



TRANE®

**Installation
Operation
Maintenance**

**RTWB Helical-Rotary
Chillers**

**200 to 700 kW
Sizes 207-224**

RTWB-SVN01B-E4

Important Notice

Personal protection



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



Goggles and gloves when handling chemicals; 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 shutdown. Assume that metal is hot.



Hearing protection.



Safety shoes.

CAUTION

Risk of damage to equipment.

WARNING

Risk for safety or health.

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 at the pressures must be done in a special enclosure or be 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.



Trane assume no liability for installation or service procedures performed by unqualified personnel.

Regulations on safety, construction, and environment vary from one country to another. Make sure that the equipment complies with local regulations.

In addition to this publication, read carefully Société Trane's and/or the Seller's General Terms and Conditions of Sale and any specific instruction which you may have received.

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General Information

Literature change history

This manual describes the installation, operation, and maintenance of RTWB units.

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

An Owner Guide on the operation of the UCM-CLD chiller controls is available as a separate document.

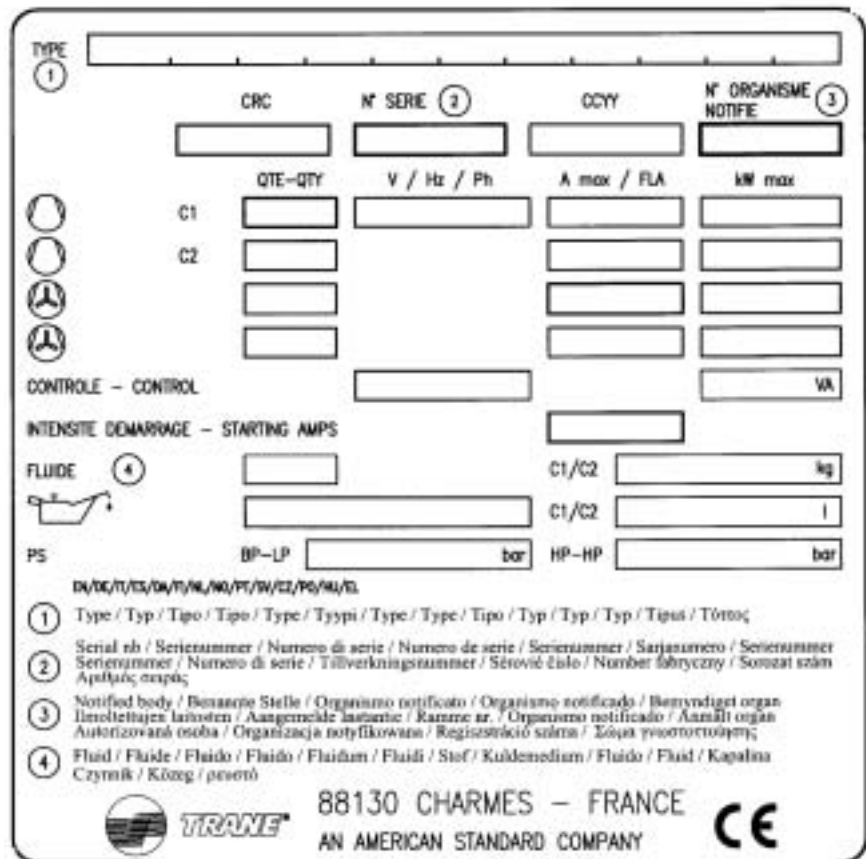


Figure 1 – Typical unit name plate

General Information

Unit inspection

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

Inspect all interior 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 the installation of a damaged unit without sales office approval.

Inspection checklist

To protect against loss due to damage incurred in transit, complete the 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 sales office.
- If concealed damage is discovered, stop unpacking the shipment. Do not remove the damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.
- Notify the Trane sales representative and arrange for repair. Do not repair the unit, however, until damage is inspected by the transportation representative.

Loose parts inventory

Check all items against the shipping list. Water flow switch (option), water-vessel drain plugs, isolation pads, rigging and electrical diagrams, and service literature are shipped in the starter panel.

General Information

Unit description

The RTWB units are helical-rotary type, water-cooled, liquid chillers designed for indoor installation. The units have two independent refrigerant circuits, with one compressor per circuit.

Each RTWB unit is completely assembled, wired, leak-tested, dehydrated, charged, and tested for proper control operation prior to shipment. The chilled-water inlet and outlet openings are covered for shipment.

The RTWB series features Trane's exclusive Adaptive Control™ logic with Clear Language Display. It monitors the control variables that govern the operation of the unit. Adaptive Control logic can correct these variables, when necessary, to optimize operational efficiencies, avoid chiller shutdown, and keep producing chilled water.

Compressor unloaders are oil pressure operated. Each refrigerant circuit is provided with filter, electronic expansion valve, and charging valves.

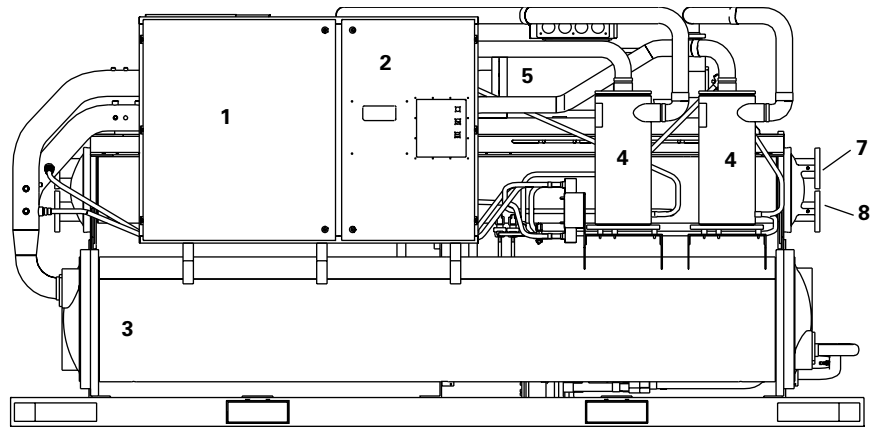


Figure 2 -- Component location for typical RTWB unit

- 1 Starter panel
- 2 Control panel
- 3 Evaporator
- 4 Oil separator
- 5 Helical-Rotary Compressor
- 7 Condenser-water outlet
- 8 Condenser-water inlet

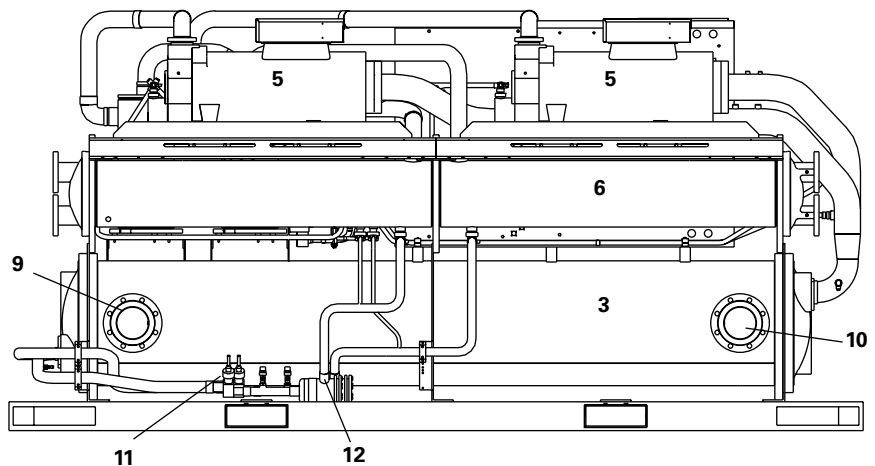


Figure 3 – Component location for typical RTWB unit (back view)

- 3 Evaporator
- 5 Helical-Rotary Compressor
- 6 Condenser
- 9 Evaporator-water outlet
- 10 Evaporator-water inlet
- 11 Electronic expansion valve
- 12 Filter dryer

General Information

Installation overview

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

- Locate and maintain the loose parts, for example, isolators, bulb wells, temperature sensors, flow sensors, or other factory-ordered, field-installed options, for installation, as required.
- Install the unit on a foundation with flat support surfaces, level within 6 mm and of sufficient strength to support concentrated weight. 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 1 m 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 and 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 vents 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.

General Information

Table 1 – Installation overview

Refer to the installation mechanical and electrical sections of this manual for detailed installation instructions.

Requirement	Trane supplied Trane installed	Trane supplied Field installed	Field supplied Field installed
Rigging			Safety chains Clevis connectors Lifting beam
Isolation		Isolation pads	Isolation pads
Electrical	Disconnect switch (optional)	Flow switches (may be field supplied)	Disconnect switch BAS wiring (optional) Water pump contactor
Water piping		Flow switches (may be field supplied)	Thermometers Water flow pressure gauges Isolation and balancing valves water piping Vents and drain valves Pressure relief valves
Pressure relief	Relief valves		Vent line
Insulation	Insulation (optional)		Insulation

Table 2 - General data

	207	208	210	211	212	214	216	217	218	220	222	224
Evaporator type	EG 120	EG 120	EG 140	EG 170	EG 170	EG 200	EG 200	EG 200	EG 250	EG 250	EG 340	EG 340
Condenser type	CG 120	CG 120	CG140	CG 170	CG 170	CG 200	CG 200	CG 200	CG 230	CG 230	CG 230	CG 230
Compressor type	K1/K1	K2/K2	L1/L1	L2/L1	L2/L2	M1/M1	M2/M1	M2/M2	N1/M2	N1/N1	N2/N1	N2/N2
Oil charge (l)	6/6	6/6	7/7	7/7	7/7	8/8	8/8	8/8	8/8	8/8	11/8	11/11
Oil type	OIL 023 E or OIL 048 E											
Refrigerant charge (kg)	39/39	39/39	60/60	60/60	60/60	60/60	60/60	60/60	69/69	69/69	74/74	74/74
Operating weight (kg)	2620	2620	3370	3450	3450	3725	3725	3725	4325	4500	4925	5000
Shipping weight (kg)	2450	2450	3050	3150	3150	3500	3500	3500	3900	4050	4250	4400
Length (mm)	2880	2880	4150	4150	4150	4150	4150	4150	4150	4150	4150	4150
Width (mm) (1)	890	890	890	890	890	890	890	890	890	890	890	890
Height (mm) (1)	1789	1789	1832	1832	1832	1832	1832	1832	1932	1932	2041	2041

(1) With compressor sound enclosure and disconnect switch handle not mounted.

