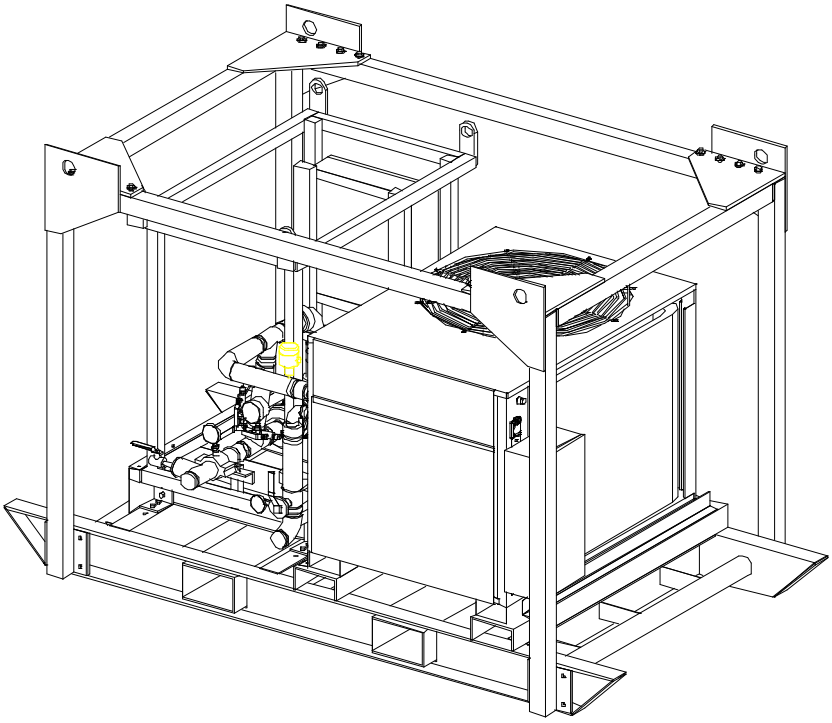
TRANE

Installation
Operation
Maintenance

10 and 15 Ton Air-cooled Cold Generators®



Models: CSRA010FAF0, CSRA015FAF0

CSRA-SVX01A-EN

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Table of Contents

General Information

NOTICE:
Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

WARNING -Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION -Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION –Indicates a situation that may result in equipment or property-damage-only accidents.

Literature History

CSRA-SVX01A-EN (April 2002)

Original issue of manual. Describes the Installation, Operation and Maintenance procedures for the unit.

Reference: The following manual is referenced throughout the manual and provide useful information for installation, operation, and maintenance.

- CGA-IOM-4 (non-rental CGA chiller)

Installation Checklist

An Installation Checklist is provided at the end of the “Installation” section of this manual. Use the checklist to verify that all necessary installation procedures have been completed. Do not use the checklist as a substitute for reading the detailed information contained in the manual. Read the entire manual before beginning installation procedures.

Unit Description

10 and 15 ton model CGA air-cooled Cold Generators are designed for outdoor installation with a vertical air discharge. Each refrigerant circuit is provided with an operating charge of refrigerant and refrigerant oil, a filter drier, sight gas/moisture indicator and thermostatic expansion valve. All units are dehydrated, leak tested, charged and tested for proper control operation before shipment. Each unit is provided with an appropriately sized close coupled hydronic pump mounted to a common base with the Cold Generator. Piping is provided to the inlet of the pump, pump to inlet of the Cold Generator, and the Cold Generator outlet. All necessary pressure gages, water temperature gages, flow switches, and valves are mounted and ready for operation.

General Information

An access panel(s) provides access to the compressor section(s), and a removable cover allows access to the control box. A unit circuit breaker enclosure is also provided with 100 feet of power cord for single power supply hook up to customer provided disconnect box. A separate circuit breaker/control panel enclosure is provided for the pump.

A bag containing the installation/operation/maintenance manual and the unit wiring diagrams ships inside the unit control box. Be sure to read this literature before installing and operating the unit. Refer to Figures 2 and 3 for circuit breaker enclosure locations.

Unit Inspection

When the unit is delivered to the job site, verify that the correct unit has been shipped by comparing the information on the unit nameplate with ordering, submittal and shipping information. Refer to “Nameplates”.

Inspect the unit - inside and out - for damage. Rotate the condenser fan(s) to ensure they turn freely. Report any apparent damage or material shortage to the carrier and ChillerSource; make a “unit damage or shortage” notation on the carrier’s delivery receipt. Specify the extent and type of damage found, and notify ChillerSource. Do not proceed with installation of a damaged unit without ChillerSource approval (800-755-5115).

Inspection Checklist

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

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

[ ] Check the unit for concealed damage before it is stored and as soon as possible after delivery. Concealed damage must be reported within 15 days.

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

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

General Information

Nameplates

The nameplates on these machines provide valuable information pertaining to the identification of the unit and its components. Be sure to provide all pertinent nameplate data when ordering parts or literature, and when making other inquiries.

Unit Nameplates

The chiller unit nameplate is mounted on the end of the unit on the compressor access panel. This nameplate (shown in Figure 1b) specifies unit model number, serial number, electrical characteristics, heat tape power requirements and refrigerant charge information.

Unit Model Number Description

All standard Trane products are identified by a multiple character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification codes used for chiller units is provided on this page. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, components and options for any specific unit. See Figure 1a.

General Information

Figure 1a — Model Number Description

MODEL NUMBER DESCRIPTION
CHILLERSOURCE

REV A

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12  3  4  567  8  9  1011
CS  R  A  010  F  A   A0

DIGITS 1 & 2

CHILLER SOURCE (CHSC)
RENTAL UNITS

DIGIT 3 - UNIT TYPE (TYPE)

R = CGA*
T = RTA*
U = RTH*
V = CVH*
W = PUMP
X = TOWER
Y = AIR HANDLER

DIGIT 4 - DEVELOPMENT SEQUENCE (DEVS)

A = FIRST SEQUENCE

DIGIT 5,6 & 7 - UNIT CAPACITY (UNCP)
UNIT TYPE R = CGA*
010 = 10 NOMINAL TONS  025 = 25 NOMINAL TONS
015 = 15 NOMINAL TONS  040 = 40 NOMINAL TONS
020 = 20 NOMINAL TONS  060 = 60 NOMINAL TONS
UNIT TYPE T = RTA*
080 = 80 NOMINAL TONS   200 = 200 NOMINAL TONS
100 = 100 NOMINAL TONS  300 = 300 NOMINAL TONS
125 = 125 NOMINAL TONS  400 = 400 NOMINAL TONS
UNIT TYPE U = RTH*
255 = 255 NOMINAL TONS  450 = 450 NOMINAL TONS
300 = 300 NOMINAL TONS
380 = 380 NOMINAL TONS
UNIT TYPE V = CVH*
360 = 360 NOM COMPR  770 = 770 NOM COMPR
400 = 400 NOM COMPR  910 = 910 NOM COMPR
450 = 450 NOM COMPR  106 = 1060 NOM COMPR
500 = 500 NOM COMPR  128 1280 NOM COMI
650 = 650 NOM COMPR
UNIT TYPE W = PUMP
    N/A
UNIT TYPE X = TOWER
    N/A
UNIT TYPE Y = AIR HANDLER
    N/A

DIGIT 8 - UNIT VOLTAGE (VOLT)

F = 460/60/3

DIGIT 9 - BUILD TYPE (PACK)

A = STANDARD RENTAL UNIT
B = GE RENTAL UNIT

DIGIT 10 & 11 - DESIGN SEQUENCE (DESQ)

A0 = 1ST

NOTE:THE UNIT NAMEPLATE IS LOCATED ADJACENT TO THE
HIGH VOLTAGE ACCESS HOLE NEAR THE CONTROL PANEL.
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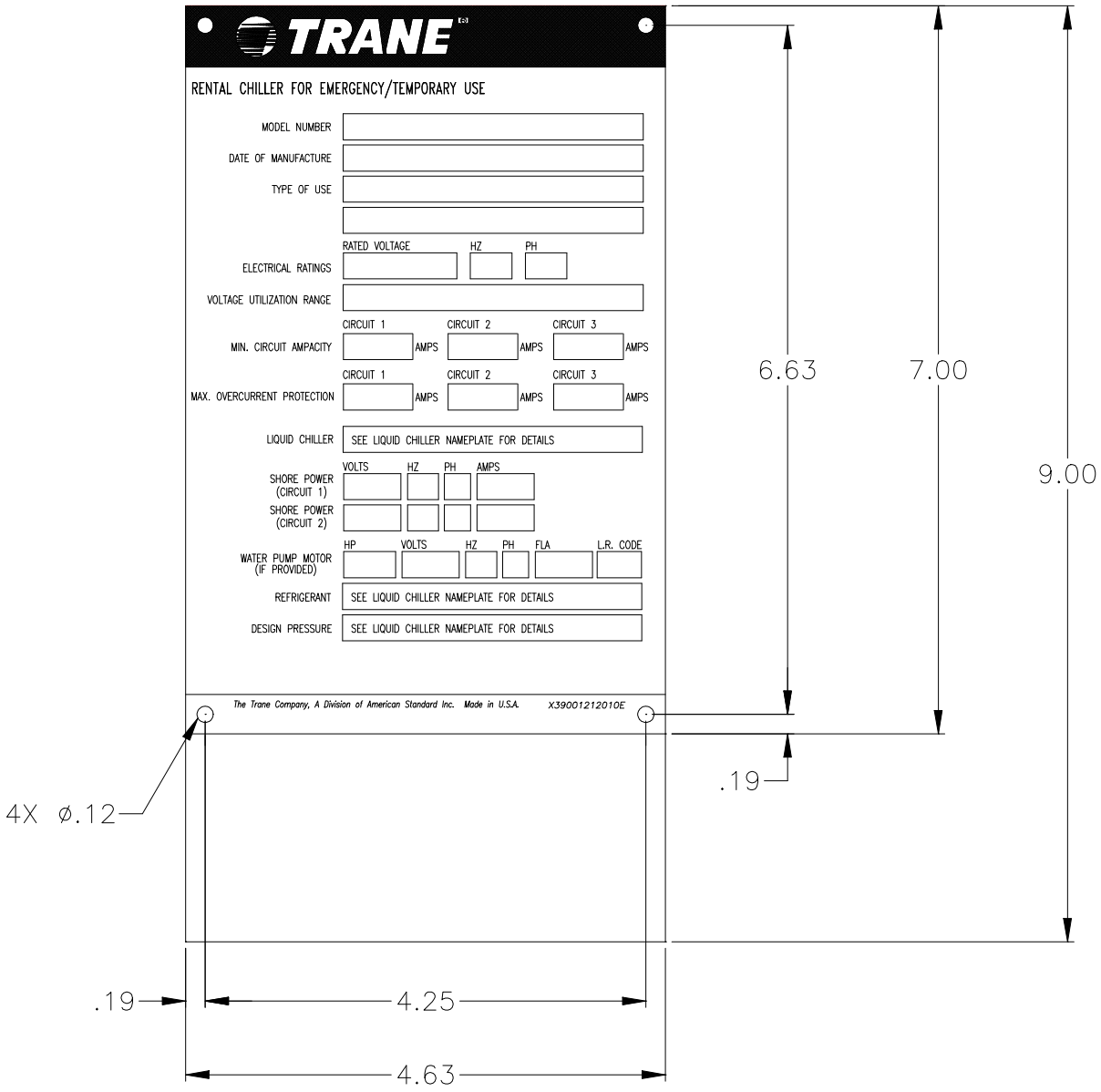
ALL STANDARD TRANE PRODUCTS ARE IDENTIFIED BY A MULTIPLE-CHARACTER MODEL NUMBER THAT PRECISELY IDENTIFIES A PARTICULAR TYPE OF UNIT. AN EXPLANATION OF THE ALPHANUMERIC IDENTIFICATION CODES USED FOR CGA UNITS IS PROVIDED ON THIS PAGE. ITS USE WILL ENABLE THE OWNER/OPERATOR, INSTALLING CONTRACTORS, AND SERVICE ENGINEERS TO DEFINE THE OPERATION, COMPONENTS AND OPTIONS FOR ANY SPECIFIC UNIT.

FIGURE 1

General Information

Figure 1 b — Unit Nameplate



Installation

Complete the “Installation Checklist” during installation to verify completion of all recommended procedures before unit start-up.

Unit Assembly Dimensions and Weights

The 10 and 15 ton assembly dimensions and weights are provided in Figure 2 and 3 and Table 1.

Handling

Each assembly is mounted on an assembly base with forklift tube slots easily accessible for wide and narrow forklift trucks with suitable capacity. At either end of the base is attached a tow-bar when additional pulling and pushing maneuvering is required. There is also an overhead lifting frame attached to the assembly base for overhead lifting without the need for additional spreader bars.

Drainage

Locate the unit so that the entire assembly can be allowed to drain during unit shutdown and repair.

Rigging

Use a forklift, crane or helicopter of suitable capacity to move the unit to its mounting.

Table 1: Unit Weights

Model No.	Tons	Shipping Weight (lbs)	Operational Weight (lbs)
CSRA010FAF0	10 T	3800	3820
CSRA015FAF0	15 T	4030	4050

⚠ WARNING
Heavy Objects!

