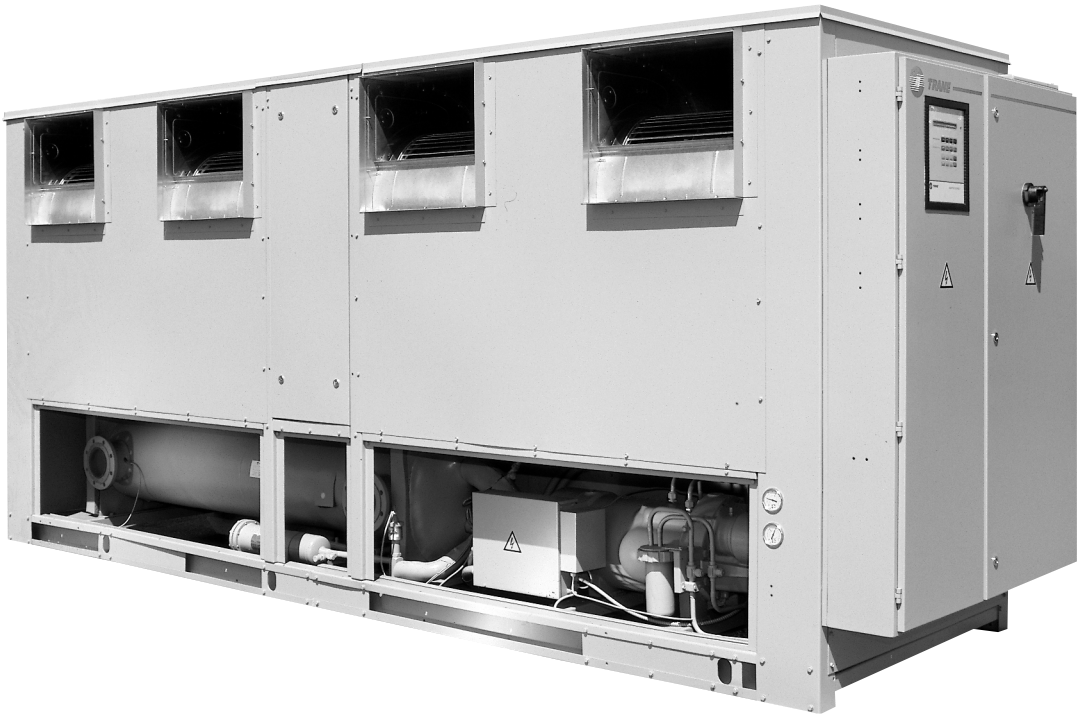
RTRA

Screw compressor liquid chillers with centrifugal fans, air cooled

Installation
Operation
Maintenance

Sizes : 107 - 108 - 109 - 110



This manual should be used jointly with the manual of the UCM-CLD reference L80 IM 025 E

Quality Management System Approval

D20 IM 001 GB

RTRA Screw compressor liquid chillers with centrifugal fans, air cooled

Foreword

These Installation Operation and Maintenance instructions are given as a guide to good practice in the installation, start-up, operation and periodic maintenance by the user of RTRA.

They do not contain the full service procedures necessary for the continued successful operation of this equipment. The services of a qualified service technician should be employed, through the medium of a maintenance contract with a reputable service company.

Warranty

Warranty is based on the general terms and conditions of the constructor. The warranty is void if the equipment is modified or repaired without the written approval of the constructor, if the operating limits are exceeded, or if the control system or the electrical wiring is modified.

Damage due to misuse, lack of maintenance, or failure to comply with the manufacturer's instructions, is not covered by the warranty obligation.
If the user does not conform to the rules of chapter "Maintenance", it may entail cancellation of warranty and liabilities by the constructor.

Reception

On arrival, inspect the unit before signing the delivery note. Specify any damage on the delivery note, and send a registered letter of protest to the last carrier of the goods within 72 hours of delivery. Notify the local sales office at the same time.
The unit should be totally inspected within 7 days of delivery. If any concealed damage is discovered, send a registered letter of protest to the carrier within 7 days of delivery and notify the local sales office.
Units are shipped with the refrigerant operating or holding charge and should be examined with an electronic leak detector to determine the hermetic integrity of the unit. The refrigerant charge is not included in the standard Warranty Cover.

General information

About this manual

Cautions appear at appropriate places in this instruction manual. Your personal safety and the proper operation of this machine require that you follow them carefully.
The constructor assumes no liability for installations or servicing performed by unqualified personnel.

About the unit

These nom de l'unité units are assembled, pressure tested, dehydrated, charged and run tested before shipment.
The information contained in this manual applies to units designated RTRA.
RTRA units are designed to operate in cooling mode only, whereas RTRA can operate in cooling or heating modes.

Refrigerant

The refrigerant provided by the constructor meets all the requirements of our units. When using recycled or reprocessed refrigerant, it is advisable to ensure its quality is equivalent to that of a new refrigerant. For this, it is necessary to have a precise analysis made by a specialized laboratory. If this condition is not respected, the constructor warranty could be cancelled.

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General information

Unit inspection

When the unit is delivered, verify that it is the correct unit and that it is properly equipped. Compare the information which appears on the unit nameplate with the ordering and submittal information. Refer to «Nameplates».
Inspect all exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a «unit damage» notation on the carrier's delivery receipt. Specify the extent and type of damage found and notify the appropriate Trane Sales Office.
Do not proceed with installation of a damaged unit without sales office approval.

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

Notify the carrier's terminal of the damage immediate, joint inspection of the damage with the carrier and the consignee.
Notify the Trane sales representative and arrange for repair. Do not repair the unit, however, until damage is inspected by the carrier's representative.

Loose parts inventory

Check all the accessories and loose parts which are shipped with the unit against shipping list. Included in these items will be vessel drain plugs, rigging and electrical diagrams, and service literature, which are placed inside the control panel and/or starter panel for shipment.

Figure 1A - Typical RTRA unit

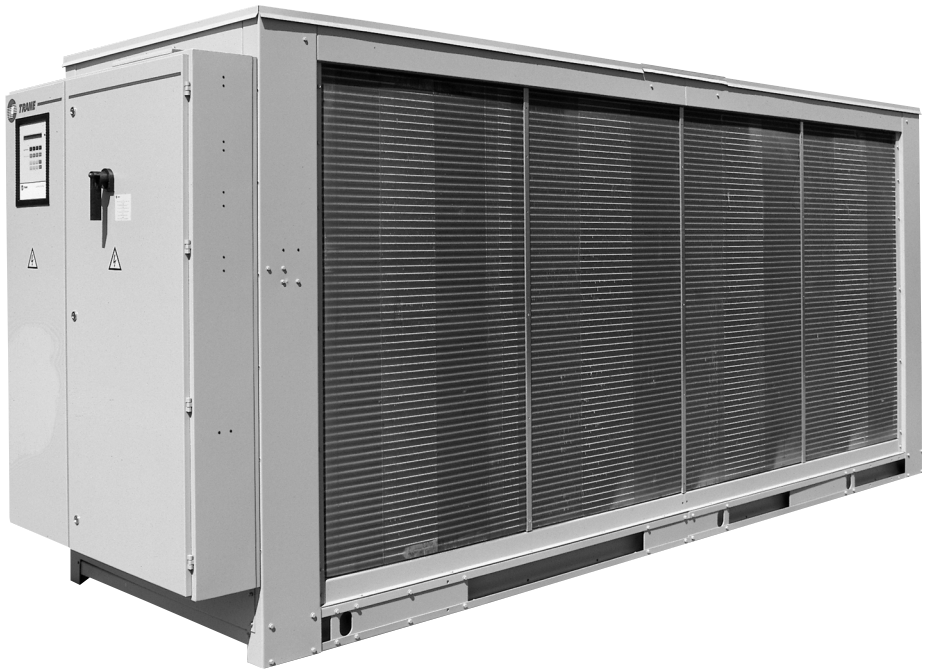


Figure 2 - Control panel

Warning : Panel or box signed by , enclosed parts under voltage. Their opening requires a special key and must be done by qualified engineers.

Figure 3 - Starter panel

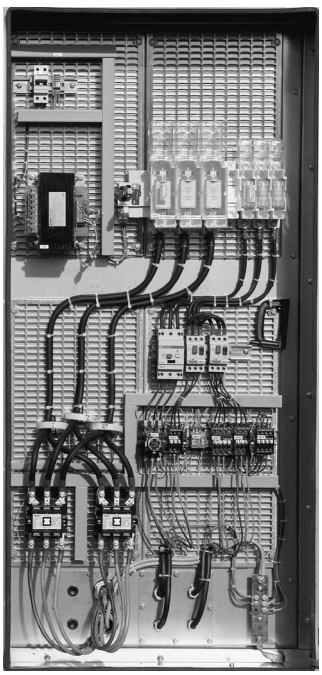


Table 1: General data

RTRA model		107	107 LF	108	108 LF	108 HE	109	109 LF	109 HE	110	110 LF	110 HE
Compressor size		CHHN60	CHHN60	CHHB70	CHHB70	CHHB70	CHHB85	CHHB85	CHHB85	CHHB100	CHHB100	CHHB100
Compressor max. amps	400/50/3 (A)	128	128	154	154	154	177	177	177	207	207	207
Comp. start amps part-winding	400/50/3 (A)	379	379	433	433	433	539	539	539	600	600	600
Comp. starting amps star-delta	400/50/3 (A)	186	186	211	211	211	264	264	264	307	307	307
Oil sump heater	(W)	150	150	150	150	150	150	150	150	150	150	150
Evap. heater cable (option)	(W)	200	200	200	200	200	200	200	200	200	200	200
Oil charge	(L)	8	8	16	16	16	16	16	16	16	16	16
R134a operating charge	(kg)	-	-	34	-	-	41	-	-	43	-	-
R22 operating charge	(kg)	33	33	34	41	41	41	54	54	43	56	56

Table 2 : Condenser fan motor selection

RTRA model	107	107 LF	108	108 LF	108 HE	109	109 LF	109 HE	110	110 LF	110 HE
Std ambient (+15°C / +40°C)	2 single speed motor										
Low ambient (+6°C / +40°C)	2 single speed motor				1 single speed motor + 1 two speed motor						
Extra low ambient (-18°C / +40°C)	1single speed motor + 1 single speed motor with speed controler										

Table 3 : Air flow

RTRA model		107	107 LF	108	108 LF	108 HE	109	109 LF	109 HE	110	110 LF	110 HE
R22 unit	(m3/s)	14.17	10.00	15.97	12.22	18.89	18.89	12.78	18.89	21.28	16.67	21.28
R134a unit	(m3/s)	-	-	14.17	-	-	16.55	-	-	18.89	-	-

Note : LF = Low Fan

HE = High Efficiency

The RTRA series features Trane's exclusive Adaptive Control logic, which monitors the control variables that govern the operation of the chiller unit. Adaptive Control logic can correct these variables, when necessary, to optimize operational effiencies, avoid chiller shutdown, and keep producing chilled water. An optional remote display is available to monitor unit operation from a remote location.
Compressor unloaders are solenoid actuated and oil pressure operated. Each refrigerant circuit its provided with an operating charge of refrigerant and oil, filter drier, electronic expansion valve, and charging valves.
The evaporator is fully insulated, has heat tape protection (option), and is equipped with water drain and vent connections.

