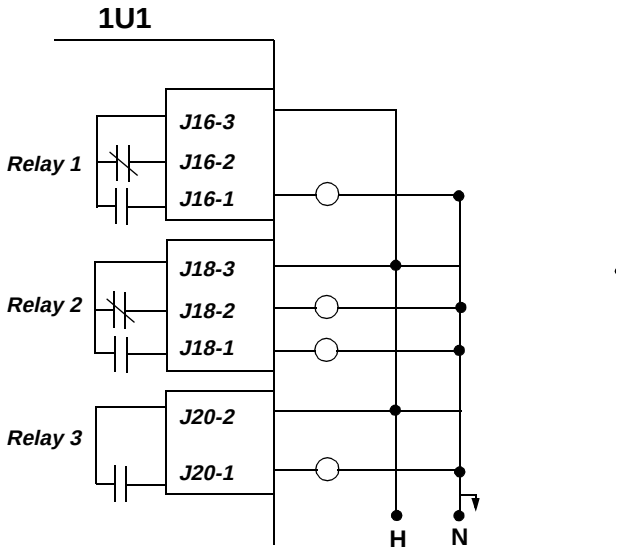
Relay 2 - Programmable*

The chiller module (1U1) provides a normally open (J18-3, J18-1) and a normally closed (J18-3, J18-2) contact closure output that may be used to remotely indicate a latching diagnostic exists.

Relay 3 - Programmable*

The chiller module (1U1) provides a normally open (J20-2, J20-1) contact closure output that may be used to remotely indicate a load limit condition (condenser, evaporator or current) existed for more than 20 minutes.

Figure 23
RTHC Electrical Installation Programmable Relays



Customer-provided 115VAC Power; Max fuse Size: 15 amp

Outdoor Air Temperature Sensor

The chiller module (1U1) provides for connection (J5-5, J5-6) of an outdoor air temperature sensor (5RT1) that may be used for outdoor air chilled water reset. The UCP2 contains the logic required, based on menu items selected, to perform these functions.

External Auto Stop

The chiller module (1U1) provides a dry contact input (J5-1, J5-2) that must be used to enable or disable the chiller from a remote location, unless a Tracer is performing this function. If this feature is not used, a jumper must be placed across this input. If the chilled water pump is controlled by the UCP2 (chiller module J12-2, J12-1), the external auto stop will start and stop the pump as described above.

Emergency Stop

The chiller module (1U1) provides a dry contact input (J5-3, J5-4) that may be used to immediately shut the chiller down. If this feature is not used, a jumper must be placed across this input. ***This method of stopping the chiller should only be used for emergency shutdowns***, because the slide valve will

not have a chance to return to the unloaded position for the next startup.

NOTE: A "panic" stop (similar to "emergency" stop) can be manually commanded using the Clear Language Display. By pressing the STOP button twice in a row, the chiller will immediately shut down, but without creating a latching diagnostic.

The CLD Stop, Tracer, commanded stop, or External Auto Stop are acceptable routine stops. In these cases, a pre-stop run-unload period is allowed for the compressor to fully unload prior to shutdown.

Operation and diagnostics are discussed in detail in sections 5 and 10.

External Base Loading

The chiller module (1U1) provides for external hard-wired control of the chiller in a mode known as "base loading."

Primarily for process control requirements, base loading provides for immediate start and loading of a chiller up to an externally or remotely adjustable current limit setpoint without regard to differential to start or stop, or to leaving water temperature control. This allows the flexibility to prestart or preload a chiller in anticipation of a large load application. It also allows you to keep a chiller on line between processes when leaving water temperature control would normally cycle the unit.

This feature is controllable either through a Tracer communication interface or a 4-20mA or 2-10VDC hard-wired analog input (J7-11, J7-12) with a binary input (J7-1, J7-2) for enable/disable. When the binary input is closed, the base load function will be enabled and the chiller will attempt to start (subject to all normal safeties and interlocks. The chiller will then load up to a current limit defined by the analog input. a 2VDC or 4 mA input corresponds to a base load of 40% RLA and a 10 VDC or 20 mA input corresponds to 100% RLA. Dip switch SW2-1 must be set ON for 4-20 mA operation.

Head Relief Request Contact

The options module (1U5) provides a contact closure output (J12-1, J12-2) that may be used to control indicating and/or auxiliary equipment in emergency situations, to provide additional heat rejection requirements. Note that this contact closes at an extreme head condition and should not be used for normal cycling of heat rejection equipment.

Tracer Controlled Contact

The options module (1U5) provides a Tracer-controlled relay normally open contact closure output (J18-1, J18-3) and normally closed contact output (J18-2, J18-3). This feature can be used for any customer-specified requirement, via programming Tracer to energize this relay.

Ice Making Contact

The options module (1U5) provides a relay contact closure output (J8-1, J8-2) that is energized any time the UCP2 is in the ice making mode. This contact can be used for any customer-specified logic such as controlling valves and pumps and transition to normal cooling after ice-making is complete.

Ice Machine Control

The options module (1U5) uses a dry contact input (J3-7, J3-8) to enable the chiller in ice-making mode. When this contact input is closed, the chiller will use the evaporator return water temperature sensor input and the active ice termination setpoint to determine if ice making is required. Ice machine control must be enabled in the UCP2 machine configuration group to perform this function.

External Chilled Water Setpoint

The options module (1U5) will accept either a 2-10 VDC or a 4-20 mA input (J9-4, J9-5) signal, to adjust the chilled water setpoint from a remote location. DIP switch SW3-1 must be set to ON for 4-20 mA or OFF for 2-10 VDC. The 2-10VDC or 4-20 mA input corresponds to a 0-65 F chilled water setpoint range, i.e. 2VDC or 4mA corresponds to 0 F and 10VDC or 20mA corresponds to 65°F.

Both external chilled water setpoint and current limit setpoint must use the same input type. External chilled water setpoint input must be installed and the type selected in the UCP2 machine configuration group.

External Current Limit Setpoint

The options module (1U5) will accept either a 2-10VDC or a 4-20mA input (J7-11, J7-12) signal to adjust the current limit setpoint from a remote location. DIP switch SW2-1 must be set to ON for 4-20mA or OFF for 2-10VDC. The 2-10VDC or 4-20mA input corresponds to a 40-120 percent current limit setpoint range i.e. 2VDC or 4 mA corresponds to 40 percent and 10VDC or 20mA corresponds to 120 percent.

Both external chilled water setpoint and current limit setpoint must use the same input type. External current limit setpoint input must be installed and the type selected in the UCP2 machine configuration group.

Tracer Temperature Sensor Option

The options module (1U5) accepts input (J7-7, J7-8) from a temperature sensor (5RT2) that may be used by Tracer for chilled water reset, ambient lockout, or other user-specified functions performed by the Tracer logic.

Percent Condenser Pressure Output

The options module (1U5) provides a 2-10 VDC output (J7-1, J7-2) signal that is proportional to the percent condenser pressure. At 2 VDC output, the condenser pressure is 0 psia and at 10 VDC output, the condenser pressure is equal to the high pressure cutout (psia) specified in the UCP2 machine configuration group. This output may be used for any user-specified function such as cooling tower water temperature control or input to a generic building automation system. Note that in many applications such as tower control, events must take place before reaching either end of the scale, and an appropriate band must be selected for proper, steady control. Refer to the instructions supplied with the controlled device for setup.

Compressor Percent RLA Output

The options module (1U5) provides a 2-10 VDC output (J7-3, J7-4) signal that is proportional to the percent compressor RLA.

Operating Principles - Mechanical

This section contains an overview of the operation and maintenance of Series R chillers equipped with microcomputer-based control systems. It describes the overall operating principles of the Series R design.

Following the section is information regarding specific operating instructions, detailed descriptions of the unit controls and options (section 5), and maintenance procedures that must be performed regularly to keep the unit in top condition (sections 8, 9). Diagnostic information (section 10) is provided to allow the operator to identify system malfunctions.

NOTE: To ensure proper diagnosis and repair, contact a qualified service organization if a problem should occur.

General

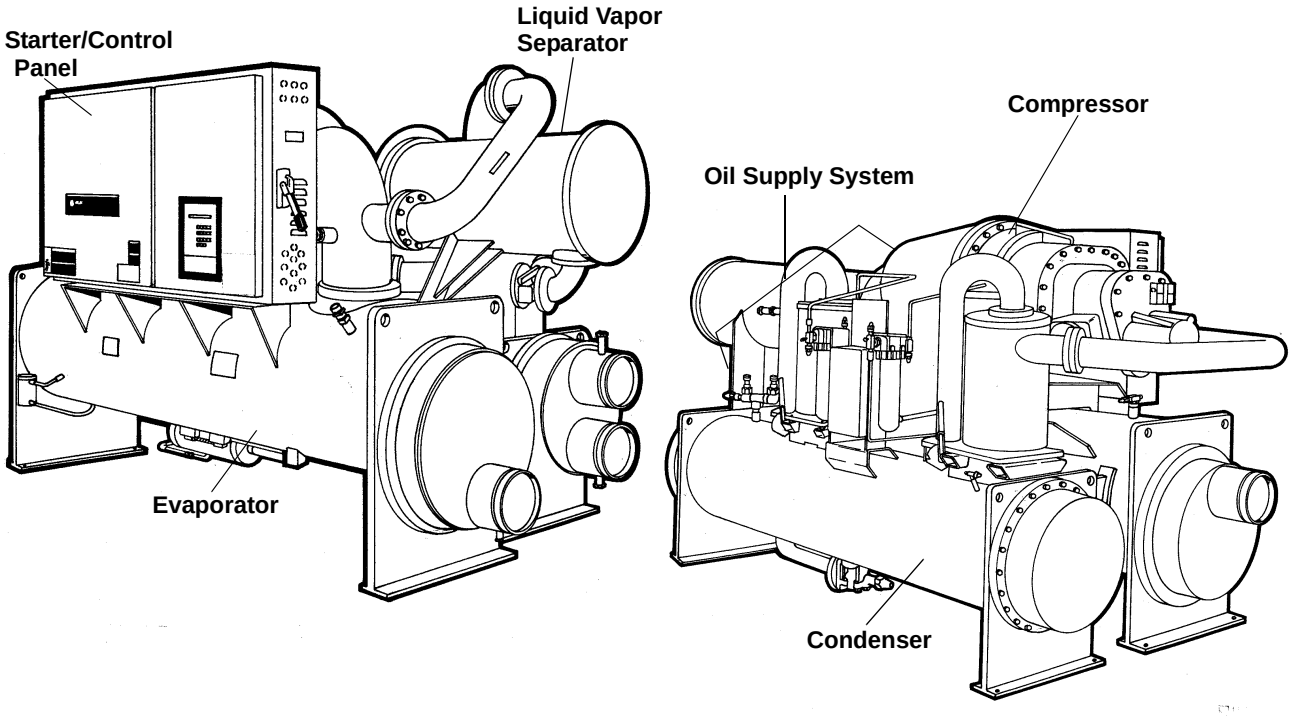
The Model RTHC units are single-compressor, helical-rotary type water-cooled liquid chillers. These units are equipped with unit-mounted starter/control panels.

The basic components of an RTHC unit are:

- Unit-mounted panel containing starter and UCP2 microprocessor
- helical-rotary compressor
- evaporator
- electronic expansion valve and liquid-vapor separator
- water-cooled condenser with integral subcooler
- oil supply system
- oil cooler (application dependent)
- related interconnecting piping.

Components of a typical RTHC unit are identified in *Figure 24* .

Figure 24
RTHC - Basic Unit Components



Refrigeration (Cooling) Cycle

The refrigeration cycle of the Series R chiller is conceptually similar to that of other Trane chiller products. It makes use of a shell-and-tube evaporator design with refrigerant evaporating on the shell side and water flowing inside tubes having enhanced surfaces.

The compressor is a twin-rotor helical rotary type. It uses a suction gas-cooled motor that operates at lower motor temperatures under continuous full and part load operating conditions. An oil management system provides oil-free refrigerant to the shells to maximize heat transfer performance, while providing lubrication and rotor sealing to the compressor. The lubrication system ensures long compressor life and contributes to quiet operation.

Condensing is accomplished in a shell-and-tube heat exchanger where refrigerant is condensed on the shell side and water flows internally in the tubes.

Refrigerant is metered through the flow system using an electronic expansion valve, that maximizes chiller efficiency at part load.

A unit-mounted starter and control panel is provided on every chiller. Microprocessor-based unit control modules (UCP2) provide for accurate chilled water control as well as monitoring, protection and adaptive limit functions. The “adaptive” nature of the controls intelligently prevents the chiller from operating outside of its limits, or compensates for unusual operating conditions, while keeping the chiller running rather than simply tripping due to a safety concern. When problems do occur, diagnostic messages assist the operator in troubleshooting.

Cycle Description

The refrigeration cycle for the RTHC chiller can be described using the pressure-enthalpy diagram shown in *Figure 25* . Key State Points are indicated on the figure and are referenced in the discussion following. A schematic of the system showing the refrigerant flow loop as well as the lubricant flow loop is shown in *Figure 26* .

Evaporation of refrigerant occurs in the evaporator that maximizes the heat transfer performance of the heat exchanger while minimizing the amount of refrigerant charge required. A metered amount of refrigerant liquid enters a distribution system in the evaporator shell and is then distributed to the tubes in the evaporator tube bundle. The refrigerant vaporizes as it cools the water flowing through the evaporator tubes. Refrigerant vapor leaves the evaporator as saturated vapor (State Pt. 1).

The refrigerant vapor generated in the evaporator flows to the suction end of the compressor where it enters the motor compartment of the suction-gas-cooled motor. The refrigerant flows across the motor, providing the necessary cooling, then enters the compression chamber. Refrigerant is compressed in the compressor to discharge pressure conditions. Simultaneously, lubricant is injected into the compressor for two purposes: (1) to lubricate the rolling element bearings, and (2) to seal the very small clearances between the compressor’s twin rotors. Immediately following the compression process the lubricant and refrigerant are effectively divided using an oil separator. The oil-free refrigerant vapor enters the condenser at State Pt. 2. The lubrication and oil management issues are discussed in more detail in the compressor description and oil management sections that follow.

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

As the refrigerant leaves the bottom of the condenser (State Pt. 3), it enters an integral subcooler where it is subcooled before traveling to the electronic expansion valve (State Pt. 4). The pressure drop created by the expansion process vaporizes a portion of the liquid refrigerant. The resulting mixture of liquid and gaseous refrigerant then enters the liquid-vapor separator chamber (State Pt. 5). At this point the available refrigerant vapor is routed directly to the compressor suction (State Pt. 1). All remaining liquid refrigerant enters the evaporator (State Pt. 6).

The RTHC chiller maximizes the evaporator heat transfer performance while minimizing refrigerant charge requirements. This is accomplished by metering the liquid refrigerant flow to the evaporator’s distribution system using the electronic expansion valve. A relatively low liquid level is maintained in the evaporator shell, which contains a bit of surplus refrigerant liquid and accumulated lubricant. A liquid level measurement device monitors this level and provides feedback information to the UCP2 unit controller, which commands the electronic expansion valve to reposition when necessary. If the level rises, the expansion valve is closed slightly, and if the level is dropping, the valve is opened slightly such that a steady level is maintained.

Figure 25
Pressure /Enthalpy Curve

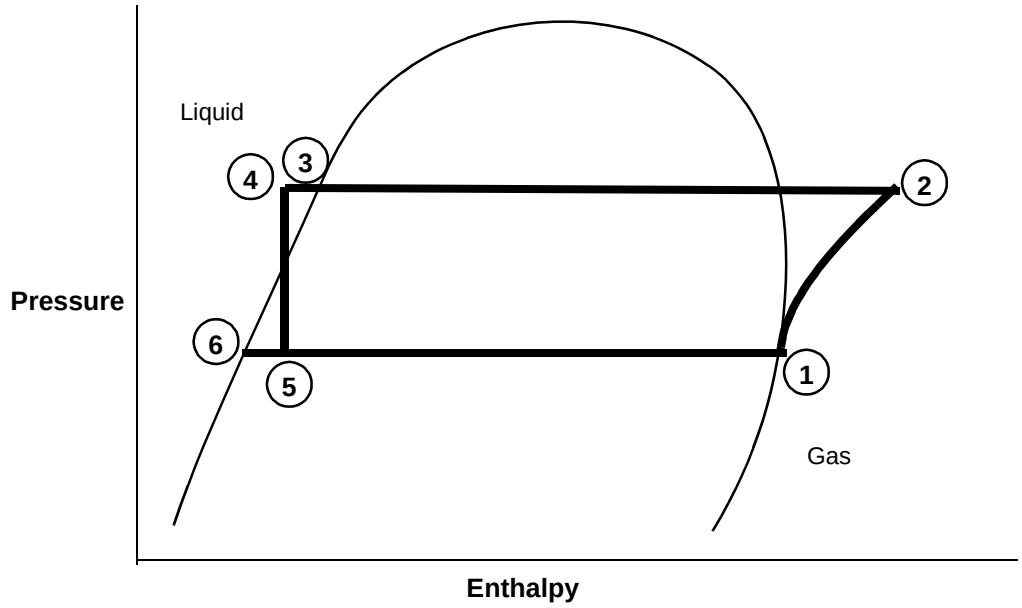
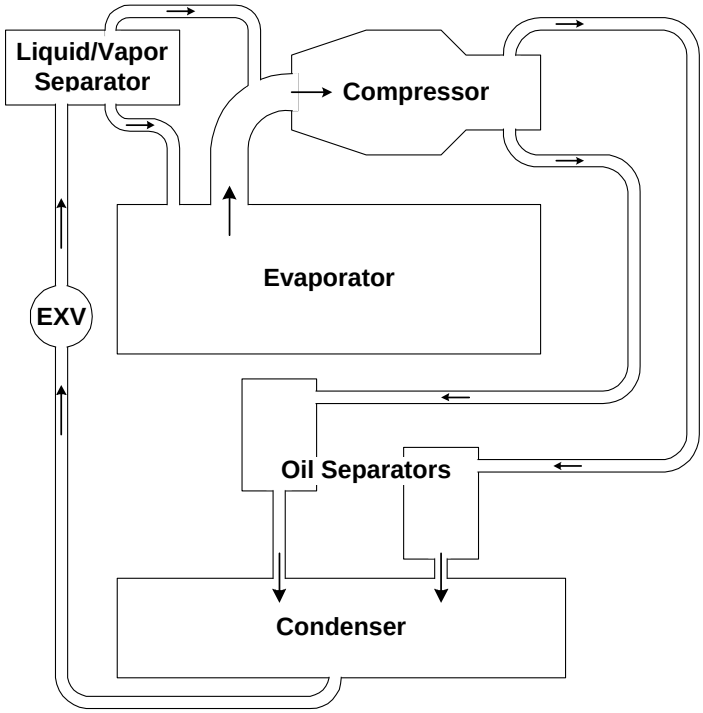
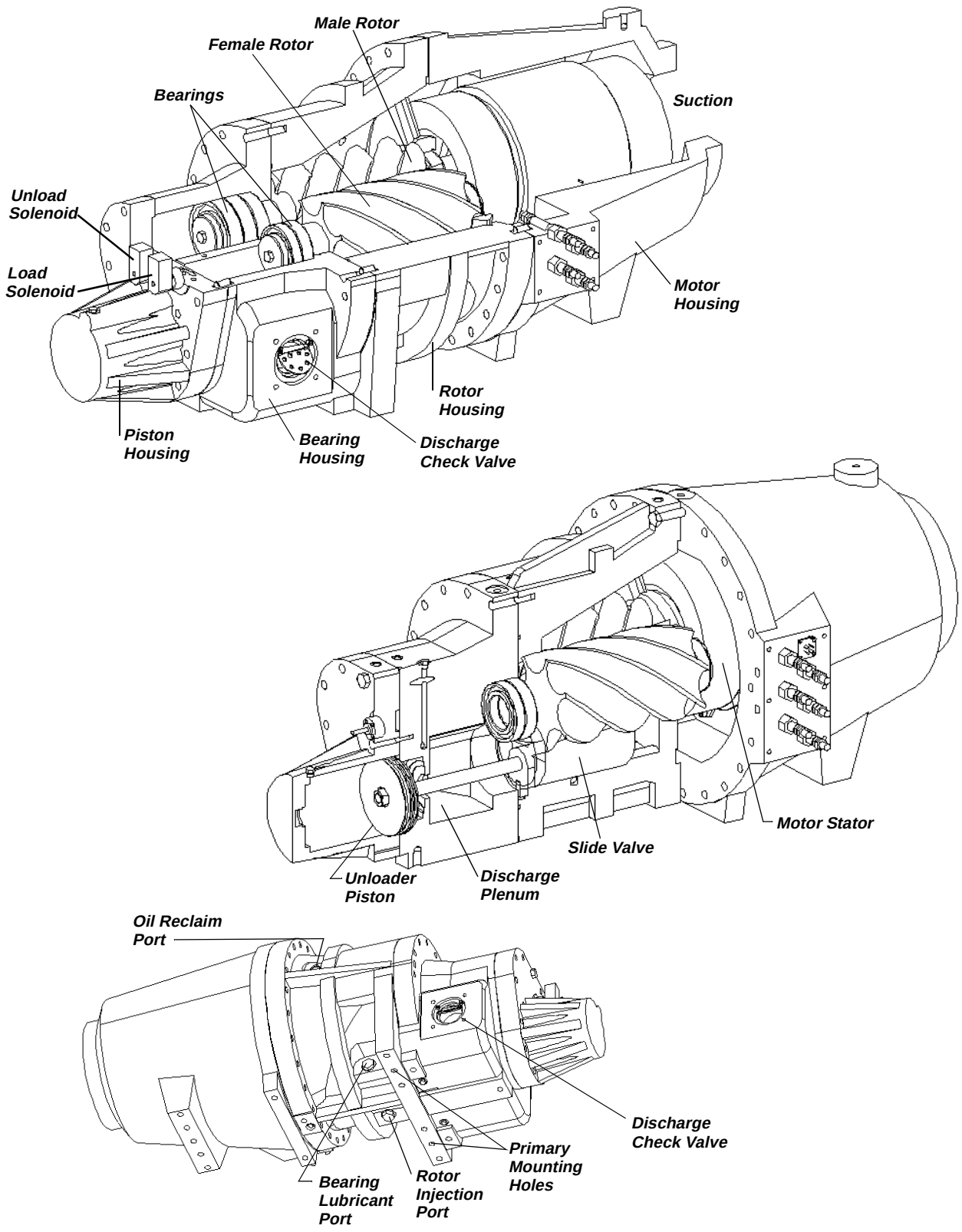


Figure 26
Refrigerant Flow Diagram



Compressor Description

Figure 27
RTHC Compressor



The compressor used by the Series R chiller consists of three distinct sections: the motor, the rotors and the bearing housing. Refer to *Figure 27*.

Compressor Motor

A two-pole, hermetic, squirrel-cage induction motor directly drives the compressor rotors. The motor is cooled by suction vapor drawn from the evaporator and entering the end of the motor housing *(Figure 27)* .

Compressor Rotors

Each Series R chiller uses a semi-hermetic, 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 that controls capacity. See *Figure 27*. 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 on the RTHC units. The slide valve is located below (and moves along) the rotors.

The helical rotary compressor is a positive displacement device. As shown in *Figure 27*, refrigerant from the evaporator is drawn into the suction opening at the end of the motor section. The gas is drawn across the motor, cooling it, and then into the rotor section. It is then compressed and released directly into the discharge plenum.

There is no physical contact between the rotors and compressor housing. Oil is injected into the bottom 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/bearing housing sections of the compressor. Positioned along the bottom of the rotors, the slide valve is driven by a piston/cylinder along an axis that parallels those of the rotors (*Figure 27*).

Compressor load condition is dictated by the coverage of the rotors by the slide valve. When the slide valve fully covers the rotors, the compressor is fully loaded. Unloading occurs as the slide valve moves away from the suction end of the rotors. Slide valve unloading lowers refrigeration capacity by reducing the compression surface of the rotors.

Slide Valve Movement

Movement of the slide valve piston (*Figure 27*) determines slide valve position which, in turn, regulates compressor capacity. Compressed vapor flowing into and out of the cylinder governs piston movement, and is controlled by the load and unload solenoid valves, 4L2 and 4L3.

The solenoid valves (both normally closed) receive “load” and “unload” signals from the UCP2, based on system cooling requirements. To load the compressor, the UCP2 opens the load solenoid valve (4L2). The pressurized vapor flow then enters the cylinder and, with the help of the lower suction pressure acting on the face of the unloader valve, moves the piston over the rotors toward the suction end of the compressor.

The compressor is unloaded when the unload solenoid valve (4L3) is open. Vapor “trapped” within the cylinder is drawn out into the lower-pressure suction area of the compressor. As the pressurized vapor leaves the cylinder, the slide valve slowly moves away from the rotors toward the discharge end of the rotors.

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

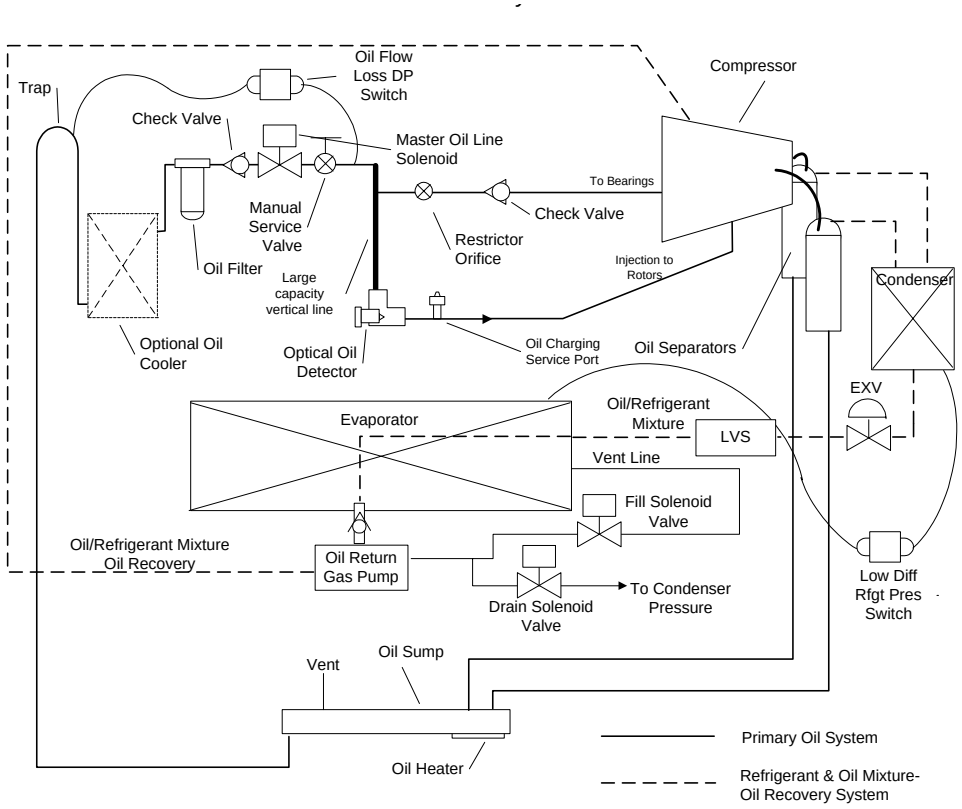
On compressor shutdown, the unload solenoid valve is energized. Springs assist in moving the slide valve to the fully-unloaded position, so the unit always starts fully unloaded.

Oil Management System

Oil Separator

The oil separator consists of a vertical cylinder surrounding an exit passageway. Once oil is injected into the compressor rotors, it mixes with compressed refrigerant vapor and is discharged directly into the oil separator. As the refrigerant-and-oil mixture is discharged into the oil separator, the oil is forced outward by centrifugal force, collects on the walls of the cylinder and drains to the bottom of the oil separator cylinder. The accumulated oil then drains out of the cylinder and collects in the oil sump located near the bottom of the chiller.

Figure 28
Oil Flow Diagram



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

Oil Flow Protection

Oil flowing through the lubrication circuit flows from the oil sump to the compressor (see *Figure 28*). As the oil leaves the oil sump, it passes through two service valves, an oil cooler (if used), oil filter, and master solenoid valve. Oil flow then splits into two distinct paths, each performing a separate function: (1) bearing lubrication and cooling, and (2) compressor oil injection.

Oil flow and quality is proven through a combination of a number of sensors, most notably two differential pressure switches and the optical oil level sensor.

If for any reason oil flow is obstructed because of a plugged oil filter, closed service valve, faulty master solenoid, or other source, a differential pressure (DP) switch will give a “high” reading (as factory-calibrated) and shut down the chiller. The differential pressure switch is factory set to open and trip on a pressure rise above 20 psid for systems without an oil cooler and 35 psid for systems with an oil cooler.

Likewise, the optical oil level sensor can detect the lack of oil in the primary oil system (which could result from improper oil charging after servicing, or oil logging in other parts of the system). The sensor can prevent the compressor from starting or running unless an adequate volume of oil is present. The combination of these two devices, as well as diagnostics associated with extended low system differential pressure and low superheat conditions, can protect the compressor from damage due to severe conditions, component failures, or improper operation.

If the compressor stops for any reason, the master solenoid valve closes; this isolates the oil charge in the sump during “off” periods. The check valves in the primary oil system prevent reverse flow that the solenoid valve may be unable to contain or “injector-to-bearing” oil flow immediately following compressor shutdown. Such flows would otherwise clear out oil from the lines and the oil sump, which is an undesirable effect.

To ensure the required system differential pressure is adequate to move oil to the compressor, the UCP2 monitors both the 7.7 psid differential switch mounted between the evaporator and the condenser and the temperature sensors mounted in both the evaporator

and condenser. If the differential is lower than required, the unit will latch out and may start a “low system differential restart inhibit timer,” if necessary, to cool the rotors.

To ensure proper lubrication and minimize refrigerant condensation in the oil sump, a heater is mounted on the side of the oil sump. A signal from the UCP2 energizes this heater during the compressor off cycle to maintain proper oil temperature. The heater element is continuously energized while the compressor is off and does not cycle on temperature.

Oil Filter

All Series R chillers are equipped with replaceable-element oil filters. Each removes any impurities that could foul the compressor internal oil supply galleries. This also prevents excessive wear of compressor rotor and bearing surfaces and promotes long bearing life. Refer to the Section 9 for recommended filter element replacement intervals.

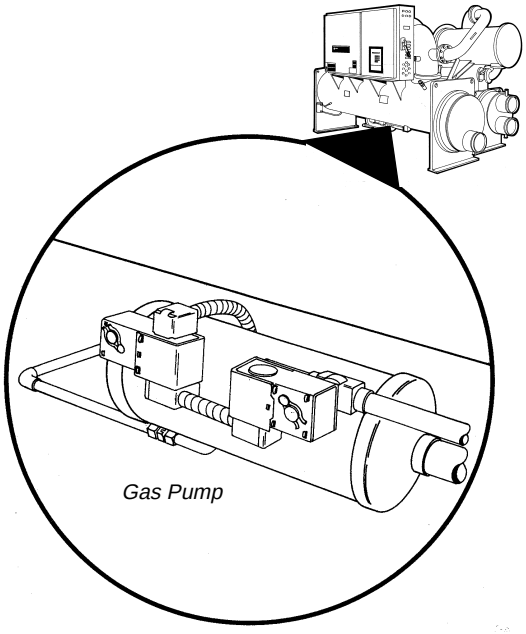
Compressor Bearing Oil Supply

Oil is injected into the rotor housing where it is routed to the bearing groups located in the motor and bearing housing sections. Each bearing housing is vented to compressor suction so oil leaving the bearings returns through the compressor rotors to the oil separator.

Compressor Rotor Oil Supply

Oil flowing through this circuit enters the bottom of the compressor rotor housing. From there it is injected along the rotors to seal clearance spaces around the rotors and lubricate the contact line between the male and female rotors.

Lubricant Recovery



Despite the high efficiency of the oil separators, a small percentage of oil will get past them, move through the condenser, and eventually end up in the evaporator. This oil must be recovered and returned to the oil sump. The function of active oil return is accomplished by a pressure-actuated pump referred to as the “gas pump.”

The gas pump, mounted just beneath the evaporator, is a cylinder with four ports controlled by two solenoids. The pump serves to return accumulating oil in the evaporator to the compressor at regular time intervals. As the refrigerant-oil mixture enters the gas pump from the bottom of the evaporator, a fill solenoid opens to allow refrigerant vapor to be vented into the top of the evaporator, and is then closed. A second solenoid then opens to allow refrigerant at condenser pressure to enter the gas pump. Simultaneously, a check valve prevents reverse flow back into the evaporator. A liquid refrigerant and oil mixture is displaced from the gas pump cylinder and is directed through a filter to the compressor. The oil then combines with oil injected into the compressor and returns to the oil sump via the oil separators.

Oil Cooler

The oil cooler is a brazed plate heat exchanger located near the oil filter. It is designed to transfer approximately one ton of heat from the oil to the suction side of the system. Subcooled liquid is the cooling source.

The oil cooler is required on units running at high condensing or low suction temperatures. The high discharge temperatures in these applications increase oil temperatures above the recommended limits for adequate lubrication and reduce the viscosity of the oil.

Operator Interface - Controls

This section contains an overview of the operator interface with the Series R chillers equipped with microcomputer-based control systems. It presents the array of options available using the Clear Language Display and the associated keypad.

The section is organized first as a discussion of the control system and the individual modules, showing their relationship and functions.

The remainder of the section presents information on accessing available chiller information using the screens to either monitor or change settings and setpoints. This part of the section covers information available to you by pressing each report key followed by the settings, tests, and diagnostics keys.

The display information is for reference only and not in the form of sequential operating or controls instructions, although certain specific instructions as to programming and changing settings is given. In many cases, background information on specific key or controls functions is provided.

In all cases, other than report data displays, caution should be observed before changing any parameters until the impact of the change on chiller performance is understood.

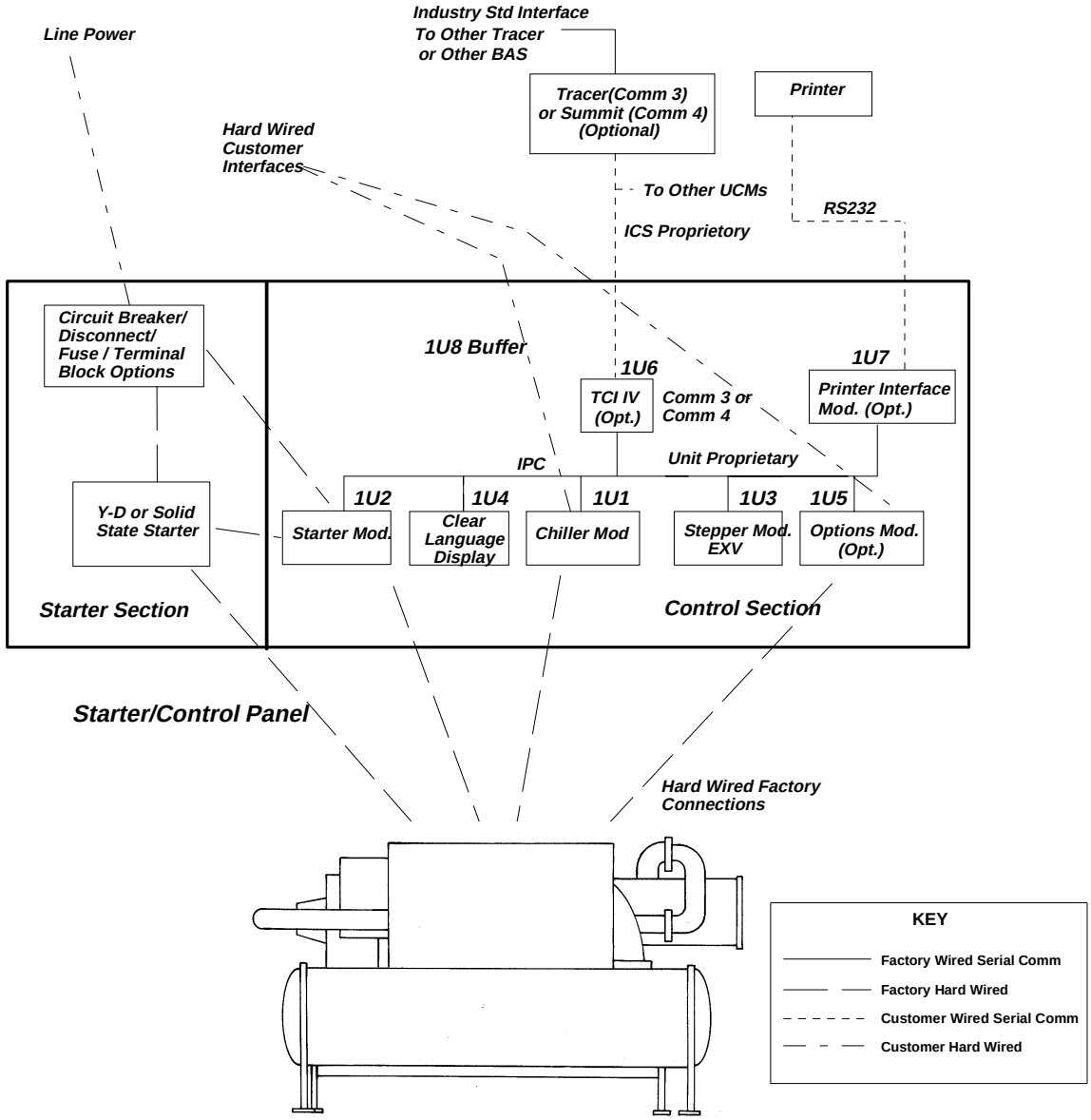
Following this section, sections 6 and 7 cover the actual startup and shutdown sequences. Maintenance schedules and procedures that must be performed to keep the unit in top condition are in sections 8 and 9. Diagnostic information (section 10) is provided to allow you to identify system malfunctions.

UCP2 Microprocessor Control System

The Unit Control Panel version 2 (UCP2) microprocessor control system is a collection of modules and software that perform system control, protection, and optimization functions for the RTHC chiller. All module control elements reside in the control panel usually “stacked” on top of one another and mounted on the panel’s backplane. Additionally, the Clear Language Display operator interface is mounted on the panel door.

The “Control System Block Diagram.” on page 2 accompanies the discussion in the following paragraphs that describe the modules and the specific chiller operating characteristics that are displayed and reported.

Figure 29
Control System Block Diagram.



Chiller Module - 1U1

The chiller module is the central processing unit of the chiller communicating commands to other modules and collecting data/status/diagnostic information from other modules over the IPC (inter processor communications) link. The chiller module performs the leaving chilled water temperature and limit control algorithms, setting capacity against any operating limit constraining the chiller.

The chiller module contains non-volatile memory, checking for valid set points and retaining them on any power loss.

Inputs and outputs include chilled water system level input/output (I/O) such as evaporator and condenser

water temperatures, evaporator and condenser water pump control, and general status and alarm relays. Other machine inputs and outputs include compressor load and unload pulse outputs, oil return pump control and oil lubrication system control and flow protection.

Stepper Module - 1U3

The stepper module is designed to drive the stepper motor electronic expansion valve. The stepper module uses liquid level inputs and stepper motor outputs to run the algorithm to control liquid level in the evaporator. The output of the control algorithm drives the electronic expansion valve. Other module I/O capabilities support general machine protection and control, including evaporator and condenser refrigerant temperatures.