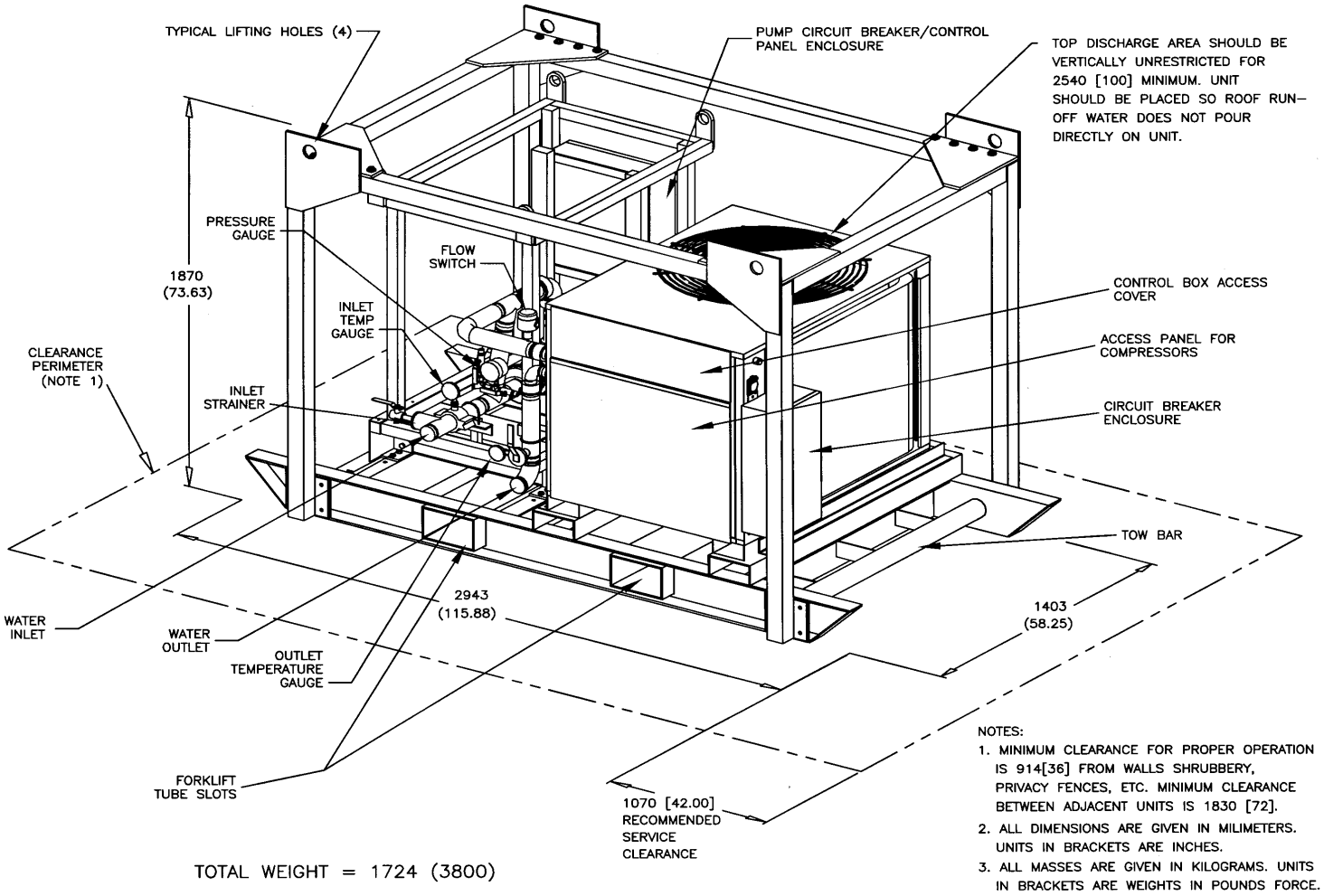
Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements may cause equipment or property-only damage. Failure to properly lift unit may result in death or serious injury. See details below.

Rig the unit using either belt or cable slings. Fasten the slings to the unit at the four holes provided in the lifting frame. The point at which the slings meet at the lifting hook must be at least 6 feet above the unit. Test-lift the unit to ensure proper balance and rigging.

Installation

Figure 2 — 10 Ton Details

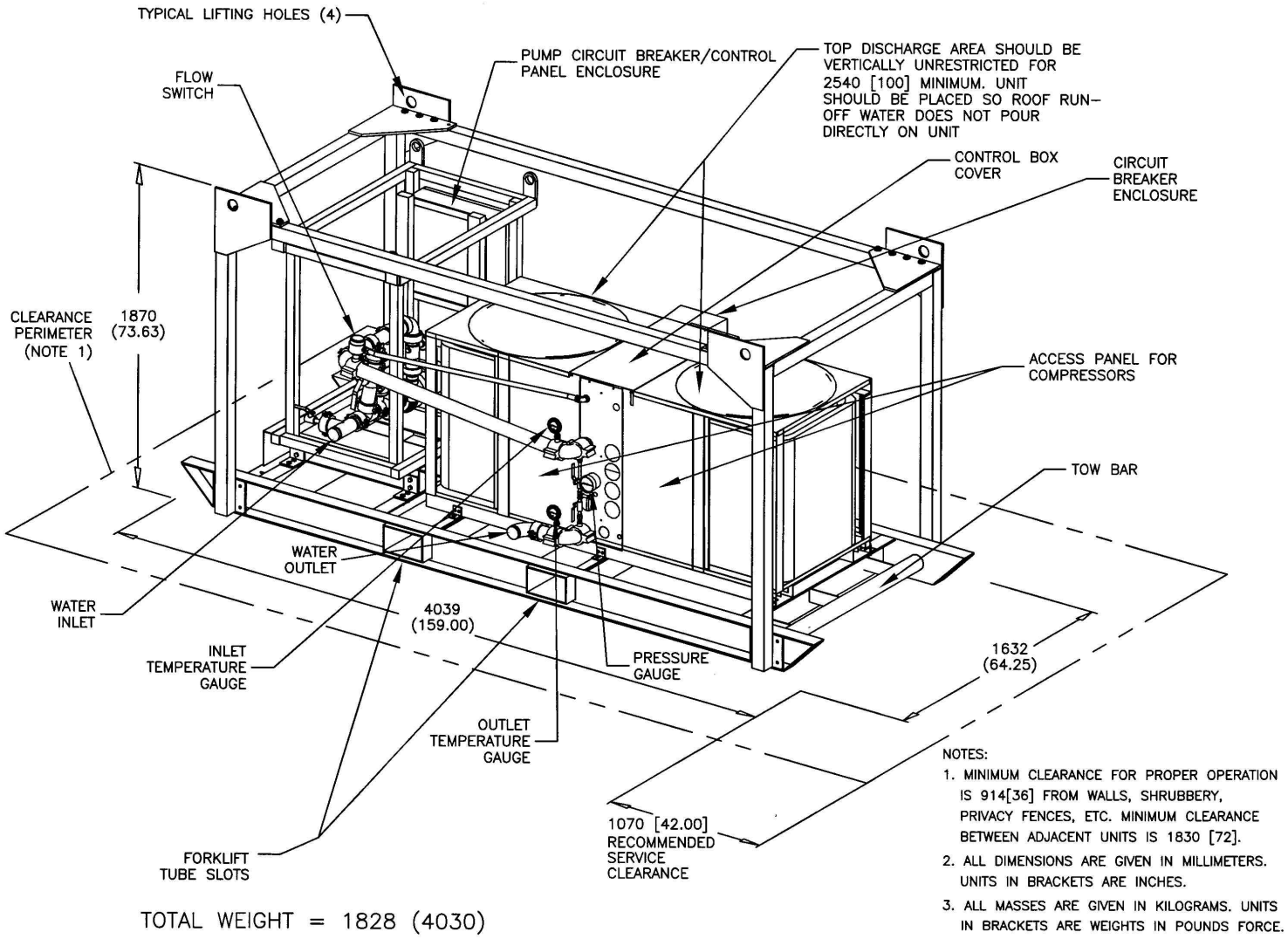
Note: Both the water inlet and outlet connections are 2 1/2" Victaulic



Installation

Figure 3 — 15 Ton Details

Note: Both the water inlet and outlet connections are 2 1/2" Victaulic



Installation

Location and Clearance Requirements

Select an installation site where air flow upward, unobstructed, through the condenser coil and away from the fan discharge. Protect the unit's condenser intakes from crosswinds exceeding 5 m.p.h. Position the unit above the snowline, and above the path of any windblown debris. Refer to Figures 2 and 3 for clearances.

CAUTION
Compressor Damage!

Installation of unit under an overhang will cause obstruction of the vertical air discharge, leading to pre-mature equipment failure.

If the unit is installed in a well or pit, the height of the pit walls must not exceed the height of the unit; the normal condenser air clearances must be doubled as well. In those applications as where multiple units are installed, the minimum distance between each unit is 6 feet, (entire perimeter).

Unit Isolation

Mounting methods that will minimize sound and vibration problems are:

1. Mount the assembly on a level surface, preferably an isolated concrete surface that completely supports the entire perimeter of the assembly base.
2. An optional neoprene pad can be installed between the assembly base and the mounting surface if assembly must be located in critical sound and vibration locations.

Unit Water Piping

General Piping Recommendations

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

CAUTION
Pump Damage!

If using an acidic commercial flushing solution, construct a temporary bypass around the pump and unit. Failure to do so may lead to equipment damage.

Installation

CAUTION
Proper Water Treatment!

The use of untreated or improperly treated water in an Air-Cooled Cold Generator may result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Evaporator Water Piping

The unit's water connection sizes and locations are shown in Figure 13.

CAUTION
Component Damage!

Evaporator pressure should not exceed 150 psig (i.e., maximum working pressure). Failure to do so may lead to equipment damage.

To prevent unit or pump damage, do NOT reverse system water piping connections to the unit or pump; water entering the evaporator is pre-piped to the discharge of the pump. If the pump is not required, open bypass valve and close inlet and discharge valves on pump. "Water Inlet" to the evaporator must enter on inlet connection to pump. Leaving water must exit the evaporator through the designated "Water Outlet" connection.

Flexible Hose and Hard Pipe Installation

General

Use the procedure described below to ensure the proper installation of flexible hose provided as part of a ChillerSource rental. It is critical that this procedure is followed to minimize premature or catastrophic failure of this hose.

CAUTION
Hose Damage!

Hose must never be pressurized over 150 psi. If higher pressures are required, "hard" suction pipe must be utilized. Failure to do so may lead to hose damage.

CAUTION
Hose Damage!

Hose must always be used in pressurized application. If a negative pressure application is required, "hard" suction pipe must be utilized. Failure to do so may lead to hose collapse and total system failure.

Installation

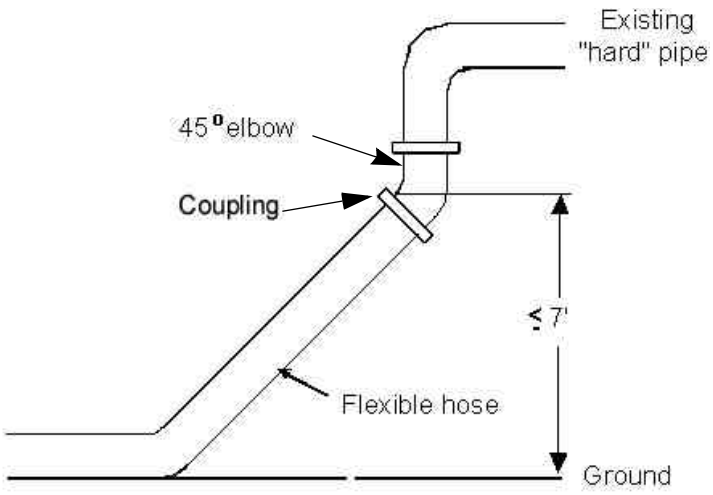
Flexible Hose Guidelines

⚠ WARNING
Hose Failure!

Failure to comply with installation instructions that follow may result in death or serious injury or equipment damage.

- Do not support the hose ONLY by its couplings; support over half of the hose's length by ground or other supporting surface otherwise coupling clamps may fail.
- Do not run hose vertically more than 7 feet otherwise coupling clamps may fail.
- Do not cut hose to “custom” fit pieces-this will affect the integrity of the hose.
- Bleed all air from the system prior to pressurizing hose to avoid couplings separating from the hose.
- Install elbows for a smooth hose transition on all vertical hose installations, see Figure 4.
- Never pressurize hose above 150 psi.

Figure 4 — Correct Vertical Hose Installation

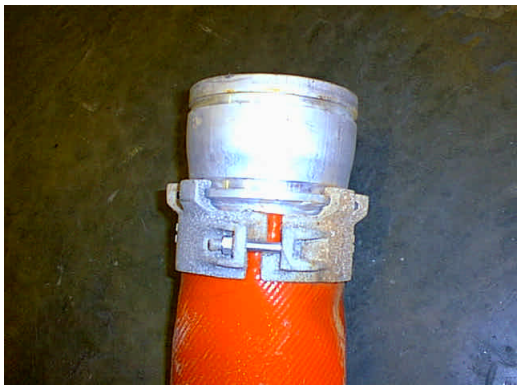


Installation

Dixon Coupling

- The Dixon coupling (See Figure 5), bolts are to be torqued prior to charging the hose with water to 40 ft-lbs. DO NOT EXCEED 40 ft-lbs. (The torque must be applied evenly between the bolts to ensure a consistent gap on each side of the coupling. Some pinching of the excess hose in the gap area is considered normal and will not create a leak or premature failure.)
- Continually monitor and retighten, if necessary, on monthly inspection intervals.

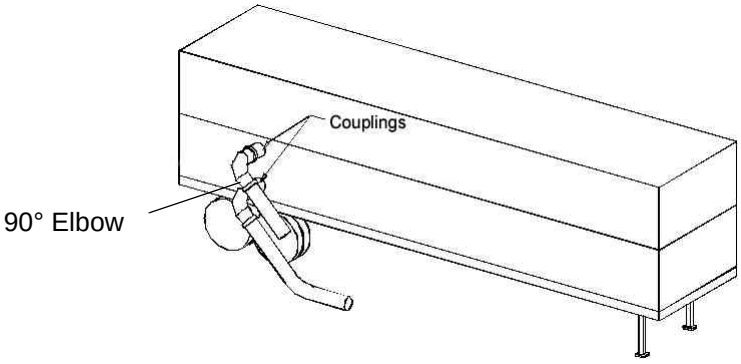
Figure 5 — Dixon Coupling



Horizontal Hose Installation

The following Figures illustrate the correct and incorrect methods for installing hose in a horizontal hookup application.

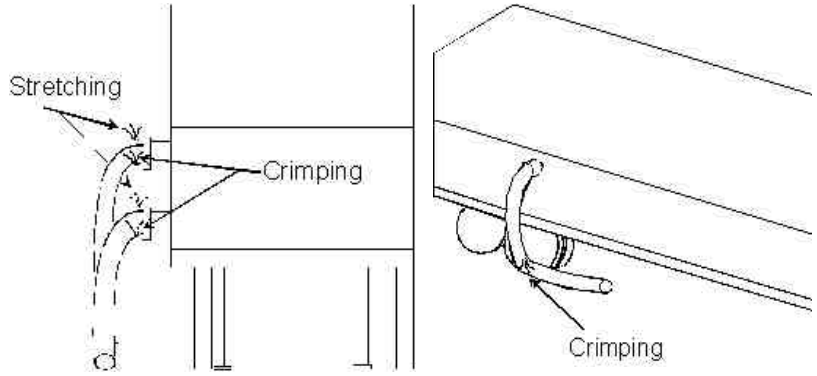
Figure 6 — Correct Horizontal Hose Installation



In this configuration either a 45° or 90° elbow can be installed. This elbow prevents stretching and crimping of the hose at the hose coupling connection. This elbow also directs the hose to the ground at an appropriate angle to minimize the crimping of the hose at the ground or supporting surfaces.