Unit description

The RTRA units are on compressor, helical-rotary type, air-cooled liquid chillers designed for installation indoors. Compressor circuits are completely assembled hermetic packages that are factory-piped, wired, leak-tested, dehydrated, charged, and tested for proper control operation before shipment.
Figures 1 thru 3 show a typical RTRA unit and its components. Table 1 contains RTRA general data

Warnings and cautions

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

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

Cautions alert personnel to conditions that could result in equipment damage.

Your personal safety and reliable operation of this machine depend upon strict observance of these precautions. The Trane Company assumes no liability for installation or service procedures performed by unqualified personnel.

Installation

Installation responsibilities

Generally, the contractor must do the following when installing an RTRA units :

1. Install unit on a flat foundation, level (within 1/4" [6mm]), and strong enough to support unit loading.
2. Install unit per the instructions contained in the installation-mechanical and installation-electrical sections of this manual.
3. Install any optional sensors and make electrical connections at the UCM-CLD.

Note : The air ambient temperature sensor (6R3), has to be field installed. It should be set in the inlet condenser air flow.

4. Where specified, provide and install valves in water piping upstream and downstream of evaporator water connections to isolate the evaporator for maintenance, and to balance/trim system.
5. If desired, supply and install flow switches in the chilled water piping; interlock each switch proper pump starter to ensure unit can only operate if water flow is established. Chilled water protection is provided by the UCM-CLD without the need for a chilled water flow switch. A flow switch for chilled water is strictly discretionary.
6. Furnish and install pressure gauges in inlet and outlet pipings of the evaporator.
7. Furnish and install a drain valve to the bottom of the evaporator.
8. Install a strainer in the entering water line, to prevent water-born debris from entering the system.
9. Where specified, furnish and install strainers ahead of all pumps and automatic modulating valves.
10. Provide and install field wiring.
11. Start unit under supervision of a qualified service technician.
12. Install heat tape and insulate the chilled water lines and any other portions of the system, as required, to prevent sweating under normal operating conditions or freezing during low ambient temperature conditions.

Important : All relief valve venting is the responsibility of the installing contactor.

Nameplates

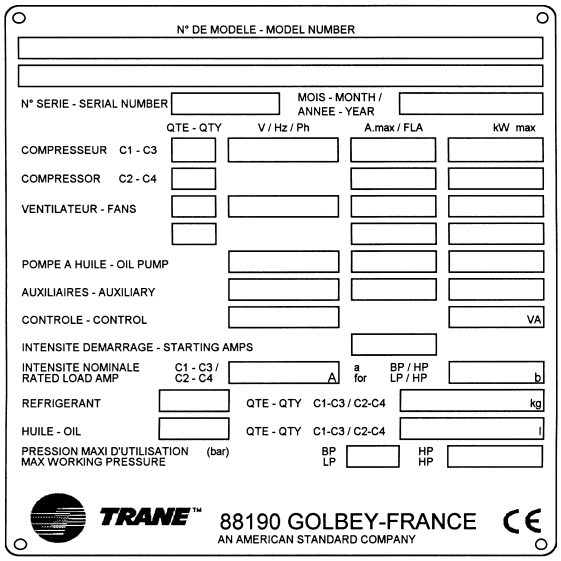
The RTRA «unit» nameplates are applied to the exterior and interior surface of the Control Panel door (figure 4). A «compressor» nameplate is located on the compressor.

Unit Nameplate

The «unit» nameplate provides the following information :

- Model number
- Serial number
- Month/year
- Compressor quantity
- Fan quantity
- Volt/Hertz/phase
- Full load amp
- Max. kW
- Auxiliary
- Control
- Starting amps
- Rated load amp
- High pressure
- Low pressure
- Refrigerant
- Oil
- Max. working pressure
- European Community marking (CE)

Figure 4 - Nameplate



Compressor Nameplate

The «compressor» nameplate provides the following information :

- Compressor model number
- Compressor electrical characteristics
- Utilization Range
- Recommended refrigerant

Storage

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

1. Store the chiller in a secure area
2. At least every three months (quarterly), check the pressure in the refrigerant circuit to verify that the refrigerant charge is intact. If it is not, contact a qualified service organization and the appropriate Trane sales office.

Pre-installation

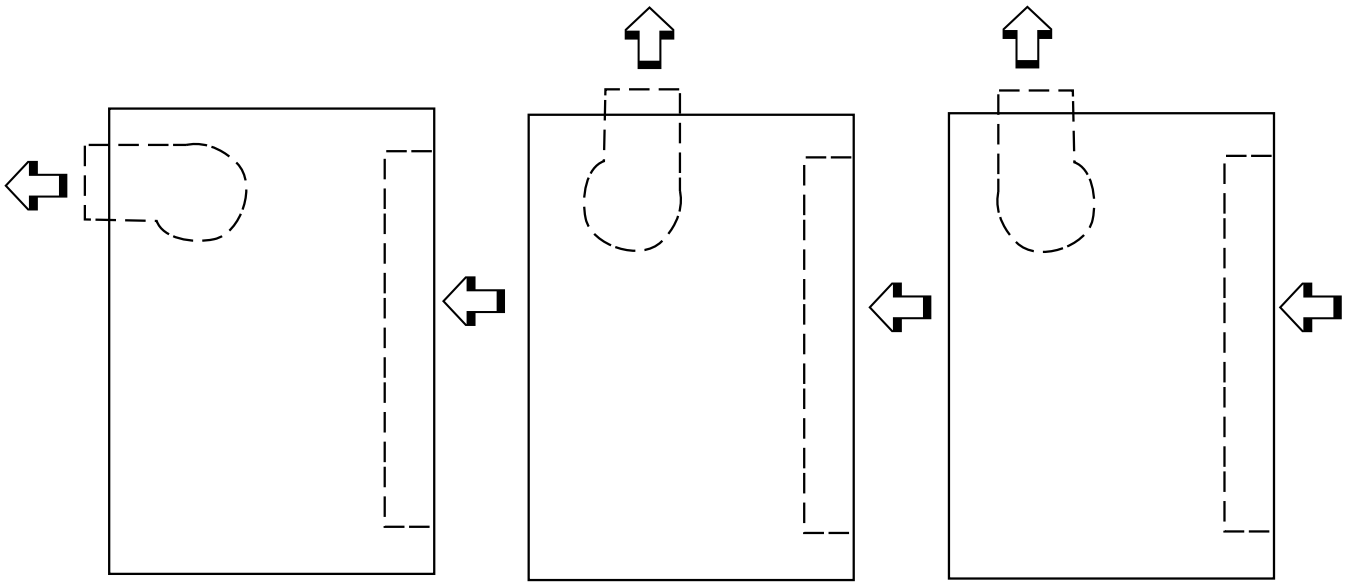
Report any damage incurred during handling or installation to the Trane sales office immediately. An installation check sheet is provided at the end of the manual.

Location requirements

Noise considerations

Locate the unit away from sound-sensitive areas. If required, install rubber vibration isolators in all water piping and use flexible electrical conduit. Refer to «Unit isolation». Consult an acoustical engineer for critical applications.

Figure 5 - Unit arrangement



Installation mechanical

Foundation

Provide rigid, non-warping mounting pads or a concrete foundation of sufficient strength and mass to support the chiller operating weight (i.e., including completed piping, and full operating charges of refrigerant, oil and water). Refer to the submittals for unit operating weights. Once in place, the chiller must be level within 1/4" (6mm) over its length and width. The Trane Company is not responsible for equipment problems resulting from an improperly designed or constructed foundation.

Clearances

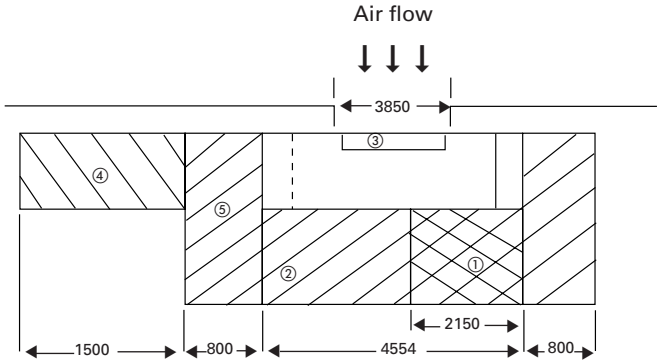
Provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points. Refer to Figure 5 and submittal drawings for the unit dimensions. A minimum of 1,20 m is recommended for compressor service and to provide sufficient clearance for the opening of control panel doors. Refer to the submittals delivered with the units for minimum clearances. In all cases, local codes which require additional clearances will take precedence over these recommendations.

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

Drainage

Locate the unit near a large capacity drain for water vessel drain-down during shutdown or repair. The evaporator is provided with a drain connection. Refer to «Evaporator-Drain». All local and national codes apply. The vent on the top of the evaporator is provided to prevent a vacuum by allowing air into the evaporator for complete drainage.

Figure 6



① Space free for pipes
② Minimum clearance for maintenance
③ Condenser
④ Minimum clearance for evaporator tube removal
⑤ Opposite end electrical panel

Lifting and moving instructions

A specific lifting method is recommended as follows :

1. Four lifting points are built into the unit.
2. Slings and spreader bar to be provided by rigger and attached to the four lifting points.
3. Minimum rated lifting capacity (vertical) of each sling and speader bar shall not be less than tabulated unit shipping weight.
4. **Caution :** this unit must be lifted with the utmost care, avoid shock load by lifting slowly and evenly.
5. To be removed after unit installation.

