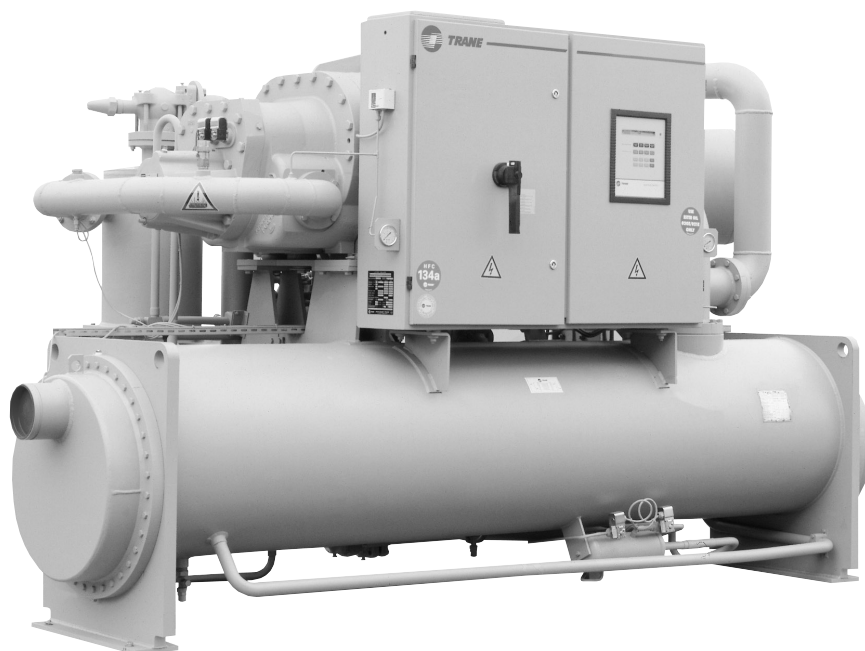




# Installation Operation Maintenance

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## RTHC Helical-Rotary Chillers 550 to 1600 kW



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**B21 IM 002 GB**

# Important Notice

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## Personal Protection



Safety glasses with side shields before entering construction sites or manufacturing areas.



Goggles and gloves when handling chemicals and when welding, cutting, brazing or grinding.



Hard hat wherever there is potential danger from falling or flying objects.



Gloves before touching any part of the machine that is operating or one that has recently been shut down. Assume that metal is hot.



Hearing protection.



Safety shoes.

## Pressure Vessel



Do not attempt to remove fittings and covers or break lines while the machine is under pressure or while it is running. Do not weld or flamecut any vessel or line until all refrigerant has been removed. Do not use oxygen to purge lines, leak test, or pressurize a machine. Do not pressure test any vessel at its design pressure (found on the equipment nameplate). Testing of the pressures must be done in a special enclosure or by using hydraulic; refer to national regulation.

## Refrigerant Emission Control

In respect of the environment, all service operation must use recovery systems to minimize losses of refrigerant to the atmosphere when servicing units with HFC refrigerants. Leak check and inspect all relief devices in accordance with national regulation.

## Handling Refrigerant

Heavy concentration of refrigerant within a confined area can displace enough oxygen to cause suffocation. Do not weld or flamecut in an atmosphere containing refrigerant vapor until the area has been well ventilated. Avoid breathing refrigerant fumes.

## Hazardous Voltage



Disconnect and lockout or tagout all electrical power, including remote disconnects before servicing.

**Société Trane® assumes no liability for installation or service procedures performed by unqualified personnel.**

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# General Information

## Literature Change History

B21 IM 002E (February 2000)  
describes installation, operation, and  
maintenance of RTHC units, design  
sequence B.

## 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.

## 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 72 hours after  
receipt and confirmed by  
registered delivery to the carrier  
and the Trane office.
- 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 carrier's representative.

## Loose Parts Inventory

Check all items against the shipping  
list. Water flow switch (optional),  
water vessel drain plugs, isolation  
pads, rigging and electrical  
diagrams, and service literature are  
shipped 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  
(refrigerant R134a or nitrogen), 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 if the unit  
is factory charged with refrigerant  
R134a.

Figure 1 - Typical Unit Nameplate

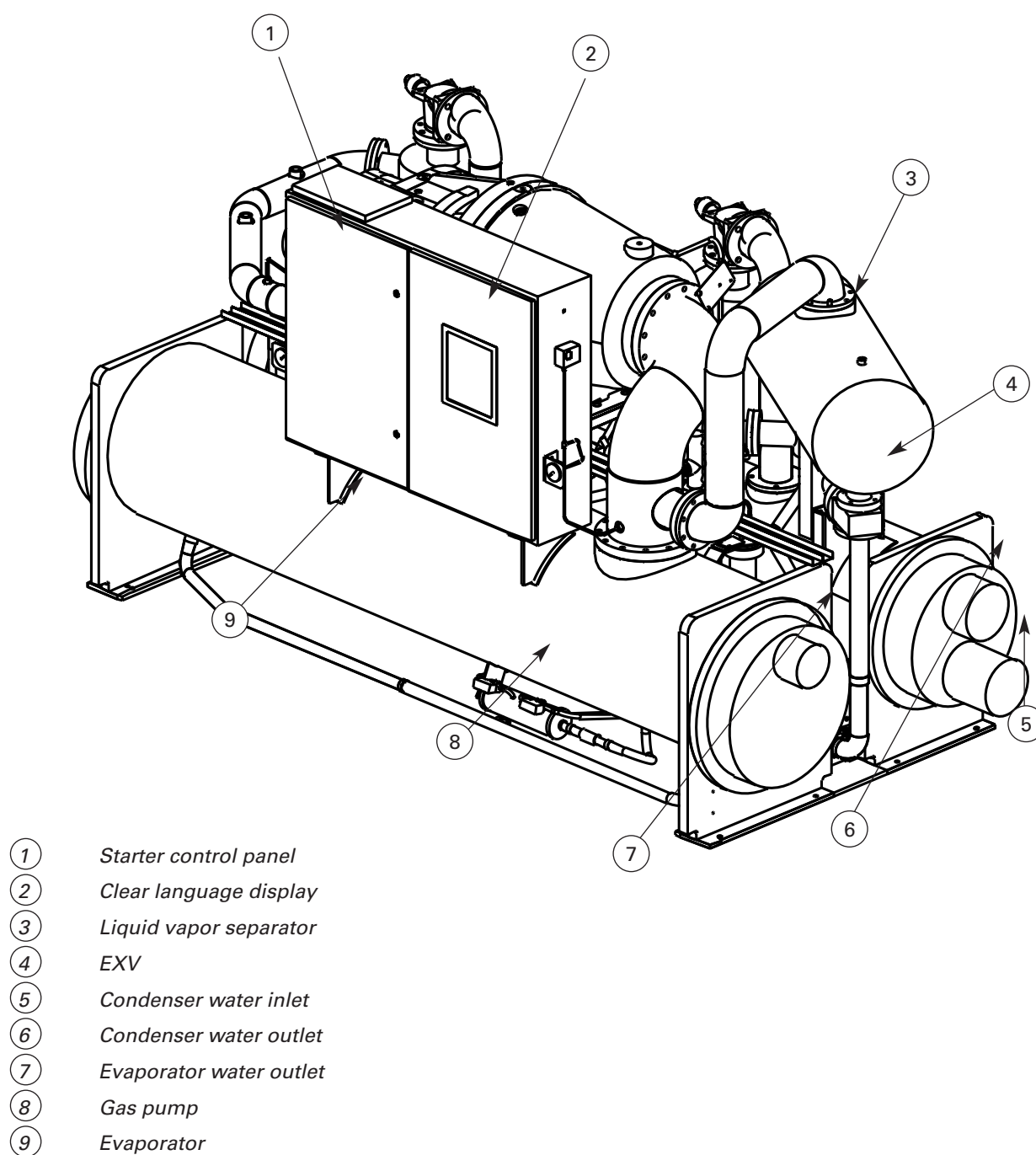
| N° DE MODELE - MODEL NUMBER                         |                  |                                |             |                         |   |
|-----------------------------------------------------|------------------|--------------------------------|-------------|-------------------------|---|
|                                                     |                  |                                |             |                         |   |
| N° SERIE - SERIAL NUMBER                            |                  | MOIS - MONTH /<br>ANNEE - YEAR |             |                         |   |
|                                                     | QTE-QTY          | V / Hz / Ph                    | A max / FLA | kW max                  |   |
| COMPRESSEUR C1 - C3                                 |                  |                                |             |                         |   |
| COMPRESSOR C2 - C4                                  |                  |                                |             |                         |   |
| VENTILATEUR - FANS                                  |                  |                                |             |                         |   |
|                                                     |                  |                                |             |                         |   |
| POMPE A HUILE - OIL PUMP                            |                  |                                |             |                         |   |
| AUXILIAIRES - AUXILIARY                             |                  |                                |             |                         |   |
| CONTROLE - CONTROL                                  |                  |                                |             | VA                      |   |
| INTENSITE DEMARRAGE - STARTING AMPS                 |                  |                                |             |                         |   |
| INTENSITE NOMINALE<br>RATED LOAD AMP                | C1-C3 /<br>C2-C4 |                                | A           | g for<br>BP/HP<br>LP/HP | b |
| REFRIGERANT                                         |                  | QTE - QTY C1-C3 / C2-C4        |             | kg                      |   |
| HUILE - OIL                                         |                  | QTE - QTY C1-C3 / C2-C4        |             | l                       |   |
| PRESSION MAXI D'UTILISATION<br>MAX WORKING PRESSURE | (bar)            |                                | BP<br>LP    | HP<br>HP                |   |
|                                                     |                  |                                |             |                         |   |



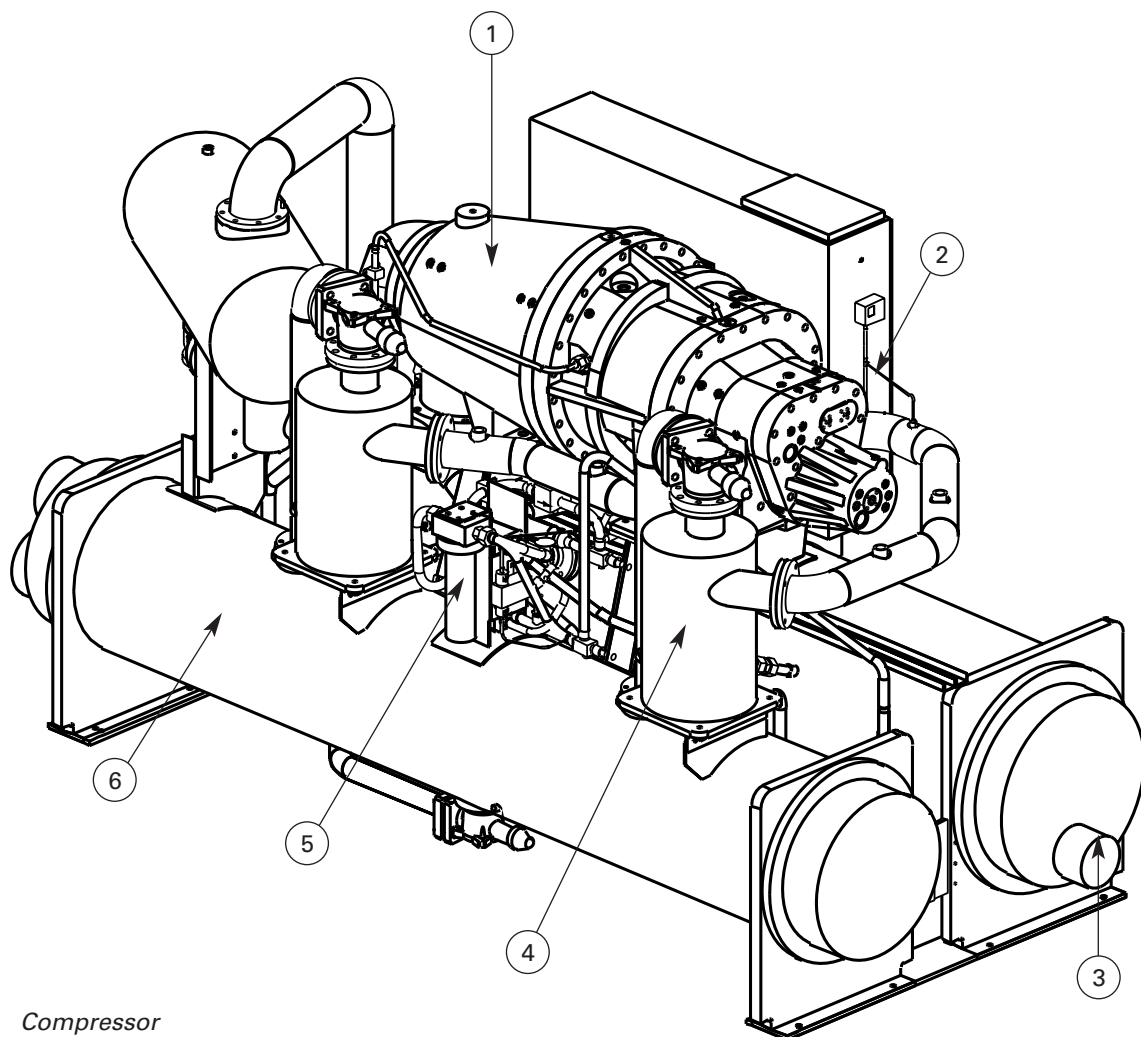
**88190 GOLBEY-FRANCE**  
 AN AMERICAN STANDARD COMPANY



**Figure 2 - Component Location for Typical RTHC Unit**



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



- ① Compressor
- ② Unit nameplate
- ③ Evaporator water inlet
- ④ Oil separator
- ⑤ Oil filter
- ⑥ Condenser



## Model Number Coding System

The model number for the unit is composed of numbers and letters that represent features of the equipment. Shown in the tables following is sample of typical unit model number, followed by the coding system.

## Typical Model Number (located on unit nameplate):

|           |   |   |   |   |   |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |    |   |
|-----------|---|---|---|---|---|---|---|---|---|----|---|---|---|---|----|---|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|----|---|
| Model No. | E | R | T | H | C | D | 1 | X | A | 1  | M | F | X | X | B  | X | X | X | X | C  | X | A | H | X  | B | X | X | 2  | A | X | 3 | E  | X | 2 | B | 1  | X |
| Digit No. | 1 |   |   |   |   | 5 |   |   |   | 10 |   |   |   |   | 15 |   |   |   |   | 20 |   |   |   | 25 |   |   |   | 30 |   |   |   | 35 |   |   |   | 40 |   |

|           |   |   |   |   |   |    |   |   |   |    |   |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |   |    |   |
|-----------|---|---|---|---|---|----|---|---|---|----|---|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|---|----|---|
| Model No. | 5 | E | X | X | X | X  | X | X | 1 | B  | X | 2 | 1 | 1 | X  | X | 4 | 4 | 7  | X | X | X | X  | 1 | X | 2 | X  | X | 2 | X | X  | A | X | X | X | X  | X |
| Digit No. |   |   |   |   |   | 45 |   |   |   | 50 |   |   |   |   | 55 |   |   |   | 60 |   |   |   | 65 |   |   |   | 70 |   |   |   | 75 |   |   |   |   | 80 |   |

| Selection Category       | Description of Selection      | Model No. | Digit |
|--------------------------|-------------------------------|-----------|-------|
| Design control           | LCBU (Charmes, France)        | E         | 1     |
| Chiller model            | Helical-Rotary liquid chiller | RTHC      | 2-5   |
| Compressor frame         | B frame                       | B         | 6     |
|                          | C frame                       | C         |       |
|                          | D frame                       | D         |       |
|                          | E frame                       | E         |       |
| Compressor capacity      | Standard capacity             | 1         | 7     |
|                          | Medium capacity               | 2         |       |
|                          | Larger capacity               | 3         |       |
| Design sequence          | Second design                 | B         | 9     |
| Refrigerant              | HFC - R134a                   | 1         | 10    |
| Pressure vessel approval | Sweden                        | B         | 11    |
|                          | Spain                         | E         |       |
|                          | Finland                       | F         |       |
|                          | Netherlands                   | H         |       |
|                          | Italy                         | I         |       |
|                          | Austria                       | K         |       |
|                          | China                         | L         |       |
|                          | France                        | M         |       |
|                          | Denmark                       | N         |       |
|                          | Germany                       | T         |       |
|                          | Poland                        | V         |       |
|                          | Switzerland                   | Z         |       |
|                          | Special                       | S         |       |
| Language                 | French                        | F         | 12    |
|                          | Italian                       | I         |       |
|                          | German                        | D         |       |
|                          | Dutch                         | H         |       |
|                          | English                       | E         |       |
|                          | Spanish                       | C         |       |
|                          | Chinese                       | G         |       |
| Voltage                  | 380/50/3 ±5%                  | C         | 23    |
|                          | 415/50/3 ±5%                  | E         |       |
|                          | 400/50/3 ±5%                  | D         |       |
|                          | Special                       | S         |       |
| Electrical code          | EN 60204 (IEC)                | A         | 25    |
|                          | Special                       | S         |       |
| Starter                  | Unit mounted star-delta       | H         | 26    |
|                          | Special                       | S         |       |
| Panel connection         | Terminal block                | X         | 28    |
|                          | Circuit breaker               | A         |       |
|                          | Fused disconnect switch       | B         |       |
|                          | Non fused disconnect switch   | C         |       |
|                          | Special                       | S         |       |

| Selection Category                  | Description of Selection | Model No. | Digit |
|-------------------------------------|--------------------------|-----------|-------|
| Evaporator size                     | 1A31-32                  |           |       |
|                                     |                          | 1B        |       |
|                                     |                          | 1C        |       |
|                                     |                          | 2A        |       |
|                                     |                          | 2B        |       |
|                                     |                          | 3A        |       |
|                                     |                          | 3B        |       |
|                                     |                          | 3C        |       |
|                                     |                          | 3D        |       |
|                                     |                          | 4A        |       |
|                                     |                          | 4B        |       |
|                                     |                          | 5A        |       |
|                                     |                          | 5B        |       |
|                                     |                          | 6A        |       |
|                                     |                          | 6C        |       |
|                                     |                          | 7A        |       |
|                                     |                          | 7B        |       |
|                                     |                          | 8A        |       |
|                                     |                          | 8B        |       |
| Evaporator water pass configuration | 2 pass right hand        | B         | 35    |
|                                     | 2 pass left hand         | C         |       |
|                                     | 3 pass right hand        | D         |       |
|                                     | 3 pass left hand         | E         |       |
|                                     | 4 pass right hand        | F         |       |
|                                     | 4 pass left hand         | G         |       |
|                                     | 5 pass right hand        | H         |       |
|                                     | 5 pass left hand         | J         |       |
|                                     | Special                  | S         |       |
| Condenser size                      |                          | 1A        | 37-38 |
|                                     |                          | 1B        |       |
|                                     |                          | 1C        |       |
|                                     |                          | 1D        |       |
|                                     |                          | 2A        |       |
|                                     |                          | 2B        |       |
|                                     |                          | 2C        |       |
|                                     |                          | 2D        |       |
|                                     |                          | 2E        |       |
|                                     |                          | 2 F       |       |
|                                     |                          | 3B        |       |
|                                     |                          | 3C        |       |
|                                     |                          | 4A        |       |
|                                     |                          | 4B        |       |
|                                     |                          | 5B        |       |
|                                     |                          | 5C        |       |
|                                     |                          | 6A        |       |
|                                     |                          | 6B        |       |
| Oil cooler                          | Without                  | X         | 39    |
|                                     | With                     | 1         |       |
| Condenser tubes                     | Gewa C                   | 5         | 41    |
|                                     | Gewa K                   | 2         |       |
|                                     | Gewa CLF                 | 4         |       |
|                                     | Special                  | S         |       |
| Condenser water pass configuration  | 2 pass right hand        | B         | 42    |
|                                     | 2 pass left hand         | C         |       |
|                                     | 3 pass right hand        | D         |       |
|                                     | 3 pass left hand         | E         |       |
|                                     | Special                  | S         |       |

| Selection Category    | Description of Selection                | Model No. | Digit |
|-----------------------|-----------------------------------------|-----------|-------|
| Waterside pressure    | Evp 10.5 bar / Cds 10.5 bar             | 1         | 49    |
|                       | Evp 21 bar / Cds 21 bar                 | 2         |       |
|                       | Evp 10.5 bar / Cds 21 bar               | 3         |       |
|                       | Evp 21 bar / Cds 10.5 bar               | 4         |       |
| Water connections     | Victaulic                               | B         | 50    |
|                       | Victaulic + coupling                    | G         |       |
|                       | Special                                 | S         |       |
| Communication card    | Without                                 | X         | 52    |
|                       | Tracer summit                           | 2         |       |
| UCP2 option           | Without                                 | X         | 53    |
|                       | Option module                           | 1         |       |
|                       | Outside air temperature                 | 2         |       |
|                       | Option module + outside air temperature | 3         |       |
| Printing interface    | Without                                 | X         | 54    |
|                       | With                                    | 1         |       |
| Additional protection | Without                                 | X         | 58    |
|                       | Under over voltage                      | 1         |       |
|                       | IP20 protection                         | 4         |       |
|                       | Under over voltage + IP20 protection    | 5         |       |
| Thermal insulation    | Without                                 | X         | 60    |
|                       | With                                    | 4         |       |
| Unit option           | Without                                 | X         | 61    |
|                       | Isolating valves                        | 1         |       |
|                       | Manometers                              | 7         |       |
|                       | Isolating valves + manometers           | 8         |       |
| Option RLK            | Without                                 | X         | 64    |
|                       | RLK STEK                                | 1         |       |
| Flow switch           | Without                                 | X         | 68    |
|                       | Flow switch Evp                         | 1         |       |
|                       | Flow switch Evp + Cds                   | 2         |       |
| Refrigerant charge    | Without refrigerant and oil (nitrogen)  | X         | 71    |
|                       | Holding charged R134a in the unit + oil | 1         |       |
|                       | Full charged R134a in the unit + oil    | 2         |       |
| Factory test          |                                         | A         | 74    |
|                       |                                         | B         |       |
|                       | Refer to Marketing Guide                | C         |       |
|                       |                                         | E         |       |
|                       | Special                                 | S         |       |
| Specials              | None                                    | X         | 75    |
|                       | Specials denoted elsewhere              | S         |       |



## Installation Overview

For convenience, Table 1 summarizes responsibilities that are typically associated with the RTHC chiller installation process.