Starter Module - 1U2

The starter module provides control of the starter when starting, running and stopping the motor. The starter module provides interface to, and control of, Y-Delta and solid state starters. The starter module also provides protection to both the motor and the compressor such as running overload, phase reversal, phase loss, phase unbalance and momentary power loss.

Options Module - 1U5

The options module satisfies control or interface requirements for a number of options. Some of these options are standalone such as generic BAS interface. Other options support either additions or modifications to the chiller itself. Some features supported by the options module are ice making, external chilled water setpoint and external current limit setpoint.

COMM 3 or COMM 4 (Tracer Interface)- 1U6

Two communication modules are available for various communication functions. One available option provides a 9600 baud non-isolated link to Tracer Summit (Comm 4) and another can provide a similar, but isolated, communications link to existing Tracer 100 systems (Comm 3).

Printer Interface Module - 1U7

The printer interface module provides a pre-formatted chiller log to the printer. The printer interface can be programed, via the Clear Language Display, to print a chiller log on command at the time of a diagnostic or on a periodic basis.

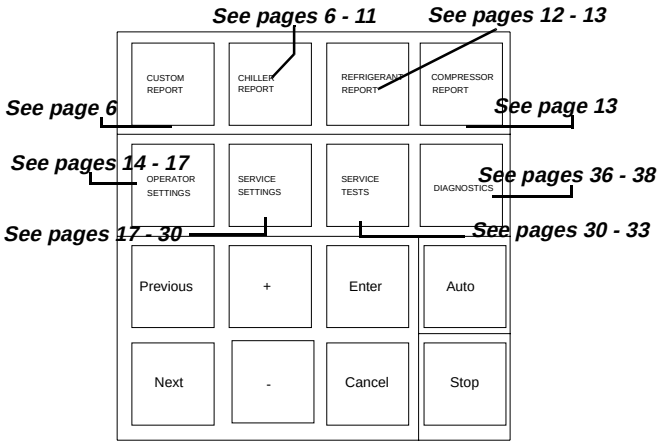
Clear Language Display (CLD) - 1U4

The local Clear Language Display is mounted on the control panel door and displays chiller data and gives access to operation/service controls, set points and chiller setup information or configuration. All setpoints and other settings are stored in non-volatile memory in the chiller module. The interface is programmed with a variety of languages.The display on the Clear Language Display is a two-line, 40 character liquid crystal. The display has a backlight so that it can be read in low light conditions.

In addition to the alpha-numeric liquid crystal display, a red “alarm” LED is installed that flashes ON-OFF whenever a latching diagnostic (requiring manual reset) is present. The red LED is also used to indicate that a function or control has been set to manual from within the service test menu for a maintenance task such as oil line charging. If a control has been set to manual, the LED is ON continuously. If a diagnostic is active while some function is in a manual mode, the LED will flash ON-OFF. Diagnostic displays and resetting procedures are discussed in Section 10.

A membrane keypad is used on the unit-mounted operator interface. The keypad is sealed, making it weather-proof and dirt-proof. The keypad has 16 keys arranged in a 4-by-4 matrix as shown in *Figure 30* .

Figure 30
Clear Language Display Key Assignments



Complex Character Clear Language Display (CCCLD)

The CCCLD is available as an option. This display functions identically to the CLD, but has a higher resolution that can support complex character sets such as those peculiar to Chinese, Korean, and Kanji.

Keypad functions are identical but the keys are “soft labeled” with the text describing them incorporated into the display in the appropriate language.

Key Functions

Report Groups

The top row of keys on the CLD provides for “view only” access to all the available chiller information in the form of three major Report Groups and one user-defined Custom Report.

The Chiller, Refrigerant, and Compressor Reports each contain a number of related items (temperatures, pressures, currents, etc.) arranged in a pre-determined order. (Values displayed are updated approximately every 2 seconds.) These items can be accessed by selecting and pressing the desired Report key that brings up the group’s “header” screen describing the type of information available in that group. *(NOTE: The header screen may be bypassed by disabling the “Menu Headings” feature under the Service Settings Group, in which case the first data item in the group will be shown.)*

The <Next> and <Previous> keys can then be used to scroll from one report item to the next. As the last item is reached, continued scrolling will cause the display to wrap around to the beginning of the report group.

More information about what items are included in each of the reports is provided later in this section.

The Custom Report allows you to select items from any of the other three Report Groups, in any order, so that frequently read information can be more quickly accessed. Refer to the paragraph on Custom Report Group Programming for information on how to set up the Custom Report.

Settings Groups

The second row of keys provide access to all adjustable setpoints, settings, and commands as divided into four major Settings Groups. Items in the Operator Settings, Service Settings, Service Tests, and Diagnostics Group can be accessed by selecting and pressing the desired Settings Group Key that will bring up the Header screen describing the type of settings available in that menu.

The <Next> and <Previous> keys allow you to move through the menu’s items not just to view the settings but to change them. Some items are password-protected; others or all, however, can be locked out within any of these settings groups without requiring the password. Items included in each of the Settings Groups, as well as password protection features, are discussed later in this section.

Changing Settings or Setpoints

Once the particular setting is displayed on the screen, pressing the <+> or <-> key will cause the setting that is displayed to increment or decrement (increase or decrease), respectively. If the <+> or <-> key is held down for more than 1/2 second, it will increase or decrease the setting continuously, at approximately 10 counts per second, until the key is released. If the key is held down for 10 seconds, the setting will change at ten times its normal incremental value.

To prevent inadvertent changes, a changed setting is not stored until the <Enter> key is pressed. The <Cancel> key may be pressed if a changed setting should not be saved. Once the <+> or <-> key has been pressed to change a particular setting, the display will show that setting but not store or save it *until the <Enter> or <Cancel> key is pressed*. The display will blank out for a moment after the <Enter> key is pressed, to indicate to the user that the key stroke has been recognized.

Note that the <Stop> and <Auto> keys act immediately and do not require the use of the <Enter> key.

STOP, AUTO

The chiller will stop when the <Stop> key is pressed, entering the run unload mode. The <Stop> key has a red background. If <Stop> is pressed a second time within five seconds, an immediate “panic stop” will be executed, bypassing the normal compressor unload period. During the five second period, a message is displayed indicating the optional command.

If the <Stop> key is pressed again during this five-second period, a message will be displayed for two seconds indicating that the panic stop is being executed.

To execute a panic stop, first press the <Stop> key.

The message displayed during the five seconds after the <Stop> key is pressed is:

IF (STOP) IS PRESSED DURING THIS DISPLAY
**** A PANIC STOP WILL BE EXECUTED ****

If the <Stop> key is pressed *again* during this five second period, the following message will be displayed for two seconds before reverting to the first screen of the chiller report where the current unit operating mode message is given. (These messages are discussed in the chiller report section.)

**** EXECUTING PANIC STOP ****

If the <Stop> key is not pressed during this five second period, the chiller will enter the Run Unload mode and the display will go to the first display of the chiller report.

If the chiller is in the Stop mode, pressing the <Auto> key causes the chiller to go into the auto/local or Auto/Remote mode. The <Auto> key is recognized by its green background color.

When the <Auto> or <Stop> keys are pressed, the display will go to the first display of the chiller report.

Communications and Settings Storage

The individual modules identified earlier in this section communicate via the InterProcessor Communication (IPC) link. The IPC allows the modules to work together to direct overall chiller operation, each module handling specific functions.

In the IPC communication protocol, the 1U1 is the initiator and arbitrator of all module communication. The 1U1 requests “packets” of information from each module in a preset sequence. The other modules respond only and cannot initiate communication. Specific IPC diagnostic techniques are discussed in section 10.

The settings used by the unit are stored in the chiller module, not in the Clear Language Display. The chiller module is also responsible for verifying that the settings memory is not corrupted. It substitutes safe default settings if the stored settings become corrupted and generates appropriate warnings or diagnostics.

If there is no IPC communication between the chiller module and the Clear Language Display at power up, the following is displayed:

No Communications - Data Not Valid

Once IPC communications have been established, the “Data Not Valid” display is used if all chiller module communications are lost for more than 5 seconds.

The Clear Language Display automatically displays the chiller operating mode (the first screen in the chiller report) after a normal power-up or after communications is re-established.

Internal communications with the Clear Language Display is not necessary for the chiller to run. However, the chiller will require Clear Language Display communications to occur at least once in 15 seconds or an informational diagnostic screen will result.

If the operator changes a setting that is communicated to the chiller module but not accepted (after 30 seconds of no key activity), the following message is displayed at the end of the chiller report:

Setting Was Not Acknowledged By Chiller
Press (Next) (Prev) To Continue

If many settings are changed in a short time or if setting changes are communicated to the chiller module but not acknowledged, the transmit buffer may become full and not able to accept additional changes. If that happens the following message is displayed for 2 seconds:

HI Xmit Buffer is Full

The Clear Language Display will generally clear its transmit buffer without the message indicating the cause of the communications problem. Persistent problems should be referred to Trane Service.

Custom Report Group - Programming Instructions

Reports are added to the custom report group by pressing the <+> key when the desired report is being displayed from its normal report location.

Reports are removed from the custom report group by pressing the <-> key when the desired custom report is being displayed.

The custom report group can contain a maximum of 20 displays. If you attempt to add more than 20 displays, the following message:

Custom Report Is Full, Report Not Added

is displayed for two seconds, indicating that the custom report is full.

If you attempt to add a report to custom report when it is already stored in custom report, the message:

Report Already In Custom Menu

will be displayed for two seconds.

NOTE: Only displays from the chiller refrigerant or compressor reports can be added to the custom report.

The custom report sequence is as follows:

User Defined Custom Report
Press (Next) (Previous) to Continue

If items are selected for the custom report, the report heading and the selected items are displayed sequentially as <Next> or <Previous> is pressed.

Should no entries be selected for the custom report, however, the second entry is:

No Items Are Selected For Custom Report
See Operator's Manual To Select Entries

The report then wraps around to the report heading when <Next> is pressed.

Chiller Report

The Chiller Report displays chiller status, water temperatures settings, and setpoints. The sequence of displays is as follows:

Chiller Status, Water Temps & Setpts
*"Press (Next) (Previous) to Continue**

Continuing, the following report option is given:

Press (Enter) for ASHRAE Guideline 3 Rpt *Press (Next) (Previous) To Continue*

If <Enter> is pressed, the ASHRAE Guideline 3 Report menu comes up. Pressing <Next> brings up the standard report as described in the following paragraphs beginning with the chiller operating mode. The report selection is a matter of preference, although slightly different parameters are displayed as shown in the comparison *Table 15* following, the numbers corresponding to the order displayed:

Table 15

Parameter Displayed	*Sequence*	
	Standard Report	*ASHRAE Report*
Operating Mode	*1*	*2*
Chilled Water Setpoint/Source	*2*	*3*
Evap Leaving Water Temp		

Table 15

Parameter Displayed	*Sequence*	
	Standard Report	*ASHRAE Report*
Ice Termination Setpoint/Source	*3*	*4*
Reset Chilled Water Setpoint/ Source	*4*	
Evap Entering Water Temp	*5*	*4*
Condenser Entering Water Temp.	*6*	*12*
Condenser Leaving Water Temp		
Current Limit Setpoint/Source	*7*	*5*
Active Current Limit Setpt/Setting Source	*8*	
Outdoor Air Temp	*9*	
Time/Refrigerant Type		*1*
Refrigerant Monitor (option only)		*6*
Saturated Evap Refgt Temp		*7*
Compressor Discharge Temp		
Compressor Starts/Running Time		*8*
Evap Refgt Pressure		*9*
Evap Approach Temp		*10*
Chilled Water Flow Switch Status		*11*
Saturated Cond Temp		*13*
Condenser Refrigerant Pressure		
Condenser Approach Temp		*14*
Cond Water Flow Switch Status		*15*

The chiller operating modes display comes up first in the standard report:

[Operating mode line 1]
[Operating mode line 2]

Line 1 (and 2 if needed) indicates a current condition of the unit as shown in the following table *(Table 16)* . In some cases, an associated timer or system parameter will be displayed that assures the transition to an expected mode is in progress, particularly during the unit start-up sequence.

Table 16
Operating Modes

Unit Operation	Operating Mode Display* (First Line/Second Line)
	Resetting
Stop	*Local Stop: Cannot Be Overridden By Any External Or Remote Device*
Stop	*Remote Display Stop: Chiller May Be Set To Auto By Any Ext Or Rmt Device*
Stop	*Remote Run Inhibit From External Source*
Stop	*Remote Run Inhibit From Tracer*
Stop	*Diagnostic Shutdown Stop*
Auto	*Diagnostic Shutdown Auto*
Auto	*Auto Waiting For Evaporator Water Flow*
Auto	*Auto Waiting For A Need To Cool*
Auto	*Waiting For Tracer Communications To Establish Operating Status*
Auto	*Starting Is Inhibited By Staggered Start Time Remaining: MIN:SEC*
Auto	*Starting Is Inhibited By Restart Inhibit Timer: Time Remaining MIN:SEC*
Auto	*Low Diff Rfgt Pres- Overheated Cprsr cool-down Time Remaining: [min:sec]*
Initialize	*Establishing Cond Water Flow Positioning Electronic Expansion Valve*
Initialize	*Establishing Cond Water Flow Time Remaining: MIN:SEC*
Initialize	*Cond Water Is Flowing Positioning Electronic Exp Valve*
Initialize	*Cond Water Is Flowing PreStart Unload Time Remaining: MIN:SEC*
Start	*Starting Compressor*
Run	*Unit Is Running*
Run	*Unit Is Running Capacity Limited By High Current*
Run	*Unit Is Running Capacity Limited By Phase Unbalance*
Run	*Unit Is Running Capacity Limited By High Cond Press*
Run	*Unit Is Running Capacity Limited By Low Evap Temp*
Run	*Unit is Running Establishing Minimum Capacity Limit*

Unit Operation	Operating Mode Display* (First Line/Second Line)
Run	*Unit Is Running; Capacity Limited By Pulldown Rate Based Soft Loading*
Run	*Unit Is Running; Capacity Limited By Current Based Soft Loading*
Auto	*Auto Waiting For Condenser Water Flow*
Run	*Unit is Running; Base Loaded*
Run	*Unit is Running; Base Loaded Capacity Limited By High Current*
Run	*Unit is Running; Base Loaded Capacity Limited By Phase Unbalance*
Run	*Unit Is Running; Base Loaded Capacity Limited By High Cond Press*
Run	*Unit Is Running; Base Loaded Capacity Limited By Low Evap Temp*
Run	*Unit is Running; Base Loaded Establishing Minimum Capacity Limit*
Run	*Unit Is Running; Base Loaded Pulldown Rate Based Soft Loading*
Run	*Unit Is Running; Base Loaded Current Based Soft Loading*
Run-Unload	*Unit Is Preparing To Shutdown*
Run-Ice Build	*Unit Is Building Ice*
Run-Ice Build	*Unit Is Building Ice Capacity Limited By High Current*
Run-Ice Build	*Unit Is Building Ice Capacity Limited By Phase Unbalance*
Run-Ice Build	*Unit Is Building Ice Capacity Limited By High Cond Press*
Run-Ice Build	*Unit Is Building Ice Capacity Limited By Low Evap Temp*
Run-Ice Build	*Ice Building Is Complete*
Run-Ice Build	*Unit Is Running; Transitioning Ice Building To Normal MIN:SEC*
Stop	*Immediate Shutdown*
Stop	*Panic Stop*
	Starter Dry Run

** Displays are not in any sequence. Some displays will never appear, depending on options and situation*

Chilled Water Setpoint and Source/Evap Leaving Water Temp (Standard Report)

Chilled Water Setpoint [source]:	*xxx.x F*
Evap Leaving Water Temp:	*xxx.x F*

This is the actual setpoint currently in use by the chiller. The "source," from where it is derived, can be either External, Tracer or Reset (meaning reset is enabled); otherwise the source is not displayed and Front Panel setoint source is implied.

or

If the chiller is in the ice making or ice making complete state, the following display is substituted for the above display:

Ice Termination Setpt [source]:	*xxx.x F*
Evap Entering Water Temp:	*xxx.x F*

where source, if displayed is Tracer; otherwise it's the Front Panel.

NOTE: The setpoint source may change automatically from the implied "Front Panel "(no source displayed) to "Tracer" if Tracer is communicating a chilled water setpoint to the chiller. The only way to override Tracer-communicated setpoints is through the operator setting menu (global setpoint override).

Reset Chilled Water Setpoint and Type/Starting Chilled Water Setpoint and Source *(Standard Report)*

The following will only be displayed if chilled water reset is enabled:

[reset type] CWS:	*xxx.x f/c*
[source] CWS:	*xxx.x f/c*

with [reset type] being outdoor air reset, return reset, or constant return reset and [source] being Front Panel, External, or Tracer.

The first line displays the actual setpoint to which the chiller is controlling, as reset upward depending on the reset type, reset ratio, and maximum reset parameters set elsewhere on the operator settings menu.

The second line displays the fundamental temperature (and its source) upon which the reset is based. This represents the lowest setpoint possible when no reset is applied.

Ice Termination Setpoint/Ice Termination Setpoint Source *(Standard Report)*

If the ice building option is installed and the chiller is not in the ice making or ice making completion mode, the following is displayed:

Ice Termination Setpt [source]:	*xxx.x F*
Press (Next) (Previous) To Continue	

where the "source" is Tracer or the Front Panel (no source field display).

Evaporator Entering and Leaving Water Temperatures *(Standard Report)*

Evap Entering Water Temp:	*xxx.x F*
Evap Leaving Water Temp:	*xxx.x F*

Condenser Entering and Leaving Water Temperatures *(Standard Report)*

Dashes "-------" will be displayed for the condenser entering or leaving water temperature if the corresponding input is open or shorted

Cond Entering Water Temp:	*xxx.x F*
Cond Leaving Water Temp:	*xxx.x F*

Current Limit Setpoint and Source *(Standard Report)*

Current Limit Setpoint [source]:	*xxx%*
Press (Next) (Previous) To Continue	

If the source is displayed, it is Tracer, External, or ice building.

Outdoor Temperature *(Standard Report)*

If the outdoor air temperature input is open or shorted, and neither outdoor air reset nor low ambient lockout is enabled, "-------" (dashes) is

displayed. Otherwise the temperature received from the chiller module is displayed.

Outdoor Air Temperature:	*xxx.x F*
Press (Next) (Previous) To Continue	

If Tracer is installed, the Tracer outdoor air temperature is displayed. If no Tracer is installed, the chiller module outdoor air temperature sensor is used.

**** * * End of Standard Report * * ****

ASHRAE Guideline 3 Report Menu

If the ASHRAE Guideline 3 Report Entry option was selected with the chiller report heading, the following header is displayed and a new sequence is established as indicated in .

ASHRAE Guideline 3 Report *Press (Next) (Previous) To Continue*

Time of Day/Refrigerant Type (ASHRAE Report)

Current Time/Date HH:MM xm Mon,	*XX XXXX*
Refrigerant Type:	*R134a*

Chiller Operating Mode (ASHRAE Report

[Operating mode line 1] *[Operating mode line 2]*

Operating mode line 1 (and line 2 if needed) is a continuous message and display the chiller's current state or activity. It may also show an associated timer or system parameter, in some cases. The message is one from Table 16, "Operating Modes," on page 8 and identical to the operating mode given in the standard report.

Chilled Water Setpoint and Source/Evap Leaving Water Temperature (ASHRAE Report)

Chilled Wtr Setpt [source]:	*xxx.x F*
Evap Leaving Water Temp:	*xxx.x F*

This is the actual setpoint currently in use by the chiller where the [source], from where it is derived. If no source is displayed, Front Panel setpoint source is implied.

or

If the chiller is in the ice making or ice making complete state, the following will appear instead of the above display:

Ice termination Setpt [source]:	*xxx.x F*
Evap Entering Water Temp:	*xxx.x F*

where the [source] is External or Tracer.

Current Limit Setpoint and Source (ASHRAE Report)

Current Limit Setpt [source] xxx%
Press (Next) (Previous) To Continue

Setting source will be Front Panel (field not displayed), Tracer, External, or ice building.

Refrigerant Monitor (ASHRAE Report)

If the analog refrigerant monitor is installed with or without the scanner option, the following item will be displayed:

Refrigerant Monitor xxx.x PPM
Press (Next) (Previous) to Continue

If the IPC MSA refrigerant monitor allows you to scan various channels, the following item will be displayed:

Refrigerant Monitor:	
Scanner Channel Y:	*XXXX PPM [Rfgt Type]*

where Y is the channel currently being scanned and XXXX is the refrigerant concentration of that channel.

Saturated Evap Temperature/Compressor Discharge Temperature (ASHRAE Report)

Saturated Evap Rfgt Temp:	*xxx.x F*
Compressor Discharge Temp:	*xxx.x F*

Compressor Starts and Running Time (ASHRAE Report)

The starts and hours counters are displayed:

Compressor Starts:	*xxxxx*
Compressor Running Time:	*HRS:MIN:SEC*

The compressor starts counter is increased with each start or attempted start of the compressor.

Evaporator Entering and Leaving Water Temperatures (ASHRAE Report)

Evap Entering Water Temp:	*xxx.x F*
Evap Leaving Water Temp:	*xxx.x F*

Saturated Evap Temperature/Evaporator Refrigerant Pressure (ASHRAE Report)

Saturated Evap Rfgt Temp: xxx.x F
Evap Rfgt Pressure: xxx.x psig

Evaporator Approach Temperature (ASHRAE Report)

Evaporator Approach Temp:	*xxx.x F*
Press (Next) (Previous) to Continue	

Note: If a negative approach temperature is displayed, check the sensors for proper operation.

Chilled Water Flow Switch Status (ASHRAE Report)

The screen displays the status of the chilled water flow switch at the input to the UCM.

Chilled Water Flow Switch Status:
Flow Switch is [y]

where [Y] is “Open/No Flow” or “Closed/Flow”

Condenser Entering and Leaving Water Temperatures (ASHRAE Report)

Cond Entering Water Temp:	*xxx.x F*
Cond Leaving Water Temp:	*xxx.x F*

Dashes will be displayed for either temperature if the input is open or shorted.

Saturated Condenser Temperature/Condenser Refrigerant Pressure (ASHRAE Report)

Saturated Cond Temp:	*xxx.x F*
Cond Rfgt Pressure:	*xxx.x psig*

Condenser Approach Temperatures (ASHRAE Report)

Condenser Approach Temp:	*xxx.x F*
Press (Next) (Previous) to Continue	

Condenser Water Flow Switch Status (ASHRAE Report)

The screen displays the status of the condenser water flow switch at the input to the UCM if and only if the differential water pressure sensor option is not installed.

Condenser Water Flow Switch Status:
Flow Switch is [y]

where [Y] is “Open/No Flow” or “Closed/Flow”

**** * * End of ASHRAE Report * * ****

Refrigerant Report

Report Heading

Refrigerant Temp & Pressure Report
Press (Next) (Previous) to Continue

Evaporator and Condenser Refrigerant Pressure

Evap Rfgt Pressure:	*xxx.x psig*
Cond Rfgt Pressure:	*xxx.x psig*

NOTE: The evaporator and condenser pressures are not measured directly but derived from associated temperatures assuming saturated conditions for R134a refrigerant.

Evaporator Refrigerant Liquid Level

Evap Liquid Level:	*sx.x inches [modifier]*
Press (Next) (Previous) To Continue	

The display will show the refrigerant liquid level in inches relative to the center of the range of the liquid level sensor as installed on the evaporator shell.

The sign “s,” either + and - or - and the modifiers “or more” used with + measurements and “or less” used with - measurements indicate the limited range of the sensor. When the sensor reads +1.0 or -1.0, the display will read +1.0 inches or more” or “-1.0 inches or less,” indicating the sensor is at the extremes of its range.

Normal operation should produce an evaporator liquid level of “0” inches meaning no deviation from the design level in the evaporator.

During normal operation and within 20 minutes of startup, the liquid level should be well within the sensor’s range of ±1 inch. Small variations in liquid level of ±.3 to .5 inch during steady state or with small load disturbances are normal.

If the liquid level remains at the extremes of its range for a long time, this indicates problems that could damage the compressor or severely reduce performance.

Electronic Expansion Valve Position

Expansion Valve Position:	*xxx.x% Open*
Expansion Valve Position:	*xxxx Steps Open*

This display shows the position of the EXV open, first as a percentage of valve stroke and also in steps (0-2040 for smaller EXV (200 T), 0-2760 for the two larger EXVs (300 and 400 T)). If pre-position of the valve is required (to allow delta P to be generated) for startup, 571 steps (28%) or 773 steps (28%), respectively, would be displayed at that time.

Just prior to compressor start, the EXV will go into a normal liquid level control, gradually opening, then closing, as determined by the liquid level sensor.

Just prior to normal compressor shutdown, at the start of the run unload mode, the EXV opens at its maximum rate to its wide open position. This helps equalize the differential pressure in the system and reduces compressor action at shutdown. Upon shutdown, the EXV is automatically recalibrated.

Saturated Evap Temperature/Evap Refrigerant Pressure

Sat Evap Rfgt Temp:	*xxx.x F*
Evap Rfgt Pressure:	*xxx.x psig*

Saturated Cond Temperature/Cond Refrigerant Pressure

Sat Cond Temp:	*xxx.x F*
Cond Rfgt Pressure:	*xxx.x psig*

Saturated Evap Temperature and Discharge Temp

Saturated Evap Rfgt Temp:	*xxx.x F*
Compressor Discharge Temp:	*xxx.x F*

Compressor Discharge Temperature/Discharge Superheat

Compressor Discharge Temp:	*xxx.x F*
Discharge Superheat:	*xxx.x F*

Evaporator and Condenser Approach Temperatures

Evaporator Approach Temp.:	*xxx.x F*
Condenser Approach Temp.:	*xxx.x F*

Note: Malfunctioning or miswired sensors should be suspected if negative approach temperatures are encountered.

Compressor Report

Report Heading

Compressor Hours, Starts & Amps
Press (Next) (Previous) to Continue

Compressor Line Currents% RLA

Compressor Line Currents -% RLA
A xxxx.x% B xxxx.x% C xxxx.x%

Compressor Line Currents Amps

Compressor Line Currents - Amps
A xxxx amps B xxxx amps C xxxx amps

Compressor Line Voltages

Compressor Line Voltages
AB xxxx v BC xxxx v CA xxxx v

This data is displayed only if the line voltage sensing option is installed. if not installed, no screen is displayed.

Compressor Starts and Running Time

The starts and hours counters are displayed as follows:

Compressor Starts:	*xxxxx*
Compressor Running Time:	*HRS:MIN:SEC*

Operator Settings

Operator Settings Group Heading

Chilled Water & Current Limit Setpts
Press (Next) (Previous) to Continue

Menu Settings Password

If the menu settings password is enabled in the service setup group, the following will be displayed after each setting group heading

Settings In This Menu Are [Status]
[password message]

Likewise, if the menu settings password is disabled in the service setup group, the above screen will not appear.

The possible values for status are “Locked” or “Unlocked.” If the password status is locked, the password message will be “Enter Password to Unlock”. Press <-> <+> <-> <+><-><+> followed by the <Enter> key to unlock.

NOTE: The last six keystrokes represent the current password and up to 20 keystrokes can be entered.

If the password status is unlocked, the password message will be “Press (Enter) to Lock.” Pressing <Enter> locks the settings in all the menus. If the password is entered to unlock the settings, this unlocks the settings in ALL menus.

Whenever a password is in use, the “Press (+) (-) to change setting” message will be suppressed on setpoint screens. Any attempt to change the setting will result in the message “Setting is Locked”. The password once entered will remain valid until canceled.

Set Contrast - (CCCLD Display Only)

The following screen is used with the complex character Clear Language Display only.

Set Contrast: Press (X) to Save
Press (+) (-) To Change Setting

Time Of Day Setting

Current Time/Date HH:MM xm Mon, XX, XXXX
(Enter) to Change: (Next) to Continue

The top level “Current Time/Date” is displayed when this screen is first selected. Pressing the <Next> or <Prev> key will go to the next or previous screen.

If the <Enter> key is selected, five separate screens can be displayed to make changes to the time and date. The “Current Time/Date” will be displayed on line one of each screen. Each screen will allow the changing of one element in the time/date at a time. The second line of each screen indicates the element that can be changed and its current value.

If the first time element changing screen (hours) is displayed and the <Prev> key is pressed, the top level “Current Time/Date” screen will be displayed and the <Enter> key *must* be pressed to re-enter the time changing screens.

If the last (fifth) time/date changing screen is displayed and the <Next> key is pressed, the next screen will be displayed. If the <Prev> key is pressed at this point, the top level “Current Time/Date” screen will be displayed and the <Enter> key will have to be pressed to re-enter the time/date changing screens.

To change an element of the current time or date, press <Enter> from the top level “Current Time/Date” screen. Press <Next> or <Prev> to get to the desired screen. Then press the <+> or <-> keys to change the element to its proper value and then press the <Enter> key to store the new time/date. The message “Updating Chiller Clock, Please Wait” is displayed for two seconds after the key is pressed.

The five time/date changing screens under the top level (“current time/date”) are as follows:

Current Time/Date HH:MM xm Mon, XX, XXXX
To Change Hour, Press (+) (-) & (Enter)

Current Time/Date HH:MM xm Mon, XX, XXXX
To Change Minute, Press (+) (-) & (Enter)

Current Time/Date HH:MM xm Mon, XX, XXXX
To Change Month, Press (+) (-) & (Enter)

Current Time/Date HH:MM xm Mon, XX, XXXX
To Change Day, Press (+) (-) & (Enter) XX

Current Time/Date HH:MM xm Mon, XX, XXXX
To Change Year, Press (+) (-) & (Enter) XXXX

Front Panel Chilled Water Setpoint

Front Panel Chilled Wtr Setpt: *xxx.x F*
Press (+) (-) to Change Setting

The range of values is 0 to 65°F (-17 to 18.3°C), in increments of 1 or 0.1°F or C depending on the service setup screen. The ROM default is 44.0°F (6.7°C).

The second line of the setting display shown above will change if an attempt is made to increase or decrease the setpoint out of the setpoint range. The second line would then become:

Top of Range, Press (-) to Change

or, if low,

Bottom of Range, Press (+) to Change

Also, if a wrong key is pressed, the display will prompt:

Press (+) (-) (Enter) (Cancel) to Continue

The exception is pressing the <Stop> key, which is always active. Other messages may display in special cases with explanations.

When the front panel chilled water setpoint is within 1.7°F of the leaving water temperature cutout setpoint or within 6°F of the low refrigerant temperature cutout setpoint, the second line of this display will read:

Limited by Cutout Setpt, (+) to Change

Front Panel Current Limit Setpoint

Front Panel Current Limit Stpt: xxx%
Press (+) (-) to Change Setting

The range of values is 40 to 100% in increments of 1%. The ROM default is 100%.

Print Report

This screen is shown only when the print option is installed.

Press (Enter) to Print Report
Press (Next) (Previous) To Continue

After <Enter> is pressed, a two-second message appears briefly indicating that the print command has been sent to the printer.

Chilled Water Reset Type

Chilled Wtr Reset Type: [type]
Press (+) (-) to Change Setting

The possible values for [type] are: disable (ROM default), return, constant return, and outdoor air.

If either disable or constant return is selected, the remaining chilled water reset displays are skipped. If either return or outdoor air are selected, the first word of the remaining chilled water reset displays will be the type of reset.

Reset Ratio

[type] Reset Ratio: *xxx%*
Press (+) (-) to Change Setting

The ratio range is 10 to 120% for return reset with a ROM default of 50% and 80 to -80% for outdoor reset with the ROM default of 10%.

Start Reset Setpoint

[type] Start Reset:	*xxx.x F*
Press (+) (-) to Change Setting	

The start reset range is 4 to 30°F (2.2 to 16.7°C) for return reset with the ROM default of 10°F (5.6°C). For outdoor reset, the range is 50 to 130°F (10 to 54.4°C) for with the ROM default of 90°F (32.2°C).

Max Reset Setpoint

[type] Max Reset Setpoint:	*xxx.x F*
Press (+) (-) to Change Setting	

The maximum reset range is 0 to 20°F (0.0 to 11.1°C) for return reset with the ROM default of 5°F (2.8°C). For outdoor reset, the range is 0 to 20°F (0.0 to 11.1°C) for with the ROM default of 5°F (2.8°C).

Ice Building Enable

This data will be displayed only if the ice making option is installed.

Ice Building	*[d/e]*
Press (+) (-) to Change Setting	

where disable is the ROM default.

Front Panel Ice Termination Setpoint

Panel Ice Termination Setpoint:	*xxx.x F*
Press (+) (-) to Change Setting	

This data will be displayed only if the ice-making option is installed.

NOTE: When the chiller is in the "ice building" mode, it will run at full load to make ice until the return water (glycol) drops below the above setpoint.

The range of values is 20.0 to 32.0°F (-6.7 to 0.0°C) in increments of 1 or 0.1°F or C, depending on the service setup screen. The ROM default is 27.0°F (-2.8°C).

Ice Making To Normal Cooling Transition Timer

This data will be displayed only if the ice making option is installed.

Ice-To-Normal Cooling Timer:	*xx min*
Press (+) (-) to Change Setting	

The range of values is 0 to 10 minutes. The ROM default is 5 minutes.

Chilled Water Setpoint Source

This screen will only be displayed if the external chilled water setpoint is installed at the machine configuration menu. If the Tracer option is installed, the word "Default" will appear in front of the setpoint source.

[Default] Chilled Water Setpoint Source:
[source]

Possible values of [source] are Front Panel (ROM default) and External source.

Current Limit Setpoint Source

This screen will only be displayed if the external chilled water setpoint is installed in the machine configuration menu. If the Tracer option is installed, the word "Default" will appear in front of the setpoint source.

[Default] Current Limit Setpoint Source:
[source]

where [source] is Front Panel (ROM default) or External.

Setpoint Source Override

Setpoint Source Override
[source]

Possible values of [source] are none (ROM default), "Use Front Panel setpoints," and "Override Tracer. Use default setpoints" for which the Tracer option must be installed. this is a global override that will

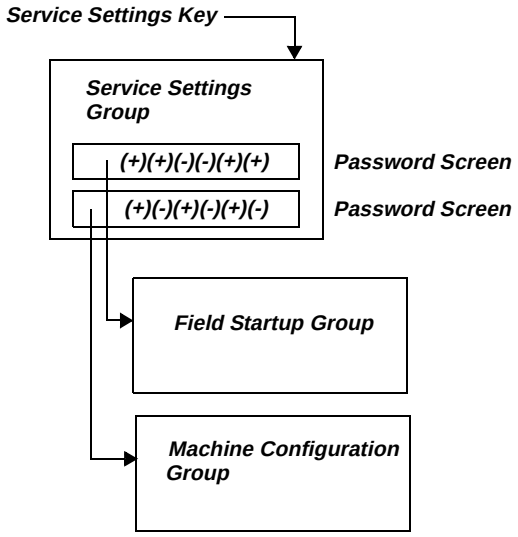
prevent Tracer, External, or Chilled Water Reset from asserting control on the chilled water setpoint.

Service Settings (Non Password Protected Service Settings Group)

All service settings are accessed by pressing the <Service Settings> key on the CLD.

The service settings menu has three distinct grouping of items as shown in *Figure 31* . The first group is the non-password protected group that consists of all of the settings, feature enables, setpoints, etc., that are unlikely to be changed often by a user or operator, changes in them do not seriously affect the standard protection or reliability of the chiller.

Figure 31
Service Settings Key Menu Structure



The other two groupings are protected, each with a separate password. These two groups are for changing parameters and settings for field commissioning and fundamental protection and control of the chiller subsystems (Service Set-up) or for programming of the UCM (machine configuration) if, for example, a UCM must be replaced.

Once properly set, the items in these protected menus should NEVER be changed again without specific knowledge of the effects of the changes. These are accessible only for field commissioning and to allow for field programming of service replacement UCMs.

Once the Service Settings key is pressed, the group heading display appears

Service Settings:	*Basic Setups*
Press (Next) (Previous) to Continue	

Menu Settings Password

Only if the menu settings password is enabled in the service setup group, will the following be displayed after each setting group heading:

Settings In This Menu Are (status)
Enter Password to Unlock

Likewise, if the menu settings password is disabled in the service setup group (See page X), the above screen not appear.

Status can be “locked” or “unlocked.” If the password status is locked, the password message will be “Enter Password to Unlock.” Press <-> <+> <-> <+> <-> <+> followed by the <Enter> key to do so. An incorrect password will result in the message “Incorrect Password” message to be displayed for 1 second.

Once the password status is unlocked, the password message will be “Press Enter to Lock.” Pressing <Enter> will lock all of the setpoint menus. Likewise, if the password status is locked and the correct password is entered, all of the setpoint menus will be unlocked.

Whenever a password is in use the “Press (+) (-) to change setting” message will not appear on setpoint screens. Any attempt to change a setpoint will result in the message “Setting is Locked” being displayed for 1 second. The password, once entered, will remain valid until canceled.

Keypad/Display Lockout

This feature allows you to lock the keypad and display. After access to the service settings is given, the following display appears

Press (Enter) to Lock Display & Keypad
Password will be required to Unlock

If the <Enter> key is pressed to lock the keypad, the following message is displayed, and all further input

from the keypad is ignored, including the <Stop> key, until the password is entered.

The password consists of pressing the <Previous> and <Enter> keys at the same time.

*****DISPLAY AND KEYPAD ARE LOCKED*****
*****ENTER PASSWORD TO UNLOCK*****

If the keypad is locked and the password is entered, the display will go to the Chiller Operating Mode display of the Chiller Report.

Language Setting

Language:	*xxxxxxx*
Press (+) (-) to Change Setting	

Possible Language Selections are: English (factory default), Francais, Deutsch, Espanol, Nippon (also know as Katakana, Use Japanese Characters), Italiano, Nederlands, CODED, and Portugues.

Possible language selections for the CCCLD are English (ROM default), Traditional Chinese, and Simplified Chinese.

Display Units

Display Units: (type)
Press (+) (-) to Change Setting

where (type) is English (factory default) or SI.

Decimal Places Displayed

Decimal Places Displayed:	*(status)*
Press (+) (-) to Change Setting	

The choices for [status] are XXX.X (factory default) and XXX.

Display Menu Headings

Display Menu Headings:	*(d/e)*
Press (+) (-) to Change Setting	

The factory default value is enabled. If disabled the menu headings in each menu or group will not appear.

Clear Custom Menu

Press (Enter) To *Clear the Custom Menu*

Pressing <Enter> will cause a brief message to appear indicating that the menu has been cleared.

Differential to Start

Differential to start is the number of degrees above setpoint that the return water temperature must drift before the chiller will start.

Differential to Start Chiller:	*xxx.x F*
Press (+) (-) to Change Setting	

The range of values is 1 to 10°F (0.5 to 5.5°C) in increments of 1 or 0.1°F or C depending on the service setup screen xxx or xxx.x. The factory default is 5°F (2.8°C).

Differential to Stop

Differential to stop is the number of degrees below setpoint that the supply water temperature must drift before the chiller will shut down. This is used to prevent nuisance shutdowns on momentary drops in temperature.

Differential to Stop Chiller:	*xxx.x F*
Press (+) (-) to Change Setting	

The range of values is 1 to 10°F (0.5 to 5.5°C) in increments of 1 or 0.1°F or C depending on the service setup screen. The factory default is 5°F (2.8°C).