Figure 7A - Right side

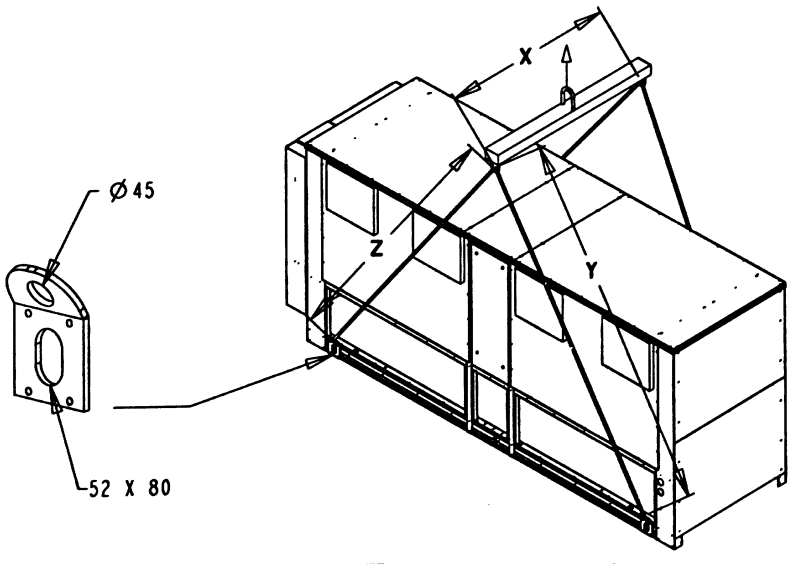
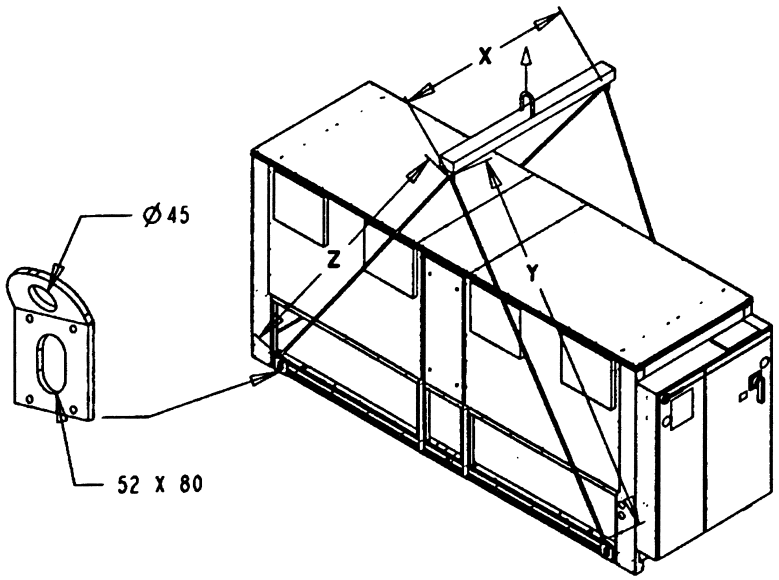


Figure 7B - Left side



RTRA model			107	108	108 HE-LF	109	109 HE-LF	110	110 HE-LF
Figure 7A	X	(mm)	N.A.	N.A.	1800	1800	1800	1800	1800
	Y	(mm)	N.A.	N.A.	3450	3450	3450	3450	3450
	Z	(mm)	N.A.	N.A.	3350	3350	3350	3350	3350
Figure 7B	X	(mm)	N.A.	N.A.	1800	1800	1800	1800	1800
	Y	(mm)	N.A.	N.A.	3250	3250	3250	3250	3250
	Z	(mm)	N.A.	N.A.	3550	3550	3550	3550	3550
Maxi weight		(kg)	N.A.	N.A.	2940	3060	3330	3100	3380
Length		(mm)	N.A.	N.A.	4566	4566	4566	4566	4566
Width		(mm)	N.A.	N.A.	1300	1300	1300	1300	1300
Height		(mm)	N.A.	N.A.	2000	2000	2000	2000	2000

N.A. : Not available.

Unit isolation and leveling

If the unit application requires maximum sound and vibration reduction, use one of the two mounting methods outlined below :

1. Construct an isolated concrete pad for the unit or provide concrete footings at each of the 6 unit mounting points. Mount the unit directly to the concrete pads or footings.
   Level the unit the base rail as a reference. The unit must be level within 1/4" (6 mm) over the entire length. Use shims as necessary to level the unit.
2. Install the optional spring isolators at each of the eight unit mounting points. Refer to submittals isolator placement locations and loading information.
   a. Secure the isolators to the mounting surface, using the mounting slots in the isolator base plate. Do not fully tighten the isolator mounting bolts at this time.
   b. Positioning pins are located on the top of each isolator, as shown in submittals. Lower the unit onto the isolators so that the pins register with the unit mounting holes.
   c. The weight of the unit will force the upper housing of each isolator down. This may cause the upper housing to contact the lower housing. Clearances between upper and lower housings must be 1/4 to 1/2 inch (6-12 mm). If the clearance on any isolators is greater than 1/2 inch (6 mm), it will be necessary to use shims or grout to achieve the required clearance.
   d. Minor adjustments can be made to the clearance by turning the leveling bolt ; clockwise to increase the clearance and counterclockwise to decrease the clearance. All eight isolators must be supporting the entire weight of the unit while these adjustments are being made.

Note : If proper clearances cannot be achieved using the leveling bolts, use shims or grounting under the isolators, as required. Isolators must not straddle small gaps in the shims or grout.

   e. Before tightening the mounting bolts, level the unit using the unit base rail as a reference.

Water piping

Thoroughly flush all water piping to the unit before making the final piping connections to the unit.

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

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

When completing the NPT-type water connections, apply a suitable pipe sealant, or Teflon tape, to prevent water leakage. To minimize heat gain and to prevent condensation, insulate all piping.

Caution : Avoid overtightening and possible damage of water connections. The lubricating properties of Teflon tape make the possibility of overtightening more likely.

Evaporator piping

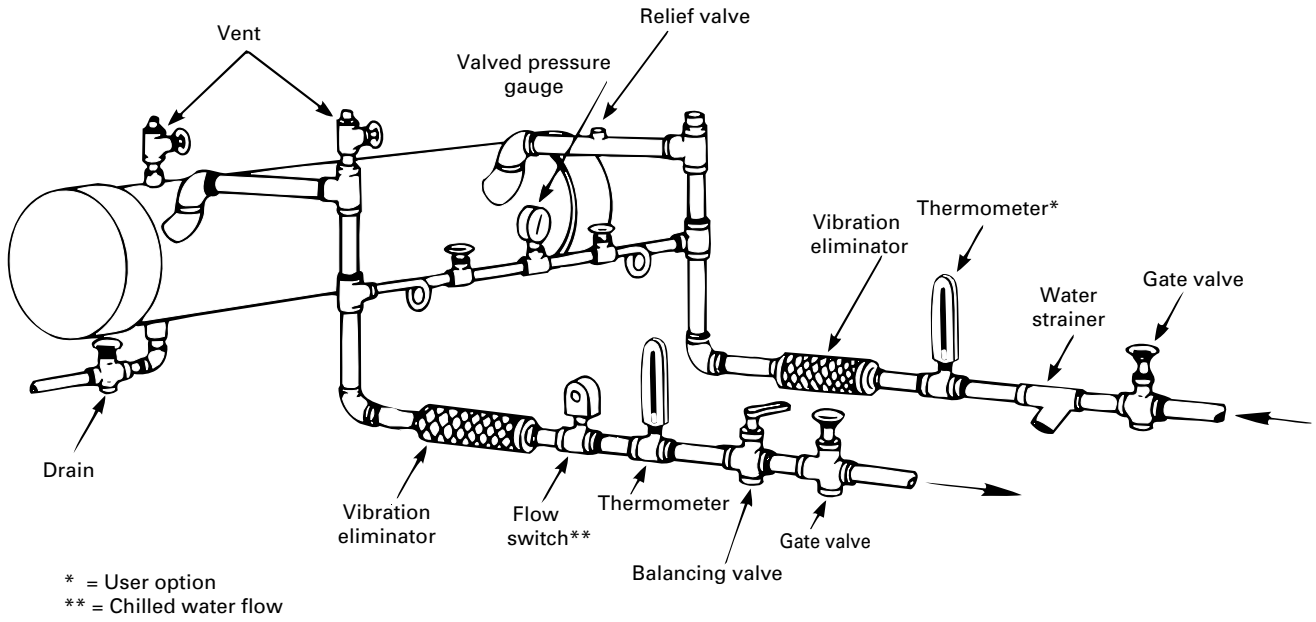
Figure 8 illustrates typical evaporator piping components. Components and layout will vary slightly, depending on the location of connections and the water source.

Caution : The chilled water connections to the evaporator are to be «Victaulic» type connections. Do not attempt to weld these connections, as the heat generated from welding can cause internal damage to the evaporator.

A vent is provided on the top of the evaporator at the return end. Be sure to provide additional vents at high points in the piping to bleed air from the chilled water system. Install necessary pressure gauges to monitor the entering and leaving chilled water pressures.

Provide shutoff valves in lines to the gauges to isolate them from the system when they are not in use. Use rubber vibration eliminators to prevent vibration transmission through the water lines.
If desired, install thermometers in the lines to monitor entering and leaving water temperatures. Install a balancing valve in the leaving water line to control water flow balance. Install shutoff valves on both the entering and leaving water lines so that the evaporator can be isolated for service.

Figure 8 - Suggested piping for typical RTRA evaporator



A pipe strainer should be installed in the entering water line to prevent water-borne debris from entering the system. Water pipe should be self supported.

Entering chilled water piping
- Air vents (to bleed air from system).
- Water pressure gauges with shutoff valves
- Vibration eliminators
- Shutoff (isolation) valves
- Thermometers (if desired)
- Cleanout tees
- Pipe strainer

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

Leaving chilled water piping
- Air vents (to bleed air from system).
- Water pressure gauges with shutoff valves.
- Vibration eliminators.
- Shutoff (isolation) valves.
- Thermometers.
- Cleanout tees.
- Balancing valve.
- Flow switch (if desired).

Caution : To prevent evaporator damage, do not exceed 14 bar evaporator water pressure.

Evaporator drain

A 3/4" drain connection is located under the outlet end of the evaporator. This may be connected to a suitable drain to permit evaporator drainage during unit servicing. A shutoff valve must be installed on the drain line.
If a drain line is not provided, install the drain plug that is shipped with the unit.

Evaporator flow switch
Chilled water flow protection is provided by the UCM-CLD without the need for a chilled water flow switch. A flow switch for chilled water is strictly discretionary but if not installed, a signal must be sent to the chiller to indicate that water flow has been established, eg. chilled water pump motor starter auxiliaries.
If additional chilled water flow protections is desired, use a field-installed flow switch or differential pressure switch with the pump interlock to sense system water flow. Install and wire the flow switch in series with the chilled water pump motor starter auxiliaries.