**Table 1**

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

| Installation Responsibility |                                     |                                            |                                                                                                                                                                         |
|-----------------------------|-------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Requirement                 | Trane® supplied<br>Trane® installed | Trane® supplied<br>Field installed         | Field supplied<br>Field installed                                                                                                                                       |
| Rigging                     |                                     |                                            | - Safety chains<br>- Lifting beam                                                                                                                                       |
| Isolation                   |                                     | - Isolation pads                           |                                                                                                                                                                         |
| Electrical                  | - Circuit breakers                  |                                            | - Circuit breakers or fusible disconnect<br>- Customer's starter panel<br>- BAS wiring<br>- Control voltage wiring<br>- Water pump contactor                            |
|                             |                                     | - Flow switches<br>(may be field supplied) | - Thermometers<br>- Water flow pressure gauges<br>- Isolation and balancing valves water piping<br>- Vents and drain valves<br>- Pressures relief valves for water side |
| Water piping                |                                     | - Flow switches<br>(may be field supplied) |                                                                                                                                                                         |
| Pressure relief             | - Relief valves                     |                                            | - Vent line                                                                                                                                                             |
| Insulation                  | - Insulation (optional)             | - Insulation                               |                                                                                                                                                                         |

- Locate and maintain the loose parts, e.g. isolators, bulb wells, 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 5 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 1m 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

- 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 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.
- 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.
- 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 2 - GENERAL DATA**

|          |                              | A EFFICIENCY |       | B EFFICIENCY |       | C EFFICIENCY |       | D EFFICIENCY |       |
|----------|------------------------------|--------------|-------|--------------|-------|--------------|-------|--------------|-------|
|          |                              | Evap.        | Cond. | Evap.        | Cond. | Evap.        | Cond. | Evap.        | Cond. |
| Comp. B1 | Heat exchanger type          |              |       | 1A           | 1A    | 1B           | 1C    |              |       |
|          | Refrigerant charge (kg)      |              |       | 153          |       | 153          |       |              |       |
|          | Oil charge (l)               |              |       | 27           |       | 27           |       |              |       |
|          | Operating weight (kg)        |              |       | 4260         |       | 4340         |       |              |       |
|          | Shipping weight (kg)         |              |       | 4290         |       | 4340         |       |              |       |
|          | Length (mm)                  |              |       | 3300         |       | 3300         |       |              |       |
|          | Width (mm)                   |              |       | 1400         |       | 1400         |       |              |       |
|          | Height (mm)                  |              |       | 1900         |       | 1900         |       |              |       |
|          | Sound pressure level (dB(A)) |              |       | 85           |       | 85           |       |              |       |
| Comp. B2 | Heat exchanger type          |              |       | 1B           | 1B    | 1C           | 1D    |              |       |
|          | Refrigerant charge (kg)      |              |       | 153          |       | 153          |       |              |       |
|          | Oil charge (l)               |              |       | 27           |       | 27           |       |              |       |
|          | Operating weight (kg)        |              |       | 4315         |       | 4425         |       |              |       |
|          | Shipping weight (kg)         |              |       | 4325         |       | 4400         |       |              |       |
|          | Length (mm)                  |              |       | 3300         |       | 3300         |       |              |       |
|          | Width (mm)                   |              |       | 1400         |       | 1400         |       |              |       |
|          | Height (mm)                  |              |       | 1900         |       | 1900         |       |              |       |
|          | Sound pressure level (dB(A)) |              |       | 85           |       | 85           |       |              |       |
| Comp. C1 | Heat exchanger type          | 3A           | 2A    | 3C           | 2B    |              |       |              |       |
|          | Refrigerant charge (kg)      | 219          |       | 219          |       |              |       |              |       |
|          | Oil charge (l)               | 33           |       | 33           |       |              |       |              |       |
|          | Operating weight (kg)        | 6135         |       | 6310         |       |              |       |              |       |
|          | Shipping weight (kg)         | 6050         |       | 6170         |       |              |       |              |       |
|          | Length (mm)                  | 3300         |       | 3300         |       |              |       |              |       |
|          | Width (mm)                   | 1575         |       | 1575         |       |              |       |              |       |
|          | Height (mm)                  | 1980         |       | 1980         |       |              |       |              |       |
|          | Sound pressure level (dB(A)) | 80           |       | 80           |       |              |       |              |       |
| Comp. C2 | Heat exchanger type          | 2A           | 2A    | 3B           | 2B    | 3D           | 2E    |              |       |
|          | Refrigerant charge (kg)      | 199          |       | 219          |       | 219          |       |              |       |
|          | Oil charge (l)               | 31           |       | 33           |       | 33           |       |              |       |
|          | Operating weight (kg)        | 6045         |       | 6255         |       | 6510         |       |              |       |
|          | Shipping weight (kg)         | 5965         |       | 6135         |       | 6315         |       |              |       |
|          | Length (mm)                  | 3075         |       | 3300         |       | 3300         |       |              |       |
|          | Width (mm)                   | 1575         |       | 1575         |       | 1575         |       |              |       |
|          | Height (mm)                  | 1980         |       | 1980         |       | 1980         |       |              |       |
|          | Sound pressure level (dB(A)) | 80           |       | 80           |       | 80           |       |              |       |
| Comp. D1 | Heat exchanger type          | 2A           | 2B    | 4A           | 2D    | 5A           | 3B    | 7A           | 5B    |
|          | Refrigerant charge (kg)      | 215          |       | 240          |       | 260          |       | 260          |       |
|          | Oil charge (l)               | 25           |       | 30           |       | 35           |       | 35           |       |
|          | Operating weight (kg)        | 6710         |       | 7220         |       | 7735         |       | 9420         |       |
|          | Shipping weight (kg)         | 6610         |       | 7050         |       | 4785         |       | 8600         |       |
|          | Length (mm)                  | 3093         |       | 3496         |       | 3810         |       | 3540         |       |
|          | Width (mm)                   | 1575         |       | 1575         |       | 1575         |       | 1855         |       |
|          | Height (mm)                  | 2000         |       | 2000         |       | 2000         |       | 2150         |       |
|          | Sound pressure level (dB(A)) | 74           |       | 74           |       | 74           |       | 74           |       |
| Comp. D2 | Heat exchanger type          | 2B           | 2C    | 4B           | 2F    | 5B           | 3C    | 7B           | 5C    |
|          | Refrigerant charge (kg)      | 215          |       | 240          |       | 260          |       | 260          |       |
|          | Oil charge (l)               | 25           |       | 30           |       | 35           |       | 35           |       |
|          | Operating weight (kg)        | 6825         |       | 7330         |       | 7865         |       | 9597         |       |
|          | Shipping weight (kg)         | 6690         |       | 7130         |       | 7575         |       | 8715         |       |
|          | Length (mm)                  | 3093         |       | 3496         |       | 3810         |       | 3540         |       |
|          | Width (mm)                   | 1575         |       | 1575         |       | 1575         |       | 1855         |       |
|          | Height (mm)                  | 2000         |       | 2000         |       | 2000         |       | 2150         |       |
|          | Sound pressure level (dB(A)) | 74           |       | 74           |       | 74           |       | 74           |       |
| Comp. D3 | Heat exchanger type          | 2B           | 2C    | 4B           | 2F    | 5B           | 3C    | 7B           | 5C    |
|          | Refrigerant charge (kg)      | 215          |       | 240          |       | 260          |       | 260          |       |
|          | Oil charge (l)               | 25           |       | 30           |       | 35           |       | 35           |       |
|          | Operating weight (kg)        | 6825         |       | 7330         |       | 7865         |       | 9597         |       |
|          | Shipping weight (kg)         | 6690         |       | 7130         |       | 7575         |       | 8715         |       |
|          | Length (mm)                  | 3093         |       | 3496         |       | 3810         |       | 3540         |       |
|          | Width (mm)                   | 1575         |       | 1575         |       | 1575         |       | 1855         |       |
|          | Height (mm)                  | 2000         |       | 2000         |       | 2000         |       | 2150         |       |
|          | Sound pressure level (dB(A)) | 74           |       | 74           |       | 74           |       | 74           |       |
| Comp. E3 | Heat exchanger type          | 6C           | 4B    | 6A           | 4A    | 8B           | 6B    | 8A           | 6A    |
|          | Refrigerant charge (kg)      | 345          |       | 345          |       | 577          |       | 577          |       |
|          | Oil charge (l)               | 43           |       | 43           |       | 61           |       | 61           |       |
|          | Operating weight (kg)        | 8070         |       | 8560         |       | 10230        |       | 12390        |       |
|          | Shipping weight (kg)         | 7580         |       | 7950         |       | 9500         |       | 11080        |       |
|          | Length (mm)                  | 3410         |       | 3410         |       | 4015         |       | 4015         |       |
|          | Width (mm)                   | 1805         |       | 1805         |       | 2040         |       | 2040         |       |
|          | Height (mm)                  | 2145         |       | 2145         |       | 2235         |       | 2235         |       |
|          | Sound pressure level (dB(A)) | 78           |       | 78           |       | 78           |       | 78           |       |

Note : Sound pressure level measured in accordance with ISO 3746.

# Installation - Mechanical

## 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 unit.
- Store the chiller in a dry, vibration-free, secure area.
- At least every three months, check the pressure in the refrigerant circuit. If the condensing pressure is below 4 bar at 20°C, call a qualified service organization and the appropriate Trane® sales office.

## Location Requirements

### Noise Considerations

- Refer to "Engineering Bulletin" for noise 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 2 for unit operating weights. Once in place, level the chiller within 5 mm over its length and width. Société Trane® 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.

**Note :** Required vertical clearance above the unit is 1 meter. 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.

**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 50°C.

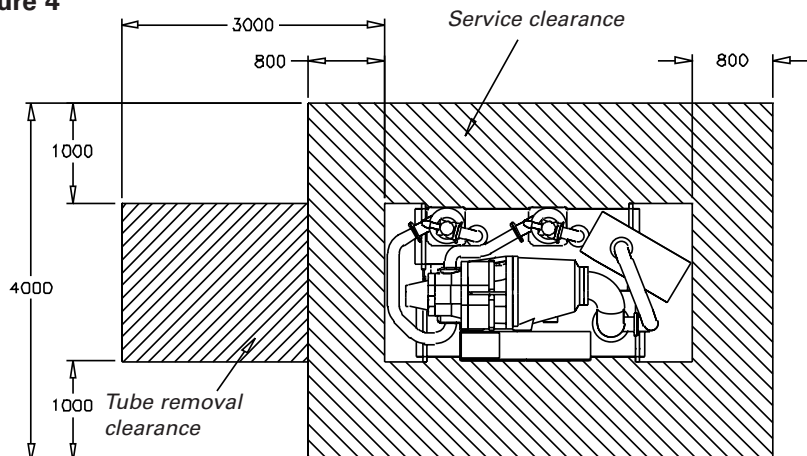
Vent the evaporator, condenser and compressor pressure relief valves in accordance with all national regulations. Refer to "Pressure Relief Valves."

Make provisions in the equipment room to keep the chiller from being exposed to freezing temperatures 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

**Figure 4**



provided with drain connections. Refer to "Water Piping." All national regulations apply.

## Access Restrictions

Door clearances for the RTHC units are given in Figure 10. Refer to the unit submittals for specific "per unit" dimensional information.

## Lifting Procedure

**⚠ Never use a forklift to move the unit. The skid (optional) is not designed to support the unit at any one point and using a forklift to move the equipment may cause unit 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 or as shown in Figure 5. Remove the base mounts.

**⚠ 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 the lifting holes provided on the unit. Attach lifting chains or cables to clevis connectors as shown in Figure 5. Each cable alone must be strong enough to lift the chiller.

**⚠ Always position the lifting beam so that cables do not contact the unit. Failure to do so may result in unit damage.**

- 4 - Attach cables to lifting beam. Total lifting weight, lifting weight distribution and required lifting cable dimensions are shown in the rigging diagram shipped with each unit and in Table 3. The lifting beam crossbar must be positioned so the lifting cables do not contact unit piping or electrical panel enclosure.

**⚠ Connect an untensioned safety chain 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.**

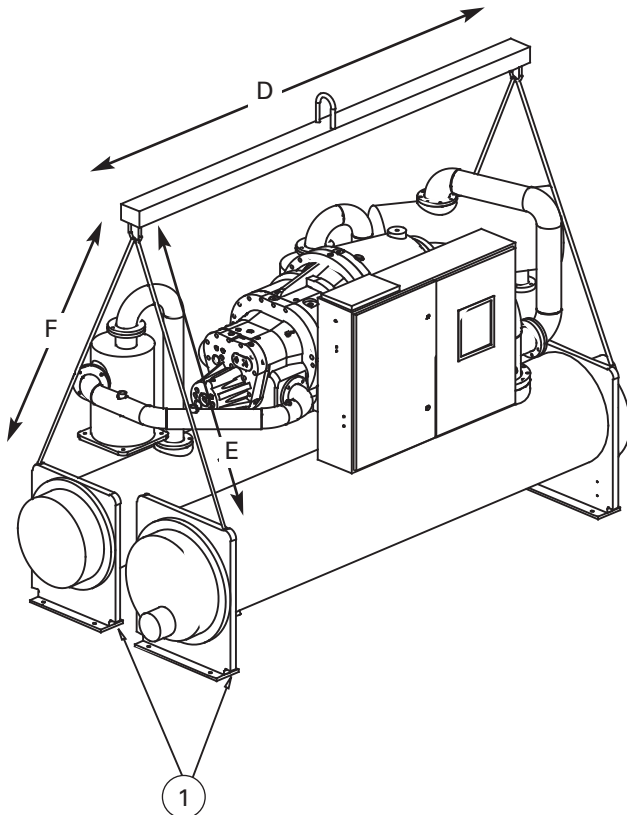
*(Alternate Moving Method)*

- 5 - 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 5 and by the rigging diagram that ships with the unit.
- 6 - During final positioning of the unit, place the isolation pads under the evaporator and condenser tube sheet supports as shown in Figure 6. Level the unit as described in the next main paragraph.

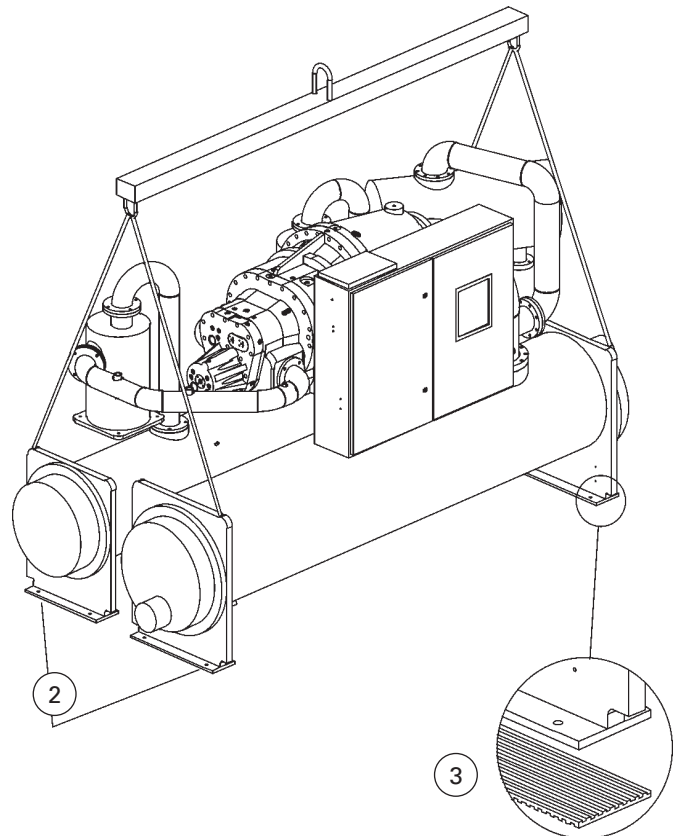
## Isolation Pads

The elastomeric pads shipped (as standard) are adequate for most installations. For additional details on isolation practices, consult an acoustical engineer for sensitive installations.

**Figure 5 - Lifting the unit**



**Figure 6 - Isolation pad placement**



- ① Jacking points
- ② Pad extends the full width of legs
- ③ Typical elastomeric isolation pad

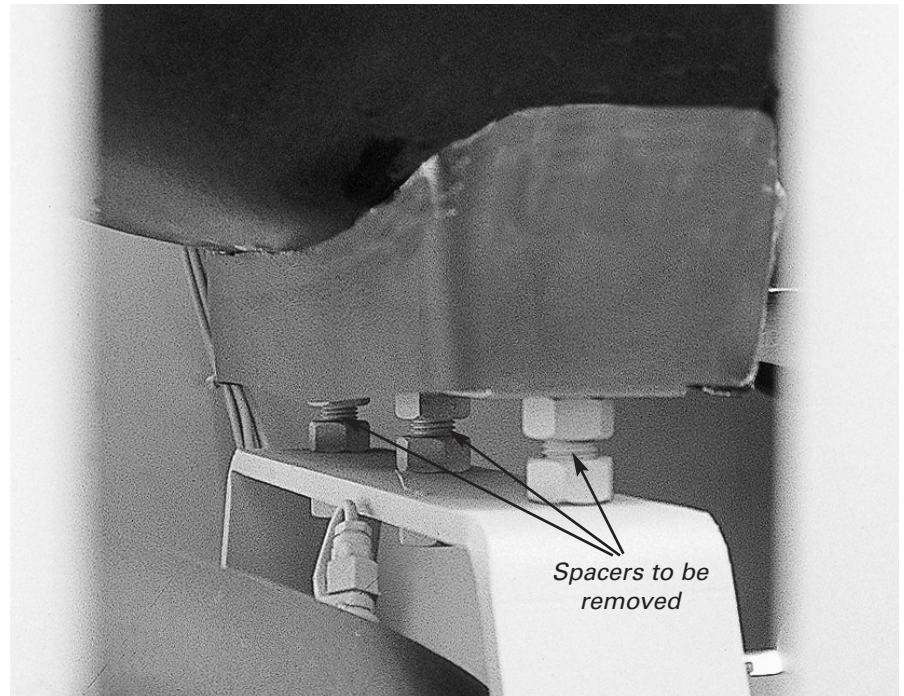
**TABLE 3 - UNIT WEIGHTS AND CABLES DIMENSIONS FOR LIFTING**

| RTHC Unit | Maxi Weight (Kg) | D (mm) | E (mm) | F (mm) |
|-----------|------------------|--------|--------|--------|
| B1 1A 1A  | 4300             | 4000   | 2150   | 2000   |
| B1 1B 1C  | 4350             | 4000   | 2150   | 2000   |
| B2 1B 1B  | 4350             | 4000   | 2150   | 2000   |
| B2 1C 1D  | 4450             | 4000   | 2150   | 2000   |
| C1 3A 2A  | 6100             | 4000   | 2150   | 2000   |
| C1 3C 2B  | 6200             | 4000   | 2150   | 2000   |
| C2 2A 2A  | 6000             | 4000   | 2090   | 2000   |
| C2 3B 2B  | 6200             | 4000   | 2150   | 2000   |
| C2 3D 2E  | 6400             | 4000   | 2150   | 2000   |
| D1 2A 2B  | 6700             | 4000   | 2090   | 2000   |
| D1 4A 2D  | 7100             | 4000   | 2090   | 2000   |
| D1 5A 3B  | 7550             | 3000   | 2075   | 2000   |
| D1 7A 5B  | 8650             | 4000   | 2250   | 2000   |
| D2 2B 2C  | 6750             | 4000   | 2090   | 2000   |
| D2 4B 2F  | 7200             | 4000   | 2090   | 2000   |

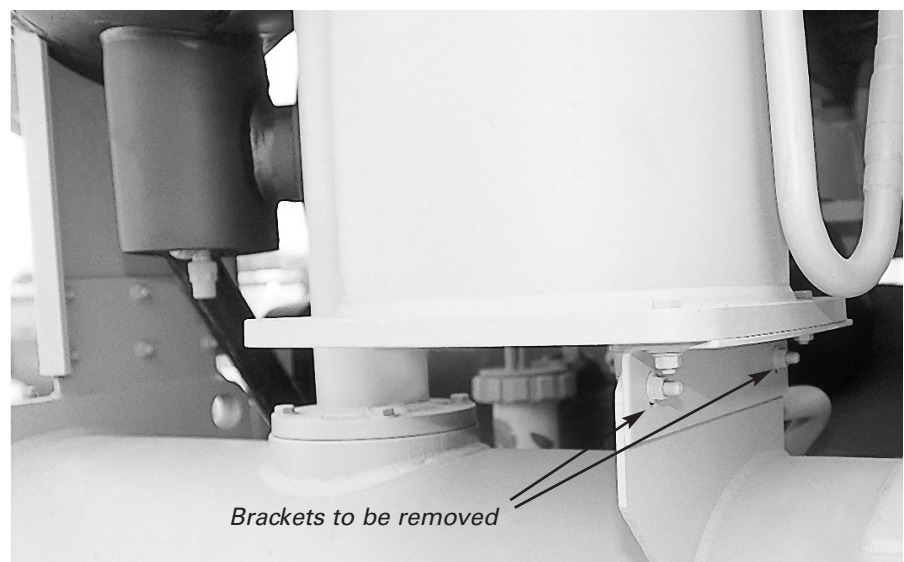
| RTHC Unit | Maxi Weight (Kg) | D (mm) | E (mm) | F (mm) |
|-----------|------------------|--------|--------|--------|
| D2 5B 3C  | 7650             | 3000   | 2075   | 2000   |
| D2 7B 5C  | 8800             | 4000   | 2250   | 2000   |
| D3 2B 2C  | 6750             | 4000   | 2090   | 2000   |
| D3 4B 2F  | 7200             | 4000   | 2090   | 2000   |
| D3 5B 3C  | 7650             | 3000   | 2075   | 2000   |
| D3 7B 5C  | 8800             | 4000   | 2250   | 2000   |
| E3 6C 4B  | 7650             | 4000   | 2150   | 2000   |
| E3 6A 4A  | 8000             | 4000   | 2150   | 2000   |
| E3 8B 6B  | 9550             | 4000   | 2480   | 2300   |
| E3 8A 6A  | 11150            | 4000   | 2480   | 2300   |



**Figure 7 - Shipping spacer removal**



**Figure 8 - Oil separator shipping brackets**



## 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 5 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 5 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

**⚠ 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.

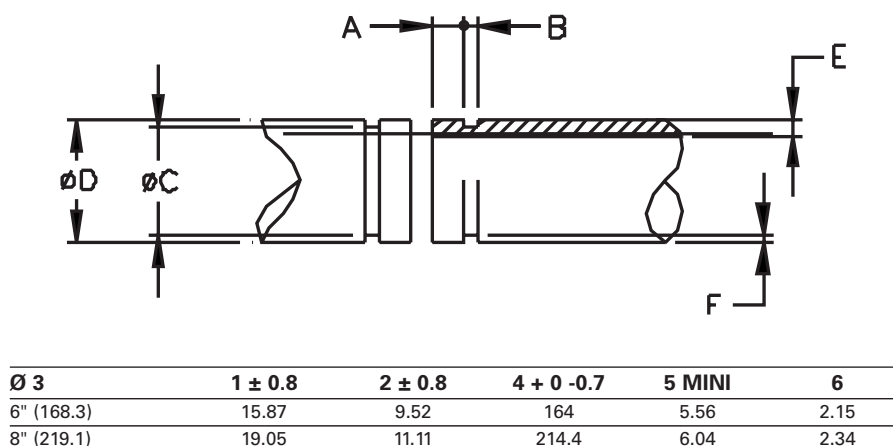
Use grooved pipe connectors for all water piping connections (refer to Figure 9). Evaporator and condenser water inlet and outlet sizes and locations are shown by the unit submittals and in Figure 10. The designation in the tables corresponds to the compressor frame code followed by the evaporator shell code followed by the condenser shell code.

### Reversing Water Boxes

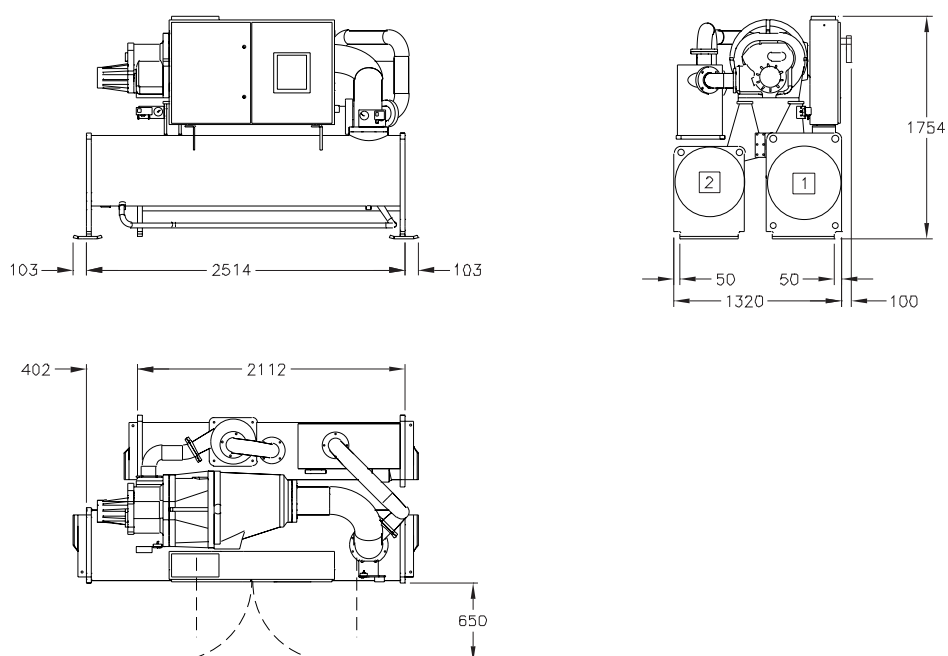
All water boxes may be reversed end-for-end. Do not rotate water boxes. Remove the sensors from the wells before removing the water box. Complete the water box switch procedure and replace the sensors. If the water boxes are reversed, be sure to properly rewire the sensors in the control panel.