Evap/Cond Pump Off Delay Time

This time delay is used to keep the chilled water pump on during the run-unload cycle, after the UCP2 has been given the command to stop. This stop command could come from the Clear Language Display, Tracer, or External Auto/Stop.

Evap Pump Off Delay:	*xx min*
Press (+) (-) to Change Setting	

The range of values is 0 to 30 minutes in increments of 1 minute. Factory default is 1 minute.

Printer Setups

NOTE: This series of screens is shown only when the printer option is installed. An RS-232 commuication-type serial printer as well as the printer interface are required for this option. Refer to the electrical drawings for details

Printer Setups
(Enter) to Change (Next) to Continue

If <Next> is pressed, the following setup screens are skipped. If <Enter> is pressed, the following screens are displayed for modifying the printer setups.

Refer to printer hardware documentation for settings and specifications when installing the printer.

Print on Time Interval [d/e]
Press (+) (-) to Change Setting

where enabled is the ROM default.

Print on Time Interval xxx Hours
Press (+) (-) to Change Setting

The range of values is 1 to 24 hours in one hour increments. The ROM default is 8 hours.

Print on Diagnostic [d/e]
Press (+) (-) to Change Setting

where enabled is the ROM default.

Number of Pre-Diag Reports: xx
Press (+) (-) to Change Setting

The range of values is 1 to 5 in increments of 1. The ROM default is 5.

Diagnostic Report Interval:	*xxx sec*
Press (+) (-) to Change Setting	

The range of values is 2 to 120 seconds in increments of 1 second. The ROM default is 5 seconds.

Printer Baud Rate: [Status]
Press (+) (-) to Change Setting

with the choices for status: 300, 1200, 2400, 4800, 9600 (ROM default), or 19200.

Printer, Parity: [Status]
Press (+) (-) to Change Setting

The choices for [status] are none (ROM default), odd,

or even.

Printer, Data Bits: [Status]
Press (+) (-) to Change Setting

The choices for status are 8 (ROM default) or 7.

Printer, Stop Bits: [Status]
Press (+) (-) to Change Setting

The choices for [status] are 1 (ROM default) or 2.

Printer Handshaking: [Status}
Press (+) (-) to Change Setting

The choices for status are XON/XOFF (ROM default), DTR, RTS, or none.

Clear Restart Inhibit Timer

The restart inhibit timer function is used to protect the compressor motor from heat caused by repeated starts within a short time. It allows for motor heating and cool down. This override should only be used with caution. Should the motor overheat because of too many successive starts, motor damage could result.

Press (Enter) to
Clear the Restart Inhibit Timer

When <Enter> is pressed, the timer is cleared and the compressor start sequence is allowed to begin immediately. A 2-second message appears as follows and then returns to the above screen.

Restart Inhibit Timer Has Been Cleared

Field Startup Group Password Request

Pswd Reqd to Access Field Startup Group
Please Enter Password

The service setup password is <+> <+> <-> <-> <+> <+> <Enter>. Successfully entering the password sends you to the service setup group heading screen below.

Press (Enter) To
Access Field Startup Group

Machine Configuration Group Password Request

Password Reqd to Access Machine Config Group
Please Enter Password

The service setup password is <+> <-> <+> <-> <+> <-> <Enter>. Successfully entering the password sends you to the machine configuration group heading screen below.

Press (Enter) To
Access Machine Configuration Group

Service Settings (Password Protected Field Startup Group)

The field startup group password is <+> <-> <-> <+> <+> <Enter>. The field startup group contains items that are primarily associated with field commissioning of the chiller as well as the fundamental control and protection of the chiller subsystems.

If the field startup password is entered, the display goes to the menu defined below. If a key is not pressed within 10 minutes in this password-protected menu, the display returns to the chiller operating mode display of the chiller report, and the password must be entered again to return to this menu.

Field Startup Group Heading

Field Start-up Group Settings
"Press (Next) (Previous) to Continue"

This header is displayed when the headers are not displayed in the service settings menu.

Keypad/Display Lock Feature Enable

This feature permits the entire keypad and display to be locked out. A message appears on the screen to describe this condition. No access is permitted to either the report screens or the setting screens when this feature is both enabled here and locked at the service settings menu.

NOTE: In this locked condition both the <Stop> and <Auto> keys ***do not function****.*

As with other keypad lock features, <Previous> and <Enter> must be pushed together to unlock.

Keypad/Display Lock Feature:	*[d/e]*
Press (+)(-) to Change Setting	

Where disabled is the ROM default.

When the keypad lock feature is disabled, the keypad lock display does not appear in the non-password protected area of the Service settings menu and the Keypad/Display cannot be locked. When the keypad/display lock feature is enabled, the keypad lock display will appear in the service settings menu so the keypad can be locked.

Menu Settings Password Enable

The menu settings password permits the settings in each of the menus to be password protected. All report menus and setting menus can still be viewed at any time if this feature is either enabled or disabled; the <Stop> and <Auto> keys also remain active. If this feature is enabled, then all menu settings are password protected.

Menu Settings Password Feature:	*[d/e]*
Press (+)(-) to Change Setting	

where disabled is the ROM Default.

When the feature is disabled, the menu setting password display does not appear at the top of each of the settings menus and the menu settings cannot be password protected. When the menu setting password feature is enabled, the menu settings password display appears just below each of the settings menu headers so the settings can be changed if the proper password is entered.

Password Duration Time

Password Duration Time	*xxx min*
Press (+) (-) to Change Setting	

where the range of values is 1 to 60 minutes in increments of one minute. The ROM default is 10 minutes.

Once a password has been successfully entered, the password entry screen for *only that* password-protected menu is replaced by a "Press (Enter) To Access" screen, the only entry into that menu for the duration of the timer. The timer is set to the value of the password duration setpoint every time a button is pressed on the CLD. If there is no key activity and the timer expires, the password protection is re-enabled on all three menus. If that happens, the password must be re-entered on each menu for access.

ICS Address

ICS Address:	*xx*
Press (+)(-) to Change Setting	

The range of values is 1 to 127 in increments of 1. The ROM default is 65

Power Up Start Delay Time

For system installations, this delay time is used to prevent multiple chillers from cycling on at the same time after power is supplied or restored to the UCP2. A programmed delay can stagger the start sequence minimizing the amount of inrush current required.

Power Up Start Delay Time:	*xxx sec*
Press (+)(-) to Change Setting	

The range of values is 0 to 600 seconds in increments of 1. The ROM default is 0 sec.

Design Delta Temperature

This value should be set at the delta temperature specified for the chiller during the initial selection, based on all operating conditions expected. If operating conditions change significantly, check with Trane technical service to see if modifications may be required.

Design Delta Temperature:	*xxx.x F*
Press (+)(-) to Change Setting	

The range of values is 4 to 30°F (2.2 to 16.7°C) in increments of 1 or 0.1°F or C depending on the service setup screen. The ROM default is 10°F (5.5°C).

Leaving Water Temperature Cutout Setpoint

Lvg Wtr Temp Cutout Setpoint:	*xxx.x F*
Press (+)(-) to Change Setting	

The range of values is -10 to 36°F (-23.3 to 2.2°C) in increments of 1 or 0.1°F or C depending on the service setup screen. The ROM default is 36.0°F (2.2°C).

When this setpoint is within 1.7°F of the front panel chilled water setpoint, the front panel chilled water setpoint is increased along with this setpoint to maintain the differential. A message will be displayed for 2 seconds to indicate that the FPCW setpoint has been increased.

When this setpoint is adjusted below 35.3°F the following is displayed on the second line: “Warning: Adequate Antifreeze Required”.

Low Refrigerant Temperature Cutout Setpoint

Low Rfgt Temp Cutout Setpt:	*xxx.x F*
Press (+)(-) to Change Setting	

The range of values is -5 to 36°F (-37.2 to 2.2°C) in increments of 1 or 0.1°F or C depending on the service setup screen. The ROM default is 32.0°F (0.0°C.

When this setpoint is within 6°F of the front panel chilled water setpoint, the front panel chilled water setpoint is increased along with this setpoint to maintain the differential. A message will be displayed for 2 seconds to indicate that the FPCW setpoint has been increased.

When this setpoint is adjusted below 28.5°F the following is displayed on the second line: “Warning: Adequate Antifreeze Required.”

Condenser Limit Setpoint

Condenser Limit Setpoint:	*xx% HPC*
Press (+)(-) to Change Setting	

The range of values is 80 to 120% in increments of 1%. The ROM default is 93%. *NOTE: This setting in relative to the high pressure cutout switch setting as defined in the machine configuration menu, and defines where the condenser limit control will take effect to avoid a high pressure cutout.*

Maximum Restart Inhibit Timer Setting

Maximum RI Timer:	*xxx minutes*
Press (+)(-) to Change Setting	

The range of values is 5 to 20 minutes in increments of 1 minute. The ROM default is 5 Minutes.

Under/Over Voltage Protection Enable

This feature is disabled if the line voltage sensing option is not installed.

Under/Over Voltage Protection:	*[d/e]*
Press (+)(-) to Change Setting	

where disabled is the ROM default.

Phase Reversal Protection Enable

Phase Reversal Protection:	*[d/e]*
Disabling could result in Cprsr Damage	

where enabled is the ROM default.

Phase Unbalance Limit Enable

The UCM provides non-defeatable phase unbalance protection that stops compressor operation with more than 30% phase unbalance. If this unbalance limit is enabled, the motor will be “limited” from running at full load as a function of % unbalance. This feature prevents excessive overheating that otherwise would result. If the limit is disabled, then no current limit is imposed due to phase unbalance.

Phase Unbalance Limit:	*[d/e]*
Press (+)(-) to Change Setting	

where enabled is the ROM default.

Momentary Power Loss Protection Enable

Momentary Power Loss Protection:	*[d/e]*
Press (+)(-) to Change Setting	

where enabled is the ROM default.

Soft Load Control Enable

Soft Load Control:	*[d/e]*
Press (+)(-) to Change Setting	

where disabled is the ROM default

Soft Load Starting Current Limit

Soft Load Starting Current Limit:	*xxx%*
Press (+)(-) to Change Setting	

The range of values is 40 to 100% in increments of 1%. The ROM default is 100%.

Soft Load Current Limit Rate Of Change

Soft Load Current Limit Rate:	*x.x%/min*
Press (+)(-) to Change Setting	

The range of values is 0.5 to 5%/Min in increments of 1 or 0.1%/Min depending on the service setup screen. The ROM default is 5%/Min.

Soft Load Lvng Wtr Temp Rate of Change

Soft Load Lvg Water Rate:	*x.x F/min*
Press (+)(-) to Change Setting	

The range of values is 0.5 to 5°F/Min (0.3 to 2.8°C/Min) in increments of 1 or 0.1°F/Min depending on the service setup screen. The ROM default is 5°F/Min (2.8°C/MIn).

LWT Control Proportional Gain

LWT Control Proportional Gain:	*xxx.x%/F*
Factory Default is 6.0%/F & 10.8%/C	

The range of values is 0 to 100%/F (0 to 180%/C) in increments of 0.1. The ROM default is 6.0%/F (10.8%/C).

LWT Control Integral Reset Time

LWT Control Integral Reset Time:	*xx sec*
Press (+)(-) to Change Setting	

The range of values is 5 to 500 Seconds in increments of 1. The ROM default is 60 sec.

LWT Control Rate Time

LWT Control Rate Time:	*xx sec*
Press (+)(-) to Change Setting	

The range of values is 0 to 25 in increments of 0.1. The ROM Default is 0 sec.

Higher numbers would improve the response of the control to transient loads, but also tend to cause control instability. Use caution and small incremental changes when making adjustments.

Liquid Level Control Proportional Gain

Liq Lvl Cntrl Proportion Gain:	*xx.x%/in*
Press (+)(-) to Change Setting	

The range of values is 0.2 to 30 in increments of 0.1. The ROM default is 10. Refer to the General Factory Settings Table.

Liquid Level Control Integral Reset Time

Liq Lvl Cntrl Integral Rset Time:	*xxx sec*
Press (+)(-) to Change Setting	

The range of values is 5 to 500 in increments of 1. The ROM default is 50. Refer to the General Factory Settings Table.

Liquid Level Control Rate Time

Liq Lvl Control Rate Time:	*xx.x sec*
Press (+)(-) to Change Setting	

The range of values is 0 to 25.5 in increments of 0.1. The ROM default is 0. Refer to the General Factory Settings Table.

Local Atmospheric Pressure

Local Atmospheric Pressure:	*xx.x psia*
Press (+)(-) to Change Setting	

The range of settings is 10 to 16 psia in increments of 1 or 0.1 psia or kPa depending on the service setup screen. The ROM default is 14.7 psia.

Service Settings (Password Protected Machine Configuration Group)

The machine configuration password is <+> <-> <+> <-> <+> <-> <Enter>. If the machine configuration password is entered, the display goes to the menu series following. If a key is not pressed within the time set on the Password Duration Screen, the display returns to the chiller operating mode display of the chiller report, and the password must be entered again to return to this menu.

Machine Configuration Group Heading

Machine Configuration Group Settings
Press (Next)(Previous) To Continue

This header appears when the headers do not appear in the service settings menu.

Compressor Model Number Frame Size and Capacity.

Compressor Frame Size & Capacity:	*[YY]*
Press (+)(-) to Change Setting	

Values for [YY] are taken from the 6th and 7th digits of the compressor model number on the compressor nameplate. The ROM default is “C2”.

Refrigerant Monitor Type

Refrigerant Monitor Type:	*[type]*
Press (+)(-) to Change Setting	

Possible values for type are none; (ROM default), analog interface, and IPC interface.

Starter Type

Starter Type:	*[type]*
Press (+)(-) to Change Setting	

Possible values for type are Y Delta (ROM default); X line; solid state, C515 series; solid state, EA series; auto transformer; and primary reactor. For the RTHC

chiller with a solid state starter option, only the EA series type starter applies. See section 3 for an overview of the solid state starter and its settings.

Startup Contactor Test - Y-D Starters Only

This screen shall be displayed only when the starter type is Y-Delta, otherwise this screen is skipped.

Level 2 Contactor Integrity Test:	*[d/e]*
Press (+)(-) to Change Setting	

where disabled is the ROM default.

Rated Load Amps

This value should be set at the design rated load amps as determined during the initial selection process. If conditions change, contact Trane Technical Support for new settings based on the new operating conditions.

Rated Load Amps:	*xxxx Amps*
Press (+)(-) to Change Setting	

The range of values is 0-2500 in 1 amp increments. The ROM default is 300 amps.

Motor Heating Constant

Motor Heating Constant:	*xxx min*
Press (+)(-) to Change Setting	

The range of values XXX is 0 to 100 minutes in 1 minute increments. The ROM default is 5 minutes. This value is used in the calculation of the restart inhibit timer. Refer to the following table for proper settings based on compressor size.

Table 17
Recommended Motor Heating Constant Settings

Compressor	*Motor Heating Constant (minutes)*
B1	*3*
B2	*3*
C1	*4*
C2	*4*
D1	*5*
D2	*5*
D3	*5*
E3	*5*

Current Overload Setting #1

Current Overload Setting #1:	*xxx*
Press (+)(-) to Change Setting	

The range of values is decimal 00 through 31. The ROM default is 00. Both the maximum acceleration timers and the overload settings are not adjustable from either the remote CLD or Tracer or any other remote/external device.

The UCP2 will continuously monitor compressor current to provide running overcurrent and locked rotor protection. Overcurrent protection is based on the phase with the highest current. It will trigger a manually resettable diagnostic, shutting the unit down, when the current exceeds a specified time-trip curve.

The compressor overload is based on the unit RLA. RLA is set in the UCP2 menu items along with the current overload settings specific to a certain current transformer (CT) and machine nameplate RLA. Use the following procedure to set the current overload #1 and #2.

First determine the CT Factor where

CT Factor = Unit Nameplate RLA/ CT Rating x 100%

Look up the CT rating from the table below. The CT Factor must be 66% or greater, but no more that 100% of the Nameplate RLA. Where more than one selection is possible, use the CT rating that will give the lowest CT Factor.

Unit Nameplate RLA	*Extension (X13580269-)*	*CT Rating Amp*
33-50	*-09*	*50*
50-75	*-10*	*75*
67-100	*-01*	*100*
100-150	*-02*	*150*
134-200	*-03*	*200*
184-275	*-04*	*275*
267-400	*-05*	*400*
334-500	*-06*	*500*
467-700	*-07*	*700*
667-1000	*-08*	*1000*

From the calculated CT Factor, the Motor Current Overload Settings # 1 and #2 can be found in *Table 18* following. Note that when one setting is changed,

the other must be changed also and the sum of the two must always be 255.

Current Overload Setting #2

Table 18
Current Overload Settings #1 and #2 as a Function of CT Factor

CT Factor	Setting #1	Setting #2	CT Factor	Setting #1	Setting #2
66	00	255	84	19	236
67	01	254	85	20	235
68	02	253	86	21	234
69	03	252	87	22	233
70	04	251	88	22	233
71	06	249	89	23	232
72	07	248	90	24	231
73	08	247	91	25	230
74	09	246	92	25	230
75	10	245	93	26	229
76	11	244	94	27	228
77	12	243	95	28	227
78	13	242	96	28	227
79	15	240	97	29	226
80	15	240	98	30	225
81	16	239	99	30	225
82	17	238	100	31	224
83	18	237			

Current Overload Setting #2:	*xx*
Press (+)(-) to Change Setting	

The range of values is decimal 224 through 255. The ROM default is 255. For security purposes the second setting is the 8-bit one's complement of the first setting above. Both the maximum acceleration timers and the overload settings are not adjustable from either the remote CLD or Tracer or any other remote/external device.

Maximum Acceleration Timer #1

This value indicates the time at which the UCP2 expects full acceleration of the motor to occur either under part-winding phase of the Y-Delta start sequence or under current limit control of the solid state starter.

Maximum Acceleration Timer #1:	*xx sec*
Press (+)(-) to Change Setting	

The range of values is 2 to 64 Sec. The ROM default is 6 seconds. Refer to the table following for proper settings based on compressor size. Both the maximum acceleration timers and the overload settings are not adjustable from either the remote CLD or Tracer or any other remote/external device. Adjusting this value to a longer time than suggested for a particular compressor, is not recommended as it can compromise the motor protection. Failure of the motor to fully accelerate within this time will cause either an aborted start, or an immediate starter transition or bypass depending on the setting of the Acceleration Time Out Action (entry below). In either case, an appropriate diagnostic is generated.

Table 19
Recommended Max. Acceleration Timer Settings

Compressor	Max Accel Timer #1	Max Accel Timer #2
B1	3	252
B2	3	252
C1	5	250
C2	5	250
D1	6	249
D2	6	249
D3	6	249
E3	6	249
ALL Sizes with Solid State Starter	6	249

Maximum Acceleration Timer #2

Maximum Acceleration Timer #2:	*xxx sec*
Press (+)(-) to Change Setting	

The range of values is 191 to 253 sec. The ROM default is 249. Timer #1 and Timer #2 settings must equal 255. Both the maximum acceleration timers and the overload settings are not adjustable from either the remote CLD or Tracer or any other remote/external device.

Acceleration Time Out Action

Acceleration Time Out Action:	*[action]*
Press (+)(-) to Change Setting	

This setting defines the action that th starter will take if the motor is not accelerated within the maximum acceleration timer #1 above.

Possible values for action include shutdown; transition [non-solid state starter types only] (ROM default); and bypass; [solid state starter types only] (ROM default). If shutdown is selected, the start will be aborted upon failure to accelerate. “Bypass” or “Transition” is the recommended setting, as it will allow the chiller to start safely in the rare event it cannot accelerate with the reduced inrush starting method, however, inrush currents similar to an “across the line” starting would occur.

EXV Size

EXV Size (TPN) Ext.):	*[size(-xx)]*
Press (+)(-) to Change Setting	

Where size(-xx) is the EXV size rating and Trane part number extension in parentheses as follows:

Table 20
EXV Size

Unit	*EXV Size (-xx)*
200	*-01*
400C	*-03*
300C	*-04*

To confirm proper EXV setting, the EXV valve terminal housing has the valve size stamped on it. *NOTE: if stamped “300,” use setting 300C (-04).*

External Chilled Water Setpoint Option

External Chilled Wtr Stpt:	*[Status]*
Press (+)(-) to Change Setting	

Possible values for status are installed or not installed (ROM default).

External Current Limit Setpoint Option

External Current Limit Setpt:	*[Status]*
Press (+)(-) to Change Setting	

Possible values for status are installed or not installed (ROM default).

High Pressure Cutout Setting

High Pressure Cutout Setting: xxxx Psig
Press (+)(-) to Change Setting

The range of values is 5-500 psig (35-3447 kPa) in increments of 5 psig/kPa. The ROM default is 180 psig (1241 kPa).

NOTE: 6.8948 kPa = 1 psi.

Line Voltage Sensing Option

Line Voltage Sensing Option:	*[status]*
Press (+)(-) to Change Setting	

Possible values for status are installed or not installed (ROM default).

Unit Line Voltage

This screen only appears if the line voltage sensing option is installed.

Unit Line Voltage:	*[volt] V*
Press (+)(-) to Change Setting	

Possible values of [volt] are 180 through 6600 in 5 volt increments. The ROM default is 460 volts. See the following tables.

Table 21
Voltage Utilization Range, 60Hz

Unit Nameplate	*UCP2 Selected Volts*	*Max. Voltage*	*Min. Voltage*
200/208	*208*	*220*	*180*
220/230/240	*240*	*253*	*207*
380	*380*	*418*	*342*
440/460/480	*480*	*508*	*416*
575/600	*600*	*635*	*520*

Table 22
Voltage Utilization Range, 50Hz

Unit Nameplate	UCP2 Selected Volts	Max. Voltage	Min. Voltage
220	*220*	*N/A*	*N/A*
380	*380*	*418*	*342*
400/415	*415*	*457*	*373*

Ice Building Option

Ice Building Option: [status]
Press (+)(-) to Change Setting

Possible values for status are installed or not installed (ROM default).

External Setpoint Analog Input Type Selection, 4-20 ma/2-10 vdc

External Setpoint Inputs: [type]
Press (+)(-) to Change Setting

Possible values for type are: 4-20ma (ROM default) and 2-10vdc.

Tracer Option

Tracer Option: [status]
Press (+)(-) to Change Setting

Possible values for status are installed or not installed (ROM Default).

NOTE: the Tracer option will automatically be installed if communication with a Tracer occurs. This screen is only necessary to de-install Tracer communication in the event of an inadvertent automatic installation (such as might occur if a chiller module is swapped in the field).

Tracer Communication Interface Module Option

TCI Module Option: [status]
Press (+)(-) to Change Setting

Possible values for status are installed or not installed (ROM default).

Notes: the Tracer communication interface module option will automatically be installed if communication with a TCI module occurs. This screen is only necessary to de-install the TCI module in the event of inadvertent installation (should a chiller module, for example, be swapped in the field).

It also can be used in factory test procedures.

Printer Option

Printer Option: [status]
Press (+)(-) to Change Setting

Possible values for status are installed or not installed (ROM default).

NOTE: the printer option will NOT automatically be installed if communication with a printer module occurs.

Programmable Relay Assignments

The UCP2 allows you to program specific use of three relays on the chiller module. These relays are available for use as signaling various outputs. Use the following screens to assign specific types of events to energize particular relays.

Once assignments are determined, begin the programming function with:

Press Enter To Access
Programmable Relays

If <Next> or <Previous> is pressed, skip to the next heading item in the menu. If <Enter> is pressed, the following screens are displayed in order:

Relay #1: [event]
Press (+)(-) to Change Setting

Relay #2:	*[event]*
Press (+)(-) to Change Setting	

Relay #3:	*[event]*
Press (+)(-) to Change Setting	

Where [event] is one of the following:

Not Used
Compressor Running (ROM Default for Programmable Relay #1)
MMR Diagnostics
MAR Diagnostics
MMR & MAR Diagnostics (ROM Default for Programmable Relay #2)
Chiller Limit Modes (ROM Default for Programmable Relay #3) (20-minute filter applied).

Any assignment change must be confirmed by pressing <Enter>.

NOTE: the particular annunciator relay on the chiller module will energize when the assigned event is true i.e. when that mode is present for 20 minutes or more or diagnostic type is active. The category "none" is provided to allow a relay to be turned off or defeated, as well as to document to Tracer that a given relay is not being used. However, the defaults are set to assign each of the relays according to the most common usage. For chiller Limit Mode assignment only, the following limits will apply: Current, Soft Load Current, and Phase Unbalance Limits.
***NOTE on Relay Ratings**: Contact loads shall not exceed 120 VAC/240 VA. Minimum premissable load is 100 mA, 5 VDC. See Interconnecting Wiring (Field Wiring Required) in Section 3.*

Refrigerant Pressure Analog Output Option

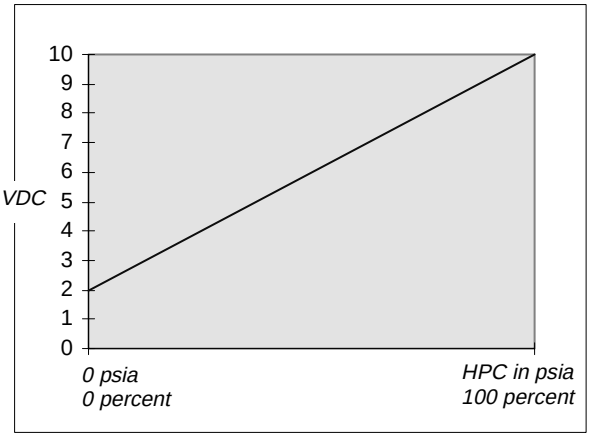
Rfgt Pressure Output Option:	*[status]*
Press (+)(-) to Change Setting	

Possible values for status are % HPC [ROM default], or delta. If %HPC is set, the optional analog pressure output (see electrical drawings for Options Module connections) will present a voltage in proportion to the condenser pressure as a percent of the High Pressure Cutout setting in absolute pressure.

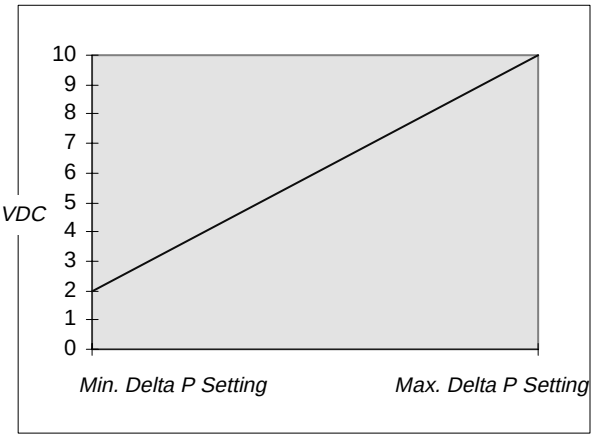
If "delta" is selected, the output voltage will be linear with the endpoints defined by th following two menu items:

NOTE: this function does not use actual measured pressures, but rather temperature sensor readings and assumes sturated conditions for R134a refrigerant.

Figure 32
Condenser Pressure Analog Output



Condenser Pressure analog Output with "%HPC" selected



Condenser Pressure analog Output with "Delta" selected

Min Delta Pressure Calibration

The following will be displayed only if the "refrigerant pressure analog output option" is set to "delta."

Min Delta Press Calib (2 VDC)	*XXXX PSID*
Press (+)(-) to Change Setting	

The range of values shall be 0-400 Psid (0-2758 kPa) in increments of 1 Psid/kPa. The ROM default is 0 Psid (0 kPa). 6.8948 kPa = 1 Psi.

Max Delta Pressure Calibration

The following will be displayed only if the “refrigerant pressure analog output option” is set to “delta.”

Max Delta Press Calib (10 VDC)	*XXXX PSID*
Press (+)(-) to Change Setting	

The range of values shall be 1-400 Psid (7-2758 kPa) in increments of 1 Psid/kPa. The ROM default is 160 Psid (1103 kPa). 6.8948 kPa = 1 Psi.

Service Settings (Password Protected Refrigerant Monitor Settings Group)

This group is only used if the refrigerant monitor is installed. For further information on the monitor, see the refrigerant monitor service literature.

If the refrigerant monitor settings password is entered, the display would go to a prescribed menu covering alarms and scanners.

Service Settings (Password Protected Refrigerant Monitor Calibration Group)

This group is only used if the refrigerant monitor is installed. For further information on the monitor, see the refrigerant monitor service literature.

If the refrigerant monitor settings password is entered, the display would go to a prescribed menu covering calibration.

Service Tests

The service tools group contains items that are primarily associated with either test or manual override of the chiller or chiller subsystems. If the service tools password is entered, the display goes to the menu below.

If a key is not pressed for the duration of the password timer, the display returns to the chiller operating mode display of the chiller report, and the password must be entered again to return to this menu.

If any item in the service tools group is in manual override, the red alarm LED will be on (non-flashing). The following table contains the service tools setpoints that affect the alarm light.

To turn the alarm light off (from an on and non-flashing state), all the conditions must be satisfied.

Function/Setpoint:	***Condition to Turn Alarm Off:***
“Chilled Water Pump”	*Auto*
“Condenser Water Pump”	*Auto*
“EXV Control”	*Auto*
“Slide Valve Control”	*Auto*
“Master Oil Line Solenoid Valve”	*Auto*
“Oil Return Fill Solenoid Valve”	*Auto*
“Oil Return Drain Solenoid Valve”	*Auto*

Service Tools Group Password Request

Pswd Reqd to Access Service Tools Group
Please Enter Password

The service tools password is <+> <+> <-> <-> <+> <+> <Enter>. Successfully entering the password sends you to the service tools group heading screen.

Service Tests Menu Heading

Service Tests & Overrides
Press (Next)(Previous) To Continue

Chilled Water Pump

Chilled Water Pump: *[Mode]*
Press (+)(-) to Change Setting

Possible values for mode are Auto (ROM default) and On.

Chilled Water Flow Switch Status

This screen displays the status of the chilled water flow switch status at the input to the UCM.

Chilled Water Flow Switch Status:
[y]

Possible Values for [y] are Flow Switch is Open/No Flow or Flow Switch is Closed/Flow.

Condenser Water Pump

Condenser Water Pump: *[mode]*
Press (+)(-) to Change Setting

Possible values for mode are Auto (ROM default) and On.

Condenser Water Flow Switch Status

The following screen is not a setpoint. This screen displays the status of the condenser water flow switch status at the input to the UCM.

Condenser Water Flow Switch Status:
[y]

Possible Values for [y] are Flow Switch is Open/No Flow or Flow Switch is Closed/Flow.

Starter Dry Run

Use the following screen when [xx] = “Disabled”.

Starter Dry Run: *[xx]*
Press +/- to Change

Possible values of [xx] are Disabled (ROM default); Shorting Relay On; Run Relay On; Start Relay On; Transition Relay On; or Start and Run Relays On.

Use the following screen when [xx] Not equal to “Disabled”.

Starter Dry Run: *[xx]*
(+)(-) (Enter): Trans Compl Inp: [y]

Possible values of [xx] are Disabled (ROM default); Shorting Relay On; Run Relay On; Start Relay On; Transition Relay On; or Start and Run Relays On.

Possible values of [y] are:

Closed (meaning the transition complete input is seeing a contact closure), or

Open (meaning the transition complete input is seeing a contact open).

If the unit is not in the local stop mode the following is displayed.

Starter Dry Run: *Disabled*
Unit Must Be In Local Stop To Execute

Expansion Valve Test

The expansion valve EIT and timing test can only be enabled if the operating mode is local stop or diagnostic shutdown stop. If the machine is in any other operating mode, the second line of the display will read “Unit Must Be In Stop To Execute”.

Expansion Valve Test:	*[d/e]*
[status]	

where “disabled” is the ROM default.

The possible values of [status] while “Disabled” are:

“Press (+) (-) to Change Setting”

“Unit Must Be In Local Stop To Execute”

The possible values of [status] while “Enabled” are:

“Waiting for EIT Status”

“EIT in Progress”

“EIT Complete”

“EIT Test Failure”

“Timing Test In Progress”, or

“Timing Test Complete.”

If the EXV EIT test is successful the [d/e] field will change back to “Disabled” and will not be accompanied by a diagnostic. If the EIT test is unsuccessful, a diagnostic will indicate the failure.

No diagnostics are indicated with the Timing Test, however, you may listen to determine if the EXV ratchets against the valve mechanical stops when expected as tabulated below:

Table 23
EXV Self Test Sequence

EXV Part Number X15110743	*Units*	*Close*	*Ratchet*	*Open*	*Ratchet (second)*
-01 (200)	*RTHC “B” Frame Comp*	*10*	*5*	*10*	*5*
-03 (400C)	*“D” Frame Comp.*	*13*	*2*	*13*	*2*
-04 (300)	*“C” Frame*	*13*	*2*	*13*	*2*

The sequence is for the valve to close normally for the period indicated, then ratchet for the designated period, open normally for a period, then ratchet again for the period given

EXV Control Mode/EXV Position Commands

The status of the EXV Control is as follows:

EXV Control Is:	*[mode]*
Press (+)(-) to Change Setting	

The possible values of mode are Auto (ROM default) and Manual.

If the EXV control mode is Auto the following is displayed:

Expansion Valve Position:	*xxx.x% Open*
Evap. Liquid Level:	*x.x inches*

If the EXV control mode is “Manual” the following is displayed. When the EXV control mode is transitioned from “Auto” to “Manual,” the manual target is initialized to the current EXV position.

EXV Pos xxx.x% Target	*xxx.x% Open*
Evap. Liquid Level:	*x.x inches*

EXV Position/percent and Steps Open

Expansion Valve Position:	*xxx.x% Open*
Expansion Valve Position:	*xxxx Steps Open*

Slide Valve Control Mode /Manual Load and Unload Commands

The mode of the slide valve is as follows:

Slide Valve Control Is:	*[mode]*
LWT = xx.x F/C	*[Y]*

where mode is Auto (ROM default), Hold, Load, or Unload.

The possible values of Y are “Current,” “Condenser Limit,” or “Evap Limit.”

If no limit mode is in effect, the following is displayed in place of the limit mode:

“(+) (-) and <Enter> “.

Manual Loading/Unloading Duty Cycle

Manual Loading/Unloading Duty Cycle: xx%
Press (+)(-) to Change Setting

The range of values is 0 to 50% in increments of 1%. The ROM default is 30%.The slide valve control triacs will pulse the solenoid valve on a 5 second period according to the duty cycle as set above, e.g. a 50% duty cycle setting will cause a 2.5 second pulse every 5 seconds. This will continue until the duty cycle is changed or the mode is returned to auto, hold, or the opposite manual mode.

Master Oil Solenoid Valve

Master Oil Line Solenoid Valve: [mode]
Press (+)(-) to Change Setting

Possible values for mode are Auto (ROM default) and On.

This item can only be set to “on” or “auto” if the Local Stop or Diagnostic Shutdown Stop. If the unit is in any other operating mode, the second line of the display will say “Unit Must Be in Stop To Set “on”” Also, the mode will automatically be set to Auto if the chiller is put into Auto mode.

Oil Loss Level Sensor Status

The following display is not a setpoint. It gives the Oil Loss Level status at the input to the UCM.

Oil Loss Level Sensor Status:
[s]

Possible values foir [s] are Wet or Dry.

Note: The dry or wet status is determined by the chiller module by using a filtered value from the sensor’s A/D input and comparing it to fixed switchpoint levels.

Oil Flow Delta Pressure Switch Status

The following display is not a setpoint. It gives the Oil Flow Delta Pressure Switch status at the input to the UCM.

Oil Loss Level Sensor Status:
[s]

Possible values of [y] are Flow Switch is Open/No Flow and Flow Switch is Closed/Flow.

Oil Return Gas Pump Fill Solenoid Valve

Oil Return Fill Solenoid Valve: [Mode]
Press (+)(-) to Change Setting

Possible values for mode are Auto (ROM default) and On.

This can only be set to On fromAuto if the operating mode is Local Stop or Diagnostic Shutdown Stop. If the unit is in any other mode, the second didplay line will read: “Unit Must Be In Stop to Set to “on.”” Also the mode will automatically be set to Auto if the chiller is put in Auto mode.

Oil Return Gas Pump Drain Solenoid

Oil Return Drain Solenoid Valve: [Mode]
Press (+)(-) to Change Setting

Possible values for mode are Auto (ROM default) and On.

This can only be set to On fromAuto if the operating mode is Local Stop or Diagnostic Shutdown Stop. If the unit is in any other mode, the second didplay line will read: “Unit Must Be In Stop to Set to “on.”” Also the mode will automatically be set to Auto if the chiller is put in Auto mode.

Module Software Revision Levels

Press (Enter) To Display Software
Revision Levels Or (Next) To Continue

If <Enter> is selected the following screen can be displayed 4 times with 4 different pairs of modules.

[Module x:]	*[Software PN]*
[Module y:]	*[Software PN]*

The modules and prefix software PN will be one of the following:

Chiller	*6200-0079-xx*
Starter	*6200-0055-xx*
Options	*6200-0040-xx*
Stepper	*6200-0081-xx*
TCI	*6200-0093-xx*
LCLD (local CLD)	*6200-0091-xx*
RCLD	*6200-0091-xx*
CCCLD (Complex Character CLD)	*6200-0092-xx*
Refrigerant Monitor	*Rev -xx*

Where xx is the software revision level as communicated over the IPC bus. The entire formal software part number for the particular module will be displayed for each of the modules or devices shown above (with the exception of the refrigerant monitor, which will only display the Rev level). If a software part number for a given module has not been read by the CLD at any time since its last reset (RAM initialization) it will display the words: “not available” in place of the software PN.

Notes: These screens will display a line item for every possible module in an RTHC system. If a module fails during operation, the software revision for that module will still appear on the CLD until after a CLD power down reset.

Factory Settings

The following table contains the values and setpoints for many menu settings as they are normally set in the factory prior to shipping the unit. Some settings are same as the ROM defaults (hardcoded settings to which the UCP would default in the event of memory errors). Other settings are made in the factory and based on a particular chiller option or application requested via the sales order. In the latter case, the factory settings would differ. Remember, before making changes to any settings, record the original pre-set values so that the original settings could be restored.