Installation Mechanical

Storage

If the chiller is to be stored for at least one month prior to the 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 the engineering bulletin for noise-consideration applications.
- Locate the unit away from sound-sensitive areas.
- Install the isolation pads under the unit.
- Install the rubber vibration isolators in all water piping.
- Use flexible electrical conduit.

Note: Consult an acoustical engineer for critical applications.

Foundation

Provide rigid, non-warping mounting pads or a concrete foundation of sufficient strength and mass to support the chiller operating weight (including completed piping and full operating charges of refrigerant, oil, and water). Refer to Table 2 for unit operating weights.

When in place, level the chiller within 6 mm over its length and width. The Trane Company is not responsible for equipment problems resulting from an improperly-designed or -constructed foundation.

Vibration eliminators

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

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

Clearances

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

Allow adequate clearance for condenser and compressor servicing. A minimum of 1 meter is recommended for compressor service and to provide sufficient clearance for the opening of the 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.

Local regulations may provide for specific requirements.

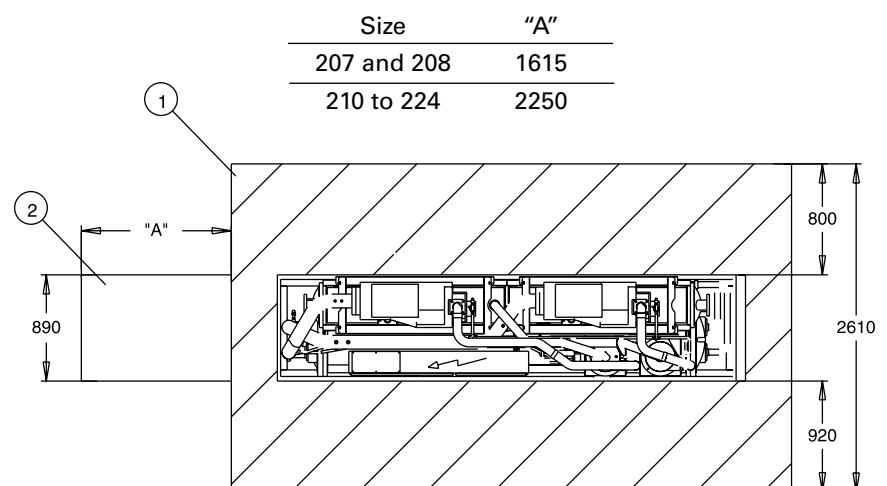


Figure 4: Minimum service clearance

1 Minimum clearance for maintenance.

2 Minimum clearance for tube removal of the evaporator or condenser (at either end of the unit).

Dimensions in mm

Installation Mechanical

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 40°C.

Vent the evaporator, condenser, and compressor pressure-relief valves venting.

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 provided with drain connections. Refer to "water piping".

Access restrictions

Door clearances for the RTWB units are given in Figure 8. Refer to the unit submittals for specific "per unit" dimensional information.

Lifting procedure

The unit can be moved by using a fork lift or chains, cables, and a lifting beam. The total lifting weight and required lifting-beam dimensions are shown in Figure 5 and on the lifting diagram shipped with each unit. Lifting-beam crossbars must be positioned so that lifting cables do not come in contact with the sides of the unit.

⚠ CAUTION

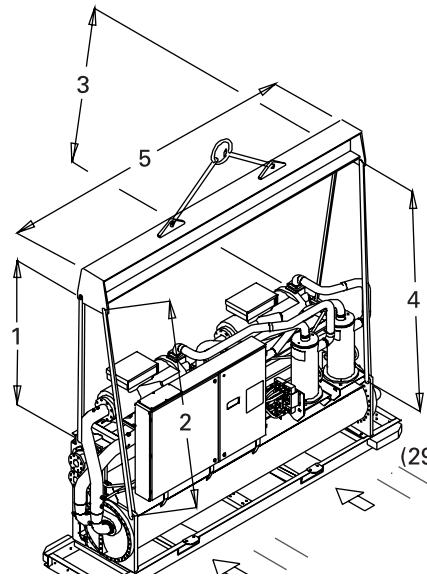
To prevent unit damage, position the lifting beam so that cables do not come in contact with the unit.

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.

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

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

Sizes 207 and 208



Sizes 210-224

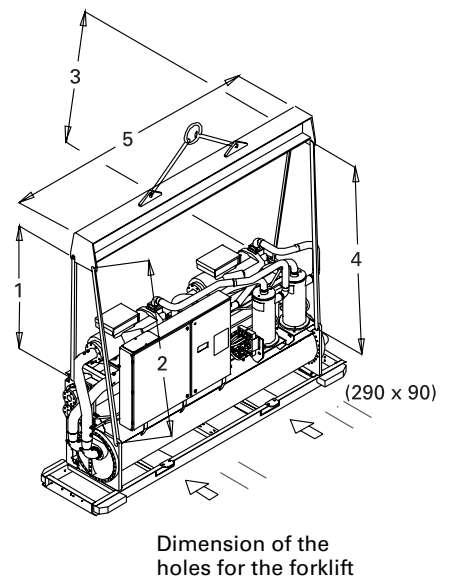


Figure 5 – Lifting and rigging

Table 3 – Shipping weights and sling lengths for lifting

Unit Size	1 (mm)	2 (mm)	3 (mm)	4 (mm)	5 (mm)	6 (mm)	Shipping Weight (kg)
207	-	-	2500	3000	2650	2200	2600
208	-	-	2500	3000	2650	2200	2600
210	2500	3030	2400	3000	3650		3050
211	2500	3030	2400	3000	3650		3150
212	2500	3030	2400	3000	3650		3150
214	2500	3030	2400	3000	3650		3500
216	2500	3030	2400	3000	3650		3500
217	2500	3030	2400	3000	3650		3500
218	2470	3060	2450	3000	3650		3900
220	2470	3060	2450	3000	3650		4050
222	2450	3100	2500	3000	3650		4250
224	2450	3100	2500	3000	3650		4400

Installation Mechanical

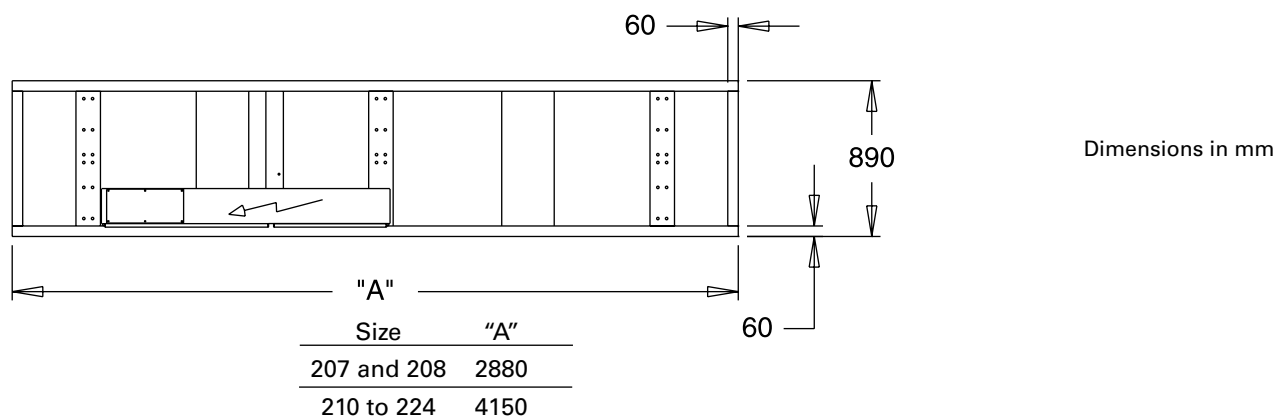


Figure 6 – Isolator pad location

Isolation pads

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

Water piping

Piping connections

CAUTION

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

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

Evaporator water piping

Figure 7 illustrates typical evaporator piping components. Components and layout will vary slightly, depending on the location of connections and the water source.

The chilled-water connections are on the back of the unit, when facing the control panel.

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.

To prevent damage to chilled-water components, do not allow evaporator pressure (maximum working pressure) to exceed 10 bar.

Provide shutoff valves in lines to the gauges, in order 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 the balance of the water flow. Install shutoff valves on both the entering and leaving-water lines so that the evaporator can be isolated for service.

A pipe strainer should be installed in the entering water line to prevent water-borne debris from entering the evaporator.