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

**Figure 9 - Dimension of tube stub for grooved connection**



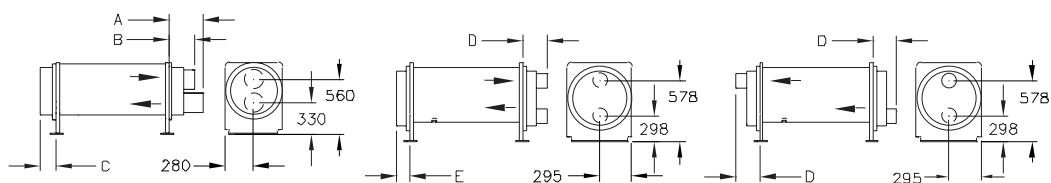
## Condenser and Evaporator Water Connections - B1 1A 1A / B1 1B 1C / B2 1B 1B / B2 1C 1D



Condenser 2 passes

Evaporator 2 or 4 passes

Evaporator 3 passes



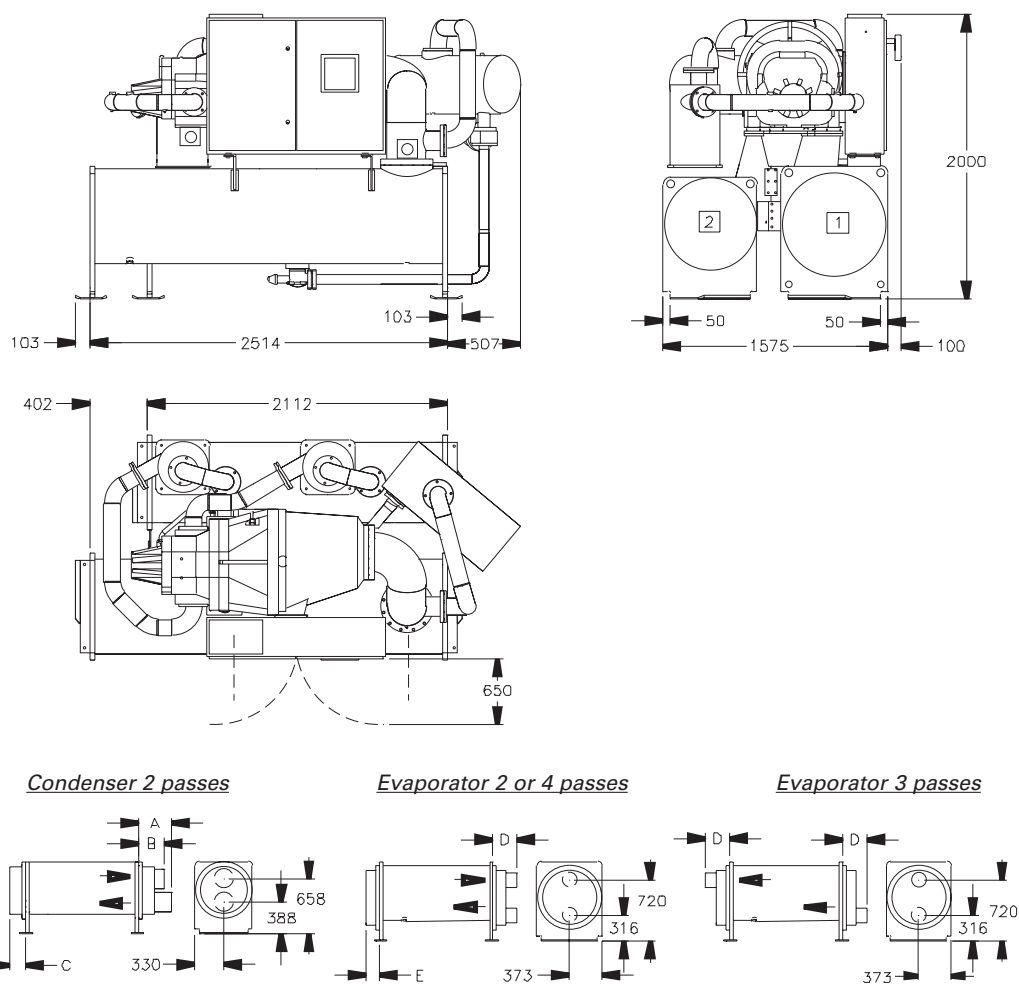
*Note : Connection configuration is available left or right hand.*

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 373 | 273 | 138 | 273 | 138 |
| 21 bar         | 373 | 275 | 153 | 273 | 153 |

1 Evaporator

2 Condenser

## Condenser and Evaporator Water Connections - C1 3A 2A / C1 3C 2B / C2 3B 2B / C2 3D 2E

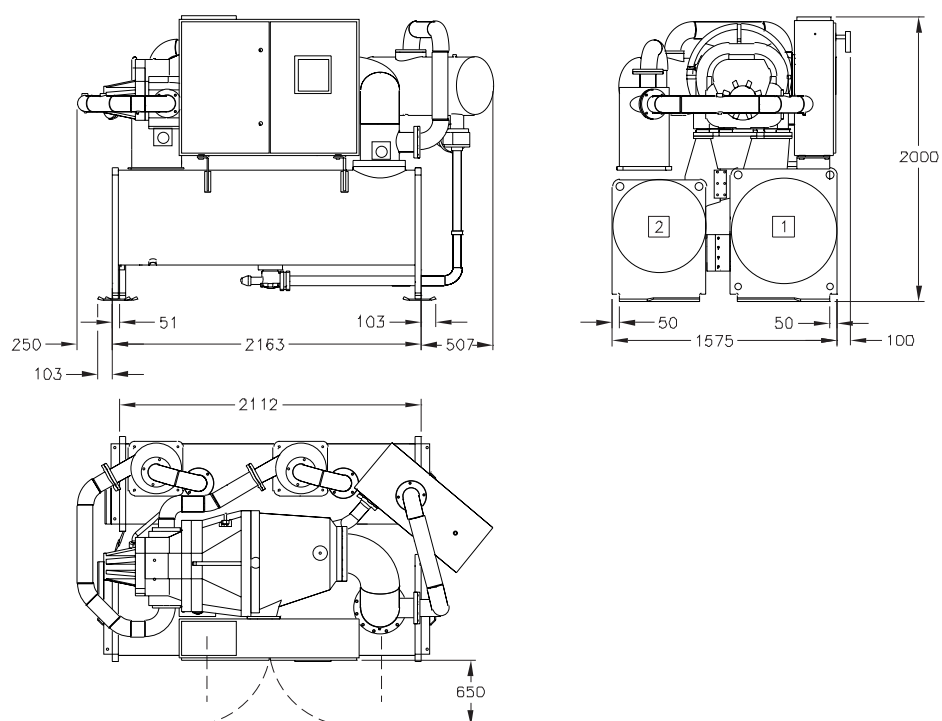


Note : Connection configuration is available left or right hand.

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 400 | 300 | 180 | 273 | 153 |
| 21 bar         | 415 | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

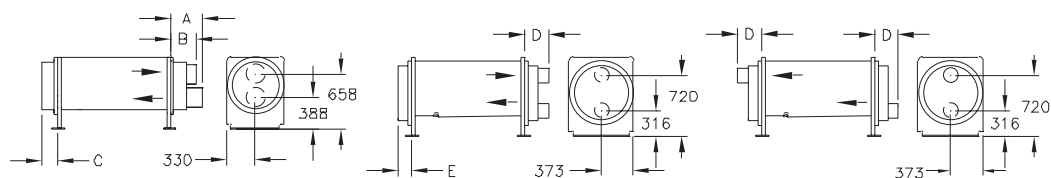
## Condenser and Evaporator Water Connections - C2 2A 2A



*Condenser 2 passes*

*Evaporator 2 or 4 passes*

*Evaporator 3 passes*

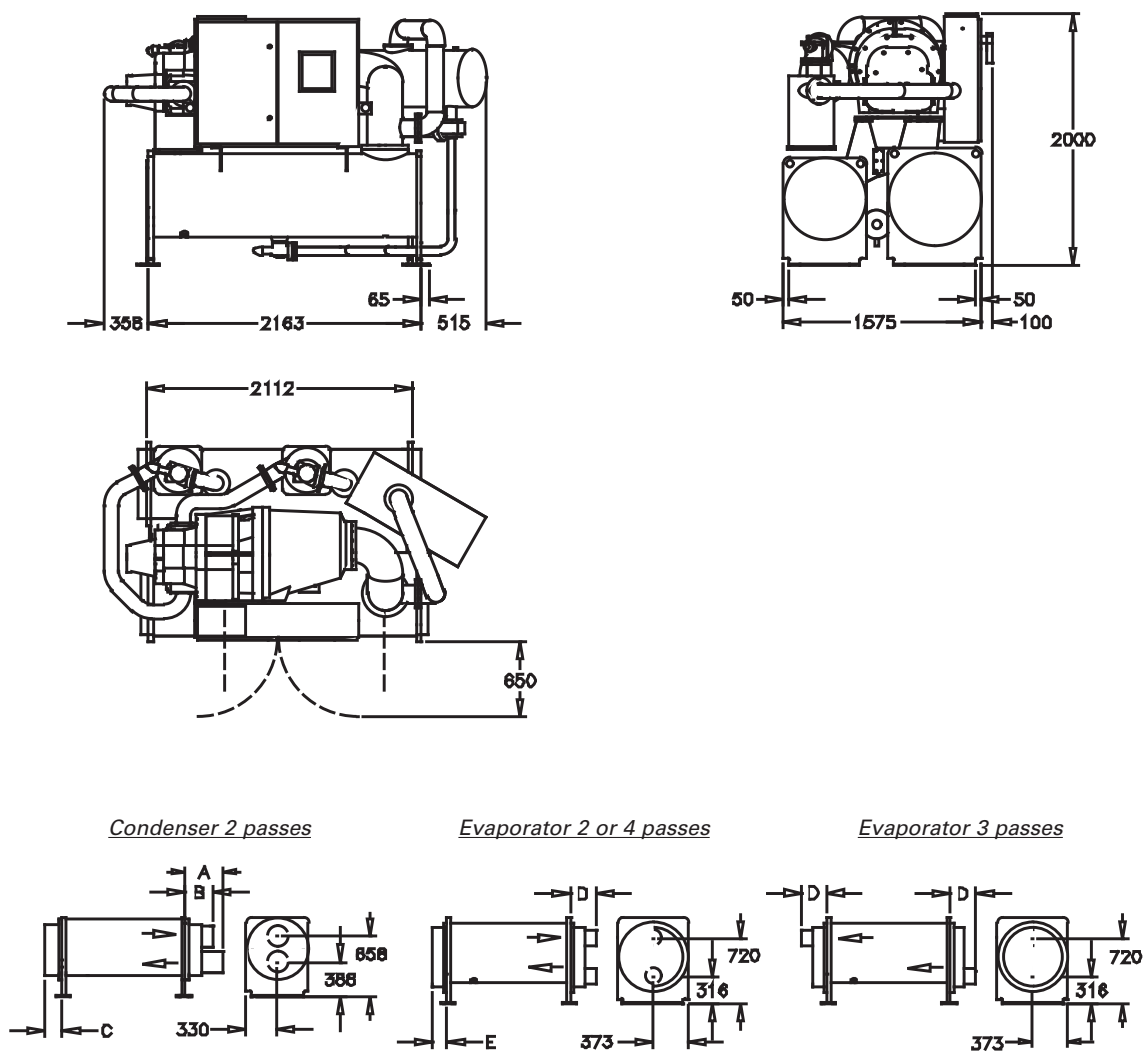


*Note : Connection configuration is available left or right hand.*

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 400 | 300 | 180 | 273 | 153 |
| 21 bar         | 415 | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

**Figure 10 - Condenser and Evaporator Water Connections - D1 2A 2B / D2 2B 2C / D3 2B 2C**

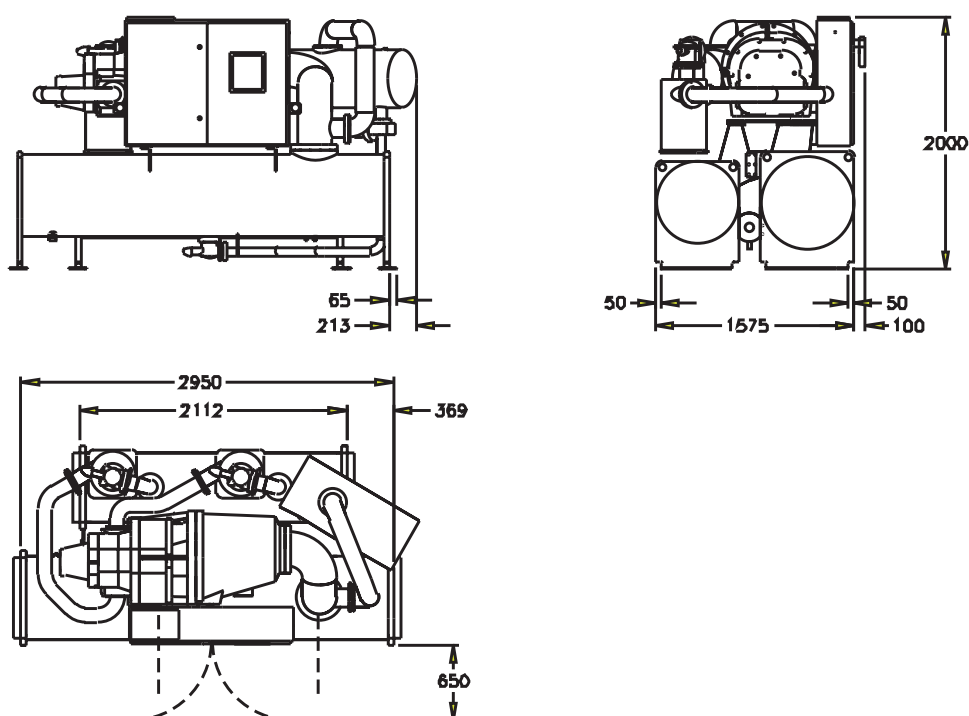


*Note : Connection configuration is available left or right hand.*

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 400 | 300 | 180 | 273 | 153 |
| 21 bar         | 415 | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

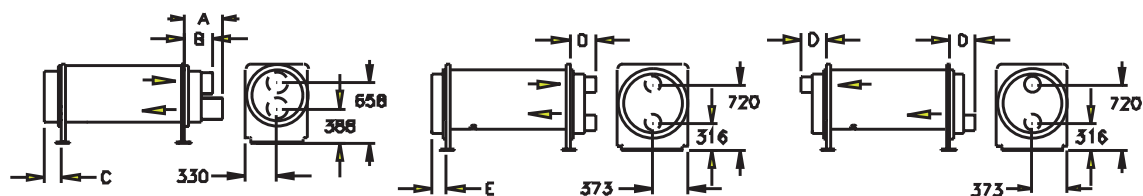
## Condenser and Evaporator Water Connections - D1 4A 2D / D2 4B 2F / D3 4B 2F



*Condenser 2 passes*

*Evaporator 2 or 4 passes*

*Evaporator 3 passes*



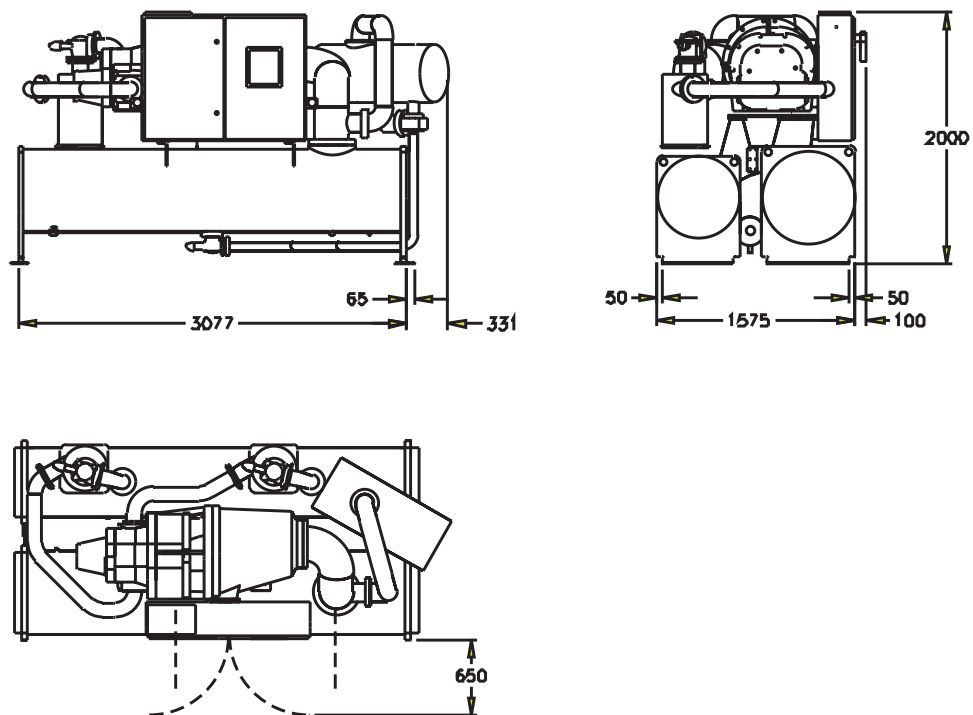
Note : Connection configuration is available left or right hand.

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 400 | 300 | 180 | 273 | 153 |
| 21 bar         | 415 | 315 | 195 | 293 | 173 |

1 Evaporator

2 Condenser

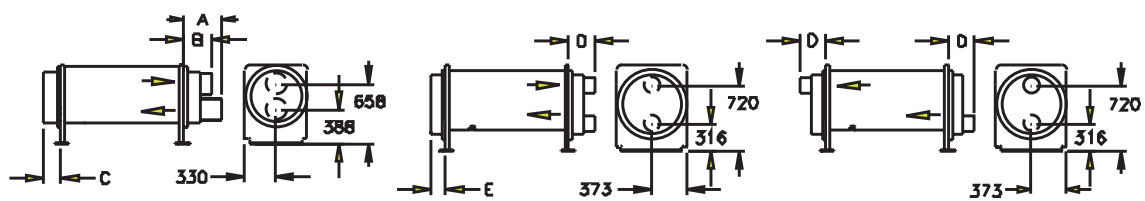
## Condenser and Evaporator Water Connections - D1 5A 3B / D2 5B 3C / D3 5B 3C



*Condenser 2 passes*

*Evaporator 2 or 4 passes*

*Evaporator 3 passes*



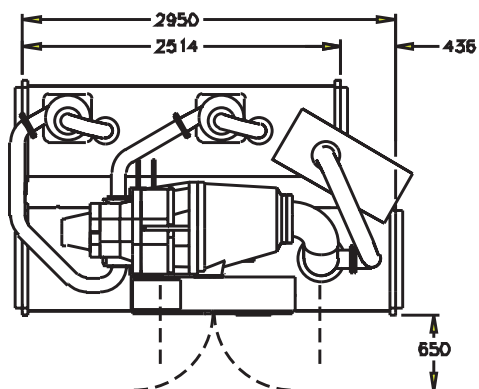
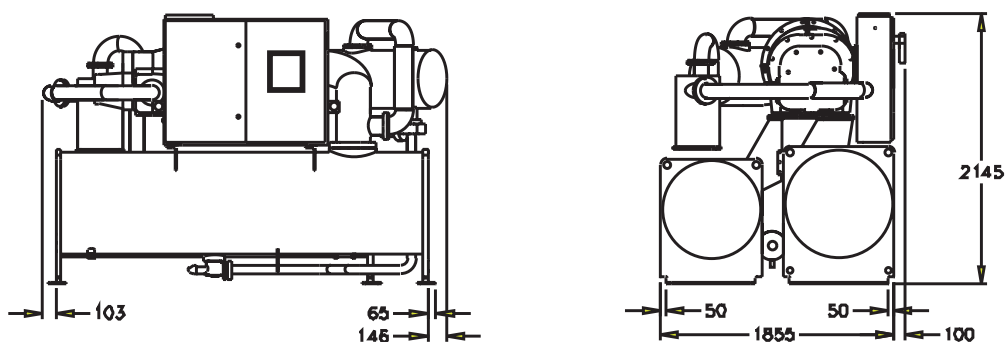
Note : Connection configuration is available left or right hand.

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 400 | 300 | 180 | 273 | 153 |
| 21 bar         | 415 | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser



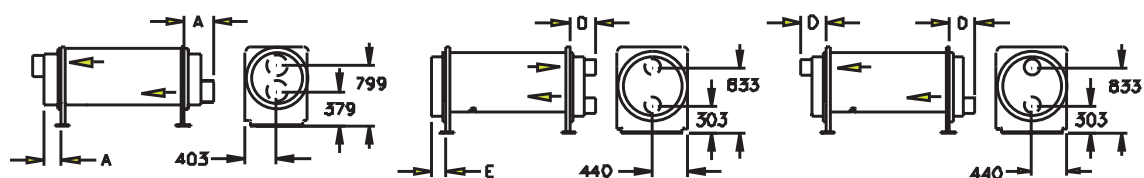
## Condenser and Evaporator Water Connections - D1 7A 5B / D2 7B 5C / D3 7B 5C



*Condenser 2 passes*

*Evaporator 2 or 4 passes*

*Evaporator 3 passes*

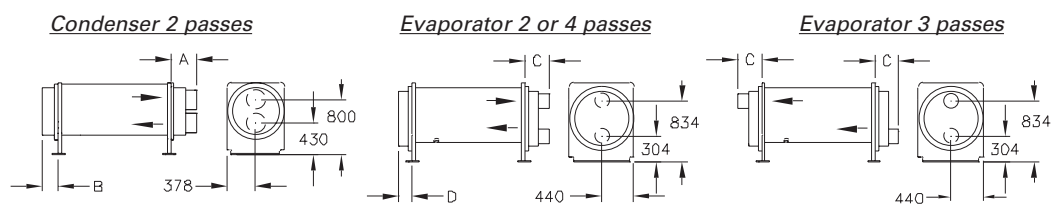
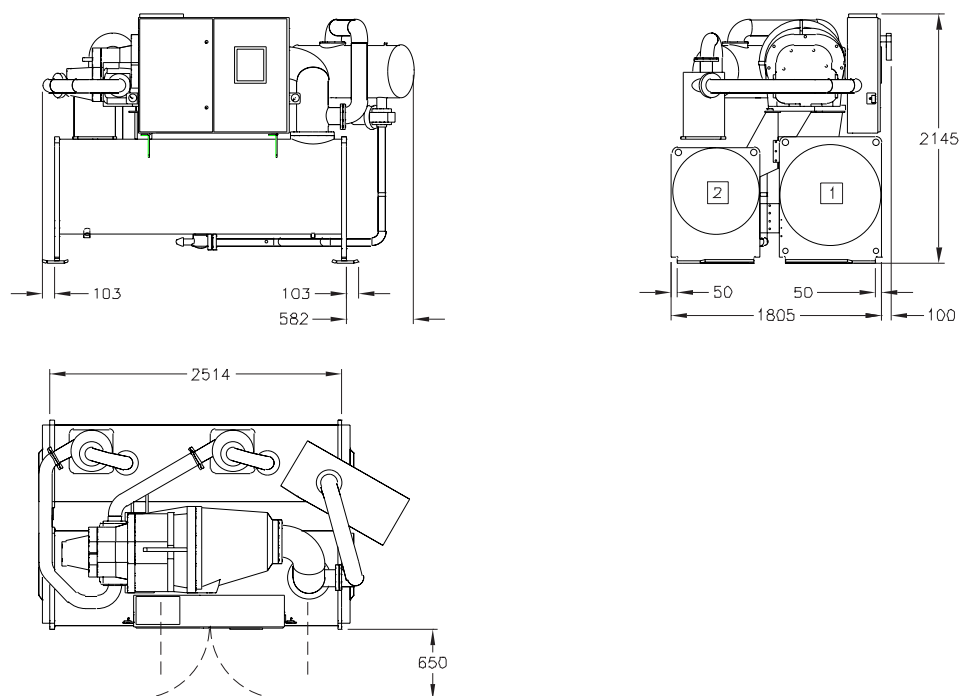


*Note : Connection configuration is available left or right hand.*

| WATER BOX TYPE | A   | B   | C   | D   | E   |
|----------------|-----|-----|-----|-----|-----|
| 10.5 bar       | 400 | 300 | 180 | 273 | 153 |
| 21 bar         | 415 | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

## Condenser and Evaporator Water Connections - E3 6A 4A

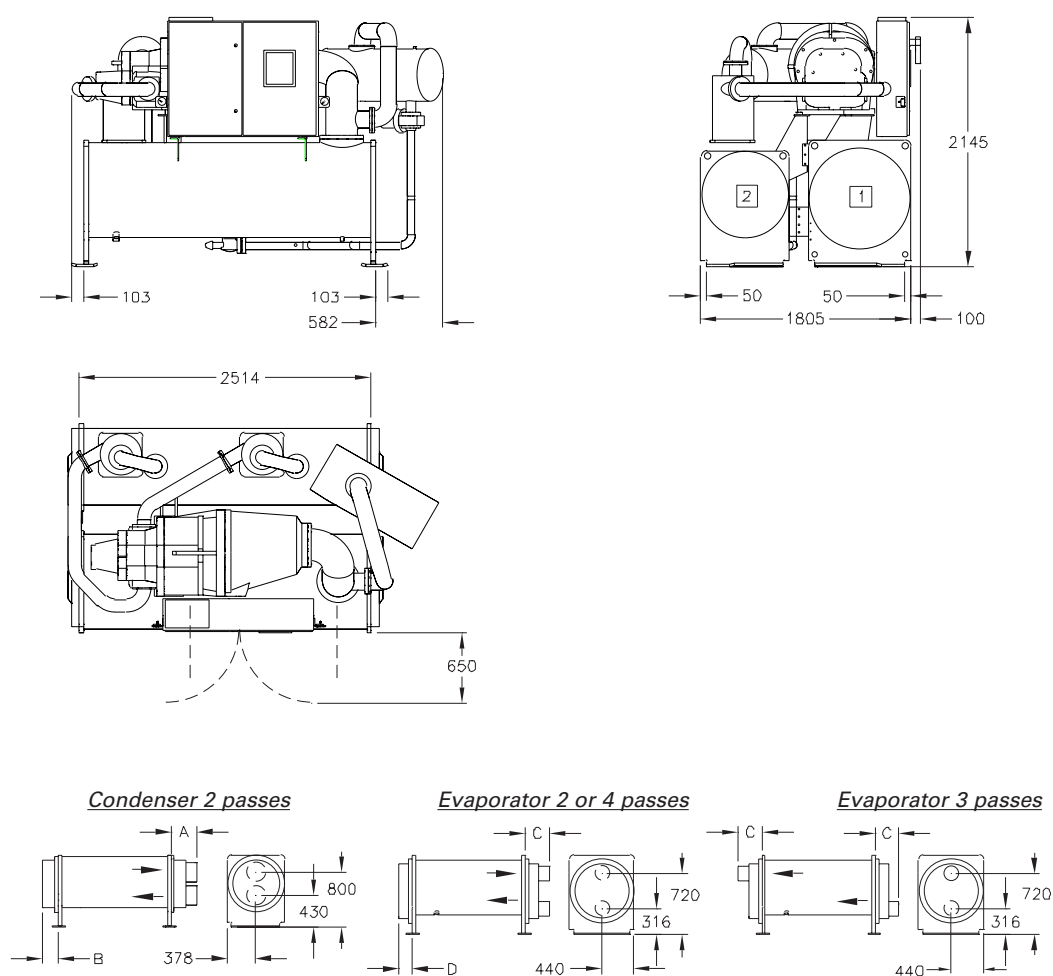


Note : Connection configuration is available left or right hand.

| WATER BOX TYPE | A   | B   | C   | D   |
|----------------|-----|-----|-----|-----|
| 10.5 bar       | 305 | 185 | 278 | 158 |
| 21 bar         | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