Specific connection and schematic wiring diagrams are shipped with the unit. Some piping and control schemes, particularly those using a single water pump for both chilled and hot water, must be analyzed to determine how and/or if a flow sensing device will provide desired operation. Follow the manufacturer's recommendations for selection and installation procedures. General guidelines for flow switch installation are outlined below :

1. 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 flow.

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

Note : The UCM-CLD provides a 6 second time delay after a «loss-of-flow» diagnostic before shutting the unit down. Contact a qualified service representative if nuisance machine shutdowns persist.

3. Adjust the switch to open when water flow falls below nominal. Refer to table 4 for minimum flow recommendations. Flow switch contacts are closed on proof of water flow.

Figure 9 - Evaporator water pressure drop

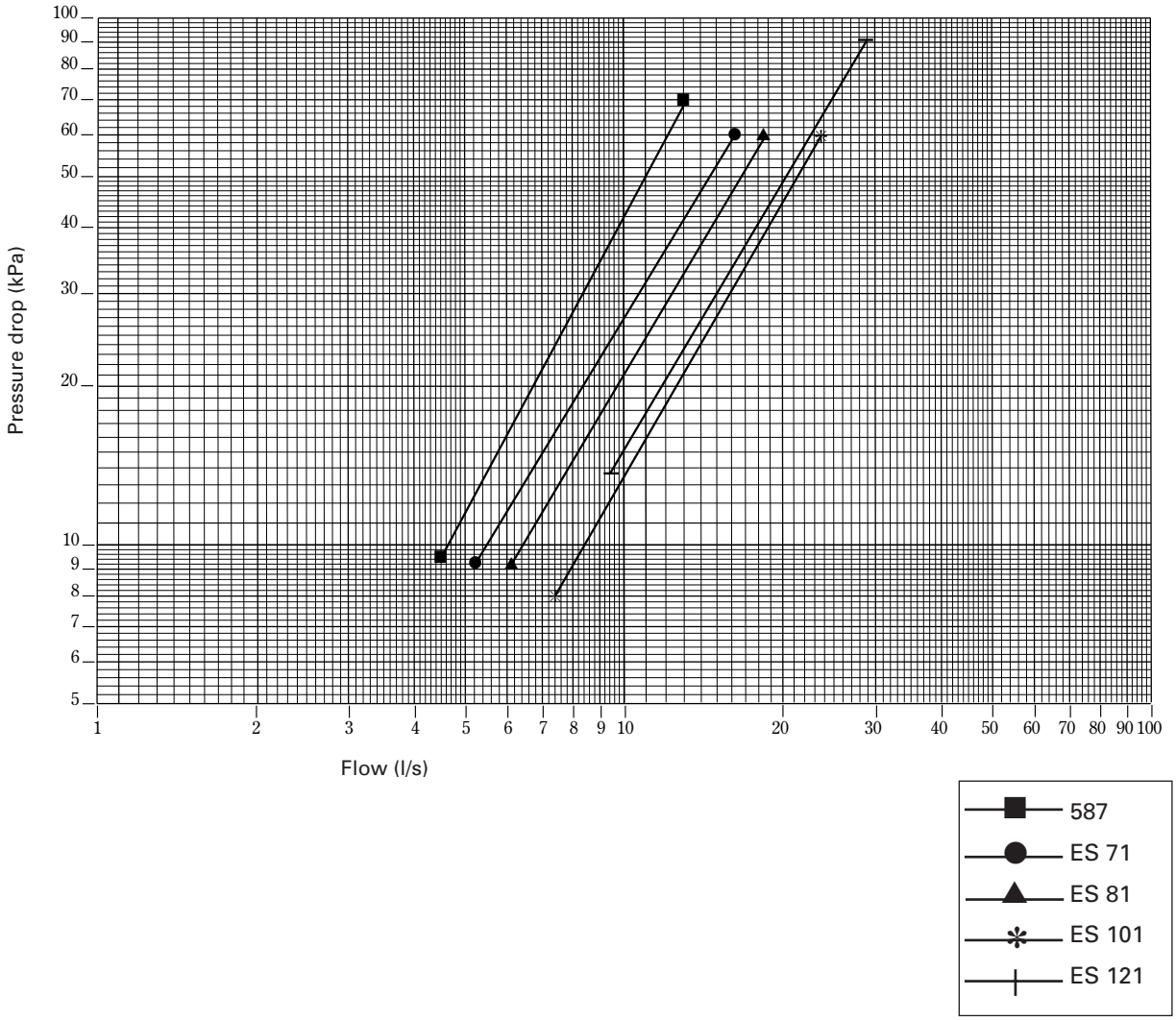


Table 4 - Evaporator data

RTRA model		107	108	108 HE	109	109 HE	110	110 HE
Evaporator model		587	587	ES71	ES81	ES101	ES101	ES121
Water storage capacity	l	95	95	145	143	118	118	106
Minimum water flow	l/s	4,5	4,5	5,3	6,1	7,6	7,6	9,1
Maximum water flow	l/s	13,5	13,5	15,8	18,1	22,6	22,6	27,2
Water connection Ø	Inch	3	3	5	5	5	5	5
Flange		PN 16	PN 16	PN 16	PN 16	PN 16	PN 16	PN 16
			DN 80			DN 125		

Water treatment

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

Customer note

This is designed for chilled water or chilled water with glycol.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 responsabilities for the results of the use of untreated or improperly treated water, or saline or brackish water.

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

Water pressure gauges

Install field-supplied pressure gauges as shown in figure 8. 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.

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

Water pressure relief valves

Install a water pressure relief valve in the evaporator inlet shutoff valve, as shown in figure 8. Refer to applicable codes for relief valve installation guidelines.

Caution : To prevent shell damage, install pressure relief valves in the evaporator water system.

Freeze protection

If the unit will remain operational at subfreezing ambient temperatures, the chilled water system must be protected from freezing, following the steps listed below :

1. Heat tape is factory-installed on the unit evaporator and will protect it from freezing in ambient temperatures down to -18°C (option).
2. Install heat tape on all water piping pumps, and other components that may be damaged if exposed to freezing temperatures. Heat tape must be designed for low ambient temperature applications. Heat tape selection should be based on the lowest expected ambient temperature, including wind chill factors.

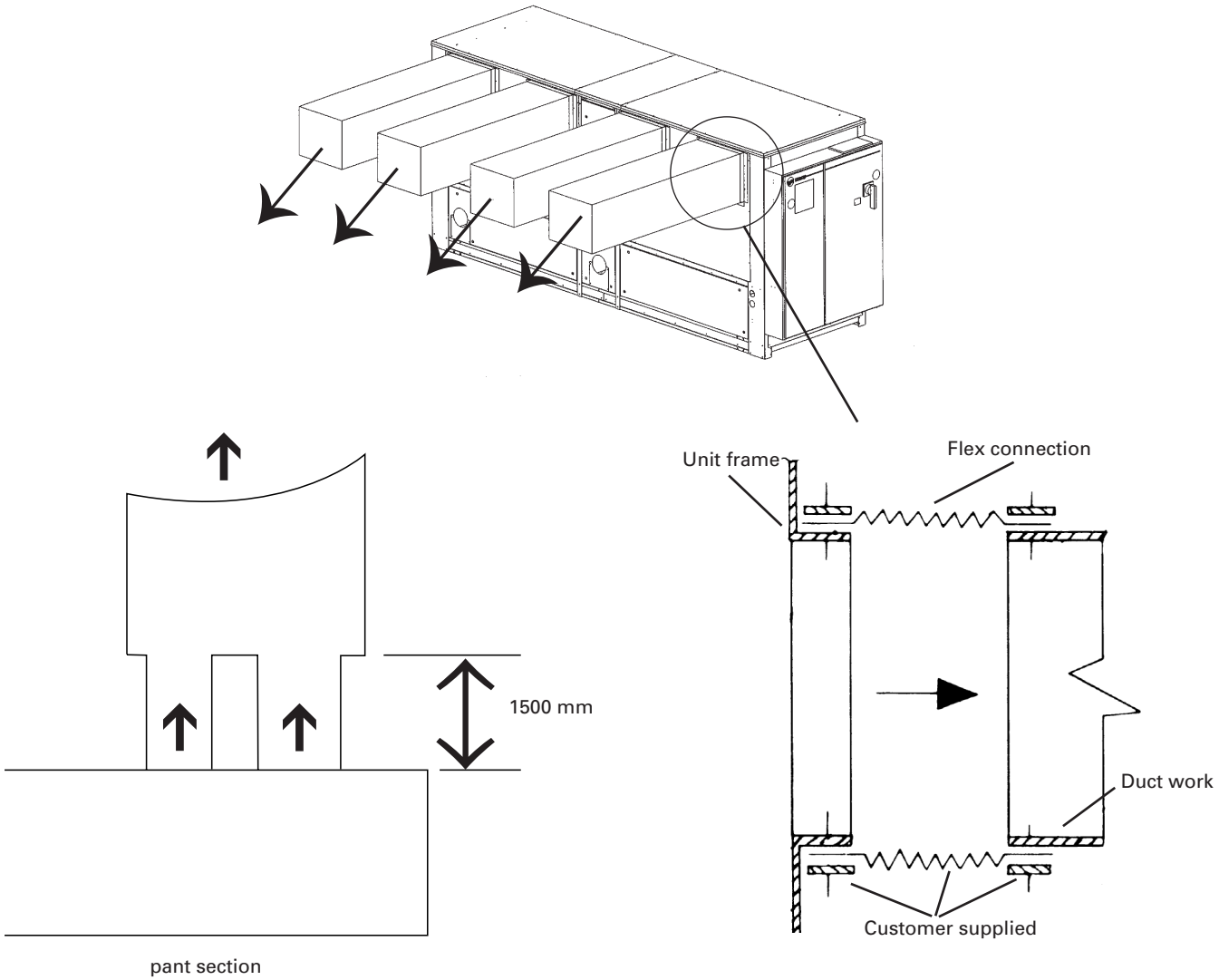
If heat tape is not used, add a nonfreezing, low temperature, corrosion inhibiting, heat transfer fluid to the chilled water system. The solution must be strong enough to provide protection against ice formation at the lowest anticipated ambient temperature. Refer to table 1 for evaporator water storage capacities.

Note : Use of glycol type antifreeze reduces the cooling capacity of the unit and must be considered in the design of the system specifications.

Ductwork recommendations
Free discharge or abrupt discharge into a plenum will be avoided, each fan discharge should have a mimum of 1,5 meter duct to avoid an excess of pressure drop.
On the units with 3 fans, each fan can be individually ducted or the single fan will be ducted with a ''pants'' section. The single fan is identified on the submittal drawing.
On the units with 4 fans, each fan can be individually ducted or each double fan can be ducted with a ''pants'' section.