Installation Mechanical

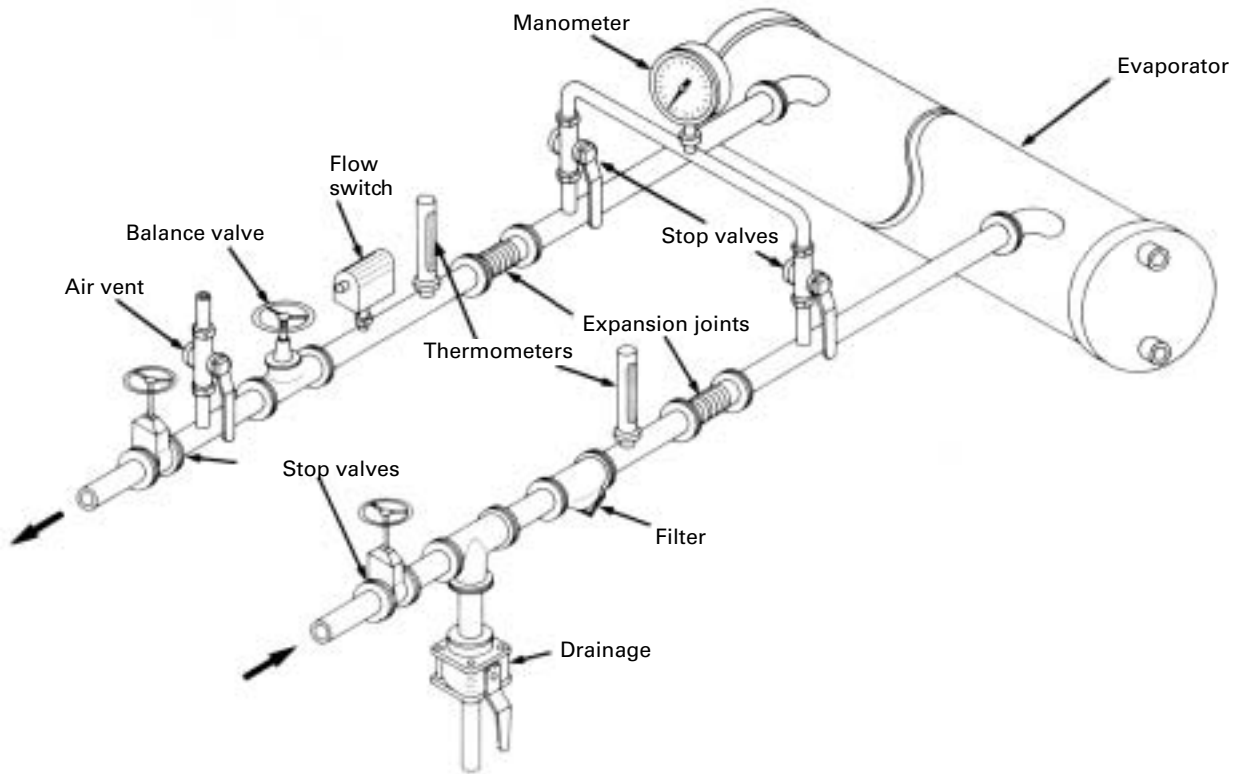


Figure 7 – Suggested piping for typical RTWB evaporator

Evaporator piping components

“Piping components” include all devices and controls used to provide proper water-system operation and unit operating safety.

These components and their general location are given above:

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

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

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
- Pressure-relief valve.

Installation Mechanical

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
- Vibration eliminators
- Shutoff (isolation) valves.
- Thermometers
- Cleanout tees
- Pipe strainer

Leaving condenser-water piping

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

To prevent condenser damage do not exceed 10 bar water pressure.

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

Condenser Water Limitation (RTWB only)

The RTWB starts and operate satisfactorily over a wide range of load conditions with controlled entering condenser water temperature. Reducing the condenser water temperature is an effective method of lowering the power input to the compressors. The optimum condenser water temperature is related to the leaving chilled water temperature and the percentage of load on the chiller. Nevertheless it is required to maintain a minimum temperature differential of 18°C between the leaving chilled water temperature and the leaving condenser temperature. This minimum temperature differential must be reached within 2 minutes from start-up and maintained thereafter.

Furthermore, the entering condenser water temperature should never drop below 20°C, whatever the other operating conditions of the chiller.

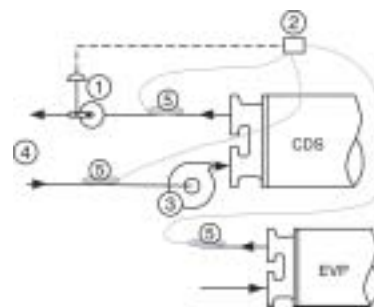
When one of these 2 parameters is expected to drop below the limit stated here above, even at start up, it is required that some form of condenser water temperature control be implemented to satisfy compressor safety and to ensure optimum chiller performance.

There are numerous methods to control condenser water temperature. Methods other than those shown can be employed to achieve the same results. Contact your local Trane office for details.

Throttling valve

This method maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to condenser pressure or system differential pressures.

Figure 8



- 1 = 2-way valve
- 2 = Customer controller
- 3 = Condenser water pump
- 4 = To/from cooling device
- 5 = Temperature sensor

Advantages:

- Good control with proper valve sizing at relatively low cost.
- Pumping cost can be reduced.

Disadvantages:

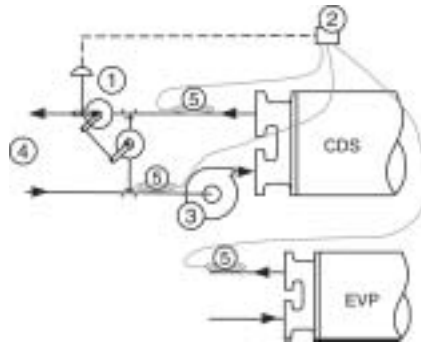
- Increased rate of fouling due to lower condenser water velocity.
- Requires pumps that can accommodate variable flow.

Installation Mechanical

Cooling device bypass

Cooling device bypass is also a valid control method if the chiller temperature requirements can be maintained.

Figure 9



- 1 = 3-way valve or 2 2-way valves
- 2 = Customer controller
- 3 = Condenser water pump
- 4 = To/from cooling device
- 5 = Temperature sensor

Advantage:

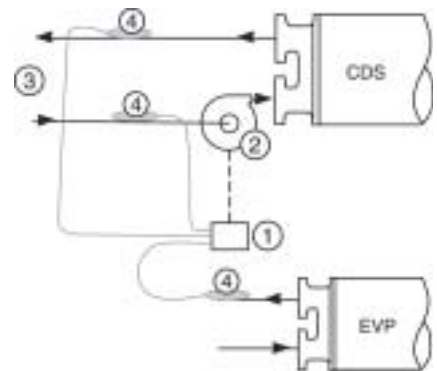
- Excellent control by maintaining constant water flow through the condenser.

Disadvantage:

- Higher cost because of the dedicated pump required for each chiller if condenser pressure is the control signal.

Condenser water pump with variable frequency drive

Figure 10



- 1 = Customer controller
- 2 = Condenser water pump with VFD
- 3 = To/from cooling device
- 4 = Temperature sensor

Advantages:

- Pumping cost can be reduced.
- Good cooling device temperature control.
- Relatively low first cost.

Disadvantages:

- Increased rate of fouling due to lower water velocity in the condenser.

Water treatment

Do not use untreated or improperly treated water. Use of untreated or improperly treated water may result in equipment damage.

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

Installation Mechanical

Water pressure gauges and thermometers

Install field-supplied thermometers and pressure gauges (with manifolds, whenever practical) as shown in Figure 7. Locate pressure gauges or taps in a straight run of pipes -avoid placement near elbows-. Be sure to install the gauges at the same elevation on each shell if the shell has 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 pressure-relief valves in both evaporator and condenser systems. Failure to do so could result in shell damage.

Install water-pressure-relief valves 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 with a water temperature increase. Refer to the 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 7.

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 flow 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.

Note: The Unit Control Module 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 machine shutdowns persist.

Adjust the switch to open when water flow falls below nominal. Refer to the evaporator and condenser data table for minimum flow recommendations. Flow-switch contacts are closed on proof of water flow.

WARNING

Refrigerant pressure relief-valve venting

To prevent injury due to inhalation of R134a 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.

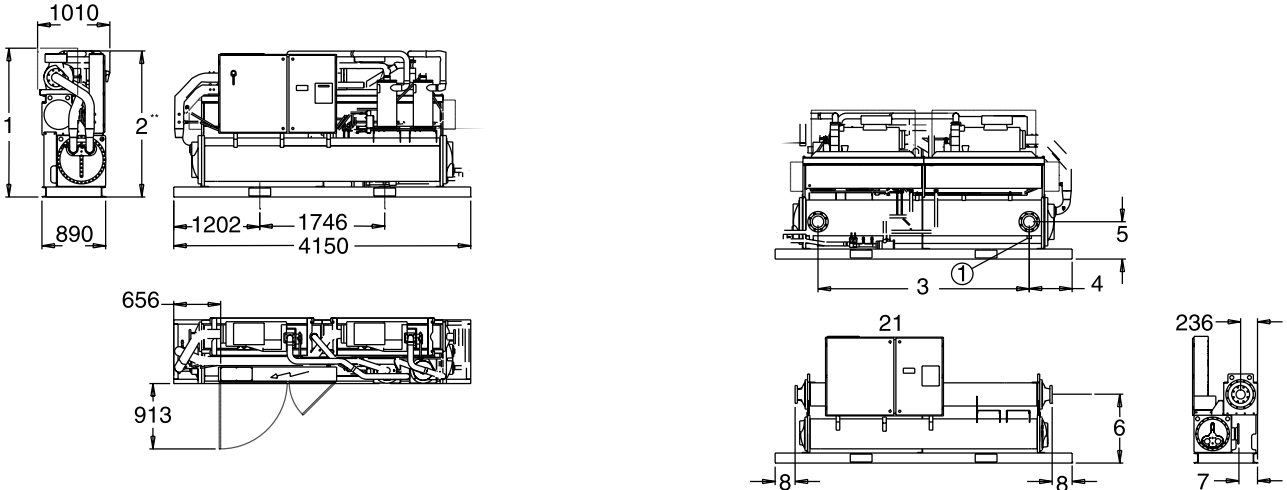
All RTWB units use evaporator, compressor, and condenser pressure-relief-valves that must be vented to the outside of the building. Relief-valve connection sizes and location are shown in the unit submittals. Refer to national regulation for relief valve vent line sizing information.

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

Note: After being opened once, relief valves tend to leak.