## Condenser and Evaporator Water Connections - E3 6C 4B

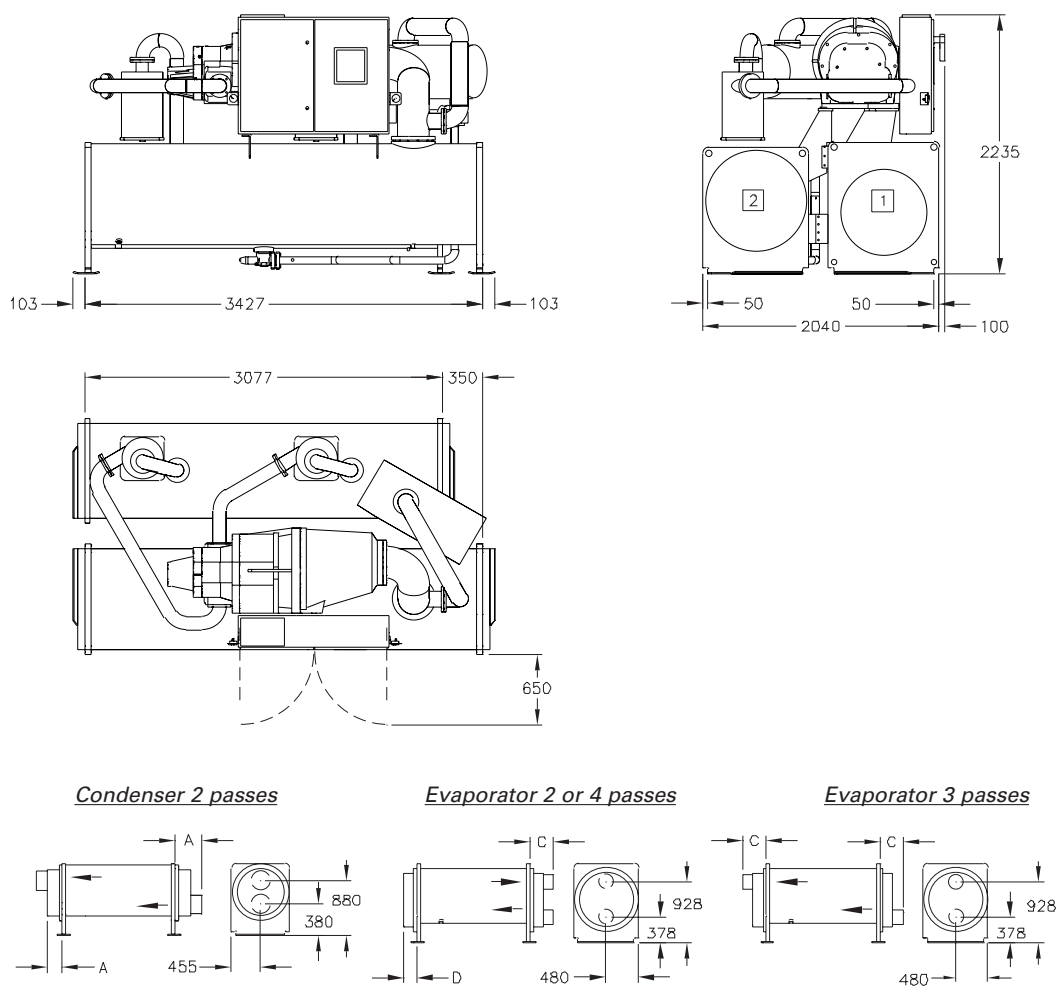


*Note : Connection configuration is available left or right hand.*

| WATER BOX TYPE | A   | B   | C   | D   |
|----------------|-----|-----|-----|-----|
| 10.5 bar       | 305 | 185 | 273 | 153 |
| 21 bar         | 315 | 195 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

## Condenser and Evaporator Water Connections - E3 8A 6A

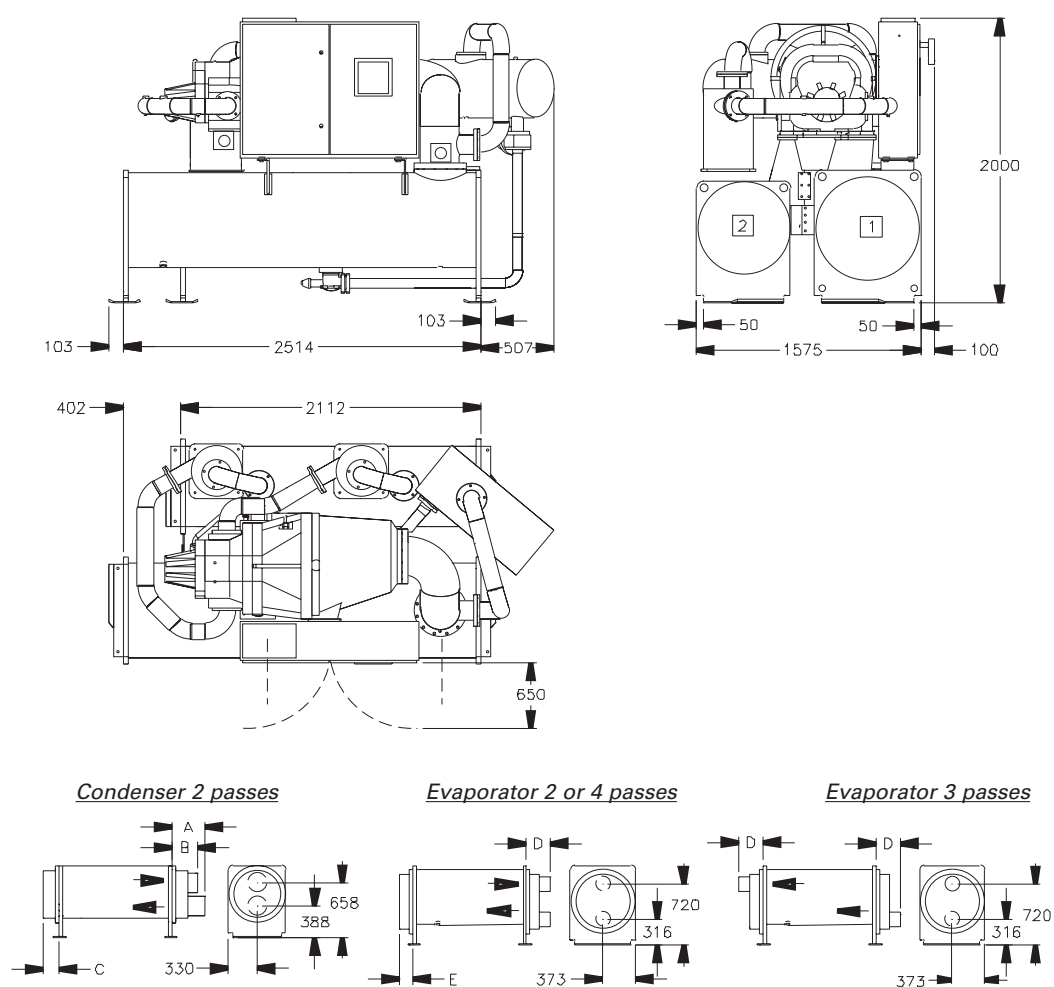


*Note : Connection configuration is available left or right hand.*

| WATER BOX TYPE | A   | C   | D   |
|----------------|-----|-----|-----|
| 10.5 bar       | 315 | 283 | 163 |
| 21 bar         | 325 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

## Condenser and Evaporator Water Connections - E3 8B 6B



Note : Connection configuration is available left or right hand.

| WATER BOX TYPE | A   | B   | C   | D   |
|----------------|-----|-----|-----|-----|
| 10.5 bar       | 315 | 195 | 273 | 153 |
| 21 bar         | 325 | 205 | 293 | 173 |

- 1 Evaporator
- 2 Condenser

**TABLE 4 - EVAPORATOR AND CONDENSER DATA**

|          |                     | A EFFICIENCY |       | B EFFICIENCY |       | C EFFICIENCY |       | D EFFICIENCY |       |
|----------|---------------------|--------------|-------|--------------|-------|--------------|-------|--------------|-------|
|          |                     | Evap.        | Cond. | Evap.        | Cond. | Evap.        | Cond. | Evap.        | Cond. |
| Comp. B1 | Heat exchanger type |              |       | 1A           | 1A    | 1B           | 1C    |              |       |
|          | Dia. shell (mm)     |              |       | 559          | 457   | 559          | 457   |              |       |
|          | Nbr of pass         |              |       | 3            | 2     | 3            | 2     |              |       |
|          | Water storage (l)   |              |       | 123          | 92    | 135          | 103   |              |       |
|          | Mini. flow (l/s)    |              |       | 11           | 12    | 12           | 14    |              |       |
|          | Maxi flow (l/s)     |              |       | 37           | 41    | 43           | 49    |              |       |
| Comp. B2 | Heat exchanger type |              |       | 1B           | 1B    | 1C           | 1D    |              |       |
|          | Dia. shell (mm)     |              |       | 559          | 457   | 559          | 457   |              |       |
|          | Nbr of pass         |              |       | 3            | 2     | 3            | 2     |              |       |
|          | Water storage (l)   |              |       | 135          | 97    | 147          | 116   |              |       |
|          | Mini. flow (l/s)    |              |       | 12           | 13    | 14           | 17    |              |       |
|          | Maxi flow (l/s)     |              |       | 43           | 45    | 48           | 59    |              |       |
| Comp. C1 | Heat exchanger type |              |       | 3A           | 2A    | 3C           | 2B    |              |       |
|          | Dia. shell (mm)     |              |       | 660          | 559   | 660          | 559   |              |       |
|          | Nbr of pass         |              |       | 3            | 2     | 3            | 2     |              |       |
|          | Water storage (l)   |              |       | 175          | 148   | 211          | 166   |              |       |
|          | Mini. flow (l/s)    |              |       | 15           | 15    | 19           | 18    |              |       |
|          | Maxi flow (l/s)     |              |       | 52           | 52    | 68           | 66    |              |       |
| Comp. C2 | Heat exchanger type | 2A           | 2A    | 3B           | 2B    | 3D           | 2E    |              |       |
|          | Dia. shell (mm)     | 660          | 559   | 660          | 559   | 660          | 559   |              |       |
|          | Nbr of pass         | 3            | 2     | 3            | 2     | 3            | 2     |              |       |
|          | Water storage (l)   | 173          | 148   | 193          | 166   | 241          | 196   |              |       |
|          | Mini. flow (l/s)    | 17           | 15    | 17           | 18    | 23           | 24    |              |       |
|          | Maxi flow (l/s)     | 60           | 52    | 60           | 66    | 81           | 88    |              |       |
| Comp. D1 | Heat exchanger type | 2A           | 2B    | 4A           | 2D    | 5A           | 3B    | 7A           | 5B    |
|          | Dia. shell (mm)     | 660          | 559   | 66           | 559   | 660          | 559   | 813          | 711   |
|          | Nbr of pass         | 3            | 2     | 3            | 2     | 3            | 2     | 4            | 3     |
|          | Water storage (l)   | 173          | 166   | 257          | 192   | 266          | 262   | 439          | 390   |
|          | Mini. flow (l/s)    | 17           | 18    | 21           | 23    | 21           | 26    | 27           | 31    |
|          | Maxi flow (l/s)     | 60           | 66    | 75           | 84    | 75           | 93    | 98           | 111   |
| Comp. D2 | Heat exchanger type | 2B           | 2C    | 4B           | 2 F   | 5B           | 3C    | 7B           | 5C    |
| Comp. D3 | Dia. shell (mm)     | 660          | 559   | 660          | 559   | 660          | 559   | 813          | 711   |
|          | Nbr of pass         | 3            | 2     | 3            | 2     | 3            | 2     | 4            | 3     |
|          | Water storage (l)   | 203          | 174   | 274          | 208   | 296          | 272   | 465          | 415   |
|          | Mini. flow (l/s)    | 21           | 20    | 23           | 27    | 24           | 27    | 29           | 34    |
| Comp. E3 | Maxi flow (l/s)     | 75           | 71    | 81           | 96    | 85           | 98    | 105          | 121   |
|          | Heat exchanger type | 6C           | 4B    | 6A           | 4A    | 8B           | 6B    | 8A           | 6A    |
|          | Dia. shell (mm)     | 813          | 660   | 813          | 660   | 864          | 813   | 864          | 813   |
|          | Nbr of pass         | 3            | 2     | 3            | 2     | 3            | 2     | 4            | 3     |
|          | Water storage (l)   | 255          | 235   | 248          | 263   | 258          | 372   | 672          | 630   |
|          | Mini. flow (l/s)    | 23           | 24    | 30           | 29    | 26           | 32    | 37           | 45    |
|          | Maxi flow (l/s)     | 81           | 86    | 109          | 103   | 92           | 115   | 132          | 162   |

**FIGURE 11 - RTHC EVAPORATOR - WATER PRESSURE DROP - (KPA)**

| Evap. | Pass | Water Flow (l/s) |    |    |    |    |    |    |    |    |    |    |     |     |
|-------|------|------------------|----|----|----|----|----|----|----|----|----|----|-----|-----|
|       |      | 15               | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70  | 75  |
| 1A    | 3    | 18               | 32 | 49 | 69 | 91 |    |    |    |    |    |    |     |     |
| 1B    | 3    | 14               | 25 | 38 | 54 | 72 | 92 |    |    |    |    |    |     |     |
| 1C    | 3    | 11               | 20 | 31 | 43 | 58 | 74 | 92 |    |    |    |    |     |     |
| 2A    | 3    |                  | 11 | 17 | 25 | 34 | 43 | 54 | 66 | 79 |    |    |     |     |
| 2B    | 3    |                  |    | 11 | 16 | 22 | 29 | 36 | 44 | 52 | 61 | 71 | 82  |     |
| 3A    | 3    | 10               | 17 | 26 | 37 | 50 | 64 | 80 | 97 |    |    |    |     |     |
| 3B    | 3    |                  | 13 | 20 | 29 | 38 | 49 | 61 | 74 | 89 |    |    |     |     |
| 3C    | 3    |                  | 10 | 16 | 23 | 31 | 39 | 49 | 59 | 71 | 83 | 96 |     |     |
| 3D    | 3    |                  |    | 11 | 16 | 22 | 28 | 35 | 43 | 52 | 61 | 70 | 80  | 91  |
| 4A    | 3    |                  |    | 15 | 21 | 29 | 37 | 46 | 57 | 68 | 79 | 92 | 105 |     |
| 4B    | 3    |                  |    |    | 18 | 25 | 31 | 40 | 49 | 58 | 69 | 80 | 91  | 104 |
| 5A    | 3    |                  |    | 15 | 22 | 30 | 39 | 48 | 59 | 70 | 82 | 95 | 109 |     |
| 5B    | 3    |                  |    |    | 17 | 23 | 30 | 38 | 46 | 55 | 64 | 75 | 86  | 98  |
| 6A    | 3    |                  |    |    | 9  | 12 | 16 | 20 | 24 | 29 | 34 | 40 | 46  | 52  |
| 6C    | 3    |                  |    | 11 | 16 | 22 | 28 | 35 | 42 | 51 | 60 | 69 | 80  | 90  |
| 7A    | 4    |                  |    |    |    |    | 30 | 37 | 46 | 55 | 65 | 75 | 86  | 98  |
| 7B    | 4    |                  |    |    |    | 20 | 26 | 33 | 40 | 48 | 57 | 66 | 76  | 86  |
| 8A    | 4    |                  |    |    |    |    | 19 | 23 | 29 | 35 | 41 | 48 | 55  | 63  |
| 8B    | 3    |                  |    |    | 16 | 22 | 28 | 35 | 43 | 52 | 61 | 70 | 81  | 92  |

**FIGURE 12 - RTHC CONDENSER - WATER PRESSURE DROP - (KPA)**

| Cond. | Pass | Water Flow (l/s) |    |    |    |    |    |    |    |    |    |    |    |    |  |
|-------|------|------------------|----|----|----|----|----|----|----|----|----|----|----|----|--|
|       |      | 15               | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 |  |
| 1A    | 2    | 15               | 25 | 37 | 51 | 66 | 84 |    |    |    |    |    |    |    |  |
| 1B    | 2    | 13               | 21 | 31 | 42 | 55 | 69 | 85 |    |    |    |    |    |    |  |
| 1C    | 2    | 11               | 19 | 27 | 38 | 49 | 62 | 76 |    |    |    |    |    |    |  |
| 1D    | 2    |                  | 13 | 20 | 27 | 35 | 44 | 54 | 65 | 77 |    |    |    |    |  |
| 2A    | 2    | 10               | 17 | 25 | 34 | 45 | 56 | 69 | 83 |    |    |    |    |    |  |
| 2B    | 2    |                  | 11 | 16 | 23 | 30 | 38 | 47 | 57 |    |    |    |    |    |  |
| 2C    | 2    |                  |    | 14 | 20 | 26 | 33 | 41 | 49 | 58 | 68 |    |    |    |  |
| 2D    | 2    |                  |    |    | 15 | 20 | 26 | 32 | 38 | 45 |    |    |    |    |  |
| 2E    | 2    |                  |    | 11 | 15 | 19 | 24 | 30 | 36 | 40 | 49 | 56 | 64 | 73 |  |
| 2F    | 2    |                  |    |    | 13 | 17 | 21 | 26 | 31 | 37 | 43 | 49 | 56 | 63 |  |
| 3B    | 2    |                  |    |    | 18 | 24 | 30 | 37 | 45 | 53 | 62 |    |    |    |  |
| 3C    | 2    |                  |    |    | 17 | 22 | 28 | 34 | 41 | 48 | 56 | 64 | 73 | 82 |  |
| 4A    | 2    |                  |    |    | 14 | 18 | 22 | 27 | 32 | 38 | 44 | 50 | 57 | 64 |  |
| 4B    | 2    |                  |    | 13 | 18 | 24 | 29 | 36 | 43 | 51 | 59 | 67 | 76 | 86 |  |
| 5B    | 2    |                  |    |    |    | 22 | 28 | 34 | 41 | 49 | 57 |    |    |    |  |
| 5C    | 3    |                  |    |    |    | 19 | 24 | 30 | 36 | 42 | 49 | 57 | 65 | 73 |  |
| 6A    | 3    |                  |    |    |    |    |    | 23 | 28 | 32 | 38 | 43 | 49 | 55 |  |
| 6B    | 2    |                  |    |    |    | 18 | 22 | 27 | 32 | 38 | 44 | 51 | 57 | 65 |  |



### 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
- Clean out tees
- Pipe strainer

#### 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
- Clean out tees
- Balancing valve
- Pressure relief valve

**⚠ To prevent evaporator damage, do not exceed 10.5 bar evaporator water pressure for standard water boxes.**

**Maximum pressure for high pressure water boxes is 21 bar. Refer to order write-up.**

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

### 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
- Clean out 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
- Clean out tees
- Balancing valve
- Pressure relief valve

**⚠ To prevent condenser damage, do not exceed 10.5 bar water pressure for standard water boxes. Maximum pressure for high pressure water boxes is 21 bar. Refer to the order write-up.**

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

## Water Regulating Valve

The water regulating valve is used when the condenser water temperature is expected to fall below 15°C. It maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to condenser pressure.

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

## Water Regulating Valve Adjustment

Refer to your specific unit water pressure drop charts.

- At condensing pressures of 550 kpa or lower, adjust valves to ensure minimum flow rate.
- At condensing pressures of 550 kpa, begin increasing flow rate.
- At condensing pressures of 650 kpa, the valve should deliver design flow rate.

**Note :** Condenser pressure can be monitored via the valve on the top of the condenser.

## Water Treatment

**⚠ 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. Société Trane® 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 12. 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.

## Water Pressure Relief Valves

**⚠ 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 regulation 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 12.

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.

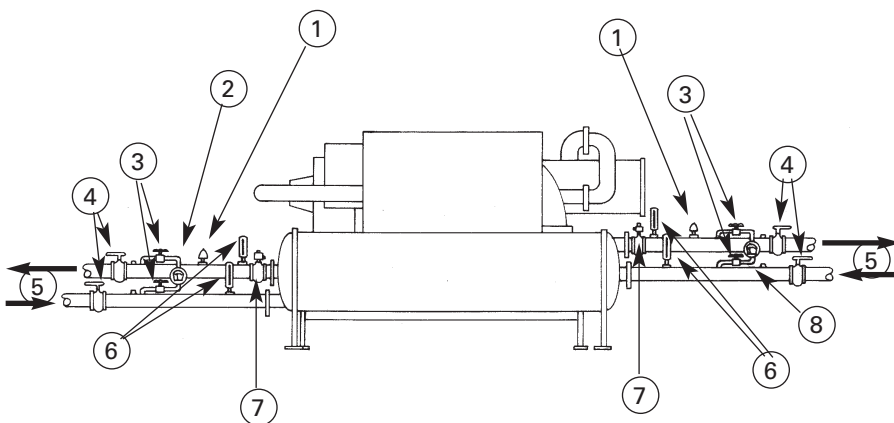
Flow switches must stop or prevent compressor operation if either system water flow drops off drastically. Follow the manufacturer’s recommendations for selection and installation procedures. General guidelines for flow switch installation are outlined below.

- Mount the switch upright, with a minimum of 5 pipe diameters of 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.

**Figure 12 - Typical thermometer, valving and manifold pressure gauge setup**



- |   |                  |
|---|------------------|
| ① | Flow switch      |
| ② | Manifold         |
| ③ | Shutoff valves   |
| ④ | Isolation valves |
| ⑤ | Flow             |
| ⑥ | Thermometers     |
| ⑦ | Relief valve     |
| ⑧ | Manifold         |

**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

To prevent injury due to inhalation of R-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.

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

All RTHC units use evaporator, compressor, and condenser pressure relief valves that must be vented to the outside of the building. Relief valve connection sizes and locations are shown in the unit submittals. Refer to national regulations for relief valve vent line sizing information.

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

**Note :** Once opened, relief valves tend to leak.

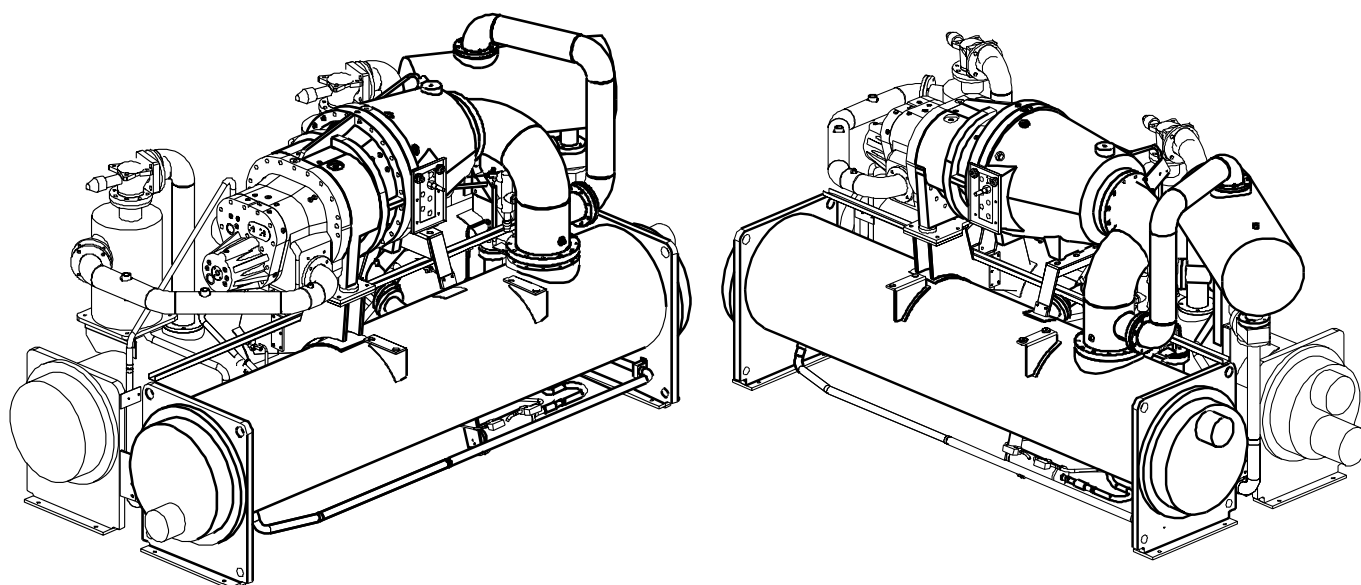
## Thermal Insulation

All RTHC units are available with optional factory-installed thermal insulation. If the unit is not factory-insulated, install insulation over the areas designated in Figure 13.

**Note :** 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.

**Figure 13 - Typical RTHC insulation requirements**



# Installation - Electrical

## General Recommendations

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

**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 national electric regulations. 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.

**TABLE 5 ELECTRICAL DATA**

| Compressor B1-B2                |                 |       |       |       |       |
|---------------------------------|-----------------|-------|-------|-------|-------|
| Nominal voltage                 | V               |       | 380   | 400   | 415   |
| Frequency                       | Hz              |       | 50    | 50    | 50    |
| Voltage utilization range       | V               | mini  | 361   | 361   | 361   |
|                                 |                 | maxi  | 399   | 399   | 399   |
| Max kW                          | kW              |       | 139   | 145   | 148   |
| Rated load amps                 | A               |       | 233   | 233   | 233   |
| Starting amps                   | A               | star  | 391   | 412   | 428   |
|                                 |                 | delta | 1229  | 1296  | 1348  |
| Power factor                    |                 |       | 0.910 | 0.900 | 0.880 |
| Fuse size (1)                   | A               |       | 250   | 250   | 250   |
| Disconnect switch size (1)      | A               |       | 250   | 250   | 250   |
| Minimum connecting wire (1) (2) | mm <sup>2</sup> |       | 95    | 95    | 95    |
| Maximum connecting wire (1) (2) | mm <sup>2</sup> |       | 240   | 240   | 240   |
| Compressor C1-C2                |                 |       |       |       |       |
| Nominal voltage                 | V               |       | 380   | 400   | 415   |
| Frequency                       | Hz              |       | 50    | 50    | 50    |
| Voltage utilization range       | V               | mini  | 361   | 361   | 361   |
|                                 |                 | maxi  | 399   | 399   | 399   |
| Max kW                          | kW              |       | 201   | 209   | 213   |
| Rated load amps                 | A               |       | 349   | 349   | 349   |
| Starting amps                   | A               | star  | 456   | 480   | 498   |
|                                 |                 | delta | 1414  | 1488  | 1544  |
| Power factor                    |                 |       | 0.875 | 0.865 | 0.850 |
| Fuse size (1)                   | A               |       | 400   | 400   | 400   |
| Disconnect switch size (1)      | A               |       | 400   | 400   | 400   |
| Minimum connecting wire (1) (2) | mm <sup>2</sup> |       | 185   | 185   | 185   |
| Maximum connecting wire (1) (2) | mm <sup>2</sup> |       | 240   | 240   | 240   |
| Compressor D1-D2-D3-E3          |                 |       |       |       |       |
| Nominal voltage                 | V               |       | 380   | 400   | 415   |
| Frequency                       | Hz              |       | 50    | 50    | 50    |
| Voltage utilization range       | V               | mini  | 361   | 361   | 361   |
|                                 |                 | maxi  | 399   | 399   | 399   |
| Max kW                          | kW              |       | 271   | 280   | 284   |
| Rated load amps                 | A               |       | 455   | 455   | 455   |
| Starting amps                   | A               | star  | 711   | 748   | 776   |
|                                 |                 | delta | 2303  | 2424  | 2515  |
| Power factor                    |                 |       | 0.905 | 0.890 | 0.870 |
| Fuse size (1)                   | A               |       | 500   | 500   | 500   |
| Disconnect switch size (1)      | A               |       | 630   | 630   | 630   |
| Minimum connecting wire (1) (2) | mm <sup>2</sup> |       | 2*150 | 2*150 | 2*150 |
| Maximum connecting wire (1) (2) | mm <sup>2</sup> |       | 2*300 | 2*300 | 2*300 |

**Use copper conductors only! 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 European standard EN 60204; therefore, all power supply wiring must be sized and selected accordingly by the project engineer.