Installation

Figure 7 — Incorrect Horizontal Hose Installation

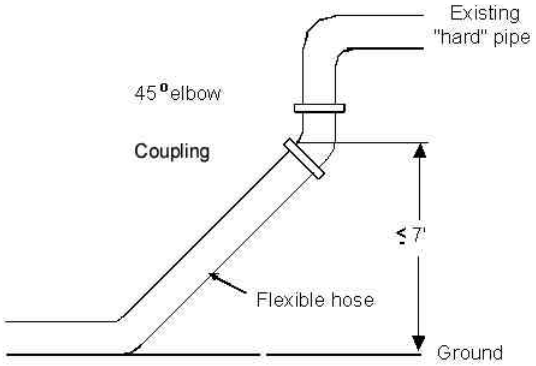


In this configuration elbows are not installed. This causes the top of the hose to be in tension, which stretches the hose out of the coupling; and the bottom of the hose to be in compression, which causes it to crimp. It also causes the hose to crimp at the ground.

Vertical Hose Installation

The following figures illustrate the correct and incorrect methods for installing hose in a vertical hookup application.

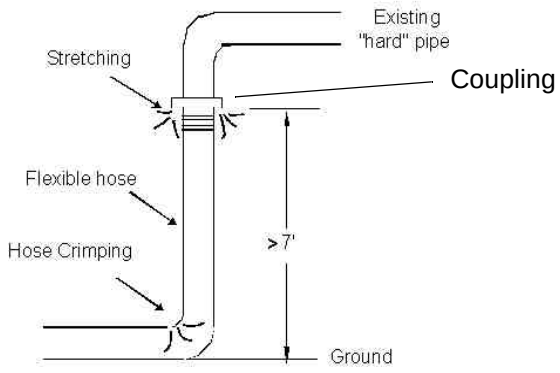
Figure 8 — Correct Vertical Hose Installation



In this configuration, the hose is installed with an elevation less than 7 feet off the ground. A 45° elbow is installed to reduce the stress in the hose coupling connection. This elbow also directs the hose to the ground at an appropriate angle to minimize the crimping of the hose at the ground or supporting surface.

Installation

Figure 9 — Incorrect Vertical Hose Installation

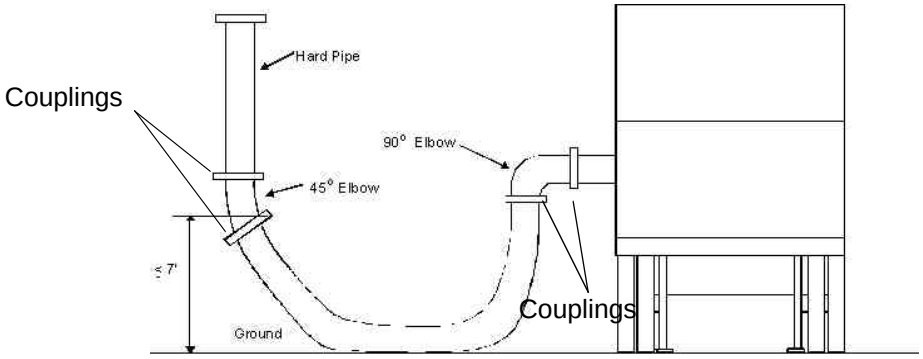


In this configuration the hose is installed without an elbow and with an elevation greater than 7 feet off the ground. This creates excessive stress at the hose coupling connection, causing the hose to stretch and separate from the coupling. It also causes the hose to crimp at the ground.

Horizontal/Vertical Installation

The following figures illustrate the correct and incorrect methods for installing hose in a horizontal and vertical combination application.

Figure 10 — Correct Horizontal/Vertical Installation



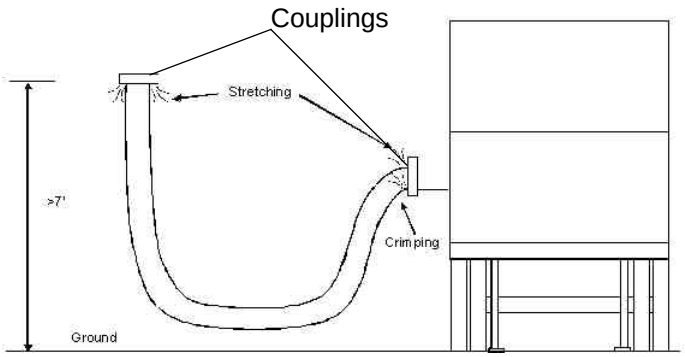
In this configuration, correct installation techniques followed are:

- the hose is installed with elbows at both connection ends
- the vertical run of hose is less than 7 feet
- the hose is adequately supported by more than half its total length on the ground

These items minimize the stretching and separation at the hose-coupling interface and also the crimping of the hose at the ground.

Installation

Figure 11 — Incorrect Horizontal/Vertical Installation



In this configuration, a number of improper installation techniques can be noted:

- elbows are not installed
- the hose is completely supported by the couplings
- the vertical run of hose is greater than 7 feet
- the hose is not adequately supported by the ground

These items cause excessive stress to be generated at the hose-coupling interface, causing the hose to stretch and separate from the coupling.

Figure 12 — Correct Unsupported Horizontal Installation

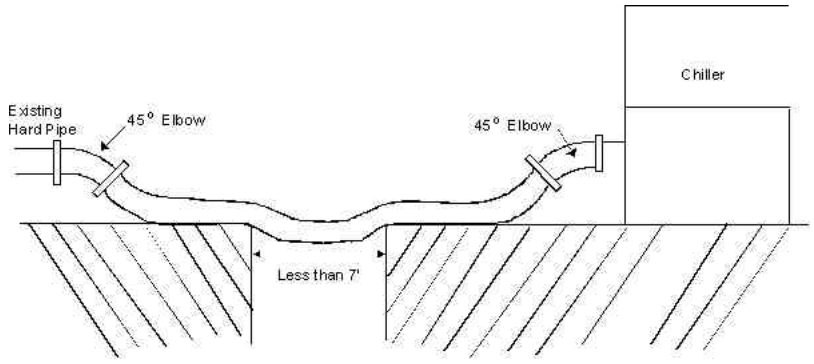


Figure 12 illustrates a correct horizontal hose installation where there is a section of unsupported hose. The length of unsupported hose should be less than 7 feet. Also, the hose must be adequately supported by having more than half its total length on the ground.

Installation

Hard Pipe Guidelines

Certain installations may require the use of hard pipe (steel or PVC). Hard pipe is typically recommended for (1) INDOOR INSTALLATIONS, (2) semi-permanent installations (three months or more) and/or (3) installations with space limitations.

When installing hard pipe:

- construct and install the piping according to local and national codes
- isolate and support the piping as required to prevent stress on the unit and vibration to building piping

If there are any questions regarding how to install water piping, contact a ChillerSource Technical Service Advisor in Charlotte, NC (800-755-5115).

Exceptions

The ChillerSource Technical Service Advisor in Charlotte, NC (800-755-5115), must authorize any exceptions to the guidelines established in this bulletin in writing.

Material Disposition

In the event the hose fails or leaks, call the ChillerSource Technical Service Advisor in Charlotte, NC (800-755-5115); tag the hose “BAD” and place it back in the shipping box.

Installation

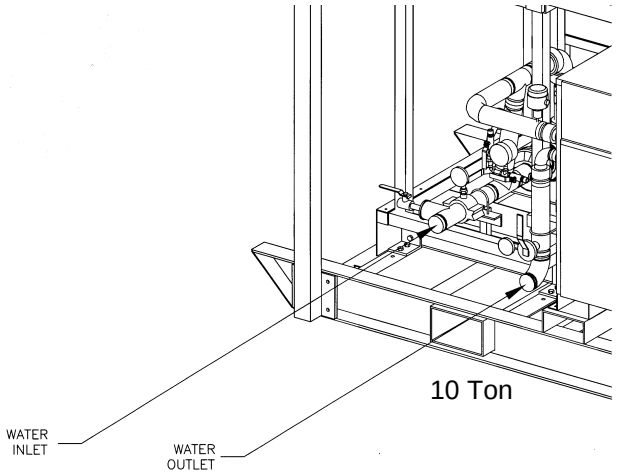
Evaporator Drain

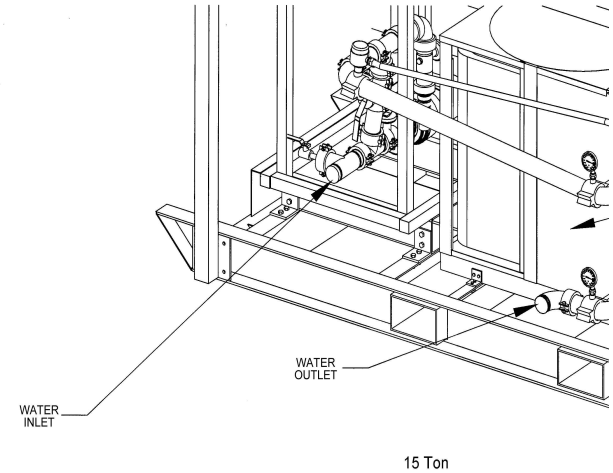
The 1/2 inch NPT drain plug is located in the leaving water tee near the bottom of the evaporator of the 15 ton (CSRA015FAF0). The 10 ton (CSRA010FAF0) features a drain valve rather than a plug. See “Extended Unit Shutdown/Winterization” on page 41 for draining instructions.

Note: If the system has been drained for shutdown, do not energize heat tapes.

Figure 13 — 10 and 15 Ton Water Inlet/Outlet Connections

Note: The water inlet and outlet connections are both 2 1/2” Victaulic.





Important: When installing water pipes, be certain to route them away from the compressor access panels to allow for compressor servicing or replacement.

Installation

Freeze Protection

General

Use the procedure described below to ensure that the chilled water system is adequately protected from freeze-up in those applications where the unit remains operational at subfreezing ambient temperatures.

1. Install chilled water piping heat tape along with a fused disconnect switch, refer to the instructions outlined under “Heat Tape Installation”. Ensure that all exposed piping is adequately protected.

Note: Heat tape is factory-installed on the unit evaporator. This heat tape will protect the evaporator from freeze-up at ambient temperatures down to -20 ° F when used in conjunction with properly applied heat tape on the field-installed water lines. Heat tape power draw is 84 watts on 10 ton units and 126 watts on 15 ton units.

2. Freeze-proof the chilled water system by adding a non- freezing, low-temperature, heat-transfer fluid to the chilled water system. Provide protection against ice formation at 10° F below the lowest expected ambient temperature.

Note: Use of an ethylene glycol-type antifreeze reduces unit cooling capacity; this condition must be accounted for during total system design. (Refer to Figure 16, “Ethylene Glycol Adjustment Factor” on page 36).

Heat Tape Installation

Install heat tape on all water piping that may be exposed to freezing temperatures. Be sure to use heat tape that is recommended for low-temperature applications; it should be rated at 110/120 volts, thermostatically-controlled, and dissipate 6 to 7 watts per linear foot.

Heat tape selection should be based on the lowest expected ambient temperature-including any wind chill factor. For those tapes not automatically (i.e., thermostatically) controlled, be sure to install an accessory thermostat.

Refer to Tables 2 and 3 for typical heat tape characteristics.

To install the heat tape properly, follow the instructions provided by the heat tape manufacturer. If none are provided, use the recommendations outlined below:

1. Wrap the heat tape around the pipe-or apply it straight along the pipe-as necessary to provide the required protection. (See Tables 2 and 3).
2. Use friction tape to secure the heat tape to the water pipe.
3. Place the thermostat tightly against-and parallel to the water pipe. then tape it into place at both ends. Be sure to install the thermostat on the most exposed (i.e. coldest) portion of the pipe.

Installation

4 Wrap the pipe with weatherproof tape. On vertical pipe runs, start the wrap at the bottom and work up as shown in Figure 14. Be sure to overlap the tape so that it will shed moisture.

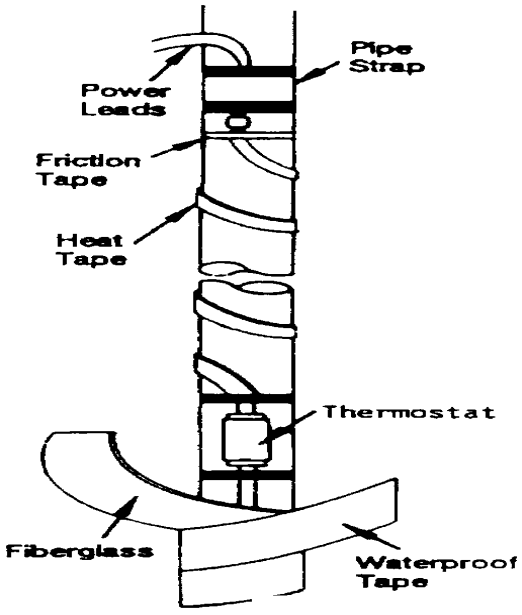
Note: If additional protection is required, insulate the pipe with fiberglass wrap before installing the outer wrap.

CAUTION
Electrical Failure!

Do not install fiberglass insulation under the outer wrap when using non-thermostatically-controlled heat tape. Failure to do so may result in unit damage.

If freezing is a potential problem, all exposed piping, pumps and other components must be similarly protected with heat tape and insulation.

Figure 14 — Typical Insulated Heat Tape Installation (Spiralled Application)



Installation

Table 2: Heat Tape Selection Table for Proper Pipe Protection with Fiberglass and Outer Wrap
(Tape installed straight along pipe)*

Method of Wrapping	Nominal Copper Pipe Size									
	3/8”	**1/2”**	**3/4”**	**1”**	**1-1/4”**	**1-1/2”**	**2”**	**3”**	**4”**	**6”**
Tape Required per Foot of Pipe	1’	1’	1’	1’	1’	1’	1’	1’	1’	1’
Protection Down to (°F)	-60	-41	-30	-19	-12	-6	0	+9	+14	+26

* All values calculated at 0 MPH wind, metallic pipe. Fiberglass wrap should not be used with non-automatic models unless used in conjunction with properly installed thermostat.