Installation Mechanical

Sizes 210-224



Sizes 207-208

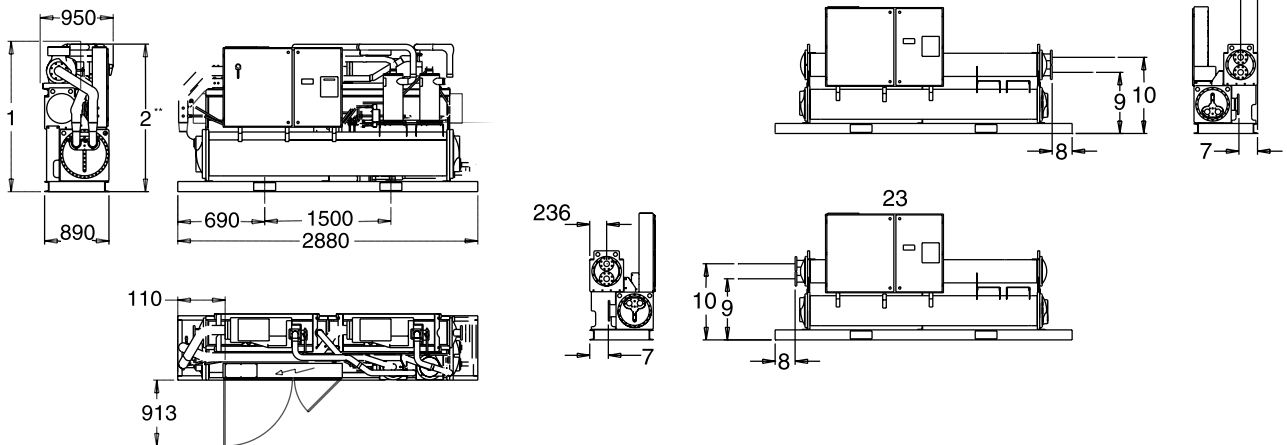


Figure 11 – Dimensions for RTWB units

Unit size	1 (mm)	2 (mm)	3 (mm)	4 (mm)	5 (mm)	6 (mm)	7 (mm)	8 (mm)	9 (mm)	10 (mm)
207	1800	1789	1792	544	384	911	318	215	806	1016
208	1800	1789	1792	544	384	911	318	215	806	1016
210	1898	1832	2844	653	408	959	258	279	854	1064
211	1898	1832	2844	653	408	959	258	279	854	1064
212	1898	1832	2844	653	408	959	258	279	854	1064
214	1898	1832	2844	653	408	959	258	279	854	1064
216	1898	1832	2844	653	408	959	258	279	854	1064
217	1898	1832	2844	653	408	959	258	279	854	1064
218	2008	1932	2952	599	498	1063	181	215	958	1168
220	2008	1932	2952	599	498	1063	181	215	958	1168
222	2097	2041	2952	599	522	1150	95	215	1045	1255
224	2097	2041	2952	599	522	1150	95	215	1045	1255

- 1: Evaporator drain
- 21: 1 pass condenser
- 22: condenser 2 passes right
- 23: condenser 2 passes left

Installation Mechanical

Table 4 – Evaporator and condenser data

Model RTWB	Evaporator code	Condenser code	Evaporator water content		Condenser water content	
			Liter	Liter	Liter	Liter
207	EG 120	CG 120	105	60		
208	EG 120	CG 120	105	60		
210	EG 140	CG 140	265	55		
211	EG 170	CG 170	220	66		
212	EG 170	CG 170	220	66		
212	EG 170	CG 170	220	66		
214	EG 200	CG 200	200	75		
216	EG 200	CG 200	200	75		
217	EG 200	CG 200	200	75		
218	EG 250	CG 230	415	78		
220	EG 250	CG 230	415	78		
222	EG 340	CG 230	560	78		
224	EG 340	CG 230	560	78		

Minimum and maximum evaporator water flow (L/s)

Evaporator Code	Pass Number	Minimum and maximum evaporator water flow (L/s)		Connection Diameter (in.)
		Minimum Water Flow	Maximum Water Flow	
EG 120	1	4.5	13.4	5
EG 140	1	6.0	18.0	6
EG 170	1	7.0	21.0	6
EG 200	1	9.0	25.0	6
EG 250	1	11.0	33.0	6
EG 340	1	14.0	43.0	6

Minimum and maximum condenser water flow (L/s)

Condenser Code	Pass Number	Minimum and maximum condenser water flow (L/s)		Connection Diameter (in.)
		Minimum Water Flow	Maximum Water Flow	
CG 120	1	8.4	31.0	5
CG 140	1	9.5	34.9	5
CG 170	1	11.9	43.7	5
CG 200	1	17.0	61.0	5
CG 230	1	17.0	61.0	5

Table 5 – RTWB Evaporator water pressure drop (kPa)

Model RTWB	Pass Number	Water flow (L/s)								
		5	10	15	20	25	30	35	40	45
207	1	6	24	-	-					
208	1	6	24	-	-					
210	1	-	57	122	-					
211	1	-	29	61	104					
212	1	-	29	61	104					
214	1		11	24	41	62				
216	1		11	24	41	62				
217	1		11	24	41	62				
218	1			17	29	45	64			
220	1			17	29	45	64			
222	1				23	35	49	66	85	106
224	1				23	35	49	66	85	106

Table 6 – RTWB Condenser water pressure drop (kPa)

Model RTWB	Pass Number	Water flow (L/s)										
		10	15	20	25	30	35	40	45	50	55	50
207	1	10	20	34	51	71	-	-				
208	1	10	20	34	51	71	-	-				
210	1	6	12	20	30	42	-	-				
211	1	-	8	14	21	29	38	48				
212	1	-	8	14	21	29	38	48				
214	1			12	18	24	32	40	48	58	68	79
216	1			12	18	24	32	40	48	58	68	79
217	1			12	18	24	32	40	48	58	68	79
218	1			12	18	24	32	40	48	58	68	79
220	1			12	18	24	32	40	48	58	68	79
222	1			12	18	24	32	40	48	58	68	79
224	1			12	18	24	32	40	48	58	68	79

Installation Electrical

General recommendations

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

⚠ WARNING

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 electrical regulations. Electrical characteristics and other unit electrical data are on the unit nameplate. Specific electrical schematics and connection diagrams are shipped with the unit.

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 conduits to interfere with other components, structural members, or equipment. All conduits must be long enough to allow compressor and starter removal.

Table 7 – Electrical data

RTWB		207	208	210	211	212	214	216	217	218	220	222	224
Nominal voltage	(V)	400	400	400	400	400	400	400	400	400	400	400	400
Frequency	(Hz)	50	50	50	50	50	50	50	50	50	50	50	50
Voltage utilization range	(V) Mini	360	360	360	360	360	360	360	360	360	360	360	360
	Maxi	440	440	440	440	440	440	440	440	440	440	440	440
Max. unit kW	(kW)	90	106	132	142	152	182	202	222	243	264	292	320
Maximum Rated Load Amps	(A)	147	170	215	235	255	297	329	360	396	432	477	521
Starting Amps (1)	(A)	170	196	228	264	279	332	374	398	430	457	520	554
Power factor		0.91	0.92	0.90	0.89	0.88	0.89	0.90	0.90	0.89	0.89	0.89	0.89
Fuse size (2)		80A	100A	125A	60/125	160A	2*160	160+200	2*200	250+200	2*250	2*315	2*315
Disconnect switch size	(A)	315	315	315	400	400	400	630	630	630	630	800	800
Maximum connecting wire (2)(3)	mm ²	240	240	240	240	240	240	2*300	2*300	2*300	2*300	2*300	2*300

(1) Star delta start. Maximum starting Amps: one compressor at full load, the other one starting.

(2) With disconnect switch option

(3) mm²/phase

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

Installation Electrical

Power supply wiring

Model RTWB chillers are designed according to European standard EN60204. 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 switch for both the chilled-water and condenser-water pumps.

Electrical panel power supply

Power supply wiring instructions for the starter/control panel are: run line voltage wiring in conduit to access opening(s) on the starter/control panel.

Compressor-motor phase sequencing

Always verify that proper rotation of the RTWB compressors 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).

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.

Installation Electrical

Control power transformer

The RTWB units are equipped with a control power transformer as standard. It is not necessary to provide control power voltage to these units.

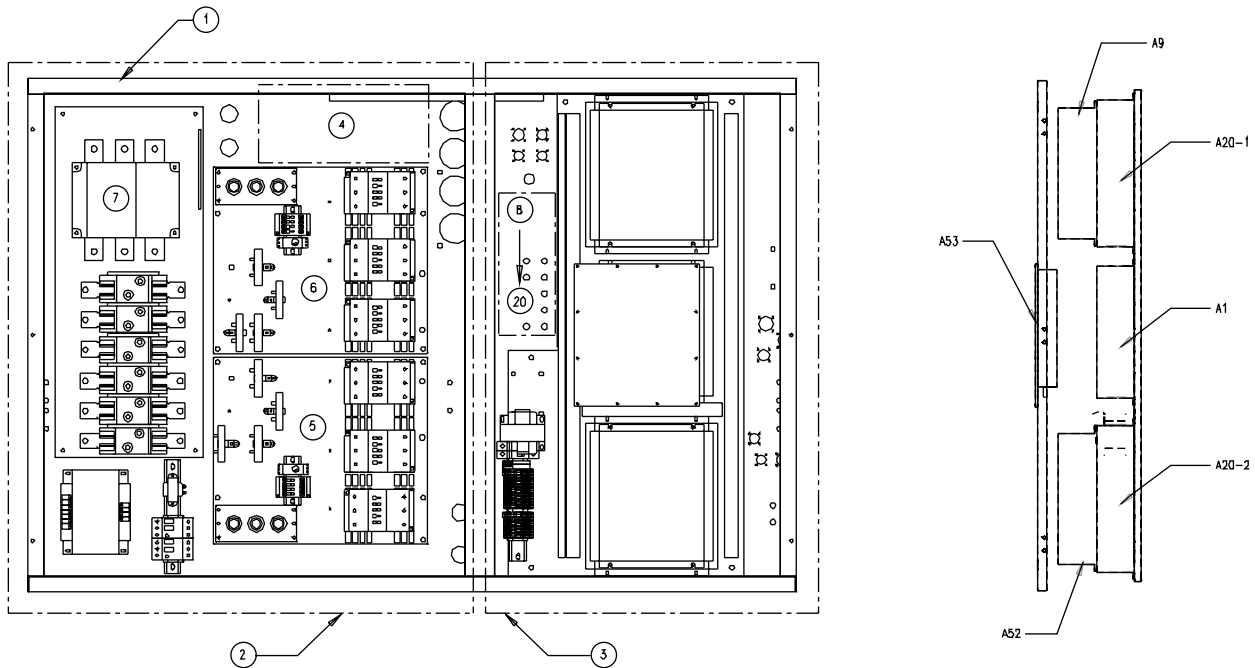


Figure 12 - Electrical panel layout

- 1 Line voltage entrance
- 2 Power section
- 3 Control section
- 4 Free space for customer pump control
- 5 Wye-delta, closed-transition starter circuit A
- 6 Wye-delta, closed-transition starter circuit B
- 7 Unit disconnect, non-fused
- 8 CKT # 1 Lockout (module A20-1 6X7-8)
- 9 CKT # 2 Lockout (module A20-2 6X9-10)
- 10 Emergency stop (Normal/Stop contact - module A1 TB1 3-4)
- 11 Zone temperature sensor (6R3) or ice-machine control (6S55) option (6R3 and 6S55 cannot be used together) (module A9TB1 1-2)
- 12 External chilled-water setpoint 4-20 mA or 2-10 V (dc)with communication interface option (module A9TB1 4-5 7-8)
- 13 Communication serial link (A9TB2 1...4)
- 14 Leaving condenser-water temperature sensor (5R53-2) option (with option PCM A70)
- 15 Chilled-water flow switch (6S56 - MODULE A1TB3-4)
- 16 External Auto/Stop (6S1 - module A1TB3 3-4)
- 17 Customer output:
 - Remote alarm indicator (from normally-closed signal)
 - Maximum capacity indicator
 - Compressor running indicator
 - Remote alarm indicator (from normally-open signal)
- 18 Chilled-water pump starter (TRANE UCM pump control - module A1TB4 8-9)
- 19 Chilled-water pump starter (Auxiliary Interlock - MODULE A1TB3 1-2)
- 20 Tracer (Option - module A9TB2 1...4)

Installation Electrical

Interconnecting wiring

IMPORTANT

Do not turn the chiller on or off using the chilled-water interlocks.