Caution : When attaching supply ductwork to condenser inlet, ensure no fasteners pierce the coil.

Figure10 - Recommended ductwork



Note : To avoid air recirculation through the ductwork, we recommend to put backdraft dampers only on the double fan situated on the right side when facing the condensing coil for the RTRA 109 HE and 110 HE, if the selected available static pressure is 150 Pa or below. KT = 1 (No recovery of the dynamic pressure).

Wiring

Power supply
All power supply wiring must be sized and selected according by the project engineer in accordance with the national electrical code.

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

Control

UCM provide :
- Alarm, running, max. capacity output
- Remote emergency stop
- External circuit lockout
- Ice making option
- External chilled water setpoint
- External current limit setpoint

Connection are shown in the field diagrams which are shipped with the unit.

Remote clear language display

The remote CLD is intented for indoor use and is not weathreproof. It is mounted in a molded plastic display box with a molded keypad. Aithough this is not the same as the membrane keypad of the unit's CLD, the key locations and labels are identical

Communication link wiring must be 1.5 mm^2 shielded, and not exeed 1500m for each link.

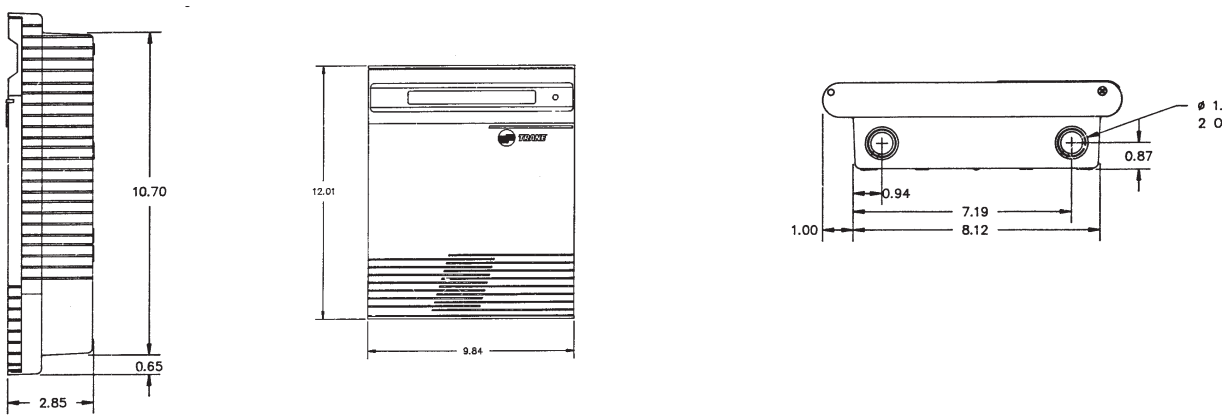
Remote CLD Mounting
All hardware (tools, screws,etc...) is to be field supplied. Figure 11 shows the remote CLD panel and the electrical access knockouts at the bottom and top of the panel. Remove the knockouts that will be used for wire entry, prior to mounting the panel.

Note : On the back of the panel is a knockout for an electrical outlet box, if one is to used.

Prior to mounting the panel, the actual microprocessing board needs to be carefully removed and set aside. To remove the board, open the protective door that cover the keypad. Remove the cover plate at the bottom of the keypad, by loosening the screw on the cover plate.
After removing the cover plate, remove the four srew that secure the keypad (one in each corner). The keypad can now be lifted out the display box.
Mark the location of the mounting holes, remove the box and drill the necessary holes in the surface. Put the display box back in position and secure it to the mounting with the required screws.

The microprocessing board can now be replaced in the display box with its four attaching screws.

Figure 11 : Remote CLD Panel



Remote CLD Panel Wiring

The Remote CLD requires a 24 V power source and a shielded, twisted-pair wire between the panel and the local CLD.

As shown in Figure 12 the wire runs from terminals J3-1 and J3-2 in the unit's buffer module (A55) to terminals J1-1 and J1-2 in the Remote CLD. Be sure that one lead is connected to the (+) terminal at each end and the other lead is connected to the (-) terminal at each end.

Do not run the shielded twisted-pair wire in a conduit that also contains circuits of greater than 30V

Attach the shield to a grounding lug in the unit's control panel. Cut and tape the shield at the Remote CLD panel

Connect the 24V power supply to terminals J2-1 and J2-2 in the Remote CLD panel. The polarity of the of the power source is not a concern, but the power source must be grounded to terminal J2-3

Note : A field supplied 24V, 40VA separation transformer with electrostatic screen must be used as a power supply for the Remote CLD.

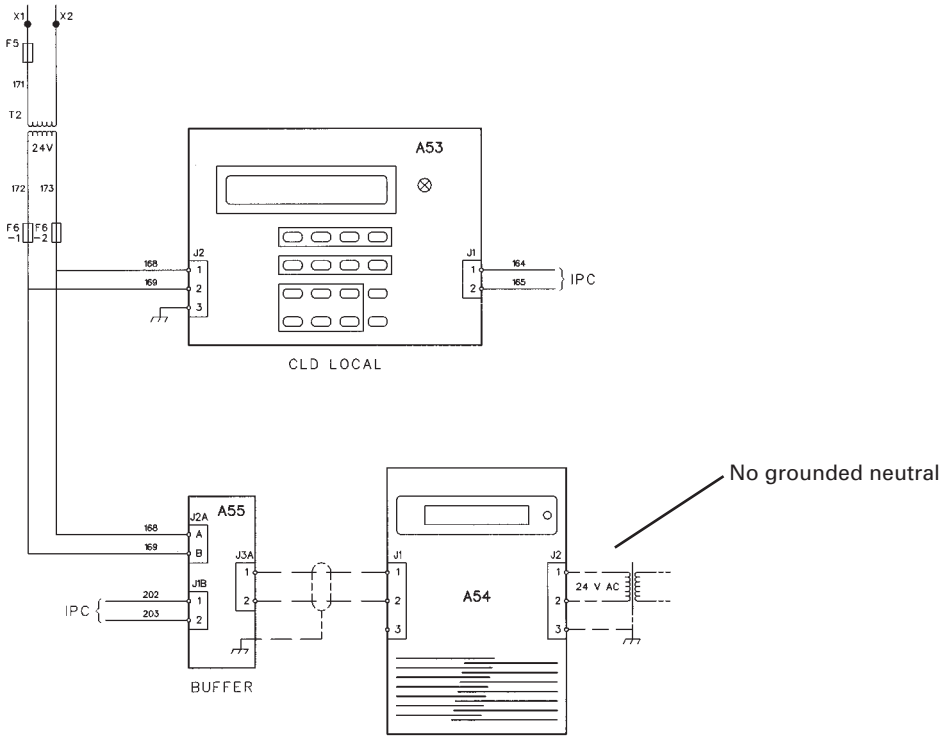
If the Remote CLD share the 24V power source with other components, a 24V/24V transformer will be installed before the Remote CLD to prevent control malfunctions.

Remote CLD Operation

No specific settings are required to used the Remote CLD. In a multiple configuration, the Remote CLD has the capability to communicate with up to four units. Each unit requires a separate communication link with the Remote CLD panel.

Terminals 1-3 are for the second unit.
Terminals 4-6 are for the third unit.
Terminals 7-9 are for the fourth unit.

Figure 12 : Wiring Diagram CLD Module



Note : IPC = Serial link

Operation

Operating principles-mechanical

General

This section describes the mechanical operating principles of Screw compressor air-cooled chillers equipped with microcomputer-based control systems.

- Unit Control Module (UCM-CLD)
- Unit-mounted panel
- Helical-rotary compressor
- Direct Expansion evaporator
- Air-cooled condenser
- Oil supply system (hydraulic and lubrication)
- Interconnecting piping

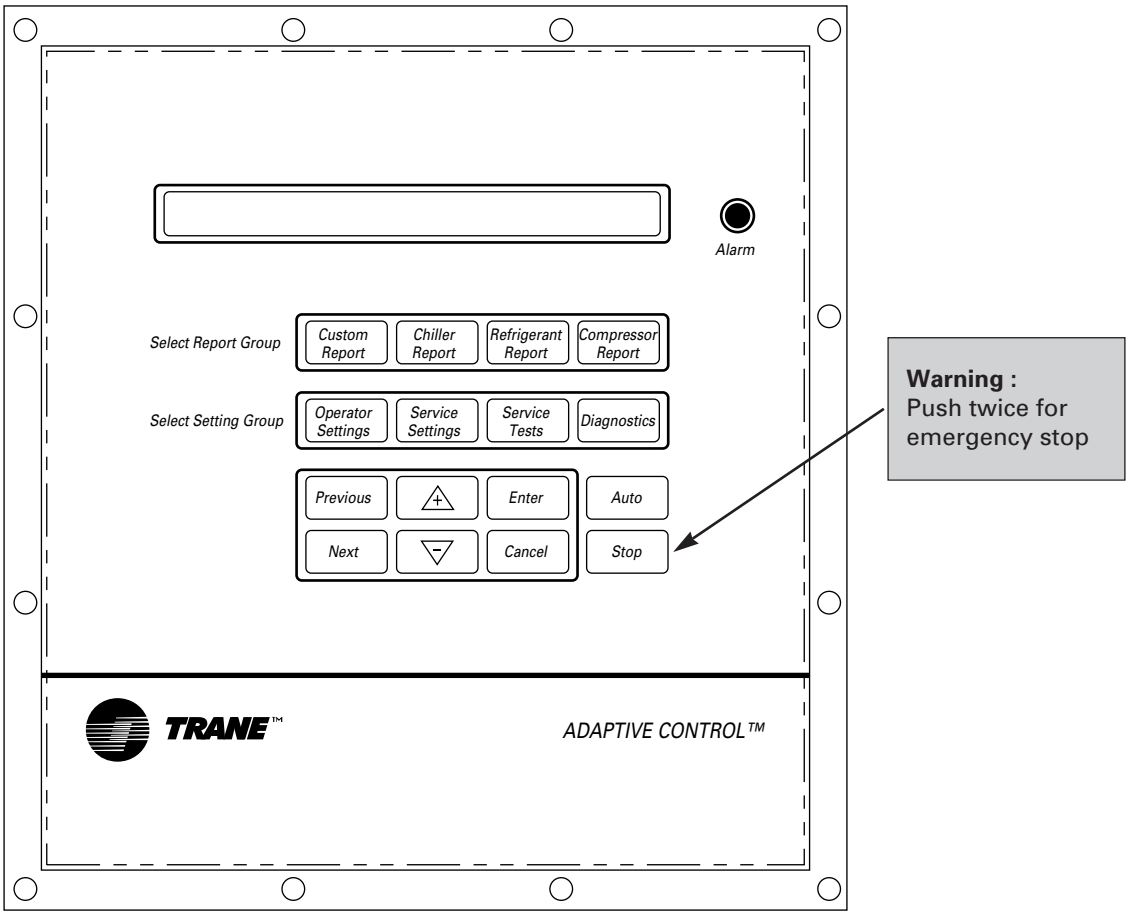
Refrigeration (cooling) cycle

Overview

The refrigeration cycle of the Screw compressor air-cooled chiller is conceptually identical to that of the Trane reciprocating air-cooled units. The major difference is that the Screw compressor unit uses helical rotary compressors, an electronic expansion valve on each circuit, an external oil cooling and filtration system, and Trane's exclusive Adaptive Control system.