Table 3: Heat Tape Selection Table for Proper Pipe Protection with Fiberglass and Outer Wrap
(Tape installed spiralled around pipe, 3 turns per foot)*

Method of Wrapping	Nominal Copper Pipe Size									
	3/8”	**1/2”**	**3/4”**	**1”**	**1-1/4”**	**1-1/2”**	**2”**	**3”**	**4”**	**6”**
Tape Required per Foot of Pipe	NR	NR	1’ 6”	1’ 8”	1’ 10”	2’ 1”	2’ 4”	2’ 11”	3’ 11”	5’ 0”
Protection Down to (°F)	NR	NR	-60	-55	-51	-50	-45	-41	-37	-35

* All values calculated at 0 MPH wind, metallic pipe. Fiberglass wrap should not be used with non-automatic models unless used in conjunction with properly installed thermostat.

NR = Not Recommended

Table 4: Electrical Data for 10 and 15 Ton Units

Model Number	Basic Unit Characteristics				Compressor Motor		
	Unit Electrical Characteristics	Allowable Voltage Range	Minimum Circuit Ampacity	Maximum Fuse Size	Amps		
					Qty.	RLA	LRA
CSRA010FAF0	460/60/3	414-506	29	35	2	10.0	71
CSRA015FAF0	460/60/3	414-506	37.4	50	2	13.5	79

Table 4: Continued

Outdoor Fan Motor			Pump Motor			Shore Power		
Amps						Unit Electrical Characteristics	Allowable Voltage Range	Circuit Amps
Qty.	HP	FLA	Qty.	HP	FLA			
1	1	2.7	1	3	3.8	115/60/3	104-126	2
2	0.5	1.6	1	3	3.8	115/60/3	104-126	2.4

Notes:

1. Minimum circuit ampacity is 125% of the largest compressor RLA (see Table 4) plus 100% of the second compressor RLA plus the sum of the condenser fan FLAs per NEC 440-33.
2. Maximum fuse size is 225% of the largest compressor RLA plus 100% of the second compressor plus the sum of the condenser fan FLAs, per NEC 440-22.

Table 5: Minimum Starting Ambient Temperatures for CGA Units

Low Ambient Units	
	No HGBP
10 Ton	0
15 Ton	0

Notes:

1. Minimum starting ambients in degrees F, based on unit at minimum step of unloading and 5 m.p.h. wind across condenser.

Table 6: Control Settings and Time Delays for CGA Units

Control Description	Electrical Designation	Contacts Open	Contacts Close (Reset)
High Pressure Cutout	HPC01, HPC02	400 ± 10 psig	250 ± 15 psig
Low Pressure Cutout	LPC01, LPC02		
Std. Units		38.5 ± 1 psig	44.5 ± 2 psig
Low Temperature Cutout	LTC		
Std. Units		36 ± 3 F	Manual Reset
Control Description	**Electrical Designation**	**Contacts Status**	**Time Delay Duration**
Anti-short Cycle Timer	ASCT1, ASCT2	Normally-open timed to close	3 Minutes
Delay Between Compressors	DBC	Normally-open timed to close	30 Seconds
Low Ambient Start Timer	LAST1, LAST2	Normally-Closed timed to open	4 Minutes

Installation

Electrical Wiring

⚠ WARNING
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

All wiring must comply with National Electric Code (NEC) and state and local requirements. Outside the United States, the national and/or local electrical requirements of other countries shall apply. The installer must provide properly sized system interconnecting and power supply wiring with appropriate fused disconnect switches. Type and locations of disconnects must comply with all applicable codes.

CAUTION
Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors may result in equipment damage.

Figures 2 and 3 show the locations of the unit electrical access openings. Table 4 provides minimum circuit ampacity, recommended fuse sizes, and motor electrical data.

Shore Power Supply (115V)

The shore power male receptacle located above the unit circuit breaker enclosure (refer to Figure 2 and 3) is provided for customer convenience to supply power (refer to Table 4 for allowable voltage range) to compressor crankcase heaters and factory supplied evaporator heat tape. The crankcase heaters should operate at least 8 hours before the compressors are allowed to start.

Chiller Source Unit Power Supply

Refer to the unit wiring schematic pasted to the control panel cover of the cold generator. The installer must provide a power supply of proper voltage. Connect power cable provided on the unit to a properly sized fused disconnect switch required by local codes. Provide proper equipment grounds where required.

Heat Tape for Unit Evaporator

The evaporator is insulated from ambient air, and protected from freezing by thermostatically controlled heat tape(s). The evaporator heat tape circuit is energized when shore power (115 V) is connected as well as when the supply power (460V) to the unit is connected. Whenever the thermostat senses 40° F +/- 6° F, it closes, energizing the heat tape(s).

Installation Checklist

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 the “Installation” section of this manual! Read the entire section carefully to become familiar with installation procedures before installing the unit.

Receiving

[ ] Verify that unit nameplate data corresponds with ordering information.

[ ] Inspect unit for shipping damages and material shortages; report any damages or shortages found to ChillerSource, 800-755-5115.

Unit Location and Mounting

[ ] Inspect unit installation location for adequate ventilation.

[ ] Provide drainage facilities for evaporator water.

[ ] Remove and discard any shipping materials (e.g., cartons, crates, etc.)

[ ] Inspect to determine that service access clearances are adequate.

[ ] Install optional isolation neoprene pad between base and mounting surface.

[ ] Level the unit.

Evaporator Piping

[ ] Flush and clean all chilled water piping.

CAUTION
Pump Damage!

If using an acidic commercial flushing solution, construct a temporary bypass around the pump and unit. Failure to do so may lead to equipment damage.

Installation Checklist

CAUTION
Proper Water Treatment!

The use of untreated or improperly treated water in an Air-Cooled Cold Generator may result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

[ ] Make water connections.

[ ] Vent chilled water system at high points in system piping.

[ ] Apply heat tape and insulation as necessary to protect all exposed field installed piping from freeze-up.

Electrical Wiring

⚠ WARNING
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Pre-Start Procedures

CAUTION
Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors may result in equipment damage.

[ ] Connect unit power supply cord to fused disconnect switch.

[ ] Connect power supply wiring, along with a fused disconnect switch, to auxiliary heat tape installed on system water piping.

Pre-Start Checklist

Once the unit is installed, complete each step in the checklist that follows, check off each step as it is completed. When all are accomplished, the unit is ready for operation.

⚠ WARNING
Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Refer to unit schematics to check the number of disconnects required to de-energize the unit.

When electrically troubleshooting the compressor make sure electrical power is NOT applied.

[ ] Inspect all wiring connections; electrical connections should be clean and tight.

CAUTION
Compressor Damage!

Check tightness of all connections in the compressor power circuit (disconnects, terminal block, contactors, compressor junction box terminals, etc.). Failure to do so may result in over-heating at connections and under voltage conditions at the compressor motor.

Pre-Start Procedures

[ ] Check power supply voltage to the unit at the circuit breaker; the voltage reading obtained must be within the voltage utilization range shown in Table 4. Also, voltage imbalance must not exceed 2%. (Refer to “Unit Voltage and Amperage Checks”)

[ ] Check the condenser fan assemblies; the fan blades should rotate freely in the fan orifice, and be securely attached to the fan shaft.

[ ] Disconnect power supply to shore power. Remove control circuit Fuse (FU) from the main unit control panel; then energize the compressor crankcase heaters by closing the unit's circuit breaker. The crankcase heaters should operate at least 8 hours before the compressors are allowed to start.

Note: To prevent compressor operation during this 8-hour interval, control circuit fuse (FU) must be removed from the unit control panel.

CAUTION
Compressor Damage!

Compressor crankcase heaters must be energized at least 8 hours before unit start-up. Failure to do so may result in compressor mechanical damage.

[ ] Fill the chilled water (evaporator) circuit, leaving the system air vents open. Close vents after filling.

CAUTION
Proper Water Treatment!

The use of untreated or improperly treated water in an Air-Cooled Cold Generator may result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

[ ] Turn handle to “On” position on pump starter enclosure. Check the pump rotation.The pump should start water circulating through the chilled water system, inspect all piping connections for leaks and make any necessary repairs.

[ ] Adjust the water flow rate through the chilled water circuit, and check the water pressure drop through the evaporator. Refer to “Water System”.

[ ] Open the unit circuit breaker; then reinstall control circuit Fuse (FU) in the unit control panel (i.e., provided the compressor crankcase heaters have been energized at least 8 hours), and re-close the circuit breaker. Adjust the flow switch (installed on the evaporator outlet piping) to provide proper operation.

Pre-Start Procedures

Note: With the water pump operating, throttle the water flow to approximately 50 percent of the full flow rate. Following the manufacturer's instructions, adjust the flow switch contacts to open at this point. Use an ohmmeter to verify opening and closure of the switch contacts.

[ ] Stop the chilled water pump.

[ ] Open all circuit breakers.

Unit Voltage and Amperage Checks

⚠ WARNING
Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Electrical power to the unit must meet stringent requirements for the unit to operate properly. Total voltage supply and voltage imbalance between phases should be within the following tolerances.

Voltage Supply — 3-Phase Units Only

Measure each leg of supply voltage at all line voltage on circuit breaker. Readings must fall within the voltage utilization range shown on the unit nameplate. If voltage on any leg does not fall within tolerance, notify the power company to correct this situation before operating the unit. Inadequate voltage to the unit will cause control components to malfunction and shorten the life of electrical components and compressor motors.

Pre-Start Procedures

Voltage Imbalance

Excessive voltage imbalance between phases in a three-phase system will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2 percent. Voltage imbalance is defined as follows:

$$\% \text{ Voltage Imbalance} = \frac{100X|V_A - V_D|}{V_A}$$

where $V_A = \frac{V_1 + V_2 + V_3}{3}$ (Avg. Voltage)

$V_1, V_2, V_3 = LineVoltages$

V_D = Line voltage that deviates farthest from V_A

Example: If the three voltages measured at the line voltage side of the circuit breaker are 453 volts, 470 volts, and 467 volts, the average (V_A) would be:

$$\frac{453 + 470 + 467}{3} = 463 \text{ volts}$$

The percentage of imbalance is then:

$$\frac{100X|463 - 453|}{463} = 2.2\%$$

The 2.2 percent imbalance that exists in the example above exceeds maximum allowable imbalance by 2.0 percent.

This much imbalance between phases can equal as much as 20 percent current imbalance with a resulting increase in winding temperature that will decrease compressor motor life.

Table 7: Chiller Evaporator Data

Unit	Water* Volume	Minimum Flow Rate	Maximum Flow Rate
	gal.	gpm	gpm
10 Ton	1.4	12	36
15 Ton	1.5	18	54

* Includes water tubing provided by the factory, on the cold generator only. Feet of Water = psi x 2.307

Pre-Start Procedures

Water System: Water Flow Rates

Establish a balanced water flow through the evaporator. Flow rates should fall between the minimum and maximum values indicated in Table 7. Evaporator water flow rates below the minimum acceptable values will result in a stratified flow; this reduces heat transfer and causes either loss of expansion valve control or repeated nuisance low pressure cutouts. Conversely, excessively high flow rates may cause erosion of components in the evaporator.

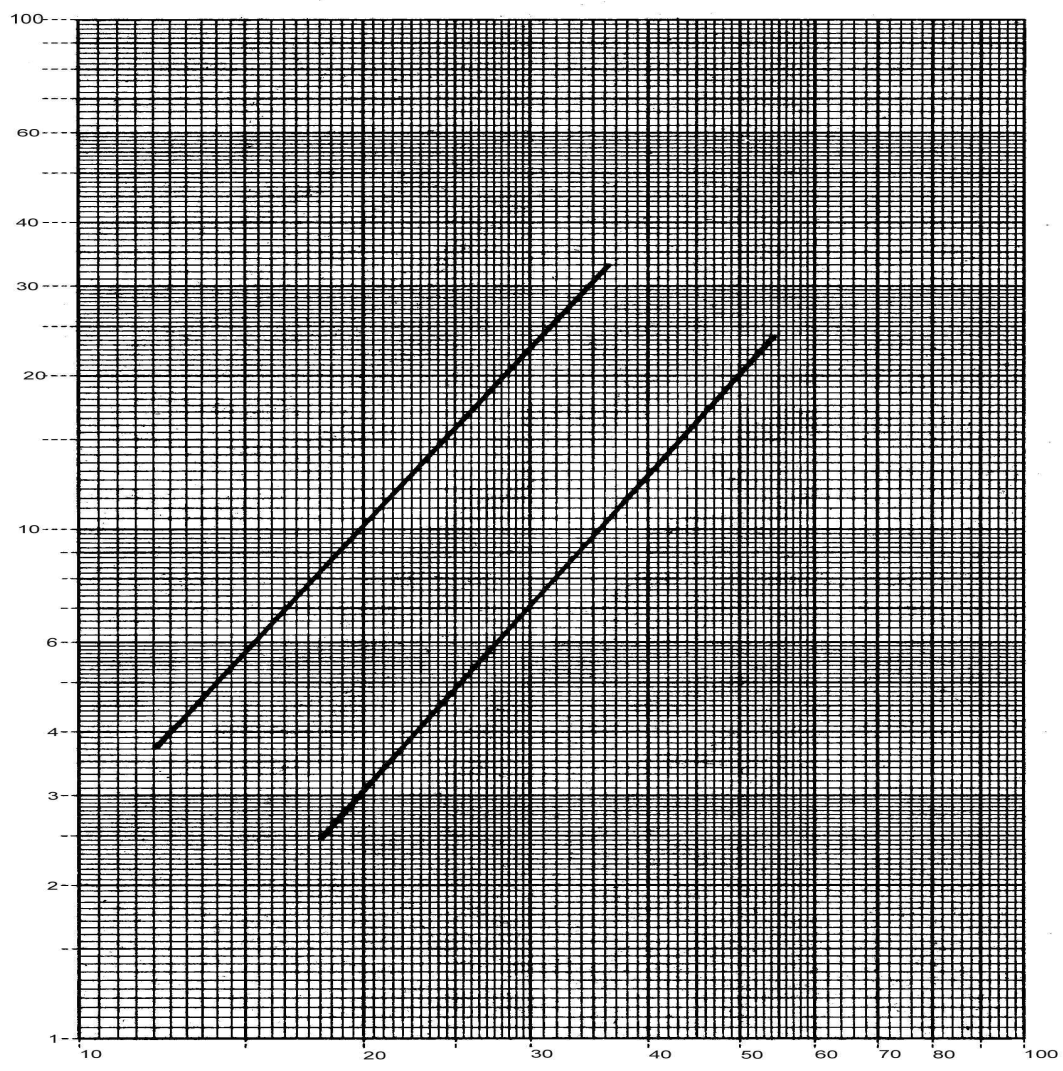
Pressure Drop Measurement

Measure the water pressure drop through the evaporator by closing the shut-off ball valve on the ¼" pipe connected to the inlet piping entering the evaporator and opening the shut-off ball valve on the ¼" pipe connected to the outlet piping leaving the evaporator. The pressure gage mounted on the ¼" pipe will indicate the pressure leaving the evaporator. Close the leaving shut-off valve and open the entering shut-off valve on the ¼" pipe assembly to record the entering pressure to the evaporator. Take the difference of the two pressures to obtain the water pressure drop. The pressure drop obtained should approximate those indicated by the pressure drop chart in Figure 15.