Table 24
General Factory Settings

Operator Settings	*Front Panel Chilled Wtr Setpt*	*44.0°F*
	Front Panel Current Limit Setpt	*100%*
	Chilled Water Reset Type	*DISABLE*
	Ice Building	*(per order or application)*
	Panel Ice Termination Setpt	*27°F*
	Ice-to-Normal Cooling Timer	*5 min*
	Chilled Water Setpt Source	*FRONT PANEL*
	Current Limit Setpt Source	*FRONT PANEL*
	Ice Termination Setpt Source	*FRONT PANEL*
	Setpoint Source Override	*NONE*
Service Settings (Non-Passwd Protect)	*Language*	*ENGLISH*
	Display Units	*ENGLISH*
	Decimal Places Displayed	*XXX.X*
	Display Menu Headings	*DISABLE*
	Differential to Start Setpt	*5.0°F*
	Differential to Stop Setpt	*5.0°F*
	Evap Pump Off Delay	*1.0 MIN*

Table 24
General Factory Settings

Service Settings (Field Startup Group)	*ICS Address*	*65*
	Power Up Start Delay Time	*0 SEC*
	Design Delta Temp Setpt	*10° F*
	Lvg Wtr Temp Cutout Setpt	*36° F*
	Low Rfgt Temp Cutout Setpt	*32° F*
	Condenser Limit Setpt	*90% HPC*
	Max. RI Timer	*5 MIN*
	Under/Over Voltage Protection	*(per application)*
	Phase Reversal Protection	*ENABLE*
	Phase Unbalance Protection	*ENABLE*
	Momentary Power Loss Protection	*ENABLE*
	External Base Loading	*DISABLE*
	Soft Load Control	*DISABLE*
	Soft Load Starting Current Limit	*100%*
	Soft Load Current Limit Rate	*5%/min*
	Soft Load Lvg Water Rate	*5° F/min*
	LWT Prop. Gain Setpt	*6%/° F*
	LWT Integral Gain Setpt	*45 sec*
	LWT Derivative Gain Setpt	*0 sec*
	Liquid Level Control Prop. Gain	*See Table 25*
	Liquid Level Control Integral Reset Time	
	Liquid Level Control Rate Time	
	Liquid Level Control Output Deadband	
	Local Atm Pressure	*14.7*
Service Settings (Machine Configuration Group)	*Compressor Frame Size and Capacity*	*(per order)*
	Refrigerant Monitor Type	*(per order)*
	Refrigerant Type	*R134A*
	Starter Type	*Y-DELTA or Solid State EA Series per order*
	Level 2 Contactor Integrity Test	*ENABLE*
	Rated Load Amps	*(per order)*
	Motor Htg Constant Setpt	*see Table 17*
	Current Overload Setting #1	*(per order)*
	Current Overload Setting #2	*(per order)*
	Maximum Acceleration Timer #1	*see Table 19*
	Maximum Acceleration Timer #2	*see Table 19*
	Acceleration Time Out Action	*TRANSITION*
	EXV Size	*see Table 20*
	EXV Electrical Protection	*ENABLED*
	Ext. Chilled Water Setpoint	*DISABLED*
	External Current Limit Setpt	*DISABLED*
	High Pressure Cutout (HPC) Setting	*180 psig*
	Line Voltage Sensing Opt.	*DISABLED*
	Unit Line Voltage	

Table 24
General Factory Settings

	Ice Building Options	*DISABLED*
	Ext. Analog Inputs	*2-10 VDC*
	Tracer Option	*Not Installed (Automatically Installs)*
	TCI Option	*Not Installed (Automatically Installs)*
	Printer Option	*(per order)*
	Programmable Relay #1	*COMPRESSOR RUNNING*
	Programmable Relay #2	*MMR & MAR*
	Programmable Relay #3	*CHILLER LIMIT*
	Refgt Pressure Analog Output Option	*(per order)*
	Min. Delta Pressure Calibration	*0 psig*
	Max. Delta Pressure Calibration	*175 psig*
Service Tests	*Chilled Water Pump*	*AUTO*
	Condenser Water Pump	*AUTO*
	Starter Dry Run	*DISABLED*
	Expansion Valve Test	*DISABLED*
	EXV Control	*AUTO*
	Slide Valve Control	*AUTO*
	Manual Load/Unload Duty Cycle	*30%*
	Master Oil Line Solenoid Valve	*Auto*
	Oil Return Gas Pump Fill Solenoid Valve	*Auto*
	Oil Return Gas Pump Drain Solenoid Valve	*Auto*

Table 25
Liquid Level Control Settings (Default)

UCP2 Menu Item	*BBB**	*BCD**	*DGG**	*DFF**	*DDE**	*CGG*	*CEF*	*CDE*	*CBC*	*EDD**	*EFF**	*EGG**
Liquid Level Control Prop. Gain (%/inch) (%/cm)	*9.4 (3.7)*	*11 (4.3)*	*10 (4)*	*8.3 (3.3)*	*6.5 (2.6)*	*11.6 (4.6)*	*8.8 (3.5)*	*7.5 (3)*	*7.0 (2.8)*	*6.5 (2.6)*	*8.3 (3.3)*	*10 (4)*
Liquid Level Control Int. Reset Time (seconds)	*70*	*70*	*60*	*60*	*60*	*80*	*80*	*80*	*80*	*60*	*60*	*60*
Liquid Level Control Rate Time (seconds)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Liq. Level Control Output Deadband (steps)	*1*	*2*	*7*	*5*	*4*	*5*	*4*	*3*	*3*	*4*	*5*	*7*

**Refer to Unit Model No. digits 6, 12, 16*

Diagnostics

When the diagnostics key is pressed, all diagnostics, both historical and active are reported followed by prompts allowing you to clear all diagnostics.

Should a diagnostic occur in Auto mode, the display will automatically go to this menu and display certain messages as explained below and detailed in Section 10, Diagnostics.

Diagnostics Group Header Display Screens

When the group is manually accessed by pressing the <Diagnostics> key, the first screens displayed provide header information for the group. These header screens include a summary screen, a

password screen, and a screen indicating whether diagnostics are present:

Active & Historic Diagnostics *Press (Next)(Previous) To Continue*

Settings In This Menu Are [status] *[password message]*

NOTE: The above password screen is only shown if the Menu Settings Password feature is enabled under the Service Settings Group. If the Settings are "locked," you will be unable to clear active or historic diagnostics unless the password is entered, but you will be able to "see" the diagnostics. As with all other groups, the Password sequence to unlock the group is < ->< +>< ->< +>< ->< +> followed by <Enter>.

If there are no diagnostics present, only the following screen will be displayed under the diagnostics group heading screen.

No Diagnostics Present
Press (Next) (Previous) To Continue

If any diagnostics are present, the following 3 screens are displayed sequentially when the <Next> key is pressed. The first:

Diagnostic Report Follows
Press (Next) For More

is followed by:

Press (Enter) To Display Operating Mode
At Time Of Last Diagnostic Or (Next) For More

The third screen will be the chiller operating mode display present when the most recent diagnostic occurred.

If one or more diagnostics are present, the following displays will be inserted into the display sequence. Diagnostics are listed in order of occurrence from newest to oldest.

The first active diagnostic screen will be:

[sn]	*[diagnostic]*
(Next)	*[diagnostic type]*

The sequence number (sn) will run from 1 through 20 with the most recent diagnostic numbered "01."

The complete listing of diagnostics is contained in Section 10.

The possible replacements for "diagnostic type" field are:

Warning Only - Reset Not Reqd (applies to all IFW diagnostics)

Unit Shutdown - Reset Reqd (applies to all MMR diagnostics)

Unit Shutdown - Automatic Reset (applies to all MAR diagnostics)

The second active diagnostic display screen will contain the diagnostic sequence number, a time and date stamp, and a help message suggesting possible service procedures. The second active diagnostic display screen will be:

[sn] occurred at HH:MM xm Mon xx, 199x
[help message]

The time will be displayed as xx:xx am/pm.

The date will be displayed as month - date- year

The month will use a standard 3-letter abbreviation. The year will not be abbreviated.

All help messages are listed in Section 10 with the associated diagnostics.

pressing the <Next> key will advance the display to the next diagnostic in the sequence.

The first historic diagnostic screen will be:

[sn] [Diagnostic]
Historic Only, Press (Next) For More

The diagnostic and sequence numbers are the same as for the active diagnostic messages. If <Next> is

pressed the second historic diagnostic screen is displayed. The second historic diagnostic screen will be:

[sn] occurred at HH:MM xm Mon xx, 199x
Historic Only, Reset At End Of Diag Menu

Up to 20 diagnostics will be displayed.

Clearing Diagnostics

At the end of the diagnostic menu, four screens will allow you to Clear/Reset the different diagnostic groups.

If any active diagnostics are present, the following screen will be displayed:

Press (Enter) To Clr Active Diagnostics
And Shutdown / Reset System

If the <Enter> key is pressed, the following message is displayed for 2 seconds:

Active Diagnostics Have Been Cleared
System Is Resetting

The display will be reset to the operating mode screen of the chiller report after this message clears.

If any historic diagnostics are present, the following screen will be displayed:

Press (Enter) To
Clear Historic Diagnostics

If the <Enter> key is pressed, the following message is displayed for 4 seconds:

Historic Diagnostics Have Been Cleared
Diagnostic Report Is Being Reset

The display will be reset to the top of the Diagnostic Menu after this message clears.

If any IPC refrigerant monitor diagnostics are present, the following screen will be displayed:

Press (+) To
Silence Rfgt Monitor Audible Alarm

NOTE: Pressing (+) will silence the audible alarm.

If the <+> key is pressed, the following message is displayed for 4 seconds:

Silencing Rfgt Monitor Audible Alarm;
Clearing Nonactive Rfgt Alarms

Daily Unit Start-Up

NOTE: Unless the UCP2 and building automation system are controlling the chilled water pump, the manual unit start sequence is as follows. Operator actions are noted.

1 Observe the red LED beside the CLD to verify that all UCP2-controlled outputs (slide valve control, electronic expansion valve, fill and drain solenoid, and master oil solenoid) are all under automatic control. The light should be *off*.

If the red LED is *on* (constantly), it indicates that some outputs are in a manual override state and this may prevent the chiller from starting or running normally. press the <Service Tests> key on the CLD, enter the appropriate password as necessary and advance through the menu to set the outputs to automatic.

If the red LED is *flashing*, this means that a diagnostic is present requiring a manual reset. (See the Diagnostics section 10 for more information.)

2 Verify that all menu items in the UCP2 are set to the desired parameters. Review settings, if desired, by checking the operator and service settings (Press the <Operator Settings> or <Service Settings> key on CLD.)

NOTE: Manual start will require that the External Auto Stop input to the UCP2 from any generic building automation system be closed. If control is from Tracer, have the Tracer send a start signal (SeeTracer Operation Manual.)

3 Turn power to the chiller on.

Once power is applied, two machine actions will occur. All modules will go through a power-up reset phase lasting about 20 seconds. Secondly, a restart inhibit timer will begin and last up to five minutes. This protects the compressor motor from damage in the event of successive start sequences that are aborted. The reset display that appears is:

The following status screens will be displayed and require no operator action:

Self Test in Progress

<Software PN>	*Local Configuration*
Copyright American Standard Inc. 1996	

<Software PN>	*Local Configuration*
Updating Unit Data, Please Wait	

At the end of the power up sequence, the UCP2 will energize the slide valve unload solenoid for a minimum of 60 seconds, drive the EXV fully open, and energize the compressor oil heater.

4 Press the <Auto> key on the CLD.

The unit will proceed to the next machine action series unless the UCP2 detects that the unit was last in stop or the unit is currently inhibited by a remote source. If that occurs, one of two screens will be displayed.

Local Stop: Cannot be Overridden By
Any External or Remote Device

or

Remote Run Inhibit
From <type> Source

where <type> is External or Tracer.

Once the remote inhibit is cleared or the chiller mode is set to Auto, the start sequence continues and the chilled water pump relay is energized. The UCP2 will confirm chilled water flow or time out if no flow is detected.

From this point, the UCP2 will be looking for a differential to start or, basically, a requirement for cooling. *(NOTE: differential to start is the degrees range above setpoint that the leaving water temperature must drift before the chiller will start.)* Until that need is apparent, no further action will occur. The following screen will come up informing the operator of the situation.

Auto
Waiting For A Need To Cool

Assuming eventually that a differential is satisfied, the start sequence continues, waiting only for the restart inhibit (or other) timer to time out.

During this waiting period, the operating mode is displayed as:

Starting is Inhibited by Restart Inhibit	
Timer: Time Remaining:	*Min; Sec*

or

Starting is Inhibited by Staggered Start	
Time Remaining:	*Min; Sec*

or

Low Diff Rfgt Pres - Overheating Cprsr	
Cooldown Time Remaining	*Min; Sec*

All of the above modes could occur and inhibit starting once a demand has been established. The first mode “Restart Inhibit” is a mode that prevents fast cycling of the compressor motor and the build up of heat caused by successive inrush starting currents occurring too close together. This mode enforces an appropriate cool-down time for the motor. Parameters effecting this mode are dependent on motor size and inrush characteristics and thus are not intended to be user adjusted.

The “Staggered Start” mode provides an easy way for a user to prevent two or more chillers in an installation, from all starting simultaneously after a power interruption or power application. The Staggered Start delay setting is adjustable in the Field Startup Group.

The last mode above is invoked if a restart is attempted immediately following the occurrence of certain critical “Low System Differential Pressure” diagnostics. This mode will then prevent restart of chiller, despite manual reset attempts, until a predetermined cool-down time has been allowed. The cool-down is necessary as the compressor has been operating with less than desired oil flow rates causing excessive rotor heating. A restart is not allowed unless 60 minutes have expired since the occurrence of the No System Differential Pressure or Low System Differential Pressure Diagnostic. The time remaining for the cool-down period is displayed with the mode. The mode reduces the risk of serious compressor damage that would otherwise result from frequent starts or short cycling situations when condenser pressures are too low.

30 seconds prior to starting, the condenser water pump relay is energized and the UCP2 confirms condenser water flow. Also the electronic expansion valve is pre-positioned (40% open) and the unload slide valve solenoid is energized. Be aware that the start of the condenser water pump and the pre-start unload may begin even before the restart inhibit timer times out.

During these last few seconds before the compressor starts, the UCP2 is completing a final component and contactor test. Finally, the master oil line solenoid is energized, the oil heater is de-energized, and the compressor starter sequence begins.

As the compressor starts, the following is displayed:

Starting

When the starting sequence is complete, unless a diagnostic occurs, the next screen will be:

Unit is Running
<limit condition if applicable>

the possible limit conditions being softloading, condenser limit, evaporator limit, current limit and phase unbalance limit. These limits are discussed in the following paragraphs.

After the starting sequence ends, the UCP2 checks for a complete starter transition, begins a run unload mode, and energizes the unload solenoid for 30 seconds

In the normal mode, the compressor slide valve will modulate to satisfy the leaving water setpoint. Also the EXV will modulate to maintain the desired liquid level control in the evaporator.

Limit Conditions

The UCP2 will automatically limit certain operating parameters during startup and run modes to maintain optimum chiller performance and prevent nuisance diagnostic trips. These limit conditions will be noted as a second line of the operating mode display "Unit is Running." (See *Table 16* in section 5 for the possibilities.) First the limit condition is noted as, for example

Unit is Running
Capacity Limited By Low Evap Temp

As the adaptive controls initiate machine actions, the status of those actions will appear as the second line as, for example

Unit is Running
Establishing Minimum Capacity Limit

The following are limit controls, all of which the UCM will limit to adjustable setpoints:

- **Current Limit Control** - The UCM reads the current from the current input and limits it using the solenoid valves that operate the slide valve.
- **Condenser Limit Control** - The UCM converts the saturated condensing refrigerant sensor reading to a pressure and limits it using the solenoid valves that operate the slide valve.
- **Evaporator Limit Control** - The UCM reads evaporator refrigerant temperature from a temperature sensor and limits it using the solenoid valves that operate the slide valve.
- **EXV/Liquid Level Control** - The UCM reads the evaporator liquid level sensor output and maintains it by opening and closing the EXV.
- **Soft Loading** - Soft loading prevents the chiller from going to full capacity during the cooldown period (often done by imposing a current limit) or slows the rate of loading during the initial pull-down (by limiting the loading).
- **Minimum Capacity Limit** - This control operates in direct response to the compressor discharge temperature and will force load the compressor in an attempt to head off a high discharge temperature cutout and diagnostic.

Note: While limit controls are in effect, sudden variations in some display readings and machine actions will be observed.

Seasonal Unit Start-Up Procedure

1. Close all valves and re-install 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). Close the vents in the evaporator chilled water circuits.
4. Open all 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

CAUTION: Insure that the oil sump heaters have been operating for a minimum of 24 hours before starting. Failure to do so may result in equipment damage.

6. Check the adjustment and operation of each safety and operating control.
7. Close all disconnect switches.
8. Refer to the sequence for daily unit startup for the remainder of the seasonal startup.

Unit Shutdown

Daily Unit Shutdown

The unit will shut down *normally* in either of two ways: when the cooling requirement is satisfied and when the <Stop> key is pressed.

NOTE: The normal shutdown sequence in the following paragraphs is discussed in terms of Clear Language Displays that will appear, events that are initiated by the operator, and machine actions that occur.

The shutdown sequence begins when either the cooling requirement is satisfied in Auto mode or when the <Stop> key is pressed. In either case, the slide valve unload solenoid is energized for 20 seconds and the electronic expansion valve is opened at the full rate. During this period the following operating mode display appears:

Unit is Preparing to Shutdown

After the 20 seconds required to close the slide valve, the expansion valve remains open and the compressor stops. Both the master oil line solenoid and the condenser water pump are de-energized and both the unload solenoid and oil heater are energized. The unload solenoid remains energized for 60 minutes. These actions mark the beginning of a time-out sequence (restart inhibit timer at a reduced rate if in Auto mode) and the chilled water pump off delay timer for up to 30 minutes (adjustable) if manual stop occurred.

If the unit was in Auto mode when the stop sequence began, the following:

Auto
Waiting For Need To Cool

is displayed and remains until the unit starts with a need to cool.

If the unit was manually stopped by the operator when the stop sequence began, the following:

Local Stop: Cannot Be Overridden By
Any External Or Remote Device

or:

Remote Run Inhibit
From <type> Source

is displayed and remains until the end of the sequence when the chilled water pump relay is de-energized.

Seasonal Unit Shutdown

1. Perform the normal unit stop sequence using the <Stop> key.

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

2. Verify that the chilled water and condenser water pumps are cycled off. If desired, open the disconnect switches to the pumps.
3. Drain the condenser piping and cooling tower, if desired.
4. Remove the drain and vent plugs from the condenser headers to drain the condenser.
5. Once the unit is secured, perform the maintenance identified in Section 9.

Periodic Maintenance

Overview

This section describes preventive maintenance procedures and intervals for the Series R unit. Use a periodic maintenance program to ensure maximum performance and efficiency of the Series R units.

An important aspect of the chiller maintenance program is the regular completion of the “Series R 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-condensables in the system).

Weekly Maintenance and Checks

After the unit has operated for approximately 30 minutes and the system has stabilized, check the operating conditions and complete the procedures below:

- ❑ Log the chiller.
- ❑ Check evaporator and condenser pressures with gauges and compare to the reading on the Clear Language Display. Pressure readings should fall within the following ranges specified in the Operating Conditions table:

NOTE: Optimum condenser pressure is dependent on condenser water temperature, and should equal the saturation pressure of the refrigerant at a temperature 2 to 5°F above that of leaving condenser water at full load.

Monthly Maintenance and Checks

- ❑ Review operating log.
- ❑ Clean all water strainers in both the chilled and condensing water piping systems.
- ❑ Measure the oil filter pressure drop. Replace oil filter if required. Refer to “Service Procedures”.
- ❑ Measure and log the subcooling and superheat. Refer to *Table 26*
- ❑ If operating conditions indicate a refrigerant shortage, leak check the unit using soap bubbles.
- ❑ Repair all leaks.
- ❑ Trim refrigerant charge until the unit operates in the conditions listed in *Table 26* at full load, ARI conditions.

NOTE: ARI conditions are: condenser water: 85°F and 3 GPM/XXX tons and evaporator water: 54-44°F

Table 26
Operating Conditions at Full Load

Description	Condition
Evaporator pressure	*40-55 psig*
Condensing pressure	*85-120 psig*
Discharge superheat	*17°F*
Subcooling	*5-10°F*
EXV percent open	*40-50% open in Auto mode*
NOTE: All conditions stated above are based on the unit running fully loaded, running at ARI conditions.	

- ❑ If full load conditions can not be met, use *Table 27* , to trim the refrigerant charge

NOTE: Conditions at minimum must be: entering condenser water: 85°F and entering evaporator water: 55°F

Table 27
Operating Conditions at Minimum Load

Description	Condition
Evaporator approach	**less than 7°F (non-glycol applications)*
Condensing approach	**less than 7°F*
Subcooling	*2-3°F*
EXV percent open	*10-20 % open*

*NOTE: * 1.0°F for new unit.*

Annual Maintenance

Shut down the chiller once each year to check the items listed below.

⚠ WARNING

Hazardous Voltage! Disconnect all electrical power, including remote disconnects before servicing. Failure to disconnect power before servicing can cause severe personal injury or death.

- ❑ Perform all weekly and monthly maintenance procedures.
- ❑ Check the refrigerant charge and oil level. Refer to Section 9 “Maintenance Procedures”. Routine oil changing is not necessary on a hermetic system.
- ❑ Have a qualified laboratory perform an oil analysis to determine system moisture content and acid level.

IMPORTANT: Due to the hygroscopic properties of the POE oil, all oil must be stored in metal containers. The oil will absorb water if stored in a plastic container

- ❑ Check the pressure drop across the oil filter. Refer to Section 9 “Maintenance Procedures”.
- ❑ Contact a qualified service organization to leak check the chiller, to inspect safety controls, and inspect electrical components for deficiencies.
- ❑ Inspect all piping components for leakage and damage. Clean out any inline strainers.
- ❑ Clean and repaint any areas that show signs of corrosion.
- ❑ Test vent piping of all relief valves for presence of refrigerant to detect improperly sealed relief valves. Replace any leaking relief valve.
- ❑ Inspect the condenser tubes for fouling; clean if necessary. Refer to Section 9 “Maintenance Procedures”.

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.

Operating Log

A sample of several operating logs and checklists have been included. Tablets are available from the parts department. Refer to Form numbers: 1-27.133(698), 1-27.134(698), 1-27.135(698) and 1-27.136(698)

Series R Start-up Test Log

Job Name	Job Location
Model #	Serial # start date:
Sales Order # ship date:	Job elevation (ft. above sea level)
STARTER DATA:	**START-UP ONLY**
Manufacturer	Chiller appearance at arrival:
Type: (solid state, wye-delta)	Compressor shipping bolts removed? Y N
Vendor ID #/Model #:	Oil separator shipping bolts removed? Y N
_____Volts _____Amps _____ Hz	Machine Gauge Pressure: psig
COMPRESSOR DATA:	Machine UCP2 Pressure psig
Model #:	**Complete if pressure test is required**
Serial #:	Vacuum after leak test= mm
NAMEPLATE DATA:	Standing vacuum test = _____ mm rise in _____ hrs
_____ RLA _____KW _____Volts 50 60 Hz	**UNIT CHARGES**
DESIGN DATA:	Unit refrigerant charge: lbs R -
_____ RLA _____ KW _____Volts 50 60 Hz	Unit Oil Charge: gal oil
CURRENT TRANSFORMER	**SUMMARY OF UNIT OPTIONS INSTALLED**
Part Number (“X” code and 2-digit extension)	Y N Tracer Communications Interface
Primary CT’s	Y N Options Module
X -	Y N Outdoor Air Sensor
X -	Y N Ice Making Control
X -	Y N Other

DESIGN CONDITIONS				
Evap Design:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____
Evap Actual:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____
Cond Design:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____
Cond Actual:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____

Owner Witness Signature: _____

MENU ITEM	15 min. run-time	30 min. run-time	1 hr. run-time
CHILLER REPORT			
Chiller Operating Mode			
Chilled Water Setpoint [source]			
Evap. Leaving Water Temp			
Evap Entering Water Temp			
Cond Leaving Water Temp			
Cond Entering Water Temp			
Active Current Limit Setpoint			
Outdoor Air Temp (optional)			
REFRIGERANT REPORT			
Evap Refrigerant Pressure			
Cond Refrigerant Pressure			
Evap Liquid Level (+1 to -1)			
EXV Valve Position (% open)			
Compressor Discharge Temp			
Discharge Superheat			
Evap Approach Temp			
Cond Approach Temp			
COMPRESSOR REPORT			
Comp Phase Currents (%RLA)			
Comp Phase Currents (Amps)			
Compressor Phase Voltage			
Compressor Starts			
Compressor Running Time			

MENU ITEMS	SETTING
OPERATOR SETTINGS	
Setting in this menu are	Lock Unlock

MENU ITEMS	SETTING
Current Time/Date	
Front Panel Chilled Water Setpt	
Front Panel Current Limit Setpt	

MENU ITEMS	SETTING
Front Panel Chilled Water Setpt	
Front Panel Current Limit Setpt	
Chilled Wtr Reset Type	
Reset Ratio	
Start Reset Setpoint	
Max Reset Setpoint	
Ice Building	D E
Panel Ice Termination Setpt	
Ice to Normal Cooling Timer	
Chilled Wtr Setpt Source	
Current Lmt Setp Source	
Ice Term Setpt Source	
Setpoint Source override	
SERVICE SETTINGS GROUP (NON-PASSWORD)	
Settings in this menu are	Lock Unlock
Keypad/display lockout	
Display units	
Decimal places display	
Display menu headings	D E
Clear Custom Menu	
Differential to start set-point	
Differential to stop set-point	
Evap pump off delay	
Clear RI timer	
SERVICE SETTINGS GROUP FIELD START-UP GROUP (++--++)	
Keypad/display Lock	D E
Menu settings password feature	D E

MENU ITEMS	SETTING
ICS Address	
Power up start delay time	
Design Delta Temp Setpt	
Lvg Wtr Temp Cutout Setpt	
Low Rfgt Cutout Setpt	
Condenser Limit Setpt	
Max. RI timer	
Under/Over Voltage	D E
Phase Reversal Protec-tion	D E
Phase Unbalance Limit	D E
Momentary Power Loss Protection	D E
Soft Load Control	D E
Soft Loading Starting Current Limit	
Soft Load Current Limit Rate	
Soft Load Leaving Water Rate	
LWT Control Propor-tional Gain	
LWT Control Integral Reset TIme	
LWT Control Rate TIme	
EXV Max Travel Setpt	
Liq. Level Control Pro-portional Gain	
Liq. Level Control Inte-gral Reset Time	
Liq. Level Control Rate TIme	
Local Atmospheric Pres-sure	

MENU ITEMS	SETTING
SERVICE SETTINGS GROUP MACHINE CONFIGURATION GROUP (+-+-+-)	
Compressor Frame Size and Capacity	
Nominal Unit Tons	
Starter Type	
Level 2 Contactor Integrity Test	D E
Rated Load Amps	
Motor Heating Constant	
Current Overload Setting #1	
Current Overload Setting #2	
Max Acceleration Timer #1	
Max Acceleration Timer #2	
Acceleration Time Out Action	Shutdown Transition
EXV Size	
External Chilled Water Setpt Option	Install Not Install
Ext. Current Limit Option	Install Not Install
High Pressure Cutout Setting	
Line Voltage Sensing Option	
Unit Line Voltage	
Ice Building Option	Install Not Install
Ext. Setpoint Inputs	4-20 ma 2-10 vdc
Tracer Option	Install Not Install
TCI Option	Install Not Install

MENU ITEMS	SETTING
Print Option	Install Not Install
Relay #1	
Relay #2	
Relay #3	
Rfgt Pres. Output Option	
Min Delta Pres. Calib.	
Max. Delta Pres. Calib.	

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Series R Start-up Test Log

Job Name	Job Location
Model #	Serial # start date:
Sales Order # ship date:	Job elevation (ft. above sea level)
STARTER DATA:	**START-UP ONLY**
Manufacturer	Chiller appearance at arrival:
Type: (solid state, wye-delta)	
Vendor ID #/Model #:	
_____Volts _____Amps _____ Hz	Machine Gauge Pressure: psig
COMPRESSOR DATA:	Machine UCP2 Pressure psig
Model #:	**Complete if pressure test is required**
Serial #:	Vacuum after leak test= mm
NAMEPLATE DATA:	Standing vacuum test = _____ mm rise in _____ hrs
_____ RLA _____KW _____Volts 50 60 Hz	**UNIT CHARGES**
DESIGN DATA:	Unit refrigerant charge: lbs R -
_____ RLA _____ KW _____Volts 50 60 Hz	Unit Oil Charge: gal oil
CURRENT TRANSFORMER	**SUMMARY OF UNIT OPTIONS INSTALLED**
Part Number (“X” code and 2-digit extension)	Y N Tracer Communications Interface
Primary CT’s	Y N Options Module
X -	Y N Outdoor Air Sensor
X -	Y N Ice Making Control
X -	Y N Other

DESIGN CONDITIONS				
Evap Design:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____
Evap Actual:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____
Cond Design:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____
Cond Actual:	_____GPM	_____ PSID	Ent. Water F_____	Leaving Water F_____

Owner Witness Signature: _____

Installation Checklist for Model RTHB/RTHC Series R

To:_____ Trane Service Company

S.O. No.:_____Serial No: _____

Job/Project Name:_____

RECEIVING

	Verify that the unit nameplate data corresponds to the ordering information.
	Inspect the unit for shipping damage and any shortages of materials. Report any damage or shortage to the carrier.

UNIT LOCATION AND MOUNTING

	Inspect the location desired for installation and verify adequate service access clearances.
	Provide drainage for evaporator and condenser water.
	Remove and discard all shipping materials (cartons, etc.)
	Install optional spring or neoprene isolators, if required. Refer to IOM for details.
	Level unit and secure it to the mounting surface.

UNIT PIPING

CAUTION: If using an acidic commercial flushing solution, construct a temporary bypass around the unit to prevent damage to the internal components of the condenser and evaporator. To avoid possible equipment damage, do not use untreated or improperly treated system water.

	Flush all unit water piping before making final connections to unit.
	Connect water piping to the evaporator and condenser.
	Install pressure gauges and shutoff valves on the water inlet and outlet to the evap. and cond.
	Install water strainers in the entering chilled water and condenser water lines.
	Install balancing valves (discretionary) and flow switches in the leaving chilled and condenser water lines.
	Install drains with shutoff valves or drain plugs on the evaporator and condenser.
	Vent the chilled water and condenser water systems at the high points of the system piping.
	Pipe relief valves outdoors in accordance to ASHRAE 15 and the IOM.

ELECTRICAL WIRING

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

	Check for tight connections for the unit power supply wiring with the fused disconnect to the terminal block (or unit-mounted disconnect) in the power section of the control panel.
	Check for tight 115 volt control wiring connections to the chilled water pump and condenser water pump
	Check Interlock Wiring, including chilled water pump control, chilled water flow interlock, condenser water pump, condenser water flow interlock, external auto stop. For further details refer to the IOM or the unit wiring.

CAUTION: Information on Interconnecting Wiring: Chilled Water Pump Interlock and External Auto/Stop must be adhered to or equipment damage may occur.

Installation Checklist for Model RTHB/RTHC Series R	
	If remote Alarm contacts, Limit Warning Contact, Outdoor Air Temperature Sensor, Emergency Stop, Head Relief Request Contact, Ice Making, External Chilled Water Setpoint, External Current Limit Setpoint, Percent Condenser Pressure output are used refer to the IOM and the unit wiring for further details.
	Control power wiring isolated in control panel/starter panel enclosure.
	Is chilled water pump control by UCP2 or Others (circle one)
PRE-START CHECK-OUT	
	Inspect all wiring connections. Connections should be clean and tight.
	Energize crankcase heaters. Heaters need to be energized 24 hours before start-up.
	Confirm that all service and isolation valves are open. Refer to RTHC-SB-1 for RTHC units and RTHB-IOM-1 for the RTHB units.
	Remove the four compressor shipping stops (snubbers) from under the compressor. (RTHC only)
	Remove shipping bolts from under the two oil separators (RTHC only)
	Confirm phase-sequencing "A-B-C". Refer to the IOM for further details.
	Check all water temperature sensors for proper installation and use of heat transfer paste.
	Fill the chilled water circuit. Type of glycol _____ Percent of glycol _____ by weight
CAUTION: To prevent equipment damage, do not use untreated or improperly treated water in the system.	
	Fill the condensing water circuit.
	Close the fused disconnect switch to supply power to the chilled water pump and condenser water pump starter.
	Start the water pumps. With water pumps running, inspect all piping connections for leakage. Make any necessary repairs.
	With water pumps running, adjust water flows and check water pressure drops through the evaporator and condenser.
	Adjust the flow switches for proper operation.
	Return pumps to the automatic mode.
	Disable machine start circuit until start-up mechanic arrives (use either the external stop or emergency stop circuit)

Model RTHB/RTHC Series R Checksheet and Request for Serviceman

To:_____ Trane Service Company

S.O. No.:_____Serial No: _____

Job/Project Name:_____

The following items are being installed and will be complete by _____

Series R Unit			Interconnecting wiring, starter to control panel
	In place and piped. Do not insulate the unit or adjacent piping. The contractor is responsible for any foreign material left in the unit.		External Interlock (flow switches, water pump aux. etc.)
Piping			Chilled water pump motor connected
Chilled water piping connected to:			Cooling tower fan rotation checked
	Series R unit (In and out different between RTHB and RTHC, refer to IOM)		Condenser water pump motor connected
	Air handling units		Pump (as applicable)
	Pumps		Power available for vacuum pump (115 VAC)
Condenser water piping connected to:			All controls installed and connected
	Series R unit (refer to IOM for details)		All magnetic starters installed and connected
	Cooling tower	**Testing**	
	Pumps		Dry nitrogen available for pressure testing
	Make-up water connected to cooling tower		Rfgt available for leak testing (25 lbs)
	Water supply connected to filling system	**Refrigerant**	
	Systems filled		Refrigerant on job site
	Pumps run, air bled from system	**Gauges, Thermometers and Air Vents**	
	Remove construction strainer and replace with permanent strainer.		Installed on both sides of evap
Flow Balancing Valves Installed			Installed on both sides of the condenser
	Leaving chilled water	**MISC**	
	Leaving condenser water		System can be operated under load conditions
Wiring			Electrician, control man and contractor's rep. are available to evacuate, charge and test the Series R under serviceman's supervision
	Compressor motor starter furnished by or approved by the Trane Company, Pueblo, CO		Owner/contractor informed on proper water treatment

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 Series R has been properly and completely installed and the applicable items listed above have been completed.

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

Compliance to ASHRAE Standard 15		
YES	No	Does the equipment room have a refrigerant monitor/sensor capable of monitoring and alarming within the acceptable exposure level (AEL) of the refrigerant?
YES	No	Does the equipment room have an audible or visual alarm (other than the light on the monitor) which is controlled by the monitor?
YES	No	Does the equipment room have the mechanical ventilation?***
YES	No	Is a self contained breathing apparatus available in close proximity of the equipment room?
YES	No	Are the purge discharge and the rupture disk piped to the indoors?
*** The mechanical ventilation consists of two flow requirements i.e., a two-speed fan where the high speed is sized by the formula Cfm=100 X the square foot of the pounds of refrigerant of the largest chiller, low speed is 0.5 Cfm per square foot of the equipment room space. (This requirement is for chillers located within the building which is the most common.)		
Owner awareness of safe refrigerant handling procedures		
YES	No	Has the owner been fully instructed on the proper use of the refrigerant used in the Series R chiller?
YES	No	Was the owner given a copy of the MSDS sheet for the refrigerant used in the chiller?
YES	No	Was the owner given a copy of Trane publication “CFC-GUIDE-2, Refrigerant Handling Guidelines”?

Additional time required to complete the start-up and adjustment due to incompleteness of the installation will be invoiced at prevailing rates.

Evaporator National Board Number: _____

Starter Model Number: _____

Compressor Serial Number: _____

Special Start-up Instructions: _____

_____

_____

Checklist Completed by: _____

Signed: _____

Dated: _____

Notice to Trane Service Agency:

A copy of this completed form must be submitted to the Series R Technical Service Department in Pueblo, CO prior to the actual start-up date.

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Series R Chiller Test Log		
Date	Sales Order No:	Voltage
Job Name:	Model No:	Contract No.:
Job Location:	Serial No:	

MENU ITEM	15 min. run-time	30 min. run-time	1 hr. run-time
CHILLER REPORT			
Chiller Operating Mode			
Chilled Water Setpoint [source]			
Evap. Leaving Water Temp			
Evap Entering Water Temp			
Cond Leaving Water Temp			
Cond Entering Water Temp			
Active Current Limit Setpoint			
Outdoor Air Temp (optional)			
REFRIGERANT REPORT			
Evap Refrigerant Pressure			
Cond Refrigerant Pressure			
Evap Liquid Level (+1 to -1)			
EXV Valve Position (% open)			
Compressor Discharge Temp			
Discharge Superheat			
Evap Approach Temp			
Cond Approach Temp			
COMPRESSOR REPORT			
Comp Phase Currents (%RLA)			
Comp Phase Currents (Amps)			
Compressor Phase Voltage			
Compressor Starts			
Compressor Running Time			

MENU ITEMS	SETTING
OPERATOR SETTINGS	
Setting in this menu are	Lock Unlock
Current Time/Date	
Front Panel Chilled Water Setpt	
Front Panel Current Limit Setpt	
Chilled Wtr Reset Type	
Reset Ratio	
Start Reset Setpoint	
Max Reset Setpoint	
Ice Building	D E
Panel Ice Termination Setpt	
Ice to Normal Cooling Timer	
Chilled Wtr Setpt Source	
Current Lmt Setp Source	
Ice Term Setpt Source	
Setpoint Source override	
SERVICE SETTINGS GROUP (NON-PASSWORD)	
Settings in this menu are	Lock Unlock
Keypad/display lockout	
Display units	
Decimal places display	
Display menu headings	D E
Clear Custom Menu	

MENU ITEMS	SETTING
Differential to start set-point	
Differential to stop set-point	
Evap pump off delay	
Clear RI timer	
SERVICE SETTINGS GROUP FIELD START-UP GROUP (++--++)	
Keypad/display Lock	D E
Menu settings password feature	D E
ICS Address	
Power up start delay time	
Design Delta Temp Setpt	
Lvg Wtr Temp Cutout Setpt	
Low Rfgt Cutout Setpt	
Condenser Limit Setpt	
Max. RI timer	
Under/Over Voltage	D E
Phase Reversal Protection	D E
Phase Unbalance Limit	D E
Momentary Power Loss Protection	D E
Soft Load Control	D E
Soft Loading Starting Current Limit	
Soft Load Current Limit Rate	
Soft Load Leaving Water Rate	
LWT Control Proportional Gain	
LWT Control Integral Reset TIme	
LWT Control Rate TIme	
EXV Max Travel Setpt	

MENU ITEMS	SETTING
Liq. Level Control Proportional Gain	
Liq. Level Control Integral Reset Time	
Liq. Level Control Rate TIme	
Local Atmospheric Pressure	
SERVICE SETTINGS GROUP MACHINE CONFIGURATION GROUP (+-+-+-)	
Compressor Frame Size and Capacity	
Nominal Unit Tons	
Starter Type	
Level 2 Contactor Integrity Test	D E
Rated Load Amps	
Motor Heating Constant	
Current Overload Setting #1	
Current Overload Setting #2	
Max Acceleration Timer #1	
Max Acceleration Timer #2	
Acceleration Time Out Action	Shutdown Transition
EXV Size	
External Chilled Water Setpt Option	Install Not Install
Ext. Current Limit Option	Install Not Install
High Pressure Cutout Setting	
Line Voltage Sensing Option	
Unit Line Voltage	
Ice Building Option	Install Not Install

MENU ITEMS	SETTING
Ext. Setpoint Inputs	4-20 ma 2-10 vdc
Tracer Option	Install Not Install
TCI Option	Install Not Install
Print Option	Install Not Install
Relay #1	
Relay #2	
Relay #3	
Rfgt Pres. Output Option	
Min Delta Pres. Calib.	
Max. Delta Pres. Calib.	

Cleaning the Condenser

⚠ CAUTION

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 condenser water temperature) is higher than predicted.

Standard water applications will operate with less than a 10°F approach. If the approach exceeds 10°F cleaning the condenser tubes is recommended.