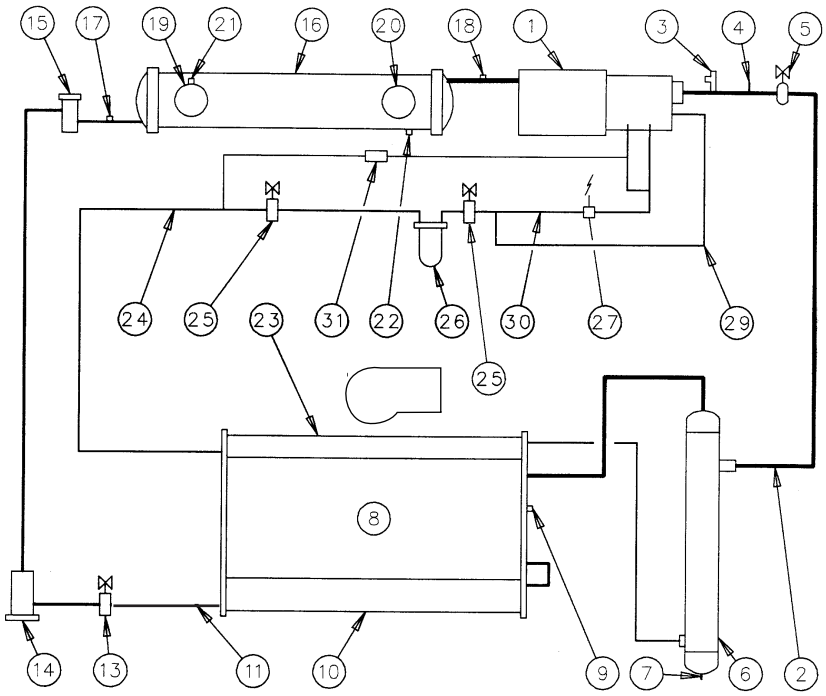
The basic characteristics of the Screw compressor refrigeration cycle provide these units with distinct operational and reliability advantages over other types of units in their size range.

Figure 13 - Operator's interface



Refer to L80 IM 025 E for operating control principle of UCM-CLD.

Figure 14 - Refrigeration system for CHHB compressors



1. Compressor
2. Discharge line
3. Safety valve (according to local code)
4. HP pressure switch
5. Discharge stop valve (option)
6. Oil separator
7. Oil separator vent
8. Condensing coil
9. Condenser saturated temperature sensor
10. Sub-cooler
11. Liquid line
13. Liquid stop valve
14. Drier filter
15. Electronic expansion valve
16. Evaporator
17. EVP refrigerant entering temperature sensor
18. EVP refrigerant leaving temperature sensor
19. Water inlet connection
20. Water outlet connection
21. Water inlet temperature sensor
22. Water outlet temperature sensor
23. Oil cooler
24. Oil line
25. Oil stop valve
26. Oil filter
27. Oil solenoid valve
29. Compressor load/unload line
30. Oil injection line
31. Oil differential pressure switch

Cycle description

Vaporized refrigerant leaves the evaporator and is drawn into the compressor. Here it is compressed and leaves the compressor as a mixture of hot gas and oil (which was injected during the compression cycle).
The mixture enters the oil separator at the two in/out caps. The separed oil flows to the bottom of the separator, while the refrigerant gas flows out the top and passes on the tubes in the condensing coils. Here circulating air removes heat from the refrigerant and condenses it.
The condensed refrigerant passes through the electronic expansion valve and into the tubes of the evaporator. As the refrigerant vaporizes, it cools the system water that surrounds the tubes in the evaporator.

Compressor description

The compressors used by the model RTRA air-cooled chiller consists of two distinct components : the motor and the rotors. Refer to figure 15.

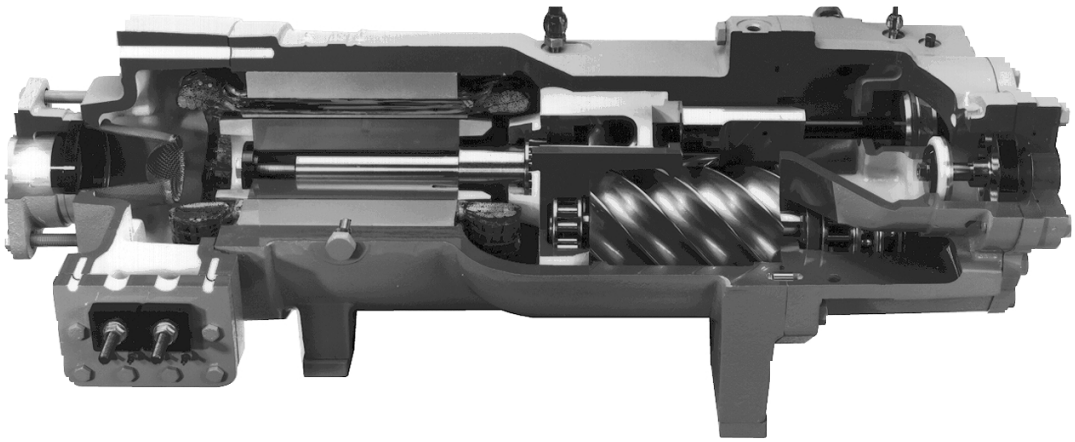
Compressor motor

A two-pole, hermetic, squirrel-cage induction motor directly drives the compressor rotors. The motor is cooled by suction refrigerant gas from the evaporator, entering the end of the motor housing through the suction line.

Compressor rotors

The compressor is a semi-hermetic direct-drive helical rotary type compressor. Each compressor has only 3 moving parts : 2 rotors - «male» and «female» - provide compression, and a slide valve controls capacity. See figure 15. The male rotor is attached to, and driven by, the motor, and the female rotor is, in turn, driven by the male rotor. Separately housed bearing sets are provided at each end of both rotors. The slide valve is located above, and moves along, the top of the rotors.
The helical rotary compressor is a positive displacement device. The refrigerant from the evaporator is drawn into the suction opening at the end of the motor barrel, through a suction strainer screen, across the motor, and into the intake of the compressor rotor section. The gas is then compressed and discharged directly into the discharge line.
There is no physical contact between the rotors and compressor housing. The rotor contact each other at the point where the driving action between the male and female rotors occurs. Oil is injected along the top of the compressor rotor section, coating both rotors and the compressor housing interior. Although this oil does provide rotor lubrication, its primary purpose is to seal the clearance spaces between the rotors and compressor housing.
A positive seal between these internal parts enhances compressor efficiency by limiting leakage between the high pressure and low pressure cavities.
Capacity control is accomplished by means of a slide valve assembly located in the rotor section of the compressor. Positioned along the top of the rotors, the slide valve is driven by a piston/cylinder along an axis that parallels those of the rotors.
Compressor load condition is dictated by the position of the slide valve over the rotors. When the slide valve is fully extended over the rotors and away from the discharge end, the compressor is fully loaded. Unloading occurs as the slide valve is drawn towards the discharge end. Slide valve unloading lowers refrigeration capacity by reducing the compression surface of the rotors.

Figure 15 - Typical CHHB compressor



Oil system operation

Overview

Oil that collects in the bottom of the oil separator is at condensing pressure during compressor operation ; therefose, oil is constantly moving to lowwer pressure areas.

As the oil leaves the separator, it passes through the oil cooler at the top of the condensing coils. It then goes through the service valve and filter. At this point, some of the oil is used to control the slide valve movement in the compressor, via the load/unload solenoids. The remaining oil passes through the oil master solenoid valve and performs the functions of compressor bearing lubrication and compressor oil injection. If the compressor stops for any reason, the master solenoid valve closes, isolating the oil charge in the separator and oil cooler during «off» periods.

To ensure proper lubrication and minimize refrigerant condensation in the compressor, a heater is mounted on the bottom of the compressor housing. A signal from the UCM energizes this heater during the compressor «Off» cycle to keep refrigerant from condensing in the compressor. The heater element is continiuously energized.

Oil separator

The mixture oil + refrigerant enters tangentially the oil separator and swirls around. Thus, the oil (which is denser) is thrown to the outside wall and flows to the bottom of the separator. It then goes to the cooling circuit. The gas exits out the middle part of the separator and is discharged into the condensing coils. (Figure 16).

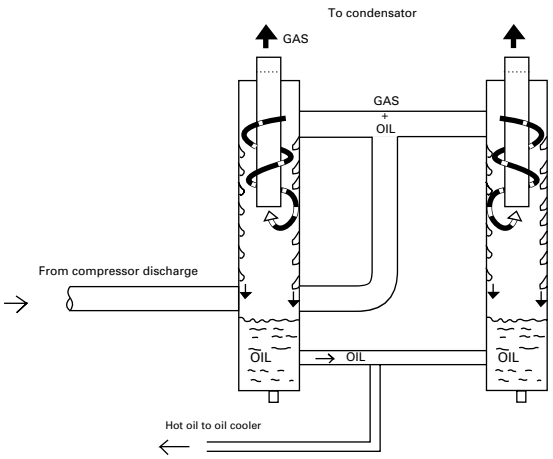
Compressor bearing oil supply

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

Compressor rotor oil supply

Oil flows through this circuit directly from the master solenoid valve, through the oil filter to the top of the compressor rotor housing. There, it is injected along the top of the rotors to seal clearance spaces between the rotors and the compressor housing and to lubricate the rotors.