Note: The pressure drop curves shown in Figure 15 are calculated at the unit water inlet and outlets. Be sure to account for any piping or fittings that may create an additional pressure drop between the unit and the pressure gauge locations.

Pre-Start Procedures

Figure 15 — 10 and 15 Ton Evaporator Water Pressure Drop (English)



Pre-Start Procedures

Table 8: Normal Operating Pressures (Approximate)

	10 Ton		15 Ton	
Ambient (F)	**Suction Pressure (psig)**	**Discharge Pressure (psig)**	**Suction Pressure (psig)**	**Discharge Pressure (psig)**
45	58	128	56	139
60	59	163	58	174
75	60	204	59	214
85	61	234	60	244
95	62	266	61	276
105	63	301	62	310
115	64	339	63	347

Ethylene Glycol Adjustment Factor

The addition of ethylene glycol to the chilled water system reduces unit capacity. To determine pressure drop of a glycol solution, obtain the pressure drop adjustment factor from the chart in Figure 16 and multiply times the pressure drop of water without glycol, i.e.;

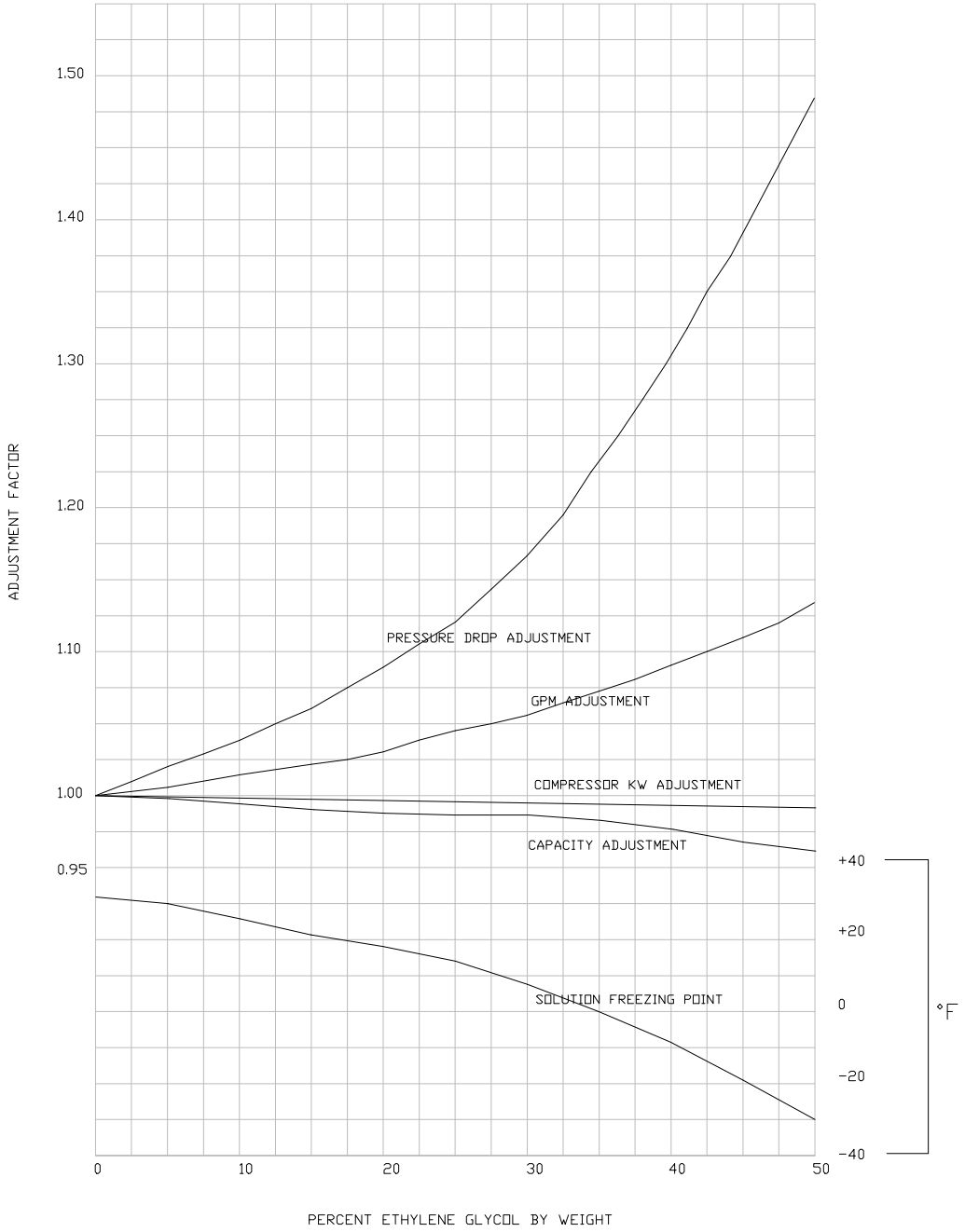
Glycol $\Delta P = H_2O\Delta P$ x Adj. Factor

Notes:

1. Based on steady state conditions with 54° F entering water temperature (EWT) and 44° F leaving water temperature (LWT).
2. An increase of 5° F in LWT while keeping the 10° F temperature drop will result in an increase of approximately 6 psi in discharge pressure when compared to the 54° F EWT, the 44° F LWT given in Table 8.
3. Pressure at low ambients will not match this table if a head pressure control is installed and operating.

Pre-Start Procedures

Figure 16 — Performance Adjustments and Solution Freezing Points (Ethylene Glycol in Evaporator)



Operation

Start-up Procedure

To properly start the unit, execute each step of the checklist that follows in the sequence indicated; check off each step as it is completed. Do not start the unit until the “Pre-Start Procedures” are complete. (Refer to Figure 17 for the unit operating controls locations.)

[ ] Disconnect shore power cord if connected.

[ ] Position pump starter panel handle to the “Off” position.

[ ] Open the unit circuit breaker; then remove control circuit fuse (FU) from the unit control panel. (This will prevent the compressors from energizing when the disconnect switch is closed.)

⚠ WARNING
Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Refer to unit schematics to check the number of disconnects required to de-energize the unit.

[ ] Position pump starter panel handle to the “On” position. If Chiller Source pump not being used, leave in “Off” position. Close the fused disconnect switch for the evaporator chilled water pump being used. Start the pump.

[ ] Close the circuit breaker for the chiller unit.

Note: The unit’s compressor crankcase heaters will energize when the disconnect switch is closed; these crankcase heaters must operate at least 8 hours before the compressors are allowed to start. The shore power supply also energizes the crankcase heaters prior to 460V supply. Disconnect shore power prior to 460 V supply to unit.

Operation

CAUTION
Compressor Damage!

Compressor crankcase heaters must be energized at least 8 hours before unit start-up. Failure to do so may result in compressor mechanical damage.

[ ] After the compressor crankcase heaters have operated a minimum of 8 hours, open the unit circuit breaker, reinstall control circuit fuse (FU) in the unit control panel, and re-close the circuit breaker.

[ ] The factory-installed evaporator heat tape (HTTB) should be energized whenever there is water in the unit evaporator. Additional heat tape supplied in the field requiring its own fused disconnect box should be closed at this time.

[ ] Reset any control that requires a manual reset.

[ ] Set the water temperature thermostat (WTT) as described on page 46.

Checking Operating Conditions

Once the unit has operated for at least 30 minutes and the system has stabilized, complete the following checklist to ensure proper unit operation.

[ ] Re-check evaporator water flow and pressure drop. These readings should be stable at proper levels. Refer to “Water System”. If pressure differential drops off, clean all evaporator water supply strainers.

[ ] Measure unit suction and discharge pressures by installing pressure gauges on the discharge and suction line access ports. Refer to Table 8 for approximate normal operating pressures.

Note: Many application variables exist which can effect operating pressures; these include ambient dry bulb temperature. as well as the installation of such options as head pressure controls or hot gas bypass. Since these variables can give misleading results, do not use operating pressures as the sole check of system operation.

[ ] Check compressor amp draw.

[ ] Check electrical power supply.

[ ] Check the liquid line sight glasses/moisture indicators for the presence of moisture.
Note: Bubbles in the liquid line may indicate either a low refrigerant charge, or excessive pressure drop in the liquid line. Such a restriction can often be identified by a noticeable difference in line temperature on either side of the restricted area. (Frost often forms on the outside of the liquid line at the point of restriction, as well.) Bubbles are not necessarily a symptom of improper system operation.

Operation

Important: A clear sight glass does not necessarily mean that the system is sufficiently charged; be sure to consider system superheat, subcooling, and unit operating pressures and ambient temperatures.

Proper unit refrigeration charge -per circuit- is indicated on the unit nameplate and also under “Refrigerant Charge Information” on page 39 of this manual.

[ ] Measure system superheat.

Normal system superheat is 12 to 15 degrees F for each circuit at ARI conditions (54° entering water, 44° leaving water, and 95° ambient temperature). If the superheat measured for either circuit does not fall within this range, alter the setting of the superheat adjustment on the thermal expansion valve to obtain the desired reading. Allow 15 to 30 minutes between adjustments for the expansion valve to stabilize at each new setting.

[ ] Measure system subcooling.

Normal subcooling for each circuit is 12 to 22 degrees F at ARI conditions (54° entering water, 44° leaving water, and 95° ambient temperature). If subcooling for either circuit is not in this range, check superheat for circuit and adjust, if required. If superheat is normal but subcooling is not, contact a qualified service technician.

[ ] If operating pressure, sight glass, superheat and subcooling readings indicate refrigerant shortage, find and repair leaks and, gas-charge refrigerant into each circuit. Refrigerant shortage is indicated if operating pressures are low and subcooling is also low.

Refrigerant Charge Information

The 10 ton units have 9 lbs. 8 oz. of refrigerant per circuit, and the 15 ton units have 12 lbs. 7 oz. of refrigerant per circuit.

CAUTION
Equipment Damage!

Do not add refrigerant to unit when suction and discharge pressures are low and subcooling is normal. Failure to follow all instructions could result in equipment damage.

Add refrigerant vapor with the unit running by charging through the access port on the suction line until operating pressures are normal.

Operation

CAUTION
Compressor Damage!

Do not allow liquid refrigerant to enter the suction line. Liquid charge at the liquid line only. Failure to follow all instructions could result in equipment damage.

[ ] If operating pressures indicated an overcharge, slowly (to minimize oil loss) recover refrigerant at the liquid line service valve.

Important: Do NOT release refrigerant to the atmosphere! Refer to latest version of the general service bulletin MSCU-SB-1.

⚠ CAUTION
Freezing Temperatures!

Do not allow liquid refrigerant to contact skin. If it does, treat the injury similar to frostbite. Slowly warm the affected area with lukewarm water and seek immediate medical attention. Direct contact with liquid refrigerant may cause minor or moderate injury.

[ ] Be sure that all remote sensing bulbs are properly installed in bulb wells with heat transfer compound. Remote bulb capillary tubes must be secured (i.e., protected from vibration and abrasion) and undamaged.

[ ] Inspect the unit. Remove any debris, tools and hardware. Secure all exterior panels, including control and compressor access panels. Replace and tighten all retaining screws.

Temporary Unit Shutdown and Restart (Not Servicing)

To shut down the unit for a short time:

1. Open the unit circuit breaker; then remove Control Circuit Fuse (FU) from the main unit control panel. Once Control Circuit Fuse (FU) is removed, re-close the unit disconnect switch. This will ensure that the compressor
2. Stop operation of the chilled water pump. Turn handle on pump starter panel to “OFF”.

To restart the unit after a temporary shutdown:

1. Restart the chilled water pump, by turning handle on pump starter panel to “ON” position.
2. Open the unit circuit breaker; then reinstall Control Circuit Fuse (FU) in the main control panel. Once fuse (FU) is installed, close the unit circuit breaker.

Operation

⚠ WARNING
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Open unit disconnect switch before installing control circuit fuse (FU) in control panel.

The unit will now operate normally provided that: (1) the water temperature thermostat (WTT) is calling for cooling, and (2) all system operating interlocks and safety circuits are satisfied.

Extended Unit Shutdown/Winterization

If the system is taken out of operation for long periods of time for any reason (e.g., seasonal shutdown), use this procedure to prepare the system for shutdown:

1. Check the refrigerant piping for leaks, fixing any that exist.
2. Service the chilled water pump and any air handling equipment according to the manufacturer's recommendations.
3. Open both electrical circuit breakers for the unit and chilled water pump; lock both in the open position.

CAUTION
Compressor Damage!

Lock both unit and chilled water pump circuit breakers in open position to prevent compressor or pump damage due to accidental start-up while system is in "shutdown" condition. Failure to do so may result in equipment damage.

Winterization: Close all evaporator water supply valves and drain the evaporator and water pump by removing the drain plug and opening the vent on the entering water line just outside the unit. Re-install the drain plug. Since the evaporator does not drain completely, add one quart of ethylene glycol antifreeze to the remaining water through the vent or evaporator drain hole, to keep the water from freezing, or refer to Table 7 and fill the evaporator with antifreeze. Protect system to 10° F below the expected ambient temperature and energize the evaporator heat tape(s) by closing the heat tape fused disconnect switch provided by the installer.

Operation

CAUTION
Evaporator Damage!

To prevent freeze damage to evaporator internal components, protect with adequate strength antifreeze, and be certain to energize evaporator heat tapes. Failure to do so may result in equipment damage.

Note: If system has been drained for shutdown do not energize heat tapes(s).