NOTE: Glycol in the water system typically doubles the standard approach.

If the annual condenser tube inspection indicates that the tubes are fouled, 2 cleaning methods can be used to rid the tubes of contaminants.The methods are:

- ❑ Mechanical tube cleaning- this method is used to remove sludge and loose material from smooth-bore condenser tubes.

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.

(To clean internally-enhanced tubes, use a bi-directional brush or consult a qualified service organization for recommendations.)

- ❑ Chemical tube cleaning

Chemical Cleaning Procedure

- ❑ Scale deposits are best removed by chemical means. Consult a qualified (i.e., one that knows the local water supply chemical/mineral content) local chemical supplier for a recommended cleaning solution suitable for the job. (A standard condenser water circuit is composed solely of copper, cast iron and steel.) 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.

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

CAUTION: To prevent oil sump heater burnout, open the unit main power disconnect switch before removing oil from the compressor.

Trane polyolester oil is the approved oil for the RTHC units. Polyolester oil is extremely hygroscopic meaning it readily attracts moisture. The oil can not be stored in plastic containers due to the hygroscopic properties. As with mineral oil, if water is in the system it will react with the oil to form acids. Use *Table 28* to determine the acceptability of the oil. The proper charge amounts are given in *Table 29* .

Table 28
POE Oil Properties

Description	*Acceptable Levels*
Moisture content	*less than 300 ppm*
Acid Level	*less than 0.5 TAN (mg KOH/g)*

Note: Mineral oil used in the RTHA and RTHB units had different acceptable levels (< 50 ppm of moisture and < 0.05 mg KOH/g)

Note: Use an oil transfer pump to change the oil regardless of chiller pressure.

Oil Sump Level Check

The oil level in the oil sump can be measured to give an indication of the system oil charge. Follow the procedures below to measure the level.

1 Run the unit fully loaded for approximately 20 minutes.

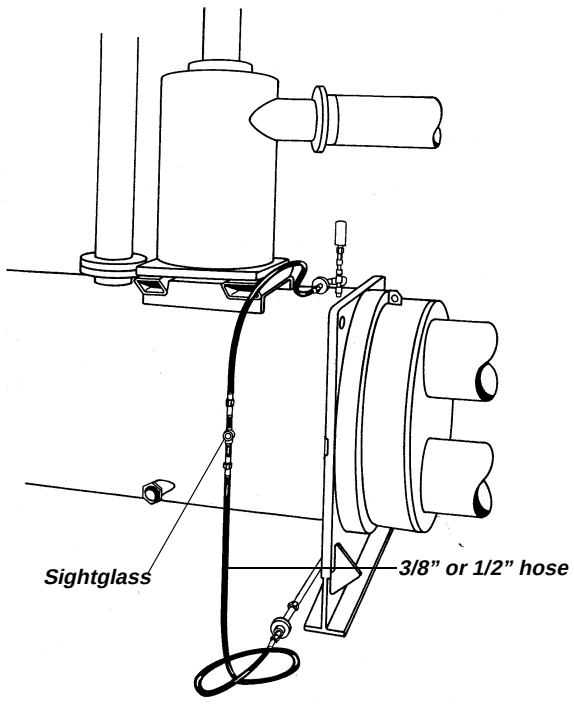
Note: Operating the unit at minimum load tends to lower oil sump levels to as low as 2", well below the normal 4.5" to 6.0" levels. This is because the evaporator tends to hold more oil at minimum load conditions. Before adding any oil, obtain an oil level reading near a full load operating condition.

2 Cycle the compressor off line.

⚠ CAUTION

CAUTION: Never operate the compressor with the sightglass service valves opened. Severe oil loss will occur.

Figure 33
Determining Oil Level in Sump



3 Attach the 3/8" or 1/2" hose with a sightglass in the middle to the oil sump drain valve and the condenser service valve at the top of the condenser.

4 After the unit is off line for 10 minutes move the sightglass along the edge of the condenser tubesheet at the same height of the oil sump.

5 The level should be between 2" and 5" from the bottom of the oil sump. If the level appears to be above 8", the oil sump is completely full. Most likely more oil resides in the rest of the system and some oil needs to be removed until the level falls between 2" and 5" in the oil sump.

6 If the level is below 2", there is not enough oil in the sump. This can occur from not enough oil in the system or more likely, oil migration to the evaporator. Oil migration can occur from a low refrigerant charge, gas pump malfunction, etc.

NOTE: If the oil is logged in the evaporator confirm the operation of the gas pump. If the gas pump is not functioning properly all oil will be logged in the evaporator.

7. After the level is determined, close the service valves and remove the hose/sightglass assembly.

Removing Compressor Oil

The oil in the compressor oil sump is under a constant positive pressure at ambient temperature. To remove oil, open the service valve located on the bottom of the oil sump and drain the oil into a suitable container using the procedure outlined below:

⚠ CAUTION

CAUTION: Due to the hygroscopic properties of the POE oil, all oil must be stored in metal containers. The oil will absorb water if stored in a plastic container.

1 Connect a line to the oil sump drain valve.

2 Open the valve and allow the desired amount of oil to flow into the container and close the charging valve.

3 Measure the exact amount of oil removed from the unit.

Oil Charging Procedure

It is critical to fill the oil lines feeding the compressor when charging a system with oil. The diagnostic “Loss of oil at the compressor” will be generated if the oil lines are not full on start-up.

Refer to *Table 29* for recommended oil charge levels.To properly charge the system with oil, follow the steps below:

1. Locate the 1/4” schrader valve between the ball valve and oil filter (or the ball valve and oil cooler, if so equipped).
2. Loosely connect oil pump to schrader valve called out in step 1.
3. Operate oil charging pump until oil appears at the charging valve connection; then tighten the connection.

Note: To keep air from entering the oil, the charging valve connection must be air- tight.

4. Close the ball valve just upstream of the schrader valve connected to the oil pump. This will allow the oil to travel through the oil lines to the compressor first rather than directly to the oil sump.
5. At the UCP2 display panel, press <Service Tests> and enter the password (++--++) followed by <Enter>).
6. Press <enter> to access the service tools group.
7. Press <next> 12 times to display “Master Oil Line Solenoid Valve: [Mode]”.
8. Press ‘+’ to change the mode from “Auto” to “On”.
9. This will energize the solenoid to allow the oil to travel from the schrader to the compressor. It takes approximately 2 gallons of oil to fill the lines.
10. Monitor the next display in the menu which is “Oil Loss Level Sensor Status: [s]. This display shows whether the optical sensor is seeing oil (wet) or if it is not (dry). After adding approximately 2 gallons the status of the sensor will change from dry to wet.
11. Once the optical oil level sensors reads wet, de-energize the master solenoid by changing the “Master Oil Line Solenoid Valve:” from “On” to “Auto”.
12. Open the ball valve just upstream of the schrader connected to the oil pump. This will allow the remainder of the charge to flow to the oil sump.

NOTE: The remainder of the oil charge can be charged into the 1/4” service valve located at the bottom of the sump if a larger connection is preferred.

Replacing the Main Oil Filter (Hot Filter)

The filter element of the unit-mounted oil filter generally must be changed if the oil flow is sufficiently obstructed. Two things can happen: first, the chiller may shut down on a “Low Oil Flow” diagnostic, or secondly, the compressor may shut down on a “Loss of Oil at Compressor (Running) diagnostic. If either of these diagnostics occurs, it is likely the oil filter needs replacement.

Specifically, the filter must be changed if the pressure drop between the two service valves in the lubrication circuit exceeds the maximum level as given in *Figure 34* . This chart shows the relationship between the pressure drop measured in the lubrication circuit as compared with operating pressure differential of the chiller (as measured by pressures in the condenser and evaporator).

Normal pressure drops between the service valves of the lubrication circuit are shown by the lower curve. The upper curve represents the maximum allowable pressure drop and indicates when the oil filter must be changed. Pressure drops that lie between the lower and upper curves are considered acceptable.

For a chiller equipped with an oil cooler, add 5 psid to the values shown in *Figure 34* . For example, if the system pressure differential was 80 psid, then the clean filter pressure drop would be approximately 15 psid (up from 10 psid). For a chiller with an oil cooler and operating with a dirty oil filter, the maximum allowable pressure drop would be 28 psid (up from 23 psid).

Under normal operating conditions the element should be replaced after the first year of operation and than as needed thereafter.

Table 29
Recommended Oil Charges

Compressor (digit 6 and 7)	Evap (digit 12 and 13)	Condenser (digit 16 and 17)	POE Oil charge (gal (L)) Without Oil Cooler	POE Oil charge (gal (L)) With Oil Cooler
B1	B1	B1	4.5 (17)	4.75 (18)
B1	C1	D1	4.5 (17)	4.75 (18)
B2	C2	D2	4.5 (17)	4.75 (18)
B2	B2	B2	4.5 (17)	4.75 (18)
C1	B2	C1	6.15 (23)	7.15 (27)
C1	B3	C2	6.15 (23)	7.15 (27)
C1	E1	F1	9.25 (35)	10.25 (39)
C2	B3	C2	6.15 (23)	7.15 (27)
C2	D3	E3	6.15 (23)	7.15 (27)
C2	G1	G1	10.5 (39)	11.5 (43)
D2	G3	G3	10.5 (39)	11.5 (43)
D2	F2	F3	9.25 (35)	10.25 (39)
D2	D2	E2	6.15 (23)	7.15 (27)
D1	G2	G2	10.5 (39)	11.5 (43)
D1	F1	F2	9.25 (35)	10.25 (39)
D1	D1	E1	6.15 (23)	7.15 (27)
D3	G3	G3	10.5 (39)	11.5 (43)
D3	D2	E2	6.15 (23)	7.15 (27)
E3	D2	E2	6.15 (23)	7.15 (27)
E3	F2	E2	9.25 (35)	10.25 (39)
E3	G3	G3	10.5 (39)	11.5 (43)

1 Isolate the oil filter by closing the two ball valves located before and after the filter.

2 Relieve the pressure from the hydraulic line through the 1/4” schrader valve located between the ball valve and the oil filter (or the ball valve and oil cooler, if so equipped).

3 Use a rubber mallet to break loose the nut that secures the oil filter element to the filter manifold.

4 Turn the nut clockwise until the filter element detaches from the manifold.

5 Remove the filter element and measure the exact amount of oil contained in the filter bowl and element.

6 Screw in the cartridge after filling the bowl with the proper amount of refrigerant oil (see Step 5). Turn the new cartridge counterclockwise and tighten securely.

7 Connect manifold gauge set at oil charging valve and evacuate the filter to 500 microns psig.

8 Charge the oil line back with the amount of oil removed. Open the isolation valves to the oil supply system.

Replacing the Gas Pump Oil Filter

The filter element in the gas pump circuit may need to be changed if the gas pump is unable to return the oil to the compressor.

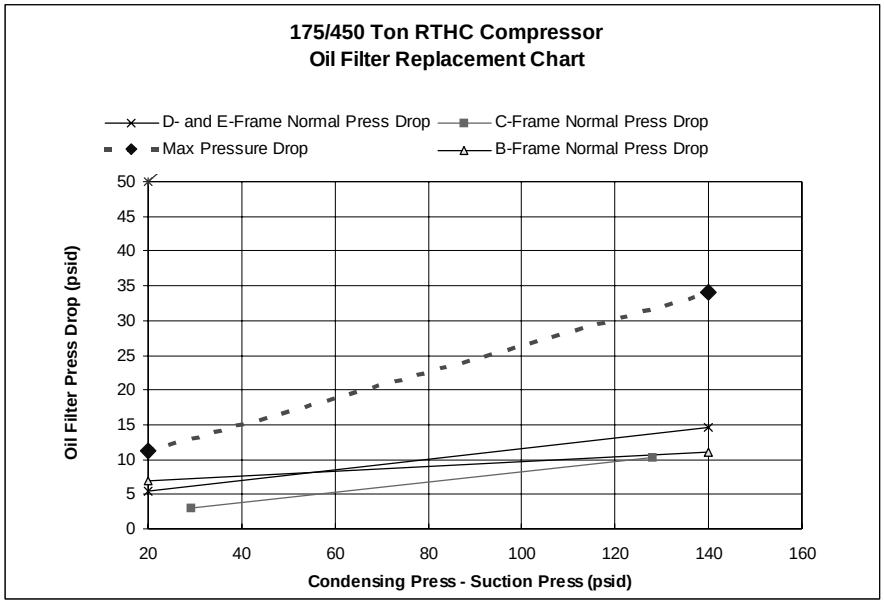
An evaporator logged with oil will have a high liquid level when referring to the liquid level sensor, low suction pressurse, and higher than normal approach on the evaporator.

Refer to *Figure 34* to determine if the pressure drop across the filter is above the normal range at full load conditions. Once the oil is logged in the evaporator, it may be necessary to manually move the oil from the evaporator to the oil sump to avoid lossof oil in the main oil lines.

⚠ CAUTION

CAUTION: DO NOT add more oil to the system

Figure 34
Oil Filter Replacement Chart (E,D, C and B Frames)



Refrigerant Charge

If a low refrigerant charge is suspected, first determine the cause of lost refrigerant. Once the problem is repaired follow the procedures below for evacuating and charging the unit.

Evacuation and Dehydration

1. Disconnect ALL power before/during evacuation.
2. Connect the vacuum pump to the 5/8” flare connection on the bottom of the evaporator and/or condenser.
3. To remove all of the moisture from the system and to insure a leak free unit pull the system down below 500 microns.
4. After the unit is evacuated, perform a standing rise test for at least an hour. The pressure should not rise more than 150 microns. If the pressures rises more than 150 microns then either a leak is present or moisture is still in the system.

NOTE: If oil is in the system, this test is more difficult. The oil is aromatic and will give off vapors that will rise the pressure of the system.

Refrigerant Charging

Once the system is deemed leak and moisture free, use the 5/8” flare connections at the bottom of the evaporator and condenser to add refrigerant charge. Use the followoing table for the correct charge amounts.

Table 30Recommended Refrigerant Charges

Compressor (digit 6 and 7)	*Evap (digit 12 and 13)*	*Condenser (digit 16 and 17)*	*HFC-134A charge (lb (kg))*
B1	*B1*	*B1*	*410 (186)*
B1	*C1*	*D1*	*450 (204)*
B2	*C2*	*D2*	*450 (204)*
B2	*B2*	*B2*	*410 (186)*
C2	*G1*	*G1*	*850 (386)*
C2	*D3*	*E3*	*575 (261)*
C1	*E1*	*F1*	*600 (272)*
C1	*B2*	*C1*	*420 (191)*
C1	*B3*	*C2*	*420 (191)*
C2	*B3*	*C2*	*420 (191)*
D2	*G3*	*G3*	*850 (386)*
D2	*F2*	*F3*	*740 (336)*
D2	*D2*	*E2*	*575 (261)*
D1	*G2*	*G2*	*850 (386)*
D1	*F1*	*F2*	*740 (336)*
D1	*D1*	*E1*	*575 (261)*
D3	*D2*	*E2*	*575 (261)*
D3	*F2*	*F3*	*740 (336)*
D3	*G3*	*G3*	*850 (386)*
E3	*D2*	*E2*	*575 (261)*
E3	*F2*	*F3*	*740 (336)*
E3	*G3*	*G3*	*850 (386)*

NOTE: Refer to the unit nameplate for specific information on optimum oil and refrigerant charge.

Freeze Protection

For unit operation in a low temperature environment, adequate protection measures must be taken against freezing. Adjusted settings and recommended ethylene glycol solution strengths are contained in *Table 31* following.

Table 31
Low Refrigerant Temperature, Ethylene Glycol, and Freeze Protection Settings

		DDE, EDE, CBC*			DFF, EFF, CDE, BCD, BBB*			DGG, EGG, CGG, CEF*		
Chilled Water Setpt (°F)	Leaving Wtr Temp Cutout (°F)	Low Rfgt Temp Cutout (°F)	Rec % Ethylene Glycol	Solution Freeze Point (°F)	Low Rfgt Temp Cutout (°F)	Rec % Ethylene Glycol	Solution Freeze Point (°F)	Low Rfgt Temp Cutout (°F)	Rec % Ethylene Glycol	Solution Freeze Point (°F)
40	34	28.6	0	32.0	28.6	0	32.0	28.6	0	32.0
39	33	27.2	2	30.6	27.6	1	31.3	27.9	0	32.0
38	32	25.7	4	29.1	26.5	3	30.1	27.2	2	31.1
37	31	24.2	6	27.6	25.4	5	28.9	26.5	3	30.2
36	30	22.7	8	26.1	24.2	6	27.7	25.7	4	29.3
35	29	21.1	11	24.5	23.0	8	26.4	24.9	6	28.3
34	28	20.2	12	23.6	22.1	10	25.5	24.0	7	27.4
33	27	19.2	13	22.6	21.1	11	24.5	23.0	8	26.4
32	26	18.1	15	21.5	20.1	12	23.5	22.0	10	25.4
31	25	17.0	16	20.4	18.8	14	22.2	20.6	12	24.0
30	24	15.9	17	19.3	17.6	15	21.0	19.3	13	22.7
29	23	14.8	18	18.2	16.6	16	20.0	18.4	14	21.8
28	22	13.6	20	17.0	15.5	17	18.9	17.4	15	20.8
27	21	12.4	21	15.8	14.4	18	17.8	16.4	16	19.8
26	20	11.2	22	14.6	13.3	20	16.7	15.4	17	18.8
25	19	9.9	23	13.3	12.1	21	15.5	14.3	19	17.7
24	18	8.6	24	12.0	10.9	22	14.3	13.2	20	16.6
23	17	7.3	25	10.7	9.7	23	13.1	12.1	21	15.5
22	16	5.9	26	9.3	8.4	24	11.8	10.9	22	14.3
21	15	4.5	27	7.9	7.1	25	10.5	9.7	23	13.1
20	14	3.1	28	6.5	5.8	26	9.2	8.5	24	11.9
19	13	1.6	30	5.0	4.4	27	7.8	7.3	25	10.7
18	12	0.1	31	3.5	3.1	29	6.5	6.0	27	9.4
17	11	-1.4	32	2.0	1.6	30	5.0	4.7	28	8.1
16	10	-2.9	33	0.5	0.2	31	3.6	3.3	29	6.7
15	9	-4.5	33	-1.1	-1.3	32	2.1	2.0	30	5.4
14	8	N/A	34	-2.8	-2.8	33	0.6	0.6	31	4.0
13	7	N/A	35	-4.4	-4.3	34	-0.9	-0.8	32	2.6
12	6	N/A	36	-6.1	N/A	34	-2.5	-2.3	33	1.1
11	5	N/A	37	-7.8	N/A	35	-4.1	-3.8	34	-0.4
10	4	N/A	38	-9.6	N/A	36	-5.7	-5.3	34	-1.9

*Notes: * Refer to unit Model No. digits 6, 12, 16*

N/A means chiller is not to be applied at leaving evaporator water temperatures, which result in the LRTC setting below those shown in the table.

When setting up an ice-making system, the ice termination setpoint is the entering water. Subtract 6°F from the setpoint to use Table 31 (Chilled Water Setpoint (ice-making only) = Ice Termination Setpoint - 6°F).

Diagnostics

Diagnostic Displays

Information regarding all active and historic diagnostics, as well as screens to clear diagnostics, can be found in the Diagnostics Group. The Diagnostics Group can be accessed at any time by pressing the <Diagnostics> key on the front panel.

Additionally, this group is automatically entered when a new diagnostic occurs. Once in the group, use the <Next> and <Previous> keys to index through the available screens and settings.

Diagnostics Group Header Display Screens

When the group is manually accessed by pressing the <Diagnostics> key, the first screens displayed provide header information for the group. These header screens include a summary screen, a password screen, and a screen indicating whether diagnostics are present:

Active & Historic Diagnostics *Press (Next)(Previous) To Continue*

Settings In This Menu Are [status] *[password message]*

NOTE: The above password screen is only shown if the Menu Settings Password feature is enabled under the Service Settings Group. If the Settings are "locked," you will be unable to clear active or historic diagnostics unless the password is entered, but you will be able to "see" the diagnostics. As with all other groups, the Password sequence to unlock the group is < ->< +>< ->< +>< ->< +> followed by <Enter>.

If there are no diagnostics present, the following screen is next,

No Diagnostics Present *Press (Next) (Previous) To Continue*

or if diagnostics are present, the following screen appears,

Diagnostic Report Follows *Press (Next) For More*

Diagnostic Annunciation

Whenever a new diagnostic is sensed by the system, regardless of what screen is currently being displayed, the CLD will annunciate the occurrence by automatically entering the Diagnostic group, and displaying a "one-time" diagnostic annunciation screen. The type of screen will depend on the type of diagnostic determined.

If the diagnostic is an MMR/MAR type (described in the Active Diagnostics section following), the screen will be

**** A MACHINE SHUTDOWN HAS OCCURRED **** *Press (Next) For More*

If the diagnostic is other than an MMR/MAR type, the screen will be:

A New Warning Has Been Detected *Press (Next) For More*

This screen will remain displayed until the <Next> or < Previous> key is pressed, and will then no longer be present in the group structure, unless, of course, another new diagnostic occurs. If <Previous> is pressed, the display will move to the Diagnostic Group Header screens above. If <Next> is pressed, the "Operating Mode at Time of Last Diagnostic" screen is displayed.

Operating Mode at Time of Last Diagnostic

Press (Enter) To Display Operating Mode *At Time Of Last Diag Or (Next) For More*

When <Enter> is pressed, the “Chiller Operating Mode” at the time of the “Last” diagnostic will be momentarily indicated. This is useful in understanding what might have caused or contributed to the diagnostic. More specific information about the last diagnostic (and other active diagnostics) is available by pressing <Next>.

Active Diagnostics

If there is at least one diagnostic present, information about each diagnostic will be presented on the following screens. (Since the information on each diagnostic spans a pair of screens, the sequence number [sn] gives order of occurrence and serves as a “tag” for the diagnostic. The first pair of diagnostic screens display the “Last” diagnostic (sn = 01) to have occurred.

[sn]	*[diagnostic]*
(Next)	*[diagnostic type]*

[sn] occurred at HH:MM xm Mon xx, 199x *[help message]*

The “diagnostic type” is discussed in the paragraphs following this. The “help message” identifies specific checks to be initiated to solve the problem. For a detailed list of all diagnostics, help messages, and causes, see *Table 32* .

Diagnostic Types

Warning Only - Reset Not Reqd (IFW) *- This type of diagnostic, also known as an Informational Warning diagnostic, suggests that while the condition is not normal, it is not a serious enough to warrant a chiller shutdown. Certain IFW diagnostics will substitute safe values for detected erroneous inputs or settings, to keep the chiller operating. The IFW diagnostics are logged in the historic diagnostic list for reference.*

Unit Shutdown - Reset Reqd (MMR) *- This type of diagnostic, also known as Machine Shutdown or Manual Reset, causes either an immediate or “friendly”[1] shutdown of the chiller to prevent system damage. Generally conditions that cause this type of diagnostic will not correct themselves, and thus the root problem must be identified and corrected. For this reason, these “latching” diagnostics require the operator to perform a manual reset to restore normal operation. The reset is accomplished via screens at the end of the diagnostics menu. See “Clearing Diagnostics.”*

Unit Shutdown - Automatic Reset (MAR) *- This type of diagnostic, also known as Machine Shutdown or Automatic Reset, causes either an “immediate”[2] or friendly shutdown of the chiller to prevent system damage. However, the conditions that cause this type of diagnostic may correct themselves without operator action (e.g., low voltage on the incoming power). For this reason, these diagnostics are non-latching and, once the condition causing them has returned to normal, the chiller will restart automatically. Attempting to manually reset an active MAR diagnostic is usually both unnecessary and ineffective.*

Other Active Diagnostics

Other active diagnostics will be presented in order of occurrence as <Next> is pressed. Note that the Operating Mode of the chiller at the time of the occurrence of a diagnostic is only given for the “Last” diagnostic.

Historic Diagnostics

Historic diagnostics follow active diagnostics in the display with their own sequence number and time date stamp shown.

[sn]	*[Diagnostic]*
Historic Only,	*Press (Next) For More*

---

1. *A **friendly** shutdown allows the chiller to go through a Run Unload period, (lasting about 40 seconds) in which the compressor is allowed to fully unload prior to shutdown. A post-shutdown unload, as well as a pre-start unload period, are also performed, which will usually allow the compressor to start unloaded on the next start.*
2. *An **immediate** shutdown, does <u>not</u> allow for an unload period and will shut down the chiller immediately. A post-shutdown unload, as well as a pre-start unload period, however, are performed, which will usually allow the compressor to start unloaded on the next start.*

[sn] occurred at HH:MM xm Mon xx, 199x
Historic Only, Reset At End Of Diag Menu

Clearing Diagnostics

At the end of the diagnostic menu, four screens allow you to Clear/Reset the different diagnostic groups.

If any active manual reset or active automatic reset diagnostics are present, the following screen will be displayed:

Press (Enter) To Clr Active Diagnostics
And Shutdown / Reset System

NOTE: Generally, caution should be exercised before resetting any active diagnostic. Be sure that the conditions that caused the diagnostic are corrected. If diagnostics recur, call Trane service.

If the <Enter> key is pressed, **all** active diagnostics will be cleared, the control system will be reset and initialized, and the following message displayed for 2 seconds:

Active Diagnostics Have Been Cleared
System Is Resetting

The display will return to the current operating mode screen of the chiller report once the reset has been completed.

If any informational warning diagnostics are present, the following screen will be displayed:

Press (Enter) To Clear IFW Diagnostics

If the <Enter> key is pressed, IFW diagnostics will be cleared from memory and the following message is displayed for 2 seconds:

IFW Diagnostics Have Been Cleared

If any historic diagnostics are present, the following screen will be displayed:

Press (Enter) To
Clear Historic Diagnostics

If the <Enter> key is pressed, historic diagnostics will be cleared from memory and the following message displayed for 4 seconds:

Historic Diagnostics Have Been Cleared
Diagnostic Report Is Being Reset

The display will be reset to the top of the Diagnostic Menu after this message clears.

The following *(Table 32, next page)* presents all possible diagnostics and related causes in alphabetical order by the diagnostic message that appears on the display. The associated help messages are also given in the last column. Entries in parentheses in the last column do not appear in the display but are additional diagnostic information.

Table 32
Diagnostics

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
At Speed Input Shorted	*MMR*	*N/A*	*a. The Up to Speed/At Speed input was found to be shorted before the compressor was started. b. Applies only to Solid State Starters*	*Check Aux Contact on Bypass Contactor*
At Speed Input Opened	*MMR*	*Immediate*	*a. The At Speed input was found to be opened with the compressor motor running after successfully obtaining at speed condition. b. Applies only to Solid State Starters.*	*Check Aux Contact on Bypass Contactor*
Check Clock	*IFW*	*N/A*	*On loss of power the clock does not keep time, if there is an extended power loss (greater than 15 seconds) this diag. is also generated to alert the operator to check the clock.*	*Check Main Power Supply, Reset Clock*
Chilled Water Flow Lost	*MAR*	*Immediate*	*a. The chilled water flow switch input was open for more than 6-10 continuous seconds. b. 6-10 seconds of continuous flow shall clear this diagnostic. c. Even though the pump times out in the STOP modes, this diagnostic shall not be called out in the STOP modes.*	*Check Pump, Valves, Flow Switch*
Chiller: Loss of Comm with Options	*IFW*	*N/A*	*The chiller module lost communications with the Options module for 15 continuous seconds. This IFW diagnostic is generated if Free Cooling is Not Installed, otherwise this is an MMR diagnostic.*	*Check IPC Wiring/ Connections*
Chiller: Loss of Comm with Local CLD	*IFW*	*N/A*	*The chiller module lost communications with the CLD module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Chiller: Loss of Comm with TCI	*IFW*	*N/A*	*The Tracer was setup as "installed" at the CLD and the chiller module lost communications with the TCI (comm 3 or comm 4) module for 15 continuous seconds*	*Check IPC Wiring/ Connections*
Chiller: Loss of Comm with TCI	*IFW*	*N/A*	*The Tracer was setup as "installed" at the CLD and the chiller module lost communications with the TCI (comm 3 or comm 4) module for 15 continuous seconds*	*Check IPC Wiring/ Connections*
Chiller: Loss of Comm with Rfgt Monitor	*IFW-AR*	*N/A*	*The Chiller module lost communications with the Refrigerant Monitor for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Chiller: Loss of Comm with Starter	*MMR*	*Friendly*	*The chiller module lost communications with the Starter module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Chiller: Loss of Comm with Stepper	*MMR*	*Friendly*	*The chiller module lost communications with the Stepper #1 module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Chiller Mod Off-Brd 5V Range	*IFW*	*N/A*	*An improper Off Board 5v voltage was detected at the Chiller Module. A 5Vdc is used for certain system level components. The micro checks to see that the A/D value falls within an acceptable range.*	*Check Chiller Module Voltages*
Cprsr did not Accelerate Fully	*MMR*	*Immediate*	*a. The UCP2 did not receive an Up to Speed or At Speed Signal (Aux contact from Bypass Contactor) within 2.5 seconds after commanding bypass, or after the Maximum Acceleration Timer has timed out, whichever is longer. b. Applies only to Solid State Starters*	*Check Starter Setup and Bypass Aux Contact*
Cprsr did not Accelerate: Shutdown	*MMR*	*Immediate*	*a. The compressor did not come up to speed (get to <85%RLA) in the allotted time defined by the Maximum Acceleration Timer. b. The clear language display setups defined "Shutdown" as the action when the Maximum Acceleration Timer was exceeded.*	*Check Main Power Supply & Wiring*
Cprsr Did Not Accelerate: Transition (The Motor is put across the line.)	*IFW*	*N/A*	*a. The compressor did not come up to speed (get to <85% RLA) in the allotted time defined by the Maximum Acceleration Timer. b. The clear language display setups defined "Transition or Bypass" as the action when the Maximum Acceleration Timer was exceeded.*	*See Troubleshooting Service Bulletin*

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Condenser Rfgt Temp Sensor	MMR	Friendly	Open or Short	Check Sensor, Wiring And Connections
Cond Entering Wtr Temp Sensor	IFW	N/A	Open or Short	Check Sensor, Wiring And Connections
Cond Leaving Wtr Temp Sensor	IFW	N/A	Open or Short.	Check Sensor, Wiring And Connections
Condenser Water Flow Overdue	MAR	N/A	Condenser water flow was not proven within 4.25 minutes of the condenser pump relay being energized. Diagnostic is reset with return of flow.	Check Pump, Valves, Flow Switch
Condenser Water Flow Lost	MAR	Friendly	a. The condenser water flow switch input was open for more than 6-10 continuous seconds. b. 6-10 seconds of continuous flow shall clear this diagnostic. c. Even though the pump times out in the STOP modes, this diagnostic shall not be called out in the STOP modes.	Check Pumps, Valves, Flow Switch
Current Overload Setpts Error	IFW	N/A	a. The redundant overload settings did not agree for 30 continuous seconds. (Continue to use the previous value for the 30 second time-out.) When this diagnostic occurs the affected Starter Module shall use the minimum overload setting as a default until either the UCP2 is reset or, if the redundant settings agree again, the starter module can go back to using the actual setting.	Review Overload Set Up
Current Overload	MMR	Immediate	Motor current exceeded overload time vs. trip characteristic.	Verify Overload Settings & Compressor Unload
Discharge Temp Sensor	MMR	Friendly	Open or Short.	Check Sensor Wiring And Connections
Emergency Stop Input	MMR	Immediate	a. EMERGENCY STOP input is open. An external interlock has tripped. Time to trip from input opening to unit stop shall be 0.1 to 1.0 seconds. Design: With input filtering and IPC delay, this will approach 2 seconds.	Check Emergency Stop Input Device
Evap Entering Wtr Temp Sensor	IFW	N/A	Open or Short a. Normal operation, no effects on control. b. Chilled Water Reset, Will just run at either normal CWS or will run at maximum reset permitted.	Check Sensor, Wiring And Connections
Evap Leaving Water Temp Sensor	MMR	Friendly	Open or Short	Check Sensor, Wiring And Connections
Evaporator Liquid Level Sensor	MMR	Friendly	Open or short	Check Sensor, Wiring, and Stepper Module
Evap Rfgt Temp Sensor	MMR	Friendly	Open or Short	Check Sensor, Wiring And Connections
Evaporator Water Flow Overdue	MAR	N/A	Evaporator water flow was not proven within 4.25 minutes of the Evaporator pump relay being energized. The diagnostic is reset with the return of water flow.	Check Pump, Valves, Flow Switch
External Chilled Water Setpoint	IFW-AR	N/A	a. Function Not “Enabled”: no diagnostics. b. “Enabled “: Out-Of-Range Low or Hi, set diagnostic, default CWS to next level of priority (e.g. Front Panel SetPoint). This IFW diagnostic will automatically reset if the input returns to the normal range.	Check Signal At Input

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
External Current Limit Setpoint	IFW-AR	N/A	a. Not "Enabled": no diagnostics. b. "Enabled ": Out-Of-Range Low or Hi, set diagnostic, default CLS to next level of priority (e.g. Front Panel SetPoint. This IFW diagnostic will automatically reset if the input returns to the normal range.	Check Signal At Input
EXV Electrical Drive Circuit	MMR	N/A	The Stepper module has detected a wiring or motor fault on the EXV output circuit just prior to EXV pre-position. The EXV motor is not driven if a problem is detected. Miswires or faults that occur in the off cycle can be detected and damage to module prevented at start-up.	Check Stepper Module, Wiring, & Motor.
High Cprsr Discharge Temp.	MMR	Immediate	a. The discharge temp. exceeded 190°F + or - 5°F. b. Time to trip from trip value exceeded shall be 0.5 to 2.0 seconds. (Note: The trip may be an "instantaneous trip" but consistent with the analog input filtering function.) c. Immediate shutdown is preferred over friendly because unloading the compressor will generally increase the discharge temperature.	See Troubleshooting Service Bulletin
High Diff. Rfgt Pressure	MMR	Friendly	a. The difference between the Condenser pressure and the evaporator pressure exceeded 160 PSID for 0.8-5.0 seconds. 152 PSID must hold, 152+ to trip in one hour.	See Troubleshooting Service Bulletin
High Evaporator Liquid Level	MMR	Friendly	The liquid level sensor is seen to be at or near its high end of range for 80 continuous minutes while the compressor is running	Check EXV, Sensor, Stpr Module & Rfgt Charge
High Pressure Cutout Tripped	MMR	Immediate	A high pressure cutout was detected. C.O. on rise @ 180 psig, reset at 135 psig (+/-5 psid on switching tolerance) Note: Pressure relief valve is 200 Psi +/- 2%,	Check Condenser Water Temp.
High Restart Inhibit Timer Warning	IFW	N/A	The restart inhibit timer has reached a maximum threshold of 15 minutes. This indicates excessive chiller cycling, steps should be taken to correct this.	Check for Excessive Chiller Cycling
Incorrect Chiller Software Installed	MMR	N/A	The incorrect EPROM was loaded into this module. This diagnostic is detected when a factory test computer sets the unit type to something other than what the EPROM software was intended.	No Message Required
Incorrect Stepper Software Installed	MMR	N/A	The incorrect EPROM was loaded into this module. This diagnostic is detected when a factory test computer sets the unit type to something other than what the EPROM software was intended.	No Message Required
Loss of Oil at Compressor (Running)	MMR	Immediate	In Running modes, Oil sensor detects lack of oil in line i.e. sensor terminal voltage above 11.5 volts (clamped at 14.0 volts) for 23 volt-seconds (778 bit for 1600 bit count-seconds). Upon transition from wet to totally dry, a trip will occur in 15 seconds nominally (distinguishing a liquid flow from a vapor flow).	Check Oil System (Master Oil Line Solenoid Valve & Oil Return System & Oil Detector Sensor)
Loss of Oil at Compressor (Stopped)	MMR		Oil Sensor detects a lack of oil trapped in line feeding compressor for 2 continuous minutes after the oil line solenoid is opened for pre-start mode. Note: Compressor start is delayed (up to an additional 90 sec) from the normal 30 sec of pre-start, waiting for oil to be detected	Check Oil System (Master Oil Line Solenoid Valve & Oil Return System & Oil Detector Sensor)
Low Chilled Water Temp: Unit Off	IFW-AR	N/A	a. The chilled water temp. fell below the cutout setpoint while the compressor was not running for 30°F Seconds. Automatic Reset of the IFW diag shall occur 2°F (1.1°C) above the cutout setpoint.	Check Flow, Sensor, Wiring and Rapid Load Loss
Low Chilled Water Temp: Unit On	MAR	Friendly	a. The chilled water temp. fell below the cutout setpoint while the compressor was running for 30°F Seconds. Automatic Reset of the MAR diag shall occur 2 ° F (1.1°C) above the cutout setpoint.	Check Flow, Sensor, Wiring and Rapid Load Loss

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Low Differential Rfgt Pressure	MMR	Friendly	A low differential temperature/pressure condition was detected that lasted for more than 240 continuous seconds. The trip point is 23.8 psid.	Check Condsr Water Temp Too Low and EXV
Low Differential Refgt Press Switch	MAR	N/A	If the 7.7 psid system differential pressure switch is not open on the attempt to start, the MAR diagnostic will keep the unit latched out until the switch is opened.	Check Low Differential Pressure Switch & its Valving, EXV
Low Discharge Superheat	MMR	Friendly	a.While Running Normally, the Discharge Superheat was less than 12°F +/- 1°F for more than 6500°F seconds. The must hold value is 13°F while the must integrate value is 11°F. b. At start-up the UCP2 shall ignore the Discharge Superheat for a minimum of 5 minutes and a maximum of 5.5 minutes.	See Troubleshooting Service Bulletin
Low Evaporator Liquid Level	MMR	Friendly	The liquid level sensor is seen to be at or near its low end of range for 80 continuous minutes while the compressor is running	Check EXV Sensor, Stpr Module & Rfgt Charge
Low Evap Rfgt Temp.	MMR	Immediate	a. The Saturated Evap Rfgt Temp dropped below the Low Rfgt Temp. Cutout Setpoint when the circuit was running for 60°F seconds. The diagnostic is ignored during the first minute of operation after a start. Special Note: During time-out of trip integral, the unload solenoid is energized continuously and the load solenoid de-energized continuously. Normal load/unload operation is resumed if the trip integral is reset by return to temperatures above the cutoff setpoint.	Check Oil Sump Vent Line Valve, Oil Return System. Check for Oil Overcharge
Low Oil Flow	MMR	MMR	The oil flow pressure switch detects no flow (high differential pressure/high logic state) for 5 continuous seconds while running.	Check Oil System (Master Oil Line Solenoid Valve & Oil Filter, Hand Valves and Diff. Pressure Switch)
Low Pressure Cutout	MMR	Immediate	The Low Pressure Cutout opened for more than 0.5-2 Seconds. C.O. on fall @ 0 psig (+/- 3 psi), reset @ 20 psig (+/-5psi). The LPC is set primarily to detect significant charge loss and thus ignore times at start-up are not required (The sat evap temp sensor is used for low temp / low pressure detection but it cannot function if saturated conditions are not present such as in the event of charge loss)	See Troubleshooting Service Bulletin
Max Acceleration Setpts Error	IFW	N/A	a. The redundant Maximum Acceleration settings did not agree for 30 continuous seconds. (Continue to use the previous value for the 30 second time-out.) When this diagnostic occurs, the affected Starter Module shall use 6 seconds as a default until either the UCP2 is reset or, if the redundant settings agree again, the starter module can go back to using the actual setting.	Review Max Acceleration Set Up
Memory Error Type IV	IFW	N/A	A page time-out error was detected while trying to write data into EEPROM. There will likely be a recall of Engineering ROM defaults on the next reset or power transition. Replace the Chiller Module as soon as a replacement is available.	Call Service to Check all Settings
Memory Error Type II: Shadow RAM	IFW	N/A	a. A Shadow RAM memory error was detected. The UCP2 is operating on all last valid values (pulled from NOVRAM) for all setup parameters. No setup parameter changes were pending to be loaded into NOVRAM, a complete recovery of all setup parameters was made and there is no need to check unit setup parameters. Compressor starts and hours were lost for not more than the last 24 hours. This is expected to be an isolated event and repair or replacement is not required. If this diagnostic occurs repeatedly, then replace the Chiller module.	No Settings Were Lost