Figure 16 - Oil separator



Slide valve movement
Movement of the slide valve piston determines slide valve position which, in turn, regulates compressor capacity. Oil flow into and out of the cylinder governs piston movement and is controlled by the normally-closed, load and unload solenoid valves.
The solenoid valves receive momentary pulsating «load» and «unload» voltage signals from the UCM-CLD based on system cooling requirements. To load the compressor, the UCM-CLD opens the load solenoid valve while keeping the unload solenoid valve closed. The pressurized oil flow then enters the cylinder and forces the slide valve to move over the rotors.
The compressor is unloaded when the load solenoid valve is kept closed and the unload solenoid valve is opened. Oil «trapped» within the cylinder is drawn out into the lower-pressure suction area of the compressor. As the pressurized oil leaves the cylinder, the slide valve gradually moves away from the rotors.
When both solenoid valves are closed, the present level of compressor loading is maintained.
Just prior to a normal compressor shutdown, the unload solenoid valve is energized and the slide valve moves to the fully-unloaded position, so the unit always starts fully unloaded.

Oil filter
All RTRA units are equipped with a replaceable-element oil filter. The filter removes any impurities that could foul the solenoid valve orifices and compressor internal oil supply galleries. This also prevents excessive wear of compressor rotor and bearing surfaces. Refer to the maintenance portion of this manual for recommended filter element replacement intervals.

Caution :
The lubricating oils recognised by Trane have been subjected to extensive testing in our laboratories and have been found to give the required satisfactory results for use with Trane compressors.

The use of any oil not conforming to Trane required standards is at the sole responsibility of the user and could result in warranty cancellation.

Condenser fan staging
The RTRA series offers either the standard or the low ambient and extra low ambient configuration on the low ambient option, the fan motors are two speed ones, on the extra low ambient option, the fan the closest to the control panel is a speed control fan.

UCM fan staging is function of the difference between the saturated condenser refrigerant temperature and the saturated evaporator refrigerant temperature, which in turn is function of the load and ambient temperature. Any number of fans can be operating at a given time depending on these variables.

Pre-start procedures

General
When installation is complete, but prior to putting the unit into service, the following pre-start procedures must be reviewed and verified correct :

1) Inspect all wiring connections to be sure they are clean and tight.

> **Warning :** Disconnect all electric power including remote disconnects before servicing. Failure to disconnect power before servicing can cause severe personal injury or death.
>
> **Caution :** Check the tightness of all connections in the compressor power circuits (disconnects, terminal block, contactors, compressor junction box terminals, etc.). Loose connections can cause overheating at the connections and undervoltage conditions at the compressor motor.

2) Verify that all refrigerant valves, as shown in figure 14, are «OPEN».

> **Caution :** Do not operate the unit with the compressor, oil discharge and liquid line service valves «CLOSED». Failure to have the «OPEN» may cause serious compressor damage.

3) Check the power voltage to the unit at the main power fused-disconnect switch. Voltage must be within the voltage utilization range, given in table 1 and also stamped on the unit nameplate. Voltage imbalance must not exceed 2%. Refer to «Unit voltage imbalance», below.
4) Check the unit power phasing.
5) Check the condenser fans to be sure that they rotate freely in the fan openings and that each is securely attached to its fan motor shaft. Check fan rotation and belt tensioning.
6) Energize the compressor sump heaters by closing the unit main disconnects. If unit-mounted disconnects are used, they must also be closed. If the unit does not have the optinal control power transformer, 115 VAC power must be filed supplied to terminals 1TB3-1 and 1TB3-2. The chiller switch must be in the STOP/RESET position.

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

7) Energize the evaporator heat tape.
8) Fill the evaporator chilled water circuit. Refer to table 14 for evaporator liquid capacities. Vent the system while it is being filled. Open the vent on the top of the evaporator during filling and close when filling is completed.

> **Caution :** Do not used untreated or improperly treated water. Equipment damage may occur.
>
> **Caution :** Do not fill chilled water system unless the evaporator heat tape has been energized.

9) Close the fused-disconnect switch (es) that supplies power to the chilled water pump starter.
10) Start the chilled water pump to begin circulation of the chilled water. Inspect all piping for leakage and make any necessary repairs.
11) With chilled water circulating through the system, adjust water flow and check water pressure drop through the evaporator are conform to the order specifications. Refer to figure 9.
12) Adjust chilled water flow switch (if installed) for proper operation.
13) Stop the chilled water pump.

Unit voltage power supply
Measure each leg of the supply voltage at the unit main power fused-disconnect. If the measured voltage on any leg is not within specified range, notify the supplier of the power and correct the situation before operating the unit.

> **Caution :** Inadequate voltage to the unit can cause control components to malfunction and shorten the life of relay contact, compressor motors and contactors.

Unit voltage unbalance
Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. The maximum allowable imbalance is 2%. Voltage imbalance is determined using the following calculations :

$$\% \text{ Imbalance} = \frac{(V_x - V_{ave}) \times 100}{V_{ave}}$$

$$V_{ave} = (V_1 + V_2 + V_3) / 3$$

V_x = phase with greatest difference from V_{ave} (without regard to sign).

For example, if the three measured voltages are 375, 389 and 388 volts, the average would be :

$$\frac{375+388+389}{3} = 384$$

The percentage of imbalance is then :

$$\frac{100\ (375-384)}{384} = 2.34\%$$

This exceeds the maximum allowable (2%) by 0.34 percent.

Water system flow rates
Establish a balanced chilled water flow through the evaporator. Chilled water flow rates below the minimum values will result in laminar flow, which reduces heat transfer and causes either loss of electronic expansion valve control or repeated nuisance, low temperature cutouts. Flow rates that are too high can cause tube erosion and damage to the tube supports and baffles in the evaporator.

> **Caution :** Once the evaporator is filled with water, the evaporator heat tapes must be energized to protect the evaporator from freezing and bursting if the outdoor air temperature drops below freezing.

Water system pressure drop
Measure chilled water pressure drop through the evaporator at the field-installed pressure taps on the system water piping. See figure 8. Use the same gauge for each measurement.
Pressure drop readings should be approximately those shown in the pressure drop charts, figure 9.

UCM-CLD set-up
Refer to manual of operation of the UCM-CLD, reference L80 IM 025 E.

Start-up procedures

If the pre-start checkout, as discussed above, has been completed, the unit is ready to start.
- Move the chiller switch on the UCM-CLD to the STOP/RESET position.
- As necessary, adjust the setpoint values in the UCM menus, as describe in the Operation Manual.
- Close the fused-disconnect switch for the chilled water pump. Energize the pump to start chilled water circulation.
- Check the service valves on the discharge line, suction line, oil line and liquid line for each circuit. These valves must be open (backseated) before starting the compressors.

Caution : To prevent compressor damage, do not operate the unit until all refrigerant and oil line service valves are opened.

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

- Energize the evaporator heat tape by closing the field-installed fused-disconnect.
- Move the chiller switch to AUTO LOCAL. If the chiller module calls for cooling and all safety interlocks are closed, the unit will start. The compressor(s) will load and unload in response to the temperature of the leaving chilled water temperature.

Once the system has been operating for approximately 30 minutes and has become stabilized, complete the start-up procedures, as follows :
- Check the evaporator and condenser refrigerant pressures on the UCM-CLD.
- Measure the system superheat. Refer to «System superheat», below.
- Measure the system subcooling. Refer to «System subcooling», below.
- A shortage of refrigerant is indicated if operating pressures are low and subcooling is also low. If the operating pressures, superheat and subcooling readings indicate a refrigerant shortage, gas charge refrigerant into each circuit, as required. With the unit running, add refrigerant vapor by connecting the charging line to the suction service valve until operating conditions become normal.

Caution : If both suction ans discharge pressures are low but subcooling is normal, a problem other than refrigerant shortage exists. Do not add refrigerant, as this may result in overcharging the circuit.

Caution : Use only refrigerants specified on the unit nameplate, to prevent compressor damage and insure full system capacity.

- If operating conditions indicate a refrigerant overcharge, remove refrigerant at the liquid line service valve. Allow refrigerant to escape slowly, to minimize oil loss. Do not discharge refrigerant into the atmosphere.

Warning : Do not allow refrigerant to directly contact skin or injury from frostbite may result.

System superheat
Normal superheat for each circuits is approximately 4°C at full operating load. Superheat temperature can be expected to be moving around the 4°C setpoint when the chiller is pulling down, the compressor slide valve is being modulated, or the fans are staging on either the same or opposite circuits. Superheat can be expected to settle out at approximately 4°C when the above items stabilize.

System subcooling
Normal subcooling for each circuit is 5°C to 7-8°C. If subcooling for either circuit does not approximate these figures, check the superheat for the circuit and adjust, if required. If superheat is normal but subcooling is not, contact a qualified Trane service technician.

Unit shutdown procedures

Temperatures shutdown and restart

To shut the unit down for a short time, use the following procedure :
1. Move the chiller switch to STOP/RESET. The compressors will continue to operate and, after unloading for 20 seconds, will stop when the compressor contactors de-energize. The condenser fans will be de-energized at this time.
2. The unit disconnect switch and unit mounted disconnect (if installed) should remain closed to keep the compressor sump heaters energized.
3. Maintain power to 1TB3-11 and 1TB3-12 to keep the evaporator heat tape energized.
4. Stop the chilled water circulation by turning off the chilled water pump.

To restart the unit after a temporary shutdown, restart the chilled water pump and move the chiller switch to either of the AUTO positions. The unit will start normally, provided the following conditions exist :
1. The UCM must receive a call for cooling and the differential to start must be above the setpoint.
2. All system operating interlocks and safety circuits must be satisfied.

Extended shutdown procedure

The following procedure is to be followed if the system is to be taken out of service for an extended period of time, eg. seasonal shutdown :

1. Test the condenser and high-side piping for refrigerant leakage.
2. Open the electrical disconnect switches for the chilled water pump. Lock the switch in the «OPEN» position.
3. Close all chilled water supply valves. Drain the chilled water from the evaporator. If the unit will be exposed to freezing ambient conditions, flush the evaporator with an antifreeze solution or energize the evaporator heat tape.
4. Open the unit main electrical disconnect and unit mounted disconnect (if installed) and lock on the «OPEN» position.
5. At least every three months (quarterly), check the pressure in the unit and leak test it with an electronic leak detector to verify that the refrigerant charge is intact.

System restart after extended shutdown

Follow the procedures below to restart the unit after extended shutdown :

1. Verify that the liquid line service valves, oil line, compressor discharge service valves and suction service valves (if installed) are open (backseated).

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

2. Close the main disconnect and unit mounted disconnect (if installed) to energize the compressor sump heaters.

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

3. Maintain power to 1TB3-11 and 1TB3-12 for the evaporator heat tape connections.
4. Fill the evaporator chilled water circuit. Refer to table 4 for evaporator liquid capacities. Vent the system while it is being filled. Open the vent on the top of the evaporator during filling and close when filling is completed.