## 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: Run the line voltage wiring in conduit to the access opening(s) on the starter/control panel. See B21 SD 001 for wire sizing and selection information and refer to Table 5 and Figure 15 that show typical electrical connection sizes and locations. Always refer to submittal information for your actual unit specifications.

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

## Compressor Motor Phase Sequencing

Always verify that proper rotation of the RTHC 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 the incoming power supply phased A, B, C (L1, L2, L3).

**To confirm the correct phase sequence (ABC), use a phase meter.**

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."

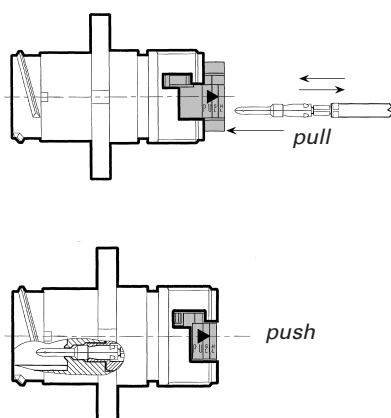
This direction may be reversed outside the alternator by interchanging any two of the line wires. It is this possible interchange of wiring that makes a phase sequence indicator necessary if the operator is to quickly determine the phase rotation of the motor.

## Module and Control Panel Connectors

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

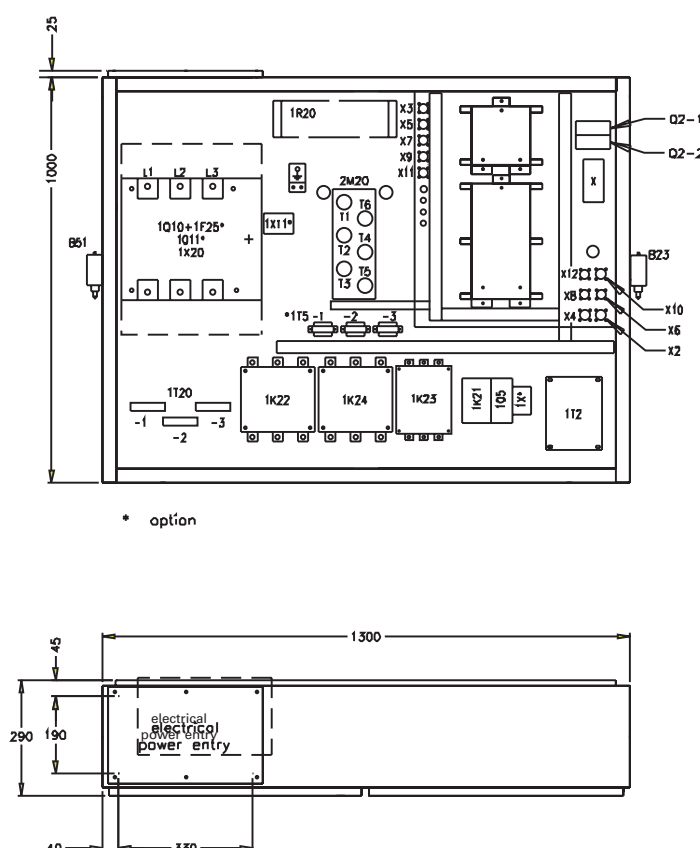
**Plugs and jacks must be clearly marked before disconnecting, because specific plugs will fit into other jacks. Possible damage to equipment may occur if the plugs are reversed with the jacks.**

**Figure 14 - Clipper connectors**



**Disconnect all electrical power, before servicing. Failure to disconnect power before servicing can cause severe personal injury or death.**

**Figure 15 - Electrical panel layout**





## 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.

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 A11 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 A11 requires a control voltage contact input (1TB3-14, J26-1) through a flow proving switch 6S56 and an auxiliary contact 6K51 from the chilled water pump starter that provides proof of flow.

### Condenser Water Pump Control\*

The chiller module A11 provides a contact closure output (J14-1, J14-2) to control the condenser water pump starter. This contact closure pulls in any time the UCP2™ generates a need for cooling based on the leaving chilled water temperature versus set point, and opens when the compressor is stopped.

### Condenser Water Flow Interlock

The chiller module A11 requires a control voltage contact input (1TB3-15, J28-2) through a flow proving switch 6S57 and an auxiliary contact 6K52 from the condenser water pump starter that provides proof of flow.

### Programmable Relay 1 - Compressor Running Contacts\* (default function)

The chiller module A11 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.

### Programmable Relay 2 - Alarm Contacts\* (default function)

The chiller module A11 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.

### Programmable Relay 3 - Limit Warning Contact\* (default function)

The chiller module A11 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.

**Note :** The following sections give you the details on other functions that can be assigned to the Relay 1, Relay 2 and Relay 3.

### Outdoor Air Temperature Sensor

The chiller module A11 provides for connection (J5- 5, J5-6) of an outdoor air temperature sensor 5R3 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 A11 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 A11 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 start-up.

**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 A11 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 set point 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 interlock.) 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 A15 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 A15 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 A15 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 A15 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 set point 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 Set Point

The options module A15 will accept either a 2-10 VDC or a 4-20 mA input (J9-4, J9-5) signal, to adjust the chilled water set point from a remote location. DIP switch SW3-1 must be set to ON for 4-20 mA or OFF for 2-10 VDC.

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

### External Current Limit Set Point

The options module A15 will accept either a 2-10VDC or a 4-20mA input (J7-11, J7-12) signal to adjust the current limit set point 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 set point range, i.e. 2VDC or 4 mA corresponds to 40 percent and 10VDC or 20mA corresponds to 120 percent.

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

### Tracer Temperature Sensor Option

The options module A15 accepts input (J7-7, J7-8) from a temperature sensor 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 A15 provides a 2-10VDC output (J7-1, J7-2) signal that is proportional to the percent condenser pressure. At 2VDC output, the condenser pressure is 0 kPa and at 10VDC output, the condenser pressure is equal to the high pressure cutout (kPa) 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.

# Operating Principles - Mechanical

---

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

## Refrigeration (Cooling) Cycle

The refrigeration cycle of the RTHC 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 16. 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 17.

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 Point 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 Point 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.

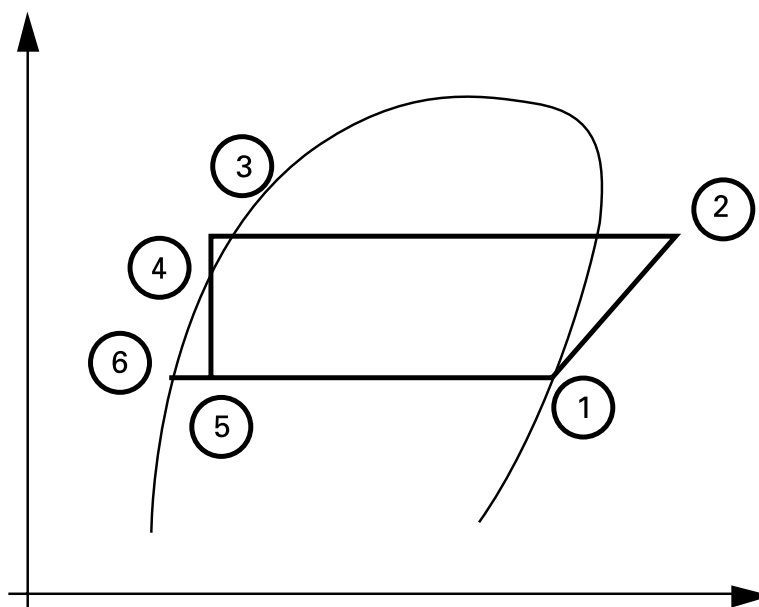
As the refrigerant leaves the bottom of the condenser (State Point 3), it enters an integral subcooler where it is subcooled before traveling to the electronic expansion valve (State



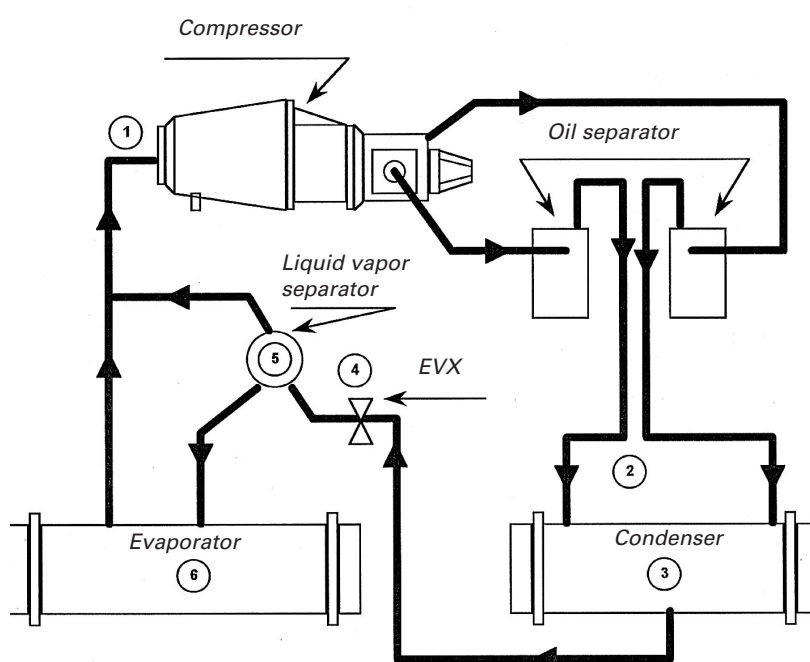
Point 4). The pressure drop created by the expansion process vaporizes a portion of the liquid refrigerant. The resulting mixture of liquid and gaseous refrigerant then enters the liquid vapor separator chamber (State Point 5). At this point the available refrigerant vapor is routed directly to the compressor suction (State Point 1). All remaining liquid refrigerant enters the evaporator (State Point 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 16 - Pressure/Enthalpy Curve**

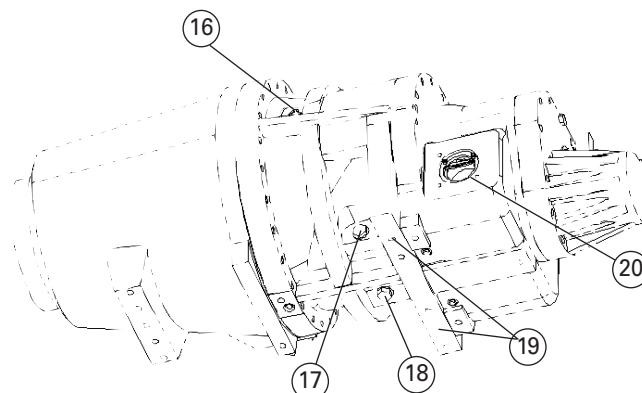
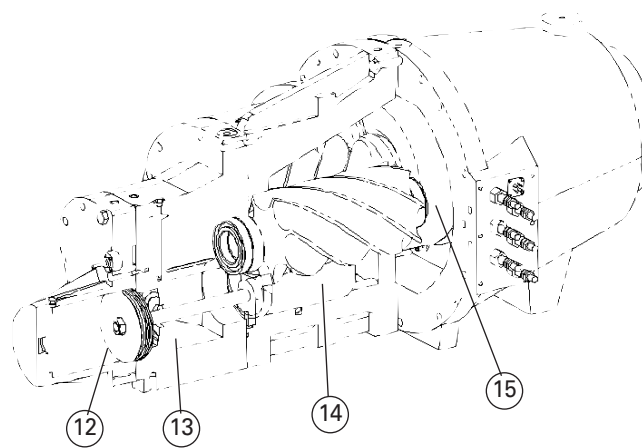
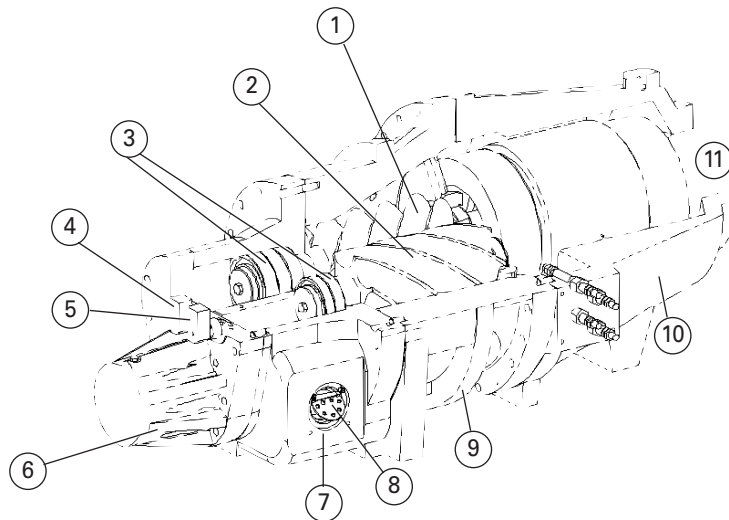


**Figure 17 - Refrigerant Flow Diagram**



## Compressor Description

Figure 18 - RTHC Compressor



- ① Male rotor
- ② Female rotor
- ③ Bearings
- ④ Unload solenoid
- ⑤ Load solenoid
- ⑥ Piston housing
- ⑦ Bearing housing
- ⑧ Discharge check valve
- ⑨ Rotor housing
- ⑩ Motor housing
- ⑪ Suction
- ⑫ Unload piston
- ⑬ Discharge plenum
- ⑭ Slide valve
- ⑮ Motor stator
- ⑯ Oil reclaim
- ⑰ Bearing lubricant port
- ⑱ Rotor injection port
- ⑲ Primary mounting holes
- ⑳ Discharge check valve

The compressor used by the RTHC chiller consists of three distinct sections: the motor, the rotors and the bearing housing. Refer to Figure 18.

#### **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 18).

#### **Compressor Rotors**

Each Series® 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 18. The male rotor is attached to, and driven by, the motor, and the female rotor is, in turn, driven by the male rotor. Separately housed bearing sets are provided at each end of both rotors. The slide valve is located below (and moves along) the rotors.

The helical-rotary compressor is a positive displacement device. As shown in Figure 18, 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 discharged 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 18).

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 18) 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, 2Y21 and 2Y22.

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 (2Y22). 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 toward the rotors.

The compressor is unloaded when the unload solenoid valve (2Y21) 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.

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.

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 19). 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.

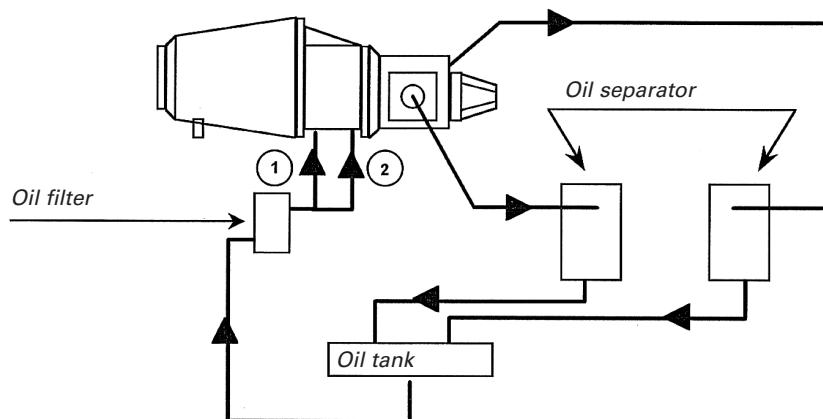
If for any reason oil flow is obstructed because of a plugged oil

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 to protect the compressor from damage.

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

**To ensure proper lubrication and minimize refrigerant condensation in the oil sump, a heater is mounted on the side of the oil 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 and does not cycle on temperature.**

**Figure 19 - Oil Flow Diagram**



### 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 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.

**Note :** The differential oil pressure switch should be set to "OPEN" on a pressure rise of greater than 1,4 bar without oil cooler, 2,4 bar with oil cooler.

### 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.

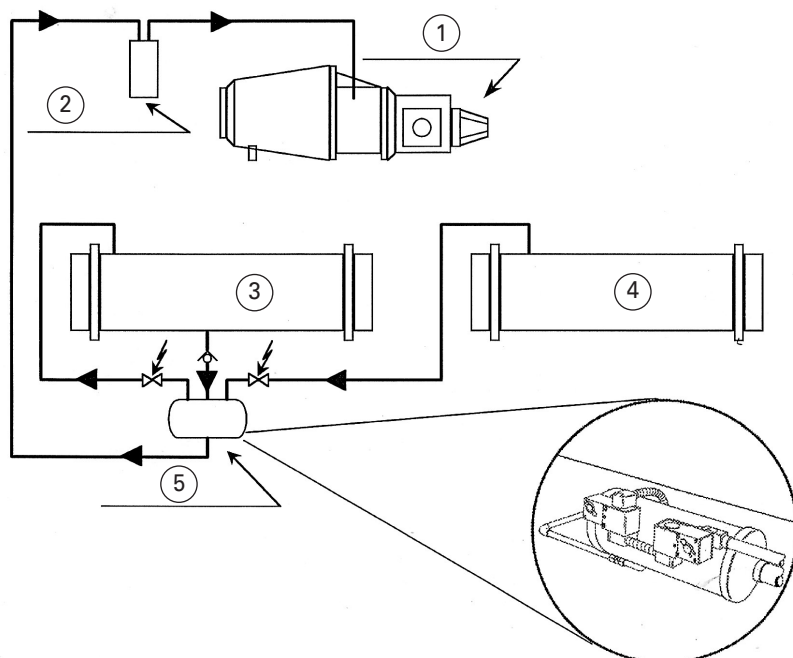
The pump serves to return accumulating oil in the evaporator to the compressor at regular time intervals. As the refrigerant-oil mixture enters the gas pump from the bottom of the evaporator, a fill solenoid opens to allow refrigerant vapor to be vented into the top of the evaporator, and is then closed. 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 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.

**Figure 20 - Gas pump diagram**



- ① Compressor
- ② Oil filter
- ③ Evaporator
- ④ Condenser
- ⑤ Gas pump

# Operator Interface - Controls

---

This section contains an overview of the operator interface with the RTHC 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 set points. 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 are 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.

## 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 and optimization functions for the RTHC chiller. All module control elements reside in the control panel on a common circuit board with a Clear Language Display operator interface.

## Chiller Module - A11

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 (InterProcessor 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 - A13

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 - A14

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 - A15

The options module satisfies control or interface requirements for a number of options. Some of these options are stand-alone, 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 set point and external current limit set point.

## COMM 4 (Tracer® Interface)- A19

The communication module is 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 - A17

The printer interface module provides a pre-formatted chiller log to the printer. The printer interface can be programmed, 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) - A53

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 set points 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 21.

**Figure 21 - Clear language display key assignments**

|                   |                                                                                     |                    |                   |
|-------------------|-------------------------------------------------------------------------------------|--------------------|-------------------|
| Custom Report     | Chiller Report                                                                      | Refrigerant Report | Compressor Report |
| Operator Settings | Service Settings                                                                    | Service Tests      | Diagnostics       |
| Previous          |  | Enter              | Auto              |
| Next              |  | Cancel             | Stop              |

### 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 provides access to all adjustable set points, 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; some 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 Set Points

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 5 seconds, an immediate "panic stop" will be executed, bypassing the normal compressor unload period. During the 5 second period, a message is displayed indicating the optional command.

If the <Stop> key is pressed again during this 5-second period, a message will be displayed for 2 seconds, indicating that the panic stop is being executed.

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

The message displayed during the 5 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 5-second period, the following message will be displayed for 2 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 5-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 A15 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 are re-established.

Internal communications with the Clear Language Display are 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 Operators 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 set points. The sequence of displays is as follows:

---

Chiller Status, Water Temps & Set Points  
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 6 following, the numbers corresponding to the order displayed). 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 7). 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 6**

| Parameter Displayed                           | Sequence        |               |
|-----------------------------------------------|-----------------|---------------|
|                                               | Standard Report | ASHRAE Report |
| Operating Mode                                | 1               | 2             |
| Chilled Water Set Point/Source                | 2               | 3             |
| Evaporator Leaving Water Temperature          |                 |               |
| Ice Termination Set Point/Source              | 3               | 4             |
| Reset Chilled Water Set Point/ Source         | 4               |               |
| Evaporator Entering Water Temperature         | 5               | 4             |
| Condenser Entering Water Temperature          | 6               | 12            |
| Condenser Leaving Water Temperature           |                 |               |
| Current Limit Set Point/Source                | 7               | 5             |
| Active Current Limit Set Point/Setting Source | 8               |               |
| Outdoor Air Temperature                       | 9               |               |
| Time/Refrigerant Temperature                  |                 | 1             |
| Refrigerant Monitor (option only)             |                 | 6             |
| Saturated Evap Refrigerant Temperature        |                 | 7             |
| Compressor Discharge Temperature              |                 |               |
| Compressor Starts/Running Time                |                 | 8             |
| Evaporator Refrigerant Pressure               |                 | 9             |
| Evaporator Approach Temperature               |                 | 10            |
| Chilled Water Flow Switch Status              |                 | 11            |
| Saturated Condenser Temperature               |                 | 13            |
| Condenser Refrigerant Pressure                |                 |               |
| Condenser Approach Temperature                |                 | 14            |
| Condenser Water Flow Switch Status            |                 | 15            |

**Table 7 - Operating Modes**

| Unit Operation | Operating Mode Display*                                                          | Unit Operation | Operating Mode Display*                                                                               |
|----------------|----------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------|
|                | (First Line/Second Line)                                                         |                | (First Line/Second Line)                                                                              |
|                | Resetting                                                                        | Run            | Unit Is Running; Capacity Limited By Pulldown Rate Based Soft Loading                                 |
| Stop           | Local Stop: Cannot Be Overridden By Any External Or Remote Device                |                | Unit Is Running; Current Based Soft Loading Capacity Limited By Auto Waiting For Condenser Water Flow |
|                | Remote Display Stop: Chiller May Be Set To Auto By Any External Or Remote Device | Auto           |                                                                                                       |
|                | Remote Run Inhibit From External Source                                          | Run            | Unit Is Running; Base Loaded                                                                          |
|                | Remote Run Inhibit From Tracer                                                   |                | Unit Is Running; Base Loaded Capacity Limited By High Current                                         |
|                | Diagnostic Shutdown Stop                                                         |                | Unit Is Running; Base Loaded Capacity Limited By Phase Unbalance                                      |
| Auto           | Diagnostic Shutdown Auto                                                         |                | Unit Is Running; Base Loaded Capacity Limited By High Cond Press                                      |
|                | Auto Waiting For Evaporator Water Flow                                           |                | Unit Is Running; Base Loaded Capacity Limited By Low Evap Temp                                        |
|                | Auto Waiting For A Need To Cool                                                  |                | Unit Is Running; Base Loaded Establishing Minimum Capacity Limit                                      |
|                | Waiting For Tracer Communications To Establish Operating Status                  |                | Unit Is Running; Base Loaded Pulldown Rate Based Soft Loading                                         |
|                | Starting Is Inhibited By Staggered Start Time Remaining: MIN:SEC                 |                | Unit Is Running; Base Loaded Current Based Soft Loading                                               |
|                | Starting Is Inhibited By Restart Inhibit Timer: Time Remaining MIN:SEC           | Run-Unload     | Unit Is Preparing To Shut Down                                                                        |
| Initialize     | Establishing Cond Water Flow Positioning Electronic Expansion Valve              | Run-Ice Build  | Unit Is Building Ice                                                                                  |
|                | Establishing Cond Water Flow Time Remaining: MIN:SEC                             |                | Unit Is Building Ice Capacity Limited By High Current                                                 |
|                | Cond Water Is Flowing Positioning Electronic Expansion Valve                     |                | Unit Is Building Ice Capacity Limited By Phase Unbalance                                              |
|                | Cond Water Is Flowing PreStart Unload Time Remaining: MIN:SEC                    |                | Unit Is Building Ice Capacity Limited By High Cond Press                                              |
| Start          | Starting Compressor                                                              |                | Unit Is Building Ice Capacity Limited By Low Evap Temp                                                |
| Run            | Unit Is Running                                                                  |                | Ice Building Is Complete                                                                              |
|                | Unit Is Running Capacity Limited By High Current                                 |                | Unit Is Running; Transitioning Ice Building To Normal MIN:SEC                                         |
|                | Unit Is Running Capacity Limited By Phase Unbalance                              | Stop           | Immediate Shutdown                                                                                    |
|                | Unit Is Running Capacity Limited By High Cond Press                              |                | Panic Stop                                                                                            |
|                | Unit Is Running Capacity Limited By Low Evap Temp                                |                | Starter Dry Run                                                                                       |
|                | Unit Is Running                                                                  |                |                                                                                                       |

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

### Chilled Water Set Point and Source/Evap Leaving Water Temp (Standard Report)

|                                           |
|-------------------------------------------|
| Chilled Water Set Point [source]: xxx.x C |
| Evap Leaving Water Temp: xxx.x C          |

Source can be either External, Tracer® or Reset (meaning reset is enabled); otherwise the source is the Front Panel and is not displayed.