System Restart After Extended Shutdown

Use this procedure to prepare the system for restart after an extended shutdown:

1. Remove winterization antifreeze as it can reduce system capacity.
2. Verify that both the unit and the chilled water pump circuit breakers are open; then remove control circuit Fuse (FU) from the unit control panel.
3. Close the unit circuit breakers to energize the compressor crankcase heaters.

Note: The unit's compressor crankcase heaters will energize when the circuit breaker is closed; these crankcase heaters must operate at least 8 hours before the compressors are allowed to start. Disconnect shore power prior to closing unit circuit breaker.

CAUTION
Compressor Damage!

Compressor crankcase heaters must be energized at least 8 hours before unit start-up. Failure to do so may result in compressor mechanical damage.

4. Fill the chilled water (i.e., evaporator) circuit; evaporator storage capacities are indicated in Table 7 (see “Water System”). Be sure to vent the system while filling it, and close the vent when system is full.

CAUTION
Proper Water Treatment!

The use of untreated or improperly treated water in an Air-Cooled Cold Generator may result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

5. Close the chilled water circuit breaker, and start the chilled water pump motor. With water circulating through the chilled water system, inspect all piping connections for leaks and make any necessary repairs.

Operation

6. Adjust the water flow rate through the chilled water circuit, and check the water pressure drop through the evaporator. Refer to “Water System”.
7. Adjust the flow switch (installed on the evaporator outlet piping) to provide proper operation.

Note: With the water pump operating, throttle the water flow to approximately 50 percent of the full flow rate. Following the manufacturer's instructions, adjust the flow switch contacts to open at this point. Use an ohmmeter to check for contact opening and closure.

8. Stop the chilled water pump.

⚠ WARNING
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

9. Open all circuit breakers; then reinstall control circuit fuse (FU) (removed in Step 1) in the main unit control panel.

The unit is now ready for normal operation; refer to “Start- Up Procedure”.

Low Ambient Operation

Field Installed Head Pressure Control Accessory

ChillerSource units will operate in outdoor ambient temperatures down to (50° F- 10 ton, 45° F -15 ton) w/o HGBP. This accessory will enable units to operate down to 0° F w/o HGBP. (See Table 5).

Head pressure control for chiller units is regulated by means of a field installed head pressure accessory which varies condenser fan speed in relation to discharge pressure.

When discharge pressure is 270 psig or higher, the condenser fan runs at full speed. At pressures between 270 psig and 180 psig, the fan speed is adjusted (increased or decreased) in direct relation to the pressure, with minimum fan speed (10% of rated motor RPM) occurring when the pressure reaches 180 psig. At pressures below 180 psig, the fan will not run.

When discharge pressure rises to 180 psig, the fan will start and run at the reduced speed. Fan speed will continue to increase as the pressure increases until full speed is reached at 270 psig.

Operation

Freeze Protection

If the unit will remain operational at subfreezing ambient temperatures, follow the recommendations outlined below to ensure adequate protection for the chilled water system.

1. Energize the factory installed chilled water piping heat tape by energizing shore power supply. If additional heat tape was installed in the field, energize the fused disconnect switch supplied by the field. Verify that all exposed piping is adequately protected.
2. “Freeze-proof the chilled water system by adding a nonfreezing, low-temperature heat transfer fluid to the chilled water. The solution used must be strong enough to provide sufficient protection to prevent ice formation at 10° F below the lowest expected ambient temperature.

Follow the manufacturer's recommendations for installation and testing procedures for any freeze-proofing fluid used. Refer to Table 7 for evaporator liquid capacities.

Note: Use of an ethylene-glycol type fluid will reduce system capacity. This factor must be considered during system design. (See Figure 7).

Electrical Control System

The controls used on CGA 10 and 15-ton units are classified either as “safety” controls or “operational” controls. Brief descriptions of the specific safety and operating controls used in the CGA control scheme are provided in the following paragraphs.

Refer to the following control descriptions and to Table 6 for control settings, and to Figure 17 for control locations.

Unit Safety Controls:

Low Pressure Cutout (LPCO1, LPCO2)

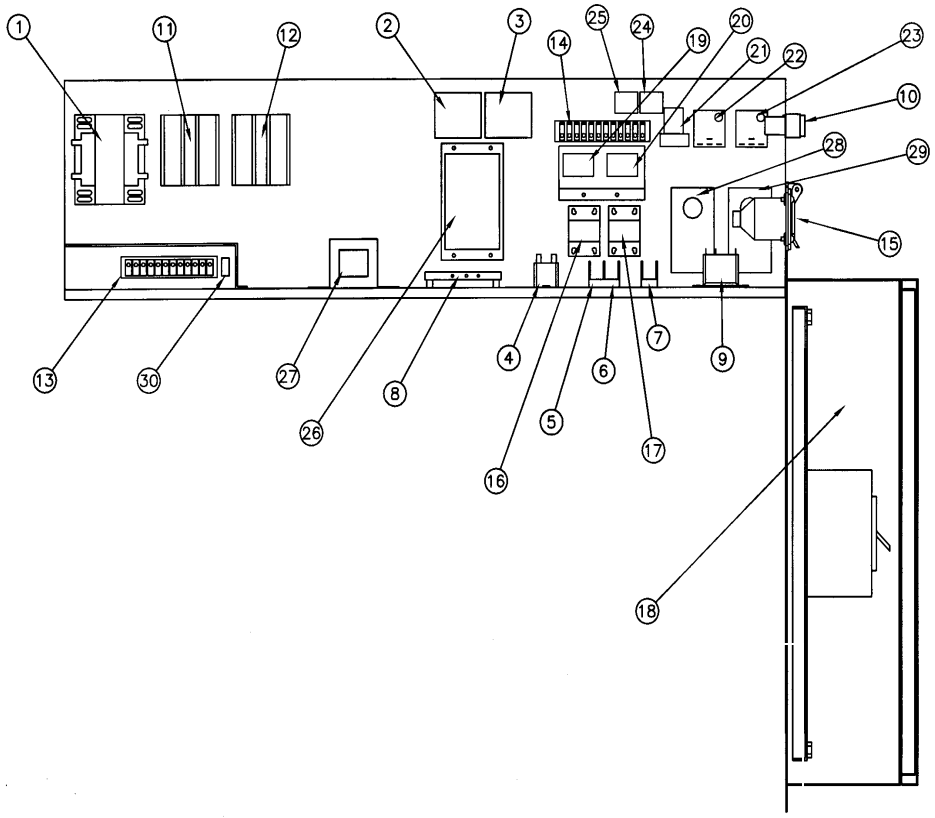
These units are protected by low pressure cutouts that open and stop compressor operation if the operating pressure drops below 38.5 ± 1 psig. The cutout automatically resets when the pressure reaches 44.5 ± 2 psig. The LPCO is a Single Pole Double Throw (SPDT) device and if it opens at low ambient start-up, it will energize Outdoor Fan (ODF) relay, stopping the outdoor fan(s) while the compressor remains energized through the Low Ambient Start Timer (LAST).

High Pressure Cutout (HPCO1, HPCO2)

These units have high pressure cutouts that open and stop compressor operation If the discharge pressure reaches 400 ± 10 psig. The cutout automatically resets when pressure drops to 250 ± 15 psig.

Operation

Figure 17 — Typical Unit Control Panels



ITEM	Device	Description	ITEM	Device	Description
1	TNS3	Crankcase Heater Transformer	14	LTB2	Low Voltage Terminal Block
2	CR1	Control Relay	15	SPP1	Shore Power Plug
3	CR3	Control Relay	16	CSC1	Start Counter
4	CR4	Phase Monitor Relay	17	CSC2	Start Counter
5	CCHF1	Crankcase Heater Fuse	18	1CB1	Circuit Breaker Enclosure
6	CCHF2	Crankcase Heater Fuse	19	CRHM1	Hour Meter
7	SPF1	Shore Power Fuse	20	CRHM2	Hour Meter
8	PHM1	Phase Monitor	21	DBC	Delay Between Compressors
9	CR2	Control Relay	22	ASCT2	Anti-Short Cycle Timer
10	9DS1	Phase Monitor Light	23	ASCT1	Anti-Short Cycle Timer
11	CC2	Compressor Contactor	24	RR1	Reset Relay
12	CC1	Compressor Contactor	25	RR2	Reset Relay
13	LTB1	Low Voltage Terminal Block	26	LAC	Low Ambient Control
			27	TNS1	Control Power Transformer
			28	LTC	Low Temperature Cutout
			29	WTT	Water Temperature Thermostat
			30	FU	Control Circuit Fuse

Operation

Reset Relays (RR1, RR2)

If the unit is shut down by the low pressure cutout (or high pressure cutout), the reset relay locks out the compressor contactor (CC1, CC2). This prevents the system from recycling until the condition that caused the low (or high) pressure cutout to trip is determined and corrected.

CAUTION
Unit Damage!

Do not reset the control circuit until the cause of the safety lockout is Identified and corrected. Failure to do so may result in unit damage.

To reset RR1 and RR2, open and re-close the unit disconnect switch.

Low Temperature Cutout (LTC)

The L TC is designed to protect the evaporator from freeze damage in the event of a water temperature thermostat (WTT) malfunction or restricted water flow. The LTC's remote sensing bulb is in the evaporator, where it monitors leaving water temperature. If, during normal unit operation, the leaving chilled water temperature falls to the trip point, the LTC will open to interrupt compressor operation. (Manual reset is required.)

Motor Overloads

These units have internal compressor and condenser fan motor overloads. These overloads protect the motors from overcurrent and overheating conditions and automatically reset as soon as they cool sufficiently.

Unit Operational Controls:

Water Temperature Thermostat (WTT)

System operation for 10 and 15-ton CGA units is governed by a two-stage water temperature thermostat (WTT). The remote sensing bulb of this device is factory-installed in a bulb well located on the evaporator water inlet; here, it monitors the temperature of the water returning to the evaporator. It has a control range of 5° F per stage, a differential of 5.0° F between stages and a set point range of -30 to + 100 degrees F.

For an explanation on determining the WTT's setpoint and a description of the WTT in operation refer to page 48.

Low Ambient Start Timer (LAST1, LAST2)

When LAST1 or LAST2 energizes, the low pressure control is bypassed for 4 minutes, this allows time for suction pressure to build sufficiently for the low pressure cutout contacts to close.

Operation

Note: A low ambient start timer checkout procedure is given on page 59 of this manual.

Anti-Short Cycle Timers (ASCT1, ASCT2)

An anti-short cycle timer is provided in each compressor control circuit to protect the compressors from starting too frequently. This can occur as a result of poor thermostat control associated with light loads and water loops that are too short. It can also occur because of sudden power outages of short duration. Whenever the contacts of the water temperature thermostat (WTI) open-or when there is a momentary power outage-the anti-short cycle timer will lock out compressor operation for 3 minutes.

Delay Between Compressors (DBC)

The delay between compressors prevents both compressors from starting at the same time by delaying compressor #2 for 30 seconds.

Unit Control System

Sequence of Operation

Refer to the unit wiring schematic pasted to the inside of the control panel cover when reviewing the control sequence described below. Refer to this legend for an explanation of the acronyms used in this sequence.

CWFIR- Chilled Water Flow Interlock Relay

LPCO -Low Pressure Cutout

HPCO -High Pressure Cutout

ASCT -Anti-short Cycle Timer

CC -Compressor Contactor

LTC -Low Temperature Cutout

DBC -Delay Between Compressors

WTT -Water Temperature Thermostat

RR -Reset Relay

Operation

10 Ton Operation

1. Disconnect shore power supply to unit if 115 V supply cord is attached to shore power receptacle.
2. With unit circuit breaker closed, power is supplied to the crankcase heaters, factory supplied evaporator heat tape, and the 24 V control circuit.
3. In order to start the chilled water pump, position handle on pump starter control panel to the “ON” position. Starting the chilled water pump and establishing flow will close the flow switch (FS).
4. When the entering water temperature (EWT) rises 5° F above the WTT's setpoint, its first stage switch closes, allowing power to pass through, the flow switch, the L TC, the ASCT1, the RR1 contacts, the LPCO1, and the HPCO1 to energize the CC1 coil. This starts compressor #1 and the outdoor fan.

15 Ton Operation

1. Disconnect shore power supply to unit if 115 V supply cord is attached to shore power receptacle.
2. With unit circuit breaker closed, power is supplied to the crankcase heaters, factory supplied evaporator heat tape, and the 24 V control circuit.
3. In order to start the chilled water pump, position handle on pump starter control panel to the “ON” position. Starting the chilled water pump and establishing flow will close the flow switch (FS), allowing power to pass through the LTC to energize the CWFIR.
4. When the entering water temperature (EWT) rises 5° above the WTT's setpoint, its first stage switch closes, allowing power to pass through the CWFIR contacts, the ASCT1, the RR1 contacts, the LPCO1, and the HPCO1 to energize the CC1 coil. This starts compressor #1 and outdoor fan #1.
5. If the EWT rises 10° F above the WTT's setpoint, its 2nd stage switch closes, allowing power to pass through the CWFIR contacts, the DBC switch, the ASCT2, the RR2 contacts, the LPCO2, and the HPCO2 to energize the CC2 coil. This starts compressor #2 and outdoor fan #2.

Determining the setpoint for the Water Temperature Thermostat (WTT)

1. Find the difference between the chiller's entering water temperature (EWT) and the leaving water temperature (LWT) while both compressors are running.
   DT = EWT - LWT
2. Decide what minimum leaving water temperature (LWT min.) is desired. This is the minimum temperature that the leaving water reaches during normal cycling of the WTT.

Operation

CAUTION
Chiller Damage!

The minimum leaving water temperature (LWTmin) is not to be lower than 40° F. Failure to maintain this minimum temperature may result in ice formation in the chiller leading to unit damage.

If the minimum leaving water temperature (LWTmin) is lower than 40° F, add the appropriate amount of ethylene glycol and adjust safety control settings.

Leaving an appropriate safety band between LWT min. and the Low Temperature Cut Out setting is important.

3. The WTT set point is then determined by the following formula:
   WTT setpoint = LWT min. + DT/2

Note: Actual leaving water temperature will dip lower than the value used in the equation above due to lag in the thermostat's control.

4. The maximum entering water temperature is computed by:
   EWT max = WTT setpoint + 10

Note: Computing EWT max is important. If the heat source is not warm enough to allow the EWT to rise to EWT max, the second stage of cooling may never activate.