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Memory Error Type III	*IFW*	*N/A*	*a. A Shadow RAM memory error was detected. The UCP2 is operating on all last valid values (pulled from NOVRAM) for all setup parameters. Setup parameter changes less than 24 hours old pending to be loaded into NOVRAM were lost. Check all setup parameters made in the last 24 hours. Compressor starts and hours were lost for not more than the last 24 hours. This is expected to be an isolated event and repair or replacement is not required. If this diagnostic occurs repeatedly, then replace the Chiller module.*	*Settings Changed in The Last 24 Hours Lost*
Memory Error Type I: NOVRAM	*MMR*	*Friendly*	*a. On either power up or following a Type II Memory Error a NOVRAM memory error was detected. The UCP2 is operating on all Engineering ROM defaults for all setup parameters. Check all setup parameters and continue to run chiller. Replace the Chiller Module as soon as a replacement is available.* *Note: It is expected that this diagnostic will be detected on the very first power up of the Chiller Module at the Manufacturer since the NOVRAM will not contain valid data on first power up.*	*Call Service to Check all Settings*
Momentary Power Loss	*MAR*	*Immediate*	*This protection can be defeated in the Service settings, Field Start-up Group*	*Determine Cause Of Power Interruption (If phasing is suspect, check that line voltage L1 is in phase with 24 volt power to starter module J2-2 or 4)*
MPL Detect Circuit Inoperative	*MMR*	*Friendly*	*A failure was detected in the Momentary Power Loss detect circuit. If there are no zero cross interrupts on Vab for 637.5 msec The timer interrupt will trip and generate a diagnostic that indicates that our ability to detect MPL is gone.*	*Suspect Starter Module Hardware Failure or Miswiring. See Troubleshooting Service Bulletin*
No Diff Rfgt Press, Cold Cond Water	*MMR*	*Immediate*	*The chiller module has detected the 7.7 psid to be open after 20 seconds from the time the unit entered the "starting Mode."*	*Check Condenser Water Temp Too Low*
Options: Loss of Comm with Chiller	*IFW*	*N/A*	*The options module lost communications with the Chiller module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Options: Loss of Comm with Starter	*IFW*	*N/A*	*The options module lost communications with the Starter module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Options Mod Off-Brd 5V Range	*IFW*	*N/A*	*An improper Off Board 5v voltage was detected at the Options Module. A 5Vdc is used for off-board devices such as the External CWS and CLS, and pressure transducers. The micro checks to see that the A/D value falls within an acceptable range.*	*Check Options Module Voltages*
Options Mod Ref Voltage Calibration	*IFW*	*N/A*	*An improper reference voltage was detected at the Options Module. A 2.5 Vdc reference is used to calibrate the non-ratiometric analog I/O such as 2-10Vdc and 4-20ma inputs as well as PWM Analog outputs. The micro checks to see that the A/D value falls within an acceptable range.*	*See Troubleshooting Service Bulletin*
Outdoor Air Temp Sensor (Outdoor Air Reset Selected)	*IFW*	*N/A*	*Open or Short* *a. Use end of range value (whatever value the open or short gives).* *b. Clear diag. when the resistance returns to normal range.*	*Check Sensor, Wiring And Connections*
Outdoor Air Temp Sensor (Outdoor Air not selected.)	*None*	*N/A*	*Open or Short* *a. Display end of range value. (dashes "-----")*	*N/A*

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Over Voltage	*MAR*	*Friendly*	*a. Line voltage above + 10% of nominal. (Must hold = + 10% of nominal. Must trip = + 15% of nominal. Reset differential = min. of 2% and max. of 4%. Time to trip = minimum of 1 min. 10 sec. and maximum of 5 min. 20 seconds) Design: Nom. trip: 60 seconds at greater than 112.5%, + or -**2.5**%, Auto Reset at 109% or less.*	*Check Main Power Supply & Wiring*
Phase Loss	*MMR*	*Immediate*	*a. No current was sensed on one or more of the current transformer inputs. (Must hold = 20% RLA. Must trip = 5% RLA.) Time to trip shall be 1 second minimum, 3 seconds maximum. Actual design trip point is 10%. The actual design trip time was 2.64 seconds.*	*Check Main Power Supply & Wiring*
Phase Reversal	*MMR*	*Immediate*	*a. A phase reversal was detected on the incoming current. On a compressor start-up the phase reversal logic must detect and trip in a maximum of 0.3 second from compressor start.*	*Check Main Power Supply & Wiring*
Phase Reversal Protection Lost	*MMR*	*Immediate*	*a. The phase reversal protection on the compressor has become inoperative. The phase rotation protection system failed to detect 2 in a row of one of the four phase circuit states: Phase reversal, Phase rotation OK, Phase A lost, Phase B lost.*	*Check Starter Module.*
Phase Seq Monitor: Phase Reversal	*MMR*	*Immediate*	*At start-up, the Phase Sequence Monitor detected a Voltage-based phase reversal in the compressor motor terminal box. The combination of the Phase Sequence Monitor and the Starter Module shall de-energize the starter within 0.3 seconds from start if a phase reversal exists. The Phase Sequence monitor presents a Form A (NO) contact which closes after 3 Phase Line Voltage of proper rotation is applied. The phase sequence monitor is only used in remote starter applications.*	*See Troubleshooting Service Bulletin*
Rfgt Monitor Auxiliary Alarm	*IFW*	*N/A*	*The Refrigerant Monitor auxiliary input signal indicates an alarm condition.*	*N/A*
Rfgt Monitor Aux Input Error	*IFW*	*N/A*	*The Refrigerant Monitor auxiliary input is outside the 4-20 mA range.*	*Check Signal At Input*
Rfgt Monitor Bench Flow Loss	*IFW*	*N/A*	*Air flow loss to the Refrigerant Monitor optical bench. a. IFW to the chiller, MMR/MAR to the Refrigerant Monitor.*	*See Refrigerant Monitor IOM Manual*
Rfgt Monitor Calibration Error	*IFW*	*N/A*	*The Refrigerant Monitor calibration failed. a. IFW to the chiller, IFW to the Refrigerant Monitor.*	*See Refrigerant Monitor IOM Manual*
Rfgt Monitor Chopper	*IFW*	*N/A*	*Refrigerant Monitor optical bench photo-interrupter failure. a. IFW to the chiller, MAR to the Refrigerant Monitor.*	*Check Chopper Wiring And Connections*
Rfgt Monitor External Reset	*IFW*	*N/A*	*The Refrigerant Monitor external reset switch (Normally Closed) is stuck in the "reset" state or the switch/jumper is missing.*	*See Refrigerant Monitor IOM Manual.*
Rfgt Monitor Fault	*IFW*	*N/A*	*A undefined diagnostic detected by the Refrigerant Monitor. a. IFW to the chiller, MMR to the Refrigerant Monitor.*	*See Refrigerant Monitor IOM Manual.*
Rfgt Monitor IR Source	*IFW*	*N/A*	*Refrigerant Monitor infrared optical source failure. a. IFW to the chiller, MAR to the Refrigerant Monitor.*	*Check IR Source Wiring And Connections*
Rfgt Monitor Level 3 Rfgt Alarm	*IFW*	*N/A*	*The Refrigerant Monitor has read a refrigerant concentration greater or equal to the level 3 setpoint.*	*N/A*
Rfgt Monitor Level 2 Rfgt Alarm	*IFW*	*N/A*	*The Refrigerant Monitor has read a refrigerant concentration greater or equal to the level 2 setpoint.*	*N/A*

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Rfgt Monitor Level 1 Rfgt Alarm	*IFW*	*N/A*	*The Refrigerant Monitor has read a refrigerant concentration greater or equal to the level 1 setpoint.*	*N/A*
Rfgt Monitor Memory Lost	*IFW*	*N/A*	*Refrigerant Monitor lost battery backed-up RAM.* *a. IFW to the chiller, MMR/MAR to the Refrigerant Monitor.*	*See Refrigerant Monitor IOM Manual*
Rfgt Monitor Out Of Temp Range	*IFW*	*N/A*	*Out of temperature range for measuring refrigerant concentration.*	*Check Bench Heater, Wiring, Connections*
Rfgt Monitor Refired Level Too Low	*IFW*	*N/A*	*The Refrigerant Monitor read less than or equal to -5 ppm refrigerant concentration.*	*Recalibrate Refrigerant Monitor*
Rfgt Monitor Scanner Flow Loss	*IFW*	*N/A*	*Air flow loss to the Refrigerant Monitor scanner.* *a. IFW to the chiller, MMR/MAR to the Refrigerant Monitor.*	*See Refrigerant Monitor IOM Manual*
Refrigerant Monitor Sensor	*IFW-AR*	*N/A*	*Open or Shorted input and the Rfgt Monitor is setup as installed at the Clear Language Display.*	*Check Sensor, Wiring, and Connections*
Rfgt Monitor Temp Sensor	*IFW*	*N/A*	*Refrigerant Monitor bench temperature sensor failure.* *a. IFW to the chiller, MAR to the Refrigerant Monitor.*	*Check Sensor, Wiring, Connections*
Severe Phase Unbalance	*MMR*	*Friendly*	*a. A 30% Phase Unbalance diagnostic has been detected. Check the Current Transformer Part Numbers (they should all match), Current Transformer resistances, line voltage phase balance, all power wiring connections, the contactor pole faces, and the motor. If all these are OK, replace the Starter module.*	*Check Main Power Supply & Wiring*
Solid State Starter Fault Rly Open	*MMR*	*Immediate*	*The **SSS** fault relay is open indicating a fault condition.*	*Check Solid State Starter Wiring & Fault Relay*
Starter Contactor Interrupt Failure	*MMR*	*Special Action Required.*	*Detected compressor currents greater than 5% on any or all phases when the compressor was commanded off. Detection time shall be 5 seconds minimum and 10 seconds maximum. When detected, this will generate the diagnostic, energize alarm relay, unload compressor, continue to command the affected compressor off, and energize the shunt trip circuit breaker output for a disconnect means. For as long as current continues, the evap and cond. pumps are commanded on as well as the oil line solenoid energized, the oil return gas pump cycled, and liquid level with EXV controlled.*	*Complete Starter Checkout Required*
Starter did not Transition	*MMR*	*Immediate*	*a. The UCP2 did not receive a transition complete signal in the designated time from the UCP2 command to transition. The must hold time from the UCP2 transition command is 1 second. The Must trip time from the transition command is 6 seconds. Actual design is 2.5 seconds.* *b. Item a. above is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters.*	*Complete Starter Checkout Required*
Starter Dry Run Test	*MMR*	*Immediate*	*While in the Starter Dry Run Mode either 50% Line Voltage was sensed at the Potential Transformers or 10% RLA Current was sensed at the Current Transformers.*	*Check Starter Wiring*
Starter Fault Type I	*MMR*	*Immediate*	*a. This is a specific starter test where (1K1) is closed first and a check is made to ensure that there are no currents detected by the CT's. If currents are detected when only 1K1 is closed first at start, then one of the other contactors is shorted.* *b. This test applies only to factory installed Y-Delta Closed Transition Starters.*	*See Troubleshooting Service Bulletin*

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Starter Fault Type II	*MMR*	*Immediate*	*a. This is a specific starter test where the Shorting Contactor (1K3) is individually energized and a check is made to ensure that there are no currents detected by the CT's. If current is detected when only S is energized at Start, then 1K1 is shorted. b. This test in a. applies to all forms of starters (Note: It is understood that many starters do not connect to the Shorting Contactor.).*	*See Troubleshooting Service Bulletin*
Starter Fault Type III	*MMR*	*Immediate*	*a. As part of the normal start sequence to apply power to the compressor the Shorting Contactor (1K3) and then the Main Contactor (1M) were energized. 1.6 seconds later there were no currents detected by the CT's for the last 1.2 Seconds on all three phases. b. This test in a. above applies to all forms of starters except Adaptive Frequency. Drives (Note: It is understood that many starters do not connect to the Shorting Contactor.).*	*See Troubleshooting Service Bulletin*
Starter: Loss of Comm with Chiller	*MMR*	*Immediate*	*The starter module lost communications with the Chiller module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Starter Mod Ref Voltage Calibration	*IFW*	*N/A*	*An improper reference voltage was detected at the Starter Module. A 2.5 Vdc reference is used to calibrate the non-ratiometric analog I/O such as 2-10Vdc and 4-20ma inputs as well as PWM Analog outputs. The micro checks to see that the A/D value falls within an acceptable range.*	*See Troubleshooting Service Bulletin*
Stepper: Loss of Comm with Chiller	*MMR*	*Friendly*	*The Stepper module lost communications with the Chiller module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Stepper: Loss of Comm with Starter	*MMR*	*Friendly*	*The Stepper module lost communications with the Starter module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
TCI: Loss of Comm with Starter	*IFW*	*N/A*	*The TCI module lost communications with the Starter module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
TCI: Loss of Comm with Options	*IFW*	*N/A*	*The TCI module lost communications with the Options module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
TCI: Loss of Comm with Options	*IFW*	*N/A*	*The TCI module lost communications with the Options module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
TCI: Loss of Comm with Chiller	*IFW*	*N/A*	*The TCI module lost communications with the Chiller module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
TCI: Loss of Comm with Stepper	*IFW*	*N/A*	*The TCI module lost communications with the Stepper #1 module for 15 continuous seconds.*	*Check IPC Wiring/ Connections*
Tracer Communications Lost	*IFW*	*N/A*	*The Tracer was setup as "installed" at the CLD and the TCI lost communications with the Tracer for 15 continuous minutes after it had been established. Continue to run the chiller with the last valid Tracer Setpoints/Mode.*	*Check Tracer to UCP Wiring/ Connections*
Tracer failed to Establish Comm	*IFW*	*N/A*	*The Tracer was setup as "installed" at the CLD and the Tracer did not communicate with the TCI within 2 minutes after power-up.*	*Check Tracer Wiring / Connections / Power*
Tracer Outdoor Air Temp Sensor Fail	*IFW*	*N/A*	*The Tracer has communicated to the UCP2 that its outdoor air temperature sensor is not operational. Either UCP2's outdoor air sensor or default values for outdoor air temperature will be used.*	*Check Sensor, Wiring, and Connections*

Diagnostic Description	Diagnostic Type	Shutdown Action	Cause	Help Message
Tracer Temperature Sensor	*IFW*	*N/A*	*Input Shorted.*	*Check Sensor, Wiring, and Connections*
Transition Complete Input Shorted	*MMR*	*N/A*	*a. The Transition Complete input was found to be shorted before the compressor was started.* *b. This is active for all electromechanical starters.*	*Check transition complete contact*
Transition Complete Input Opened	*MMR*	*Immediate* *Friendly*	*a. The Transition Complete input was found to be opened with the compressor motor running after a successful completion of transition.* *b. This is active only for Y-Delta, Auto-Transformer, and Primary Reactor Starters.*	*Complete Starter Checkout Required*
Under Voltage	*MAR*	*Friendly*	*a. Line voltage below - 10% of nominal or the Under/Overvoltage transformer is not connected. (Must hold = - 10% of nominal. Must trip = - 15% of nominal. Reset differential = min. of 2% and max. of 4%. Time to trip = min. of 1 min. and max. of 5 min.)* *Design: Nom. trip: 60 seconds at less than 87.5%, ±2.8% at 200V or +/- 1.8% at 575V, Auto Reset at 90% or greater.*	*Check Main Power Supply & Wiring*

Wiring Schematics

General

Typical field connection diagrams, electrical schematics and connections diagrams for the RTHC units are shown in the following section.

NOTE: The drawings in this section are provided for reference only. These diagrams may not reflect the actual wiring of your unit. For specific electrical connection and schematic information, always refer to the wiring diagrams that were shipped with the unit.

Unit Electrical Data

To determine the specific electrical characteristics of a particular chiller, refer to the nameplates mounted on the units.

⚠ WARNING

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

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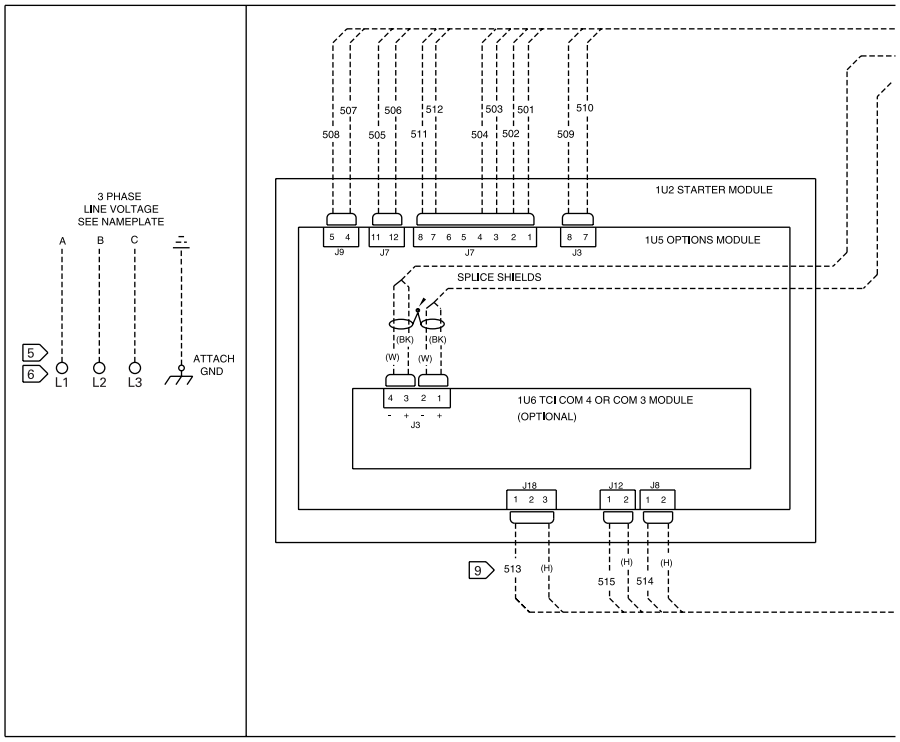
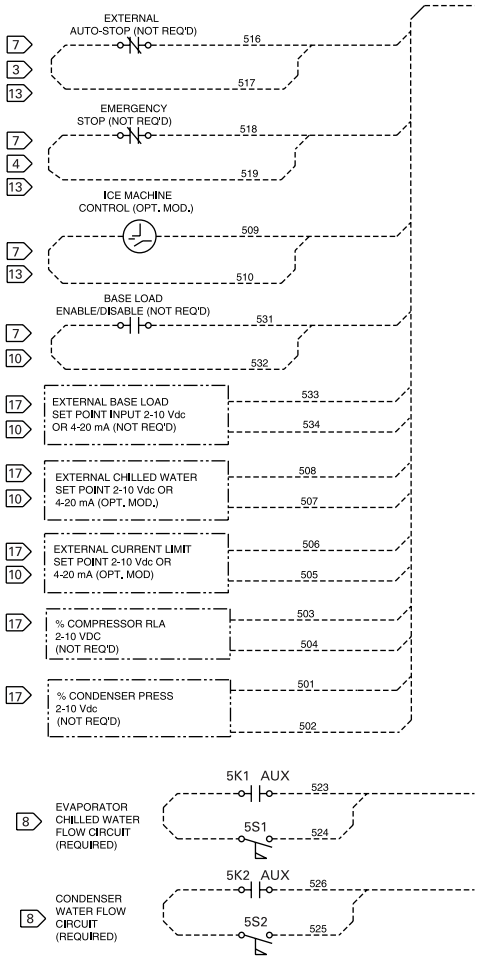
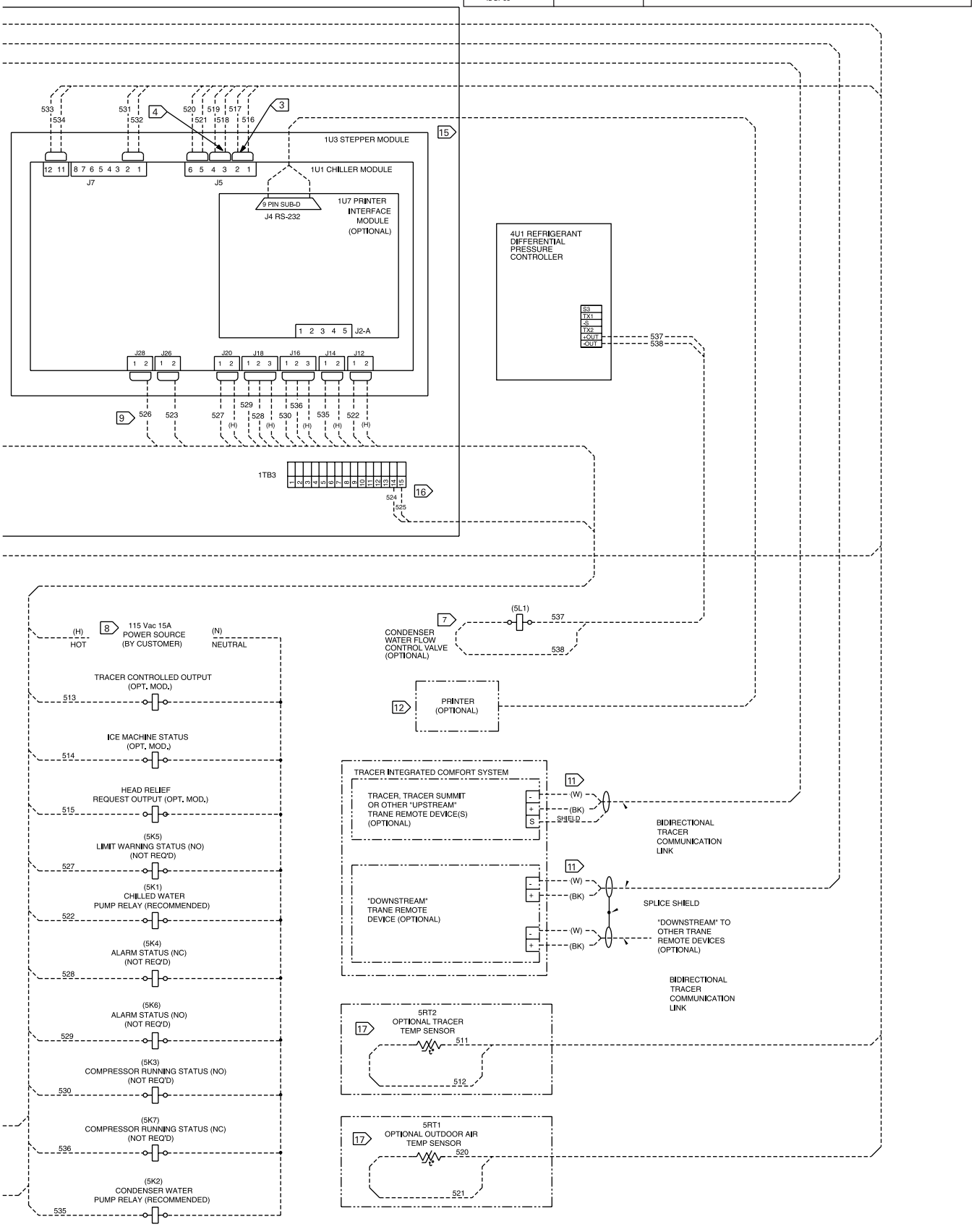


NOTES:

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. TERMINALS J5-1 AND -2 ON CHILLER MODULE (1U1) MUST BE JUMPERED(W11) IF NOT USED.
4. TERMINALS J5-3 AND -4 ON CHILLER MODULE (1U1) MUST BE JUMPERED(W12) IF NOT USED.
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 MCA (MINIMUM CIRCUIT AMPACITY). PHASING OF 3 PHASE INPUT; L1 TO A, L2 TO B, L3 TO C WHERE ABC REPRESENTS STANDARD PHASE ROTATION.
7. CLASS 2 WIRING. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.
8. 115V AC. #14 AWG 600V WIRE.
9. FIELD WIRED ELECTRICAL LOADS ARE NOT TO EXCEED 120VAC/240VA EACH FOR CONNECTIONS AT TERMINALS 1U1J12-1,2; 1U1J14-1,2; 1U1J16-1,3; 1U1J18-1,2,3; 1U1J20-1,2; 1U5J12-1,2; 1U5J18-1,3; AND 1U5J8-1,2.
10. THESE INPUTS ARE DESIGNED WITHOUT DIRECT GROUND REFERENCES. THEY DO NOT REQUIRE ISOLATION PROVISIONS AS LONG AS THE COMMON MODE VOLTAGE AT EITHER TERMINAL IS BETWEEN -10.1 AND +10.6 Vdc WITH RESPECT TO PANEL GROUND.
11. USE TWISTED SHIELDED PAIR 18 AWG WIRE.
12. 9 PIN SUB.D RS 232 CONNECTION. REFER TO IOM FOR ADDED REQUIREMENTS.
13. CONTACTS TO BE SUITABLE FOR USE WITH 24 Vdc, 12mA CIRCUIT.
15. THE FIVE 1/2" CONDUIT KNOCKOUTS AND ONE 1-1/4" KNOCKOUT LOCATED NEAR THE TOP OF THE BACK AND RIGHT SIDE OF THE CONTROL PANEL ARE FOR USE WITH LOW VOLTAGE CLASS 2 CIRCUIT WIRING.
16. THE SIX 1/2" CONDUIT KNOCKOUTS AND 4 1-1/4" KNOCKOUTS LOCATED NEAR THE BOTTOM OF THE RIGHT HAND SIDE OF THE CONTROL PANEL ARE FOR USE WITH 115 VOLT CIRCUIT WIRING.
17. CLASS 2 WIRING, DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE. MAXIMUM LENGTH IN FEET IS: 5000 FOR 14 AWG, 2000 FOR 16 AWG & 1000 FOR 18 AWG.



REPLACES	AUTOCAD	FILE NUMBER	DRAWING NUMBER 2307-9409	REV F
REVISION DATE 5-11-99	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	FIELD WIRING RTHC		
DRAWN BY AM	THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS DISCLOSED TO OUTSIDE PARTIES WITHOUT THE WRITTEN CONSENT OF THE TRANE COMPANY			
DATE 12-27-96	SIMILAR TO			



NOTES:

1. DASHED LINES INDICATE FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS. NOTES IN SQUARE BRACKETS i.e: [...]. DENOTE THE TYPE OF SIGNALING USED AND WHETHER DEVICE SHOWN PROVIDES AN INPUT TO OR USES AN OUTPUT FROM. THE UCP2 CONTROLS.

2. ALL FIELD WIRING SHALL BE IN ACCORDANCE WITH APPLICABLE LOCAL STATE AND NATIONAL ELECTRICAL CODES.

3 REQUIRED DEVICE AND/OR CIRCUITRY BY OTHERS.

4 REQUIRED DEVICE AVAILABLE FROM TRANE. FIELD INSTALLED.

5. THE FOLLOWING CAPABILITIES ARE OPTIONAL AND ARE IMPLEMENTED AS REQUIRED FOR A SPECIFIC APPLICATION.

A FIELD INSTALLED ACCESSORY AVAILABLE FROM TRANE.

B FIELD INSTALLED ACCESSORY FROM TRANE; REQUIRES UCP2 OPTIONS MODULE AND EITHER A TRACER OR A TRACER SUMMIT COMMUNICATIONS MODULE.

D INTERFACE WITH TRACER SYSTEM REQUIRES UCP2 TRACER COMMUNICATIONS MODULE (COM 3).

E INTERFACE WITH TRACER SUMMIT SYSTEM REQUIRES UCP2 TRACER SUMMIT COMMUNICATIONS MODULE (COM 4).

F OPTIONAL DEVICE AND/OR CIRCUITRY BY OTHERS.

G OPTIONAL DEVICE AND/OR CIRCUITRY BY OTHERS; REQUIRES UCP2 OPTIONS MODULE.

H OPTIONAL DEVICE AND/OR CIRCUITRY BY OTHERS; REQUIRES UCP2 PRINTER INTERFACE.

I THERE ARE THREE GENERAL USE "PROGRAMMABLE RELAY" DRY CONTACT OUTPUTS AVAILABLE FROM THE UCP2 CHILLER MODULE. THE DEFAULT ASSIGNMENTS FOR THESE RELAYS ARE ASSUMED FOR THIS DRAWING.
OTHER POSSIBLE ASSIGNMENTS INCLUDE:
MMR DIAGNOSTIC OCCURED
MAR DIAGNOSTIC OCCURED
REFER TO THE RTHC INSTALLATION AND OPERATION MANUAL FOR FURTHER DETAILS.

6 OPENING THE EXTERNAL AUTO-STOP CONTACT WILL INITATE A SHUT DOWN SEQUENCE OF THE CHILLER. CLOSURE OF THE CONTACT WILL ALLOW THE CHILLER TO RETURN TO NORMAL AUTOMATIC OPERATION.

7 AN OPENING OF THE EMERGENCY STOP CONTACT WILL SHUT THE CHILLER DOWN IMMEDIATELY AND TRIGGER AN EMERGENCY STOP INPUT DIAGNOSTIC. CLOSURE OF THE CONTACT AND A MANUAL RESET OF THE UNIT CONTROL DIAGNOSTIC WILL ALLOW THE CHILLER TO RETURN TO NORMAL OPERATION.

GENERAL WIRING REQUIREMENTS AND PROVISIONS

8. DO NOT RUN LOW VOLTAGE WIRING (30 VOLT MAX) IN CONDUIT OR RACEWAY WITH HIGHER VOLTAGE WIRING.

9 THE SIX 1/2" CONDUIT KNOCKOUTS AND ONE 1-1/4" KNOCKOUT LOCATED NEAR THE TOP OF THE BACK AND RIGHT HAND SIDE OF THE CONTROL PANEL ARE FOR USE WITH LOW VOLTAGE 30 VOLT CIRCUIT WIRING.

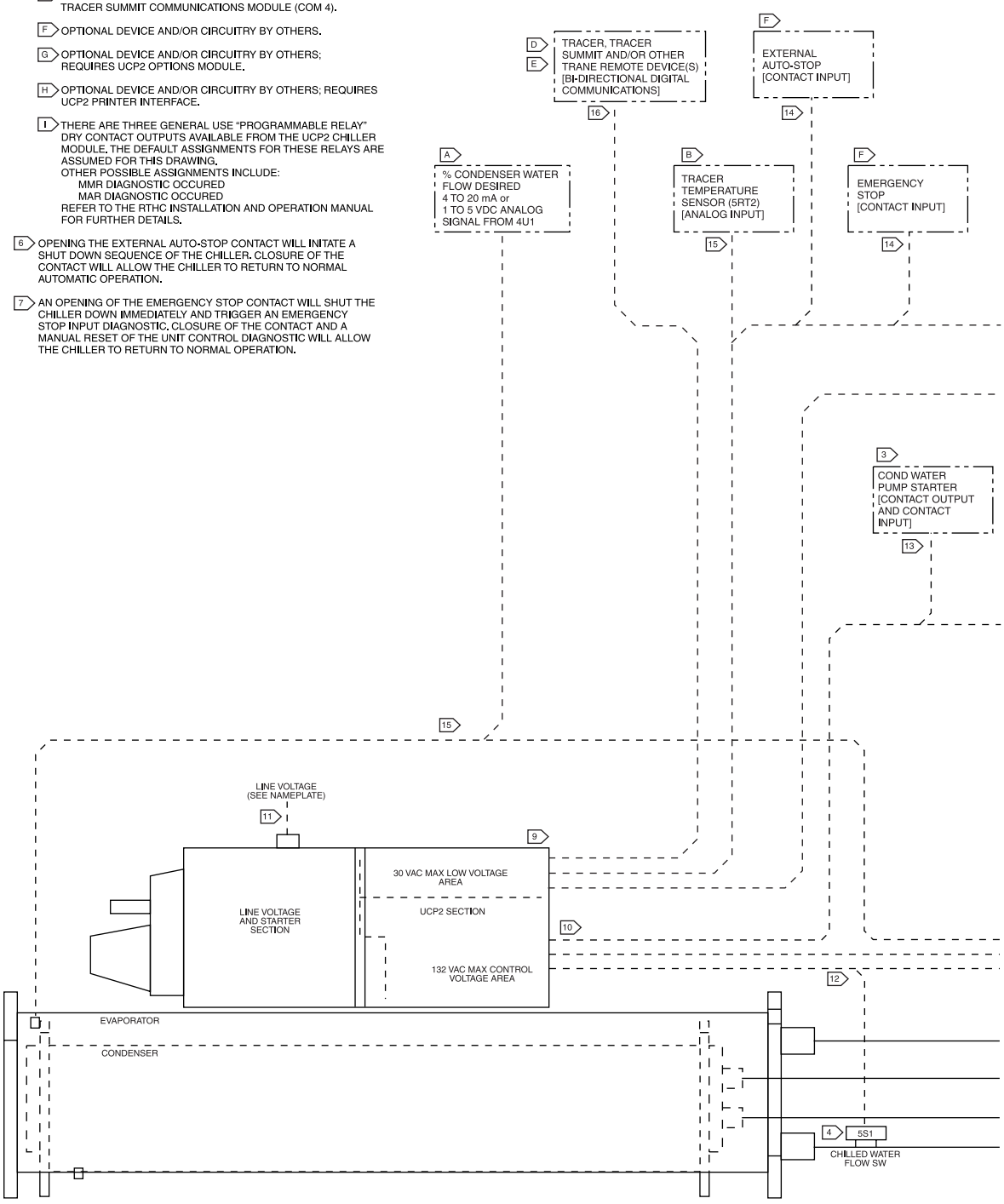
10 THE SIX 1/2' CONDUIT KNOCKOUTS AND 4 1-1/4" KNOCKOUTS LOCATED NEAR THE BOTTOM OF THE RIGHT HAND SIDE OF THE CONTROL PANEL ARE FOR USE WITH 115 VOLT CIRCUIT WIRING.

REQUIRED WIRING:

11 REFER TO THE UNIT NAMEPLATE AND TABLE I TO DETERMINE WIRE GAUGE, AS WELL AS NUMBER AND ARRANGEMENT OF CONDUCTORS AND CONDUIT. USE 600 VOLT COPPER CONDUCTORS ONLY. 200 TO 600 VOLT CIRCUIT, PROVIDE AN EQUIPMENT GROUND IN ACCORDANCE WITH APPLICABLE ELECTRIC CODES.

12 TWO 14 AWG, 600 VOLT CONDUCTORS. 115 VOLT CIRCUIT

13 FOUR 14 AWG, 600 VOLT CONDUCTORS, 115 VOLT CIRCUIT. SEPARATE 115 Vac POWER IS REQUIRED TO STARTER.



REPLACES	2D CAD	FILE NUMBER	DRAWING NUMBER	REV
	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.		2307-9411	E
REVISION DATE 5-11-99		RTHC FIELD LAYOUT DIAGRAM		
DRAWN BY AM				
DATE 12-30-96	SIMILAR TO			

OPTIONAL WIRING AS REQUIRED FOR A SPECIAL SYSTEM ALLICATION

14 CLASS 2 WIRING. TWO CONDUCTORS.

15 CLASS 2 WIRING, TWO CONDUCTORS. MAXIMUM LENGTH IN FEET IS: 5000 FOR 14 AWG. 2000 FOR 16 AWG & 1000 FOR 18 AWG.

16 TRANE ICS SHIELDED TWISTED PAIR COMMUNICATION CABLE 14-18 AWG. 600V CABLE. 30 VOLT CIRCUIT. THE SUM TOTAL LENGTH OF ALL INTERCONNECTED CABLE SEGMENTS NOT TO EXCEED 5000 FEET. GROUND THE SHIELD AT THE TRACER END ONLY. REFER TO THE IOM FOR COMPLETE CABLE AND INSTALLATION REQUIREMENTS.

19 RS232 INTERCONNECTION CABLE WITH 9 PIN SUB-D FEMALE CONNECTOR TO MATE WITH IU7-J4 IN THE CONTROL PANEL AND A PRINTER COMPATIBLE CONNECTOR AT THE OTHER END. 600 VOLT CABLE, 30 VOLT CIRCUIT. LENGTH NOT TO EXCEED 50 FEET. THE CONTROL PANEL 1-1/4" KNOCKOUT IS PROVIDED FOR ENTRANCE OF THIS CABLE WHEN USED.