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 Set Point [source]: xxx.x C |
| Evap Leaving Water Temp: xxx.x C            |

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

**Note :** The set point source may change automatically from "Front Panel" (no source displayed) to "Tracer" if Tracer is communicating a chilled water set point to the chiller. The only way to override Tracer-communicated set points is through the operator setting menu (global set point override).

### Reset Chilled Water Set Point and Type/Starting Chilled Water Set Point 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 set point 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 set point possible when no reset is applied.

### Ice Termination Set Point/Ice Termination Set Point Source (Standard Report)

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

|                                             |
|---------------------------------------------|
| Ice Termination Set Point [source]: xxx.x C |
| 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)

|                                             |
|---------------------------------------------|
| Ice Termination Set Point [source]: xxx.x C |
| Press (Next) (Previous) To Continue         |

### 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 C |
| Cond Leaving Water Temp: xxx.x C  |

### Current Limit Set Point and Source (Standard Report)

|                                        |
|----------------------------------------|
| Current Limit Set Point [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 C    |
| 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 6, "Operating Modes," and identical to the operating mode given in the standard report.

### Chilled Water Set Point and Source/Evap Leaving Water Temperature (ASHRAE Report)

|                                          |
|------------------------------------------|
| Chilled Water Set Point[source]: xxx.x F |
| Evap Leaving Water Temp: xxx.x F         |

where the "source" is the Front Panel (field not displayed) or Tracer® or an External source.

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 Set Point [source]: xxx.x C |
| Evap Entering Water Temp: xxx.x C           |

where the [source] is External or Tracer.

### Current Limit Set Point and Source (ASHRAE Report)

|                                       |
|---------------------------------------|
| Current Limit Set Point [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 |
| Refrigerant 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 Refrigerant Temp: xxx.x C |
| Compressor Discharge Temp: xxx.xC        |

### Compressor Starts and Running Time (ASHRAE Report)

The starts and hours counters are displayed:

|                                      |
|--------------------------------------|
| Compressor Starts: xxxxx             |
| Compressor Running Time: HRS:MIN:SEC |

### Evaporator Entering and Leaving Water Temperatures (ASHRAE Report)

|                                   |
|-----------------------------------|
| Evap Entering Water Temp: xxx.x C |
| Evap Leaving Water Temp: xxx.xC   |

### Saturated Evap Temperature/Evaporator Refrigerant Pressure (ASHRAE Report)

|                                          |
|------------------------------------------|
| Saturated Evap Refrigerant Temp: xxx.x C |
| Evap Refrigerant Pressure: xxx.x kpa     |

### Evaporator Approach Temperature (ASHRAE Report)

|                                     |
|-------------------------------------|
| Evaporator Approach Temp: xxx.x C   |
| 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 C |
| Cond Leaving Water Temp: xxx.x C  |

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 C         |
| Cond Refrigerant Pressure: xxx.x kpa |

### Condenser Approach Temperatures (ASHRAE Report)

|                                     |
|-------------------------------------|
| Condenser Approach Temp: xxx.x C    |
| 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 Refrigerant Pressure : xxx.x kpa |
| Cond Refrigerant Pressure : xxx.x kpa |

**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 cm [modifier] |
| Press (Next) (Previous) To Continue   |

The display will show the refrigerant liquid level in centimeters 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 +2.5 or -2.5, the display will read "+2.5 centimeter or more"

or "-2.5 centimeter or less," indicating the sensor is at the extremes of its range.

Normal operation should produce an evaporator liquid level of "0" centimeter meaning no deviation from the design level in the evaporator.

During normal operation and within 20 minutes of start-up, the liquid level should be well within the sensor's range of  $\pm 2.5$  inch. Small variations in liquid level of  $\pm 1$  to 1.5 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, 0-2760 for larger EXV). If pre-position of the valve is required (to allow delta P to be generated) for start-up, 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 Refrigerant Temp : xxx.x C   |
| Evap Refrigerant Pressure : xxx.x kpa |

#### Saturated Cond Temperature/Cond Refrigerant Pressure

|                                      |
|--------------------------------------|
| Sat Cond Temp: xxx.x C               |
| Cond Refrigerant Pressure: xxx.x kpa |

#### Saturated Evap Temperature and Discharge Temp

|                                           |
|-------------------------------------------|
| Saturated Evap Refrigerant Temp : xxx.x C |
| Compressor Discharge Temp : xxx.x C       |

#### Compressor Discharge Temperature/Discharge Superheat

|                                     |
|-------------------------------------|
| Compressor Discharge Temp : xxx.x C |
| Discharge Superheat : xxx.x C       |

#### Evaporator and Condenser Approach Temperatures

|                                     |
|-------------------------------------|
| Evaporator Approach Temp. : xxx.x C |
| Condenser Approach Temp. : xxx.x C  |

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

### Compressor Report

#### Report Heading

|                                     |
|-------------------------------------|
| Compressor Hours, Starts & Amps     |
| Press (Next) (Previous) To Continue |

#### Compressor Line Currents% RLA

|                                 |
|---------------------------------|
| Compressor Line Currents -% RLA |
| A xxx.x% B xxx.x% C xxx.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 Set Points |
| 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 6 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 set point 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

|                                         |
|-----------------------------------------|
| CurrentTime/Date HH:MM xm Mon, XX, XXXX |
| (Enter) To Change: (Next) To Continue   |

The top level "CurrentTime/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 "CurrentTime/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 "CurrentTime/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 "CurrentTime/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 "CurrentTime/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:

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

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

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

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

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

#### Front Panel Chilled Water Set Point

|                                              |
|----------------------------------------------|
| Front Panel Chilled Water Set Point: xxx.x C |
| Press (+) (-) To Change Setting              |

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

The second line of the setting display shown above will change if an attempt is made to increase or decrease the set point out of the set point 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 set point is within 1°C of the leaving water temperature cutout set point or within 3°C of the low refrigerant temperature cutout set point, the second line of this display will read:

|                                            |
|--------------------------------------------|
| Limited By Cutout Set Point, (+) To Change |
|--------------------------------------------|

#### Front Panel Current Limit Set Point

|                                      |
|--------------------------------------|
| 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 Water 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 Set Point

|                                 |
|---------------------------------|
| [type] Start Reset: xxx.x C     |
| Press (+) (-) To Change Setting |

The start reset range is 2.2 to 16.7°C for return reset with the ROM default of 5.6°C. For outdoor reset, the range is 10 to 54.4°C for with the ROM default of 32.2°C.

## Max Reset Set Point

|                                     |
|-------------------------------------|
| [type] Max Reset Set Point: xxx.x C |
| Press (+) (-) To Change Setting     |

The maximum reset range is 0.0 to 11.1°C for return reset with the ROM default of 2.8°C. For outdoor reset, the range is 0.0 to 11.1°C for with the ROM default of 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 |

## Front Panel Ice Termination Set Point

|                                          |
|------------------------------------------|
| Panel Ice Termination Set Point: xxx.x C |
| Press (+) (-) To Change Setting          |

This data will be displayed only if the icemaking option is installed. The range of values is -6.7 to 0.0°C in increments of 1 or 0.1°C, depending on the service setup screen. The ROM default is -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 Set Point Source

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

|                                           |
|-------------------------------------------|
| [Default] Chilled Water Set Point Source: |
| [source]                                  |

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

## Current Limit Set Point Source

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

|                                           |
|-------------------------------------------|
| [Default] Current Limit Set Point Source: |
| [source]                                  |

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

## Set Point Source Override

|                           |
|---------------------------|
| Set Point Source Override |
| [source]                  |

Possible values of [source] are none (ROM default), "Use Front Panel set points," and "Override Tracer." Use default set points, for which the Tracer option must be installed.

## 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. The first group is the non-password protected group that consists of all of the settings, feature enables, set points, 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.

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 Setup) 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 the above screen will 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 set point menus. Likewise, if the password



status is locked and the correct password is entered, all of the set point menus will be unlocked.

Whenever a password is in use the "Press (+) (-) To Change Setting" message will not appear on set point screens. Any attempt to change a set point 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: xxxxxxxx              |
| Press (+) (-) To Change Setting |

Possible language selections are: English (factory default), Francais, Deutsch, Español, Nippon (also known as Katakana; use Japanese characters), Italiano, Nederlands, CODED, and Portuguese.

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 set point that the return water temperature must drift before the chiller will start.

|                                        |
|----------------------------------------|
| Differential To Start Chiller: xxx.x C |
| Press (+) (-) To Change Setting        |

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

#### Differential to Stop

Differential To Stop is the number of degrees below set point 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 C |
| Press (+) (-) To Change Setting       |

The range of values is 0.5 to 5.5°C in increments of 1 or 0.1° C depending

on the service setup screen. The factory default is 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:

|                                      |
|--------------------------------------|
| 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 |
|----------------------------------------|

#### Service Setup and Machine Configuration Menus

The Service Setup and Machine Configuration menus do not contain any operator settable functions. These two menus contain machine settings which are performed at the factory or possibly when field servicing/replacing a module. These two groups are SERVICE LEVEL password protected and are intended for entrance by qualified service personnel only. Do not attempt to enter these two groups: there is no reason for an operator to enter these groups. Improper adjustment of the settings within these groups could affect machine reliability and personnel safety.

#### Service Tools Group Password Request

|                                          |
|------------------------------------------|
| Pswd Req'd 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 set point. 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] is 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 diagnoses of problems 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:

*Small EXVs (normally 150 to 200 Ton RTHC Units):* Ratchet for 15 seconds. Close normally for 10 seconds, then ratchet for 5 seconds. Open normally for 10 seconds, then ratchet for 5 seconds

*Large EXVs (normally 300 to 400 Ton RTHC Units):* Ratchet for 15 seconds. Close normally for 13 seconds, then ratchet for 2 seconds. Open normally for 13 seconds, then ratchet for 2 seconds

### 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 cm            |

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 cm        |

### 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.

## Module Software Revision Levels

|                                                                            |
|----------------------------------------------------------------------------|
| Press (Enter) To Display Software<br>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<br>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.

**Note :** 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.

## 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]<br>[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<br>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]<br>(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" are:

*Warning Only* - Reset Not Required  
(applies to all IFW diagnostics)

*Unit Shutdown* - Reset Required  
(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.<br>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<br>And Shutdown / Reset System |
|------------------------------------------------------------------------|

If the <Enter> key is pressed, the following message is displayed for 2 seconds:

|                                                             |
|-------------------------------------------------------------|
| Active Diagnostics Have Been Cleared<br>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<br>Clear Historic Diagnostics |
|------------------------------------------------|

If the <Enter> key is pressed, the following message is displayed for 4 seconds:

|                                                                            |
|----------------------------------------------------------------------------|
| Historic Diagnostics Have Been Cleared<br>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<br>Silence Refrigerant Monitor Audible Alarm |
|-----------------------------------------------------------|

**Note :** Pressing (+) will silence the audible alarm.

If the <+> key is pressed, the following message is displayed for 4 seconds:

|                                                                                       |
|---------------------------------------------------------------------------------------|
| Silencing Refrigerant Monitor Audible Alarm;<br>Clearing Nonactive Refrigerant Alarms |
|---------------------------------------------------------------------------------------|

# Unit Start-Up

## 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 (see Tracer 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<br>Copyright American Standard Inc. 1996 |
| <Software PN> Local Configuration<br>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<br>Any External Or Remote Device |
| Remote Run Inhibit<br>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 set point that the return 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<br>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<br>Timer: Time Remaining: Min; Sec |
|-----------------------------------------------------------------------------|

or

|                                                                      |
|----------------------------------------------------------------------|
| Starting Is Inhibited By Staggered Start<br>Time Remaining: Min; Sec |
|----------------------------------------------------------------------|

Thirty 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 soft loading, 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 set point. 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 start-up 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 6 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. For example:

|                                     |
|-------------------------------------|
| Unit Is Running                     |
| Establishing Minimum Capacity Limit |

The following are limit controls, all of which the UCM will limit to adjustable set points:

- **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 reads condenser pressure from a pressure transducer input 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 cool down 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.

**⚠ 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 start-up for the remainder of the seasonal start-up.

# 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 Shut Down |
|--------------------------------|

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 is displayed:

|                          |
|--------------------------|
| Auto                     |
| Waiting For Need To Cool |

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 is displayed:

|                                     |
|-------------------------------------|
| Local Stop: Cannot Be Overridden By |
| Any External Or Remote Device       |

or:

|                    |
|--------------------|
| Remote Run Inhibit |
| From <type> Source |

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 RTHC unit. Use a periodic maintenance program to ensure maximum performance and efficiency of the RTHC units.

**Note :** Stay aware of national regulation that may prescribe specific maintenance and intervals.

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

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

## 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 :** Condenser pressure is dependent on condenser water temperature, and should equal the saturation pressure of the refrigerant at a temperature 1 to 3°C above that of leaving condenser water at full load.

## Monthly Maintenance and Checks

**⚠ Must be performed by qualified personnel:**

- 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 9
- 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 8 at full load, standard condition.

**Note :** Standard conditions are:  
condenser water: 27/32°C and  
evaporator water: 12/7°C.

**TABLE 8**

| Description         | Condition   |
|---------------------|-------------|
| Evaporator pressure | 3 - 3.5 b   |
| Condensing-pressure | 7 - 9 b     |
| Discharge superheat | 10°C        |
| Subcooling          | 4°C         |
| EXV percent open    | 35-45% open |

**Note :** All conditions stated above are based on the unit running fully loaded, and should only be used as indication.

## Annual Maintenance

Shut down the chiller once each year to check the items listed below.

- 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 closed system.
- Have a qualified laboratory perform an oil analysis to determine system moisture content and acid level.

- 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.
- Follow national regulation when special prescriptions.



## Check Sheets

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### **Contractor Confirmation Check Sheet**

This check sheet must be completed by the installing contractor and submitted prior to requesting Trane® Service start-up support. The check sheet identifies a list of items that need to be completed prior to actual machine start-up (page 58).

### **RTHC Start-Up Test Log**

This test log is specifically intended for use by Trane Service technicians at initial start-up (page 67).

### **RTHC Operating Log**

The operating log is intended for use by Trane Service technicians and RTHC owner/operators to record unit operating characteristics during periodic maintenance (page 68).

### **RTHC UCP2™ Log**

This form is specifically intended for use by Trane Service technicians at initial start-up to record all UCP2 settings (page 69).



## CONTRACTOR CONFIRMATION CHECK SHEET

|                                             |                                            |                  |                                             |
|---------------------------------------------|--------------------------------------------|------------------|---------------------------------------------|
| Addressed to the Trane® Service office of : |                                            |                  |                                             |
| Job name:                                   |                                            | Job location:    |                                             |
| Model No.:                                  |                                            | Sales order No.: |                                             |
| <b>RTHC Unit</b>                            |                                            |                  |                                             |
|                                             | Unit installed                             |                  | Connected to the cooling tower              |
|                                             | Isolator pads in place                     |                  | Connected to the pumps                      |
| <b>Chilled Water</b>                        |                                            |                  |                                             |
|                                             | Connected to the unit                      |                  | System flushed and then filled              |
|                                             | Connected to the air handling units        |                  | Pump run and air bled                       |
|                                             | Connected to the pumps                     |                  | Strainers cleaned                           |
|                                             | System flushed and then filled             |                  | Flow switch installed and checked/set       |
|                                             | Pump run and air bled                      |                  | Throttling cock installed in leaving water  |
|                                             | Strainers cleaned                          |                  | Thermometers installed (Leav./Ent.)         |
|                                             | Flow switch installed and checked/set      |                  | Gauges installed (Leav./Ent.)               |
|                                             | Throttling cock installed in leaving water |                  | Cooling water control operational           |
|                                             | Thermometers installed (Leav./Ent.)        |                  | Water treatment equipment                   |
|                                             | Gauges installed (Leav./Ent.)              | <b>Wiring</b>    |                                             |
| <b>Cooling Water</b>                        |                                            |                  |                                             |
|                                             | Connected to the unit                      |                  | Power supply connected and available        |
|                                             |                                            |                  | External interlock connected                |
|                                             |                                            | <b>Load</b>      |                                             |
|                                             |                                            |                  | System can be operated under load condition |

We will therefore require your service technician on job by \* \_\_\_\_\_

Checklist completed by \_\_\_\_\_ Dated \_\_\_\_\_

\* Return this completed checklist to your Trane Service office as soon as possible to enable the start-up visit to be scheduled. Be aware that advance notification is required to allow scheduling of the start-up as close to the requested date as possible.

Additional time required to complete the start-up and adjustment due to incompleteness of the installation will be invoiced at prevailing rates.

| <b>RTHC Start-Up Test Log</b>                                                  |     |                                                                           |                                    |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|------------------------------------|
| Job Name:                                                                      |     | Job Location:                                                             |                                    |
| Model No.:                                                                     |     | Serial No.:                                                               | Start Date:                        |
| Sales Order No.:                                                               |     | Ship Date:                                                                | Job Elevation (m. above sea level) |
| <b>COMPRESSOR DATA</b>                                                         |     | <b>IF PRESSURE TEST IS REQUIRED</b>                                       |                                    |
| Model No.:                                                                     |     | Vacuum after leak test =                      mm                          |                                    |
| Serial No.:                                                                    |     | Standing vacuum test =                      mm rise in Hrs                |                                    |
| <b>NAMEPLATE DATA</b>                                                          |     | <b>UNIT CHARGES</b>                                                       |                                    |
| _____ RLA                      _____ kW<br>_____ Volts      50      60      Hz |     | Unit refrigerant charge :                      Kg                      R- |                                    |
|                                                                                |     | Unit oil charge:                      litres                      Oil     |                                    |
| <b>DESIGN DATA</b>                                                             |     | <b>CHILLER APPEARANCE AT ARRIVAL</b>                                      |                                    |
| _____ RLA                      _____ kW<br>_____ Volts      50      60      Hz |     |                                                                           |                                    |
| <b>CURRENT TRANSFORMER</b>                                                     |     | <b>SUMMARY OF UNIT OPTIONS INSTALLED</b>                                  |                                    |
| Part Number ( x code & 2-digit extension)                                      |     | Y    N    Tracer® Communication Interface                                 |                                    |
| Primary CTs                                                                    |     | Y    N    Options Module                                                  |                                    |
| X                                                                              |     | Y    N    Outdoor Air Sensor                                              |                                    |
| X                                                                              |     | Y    N    Icemaking Control                                               |                                    |
| X                                                                              |     | Y    N    Other                                                           |                                    |
| <b>OPERATING CONDITIONS</b>                                                    |     |                                                                           |                                    |
| Evap Design:                                                                   | l/s | Kpa Ent. Water C°                                                         | Leaving Water C°                   |
| Evap Actual:                                                                   | l/s | Kpa Ent. Water C°                                                         | Leaving Water C°                   |
| Cond Design:                                                                   | l/s | Kpa Ent. Water C°                                                         | Leaving Water C°                   |
| Cond Actual:                                                                   | l/s | Kpa Ent. Water C°                                                         | Leaving Water C°                   |

Owners Witness Signature: \_\_\_\_\_



## RTHC OPERATING LOG

|               |              |               |
|---------------|--------------|---------------|
| Date:         | Sales Order: | Voltage:      |
| Job Name:     | Model No.:   | Contract No.: |
| Job Location: | Serial No.:  |               |

| MENU ITEM | TIME |  |  |  |  |  |
|-----------|------|--|--|--|--|--|
|           |      |  |  |  |  |  |

### CHILLER REPORT

|                                  |  |  |  |  |  |  |
|----------------------------------|--|--|--|--|--|--|
| Chiller Operating Mode           |  |  |  |  |  |  |
| Chiller Water Set Point (source) |  |  |  |  |  |  |
| Evap Leaving Water Temp          |  |  |  |  |  |  |
| Evap Entering Water Temp         |  |  |  |  |  |  |
| Cond Leaving Water Temp          |  |  |  |  |  |  |
| Cond Entering Water Temp         |  |  |  |  |  |  |
| Active Current Limit Set Point   |  |  |  |  |  |  |
| Outdoor Air Temp (optional)      |  |  |  |  |  |  |

### REFRIGERANT REPORT

|                             |  |  |  |  |  |  |
|-----------------------------|--|--|--|--|--|--|
| Evap Refrigerant Pressure   |  |  |  |  |  |  |
| Evap Refrigerant Temp       |  |  |  |  |  |  |
| Cond Refrigerant Pressure   |  |  |  |  |  |  |
| Cond Refrigerant Temp       |  |  |  |  |  |  |
| Evap Liquid Level           |  |  |  |  |  |  |
| 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     |  |  |  |  |  |  |

## RTHC UCP2™ Log

| MENU ITEM                                              | SETTING       | MENU ITEM                                                                              | SETTING               |
|--------------------------------------------------------|---------------|----------------------------------------------------------------------------------------|-----------------------|
| <b>OPERATOR SETTINGS</b>                               |               | Soft Load Control                                                                      | D      E              |
| Settings In This Menu Are:                             | Lock / Unlock | Soft Loading Starting Current Limit                                                    |                       |
| Current Time / Date                                    |               | Soft Loading Current Limit Rate                                                        |                       |
| Front Panel Chilled Water Set Point                    |               | Soft Loading Leaving Limit Rate                                                        |                       |
| Front Panel Chilled Limit Set Point                    |               | LWT Control Proportional Gain                                                          |                       |
| Chilled Water Reset Type                               |               | LWT Control Integral Reset Time                                                        |                       |
| Reset Ratio                                            |               | LWT Control Rate Time                                                                  |                       |
| Start Reset Set Point                                  |               | EXV Max Travel Set Point                                                               |                       |
| Max Reset Set Point                                    |               | Liq Level Control Proportional Gain                                                    |                       |
| Ice Building                                           |               | Liq Level Control Integral Reset Time                                                  |                       |
| Panel Ice Termination Set Point                        |               | Liq Level Control Deadband                                                             |                       |
| Ice to Normal Cooling Timer                            |               | <b>SERVICE SETTINGS GROUP<br/>MACHINE CONFIGURATION GROUP<br/>(PASSWORD PROTECTED)</b> |                       |
| Chilled Water Set Point Source                         |               |                                                                                        |                       |
| Current Limit Set Point Source                         |               |                                                                                        |                       |
| Ice Term Set Point Source                              |               | Compressor Frame Size & Capacity                                                       |                       |
| Set Point Source Override                              |               | Nominal Unit Tons                                                                      |                       |
| <b>SERVICE SETTINGS GROUP<br/>(NON-PASSWORD)</b>       |               | Starter Type                                                                           |                       |
| Keypad / Display Lockout:                              | Lock / Unlock | Level 2 Contactor Integrity test                                                       |                       |
| Settings In This Menu Are:                             |               | Rated Load Amps                                                                        |                       |
| Display Units                                          |               | Motor Heating Constant                                                                 |                       |
| Decimal Places Display                                 |               | Current Overload Setting # 1                                                           |                       |
| Display Menu Headings                                  |               | Current Overload Setting # 2                                                           |                       |
| Clear Custom Menu                                      |               | Max Acceleration Timer # 1                                                             |                       |
| Differential To Stop Set Point                         |               | Max Acceleration Timer # 2                                                             |                       |
| Differential To Start Set Point                        |               | Acceleration Time Out Action                                                           |                       |
| Evap Pumps Off Delay                                   |               | Shutdown/Transition                                                                    |                       |
| Clear RI Timer                                         |               | EXV Size                                                                               |                       |
| <b>SERVICE SETTINGS GROUP<br/>(PASSWORD PROTECTED)</b> |               | External Chilled Water Set Point Option                                                | Install / Not Install |
| Keypad / Display Lock                                  | D      E      | Ext. Current Limit Option                                                              | Install / Not Install |
| Menu Settings Password Feature                         | D      E      | High Pressure Cutout Setting                                                           |                       |
| ICS Address                                            |               | Line Voltage Sensing Option                                                            |                       |
| Power-Up Start Delay Time                              |               | Unit Line Voltage                                                                      |                       |
| Design Delta Temp Set Point                            |               | Ice Building Option                                                                    | Install / Not Install |
| Lvg Water Temp Cutout Set Point                        |               | Ext. Set Point Inputs                                                                  |                       |
| Low Refrigerant Cutout Set Point                       |               | Tracer Option                                                                          | Install / Not Install |
| Condenser Limit Set Point                              |               | TCI Option                                                                             | Install / Not Install |
| Max. RI Timer                                          |               | Print Option                                                                           | Install / Not Install |
| Under / Over Voltage                                   | D      E      | Relay # 1                                                                              |                       |
| Phase Reversal Protection                              | D      E      | Relay # 2                                                                              |                       |
| Phase Unbalance Limit                                  | D      E      | Relay # 3                                                                              |                       |
| Momentary Power Loss Protection                        | D      E      |                                                                                        |                       |

# Maintenance Procedures

## Cleaning the Condenser

**⚠ 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 5°C approach. If the approach exceeds 5°C 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 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, consult a qualified service organization for recommendations.)