ADDITIONAL INFORMATION

A. Average Chiller Leaving Water Temperature (LWTavg) During Two Stage Thermostatic Control as the Load Varies
   LWTavg = WTTsetpoint -DT/2 + 5
B. The Maximum Leaving Water Temperature During Normal Thermostatic Cycling is computed by:
   LWTmax = WTTsetpoint -DT/2 + 10

Example:

1. Entering Water Temperature is 55° F based on an actual reading. Leaving Water Temperature is 45° F.
   DT = EWT -LWT
   DT = 55 -45
   DT = 10° F

2. Desired Minimum Leaving Water Temperature is 40° F. This temperature is minimum allowable leaving water temperature without requiring ethylene glycol and special controls settings.
3. New Thermostat Setting:
   WTTsetpoint = LWTmin + DT/2
   WTTsetpoint = 40 + 10/2
   WTTsetpoint = 45° F

Operation

4. Maximum Entering Water Temperature:
   EWTmax = WTTsetpoint + 10
   EWTmax = 45 + 10
   EWTmax = 55° F

A. Average Leaving Water Temperature:
   LWTavg = WTTsetpoint -DT/2 + 5
   LWTavg = 45 -10/2 + 5
   LWTavg = 45° F

B. Maximum Leaving Water Temperature:
   LWTmax = WTTsetpoint -DT/2 + 10
   LWTmax = 45 -10/2 + 10
   LWTmax = 50° F

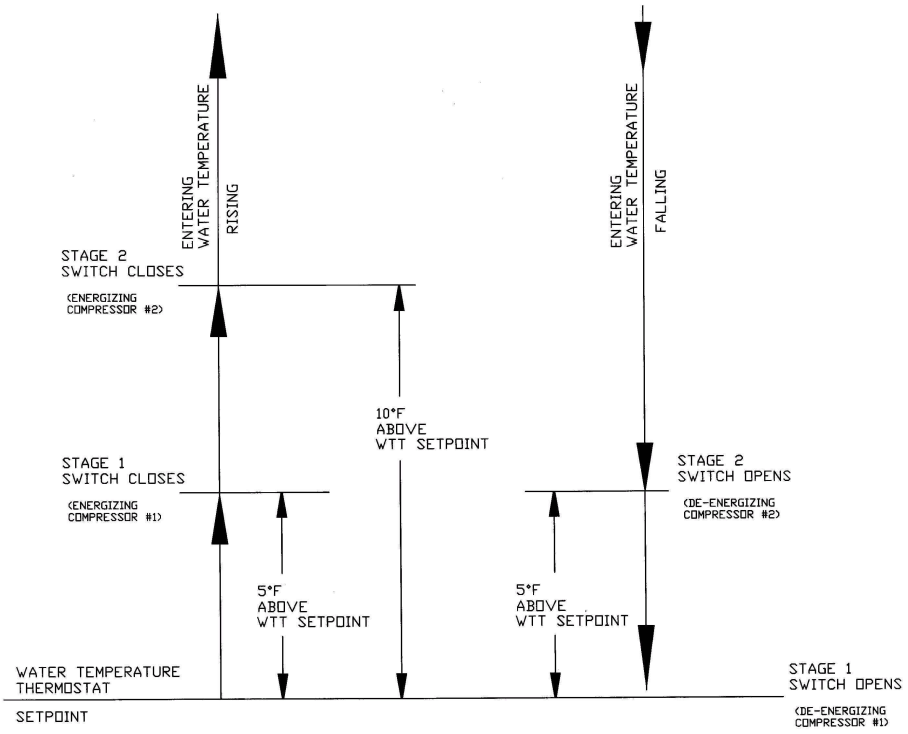
Water Temperature Thermostat Operation

1. At start up, If the entering water temperature (EWT} is less than 5° F above the WTT setpoint, the unit will not run. When the EWT rises to 5° F above the WTT setpoint, its first stage switch closes, energizing compressor #1.
2. If the EWT continues to rise and reaches 10° F above the WTT setpoint, its second stage switch closes, energizing compressor #2.
3. When the cooling demand is met and the EWT drops to 5° F above the WTT setpoint, its second stage switch opens, dropping out compressor #2.
4. If the EWT continues to fall and reaches the WTT setpoint, its first stage switch opens, dropping out compressor #1.

A graphic representation of the above explanation is shown in Figure 18.

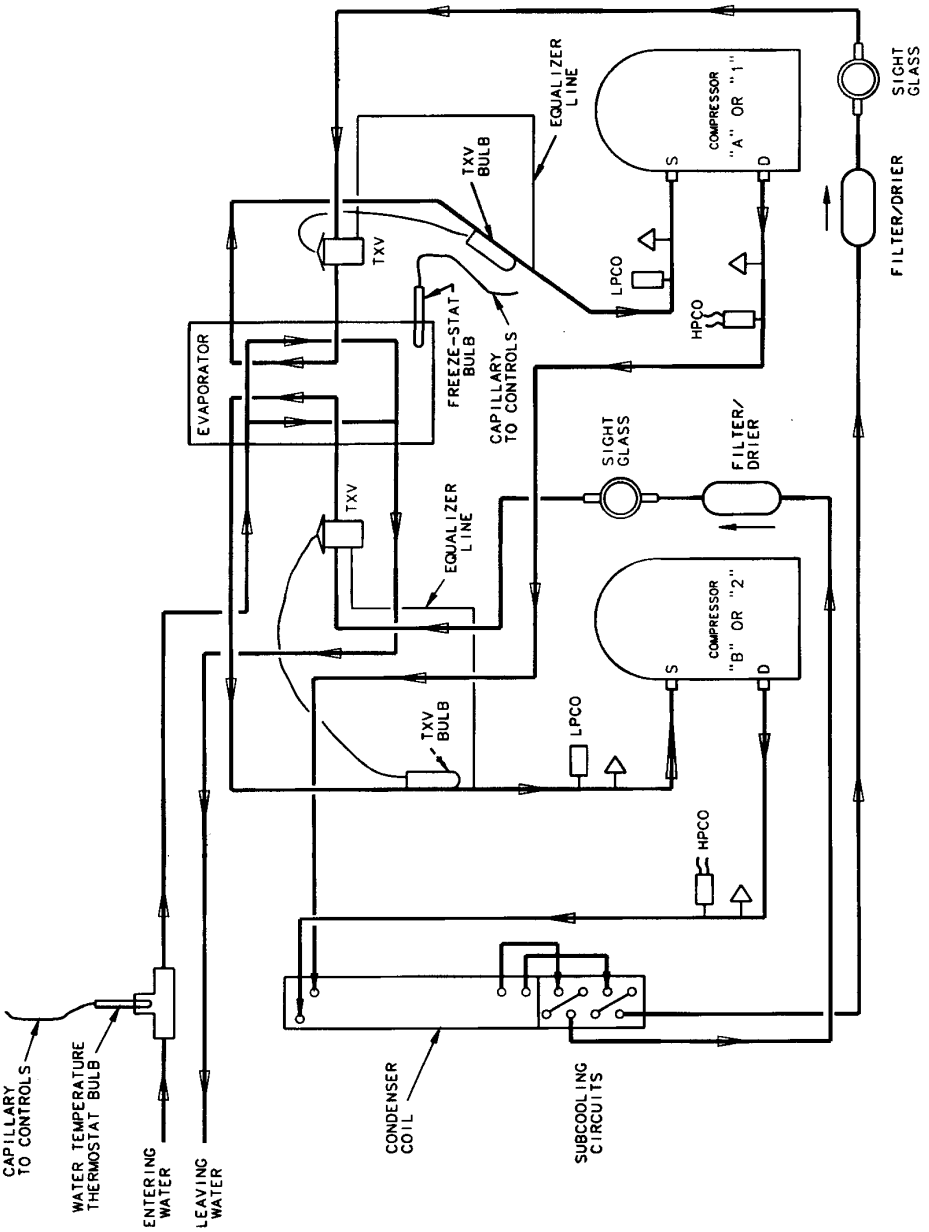
Operation

Figure 18 — WTT Switching Action



Schematics

Figure 19 — Unit Refrigeration Schematic for 10 Ton (CSRA010FAFO)

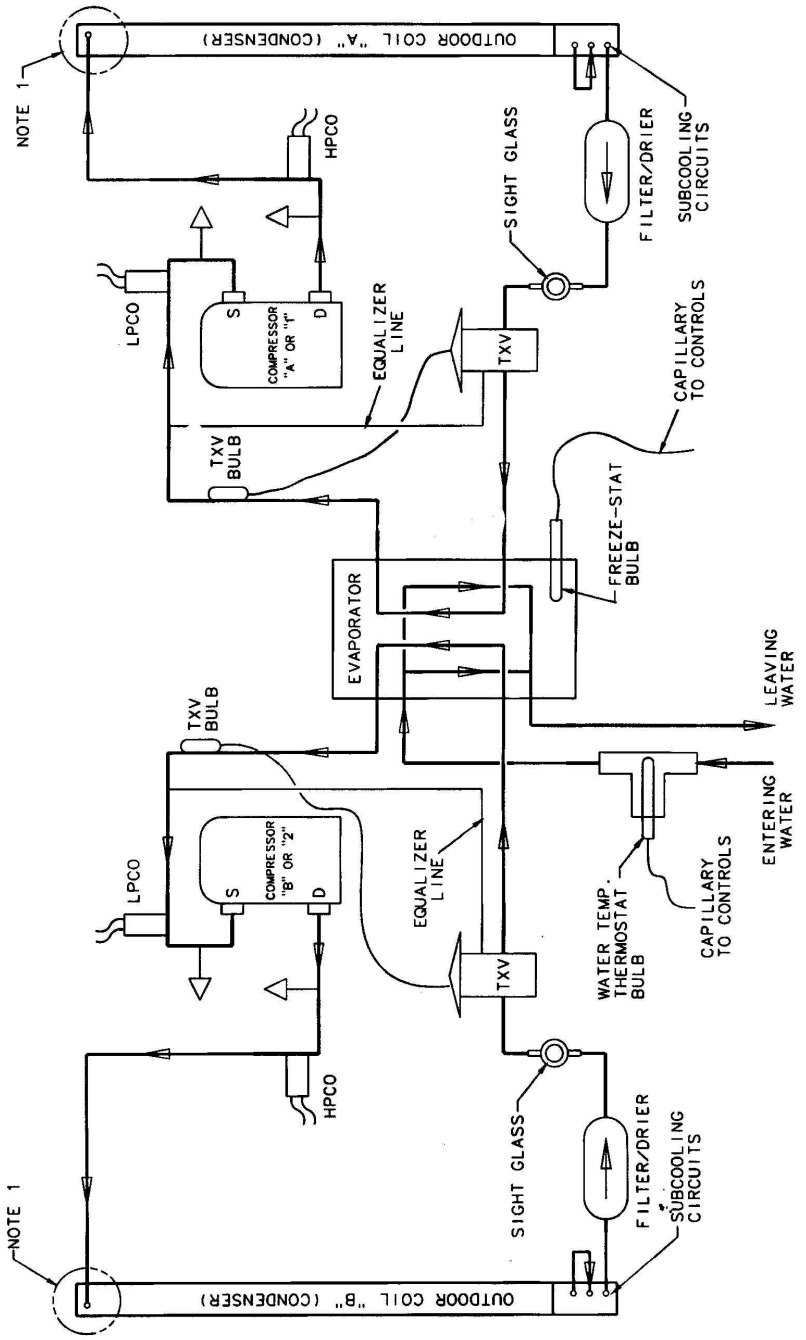


Notes: 1. Circuits through the condenser coil are not shown.

Symbol	Definition
⟶△	Pressure Gauge Connection
LPCO	Low Pressure Control Connection
HPCO	High Pressure Cut Out Switch
TXV	Thermal Expansion Valve

Schematics

Figure 20 — Unit Refrigeration Schematic for 15 Ton (CSRA015FAFO)



Notes: 1. Circuits through the condenser coil are not shown.

Symbol	Definition
⟶	Pressure Gauge Connection
LPCO	Low Pressure Control Connection
HPCO	High Pressure Cut Out Switch
TXV	Thermal Expansion Valve

Maintenance

Periodic Maintenance

Perform all of the indicated maintenance procedures at the intervals scheduled. This will prolong the life of the unit and reduce the possibility of costly equipment failure.

Note: Use an “Operator's Log” (such as the one at the back of this manual) to record a weekly operating conditions history for the unit. This operating log can be a valuable diagnostic tool for service personnel; by noticing trends in operating conditions, the operator can often foresee and prevent problem situations before they become serious.

If the unit does not perform properly during any of these maintenance inspections, consult the “Trouble Analysis” section of this manual for possible causes and recommended repairs.

Weekly Maintenance

Once the unit has been operating for about 30 minutes and the system has stabilized, check operating conditions and complete the checkout procedure described below:

[ ] Check suction and discharge pressures. (Refer to “Checking Operating Conditions”.

[ ] Check the liquid line sight glasses/moisture indicators. (Refer to “Checking Operating Conditions”).

[ ] If operating pressures and sight glass/moisture indicator conditions indicate a refrigerant shortage, measure system superheat and system subcooling. (Refer to “Checking Operating Conditions”).

[ ] If operating conditions indicate an overcharge, slowly (to minimize oil loss) recover refrigerant at the liquid line service valve.

Important Note: Do Not release refrigerant to the atmosphere! Refer to general service bulletin MSCU-SB-1 (latest edition).

⚠ CAUTION
Freezing Temperatures!

Do not allow liquid refrigerant to contact skin. If it does, treat the injury similar to frostbite. Slowly warm the affected area with lukewarm water and seek immediate medical attention. Direct contact with liquid refrigerant may cause minor or moderate injury.

[ ] Inspect the entire system for unusual conditions and inspect coils for dirt and debris. If coils are dirty, clean them. (Refer to “Coil Cleaning”).

Maintenance

Note: Use an operating log (such as the one at the end of this manual) to record a weekly operating conditions history for the unit. A complete operating log is a valuable diagnostic tool for service personnel.

⚠ WARNING
Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Refer to unit schematics to check the number of disconnects required to de-energize the unit.

Monthly Maintenance

[ ] Perform all weekly maintenance procedures.

[ ] Measure and record system superheat.

[ ] Measure and record system subcooling.

[ ] Open the unit circuit breaker; then manually rotate the outdoor fans to ensure proper orifice clearance.

[ ] Inspect the fan mounting bolts for tightness.

[ ] Check fan set screws for tightness.

Annual Maintenance

[ ] Perform all weekly and monthly maintenance procedures.

[ ] Have a qualified service technician check the setting and function of each control and inspect the condition of all contactors and replace as necessary.