20 TWO 14 AWG, 600 VOLT CONDUCTORS. 115 VOLT CIRCUIT. SEPARATE 115 Vac POWER IS REQUIRED.

21 TWO OR THREE 14 AWG, 600 VOLT CONDUCTORS, 115 VOLT CIRCUIT. SEPARATE 115 Vac POWER IS REQUIRED.

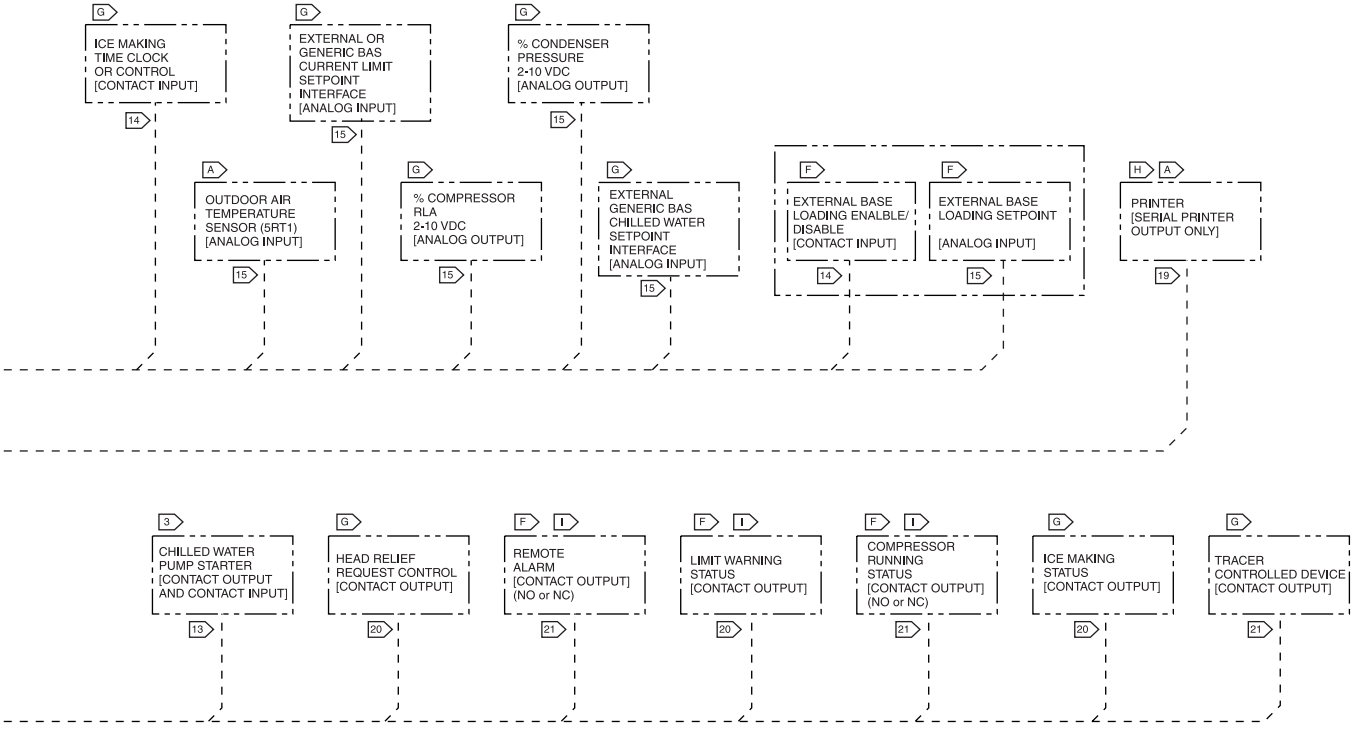
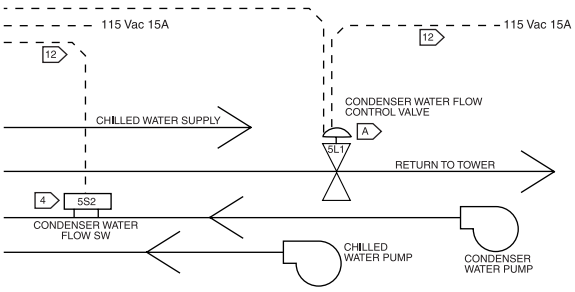


TABLE 2		
STARTER PANEL CONNECTION	SELECTION RLA	LUG SIZE L1-L3 (EACH PHASE)
MAIN LUGS ONLY	000-606	(2) #4-500 MCM
	607-888	(4) #4/0-5000 MCM
MAIN CIRCUIT BREAKER OR NON-FUSED DISCONNECT SWITCH	000-185	(1) #4-350 MCM
	186-296	(2) #2/0-250 MCM or (1) #2/0-500 MCM
	297-592	(2) #1-500 MCM
	593-888	(4) #4/0-500 MCM



PROCEDURE:
To use TABLE 1 select the RLA value from the unit nameplate. Go to one or more columns in the chart below and find a value that is equal to, or greater than, the RLA value. Read across to the left column and note the wire size, and across the top for the method, that is required for the installation. This table assumes a minimum circuit ampacity=1.25*(RLA)

NOTE:
This procedure will offer several options for providing electrical service to the starter panel. Before making a final selection, review the accompanying TABLE 2 indicating wire ranges for the available lug sizes supplied on the equipment.

TABLE 1

RECOMMENDED WIRE SELECTION TABLE (REF.1996 NEC)
RATED LOAD AMPS (RLA)

MIN WIRE SIZE COPPER 75°C	SUPPLY LEADS FOR ALL STARTER PANELS						
	1 CONDUIT 3 WIRE	1 CONDUIT 6 WIRE	1 CONDUIT 9 WIRE	2 CONDUIT 6 WIRE	2 CONDUIT 12 WIRE	3 CONDUIT 9 WIRE	4 CONDUIT 12 WIRE
	1 wire/ph/co	2 wire/ph/co	3 wire/ph/co	1 wire/ph/co	2 wire/ph/co	1 wire/ph/co	1 wire/ph/co
8	40	**	**	**	**	**	**
6	52	**	**	**	**	**	**
4	68	**	**	**	**	**	**
3	60	**	**	**	**	**	**
2	92	**	**	**	**	**	**
1	104	**	**	**	**	**	**
0	120	192	252	360	384	360	480
00	140	224	294	420	448	420	560
000	160	256	336	480	512	480	640
0000	184	294	386	552	589	552	736
250	204	326	428	612	653	612	816
300	228	356	479	684	730	684	912
350	248	397	521	744	794	744	992
400	268	429	563	804	858	804	1072
500	304	486	638	912	973	912	1216

** Electrical conductors may be connected in parallel only for size 1/0 wire and larger per Nec 310-4.

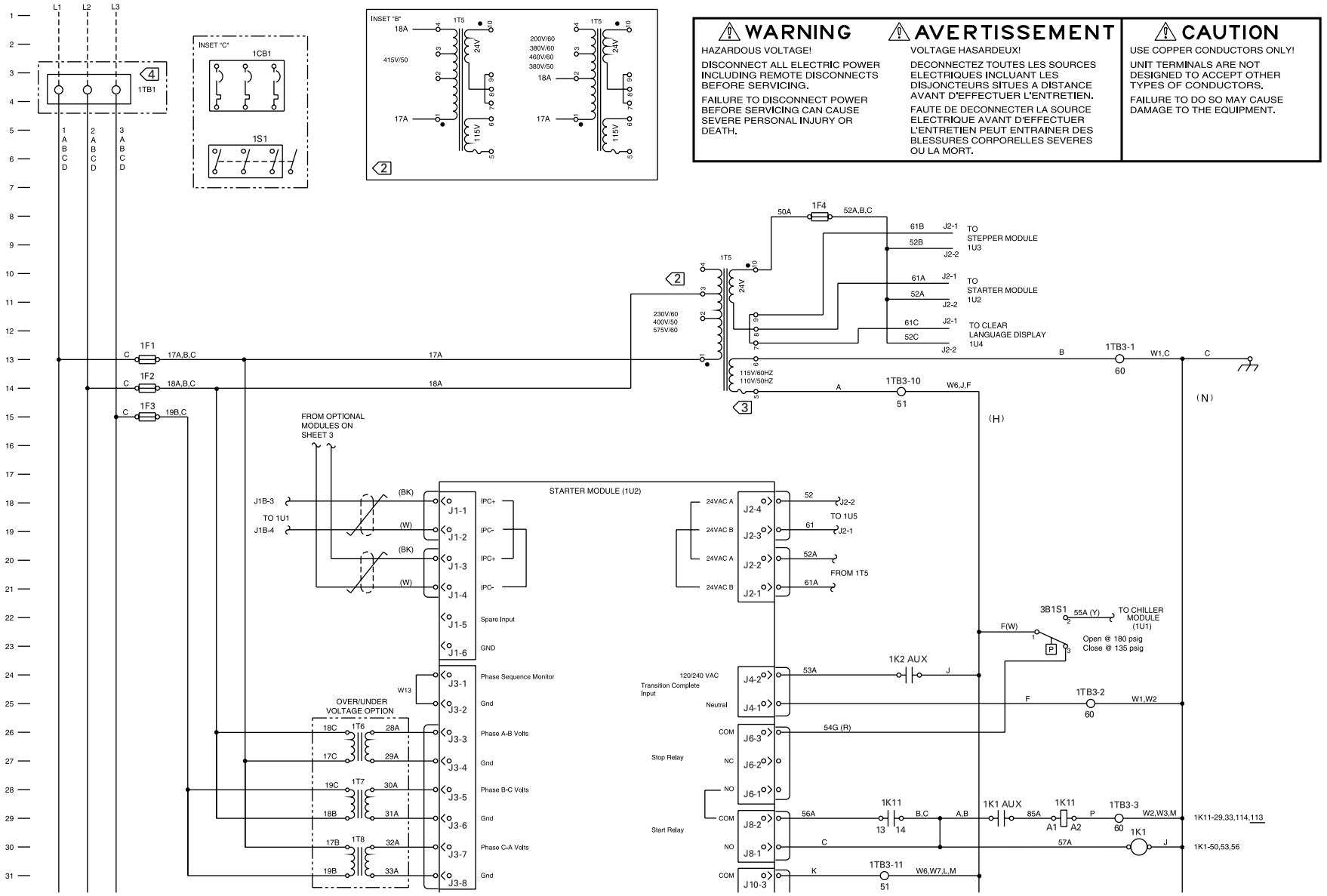
The unit nameplate will be marked 'Maximum Fuse or Circuit Breaker Size'
The maximum fuse or circuit breaker size is calculated as follows:

Calculated value = 2.25 * (Compressor RLA)

The calculated value is then used to select the fuse or circuit breaker from the standard sizes.

Standard Sizes =100, 110, 125, 150, 175, 200, 225, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1200, 1600, 2000.

Maximum Fuse or Circuit Breaker Size = The standard size that is closest to the calculated value without exceeding it.



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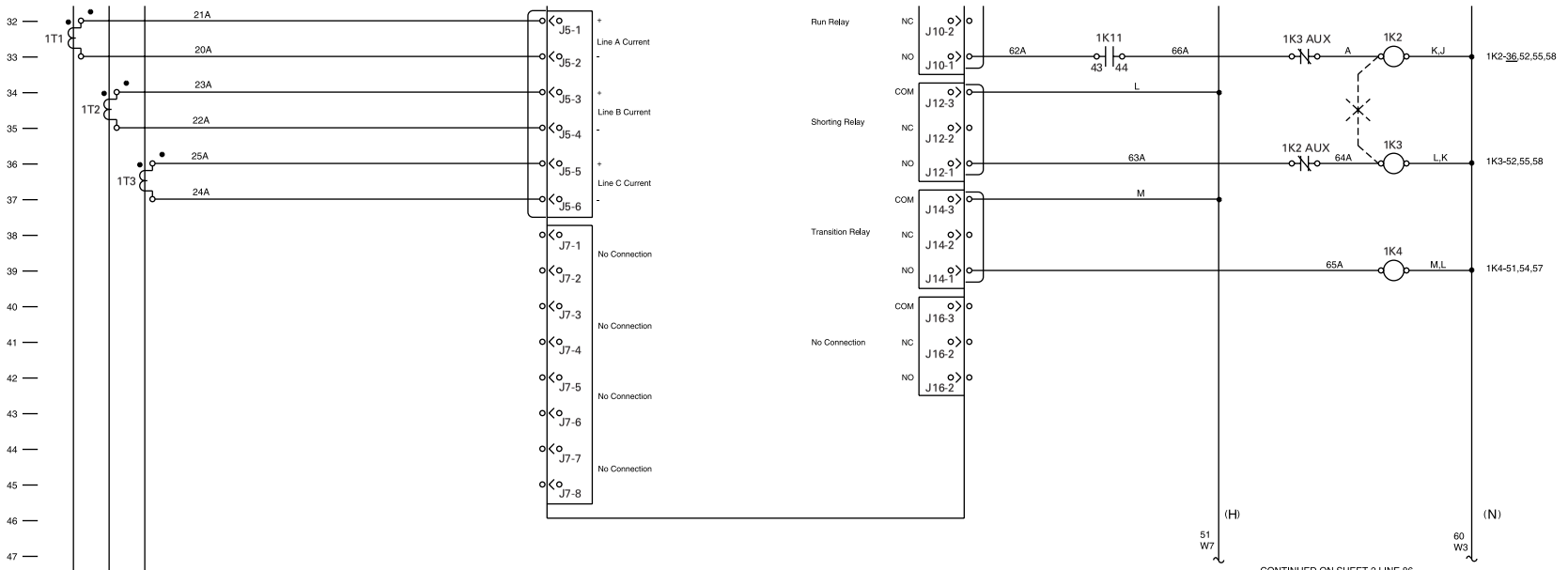

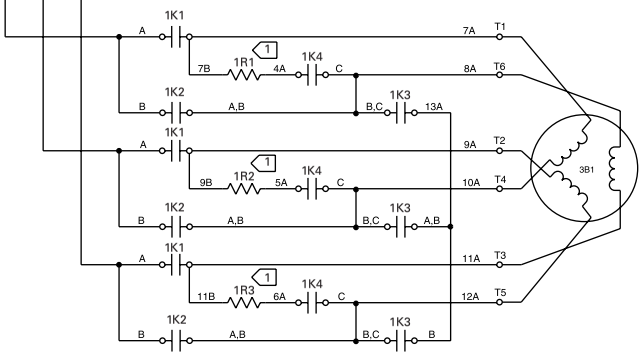

GENERAL NOTES:

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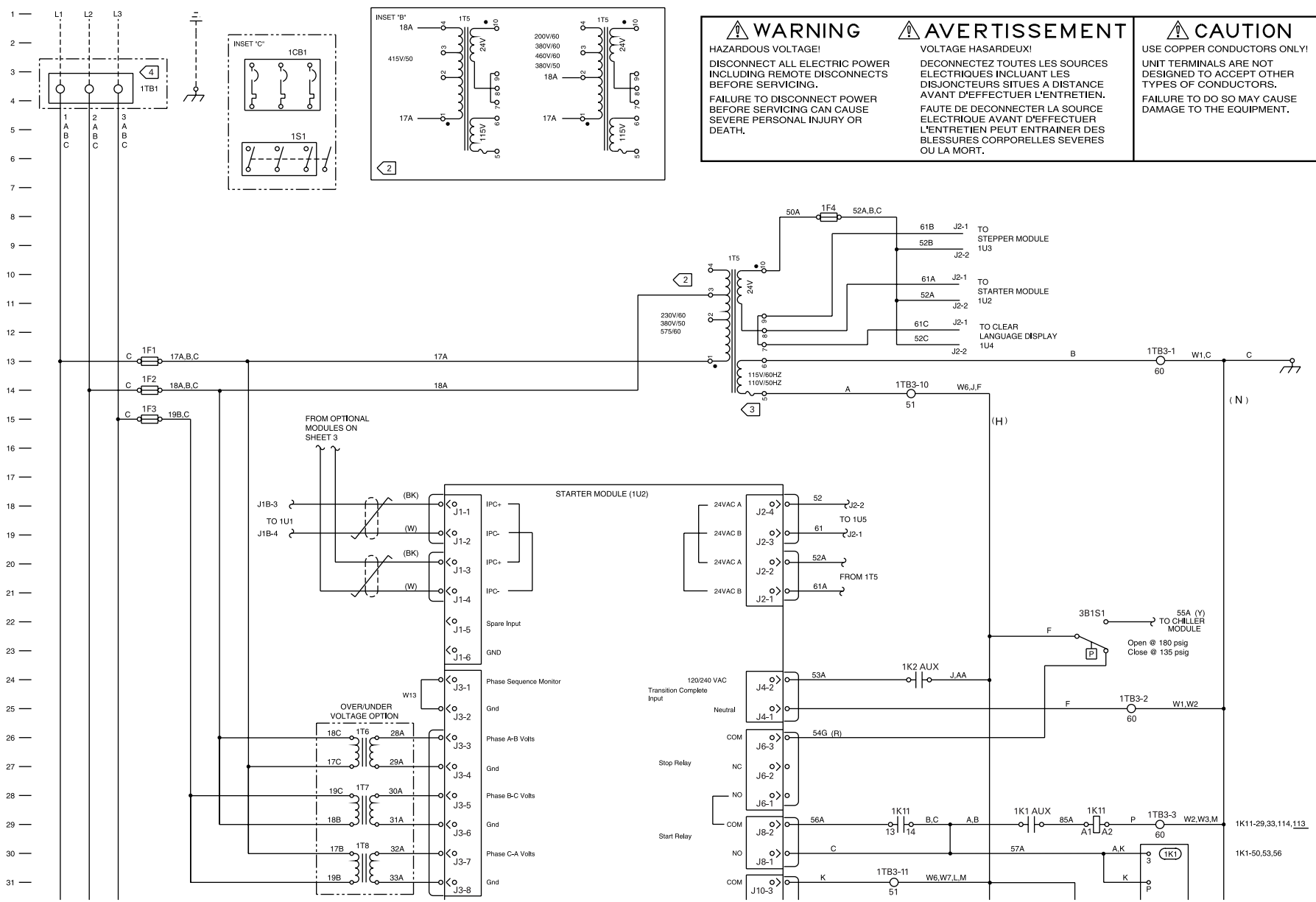
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINES INDICATE WIRING BY TRANE CO.
3. NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF THE CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT.

NOTES:

1. TRANSITION RESISTORS SHOWN MAY BE COMPRISED OF ONE, OR A PARALLEL OR SERIES COMBINATION OF TWO OR THREE RESISTORS, DEPENDING ON RLA RATING OF COMPRESSOR. REFER TO RESISTOR SELECTION CHART IN DRAWING PACKAGE SHIPPED WITH UNIT.
2. WIRING FOR TRANSFORMER 1T5 IS SHOWN FOR VOLTAGES 230V/60, 400V/50, 575V/60, SEE INSET "B" FOR OTHER VOLTAGES.
3. BUSMAN FUSE GMC 6 MEDIUM SLO BLOW ONLY.
4. TERMINAL BLOCK OPTION SHOWN SEE INSET "C" FOR OTHER OPTIONS.

REPLACES	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	FILE NUMBER	DRAWING NUMBER 2307-6477	REV K
REVISION DATE		RTHC WYE - DELTA START SIZE 3,4,5 SHEET 1 OF 4		
DRAWN BY				
DATE	SIMILAR TO			



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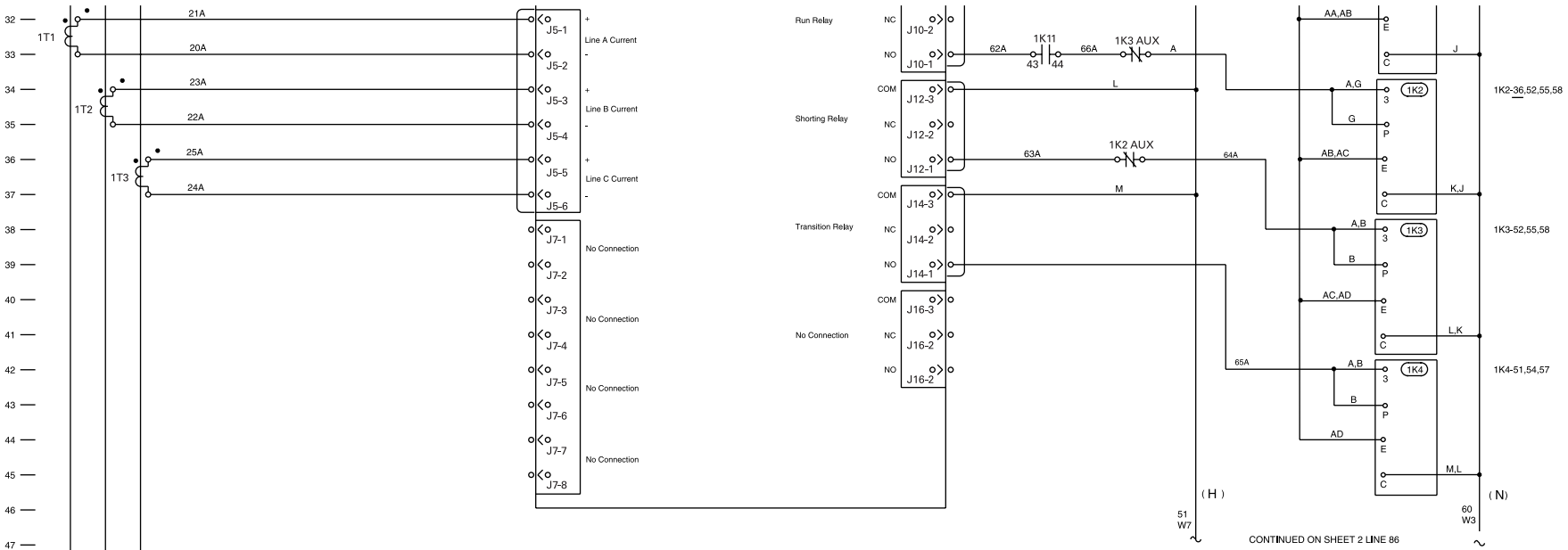

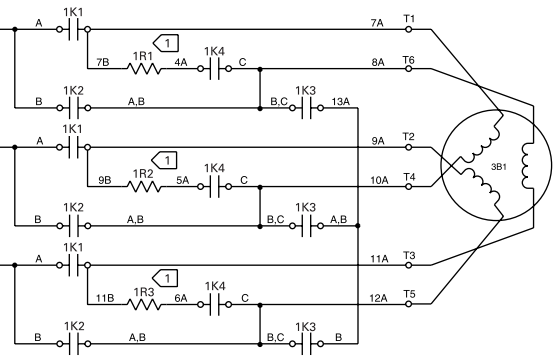

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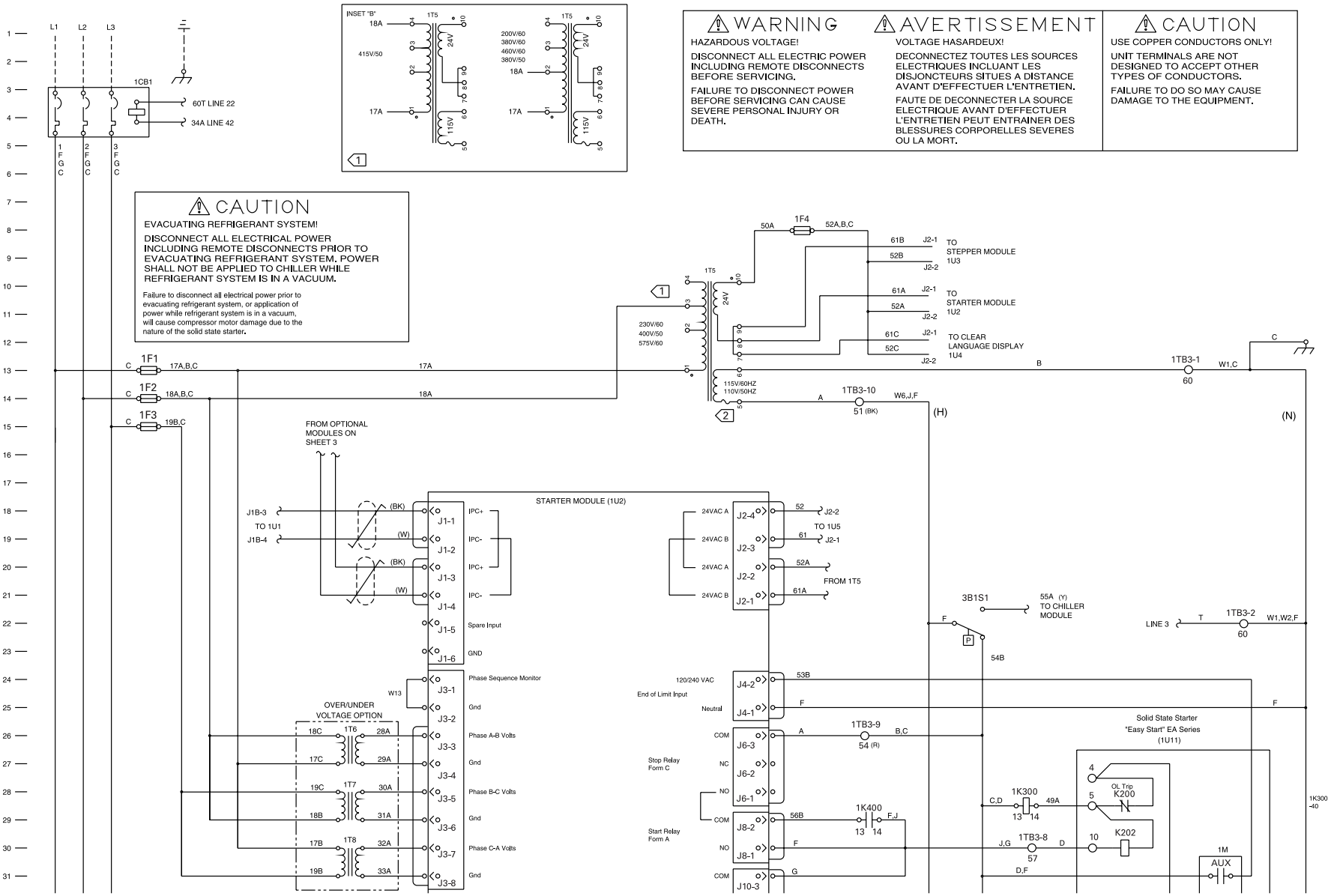
3. BUSMAN FUSE GMC 6 MEDIUM SLO BLOW ONLY.
4. TERMINAL BLOCK OPTION SHOWN SEE INSET "C" FOR OTHER OPTIONS.

REPLACES	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	FILE NUMBER	DRAWING NUMBER 2307-9416	REV D
REVISION DATE		RTHC WYE - DELTA START SIZE 6		
DRAWN BY		SHEET 1 0F 4		
DATE	SIMILAR TO			



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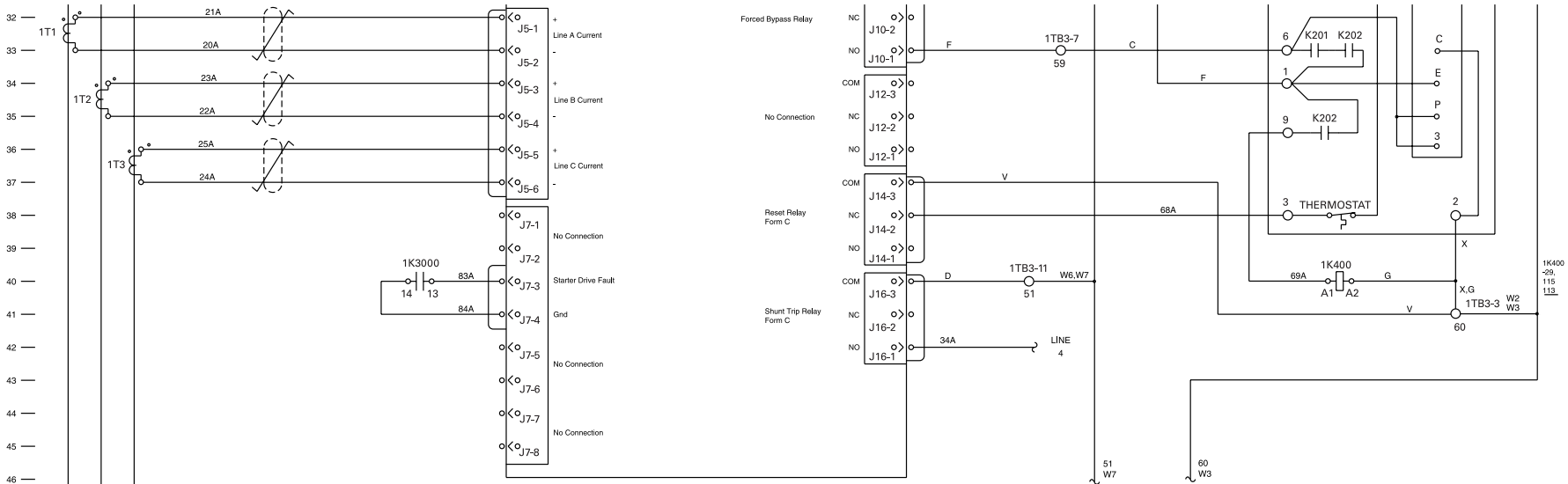
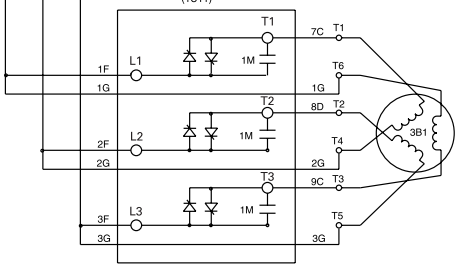
⚠ CAUTION

EVACUATING REFRIGERANT SYSTEM!

DISCONNECT ALL ELECTRICAL POWER INCLUDING REMOTE DISCONNECTS PRIOR TO EVACUATING REFRIGERANT SYSTEM. POWER SHALL NOT BE APPLIED TO CHILLER WHILE REFRIGERANT SYSTEM IS IN A VACUUM.

Failure to disconnect all electrical power prior to evacuating refrigerant system, or application of power while refrigerant system is in a vacuum, will cause compressor motor damage due to the nature of the solid state starter.





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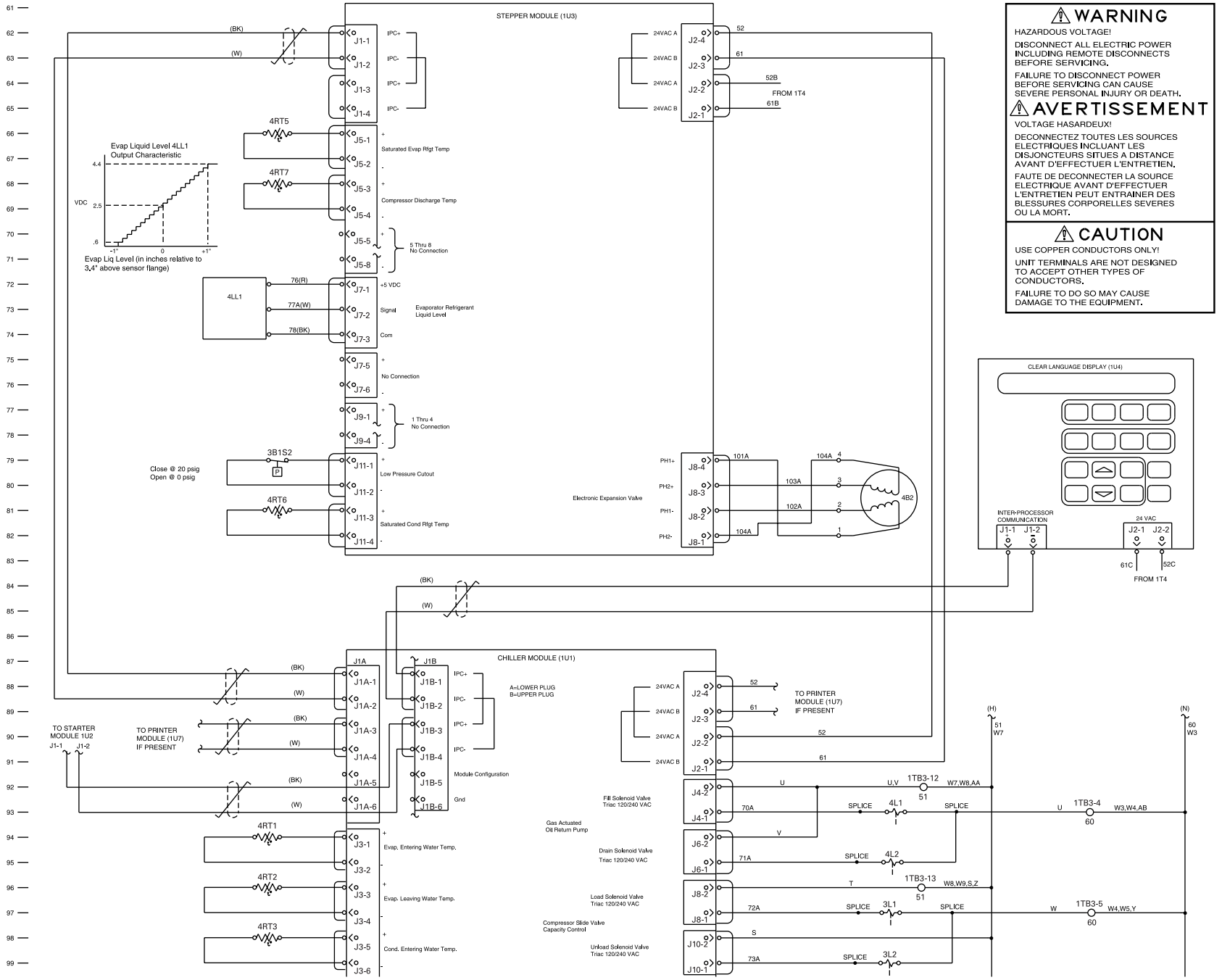
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINES INDICATE WIRING BY TRANE CO.
3. NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF THE CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT.

REPLACES		FILE NUMBER	DRAWING NUMBER 2307-6476	REV K
REVISION DATE	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	RTHC SOLID STATE STARTER		
DRAWN BY		SHEET 1 OF 4		
DATE	SIMILAR TO			



⚠ WARNING

HAZARDOUS VOLTAGE!

DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

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

⚠ AVERTISSEMENT

VOLTAGE HASARDEUX!

DECONNECTEZ TOUTES LES SOURCES ELECTRIQUES INCLUANT LES DISJONCTEURS SITUES A DISTANCE AVANT D'EFFECTUER L'ENTRETIEN.

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

⚠ CAUTION

USE COPPER CONDUCTORS ONLY!

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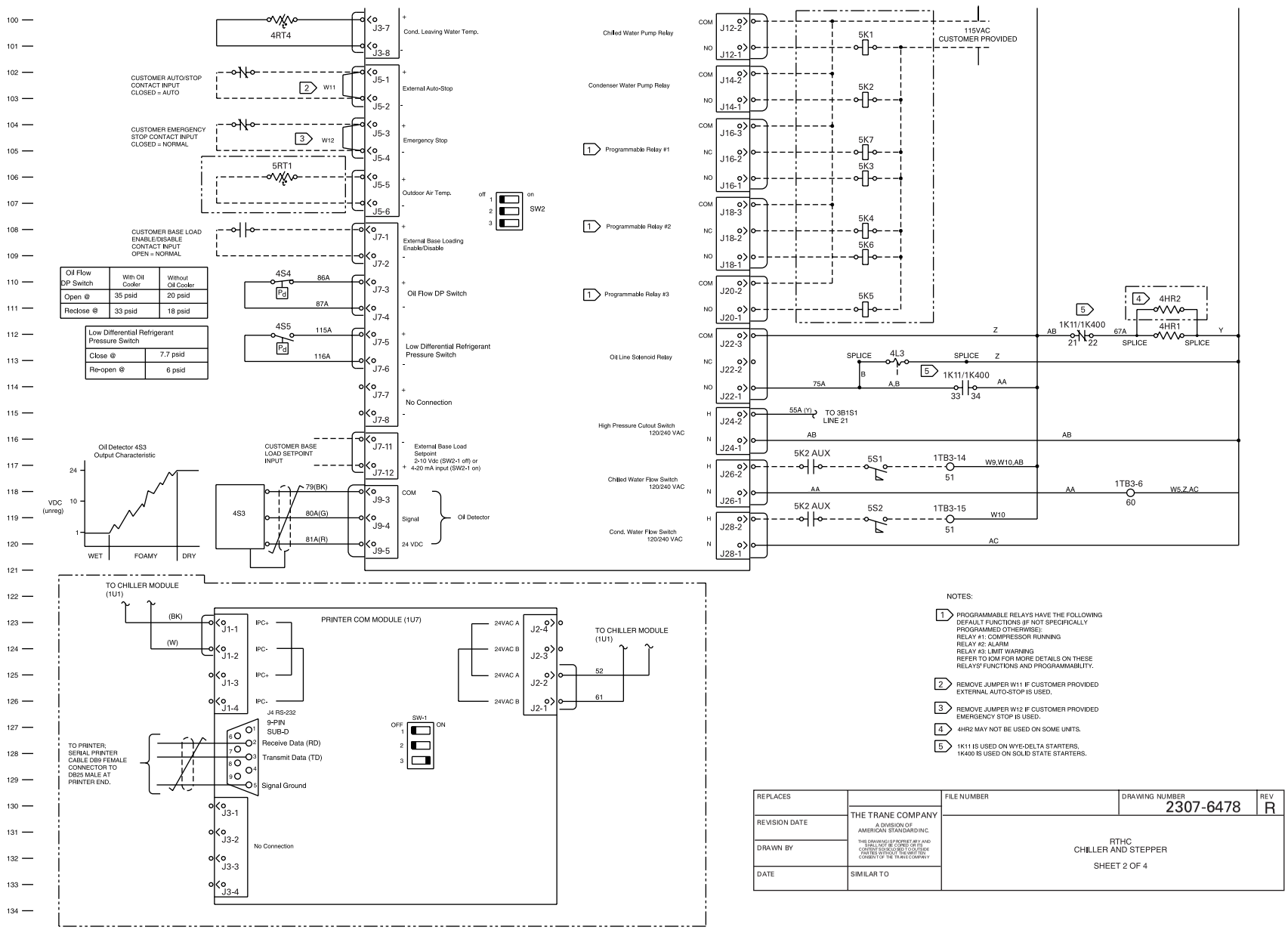
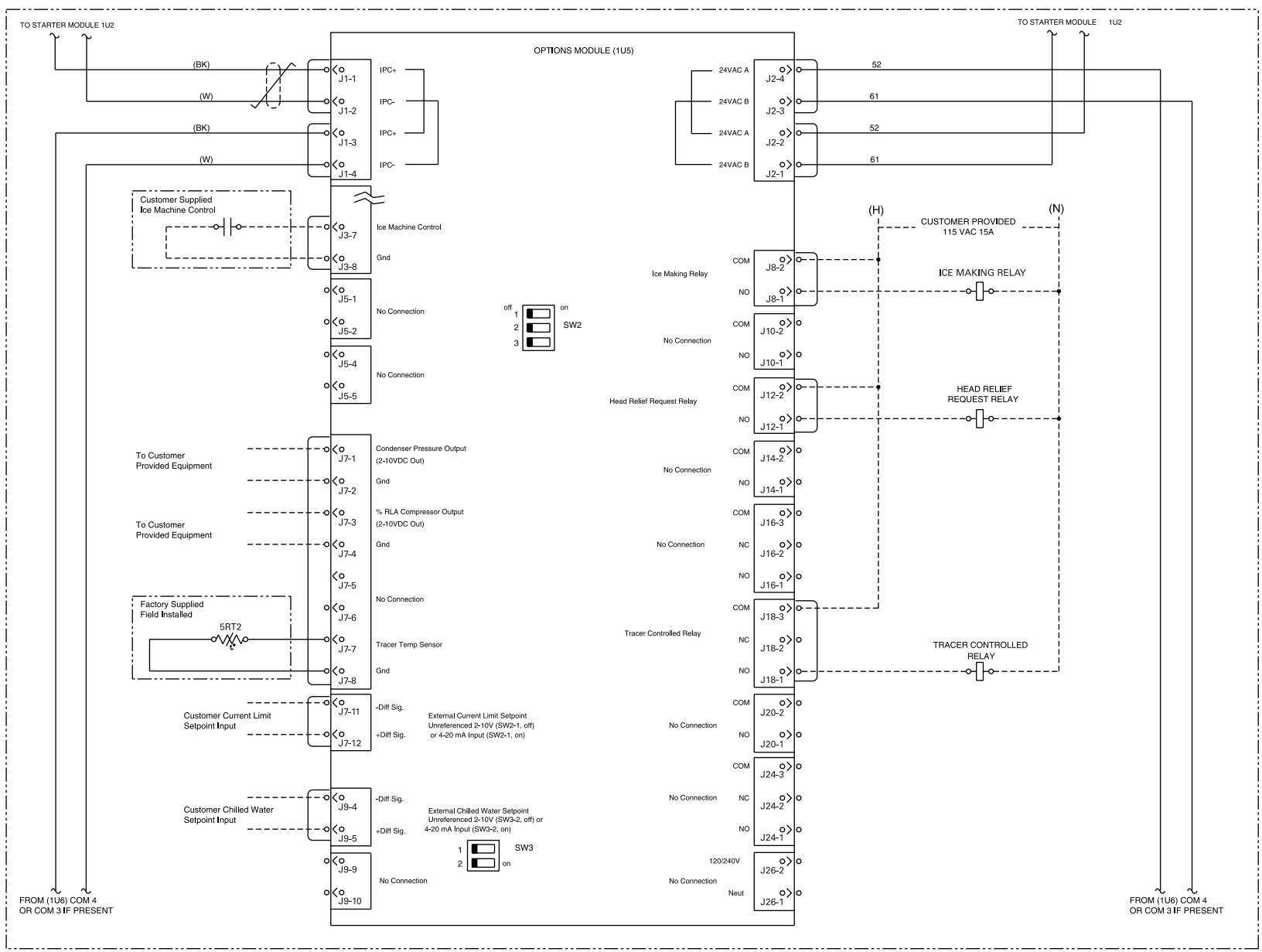
FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.