### 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

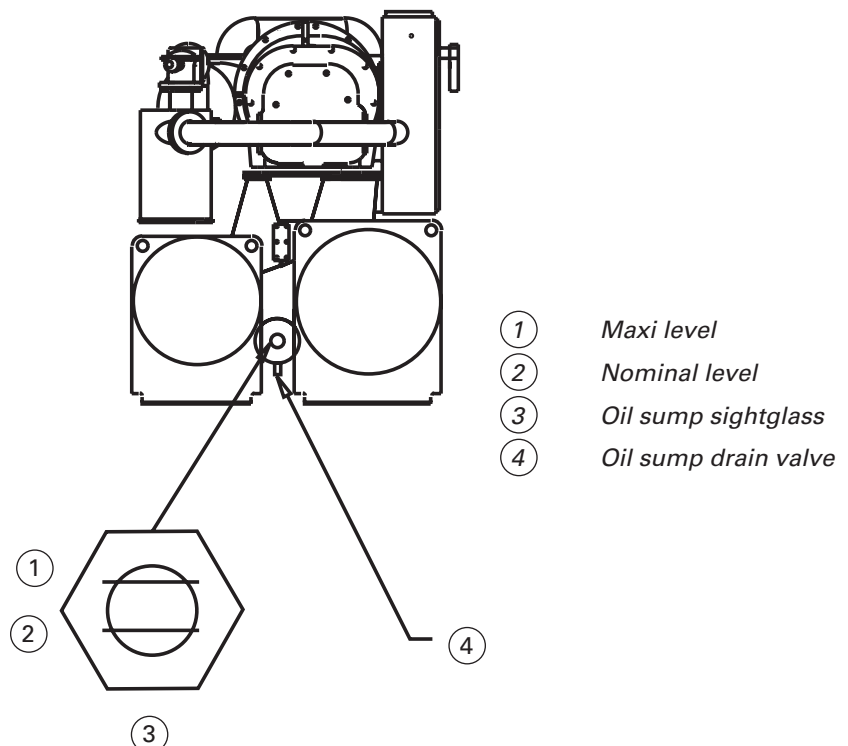
is deemed necessary, use the same cleaning methods described for the condenser tubes.

## Compressor Oil

**⚠ 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 cannot 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 9 to determine the acceptability of the oil. The proper charge amounts are given in Table 2.

**Figure 22 - Determining Oil Level in Sump**



Trane® approved oils : OIL 022E and OIL 023E

**TABLE 9**

| POE OIL PROPERTIES |                              |
|--------------------|------------------------------|
| Description        | Acceptable Levels            |
| Moisture content   | less than 300 ppm            |
| Acid Level         | less than 0.5 TAN (mg KOH/g) |

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 check the level

1. Run the unit not fully loaded for approximately 20 minutes.
2. Cycle the compressor off line.
3. Refer to Figure 22 to determine the nominal oil level.

**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.

## 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:

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 2 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 4 litres 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 4 litres 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 Oil 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 23. 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 4 Kpa to the values shown in Figure 23. For example, if the system pressure differential was 55 Kpa, then the clean filter pressure drop would be approximately 10 Kpa (up from 7 Kpa). For a chiller with an oil cooler and operating with a dirty oil filter, the maximum allowable pressure drop would be 20 Kpa (up from 15 Kpa).

Under normal operating conditions the element should be replaced after the first year of operation and then as needed thereafter.

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 counter-clockwise 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.

### 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 and during evacuation.
2. Connect the vacuum pump to the 5/8" flare connection on 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 any more than 150 microns. If the system 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.

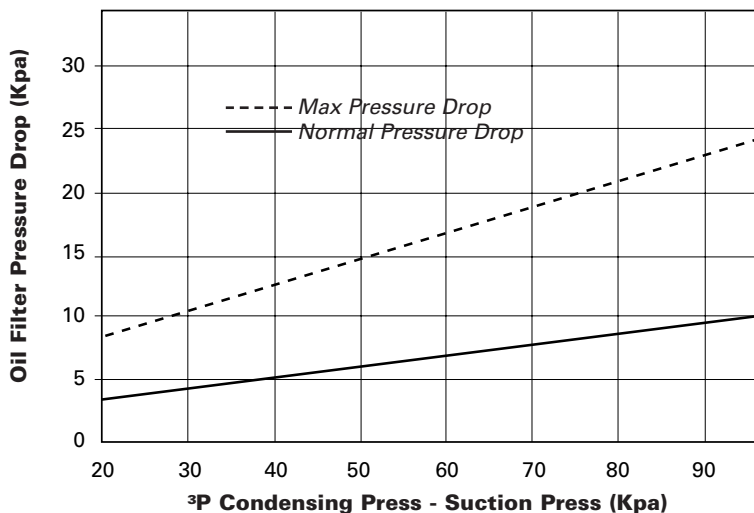
### Refrigerant Charging

Once the system is deemed leak- and moisture free, use the 5/8" flare connections at the evaporator and condenser to add the refrigerant charge. Use Table 2 for the correct charge amounts.

### 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 10 following.

**Figure 23 - Oil Filter Replacement Chart (D1, D2, D3)**



**TABLE 10 - LOW REFRIGERANT TEMPERATURE, ETHYLENE GLYCOL, AND FREEZE PROTECTION SETTINGS**

| A Efficiency |          |                 |          |          | B Efficiency    |          |          |                 | C Efficiency |          |                 |          | C Efficiency |                 |          |          |
|--------------|----------|-----------------|----------|----------|-----------------|----------|----------|-----------------|--------------|----------|-----------------|----------|--------------|-----------------|----------|----------|
| Chilled      | Leaving  | Low Refrigerant | Rec %    | Solution | Low Refrigerant | Rec %    | Solution | Low Refrigerant | Rec %        | Solution | Low Refrigerant | Rec %    | Solution     | Low Refrigerant | Rec %    | Solution |
| Water        | Wtr Temp | Temp            | Ethylene | Freeze   | Temp            | Ethylene | Freeze   | Temp            | Ethylene     | Freeze   | Temp            | Ethylene | Freeze       | Temp            | Ethylene | Freeze   |
| Setup        | Cutout   | Cutout          | Glycol   | Point    | Cutout          | Glycol   | Point    | Cutout          | Glycol       | Point    | Cutout          | Glycol   | Point        | Cutout          | Glycol   | Point    |
| 6.0          | 2.7      | -2.0            | 0        | -0.2     | .1.0            | 0        | 0.9      | -0.8            | 0            | 1.1      | 0.0             | 0        | 1.9          |                 |          |          |
| 5.0          | 1.7      | -3.4            | 10       | -1.5     | -2.2            | 0        | -0.3     | -2.0            | 0            | -0.1     | -1.2            | 0        | 0.7          |                 |          |          |
| 4.0          | 0.7      | -4.5            | 10       | -2.7     | -3.3            | 5        | -1.4     | -3.1            | 5            | -1.2     | -2.3            | 0        | -0.4         |                 |          |          |
| 3.0          | -0.3     | -5.6            | 11       | -3.7     | -4.3            | 8        | -2.4     | -4.1            | 7            | -2.2     | -3.4            | 6        | -1.5         |                 |          |          |
| 2.0          | -1.3     | -6.6            | 13       | -4.7     | -5.3            | 10       | -3.4     | -5.1            | 10           | -3.2     | -4.4            | 8        | -2.5         |                 |          |          |
| 1.0          | -2.3     | -7.5            | 15       | -5.6     | -6.2            | 12       | -4.4     | -6.0            | 12           | -4.2     | -5.4            | 10       | -3.5         |                 |          |          |
| 0.0          | -3.3     | -8.4            | 16       | -6.5     | -7.2            | 14       | -5.3     | -7.0            | 14           | -5.1     | -6.4            | 12       | -4.5         |                 |          |          |
| -1.0         | -4.3     | -9.2            | 16       | -7.4     | -8.1            | 16       | -6.2     | -7.9            | 16           | -6.0     | -7.3            | 15       | -5.4         |                 |          |          |
| -2.0         | -5.3     | -10.1           | 20       | -8.2     | -9.0            | 18       | -7.1     | -8.8            | 18           | -6.9     | -8.3            | 16       | -6.4         |                 |          |          |
| -3.0         | -6.3     | -11.0           | 22       | -9.1     | -9.9            | 20       | -8.1     | -9.8            | 19           | -7.9     | -9.2            | 18       | -7.3         |                 |          |          |
| -4.0         | -7.3     | -11.9           | 23       | -10.0    | -10.9           | 21       | -9.0     | -10.8           | 21           | -8.9     | -10.2           | 20       | -8.3         |                 |          |          |
| -5.0         | -8.3     | -12.9           | 25       | -11.0    | -11.9           | 23       | -10.0    | -11.8           | 23           | -9.9     | -11.3           | 22       | -9.4         |                 |          |          |
| -6.0         | -9.3     | -14.0           | 26       | -12.1    | -13.0           | 25       | -11.1    | -12.8           | 24           | -10.9    | -12.4           | 24       | -10.5        |                 |          |          |
| -7.0         | -10.3    | -15.2           | 28       | -13.3    | -14.1           | 26       | -12.2    | -14.0           | 26           | -12.1    | -13.5           | 25       | -11.6        |                 |          |          |
| -8.0         | -11.3    | -16.5           | 29       | -14.6    | -15.3           | 28       | -13.4    | -15.2           | 28           | -13.3    | -14.7           | 27       | -12.9        |                 |          |          |
| -9.0         | -12.3    | -18.0           | 31       | -16.1    | -16.6           | 29       | -14.7    | -16.5           | 29           | -14.6    | -16.1           | 29       | -14.2        |                 |          |          |
| -10.0        | -13.3    | -               | -        | -        | -               | -        | -        | -               | -            | -        | -               | -        | -            |                 |          |          |

# 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 Diagnostics 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 Diagnostics 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>.

mation 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 28.

## Diagnostic Types

**Warning Only - Reset Not Required (IFW)** - *This type of diagnostic, also known as an Informational Warning diagnostic, suggests that while the condition is not normal, it is not 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 Required (MMR)** - *This type of diagnostic, also known as Machine Shutdown or Manual Reset, causes either an immediate or "friendly" 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” 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     |
| [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 Clear Active Diagnostics |
| And Shut Down / 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.

Table 11 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 11 - 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.<br>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.<br>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.<br>b. 6-10 seconds of continuous flow shall clear this diagnostic.<br>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 set up 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 set up 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 Refrigerant 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-IFW Brd 5V Range               | 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         |

| Diagnostic Description                                                        | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                                                                          | Help Message                             |
|-------------------------------------------------------------------------------|-----------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Chiller Mod Ref Voltage Calibration                                           | IFW             | N/A             | An improper reference voltage was detected at the Chiller 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.                                                                                                        | Check Chiller Module Voltages            |
| Compressor 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).<br>b. Applies only to Solid State Starters                                                                                                                         | Check Starter Setup & Bypass Aux Contact |
| Compressor 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.<br>b. The clear language display setups defined “Shutdown” as the action when the Maximum Acceleration Timer was exceeded.                                                                                                                                        | Check Main Power Supply & Wiring         |
| Compressor 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.<br>b. The clear language display setups defined “Transition or Bypass” as the action when the Maximum Acceleration Timer was exceeded.                                                                                                                            | See Troubleshooting Service Bulletin     |
| Condenser Refrigerant Temp Sensor                                             | MMR             | Friendly        | Open or Short.                                                                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & Connections       |
| Condenser Entering Wtr Temp Sensor                                            | IFW             | N/A             | Open or Short.                                                                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & Connections       |
| Condenser Leaving Wtr Temp Sensor                                             | IFW             | N/A             | Open or Short.                                                                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & 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.                                                                                                                                                                                                                                                                                           | Check Pump, Valves, Flow Switch          |
| Condenser Water Flow Lost                                                     | MAR             | Friendly        | a. The Chilled Water Flow switch input was open for more than 6-10 continuous seconds.<br>b. 6-10 seconds of continuous flow shall clear this diagnostic.<br>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 Set Points 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 timeout.) 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                   |

| Diagnostic Description                | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                         | Help Message                                 |
|---------------------------------------|-----------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 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 & 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.<br>Design: With input filtering and IPC delay, this will approach 2 seconds.                                                                                                                    | Check Emergency Stop Input Device            |
| Evaporator Entering Water Temp Sensor | IFW             | N/A             | Open or Short<br>a. Normal operation, no effects on control.<br>b. Chilled Water Reset; will just run at either normal CWS or will run at maximum reset permitted.                                                                                                                                                                            | Check Sensor, Wiring & Connections           |
| Evaporator Leaving Water Temp Sensor  | MMR             | Friendly        | Open or Short                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & Connections           |
| Evaporator Liquid Level Sensor        | MMR             | Friendly        | Open or Short                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & Stepper Module        |
| Evaporator Refrigerant Temp Sensor    | MMR             | Friendly        | Open or Short                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & 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.                                                                                                                                                                                                                                        | Check Pump, Valves, Flow Switch              |
| External Chilled Water Set Point      | IFW-AR          | N/A             | a. Function Not "Enabled": no diagnostics.<br>b. "Enabled" Out-Of-Range Low or Hi; set diagnostic, default CWS to next level of priority (e.g. Front Panel Set Point). This IFW diagnostic will automatically reset if the input returns to the normal range.                                                                                 | Check Signal At Input                        |
| External Current Limit Set Point      | IFW-AR          | N/A             | a. Not "Enabled" : no diagnostics.<br>b. Enabled Out-Of-Range Low or Hi; set diagnostic, default CLS to next level of priority (e.g. Front Panel Set Point). 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. Motor or wiring failures that occur during operation cannot be prevented from causing further module damage, but 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         |



| Diagnostic Description               | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                                                     | Help Message                                                                                |
|--------------------------------------|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| High Compressor Discharge Temp       | MMR             | Immediate       | a. The discharge temp. exceeded 88°C +/- 2.8°C<br>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).<br>c. Immediate shutdown is preferred over friendly because unloading the compressor will generally increase the discharge temperature. | See Troubleshooting Service Bulletin                                                        |
| High Diff Refrigerant Pressure       | MMR             | Friendly        | a. The difference between the condenser pressure and the evaporator pressure exceeded 110 kpa for 0.8-5.0 seconds. 1050 kpa must hold, 10.5+ 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, Strp Module & Refrigerant Charge                                         |
| High Pressure Cutout Tripped         | MMR             | Immediate       | A high pressure cutout was detected. C.O. on rise @ 125 kpa, reset at 930 kpa (~ 1250 kpa on switching tolerance)                                                                                                                                                                                                                                                         | 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.                                                                                                                                                                                |                                                                                             |
| 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.                                                                                                                                                                                |                                                                                             |
| 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 for.                                                                                                                                                                            |                                                                                             |
| Loss of Oil at Compressor (Running)  | MMR             |                 | In Running modes, Oil sensor detects lack of oil in line for 510 continuous seconds (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 prestart mode. Note : Compressor start is delayed (up to an additional 90 sec) from the normal 30 sec of prestart, 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             | The chilled water temperature fell below the cutout Set Point. Automatic Reset of the IFW diag shall occur 1.1°C above the cutout Set Point.                                                                                                                                                                                                                              | Check Flow Sensor & Wiring                                                                  |

| Diagnostic Description                  | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                                                                                                     | Help Message                                                                                          |
|-----------------------------------------|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Low Chilled Water Temp Unit On          | MAR             | Friendly        | The chilled water temp. fell below the cutout Set Point. Automatic Reset of the MAR diag shall occur 1.1 °C above the cutout Set Point.                                                                                                                                                                                                                                                                                   | Check Flow Sensor & Wiring                                                                            |
| Low Differential Refrigerant Pressure   | MMR             | Friendly        | A low differential temperature/pressure condition was detected that lasted for more than 600 continuous seconds. The trip point is 165 KPa.                                                                                                                                                                                                                                                                               | See Troubleshooting Service Bulletin                                                                  |
| Low Discharge Superheat                 | MMR             | Friendly        | a. While running normally, the Discharge Superheat was less than 6.5°C. The Must Hold value is 7°C while the Must Integrate value is 6°C<br>b. At start-up the UCP2™ shall ignore the Discharge Superheat for a minimum of 5 minutes and a maximum of 5.5 minutes. This timer should be reset every time the chiller starts up. Discharge Superheat shall be monitored only while the chiller is in any of the Run modes. | See Troubleshooting Service Bulletin                                                                  |
| Low Evaporator Liquid Level Refrigerant | IFW             | N/A             | 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, Strp Module & Charge                                                                |
| Low Evap Refrigerant Temp               | MMR             | Immediate       | The Saturated Evaporator Refrigerant Temperature dropped below the Low Refrigerant Temperature Cutout Set Point.                                                                                                                                                                                                                                                                                                          | Check Operation, Call Service                                                                         |
| Low Oil Flow                            | MMR             | MMR             | The Oil Flow pressure switch detects no flow (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. On fall @ 0.2 bar, reset @ 1.2 bar. The LPC is set primarily to detect significant charge loss and thus “ignore times” at start-up are not required; (The Saturated Evaporator Temperature 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 Set Points 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 EPROM. 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                                                                    |

| Diagnostic Description              | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Help Message                                                                                                                                         |
|-------------------------------------|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Memory Error<br>Type II: Shadow RAM | IFW             | N/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                                                                                                                                |
| Memory Error<br>Type III            | IFW             | N/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<br>Type I: NOVRAM      | MMR             | Friendly        | 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.<br>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 6375 msec (prior to Centravac Upgrade 4: approx. 3 half line cycles), the timer interrupt will trip and generate a diagnostic that indicates that our ability to detect MPL is gone. If Vab was truly gone the module would be powered down so if we can detect that Vab is gone then there must be a hardware failure on the board.                                                                                                | See Troubleshooting Service Bulletin                                                                                                                 |
| 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                                                                                                                        |

| Diagnostic Description                               | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                                                                                               | Help Message                         |
|------------------------------------------------------|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Options Module Off Board 5V Range                    | IFW             | N/A             | An improper Off Board 5v voltage was detected at the Options module. A 5Vdc is used for Offboard 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<br>a. Use end of range value (whatever value the Open or Short gives).<br>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<br>Display end of range value. idashes U ~V).                                                                                                                                                                                                                                                                                                                                                         | N/A                                  |
| Over Voltage                                         | MAR             | Friendly        | 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.)<br>Design: Nom. Trip: 60 seconds at greater than 112.5%, Auto Reset at 109% or less.                                                                                                  | Check Main Power Supply & Wiring     |
| Phase Loss                                           | MMR             | Immediate       | 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 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 seconds from compressor start.                                                                                                                                                                                                                                    | Check Main Power Supply & Wiring     |
| Phase Reversal Protection Lost                       | MMR             | Immediate       | 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 Sequence 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. | See Troubleshooting Service Bulletin |
| Refrigerant Monitor Auxiliary Alarm                  | IFW             | N/A             | The Refrigerant monitor auxiliary input signal indicates an alarm condition.                                                                                                                                                                                                                                                                                                                                        | N/A                                  |

| Diagnostic Description                        | Diagnostic Type | Shutdown Action | Cause                                                                                                                           | Help Message                            |
|-----------------------------------------------|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Refrigerant Monitor Auxillary Input Error     | IFW             | N/A             | The Refrigerant monitor auxiliary input is outside the 4-20 mA range.                                                           | Check Signal At Input                   |
| Refrigerant Monitor Bench Flow Loss           | IFW             | N/A             | Air flow loss to the Refrigerant monitor optical bench.<br>a. IFW to the chiller, MMR/MAR to the Refrigerant monitor.           | See Refrigerant Monitor IOM Manual      |
| Refrigerant Monitor Calibration Error         | IFW             | N/A             | The Refrigerant monitor calibration failed.<br>IFW to the chiller, IFW to the Refrigerant monitor.                              | See Refrigerant Monitor IOM Manual      |
| Refrigerant Monitor Chopper                   | IFW             | N/A             | Refrigerant monitor optical bench photo-interrupter failure.<br>IFW to the chiller, MAR to the Refrigerant Monitor.             | Check Chopper Wiring & Connections      |
| Refrigerant 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      |
| Refrigerant Monitor Fault                     | IFW             | N/A             | A undefined diagnostic detected by the Refrigerant monitor.<br>IFW to the chiller, MMR to the Refrigerant monitor.              | See Refrigerant Monitor IOM Manual      |
| Refrigerant Monitor IR Source                 | IFW             | N/A             | Refrigerant monitor infrared optical source failure.<br>IFW to the chiller, MAR to the Refrigerant monitor.                     | Check IR Source Wiring & Connections    |
| Refrigerant Monitor Level 3 Refrigerant Alarm | IFW             | N/A             | The Refrigerant monitor has read a refrigerant concentration greater or equal to the level 3 Set Point.                         | N/A                                     |
| Refrigerant Monitor Level 2 Refrigerant Alarm | IFW             | N/A             | The Refrigerant monitor has read a refrigerant concentration greater or equal to the level 2 Set Point.                         | N/A                                     |
| Refrigerant Monitor Level 1 Refrigerant Alarm | IFW             | N/A             | The Refrigerant monitor has read a refrigerant concentration greater or equal to the level 1 Set Point.                         | N/A                                     |
| Refrigerant Monitor Memory Lost               | IFW             | N/A             | Refrigerant monitor lost battery backed-up RAM.<br>IFW to the chiller, MMR/MAR to the Refrigerant monitor.                      | See Refrigerant Monitor IOM Manual      |
| Refrigerant Monitor Out Of Temp Range         | IFW             | N/A             | Out of temperature range for measuring refrigerant concentration.                                                               | Check Bench Heater, Wiring, Connections |
| Refrigerant Monitor Refired Level Too Low     | IFW             | N/A             | The Refrigerant monitor read less than or equal to -5 ppm refrigerant concentration.                                            | Recalibrate Refrigerant Monitor         |
| Refrigerant Monitor Scanner Flow Loss         | IFW             | N/A             | Air flow loss to the Refrigerant Monitor scanner.<br>IFW to the chiller, MMR/MAR to the Refrigerant monitor.                    | See Refrigerant Monitor IOM Manual      |

| Diagnostic Description               | Diagnostic Type | Shutdown Action         | Cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Help Message                                   |
|--------------------------------------|-----------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Refrigerant Monitor Sensor           | IFW-AR          | N/A                     | Open or shorted input and the Refrigerant monitor is set up as installed at the Clear Language Display.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Check Sensor, Wiring & Connections             |
| Refrigerant Monitor Temp Sensor      | IFW             | N/A                     | Refrigerant monitor bench temperature sensor failure. IFW to the chiller, MAR to the Refrigerant Monitor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Check Sensor, Wiring & Connections             |
| Severe Phase Unbalance               | MMR             | Friendly                | 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 Relay 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 evaporator and condenser 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.<br>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 the main contactor is closed first and a check is made to ensure that there are no currents detected by the CTs. If currents are detected when only the main contactor is closed first at start, then one of the other contactors is shorted.<br>b. This test applies only to factory installed Y-Delta Closed Transition starters.                                                                                                                                                                                                                              | See Troubleshooting Service Bulletin           |
| Starter Fault Type II                | MMR             | Immediate               | a. This is a specific starter test where the Shorting Contactor is individually energized and a check is made to ensure that there are no currents detected by the CTs. If current is detected when only S is energized at Start, then the main contactor is shorted.<br>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           |

| Diagnostic Description              | Diagnostic Type | Shutdown Action | Cause                                                                                                                                                                                                                                                                                                                                                                                                                                         | Help Message                           |
|-------------------------------------|-----------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Starter Fault<br><br>Type III       | MMR             | Immediate       | a. The Shorting Contactor and then the Main Contactor were energized as part of the normal start sequence to apply power to the compressor. 1.6 seconds later there were no currents detected by the CTs for the last 1.2 seconds on all three phases.<br>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 set up as Uninstalled 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 Set Points/Mode.                                                                                                                                                                                                            | Check Tracer to UCP Wiring/Connections |
| Tracer Failed To Establish Comm     | IFW             | N/A             | The Tracer was set up as Uninstalled at the CLD, and the Tracer did not communicate with the TCI within 2 minutes after power-up.                                                                                                                                                                                                                                                                                                             | Check Tracer Wiring/Connections/Power  |



| Diagnostic Description                     | Diagnostic Type | Shutdown Action       | Cause                                                                                                                                                                                                                                                                                                                                                                                         | Help Message                       |
|--------------------------------------------|-----------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Tracer Outdoor Air Temperature 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 & Connections |
| Tracer Temperature Sensor                  | IFW             | N/A                   | Input shorted.                                                                                                                                                                                                                                                                                                                                                                                | Check Sensor, Wiring & Connections |
| Transition Complete Input Shorted          | MMR             | N/A                   | a. The Transition Complete input was found to be shorted before the compressor was started.<br>b. This is active for all electromechanical starters.                                                                                                                                                                                                                                          | Check Transition Complete Contact  |
| Transition Complete Input Opened           | MMR             | Immediate<br>Friendly | a. The Transition Complete input was found to be opened with the compressor motor running after a successful completion of transition.<br>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 = minimum of 2% and max. of 4%. Time To Trip = minimum of 1 minute and max. of 5 min.)<br>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     |