[ ] If the chiller is not piped to drain facilities, make sure the drain is clear to carry away system water.

[ ] Drain water from evaporator pump and associated piping systems. Inspect all piping components for leakage. damage, etc. Clean out any in-line water strainers.

Maintenance

[ ] Clean and repaint any corroded surfaces.

[ ] Clean condenser coils. (Refer to “Coil Cleaning”).

[ ] Inspect the expansion valve sensing bulbs for cleanliness; clean if required. These sensing bulbs must make good contact with the suction lines, and must be properly insulated.

[ ] Determine whether or not lubrication of the outdoor fan motor bearings is needed; lubricate bearings with a light-weight oil (e.g., SAE-20 non-detergent or equivalent), if necessary.

Note: CGA outdoor fan motor assemblies are permanently lubricated and usually do not require additional oiling unless the unit is installed in a “dirty” environment. Under such conditions, lubricate the fan motor bearings after every 10,000 hours of operation. Do not over lubricate!

[ ] Clean condenser fans.

Maintenance Procedures

This section describes specific maintenance procedure(s) which 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
Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Refer to unit schematics to check the number of disconnects required to de-energize the unit.

Coil Cleaning

Clean the condenser refrigerant coil at least once each year (or more frequently if the unit is located in a “dirty” environment) to help maintain proper unit operating efficiency. Specific instructions for cleaning refrigerant coils are outlined below. Follow these instructions as closely as possible to avoid potential damage to the coils.

Maintenance

⚠ WARNING
Hazardous Chemicals!

Coil cleaning agents can be either acidic or highly alkaline. Handle chemical carefully. Proper handling should include goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturers Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

To clean the refrigerant coil, a soft brush and sprayer (i.e., either a garden pump-up type, or a high-pressure sprayer) must be used. In addition, a high-quality detergent is required; suggested brands include “SPREX A.C.”, “OAKITE 161”, “OAKITE 166”, and “COILOX”.

Note: If the detergent is strongly alkaline (i.e., has a pH value greater than 8.5) after mixing, an inhibitor must be added.

Cleaning Procedure:

1. Disconnect power to the unit.

⚠ WARNING
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Refer to unit schematics to check the number of disconnects required to de-energize the unit.

2. Remove enough panels and components from the unit to gain access to the condenser coils.
3. Protect all electrical devices such as motors and controls from dust and water.
4. Straighten coil fins with a fin rake, if necessary.
5. Use a soft brush to remove loose dirt and debris from both sides of the coil.
6. Mix the detergent with water according to the manufacturer's instructions. To improve the cleansing ability of the solution, heat it to a maximum of 150° F.

Maintenance

⚠ WARNING
Hazardous Pressures!

Coils contain refrigerant under pressure. When cleaning coils, maintain coil cleaning solution temperature under 1500F to avoid excessive pressure in the coil. Failure to follow these safety precautions could result in coil bursting, which could result in death or serious injury.

7. Place the cleaning solution in the sprayer. Be sure to follow these guidelines if a high-pressure sprayer is used: (1) minimum nozzle spray angle is 15 degrees; (2) spray solution at 90 degrees to the coil face; (3) keep sprayer nozzle at least six inches from the coil; and, (4) sprayer pressure must not exceed 600 psi.
8. Spray the leaving air side of the coil first; then spray the entering air side of the coil. Allow the detergent-and- water solution to stand on the coil for 5 minutes.
9. Rinse both sides of the coil with cool, clean water.
10. Inspect the condenser coil. If it still appears to be dirty, repeat Steps 7 and 8.
11. Remove protective covers installed in step 3.
12. Reinstall all unit components and panels; then restore electrical power to the unit.

Cleaning the Evaporator

The chilled water system is a closed loop. It should not accumulate a large amount of scale or sludge. Inlet strainer should be cleaned periodically. If the chiller is fouled, first try to dislodge foreign material by back-flushing the system several times. If this does not work, take a water sample from the evaporator and analyze it. Determine treatment based on the findings.

CAUTION
Evaporator Damage!

Do not use an acidic type cleaning agent. Failure to follow these instructions may result in damage to the internal evaporator components.

Water Treatment

CAUTION
Proper Water Treatment!

The use of untreated or improperly treated water in an Air-Cooled Cold Generator may result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Trouble Analysis

Low Ambient Start Timer (LAST) Checkout Procedure

⚠ WARNING
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

To determine whether or not a low ambient start timer is defective, follow these steps.

1. Remove power from the CGA unit by opening the supply power circuit breaker.
2. Disable both low pressure cutouts (LPCO1 and LPCO2) by disconnecting the wires from their number 1 terminals. Tape the disconnected wires to prevent shorting.
3. Restore power to the system, energize compressor number one and check how long it runs before cutting out.
4. Remove power from the system and disable compressor number one. Tape any wires removed to prevent shorting.
5. Restore power to the system, energize compressor number two and check how long it runs before cutting out.
6. Remove power from the system and re-connect the wires removed from the low pressure cutouts in step two. Re-connect the wires that disabled compressor number one.
7. Restore power to the unit.

Conclusion: Compare the compressor run times verified in steps 3 and 5 with the rated duration of the low ambient start timers. (The rated duration times are usually stamped on the timers or given in the unit literature). If the compressor run times don't match the duration times of the low ambient start timers, the timers are defective and must be replaced.

Preliminary Troubleshooting Inspection

If operational difficulties are encountered, be sure to perform these preliminary checks before referring to the troubleshooting charts:

[ ] Check the water temperature thermostat (WTT) to ensure that it is set correctly, receiving control power, and “making/breaking” at the proper intervals.

Trouble Analysis

⚠ WARNING
Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

[ ] Verify that the unit is receiving electrical supply power, and that the fuses in the main control panel are intact.

[ ] Check the evaporator for proper water supply. Check the flow switch for proper operation, and take pressure drop readings across the evaporator.

After completing the preliminary checks described above, be sure to inspect the unit for other obvious causes of trouble such as an excessively dirty condenser coil, leaking water connections, broken or disconnected wires, etc. If everything appears to be in order, but the unit still fails to operate properly, refer to the appropriate troubleshooting chart and contact a qualified service technician.

Troubleshooting Charts

The troubleshooting charts which follow are provided to serve as an aid for identifying the cause of any system malfunctions that may occur. Within each chart are three columns: (1) the Symptom column describes the behavior the unit is exhibiting; (2) the Probable Cause column identifies the most likely sources of the malfunction; and, (3) the Recommended Action column describes the suggested action for correcting the problem.

Note: The troubleshooting charts which follow are provided solely as a guide for determining the cause of mechanical failure or malfunction. When mechanical problems do occur, Trane recommends that qualified service personnel be contacted (ChillerSource, 800-755-5115) to help ensure proper diagnosis and repair of the unit.

The following warning applies to many of the recommended actions suggested in the troubleshooting charts.

⚠ WARNING
Live Electrical Components!

During troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Troubleshooting

Symptom

A. Compressor neither starts nor hums

Probable Cause	Recommended Action
1. No power to unit.	Check for the following:
	a. Disconnect switch open.
	b. Fuse(s) blown.
2. No call for cooling.	Check for the following:
	a. Defective thermostat.
	b. Broken or improper control wiring.
	c. Blown control power fuse.
3. Anti-short cycle timer has not times out.	Wait at least 3 minutes for the anti-short cycle timer to time out.
4. Unit locked out by reset relay.	Check for the following:
	a. Excessive discharge pressure; see “Discharge Pressure Too High”
	b. Defective high pressure control.
	c. Low Charge; Low pressure switch open.
	d. Defective reset relay contact.
5. Compressor contactor will not close.	Check for the following:
	a. Defective compressor contactor.
	b. Improper wiring.
	c. Reset relay open.
	d. Low pressure control open.
	e. Cooling relay not energized. Defective relay; check thermostat circuit. See probable cause #2 above.
6. Compressor winding stat open.	See “Compressor Motor Winding Stat Open”.
	a. Check compressor amp draw.

Symptom

B. Compressor hums, but will not start.

Probable Cause	Recommended Action
1. Low voltage at compressor.	Check for the following:
	a. Single blown fuse.
	b. Low line voltage.
	c. Defective compressor contactor.
	d. Loose wiring connections.
2. Defective compressor.	Check for the following:
	a. Open motor winding.
	b. Excessive amp draw on all phases.
3. Insufficient starting voltage (Single-phase units only)	Check for the following:
	a. Defective start capacity.
	b. Defective start relay.

Symptom

C. 2nd stage compressor fails to start.

Probable Cause	Recommended Action
1. Time delay contacts fail to close.	Replace time delay relay.
2. No call for cooling.	Check for the following:
	a. Defective thermostat.
	b. Broken or improper control wiring.
3. Unit locked out by reset relay.	See Symptom A, Probable Cause #4.
4. Compressor contactor will not close.	See Symptom A, Probable Cause #5.

(Continued on next page)

Troubleshooting

Symptom

D. Compressor short cycles.

Probable Cause	Recommended Action
1. Intermittent Contact in control circuit.	Check for the following:
	a. Defective relay contacts.
	b. Loose wiring connections.

Symptom

E. Compressor runs continuously.

Probable Cause	Recommended Action
1. Unit undersized for load (cannot maintain water temperature).	Check for cause of excessive load.
2. Thermostat setpoint too low.	Readjust thermostat.
3. Defective thermostat or control wiring.	Replace thermostat. Replace or repair control wiring.
4. Welded contacts on compressor contactor.	Repair or replace contactor.
5. Leaky valves in compressor (indicated by abnormally low discharge and high suction pressures).	Replace compressor.
6. Shortage of refrigerant (indicated by reduced capacity, high superheat, low subcooling and low suction pressure).	Find and repair refrigerant leak. Recharge system.

Symptom

F. Compressor motor winding stat open.

Probable Cause	Recommended Action
1. Excessive load on evaporator (indicated by high supply water temperature).	Check for the following:
	a. Excessive water flow.
	b. High return water temperature.
2. Lack of motor cooling indicated by excessive superheat).	Check for the following:
	a. Improper expansion valve setting.
	b. Faulty expansion valve.
	c. Restriction in liquid line.
3. Improper voltage at compressor.	Check for the following:
	a. Low or imbalanced line voltage.
	b. Loose power wiring.
	c. Defective compressor contactor.
4. Internal parts of compressor damaged.	Replace compressor.

Symptom

G. Compressor is noisy.

Probable Cause	Recommended Action
1. Internal parts of compressor damaged or broken (compressor knocks).	Replace compressor.
2. Liquid flood-back (indicated by abnormally cold suction line and low superheat.	Check and adjust superheat.
3. Liquid refrigerant in compressor at start-up (indicated by abnormally cold compressor shell).	Check crankcase heater. Check for refrigerant overcharge.

Symptom

H. System short of capacity.

Probable Cause	Recommended Action
1. Low refrigerant charge (indicated by high superheat and low subcooling).	Add refrigerant.

(Continued on next page)

Troubleshooting

2. Clogged filter drier (indicated by temperature change in refrigerant line thru drier).	Replace filter drier or filter drier core.
3. Incorrect expansion valve setting.	Re-adjust expansion valve.
4. Expansion valve stuck or obstructed (i.e., high superheat and high water temperature).	Repair or replace expansion valve.
5. Low evaporator water flow.	Check strainers. Adjust water flow.
6. Noncondensibles in system.	Evacuate and recharge system.
7. Leaky valves in compressor (i.e., operation at abnormally high suction and low discharge pressures).	Replace compressor.

Symptom

I. Suction pressure too low.

Probable Cause	Recommended Action
1. Shortage of refrigerant (i.e., high superheat, low subcooling).	Find and repair leak; recharge system.
2. Thermostat set too low (i.e., low discharge pressure, low leaving water temperature).	Readjust thermostat.
3. Low water flow.	Check for clogged strainers and incorrect balancing valve settings.
4. Clogged filter drier.	Check for frost on filter drier. Replace if needed.
5. Expansion valve power assembly has lost charge.	Repair or replace expansion valve power head assembly.
6. Obstructed expansion valve (i.e., high superheat).	Clean or replace valve.

Symptom

J. Suction pressure too high.

Probable Cause	Recommended Action
1. Excessive cooling load (i.e., high supply water temperatures).	See Symptom E.
2. Expansion valve overfeeding (i.e. super-heat too low, liquid flooding to compressor).	Adjust superheat setting; verify that remote bulb is properly attached to suction line.
3. Suction valves broken (i.e., noisy compressor).	Replace compressor.

Symptom

K. Discharge pressure too low.

Probable Cause	Recommended Action
1. Shortage of refrigerant (i.e., low subcooling, high superheat, bubbles in sight glass).	Find and repair leak; recharge system.
2. Broken or leaky compressor discharge valves.	Replace compressor.
3. Defective low pressure switch.	Replace defective control.
4. Unit running below minimum operating ambient.	Provide adequate head pressure controls, or an ambient lockout switch.

Symptom

L. Discharge pressure too high.

Probable Cause	Recommended Action
1. Too little or too warm condenser air; airflow restricted.	Clean coil; check fans and motors for proper function.
2. Air or noncondensibles gas in system (i.e., exceptionally hot condenser).	Evacuate and recharge system.

(Continued on next page)

Troubleshooting

3. Refrigerant overcharge refrigerant. (i.e., high subcooling, low superheat, high suction pressure).	Recover excess
4. Excessive system load.	Reduce load.
5. Defective condenser fan or fan pressure control (i.e., 1 fan off, high condenser pressure).	Repair or replace switch.

Operator's Maintenance Log

	Refrigerant Conditions				Operating Pressures (Psig)		Water Temps (F)		
	Compressor #1		Compressor #2		Compressor #1	Compressor #2	Evaporator		Outdoor
Date	SubCooling	SuperHeat	SubCooling	SuperHeat	Suct. Disch.	Suct. Disch.	Inlet	Outlet	Ambient (F)

Note: Perform each inspection annually with the unit operating and stabilized.

For further information on this product or other Trane products, refer to the "Trane Service Literature Catalog, ordering number IDX-IOM-1. This catalog contains listings and prices for all service literature sold by Trane. The catalog may be ordered by sending a $25.00 check to: The Trane Company, Service Literature Sales, 3600 Pammel Creek Road, La Crosse WI 54601.

RSS/PM

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Literature Order Number	CSRA-SVX01A-EN
File Number	SV-CAP-Chillersource-CSRA-SVX01A-EN-0402
Supersedes	New
Stocking Location	La Crosse