When making field connections, refer to the appropriate field layout, wiring schematics, and control diagrams that ship with the unit.

Chilled-water pump control

CAUTION

The chilled-water pump must operate for a minimum of one minute after the UCM receives a command, through the external Auto/Stop input, to shut down the chilled-water system.

On the RTWB units, the controller will initiate the "Run:Unload" mode to terminate a cycle from any of the following:

- Stop key pressed
- Loss of load
- External Auto/Stop input opened

The "Run:Unload" operating mode commands the compressor to completely unload, which takes about ½ minute. This will allow the compressors to be totally unloaded for the next start-up. If only the proof-of-chilled-water-flow interlock is used, the chiller will shut down with an immediate (non-friendly) shutdown and initiate an automatic reset diagnostic.

1. External Auto/Stop (terminals A1 TB3-3 and -4)
This input is supplied by the field. A contact closure will start the chiller water pump and chiller, via the UCM pump control contacts. Opening the contact will put the operating compressors into "Run:Unload" mode and initiate a timing period (1 to 30 minutes, adjustable through the Clear Language Display). This will delay termination of the chilled-water pump operation via the UCM pump control contacts. Examples of the input terminals 1UTB3-3 and -4 would be a time clock, ambient thermostat, building automation system.

2. UCM Pump Control Contacts (Terminals A1 TB4-8 and -9)
This output is a set of contacts that will close, starting the chilled-water pump when the external Auto/Stop contacts are closed. When the contacts are opened, 1 to 30 minutes later (adjustable through the Clear Language Display), the UCM pump control contacts open.
3. Proof-of-Chilled-Water-Flow Interlock (Terminals A1 TB3-1 and -2)
This terminal must be field-installed. Contact closure between the terminals indicates proof of chilled-water flow. Examples of this are a pump starter auxiliary contact, flow switch, differential pressure switch, or a contact from a building automation system. Opening of this contact will immediately shut down the chiller and initiate an automatic reset diagnostic, indicating loss of chilled-water flow
4. Condenser-Water Pump For the condenser-water pump interlock on the RTWB units, connect leads from terminals 6X3 to 6X6 and the water pump control. The circuit is 110 V (ac) and the load is not to exceed 1150 VA inrush, 115 VA sealed. This will interlock the condenser-water pump operation with the unit operation. This insures that the condenser-water pump is operating before the compressor(s) is started.
5. Alarm/Running/Maximum Capacity Outputs
Terminals 1 to 7 on terminal strip TB4 of the A1 board provide a variety of contact outputs on the RTWB. These are dependent on the setting of Programmable Relay Setup (Service Setting Menu) and its relationship to diagnostics, compressors operating, and the system operating at full capacity.

As shown in Figure 13, there are three relays.

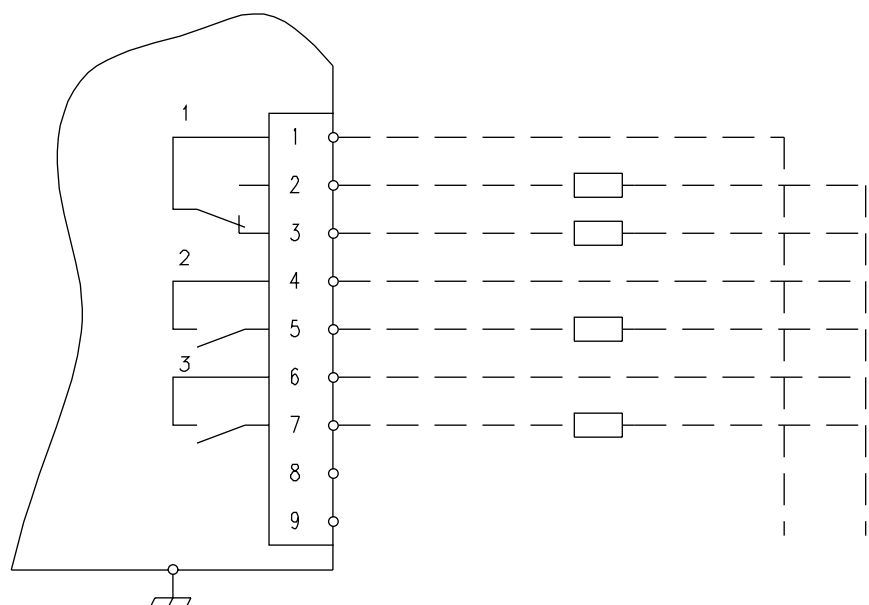


Figure 13 – Alarm / Running / Maximum capacity relay output for the RTWB unit.

Installation Electrical

Table 8 – Alarm / Running / Maximum capacity relay output configuration

Relay output configuration		
1	Relay 1	Alarm
	Relay 2	Compressor running
	Relay 3	Maximum capacity
2	Relay 1	Circuit 1 alarm
	Relay 2	Circuit 2 alarm
	Relay 3	Maximum capacity
3	Relay 1	Alarm
	Relay 2	Circuit 1 running
	Relay 3	Circuit 2 running

Table 9 – Alarm / Running / Maximum capacity menu setting

Programmable Relay Setup Setting (service setting menu)	Relay Output Configuration (Table 6)	Diagnostic that the Alarm relay(s) is active		
		MMR / CMR diag.	MAR / CAR diag.	IFW diag.
1	1	YES	NO	NO
2	1	YES	YES	NO
3	1	YES	YES	YES
4	1	YES	NO	YES
5	2	YES	NO	NO
6	2	YES	YES	NO
7	2	YES	YES	YES
8	2	YES	NO	YES
9	3	YES	NO	NO
10	3	YES	YES	NO
11	3	YES	YES	YES
12	3	YES	NO	YES

Notes:

MMR: Machine Manual Reset

CMR: Circuit Manual Reset

MAR: Machine Auto Reset

CAR: Circuit Auto Reset

IFW: Informational Warnings

Installation Electrical

Low-voltage wiring

The remote devices described below require low-voltage wiring. All wiring to and from these remote input devices to the UCM, as described in the hereafter paragraph, must be made with shielded, twisted-pair conductors. Be sure to ground the shielding only at the Clear Language Display.

CAUTION

To prevent control malfunction, do not run low-voltage wiring (<30V) in conduits with conductors carrying more than 30 V.

Emergency stop (normal trip)

The Clear Language Display provides auxiliary control for a customer-specified or -installed latching tripout. When this remote contact 6S2 (furnished by the customer) is provided, the chiller will run normally when the contact is closed. When the contact opens, the unit will trip off on a manually-resettable diagnostic. This condition requires manual reset at the chiller switch on the front of the Clear Language Display.

To connect, first remove the jumper located between terminal 3 and 4 of A1TB1. Refer to the field diagrams that are shipped with the unit.

External circuit lockout - Circuit number 1

The UCM provides auxiliary control of a customer-specified or -installed contact closure, for individual operation of circuit number 1. If the contact is closed, the refrigerant circuit will not operate. The refrigerant circuit will run normally when the contact is opened.

External circuit lockout will only function if External Circuit Lockout (service setting Menu) is enabled.

Connections are shown in the field diagrams that are shipped with the unit.

Installation Electrical

External circuit lockout - Circuit number 2

The UCM provides auxiliary control of a customer-specified or -installed contact closure, for individual operation of circuit number 2. If the contact is closed, the refrigerant circuit will not operate. The refrigerant circuit will run normally when the contact is opened.

External circuit lockout will only function if External Circuit Lockout (service setting Menu) is enabled.

Connections are shown in the field diagrams that are shipped with the unit.

Ice-making option

Ice-machine control (Operator Setting Menu) must be enabled. The UCM provides auxiliary control for a customer-specified or -installed contact closure for ice making. When contact 6S55, module A9, terminals TB1 1 and 2, is provided, the chiller will run normally when the contact is open. Upon contact closure, the UCM will initiate an ice-building mode, in which the unit runs fully loaded at all times. Ice-building shall be determined either by opening the contact or based on the entering evaporator-water temperature setting under Active Ice Termination Setting (Chiller Report Menu). The UCM will not permit ice-building mode to be reentered until the unit has been switched out of ice-building mode (open 6S55 contacts) and then switched back into ice-building mode.

In ice-building, the current setpoint will be set at 120%. For example, if the front panel or external current limit setpoint is set to 80%, in ice-building the active current limit is 120%.

If, while in ice-building mode, the unit gets down to the freeze stat setting (water or refrigerant), the unit will shut down on a manually resettable diagnostic, just as in normal operation.

External chilled-water setpoint: voltage source 2-10 V (dc), or Current source 4-20 mA

This option allows the external setting of the chilled-water setpoint, independent of the front panel chilled-water setpoint, by one of the two means:

- 1 - An isolated voltage input 2-10 V (dc)
- 2 - An isolated current loop input 4-20 mA

Isolated 2-10 V (dc) voltage source input

Set dip switch SW1-1 of the option module A9 to "OFF". Connect the voltage source to terminals 4 (+) and 5 (-) on option module A9TB1. CWS is now based on the following equation:

$$\text{CW Setpoint } ^\circ\text{C} = (\text{V (dc)} * 4.88) - 27.56$$

Sample values for CWS vs. V (dc) signals are shown in Table 10.