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

5. Close the fused disconnect switch that provides power to the chilled water pump.
6. Start the chilled water pump and, while chilled water is circulating, inspect all piping for leakage. Make any necessary repairs before starting the unit.
7. While the chilled water is circulating, adjust the chilled water flow and check the chilled water pressure drop through the evaporator.
8. Adjust the flow switch on the evaporator piping (if installed) for proper operation.
9. Stop the chilled water pump. The unit is now ready for start-up as described in «Start-up procedures».

Maintenance

Periodic maintenance

General

Perform all maintenance procedures and inspections at the recommended intervals. This will prolong the life of the equipment and minimize the possibility of costly failures. Use an «Operator's log», to record an operating history for the unit. The log serves as a valuable diagnostic tool for service personnel. By observing trends in operating conditions, an operator can anticipate and prevent problem situations before they occur.

Weekly maintenance

After the unit has been operating for approximately 30 minutes and the system has stabilized, check the operating conditions and complete the procedures below :

- Check the evaporator refrigerant pressure and the condenser refrigerant pressure in menu on the UCM-CLD.
- If operating pressure conditions seem to indicate refrigerant shortage, measure the system superheat and system subcooling. Refer to «System superheat» and «System subcooling».
- If operating conditions indicate a refrigerant overcharge, remove refrigerant at the liquid line service valve. Allow refrigerant to escape slowly, to minimize oil loss. Do not discharge refrigerant into the atmosphere.
- Inspect the entire system for unusual conditions and inspect the condenser coils for dirt and debris. If the coils are dirty, refer to «Coil cleaning».

Monthly maintenance

- Perform all weekly maintenance procedures.
- Measure and record the system superheat. Refer to «System superheat».
- Measure and record the system subcooling. Refer to «System subcooling».
- Check fan belt tensioning.

Warning : Position all electrical disconnects in the «OPEN» position and lock them, to prevent injury or death due to electrical shock.

Annual maintenance

- Perform all weekly and monthly maintenance procedures.
- Have a qualified service technician check the setting and function of each control. Inspect the condition of compressor and control contactors and replace as required.
- Inspect all piping components for leakage and damage. Clean out any inline strainers.
- Clean and repaint any areas that show signs of corrosion.
- Clean the condenser coils. Refer to «Coil cleaning».
- Clean the condenser fans. Check the fan assemblies for proper clearance in the fan openings and for motor shaft misalignment, abnormal end play, vibration and noise.
- Check fan belt tension.
- Replace worn belt.
- Check the oil level.
- Oil acidity test.

Warning : The refrigeration circuit of this equipment is pressurized. Use proper service procedure to relive pressure before servicing.

Coil cleaning

Clean the condenser coils at least once each year, or more frequently if the unit is located in a «dirty» environment. This will maintain proper unit operating efficiencies. Follow the detergent manufacturer's instructions as closely as possible to avoid damage to the coils.
To clean the coils, use a soft brush and a sprayer.

Note : If the detergent mixture is strongly alkaline (pH value greater than 8.5), an inhibitor must be added.

Chemically cleaning the evaporator
The chilled water system is a closed-loop and therefore should not accumulate scale or sludge. If the chiller becomes fouled, first attempt to dislodge the material by backflushing the system. If, after several attemps, chemically clean the evaporator.

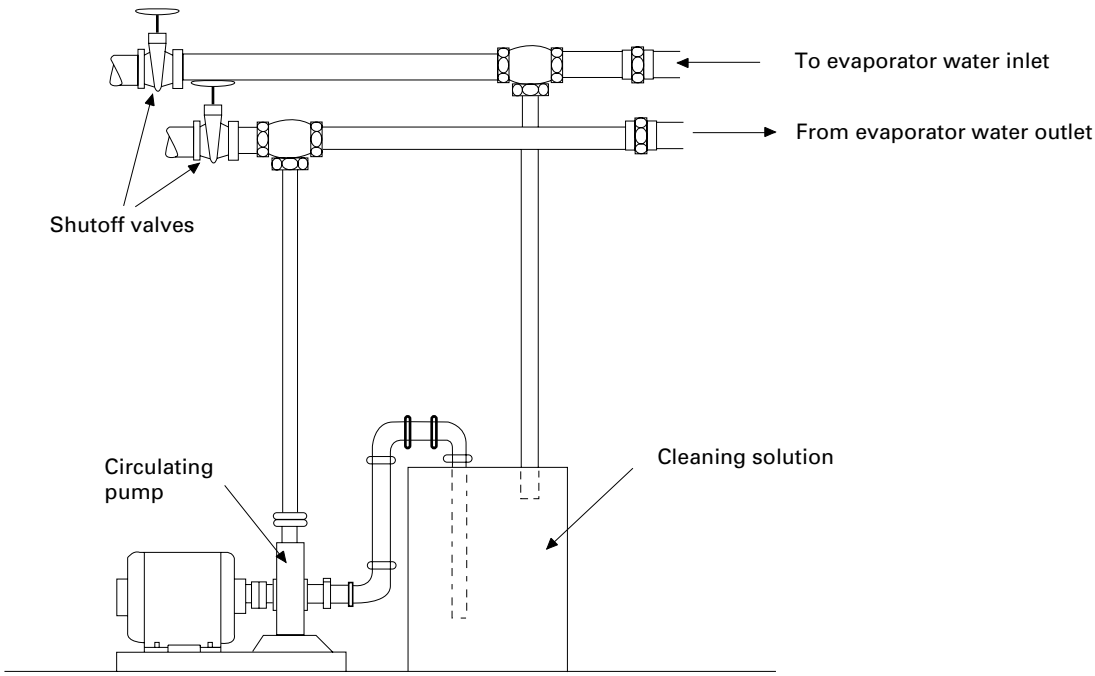
Caution : Do not use an acid type cleaning agent that will damage steel, galvanized steel, polypropylene, or internal copper components.

With this information, water treatment firms will be able to recommend a suitable chemical for use in this system.
A typical configuration for chemical cleaning is shown in figure 17. The supplier of the cleaning chemicals must provide or approve :
All of the materials used in this configuration
The amount of chemicals used
The length of time the chemicals are used
Any safety precautions and handling instructions

Service pumpdown
The UCM-CLD provides a one-time "Service Pumpdown" mode with which the service engineer can start a particuliar compressor and run it for one minute to pump-down the refrigerant circuit low side.

Caution : Do not use this procedure more than once. The suction pressure must be monitored with an external gauge. If the suction pressure drops below 1,3 bar, press the "Stop" key to cycle off the compressor.

Figure 17 - Chemical cleaning configuration



Start log sheet

Job Name					Elevation Above	
Job Location					Sea Level	m
Unit Model No.					S.O. No.	
Unit Serial No.		Nameplate Volt			Ship Date	
Comp	Model No.					
	Serial No.			Nameplate RLA		
Cond Fan Motor RLA		Evap	Design		Actual	
Heat Tape Volt		Pres. Drop	kPa	l/s	kPa	l/s

		Fifteen Minute Intervals			
Unit	A-B				
Voltage	A-C				
	B-C				
Compressor	1				
Amperage	2				
	3				
Unit Operator Mode					
Last Diagnostic					
Evap water Ent °C					
Evap water Lvg °C					
Cond. air inlet t°					
Cond. air outlet t°					
Comp Suction °C					
Comp Sat. Evap °C					
Comp Evap Pres #					
Comp Sat. Cond °C					
Comp Cond Pres #					
Comp Starts					
Comp Hours					
Comp Hours					
Static pressure (Pa)					
Condenser Fans On		PNL	PNL	PNL	PNL
Comments					

Date	SVC Tech	Owner

Installation checklist

RTRA Trane Air Cooled Liquid Chiller

This list must be checked off by the installer to ensure correct installation before the unit starts up.

Unit acceptance

- ❑ Check for damage, if any, on transportation
- ❑ Check for equipment shipped against delivery slip
- ❑ Check lifting system

Unit positioning

- ❑ Remove packaging
- ❑ Check position of unit
- ❑ Check unit is level
- ❑ Check clearance around condenser
- ❑ Check clearance required for maintenance access
- ❑ Check position of rubber pads

Chilled water circuit

- ❑ Check presence of strainer ahead of evaporator
- ❑ Check the tightness of the water circuit
- ❑ Check thermometer positioning
- ❑ Check manometer positioning
- ❑ Check chilled water flow rate balancing system
- ❑ Check rinsing and filling of chilled water pipes
- ❑ Check pump operation and water flow

Electrical equipment

- ❑ Check direction of rotation of compressors and fan motors
- ❑ Check installation and rating of mains power switch/fuse
- ❑ Check that electrical connections comply with specification
- ❑ Check that electrical connections match information on manufacturer's identification plate
- ❑ Check electrical connections and connections to mains power switch
- ❑ Water pressure switch

Ducting

- ❑ External pressures of air inlet and discharge ducting

General

- ❑ Check available cooling charge (50% of rated installation load)
- ❑ Check with other trades handling installation works

Comments : .....
.....
.....
.....
.....

Signature : ..... Company : .....

Order N° .....

Work site : .....

Please return to your local Trane Service Agency

Notes

Notes

Safety recommendations

To avoid accidents and damage, the following recommendations should be observed during maintenance and service visits :

1. The maximum allowable pressures for system leak testing on low and high pressure side are given in the chapter "Installation". Always provide a pressure regulator.
2. Disconnect the main supply before any servicing on the unit.
3. Service work on the refrigeration system and the electrical system should be carried out only by qualified and experienced personnel.

Maintenance contract

It is strongly recommended that you sign a maintenance contract with your local Service Agency. This contract provides regular maintenance of your intallation by a specialist in our equipment. Regular maintenance ensures that any malfunction is detected and corrected in good time and minimizes the possibility that serious damage will occur. Finally, regular maintenance ensures the maximum operating life of your equipment. We would remind you that failure to respect these installation and maintenance instructions may result in immediate cancellation of the warranty.

Training

The equipment described in this manual is the result of many years of research and continuous development. To assist you in obtaining the best use of it, and maintaining it in perfect operating condition over a long period of time, the constructor have at your disposal a refrigeration and air conditioning service school. The principal aim of this is to give operators and maintenance technicians a better knowledge of the equipment they are using, or that is under their charge. Emphasis is particularly given to the importance of periodic checks on the unit operating parameters as well as on preventive maintenance, which reduces the cost of owing the unit by avoiding serious and costly breakdown.

The constructor's policy is one continuous product improvement, and he reserves the right to alter any details of the products at any time without notice

This publication is a general guide to install, use and properly maintain our products. The information given may be different from the specification for a particular country or for a specific order. In this event, please refer to your nearest office.

For additional information, contact :

Distributor / Installer stamp

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