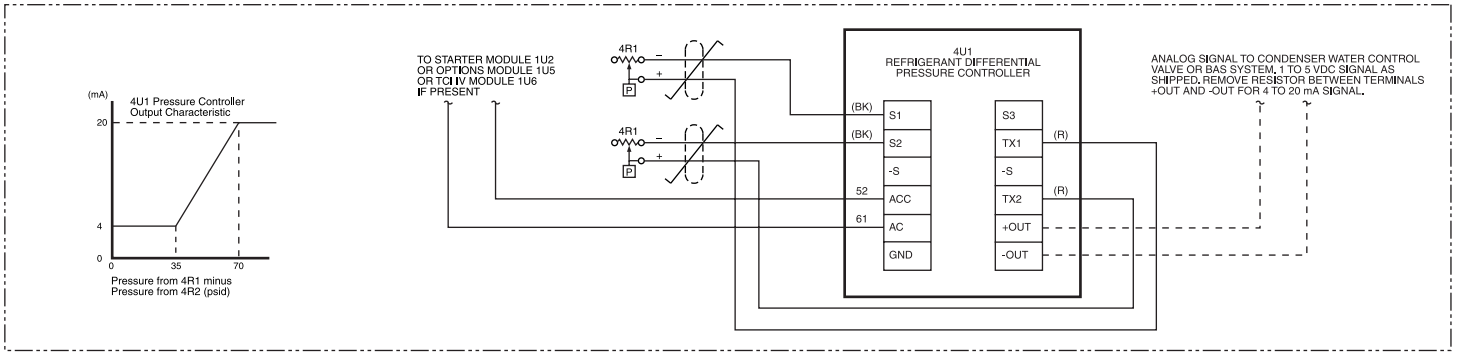


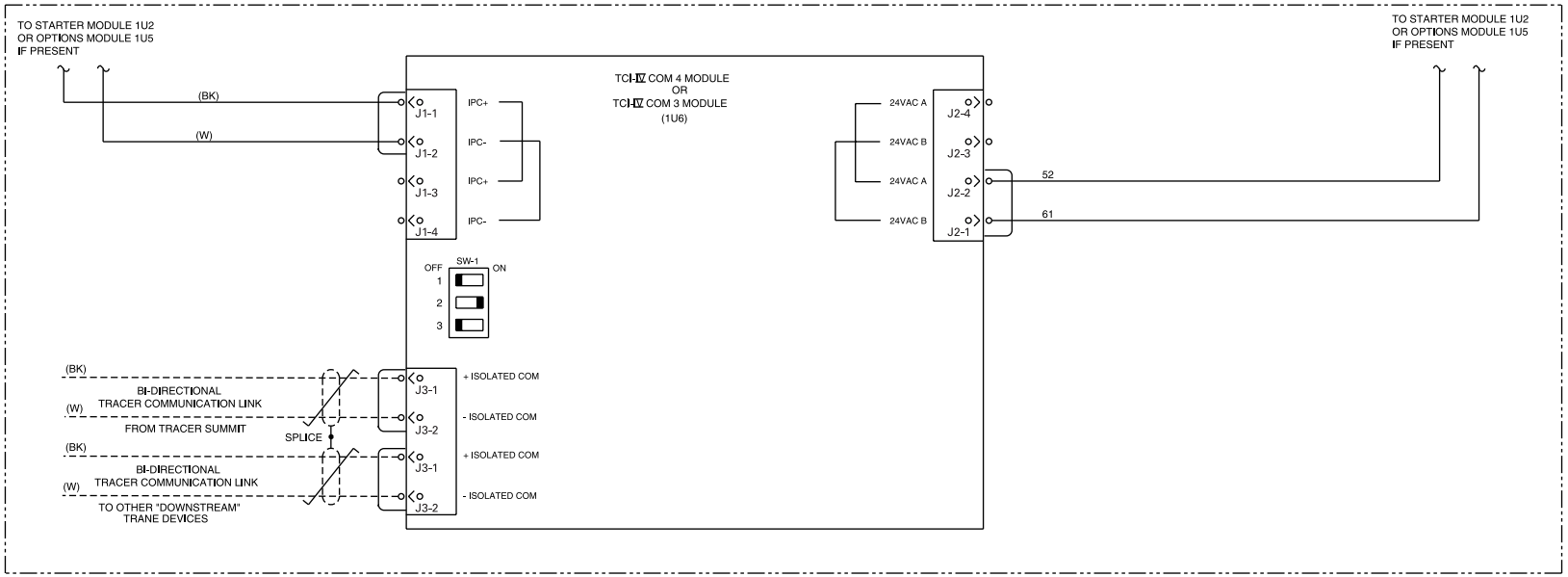
NOTES:

1. PROGRAMMABLE RELAYS HAVE THE FOLLOWING DEFAULT FUNCTIONS (IF NOT SPECIFICALLY PROGRAMMED OTHERWISE):
   RELAY #1: COMPRESSOR RUNNING
   RELAY #2: ALARM
   RELAY #3: LIMIT WARNING
   REFER TO IOM FOR MORE DETAILS ON THESE RELAYS' FUNCTIONS AND PROGRAMMABILITY.
2. REMOVE JUMPER W11 IF CUSTOMER PROVIDED EXTERNAL AUTO-STOP IS USED.
3. REMOVE JUMPER W12 IF CUSTOMER PROVIDED EMERGENCY STOP IS USED.
4. 4HR2 MAY NOT BE USED ON SOME UNITS.
5. 1K11 IS USED ON WYE-DELTA STARTERS, 1K400 IS USED ON SOLID STATE STARTERS.

REPLACES		FILE NUMBER	DRAWING NUMBER 2307-6478	REV R
REVISION DATE	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	RTHC CHILLER AND STEPPER		
DRAWN BY	THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS DISCLOSED TO THIRD PARTIES WITHOUT THE WRITTEN CONSENT OF THE TRANE COMPANY			
DATE	SIMILAR TO	SHEET 2 OF 4		


TO STARTER MODULE 1U2
OPTIONS MODULE (1U5)
TO STARTER MODULE 1U2
(BK)
(W)
(BK)
(W)
J1-1
J1-2
J1-3
J1-4
IPC+
IPC-
IPC+
IPC-
24VAC A
24VAC B
24VAC A
24VAC B
J2-4
J2-3
J2-2
J2-1
52
61
52
61
Customer Supplied
Ice Machine Control
J3-7
J3-8
Ice Machine Control
Gnd
(H)
(N)
CUSTOMER PROVIDED
115 VAC 15A
Ice Making Relay
COM
NO
J8-2
J8-1
ICE MAKING RELAY
J5-1
J5-2
No Connection
off
1
2
3
on
SW2
No Connection
COM
NO
J10-2
J10-1
J5-4
J5-5
No Connection
Head Relief Request Relay
COM
NO
J12-2
J12-1
HEAD RELIEF
REQUEST RELAY
To Customer
Provided Equipment
J7-1
J7-2
Condenser Pressure Output
(2-10VDC Out)
Gnd
No Connection
COM
NO
J14-2
J14-1
To Customer
Provided Equipment
J7-3
J7-4
% RLA Compressor Output
(2-10VDC Out)
Gnd
No Connection
COM
NC
NO
J16-3
J16-2
J16-1
J7-5
Factory Supplied
Field Installed
5RT2
J7-6
J7-7
J7-8
No Connection
Tracer Temp Sensor
Gnd
Tracer Controlled Relay
COM
NC
NO
J18-3
J18-2
J18-1
TRACER CONTROLLED
RELAY
Customer Current Limit
Setpoint Input
J7-11
J7-12
-Diff Sig.
+Diff Sig.
External Current Limit Setpoint
Unreferenced 2-10V (SW2-1, off)
or 4-20 mA Input (SW2-1, on)
No Connection
COM
NO
J20-2
J20-1
COM
J24-3
Customer Chilled Water
Setpoint Input
J9-4
J9-5
-Diff Sig.
+Diff Sig.
External Chilled Water Setpoint
Unreferenced 2-10V (SW3-2, off) or
4-20 mA Input (SW3-2, on)
No Connection
NC
NO
J24-2
J24-1
1
2
SW3
on
120/240V
Neut
J26-2
J26-1
J9-9
J9-10
No Connection
No Connection
FROM (1U6) COM 4
OR COM 3 IF PRESENT
FROM (1U6) COM 4
OR COM 3 IF PRESENT





REPLACES	2D CAD	FILE NUMBER	DRAWING NUMBER	REV
	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.		2307-6479	K
REVISION DATE 5-5-99		SCHEMATIC WIRING RTHC OPTIONS		
DRAWN BY AM				
DATE 7-14-97	SIMILAR TO	SHEET 3 OF 4		

⚠ WARNING

HAZARDOUS VOLTAGE!

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⚠ AVERTISSEMENT

VOLTAGE HASARDEUX!

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LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
4RT1	EVAPORATOR ENTERING WATER TEMP SENSOR	94
4RT2	EVAPORATOR LEAVING WATER TEMP SENSOR	96
4RT3	CONDENSER ENTERING WATER TEMP SENSOR	98
4RT4	CONDENSER LEAVING WATER TEMP SENSOR	100
4RT5	SATURATED EVAPORATOR RFGT TEMP SENSOR	66
4RT6	SATURATED CONDENSER RFGT TEMP SENSOR	81
4RT7	COMPRESSOR DISCHARGE TEMP SENSOR	68
4LL1	EVAPORATOR REFRIGERANT LIQUID LEVEL SENSOR	72
4S3	OIL LOSS LEVEL SENSOR	118
4S4	OIL FLOW DIFFERENTIAL PRESSURE SWITCH	110
4S5	LOW DIFFERENTIAL REFRIGERANT PRESSURE SWITCH	112
3L1	SLIDE VALVE LOAD SOLENOID VALVE	97
3L2	SLIDE VALVE UNLOAD SOLENOID VALVE	99
4L1	OIL RETURN GAS PUMP FILL SOLENOID VALVE	93
4L2	OIL RETURN GAS PUMP DRAIN SOLENOID VALVE	95
4L3	MASTER OIL LINE SOLENOID	113
3B1S1	HIGH PRESSURE CUTOUT SWITCH	22
3B1S2	LOW PRESSURE CUTOUT	79
4HR1,4HR2	OIL HEATER	111,112
4B2	ELECTRONIC EXPANSION VALVE	80
1T6-8	POTENTIAL TRANSFORMERS	26,28,30
1T1,2,3	CURRENT TRANSFORMERS	22,34,36
1K1	START CONTACTOR	30
1K2	RUN CONTACTOR	33 or 34
1K3	SHORTING CONTACTOR	36 or 38
1K4	TRANSITION CONTACTOR	39 or 42

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1M	BYPASS CONTACTOR	30
1K11	CONTROL RELAY	29
1R1-1K9	TRANSITION RESISTORS	51,54,57
1U11	SOLID STATE STARTER	26,51
1CB1	SHUNT TRIP CIRCUIT BREAKER	3
1S1	UNFUSED DISCONNECT	6
1T5	UCP2 AND CONTROL POWER TRANSFORMER	10
1U1	CHILLER MODULE	87
1U2	STARTER MODULE	18
1U3	STEPPER MODULE	62
1U4	CLEAR LANGUAGE DISPLAY OR COMPLEX CHARACTER DISPLAY	75
1U5	OPTIONS MODULE	136
1U6	TCI-IVCOM 4 (SUMMIT INTERFACE) OR COM 3 (TRACER INTERFACE)	176
1U7	PRINTER INTERFACE (SERIAL)	123
1K300	CONTROL RELAY	28
1K400	CONTROL RELAY	40
5RT1	OUTDOOR AIR TEMP SENSOR	106
5RT2	TRACER TEMP SENSOR (TRANE SUPPLIED, CUST INSTALLED)	155
5K1	CHILLED WATER PUMP RELAY	100
5K2	CONDENSER WATER PUMP RELAY	103
5K3	COMPR, RUNNING RELAY (NO) (TYPICAL APPLICATION)	106
5K4,5K6	ALARM RELAY NC, NO (TYPICAL APPLICATION)	108,109
5K5	LIMIT WARNING RELAY (TYPICAL APPLICATION)	110
5K7	COMPR, RUNNING RELAY (NC) (TYPICAL APPLICATION)	105
5S1	EVAPORATOR CHILLED WATER FLOW SWITCH	117
5S2	CONDENSER WATER FLOW SWITCH	119

SEE NOTE 1 SHEET 2

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	CONTROL PANEL
2	NOT USED
3	COMPRESSOR
4	UNIT MTD
5	CUSTOMER PROVIDED

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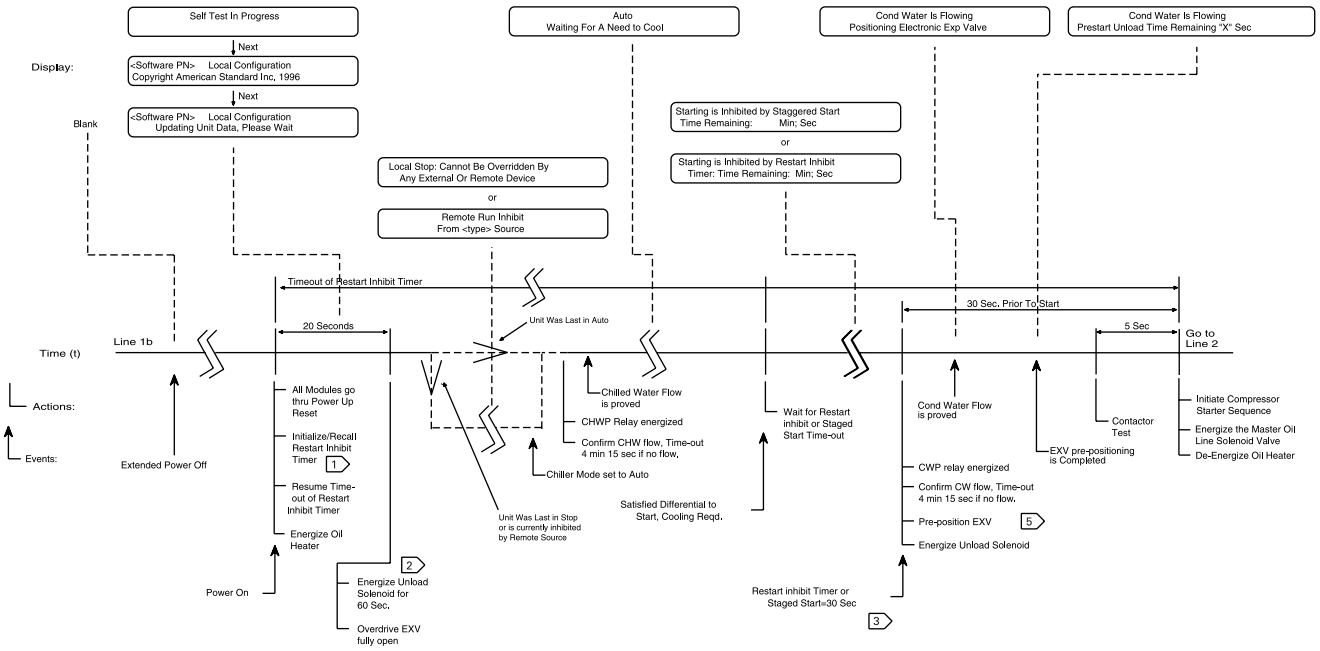
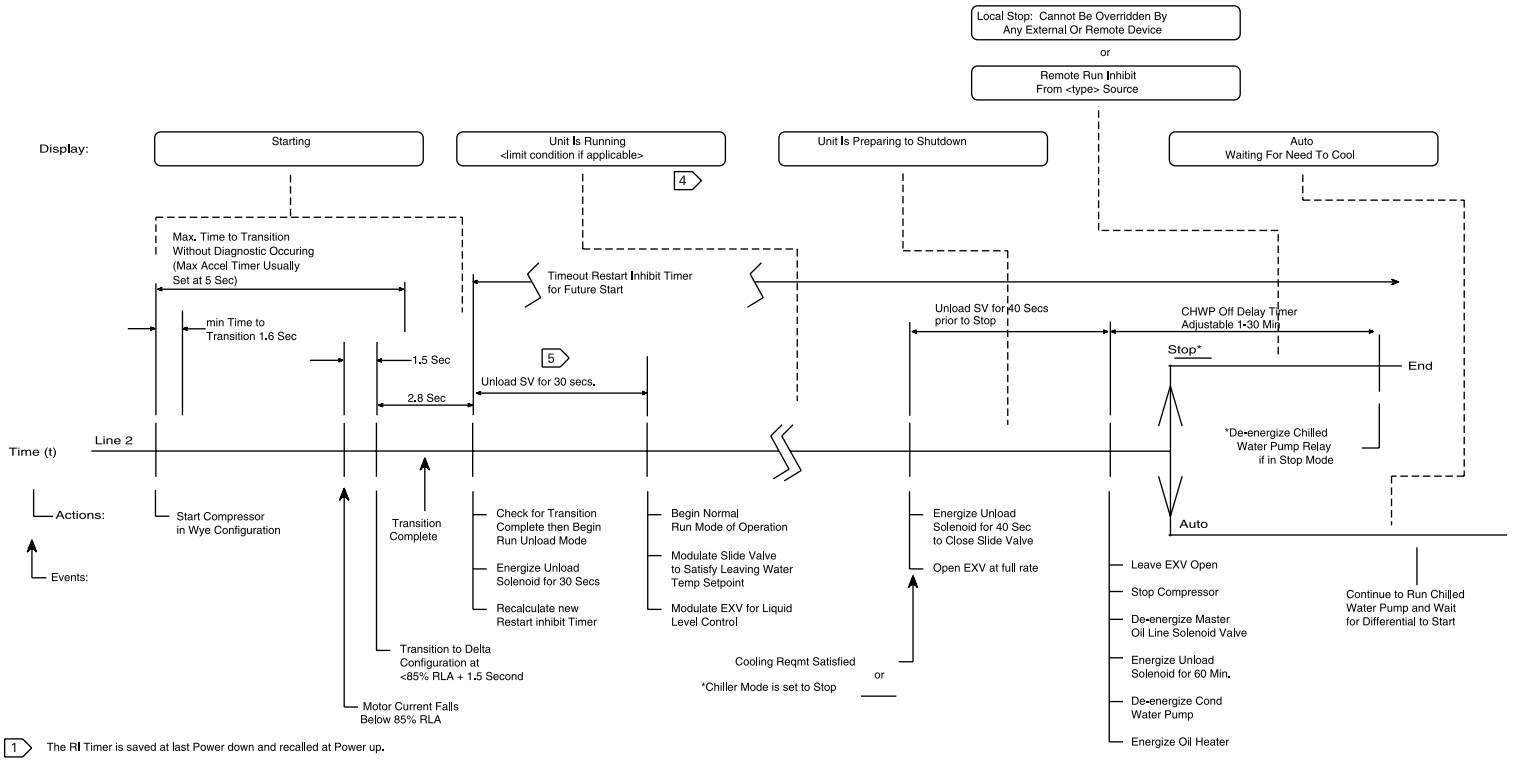
RTHC SEQUENCE OF OPERATION

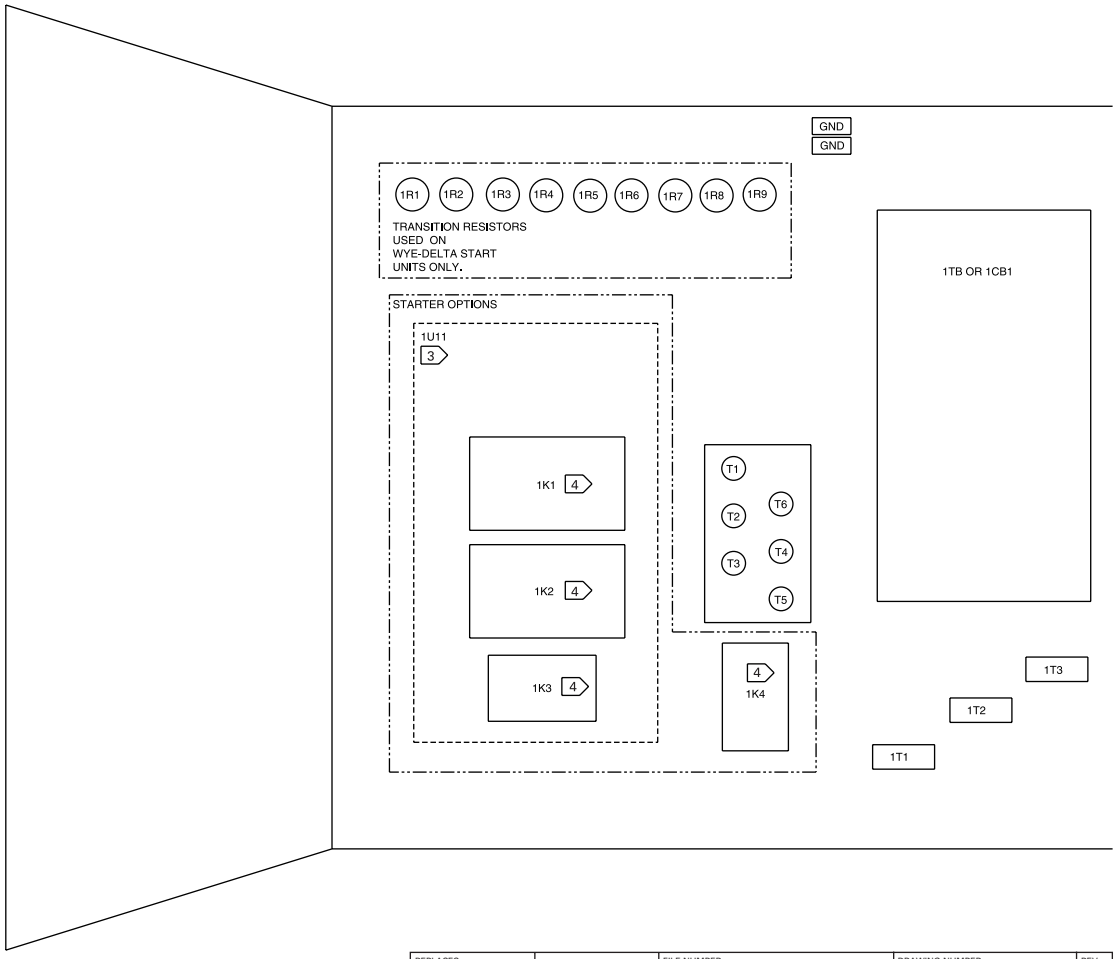
(WYE-Delta Closed Transition Starter Shown)





1. The RI Timer is saved at last Power down and recalled at Power up.
2. The Unload Solenoid is energized for up to 60 minutes on all UCM Power-Ups (or hardware Reset). As a minimum, there will be 60 seconds of Unload from Power-up to Start since the 60 second unload timer on a power up and the 30 second pre-start unload timer are overlapping timers.
3. The Start of the CWP and Pre-Start Unload may begin when the Restart Inhibit Timer is less than 30 seconds.
4. Limit Conditions that may occur during UNIT IS RUNNING, include Softloading, Condenser Limit, Evaporator Limit, Current Limit, Phase Unbalance Limit, and Minimum Capacity Limit.
5. The EXV is always pre-positioned just prior to start, and is held there for 30 seconds before starting closed loop control.
6. The Unload Solenoid is energized for 30 seconds on all Diagnostic Resets (or Software Reset).

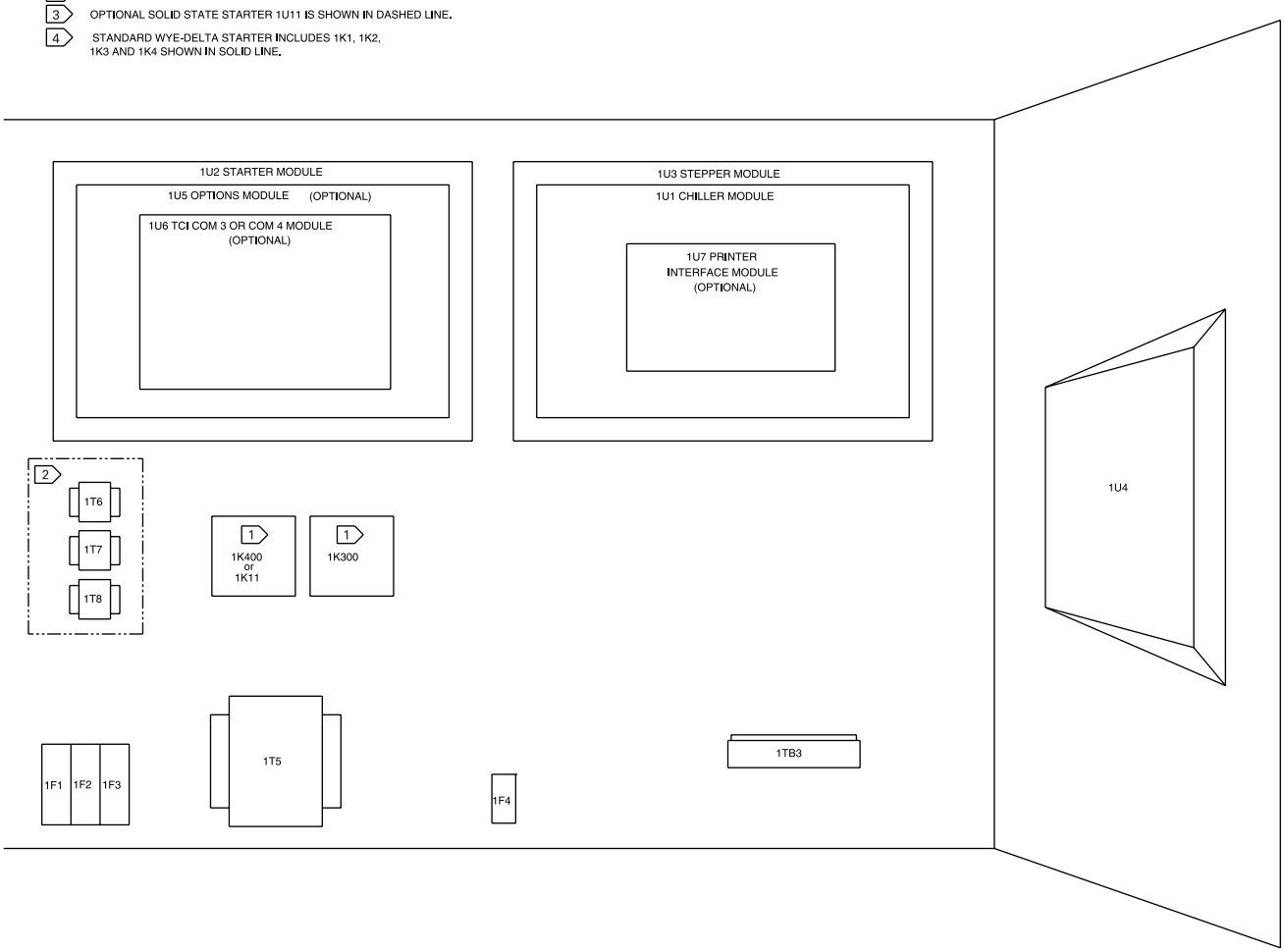
REPLACES	2D CAD	FILE NUMBER	DRAWING NUMBER 2307-6496	REV N
REVISION DATE 5-11-99	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	RTHC LEGEND		
DRAWN BY RO	THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS DISCLOSED TO OUTSIDE PARTIES WITHOUT THE WRITTEN CONSENT OF THE TRANE COMPANY	SHEET 4 OF 4		
DATE 3-1-96	SIMILAR TO			



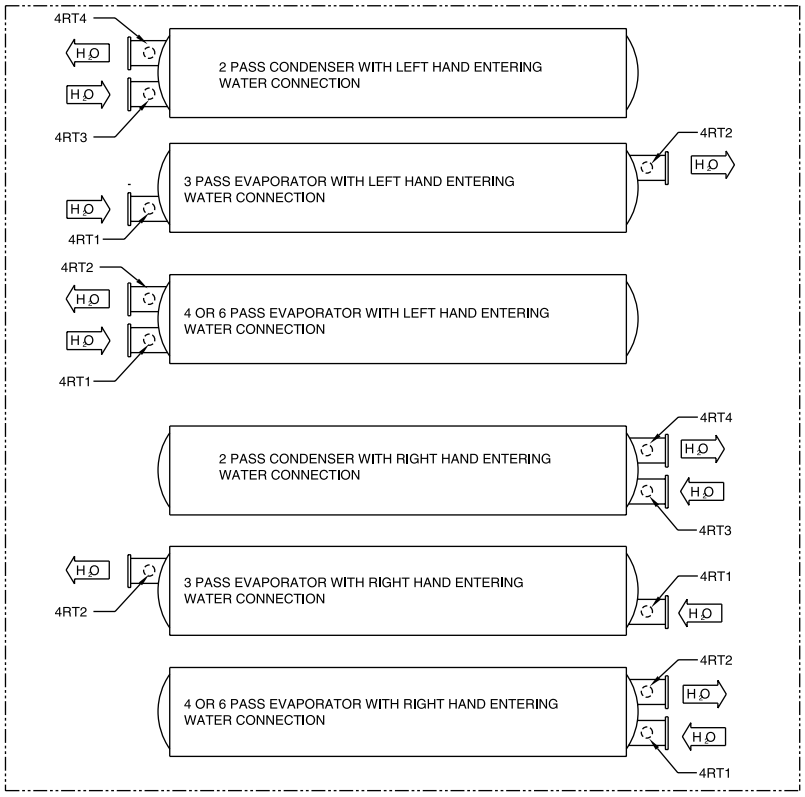
REPLACES	2D CAD	FILE NUMBER	DRAWING NUMBER 2307-6481	REV H
REVISION DATE 5-4-99	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	RTHC COMPONENT LOCATION		
DRAWN BY AM				
DATE 12-23-96	SIMILAR TO			

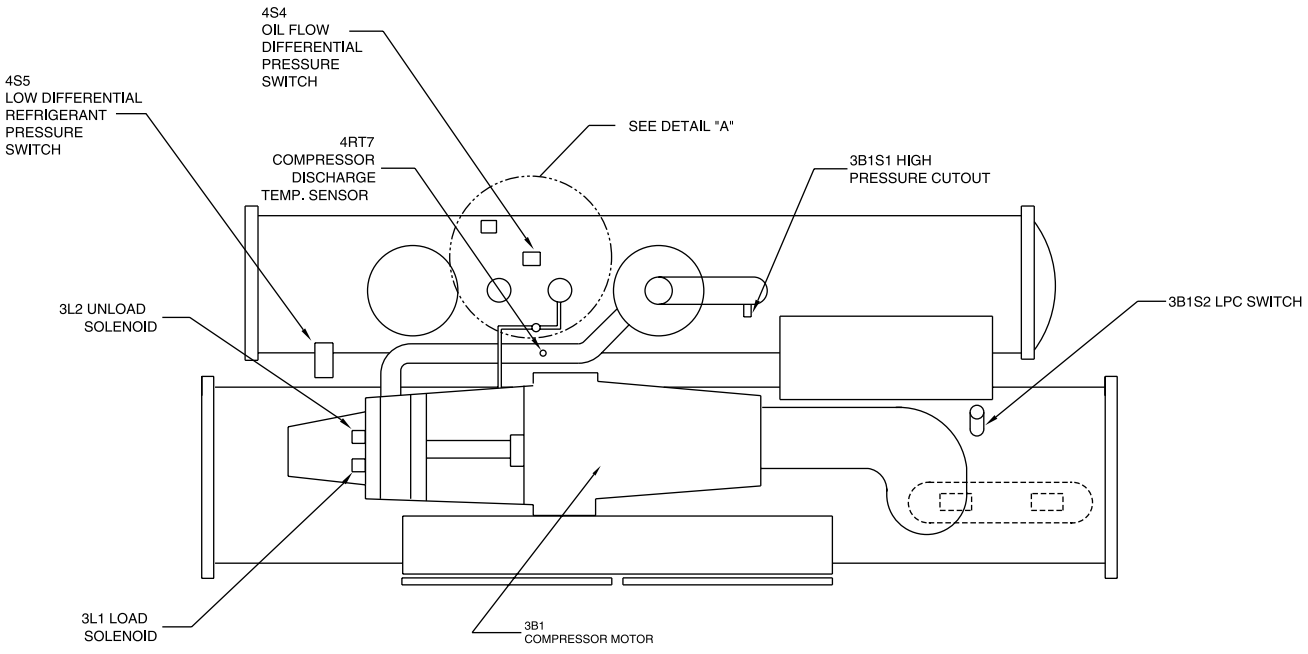
NOTES:

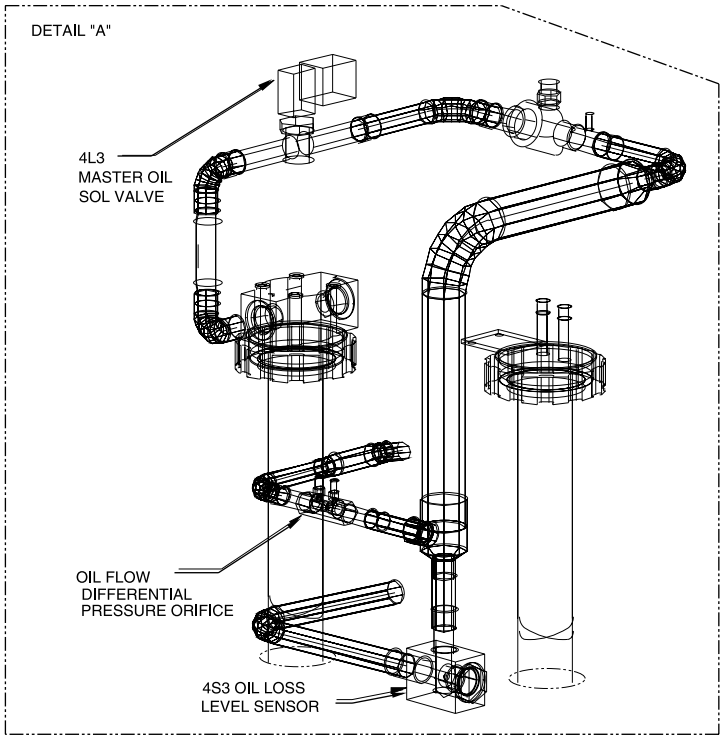
1. 1K300 AND 1K400 ARE USED ON SOLID STATE STARTER UNITS ONLY
   1K11 IS USED ON UNITS WITH WYE-DELTA STARTERS ONLY
2. USED ON OVER/UNDER VOLTAGE OPTION ONLY
3. OPTIONAL SOLID STATE STARTER 1U11 IS SHOWN IN DASHED LINE.
4. STANDARD WYE-DELTA STARTER INCLUDES 1K1, 1K2,
   1K3 AND 1K4 SHOWN IN SOLID LINE.

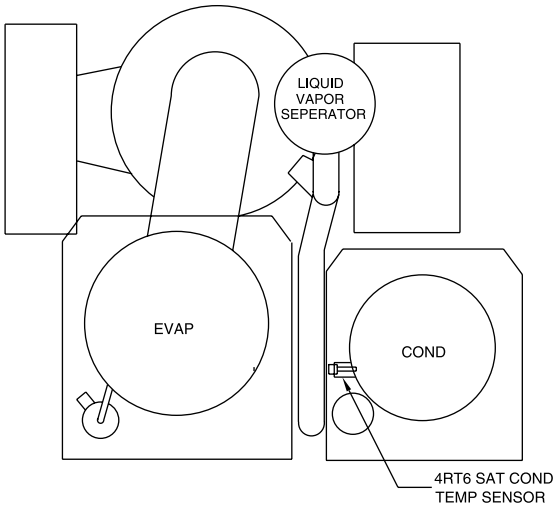


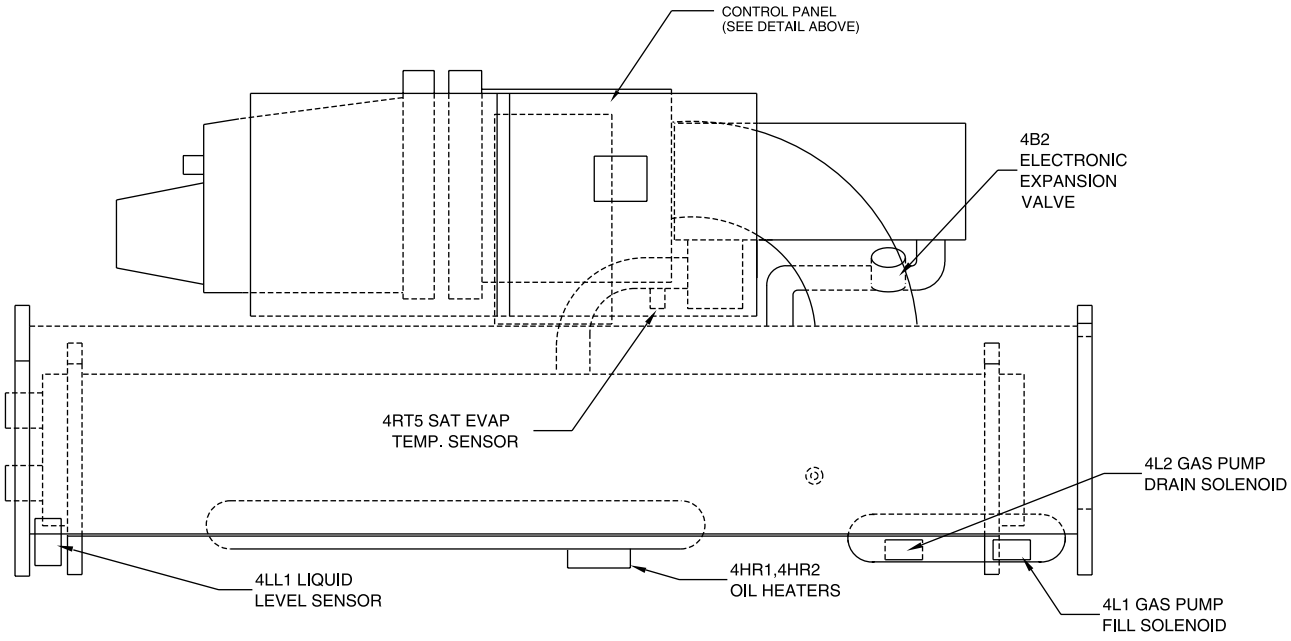
EVAPORATOR AND CONDENSER TEMPERATURE SENSOR & WATER CONNECTIONS LOCATIONS.
NOTE ALL SHELLS SHOWN AS SIDE VIEW.











REPLACES	2D CAD	FILE NUMBER	DRAWING NUMBER 2307-6481	REV H
REVISION DATE 5-4-99	THE TRANE COMPANY A DIVISION OF AMERICAN STANDARD INC.	RTHC COMPONENT LOCATION		
DRAWN BY AM				
DATE 12-23-96	SIMILAR TO	(CONT.)		