Table 10: Input values vs. External chilled-water setpoint

Voltage (V (dc))	Current (mA)	Resulting chilled-water setpoint (°C)
3.6	7.2	-10
4.6	9.2	-5
5.6	11.3	0
6.7	13.3	5
7.7	15.4	10

Installation Electrical

Isolated 4-20 mA current source input

Set dip switch SW1-1 of the option module A9 to "ON." Connect the current source terminals 4 (+) and 5 (-). CWS is now based on the following equation:

$$\text{Setpoint } (^{\circ}\text{C}) = (\text{mA} * 2.44) - 27.56$$

External current limit setpoint: voltage source 2-10 V (dc) or current source 4-20 mA.

This option allows the external setting of the current limit setpoint, independent of the front panel current-limit setpoint, by one of the two means:

- 1 - an isolated voltage input 2-10 V (dc)
- 2 - an isolated voltage input 4-20 mA

To enable external current-limit setpoint operation, external current-limit setpoint (operator setting menu) should be set to "E" using the clear language display.

1- 2-10 V (dc) voltage source input
Set dip switch SW1-2 of the option module A9 to "OFF." Connect the voltage source to terminals 7 (+) and 8 (-) of the option module A9. CLS is now based on the following equation:

$$\text{CL Setpoint \%} = (\text{V (dc)} * 10) + 20$$

Sample values for CLS vs. V (dc) signals are shown in Table 9.

Minimum setpoint : 40% (2.0 V (dc) input)

Maximum setpoint : 120% (10.0 V (dc) input)

4-20 mA Current source input
Set dip switch SW1-2 of the option module A9 to "ON." Connect the current source to terminal 7 (+) and 8 (-) of option module A9. CLS is now based on the following equation:

$$\text{CL Setpoint \%} = (\text{mA} * 5) + 20$$

Sample values for CLS vs mA signals are shown in Table 9.

Minimum setpoint = 40% (4.0 mA)

Maximum setpoint = 120% (20.0 mA)

Table 11: Input values vs. external current-limit setpoint

Voltage (V (dc))	Current (mA)	Resulting current-limit setpoint (% RLA)
2.0	4.0	40
3.0	6.0	50
4.0	8.0	60
5.0	10.0	70
6.0	12.0	80
7.0	14.0	90
8.0	16.0	100
9.0	18.0	110
10.0	20.0	120

Outdoor air-temperature sensor

This sensor is used for low ambient lockout and chilled-water reset by outdoor air temperature. This sensor is optional on the RTWB units.

Remove the sensor from its shipping location in the control panel and install it in the fresh-air intake on the north wall of the building. Protect the sensor from direct sunlight and shelter it from the elements.

Connect leads to terminals 1 and 2 from module A9TB1. All wiring to and from the remote sensor must be made with shielded, twisted-pair conductors. Be sure to ground the shielding only at the UCM. Apply tape to the sensor end of the shielding to prevent it from contacting the surface.

Communication card

This option allows the Clear Language Display in the control panel on RTWB units to exchange information (operating setpoints and Auto/Standby commands) with a higher-level control device, such as Tracer. A shielded, twisted-pair connection establishes the bidirectional communications link between the unit control panel and the Tracer.

⚠ CAUTION

Note: The shielded, twisted-pair conductors must run in a separate conduit.

⚠ CAUTION

To prevent control malfunction, do not run low-voltage wiring (<30V) in conduits with conductors carrying more than 30 volts.

⚠ WARNING

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

⚠ CAUTION

To prevent overheating at the terminal connections, use copper conductors only.

Installation Electrical

General

Field wiring for the communication link must meet the following requirements:

1. All wiring must be in accordance with local codes.
2. Communication link wiring must be shielded, twisted-pair wiring.
3. The maximum total length for each communication link is 1,500 meters.
4. The communication link cannot pass between buildings.
5. All UCM on the communication link can be connected in a "daisy chain" configuration.

Communication-link connection procedure

1. Refer to the Tracer installation literature to determine proper communication-link termination connections at the Tracer module.
2. Connect the shield of the communication-link wiring to the designated shield terminal at the Tracer module.
3. Connect leads to terminals 1 and 2 of TB2 of the module A9 of the UCM to the Tracer. There is no polarity requirement for the connection.
4. At the UCM, the shield should be cut and taped to prevent any contact between the shield and ground.

Note: On multiple-unit installations, splice the shielding of the twisted pairs that come into each UCM in the "daisy chain" system. Tape the spliced connections to prevent any contact between the shield and ground. At the last Clear Language Display in the chain, the shield should be cut and taped off.

5. To get the chiller to communicate with a Tracer on a multiple-unit controller, the ICS address under the "service settings" menu must be set and the optional A9 module must be installed. The Tracer will look for chiller addresses 55,56,57,58,59, or 60. Each chiller must have a unique address.

Installation Electrical

Installation check list

Complete this checklist as the unit is installed, to verify that all recommended procedures are accomplished before the unit is started. This checklist does not replace the detailed instructions given in sections 2 and 3 of this manual. Read both sections completely, to become familiar with the installation procedures, prior to beginning the work.

Receiving

- Verify that the unit nameplate data corresponds to the ordering information.
- Inspect the unit for shipping damage and any material shortage. Report any damage or material shortage to the carrier.

Unit location and mounting

- Inspect the location desired for installation and verify adequate service-access clearances.
- Provide drainage for evaporator and condenser water, if applicable.
- Remove and discard all shipping materials.
- Install optional neoprene if required.
- Level the unit and secure it to the mounting surface.

Unit water piping

- Flush all unit water piping before making final 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.

- Connect the water piping to the evaporator and condenser.
- Install pressure gauges and shutoff valves on the water inlet and outlet, if applicable.
- Install a water strainer in the entering chilled-water line, if applicable.
- Install a balancing valve and flow switch in the leaving chilled-water line, if applicable.
- Install a drain with shutoff valve or a drain plug on the evaporator, if applicable.
- Vent the chilled-water and condenser-water systems at high points in the system piping, if applicable.

Operating Principles – Mechanical

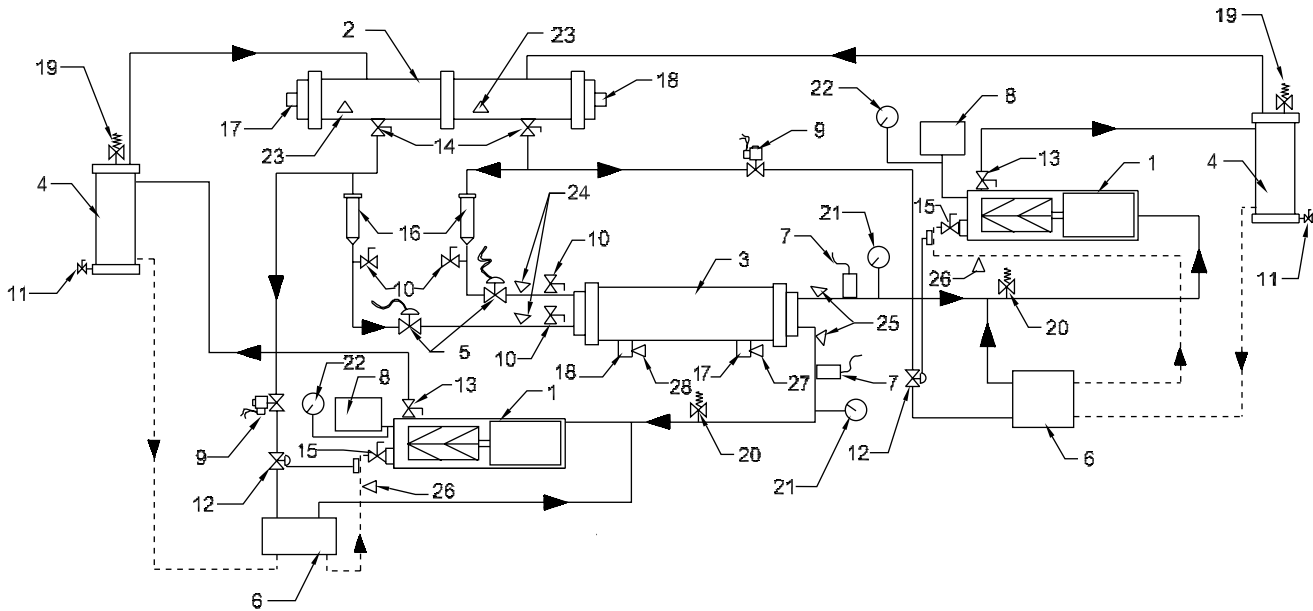


Figure 14 – RTWB refrigeration system and control components

General

This section describes the mechanical operating principles of the RTWB chillers equipped with microprocessor-based control systems.

The model RTWB chillers are dual-compressor, helical-rotary-type, water-cooled liquid chillers. The basic components of a RTWB unit are:

- Clear Language Display and control modules
- Helical-rotary compressor
- Direct-expansion evaporator
- Water-cooled condenser
- Oil supply system
- Interconnecting piping

Components of a typical RTWB unit are identified in Figure 2 and 3.

- 1 Compressor
- 2 Condenser
- 3 Evaporator
- 4 Oil separator
- 5 Electronic expansion valve
- 6 Oil cooler (option)
- 7 Low-pressure switch
- 8 High-pressure switch
- 9 Solenoid valve
- 10 Refrigerant charging valve
- 11 Oil-separator draining valve
- 12 Oil-cooler expansion valve
- 13 Compressor discharge valve (option)
- 14 Liquid-line service valve
- 15 Oil-circuit service and charging valve
- 16 Filter
- 17 Chilled-water outlet connection
- 18 Chilled-water inlet connection
- 19 High-pressure safety valve (supply if required by code vessel approval)
- 20 Low-pressure safety valve
- 21 Low-pressure gauges (option)
- 22 High-pressure gauges (option)
- 23 Saturated refrigerant temperature sensor (condenser)
- 24 Saturated Refrigerant temperature sensor (evaporator)
- 25 Refrigerant temperature sensor (suction)
- 26 Oil temperature sensor
- 27 Leaving chilled-water temperature sensor
- 28 Entering chilled-water temperature sensor (option)

Unit Start-Up Procedures

Pre-start checkout

General

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

- [] 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 circuit (disconnects, terminal block, contactors, compressor junction box terminals, ...). Loose connections can cause overheating at the connections and undervoltage conditions at the compressor motor.