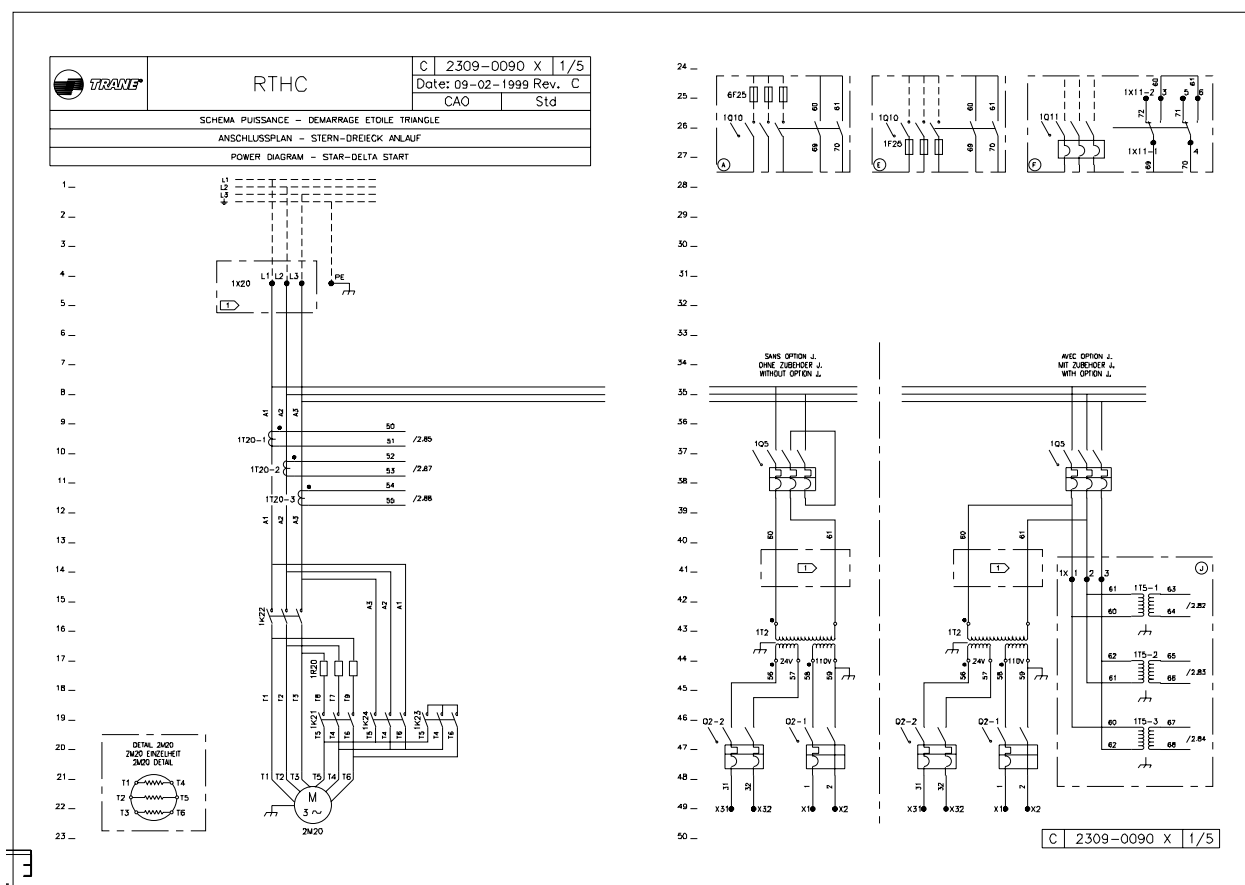
# Unit Wiring

## General

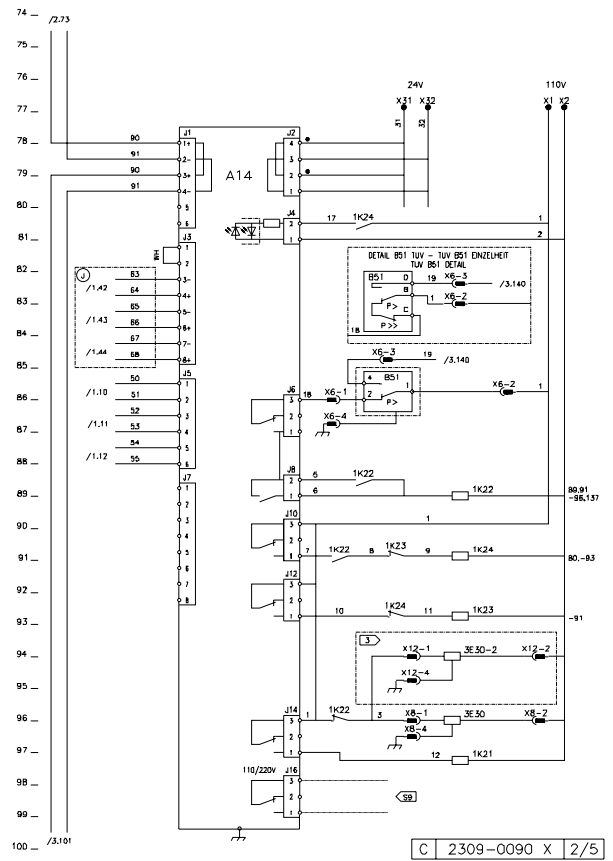
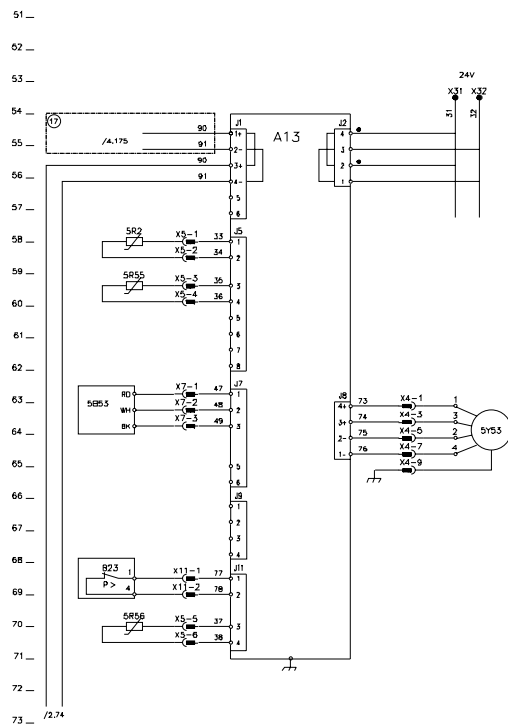
Typical field connection diagrams, electrical schematics and connection diagrams for RTHC units of "A" design sequence are shown on the following pages.

**Note :** The typical wiring diagrams in this manual are provided only for general reference. These diagrams may not reflect the actual wiring of your unit. For specific electrical connection and schematic information, always refer to the wiring diagrams which were shipped with your unit.

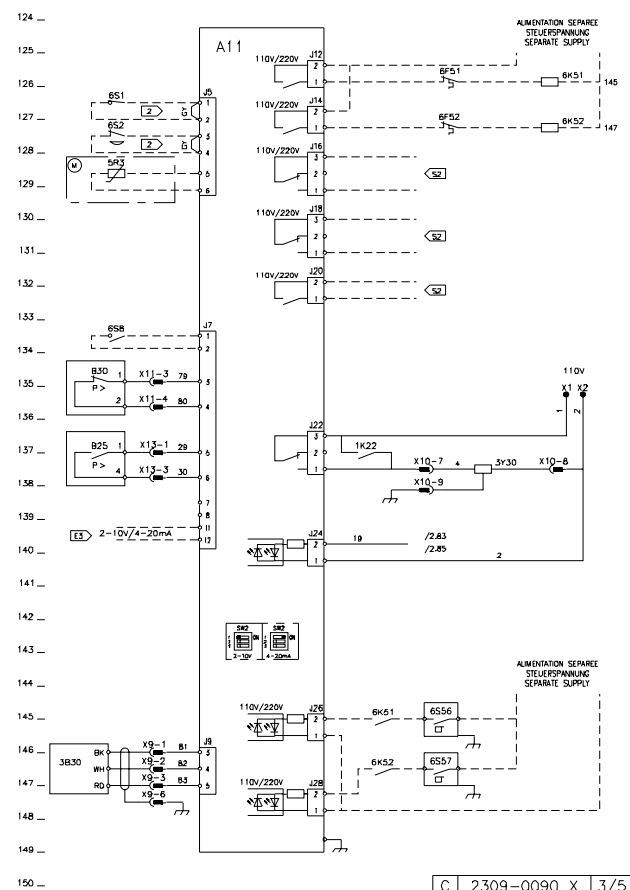
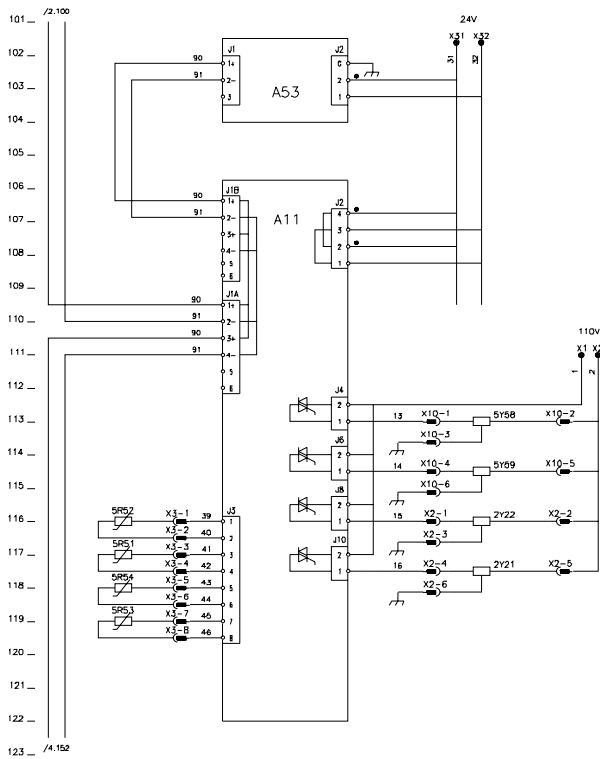
Figure 24



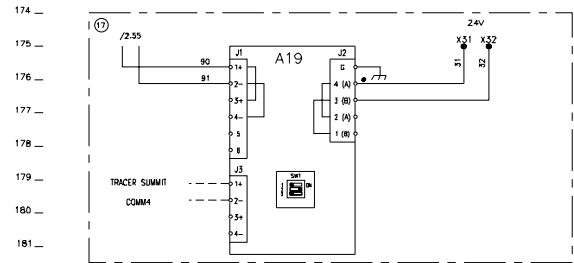
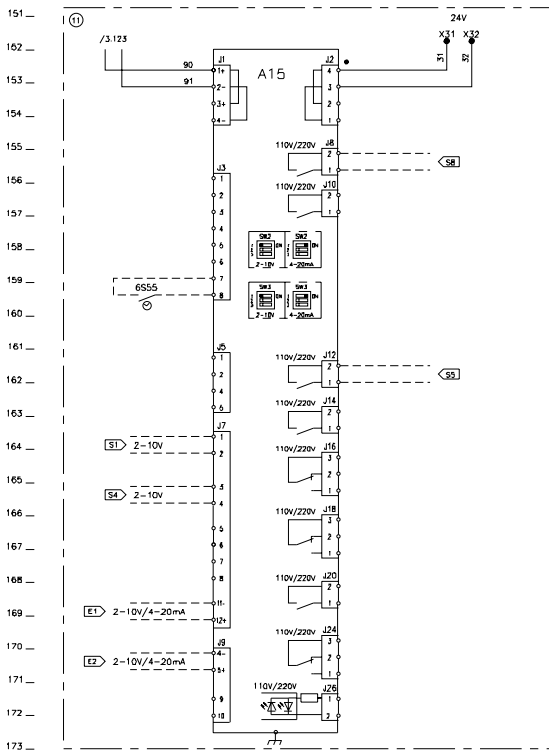
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|-----------------------------------------------------------------------------------|------------------------------|-------------------------|
|  | RTHC                         | C 2309-0090 X 2/5       |
|                                                                                   |                              | Date: 09-02-1999 Rev. C |
|                                                                                   | SCHEMA ELECTRIQUE CONTRÔLE   | CAO Std                 |
|                                                                                   | VERDRÄHTUNGSSCHEMA STEUERUNG |                         |
|                                                                                   | CONTROL WIRING DIAGRAM       |                         |



|                                                                                   |      |                         |     |
|-----------------------------------------------------------------------------------|------|-------------------------|-----|
|  | RTHC | C 2309-0090 X 3/5       |     |
|                                                                                   |      | Date: 09-02-1999 Rev. C |     |
|                                                                                   |      | CAO                     | Std |
|                                                                                   |      |                         |     |
| SCHEMA ELECTRIQUE CONTROLE                                                        |      |                         |     |
| VERDRAHTUNGSSCHEMA STEUERUNG                                                      |      |                         |     |
| CONTROL WIRING DIAGRAM                                                            |      |                         |     |



|                                                                                   |      |                         |
|-----------------------------------------------------------------------------------|------|-------------------------|
|  | RTHC | C 2309-0090 X 4/5       |
|                                                                                   |      | Date: 09-02-1999 Rev. C |
|                                                                                   |      | CAO Std                 |
| SCHEMA ELECTRIQUE CONTROLE                                                        |      |                         |
| VERDRÄHTUNGSSCHEMA STEUERUNG                                                      |      |                         |
| CONTROL WIRING DIAGRAM                                                            |      |                         |



|                                                                                   |      |                         |
|-----------------------------------------------------------------------------------|------|-------------------------|
|  | RTHC | C 2309-0090 X 5/5       |
|                                                                                   |      | Date: 09-02-1999 Rev. C |
|                                                                                   |      | CAO Std                 |
| NOMENCLATURE                                                                      |      |                         |
| LEGENDE                                                                           |      |                         |
| COMPONENTS DESIGNATION                                                            |      |                         |

| ITEM | OPTIONS                           | ZUBEHOER                        | OPTIONS                        |
|------|-----------------------------------|---------------------------------|--------------------------------|
| (A)  | INTERRUPTEUR-SECTIONNEUR          | HAUPTSCHALTER                   | DISCONNECT SWITCH              |
| (E)  | INTERRUPTEUR-SECTIONNEUR FUSIBLES | HAUPTSCHALTER                   | FUSES DISCONNECT SWITCH        |
| (O)  | DISJONCTEUR                       | SCHUTZSCHALTER                  | CIRCUIT BREAKER                |
| (T)  | TRANSFO. DE SUR/SOUS TENSION      | UEBER/UNTERSCHANNUNGSTRANSFO.   | OVER/UNDER VOLTAGE TRANSFO.    |
| (M)  | SONDE TEMPERATURE AIR EXTERIEUR   | TEMPERATUR SENSOR UMGEBUNDSLUFT | OUTDOOR TEMPERATURE AIR SENSOR |
| (I)  | MODULE OPTION                     | OPTIONALES MODUL                | OPTION MODULE                  |
| (C)  | TRACER SUMMIT COMMA4              | TRACER SUMMIT COMMA4            | TRACER SUMMIT COMMA4           |

| ITEM     | FRANCAIS                           | DEUTSCH                              | ENGLISH                            |
|----------|------------------------------------|--------------------------------------|------------------------------------|
| A11      | MODULE REFRIGERISSEUR              | MODUL KUEHLUNG MASCHINE              | CHILLER MODULE                     |
| A13      | MODULE MOTEUR PAS A PAS            | SCHRITTMODUL                         | STEPPER MODULE                     |
| A14      | MODULE DEMARREUR                   | STARTER MODUL                        | STARTER MODULE                     |
| A15      | MODULE OPTION                      | OPTIONALES MODUL                     | OPTION MODULE                      |
| A19      | INTERFACE TRACER SUMMIT COMMA4     | TRACER SCHNITTSTELLE SUMMIT COMMA4   | TRACER INTERFACE SUMMIT COMMA4     |
| A53      | INTERFACE UTILISATEUR LOCAL        | LOKALE MENSCH/MASCHINE SCHNITTSTELLE | LOCAL HUMAN INTERFACE              |
| B23      | PRESSOSTAT BASSE PRESSION          | DRUCKSCHALTER NIEDERDRUCK            | LOW PRESSURE CONTROL               |
| B25      | PRESSOSTAT DIFFERENTIEL HP/LP      | HP/LP DIFFERENZDRUCKSCHALTER         | HP/LP DIFFERENTIAL CONTROL         |
| B30      | PRESSOSTAT D'HUILE                 | DRUCKSCHALTER OEL                    | OIL PRESSURE CONTROL               |
| B51      | PRESSOSTAT HAUTE PRESSION          | DRUCKSCHALTER HOCHDRUCK              | HIGH PRESSURE CONTROL              |
| C2       | DISJONCTEUR                        | SCHUTZSCHALTER                       | CIRCUIT BREAKER                    |
| X...     | BORNE CONTROLE                     | KLEMMEN, STEUERUNG                   | CONTROL TERMINAL BLOCK             |
| I25      | FUSIBLE COMPRESSEUR                | SICHERUNG, VERDICHTER                | COMPRESSOR FUSE                    |
| 1K21     | CONTACTEUR TRANSITION COMPR.       | SCHUTZ, UEBERGANG VERDICHTER         | COMPRES. TRANSITION CONTACTOR      |
| 1K22     | CONTACTEUR MARCHÉ COMPRESSEUR      | SCHUTZ, BETRIEB VERDICHTER           | COMPRESSOR RUN CONTACTOR           |
| 1K23     | CONTACTEUR ETIOLE COMPRESSEUR      | SCHUTZ, STERN VERDICHTER             | STAR COMPRESSOR CONTACTOR          |
| 1K24     | CONTACTEUR TRIANGLE COMPR.         | SCHUTZ DREIECK VERDICHTER            | DELTA COMPRESSOR CONTACTOR         |
| 1G5      | DISJONCTEUR                        | SCHUTZSCHALTER                       | CIRCUIT BREAKER                    |
| 1Q10     | INTERRUPTEUR SECTIONNEUR UNITE     | TRENNER MASCHINE                     | DISCONNECT SWITCH                  |
| 1Q11     | DISJONCTEUR                        | SCHUTZSCHALTER                       | CIRCUIT BREAKER                    |
| 1R20     | RESISTANCE DE TRANSITION           | WIDERSTAND UEBERGANG                 | TRANSITION RESISTOR                |
| 1T2-5    | TRANSFORMATEUR                     | TRANSFORMATOR                        | TRANSFORMER                        |
| 1T20     | TRANSFORMATEUR D'INTENSITE         | STROMWANDLER                         | CURRENT TRANSFORMER                |
| 1X, 1X11 | BORNE CONTROLE                     | KLEMMEN, STEUERUNG                   | CONTROL TERMINAL BLOCK             |
| 1X20     | BORNIER PUISSANCE COMPRESSEUR      | KLEMMEN, KRAFTSTROM, VERDICHTER      | COMP. POWER CIRCUIT TERM. STRIP    |
| 2M20     | MOTEUR COMPRESSEUR                 | MOTOR, VERDICHTER                    | COMPRESSOR MOTOR                   |
| 2V21     | ELECTROVANNE DECHARGE COMPR.       | MAGNETVENTIL, LEISTUNGSREG           | COMPRESSOR UNLOAD SOLENOID VALVE   |
| 2V22     | ELECTROVANNE CHARGE COMPRESSEUR    | MAGNETVENTIL, LEISTUNGSREG           | COMPRESSOR LOAD SOLENOID VALVE     |
| 5B30     | CONTROL. PRESSION D'HUILE          | ÖLSTANDSKONTROLLE                    | OIL CONTROL                        |
| 3E30     | RESISTANCE CHAUFFAGE HUILE         | ÖLHEIZUNG, VERDICHTER                | COMPRESSOR OIL HEATER              |
| 3Y30     | ELECTROVANNE CIRCUIT HUILE         | MAGNETVENTIL, ÖLKREIS                | OIL LINE SOLENOID VALVE            |
| 5A53     | CONTROL. NIVEAU REFRIGERANT E.V.P. | VERD. NIVEAUMITTEL NIVEAU SENSOR     | E.V.P. REFRIGERANT LEVEL CONTROL   |
| 5B2      | SONDE PROTECTION ANTIGEL           | FUEHLER, FROSTSCHUTZ                 | FREEZE PROTECTION SENSOR           |
| 5B3      | SONDE TEMPERATURE AIR EXTERIEUR    | FUEHLER, UMGEBUNDSLUFT               | OUTDOOR TEMPERATURE AIR SENSOR     |
| 5B51     | SONDE TEMP. SORTIE EAU E.V.P.      | FUEHLER, WASSERAUSSTRIIT VERD.       | LEAVING E.V.P. WATER TEMP. SENSOR  |
| 5B52     | SONDE TEMP. ENTREE D'EAU E.V.P.    | FUEHLER, WASSERAUSSTRIIT VERD.       | ENTERING E.V.P. WATER TEMP. SENSOR |
| 5B53     | SONDE TEMP. SORTIE EAU CDS         | FUEHLER, WASSERAUSSTRIIT VERD.       | LEAVING CDS WATER TEMP. SENSOR     |
| 5B54     | SONDE TEMP. ENTREE EAU CDS         | FUEHLER, WASSERAUSSTRIIT VERD.       | ENTERING CDS WATER TEMP. SENSOR    |
| 5B55     | SONDE TEMP. REFROIDISSEMENT        | FUEHLER, KUEHLSTEMP.                 | DISCHARGE TEMPERATURE SENSOR       |
| 6B56     | SONDE TEMP. SATURÉE CONDENSEUR     | FUEHLER, VERFLUESSIGER TEMP.         | SAT. CDS REFRIG. TEMP. SENSOR      |
| 5V53     | VANNE DE DETENTE ELECTRONIQUE      | ELEKTRONISCHES EXPANSIONVENTIL       | ELECTRONIC EXPANSION VALVE         |
| 5V58     | ELECTROVANNE DE REPLESSAGE         | MAGNETVENTIL, FUELLEN                | FILL SOLENOID VALVE                |
| 5V59     | ELECTROVANNE DE VIDANGE            | MAGNETVENTIL, ABLASSEN               | DRAIN SOLENOID VALVE               |
| 6F26     | FUSIBLE COMPRESSEUR                | SICHERUNG, VERDICHTER                | COMPRESSOR FUSE                    |
| 6T51     | RELAS THERMIQUE POMPE A EAU        | UEBERSTROMUNGSSCHUTZ, WASSER PUMPE   | WATER PUMP OVERLOAD RELAY          |
| 6K51     | CONTACTEUR POMPE A EAU A.V.P.      | SCHUTZ, WASSERPUMPE, VERDAMPFER      | CHILLED WATER PUMP CONTACTOR       |
| 6K52     | CONTACTEUR POMPE A EAU CDS         | SCHUTZ, WASSERPUMPE, VERFLUESS       | CONDENSOR WATER PUMP CONTACTOR     |
| 6S1      | INTERRUPTEUR M/A UNITE             | SCHALTER, EN/AUS MASCHINE            | ON/OFF SWITCH UNIT                 |
| 6S2      | ARRET D'URGENCE UNITE              | NOTSCHALTER-AUS                      | UNIT EMERGENCY STOP                |
| 6S8      | INTERRUPTEUR M/A "BASE LOAD"       | SCHALTER EN/AUS "BASE LOAD"          | BASE LOAD ENABLE/DISABLE SWITCH    |
| 6S55     | FONCTIONNEMENT STOCKAGE DE GLACE   | EISPEICHERBETRIEB                    | ICE MAKING ENABLE                  |
| 6S56     | INTERRUPTEUR DEBIT D'EAU E.V.P.    | STROMMESSWAECHTER VERD.              | E.V.P. WATER FLOW SWITCH           |
| 6S57     | INTERRUPTEUR DEBIT D'EAU CDS       | STROMMESSWAECHTER VERFLUESSIGER      | CDS, WATER FLOW SWITCH             |

NOTES - BEACHTEN:

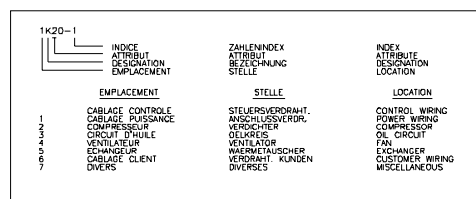
- [1] VOIR DETAIL SI OPTION A, E, OU F MONTÉE - SIEHE EINZELHEUT, WEENN OPTION A, E ODER F MONTERT IST - SEE DETAIL IF OPTION A, E OR F MOUNTED.
- [2] SUPPRIMER CE PONAGE POUR L'UTILISATION DE CETTE ENTREE - ENTFERNEN DIESEN JUMPER, WEENN DIESE EINGANG BELEGT IST - REMOVE THIS JUMPER WHEN USING THIS ENTRY.
- [3] SÉLECTION POUR - NUR FÜR - ONLY FÜR RTHC D1 7A8L 02 7B8L 03 7B8L 03 8C4L 03 8A4L 03 8B8L 03 8A4L

SORTIES MODULES POUR RACCORDEMENT CLIENT - MODULAUSGANG KUNDE - CUSTOMER OUTPUT:

- [51] INFORMATION PRESSION CONDENSEUR - INFO VERFLUESSIGERDRUCK - CONDENSING PRESSURE INFORMATION.
- [52] RELAS PROGRAMMABLE - FUNKTION DES RELAS PROGRAMMIERBAR - PROGRAMMABLE RELAY.
- [54] INFORMATION RLA COMPRESSEUR - INFORMATION VERLUESSIGER IN BETRIEB - RLA COMPRESSOR INFORMATION.
- [55] ALARME VE CONDENSEUR - KÜHLMITTEL VERFLUESSIGER ALARM - HEAD PRESSURE RELAY ALARM REQUIRED.
- [58] RELAS ICE MAKING - RELAS KUEHLBETRIEB - ICE MAKING RELAY.
- [59] DEFUIT D'ALARME ETIOLE-TRIANGLE - STERN/DRUCK STÖRUNG RELAY - SHUNT TRIP RELAY.

ENTREES MODULES POUR RACCORDEMENT CLIENT - MODULEINGANG KUNDE - CUSTOMER INPUT:

- [E1] POINT DE CONDENSE EXTERNE IF INTENSITE - SOILNERT EXT. STROMREGELUNG - EXTERNAL CURRENT LIMIT SETPOINT.
- [E2] POINT DE CONDENSE EXTERNE EAU FROIDE - SOILNERT EXT. KALTWASSERTEMP. - EXTERNAL CHILLED WATER SETPOINT.
- [E3] POINT DE CONDENSE "EXTERNAL BASE LOADING" - SOILNERT "EXTERNAL BASE LOADING" - EXTERNAL BASE LOADING SETPOINT.



|                |                          |                 |
|----------------|--------------------------|-----------------|
| CABLAGE TRANE  | TRANE VERDRÄHTUNG        | TRANE WIRING    |
| CABLAGE CLIENT | VERDRÄHTUNG DURCH KUNDEN | CUSTOMER WIRING |

C 2309-0090 X 5/5



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Literature Number: **B21 IM 002 GB**

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Date: 23 February 2000

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Supersedes B21 IM 002

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Stocking Location: La Crosse

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*Since The Trane Company has a policy of continuous product improvement, it reserves the right to change design and specifications without notice.*

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