- [] Verify that all refrigerant valves are open.

⚠ CAUTION

Do not operate the unit with the compressor, oil discharge, or liquid line valves closed. Failure to have these open may cause serious compressor damage.

- [] Check the power supply voltage to the unit at the main-power, fused disconnect switch. Voltage must be within the voltage utilization range, given in Table 7 and also stamped on the unit nameplate. Voltage imbalance must not exceed 2%

⚠ WARNING

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

- [] Check the unit power phasing to be sure that it has been installed in an "ABC" sequence.

⚠ WARNING

It is imperative that I1-I2-I3 in the starter be connected in the A-B-C phase sequence to prevent equipment damage due to reverse rotation.

- [] Fill the evaporator and condenser chilled-water circuits. Refer to Table 2 for liquid capacities. Vent the system while it is being filled. Open the vents on the top of the evaporator and condenser during filling, and close them when filling is completed

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

⚠ CAUTION

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

- [] Close the fused disconnect switch that supplies power to the chilled-water pump starter and the condenser pump starter.
- [] Start the chilled-water pump and condenser-water pump to begin circulation of the water. Inspect all piping for leakage and make any necessary repairs.
- [] With water circulating through the system, adjust the water flow and check the water-pressure drop through the evaporator and condenser. Refer to Tables 5 and 6.
- [] Adjust the chilled-water flow switch and the condenser-water flow switch (if installed) for proper operation.
- [] Prove all interlock and interconnecting wiring interlock as described in section 3.
- [] Check and set, as required, all Clear Language Display menu items.
- [] Stop the chilled-water pump and the condenser-water pump.

Unit Start-Up Procedures

Unit voltage power supply

Voltage to the unit must meet the criteria given in Table 7. Measure each phase of the supply voltage at the unit main-power, fused disconnect. If the measured voltage on any phase is not within the 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 contacts, compressor motors, and contactors.

Unit voltage imbalance

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:

$$\% \text{ imbalance} = \frac{(U_x - U \text{ average})}{U \text{ average}}$$

$$U \text{ average} = (U_1 + U_2 + U_3) / 3$$

U_x = phase with greatest difference from U average (without regard to sign).

For example, if the three measured voltages are 401, 410, and 407 volts, the average would be:

$$\frac{401 + 412 + 417}{3} = 410$$

The percentage of imbalance is then:

$$\frac{100 * (410 - 401)}{410} = 2.2\%$$

This exceeds the maximum allowable (2%) by 0.2%.

Unit voltage phasing

⚠ WARNING

It is imperative that L1-L2-L3 in the starter be connected in the A-B-C phase sequence, to prevent equipment damage due to reverse rotation.

It is important that proper rotation of the compressors be established before the unit 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.

When rotation is clockwise, phase sequence is usually called "ABC;" when counterclockwise, "CBA."

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

Water system flow rates

Establish a balanced chilled-water flow through the evaporator. The flow rates should be between the minimum and maximum values given in Table 4.

The flow rates through the condenser must also be balanced according to the flow rates table (Table 4).

Water system pressure drop

Measure the water pressure drop through the evaporator and condenser at the field-installed pressure taps, on the system water piping. Use the same gauge for each measurement. Do not include valves, strainers, or fittings in the pressure drop reading.

Unit Start-Up Procedures

Start up procedure

General

If the pre-start checkout, as discussed above, has been completed, the unit is ready to start. The Clear Language Display is shown in Figure 12. Complete each step in sequence, as follows:

- [] Press the Stop key on the Clear Language Display.
- [] As necessary, adjust the setpoint values in the Clear Language Display menus.
- [] Close the fused disconnect switch for the chilled-water pump and the condenser-water pump. Energize the pumps to start the 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 before starting the compressors.

⚠ CAUTION

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

- [] Verify that the chilled-water pump runs for one minute after the chiller is commanded to stop (for normal chilled-water systems).
- [] Press the Auto key. If the chiller control 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.

After the system has been operating for approximately 30 minutes and has become stabilized, complete the start-up procedures as follows.

- [] Check the evaporator refrigerant pressure and the condenser refrigerant pressure under the Refrigerant Report on the Clear Language display.
- [] Measure the system superheat.
- [] Measure the system subcooling.
- [] A shortage of refrigerant is indicated if the operating pressures are low and the 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 and charging through the backseat port until operating conditions become normal.

⚠ CAUTION

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

Use only the refrigerant 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 suction superheat for each circuit is approximately 3°C at full operating load. Superheat temperature can be expected to be moving around a 3°C setpoint when the chiller is pulling down or when the compressor slide valve is being modulated.

System subcooling

Normal subcooling for each circuit ranges from 5.5°C to 11°C, depending on the unit. If subcooling for either circuit does not approximate these figures, check the superheat for the circuit and adjust it, if required. If superheat is normal but subcooling is not, contact a qualified service technician.

Unit Shutdown Procedures

Unit shutdown procedures

Temporary shutdown and restart

To shut the unit down for a short time, use the following procedure:

- Press the Stop key on the Clear Language Display. The compressors will continue to operate and, after unloading for 20 seconds, will stop when the compressor contactor de-energizes.
- Stop the water circulation by turning off both the chilled-water pump and the condenser-water pump.

To restart the unit after a temporary shutdown, restart the chilled-water pump and the condenser-water pump, and press the Auto key. The unit will start normally if the following conditions exist:

- The UCM must receive a call for cooling and the differential-to-start must be above the setpoint.
- 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 as a seasonal shutdown:

Test the unit for refrigerant leakage and repair as necessary.

Open the electrical disconnect switches for the chilled-water pump and the condenser-water pump. Lock the switches in the "open" position.

⚠ CAUTION

Lock the chilled-water and condenser-water pump disconnects open, to prevent pump damage.

- Close all chilled-water supply valves and the condenser-water supply valves. Drain the water from the evaporator and the condenser.
- Open the unit main electrical disconnect and the unit-mounted disconnect (if installed), and lock in the "Open" position.

⚠ CAUTION

Lock the disconnects on the "Open" position to prevent accidental start-up and damage to the system when it has been set up for extended shutdown.

At least every three months, check the pressure in the unit to verify that the refrigerant charge is intact.

System restart after extended shutdown

- Follow the procedures below to restart the unit after an extended shutdown:
- Verify that the liquid-line service valves, oil line, and compressor discharge service valves are open.

⚠ CAUTION

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

- Check the oil-separator oil level. See the Maintenance paragraph.
- Fill the evaporator- and condenser-water circuits. Refer to Table 4 for evaporator- and condenser-water content. Vent the system while it is being filled. Open the vents on the tops of the evaporator and condenser during filling and close them when filling is completed.

⚠ CAUTION

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

- Close the fused disconnect switches that provide power to the chilled-water pump and the condenser-water pump.
- Start both the evaporator- and condenser-water pumps and, while water is circulating, inspect all piping for leakage. Make any necessary repairs before starting the unit.
- While the water is circulating, adjust the water flows and check the water pressure drops through the evaporator and the condenser. Refer to "Water System Flow Rates" and "Water System Pressure Drop."
- Adjust the flow switch (s) on the evaporator piping and the condenser piping (if installed) for proper operation.
- Stop both water pumps. The unit is now ready for the start-up procedure.

Periodic 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.

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 the Refrigerant Report Menu on the Clear Language Display.
- [] If operating pressure conditions seem to indicate a refrigerant shortage, measure the system superheat and system subcooling. Refer to the Start-up procedure paragraph.
- [] 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.

- [] Inspect the entire system for unusual conditions.

Monthly maintenance

- [] Perform all weekly maintenance procedures
- [] Measure and record the system superheat. Refer to the Start-up procedure paragraph.
- [] Measure and record the system subcooling. Refer to the Start-up procedure paragraph.

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.
- [] Check the refrigerant charge and oil level. Refer to the Refrigerant charging paragraph. Routine changing of oil is not required.
- [] Have a qualified laboratory perform a compressor-oil analysis to determine the system moisture content and acid level. This analysis is a valuable diagnostic tool.
- [] Check the pressure drop across the oil filter. See the Maintenance paragraph.
- [] Contact a qualified service organization to leak-test the chiller, to check operating and safety controls, and to 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.

WARNING

Position all electrical disconnects in the "Open" position and lock them, to prevent injury or death due to electrical shock.

Periodic Maintenance

Maintenance

General

This section describes specific maintenance procedures that must be performed as a part of the normal maintenance program for this unit. Be certain that electrical power to the unit is disconnected before performing these procedures.

WARNING

Position all electrical disconnects in the "Open" position and lock them, to prevent injury or death due to electrical shock.

Cleaning the evaporator

The evaporator water system is a part of a closed loop and should not accumulate an appreciable amount of scale or sludge. If it is determined that the chiller is fouled, attempt to dislodge any foreign material by backflushing the system several times. If this does not work satisfactorily, chemically clean the chiller using the procedures outlined in the following section.

Cleaning the condenser

General

Water that is available for condensing frequently contains minerals or other contaminants that collect on the inside of the condenser tubes. Scale accumulation will accelerate with high condensing temperatures and the use of water with high mineral content. Cooling devices collect dust and foreign material that are also deposited on the condenser tubes, forming sludge.

To maintain maximum efficiency, the condenser must remain as free of these deposits as possible. Even a very thin layer on the inside tube surfaces reduces the heat-transfer ability of the condenser. Indications of scale deposits are: decreased water flow through the condenser, reduced temperature differential between the entering and leaving condenser-water, and abnormally high condensing temperatures.

There are two accepted methods of cleaning the condenser tubes, as discussed in the following paragraphs.

Mechanical cleaning

The mechanical cleaning method is used primarily to remove sludge and other loose material from the condenser tubes.

Follow the steps below:

Turn off the chiller and condenser water supplies.

Break piping connections and the unions.

Remove the condenser heads.

Run a round nylon brush from the end through the tubes, to loosen deposits.

Flush the tubes with water. Then inspect the tubes for scale accumulation. If there is no scale in the tubes, reassemble the condenser and piping.

If there is scale in the tubes, follow the procedures in the following paragraph.

Chemical cleaning

Chemical cleaning is the most satisfactory method of cleaning scale from the condenser. With this treatment, scale is dissolved and flushed away by circulating a chemical solution through the tubes and headers.

Internal condenser components are composed of copper, steel, and cast iron. With this information, water treatment firms will be able to recommend a suitable chemical for this purpose. If water treatment is not available, consult a chemical supply house.

Water treatment

The use of untreated or improperly treated water in the unit may result in the formation of scale, algae, or slime. It may also cause erosion or corrosion. It is recommended that a qualified water treatment specialist provide recommendations for proper water treatment. The Trane Company assumes no responsibility for equipment failure caused by the use of untreated or improperly treated water.

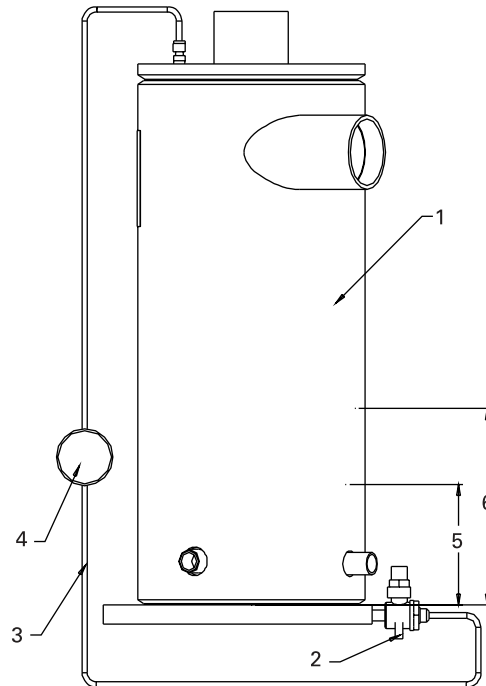
Periodic Maintenance

Oil separator check level

Follow the steps listed below and refer to the notes listed in Figure 12.

1. Turn off the unit.
2. Attach the hoses and sight glass to the oil-separator Schrader valves, as shown in Figure 12. Remove non-condensibles.
3. After the unit has been off for 10 minutes, move the sight glass up and down until the level can be seen.
4. After the level has been determined, remove the sight glass and hoses.

Figure 15 – System Oil Specifications



- 1: Oil separator
- 2: Valve
- 3: ¼" refrigeration hose
- 4: Sight glass
- 5: Minimum oil level
- 6: Maximum oil level

Table 12 – Oil level limit

	Oil separator diameter		
	152 mm	203 mm	254 mm
Minimum oil level (mm)	90	120	145
Maximum oil level (mm)	155	205	235

Periodic Maintenance

Oil filter change

Note: Routine changing of the oil or the oil filter is not recommended. The oil filter is oversized for this application.

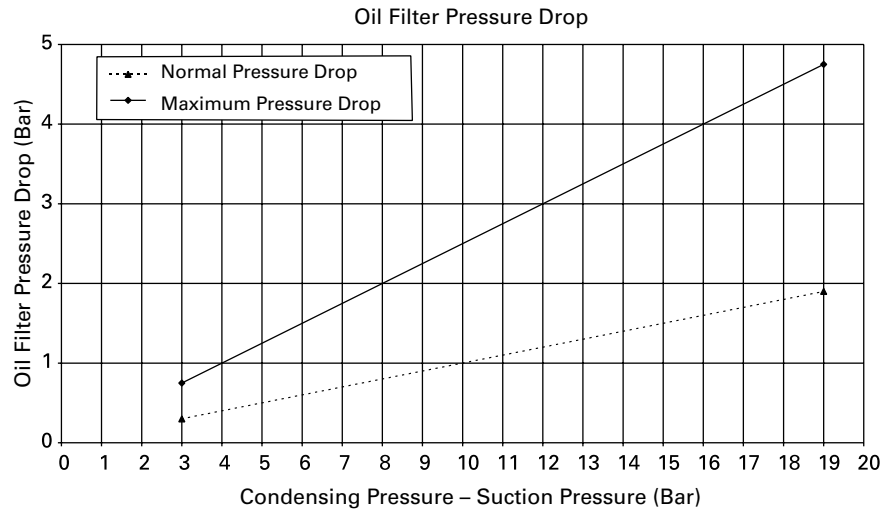
The oil and filter should be replaced only if analysis reveals that the oil is contaminated. Oil type and system capacities are shown in Table 2.

Pressure drop across the oil filter is shown in Figure 13. Oil filter pressure drop is the difference between the two pressure-control ports.

Refrigerant filter change

If the temperature drop through the filter is higher than 4K, the filter should be changed.

Figure 16 – Oil filter pressure drop



Periodic Maintenance

To change the oil filter in the unit, refer to Figure 14 and follow the steps listed below.

For units without the discharge valve option:

1. Shut off the compressor and disconnect all electrical service to the compressor.
2. Vacuum the refrigerant out of the circuit.
3. Remove the seven bolts on the oil filter cover. A pan may be necessary to catch any oil that is released after the cover is loosened.
4. Remove the cover and the oil filter element.
5. Install the new filter element.
6. Coat the new cover gasket with refrigerant oil.
7. Install the cover plate and cover plate gasket.
8. Install a new copper gasket under the bolt head that had one at time of removal. Replace all other bolts and tighten to 89.5 Nm.
9. Vacuum the refrigerant circuit at 500 micron and isolate the vacuum pump.
10. Confirm that no moisture or leaks are present by letting the vacuum stand for 2 hours. The pressure should not raise more than 250 microns.
11. Charge the unit with oil, in a quantity equal to what has been removed, by using the charging valve placed on the oil filter.
Note: the oil is very sensitive to moisture. Use the oil immediately after the oil can has been opened.
12. Charge the unit with refrigerant R134a (refer to the charging procedure)

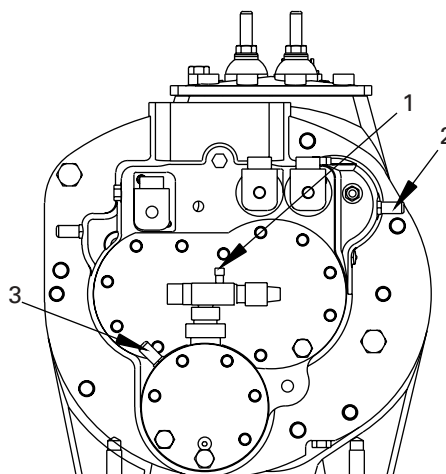
Periodic Maintenance

For units with the discharge valve option:

1. Closed the angle valve placed on the refrigerant liquid line to store the refrigerant in the condenser.
2. After the compressor stops, closed the compressor discharge valve and disconnect the unit.
Note: Do not make successive vacuums by using the compressor. Irreversible compressor damage could occur.
3. Vacuum the refrigerant remaining in the evaporator.
4. Remove the seven bolts on the oil filter cover. A pan may be necessary to catch any oil that is released after the cover is loosened.
5. Remove the cover and the oil filter element.
6. Install the new filter element.
7. Coat the new cover gasket with refrigerant oil.
8. Install the cover plate and cover plate gasket.

9. Install a new copper gasket under the bolt head that had one at time of removal. Replace all other bolts and tighten to 89.5 Nm.
10. Vacuum the refrigerant circuit at 500 micron and isolate the vacuum pump.
11. Confirm that no moisture or leaks are present by letting the vacuum stand for 2 hours. The pressure should not raise more than 250 microns.
12. Charge the unit with oil, in a quantity equal to what has been removed, by using the charging valve placed on the oil filter.
Note: the oil is very sensitive to moisture. Use the oil immediately after the oil can has been opened.
13. Charge the unit with refrigerant R134a (refer to the refrigerant charging paragraph).
14. Open all the valves before restarting the chiller.

Figure 17 – Oil filter change



- 1: Oil charging valve
- 2: Oil pressure control port
- 3: Oil pressure control port

Periodic Maintenance

Refrigerant charging

If the refrigerant needs to be adjusted, be certain to monitor the subcooling and superheat measurements. The subcooling needs to be between 6 and 12°C when the unit is running fully loaded. The superheat needs to be close to, or at, the superheat setpoint entered in the UCM.

CAUTION

The evaporator water flow must be established and maintained while adjusting the charge. Refrigerant pressures below 2,3 bar gauge can cause freezing and rupturing of the evaporator tubes.

Adding refrigerant

The RTWB units are shipped with an entire charge of refrigerant and oil. If the unit has no pressure, the system must be leak tested prior to adding refrigerant. Evacuate the system down to at least 500 microns prior to adding the refrigerant.

CAUTION

Water must be flowing through the tube bundles during this entire process. Refrigerant pressures below 2,3 bar gauge can cause freezing and rupturing of the heat exchangers.

1. Connect 110 V power to the female stepload solenoid and the male load/unload solenoids. This must be done to evacuate all of the cavities in the compressor.
2. Open all service valves.
3. Connect hoses from the vacuum pump to the LP and HP ports on the unit.
4. Evacuate the system to 500 microns and isolate the vacuum pump.
5. Confirm that no moisture or leaks are present by letting the vacuum stand for 2 hours. The pressure should not raise more than 250 microns.
6. Close the liquid line valve placed at the outlet of the condenser.
7. Open the EXV and add refrigerant by using the charging valve placed on the liquid line.
8. After the pressure between the refrigerant bottle and the refrigerant circuit is balanced, make a vacuum by using the compressor in order to store the refrigerant in the condenser.
9. Continue to charge the machine by using the refrigerant charging valve placed on the liquid line.
10. After the pressure is balanced between the bottle and the machine, open the liquid line valve and start the compressor.
11. Complete the charge by using the charging valve placed on the suction line. For the correct refrigerant charge refer to the Table 2.

Maintenance Contract

It is strongly recommended that you sign a maintenance contract with your local Service Agency. This contract provides regular maintenance of your installation 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 owning the unit by avoiding serious and costly breakdowns.



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Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice. Only qualified technicians should perform the installation and servicing of equipment referred to in this publication.

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